Bioprospecting and Deep-Sea Genetic Resources in a Fragmenting International Law

Niels Krabbe

Juridiska institutionens skriftserie
School of Business, Economics and Law at University of Gothenburg
Skrift 038
2021

Bioprospecting and Deep-sea Genetic Resources in a Fragmenting International Law

Cover: Illustration by Signe Hagerman
Print: Stema specialtryck AB, Borås

ISBN 978-91-8009-376-7 (Print)
ISBN 978-91-8009-377-4 (PDF)

Tryckssak
3041 0234

Abstract

This thesis investigates if public international law manages to function as a coherent system in the case of deep-sea bioprospecting, where rules in three regimes provide seemingly inconsistent obligations for states.

Based on an investigation of the development of bioprospecting and patenting of deep-sea genetic resources, the study explores how rules in the United Nations Convention on the Law of the Sea (UNCLOS), the Convention on Biological Diversity (CBD) and the World Trade Organization Agreement on Trade-Related Aspects of Intellectual Property Rights (WTO TRIPS) apply to such activities. It is illustrated how rules of these treaties provide different and seemingly inconsistent obligations for states in the context of deep-sea bioprospecting. This is explained by their origin in different *regimes* of public international law with distinctively dissimilar perspectives on the appropriation of genetic resources.

It is discussed how the *prima facie* norm conflict in some cases can be resolved on the basis of the principles on treaty application and interpretation under the Vienna Convention on the Law of Treaties. In other cases, such as the obligations for bioprospecting of deep-seabed micro-organisms, states are faced with an irreconcilable dilemma; the different treaty obligations cannot be simultaneously applied. In order to prevent such conflicts and ensure the credibility of international law as a functioning system, new approaches are suggested, in particular the development of holistic conflict clauses and *lex specialis*. The case of deep-sea bioprospecting calls for a more state-oriented perspective in the debate on the fragmentation of international law.

For my mother, Margrethe Krabbe (1948 - 2017), who taught me the joy of learning and the love of all living things

There is a pleasure in the pathless woods,
There is a rapture on the lonely shore,
There is society where none intrudes,
By the deep sea, and music in its roar:
I love not Man the less, but Nature more,
From these our interviews, in which I steal
From all I may be, or have been before,
To mingle with the Universe, and feel
What I can ne'er express, yet cannot all conceal.

Lord Byron

Acknowledgements

The research presented in this thesis was funded by an employment as a doctoral candidate at the Department of Law of the University of Gothenburg. I am most grateful for having been offered this opportunity. Over the past five years my research has benefited greatly from stimulating exchanges with colleagues from different strands of legal scholarship. I'd like to thank all my colleagues at the department, in particular those involved in the Ocean Governance Law Group, which represents a truly inspiring academic setting.

The research could not have been produced without the numerous friends and colleagues who have provided inspiration and advice throughout this project. I am particularly indebted to my supervisors Professors David Langlet and Ulf Petrusson.

Over the years I have had the pleasure to discuss my thoughts, and learn from, legal scholars, judges, negotiators, government officials and my students. I owe a great debt to all of them, including those that do not appear here explicitly by name. My research has also benefited greatly from discussions with scholars in other disciplines. Colleagues in different fields of marine sciences have enthusiastically introduced me to the strange world of the ocean depths. I have learnt about the connections between organisms, technology and application from biotechnologists and geneticists.

I would like to thank Professors Gregor Noll, Mikael Baaz and Ulf Linderfalk, as well as Matilda Arvidsson and Hannes Lenk for acting as opponents at my doctoral seminars. I would also like to thank all participants in the doctoral retreats Critical Research in International Law 2017 and 2018, organized by Professor Pål Wrange at the Stockholm Centre for International Law and Justice. Professors Anne Orford, David Kennedy and Rosemary Rayfuse provided particularly helpful external advice on the direction of this project.

I am also most grateful to those who inspired and encouraged me to venture into research, including Professor Harry N. Schreiber at UC Berkeley as well as Judges Tomas Heidar and Rüdiger Wolfrum at the Rhodes Academy of Oceans Law and Policy. I am equally indebted to my high school teacher Rolf Wendin at Schillerska gymnasiet, who opened the door to social sciences.

On a more personal note, I have thoroughly enjoyed sharing joys and hardships with Aron Westholm and Patrik Emblad. To me, our common office has served as a monastery of friendship and wisdom. I would also like to thank Gabriela Argüello, Elin Sandegård, Kristina Hultegård, Kristina Wejstål, David Jivegård, Jhonnie Kern, Jonas Kyrönviita and all other doctoral student colleagues. My good friend Signe Hagerman has kindly provided graphic design and artwork.

Lastly, I would never have set out on this course without the support of my family. I was born into a warm and loving home where culture, nature, learning and discussion were held in high esteem. I remain forever grateful for these gifts from my mother and father. My sister, brothers and my extended family in Denmark and Sweden has also been a great source of inspiration and comfort. Most of all, my wife Cecilia, the rock of our family and my high school sweetheart has carried me through this project.

Niels Krabbe

Brännö, 25 April 2021

Contents

Preface

This study comprises an analysis of the rules in international law applicable to deep-sea bioprospecting. These rules, which concern access to, protection of, and patentability of deep-sea biological resources are found in three distinct regimes of international law. To what extent these rules are compatible or can possibly be made compatible through the use of established methods of application and interpretation of international law is the central theme of the study. In this way, it is a case study on fragmentation of international law and the ability of the system's internal mechanisms to overcome apparent inconsistencies in allegedly hard cases like deep-sea bioprospecting.

For deep-sea bioprospecting, international law provides inconsistent rules, originating from distinct regimes characterized by distinct logics and underlying objectives. This puts states in a paradoxical situation; it is impossible to implement one obligation without violating another. Rules of treaty application and interpretation are unable to fully dissolve this problem. Such cases of catch 22 of international law connect to an increasing systemic fragmentation into different regimes. As is shown in the case of deep-sea bioprospecting, regimes are based on different objectives and logics. When rules from several regimes apply in parallel there is a risk for norm conflicts.

This dysfunctionality and the resulting lack of credibility challenges the legitimacy of international law as a coherent system. It puts states in a situation where their only option is to implement international law selectively, by means of norm shopping. It also increases the risk for powerful states to dominate the system, by circumventing a prohibitive rule in one treaty by reference to a permissive rule in another. The dilemma of norm conflict may be prevented, it is suggested, by increasing institutional cooperation and consideration of rules across treaty boundaries as well as the development of holistic conflict clauses and *lex specialis*. This is particularly relevant in the marine sphere, where different uses, activities and their implications transcend boundaries and a broad range of treaties provide different and partly overlapping obligations. Nowhere else is it more acute than in areas beyond national jurisdiction, where different commons-principles and lack of exclusive state rights provide special legal conditions.

A. Approaching deep-sea bioprospecting and international law

A.1. Introductory remarks

A commercial enterprise commissions a marine research vessel and sails to the Mid-Atlantic, well beyond the maritime zones of Atlantic coastal states. There, a submarine vessel is sent down to harvest samples of organisms in an extremophile tubeworm community situated at a hydrothermal vent, ecosystems where organisms display functions which have not been identified elsewhere on the planet. On board the research vessel, the DNA of a retrieved micro-organism is sequenced. In subsequent clinical trials on land, a protein discovered during sequestration is demonstrated to have tumor-inhibiting properties. A patent application is filed, with prospects for the development of a commercially lucrative pharmaceutical drug.

Under US interpretation, not only of its own treaty obligations, but of the implication of international law in general, there is nothing preventing such operations or the enterprise from applying for and being granted a patent, provided that the discovery meets standard requirements. In the view of Argentina, by contrast, the actual bioprospecting mission would be unlawful without an express permit from the International Seabed Authority. Moreover, the findings would have to be shared universally. Any application for or granting of patents or other exclusive rights based on the finding would amount to illegal appropriation of a global resource belonging to all of humanity. The European Union would consider it in line with international law to conduct the mission, provided that the conservation of the relevant ecosystem is not endangered, and much like the US, the EU would grant patent for the invention. They may, however, suggest that international law rules require that the benefits from the finding should somehow be shared.

How can the different legal perspective across states be explained, considering that they are based on the same rules of international law? The diverging views on deep-sea bioprospecting, which also are reflected in domestic law, are the result of different understandings among states of what obligations apply to deep-sea bioprospecting.

In this study, the rules of international law applying to such activities will be examined. The study will explore how, as a result of fragmentation, different regimes of international law have developed seemingly inconsistent obligations to the same activity and how deep-sea bioprospecting should be considered under treaty law. Deep-sea bioprospecting thus presents states with a legal dilemma. In order to understand the challenges this new activity represents for international law, a closer look at characteristics of deep-sea bioprospecting is required.

A.2. Why investigate the legal status of deep-sea bioprospecting under international law?

A.2.1. A difficult case under international law

The status under international law of the deep sea and its resources as global commons beyond national jurisdiction raises legal challenges to the bioprospecting of genetic resources in these areas. Moreover, different sub-fields of international law provide potentially conflicting obligations relating to such activities. States are both required to enable and prevented from allowing the appropriation of genetic resources from these areas for private purposes, as well as obliged to ensure their conservation.

The law of the sea has been developed based on a rigid division between scientific research and resource extraction as well as a narrow conception of how marine resources can and should be exploited, reflecting human use and scientific knowledge of the 1970 and 80s, when central provisions in the United Nations Convention on the Law of the Sea (UNCLOS)[1] were negotiated. Yet these rules have a general scope of application, which in important regards encompasses deep-sea bioprospecting. The deep-sea areas of the oceans largely overlap with the areas which under the law of the sea are considered beyond national jurisdiction. These are divided into two distinctive legal commons-concepts: The High Seas includes the water column beyond the limits of the maritime zones of coastal states. The Area encompasses the seafloor and underlying sediments beyond the continental shelf of coastal states.

[1] The United Nations Convention on the Law of the Sea, signed in Montego Bay, Jamaica 10 December 1982 and became effective 16 November 1994, 1833 U.N.T.S. 397 (UNCLOS) (United Nations ed., United Nations 1997).

The two zones differ considerably as legal concepts, but have important elements in common. Both the rules on the High Seas and the Area are based on the notion that no state is entitled to assert sovereignty over these areas, and resources contained in these parts of the oceans are generally regarded as global commons. However, the legal implications differ considerably between the two zones. The commons regime of the High seas is essentially one of open-access, enabling appropriation of living organisms by all states and private actors as the main rule. The commons regime of the Area, on the other hand, is built on the principle of common heritage of mankind, which implies that appropriation in the form of resource extraction, as well as scientific research, only can be undertaken for the benefit of mankind, as opposed to state or private interest. Indeed, under the law of the sea, no actor is granted access unless complex procedures and requirements have been fulfilled.

In contrast to this restrictive approach to appropriation of deep-sea genetic resources, WTO-law has a more permissive perspective. According to the standard rule, states should grant patents for biotechnological inventions originating in deep-sea organisms provided that patent criteria are fulfilled. The Agreement on Trade-Related Aspects of Intellectual Property Rights (TRIPS)[2] provides no exception from the obligation to enable claims for exclusive rights to biotechnological inventions originating in deep-sea organisms.

On the contrary, states are prevented from excluding the types of organisms which appear to be most relevant in bioprospecting from patentability. States are thus not merely free to accept claims for legal rights connected to genetic functions of deep-sea organisms: They are required to ensure the protection of private claims for exclusive rights by means of patenting for the types of organisms which include the most commercially relevant bioresources.

[2] Agreement on Trade-Related Aspects of Intellectual Property Rights (TRIPS), 15 April 1994, Marrakesh Agreement Establishing the World Trade Organization, Annex 1C, 1869 U.N.T.S. 299 (WTO TRIPS).

International environmental law represents a third approach to the appropriation of deep-sea resources. Much of the rules of the Convention on Biological Diversity (CBD)[3] are geographically confined to coastal waters, where an advanced system for safeguarding national sovereignty over genetic resources applies. No restrictions are raised in relation to the appropriation of deep-sea genetic resources per se. It does, however, provide obligations to share results, not to cause damage to ecosystems, as well as duties to cooperate for the conservation and sustainable use of biodiversity in their natural habitats.

Bioprospecting and the genetic resources of deep-sea organisms thus represent an example of how different areas of international law can provide obligations relating to the same activity in a multitude of different and, potentially conflicting ways. Generally, depending on what area of international law is used as perspective, the legal status of organisms and the use of their genetic resources would be interpreted differently. As a result, across different areas of international law, rules are provided for distinct aspects of the appropriation of organisms and their genomes. This goes for terrestrial as well as marine life, but it is most striking and arguably most relevant on the marine side, where the limitations on state sovereignty are manifold and the legal status of the major part of the oceans as global commons highlights dissimilar perspectives. These differences between sub-areas of international law, in this study referred to as regimes, raise a multitude of questions: How do obligations across different regimes apply to deep-sea bioprospecting? What underlying reasons might explain why rules diverge? How does international law handle cases of potentially overlapping and conflicting norms? Can it be established what rules should be given priority?

In this study, the emphasis is on how international law applies to deep-sea bioprospecting, and how inconsistency between obligations relating to such activities could be explained and understood under treaty law rules. The interest of investigating this problem is further supported by extra-legal aspects of deep-sea bioprospecting.

[3] The Convention on Biological Diversity, regarding the conservation of biodiversity, the sustainable use of its components and the fair and equitable sharing of the benefits arising thereof, signed at the Earth Summit in Rio de Janeiro, Brazil, in 1992 and entered into force on 29 December 1993, 1760 U.N.T.S. 69 (CBD).

A.2.2. Growing interest in marine bioprospecting

The seemingly inconsistent rules for deep-sea bioprospecting in international law is not just a theoretical problem. Indeed, the organisms of the deep sea are emerging from the dark abyssal plains and mid-ocean ridges and their instrumental value in biotechnology development is becoming increasingly apparent. Technology and practical procedures relating to deep-sea bioprospecting have undergone dramatic changes in recent years. Genetic sequencing and engineering have opened new possibilities. Increased cooperation has blurred the lines between research and commercial development. The commercial potential of deep-sea genetic resources is closely connected to the challenges that the elements raise for the survival of all organisms in these parts of the biosphere. In order to withstand the extreme conditions in the deep sea, life has developed its most peculiar forms, with properties that cannot be found anywhere else. The prospects of using these functions in commercial development has been propelled by decreased costs in sequencing and submersible vehicles. The increasing commercial interests, technological development and the unique biological conditions of the deep sea and its organisms makes it evident that there are also practical arguments for investigating the legal status of bioprospecting under international law.

Interest in deep-sea bioprospecting is indeed soaring. Discoveries in marine organisms are increasingly being patented for pharmaceutical purposes.[4] Already by 2007, more than 15,000 molecules from marine genetic resources had been isolated and described.[5] Such bioactive compounds with anti-inflammatory, anti-carcinogenic or anti-tumor functions, or those with the potential to treat HIV/AIDS are already being used in the biotechnology, biopharmaceutical and cosmetics industries.[6] Since 1999, the number of patents originating from marine genetic resources has increased on average 12 per cent each year, which is more than 10 times faster than the rate of

[4] David Leary, et al., Marine genetic resources: A review of scientific and commercial interest, 33 MARINE POLICY (2009).

[5] Sybille Van den Hove & Vincent Moreau, Deep-sea biodiversity and ecosystems: a scoping report on their socio-economy, management and governance (2007).

[6] Salvatore Arico & Charlotte Salpin, Bioprospecting of Genetic Resources in the Deep Seabed: Scientific, Legal and Policy Aspects § 20 (United Nations University, Institute of Advance Studies. 2005).

description of marine species.[7] The increased activity in marine bioprospecting is mainly due to two factors.

Firstly, rapid technological innovation enables a more cost-effective and economically viable exploration of the genetic diversity of the oceans. This includes not only marine equipment such as submersible vehicles. As will be discussed in Part B, an even more significant factor has been the remarkable development and lowering costs relating to laboratory technology, including genetic sequencing and engineering. This laboratory development has not just propelled marine biotechnology; the increased interest in marine genetic resources is part of a generally growing interest in bio-based innovation, which aside from technological factors can also be explained by the move away from synthetic-based drug development. The genetic sequencing revolution in the 1990s prompted the pharmaceutical sector to abandon bio-based innovation and turn to large-scale sampling of synthetic compounds. The increasing realization in recent years that not even large-scale testing of synthetic samples can compensate for the developmental shortcuts enabled by the evolution of natural organisms has resulted in a resurgence of interest in bioprospecting.

Secondly, in bioprospecting generally, operations target areas and species with a high likelihood of providing new and useful properties. Two interests are considered central in this regard: the *diversity* and *novelty* of genetic resources. This explains why the bioprospecting trend is particularly pronounced in relation to marine organisms. The microbial and prokaryote gene richness found in the oceans is expected to be orders of magnitude greater than the rest of the biosphere.[8] Moreover, life in the seas remains largely unexplored. Studies indicate that bioprospecting of a marine species is twice as likely to result in a patent, compared to a terrestrial species. Today there are 18,000 products with their origins in marine organisms belonging to 4,800 named species.[9] The number of such products increases by about 4 per cent annually.[10]

[7] Jesús M. Arrieta, et al., *What Lies Underneath: Conserving the Oceans' Genetic Resources*, 107 PROCEEDINGS OF THE NATIONAL ACADEMY OF SCIENCES (2010).

[8] VAN DEN HOVE & MOREAU. 2007; Richard J. McLaughlin, Exploiting Marine Genetic Resources beyond National Jurisdiction and the International Protection of Intellectual Property Rights: Can They Coexist?, in LAW, TECHNOLOGY AND SCIENCE FOR OCEANS IN GLOBALISATION: IUU FISHING, OIL POLLUTION, BIOPROSPECTING, OUTER CONTINENTAL SHELF (Davor Vidas ed. 2010).

[9] Arrieta, et al., Proceedings of the National Academy of Sciences (2010).

[10] Valuing the Deep: Marine Genetic Resources in Areas Beyond National Jurisdiction. (2014).

This development has not gone unnoticed in the political and economic sphere. The economic potential of blue biotechnology has been identified as one of the main areas in the EU Maritime Strategy. The European Commission is expecting substantial growth in the sector.[11] As a consequence, the EU has allocated considerable resources for research initiatives in the marine bioprospecting field.[12]

A.2.3. The genetic resources of the ocean deeps

Why, then, is the legal regime for bioprospecting in the deep seas chosen as the subject for the present study instead of the rules applying to such activities in coastal waters? The first reason is connected to the legal status of the deep seas, as discussed above. The second reason relates to the nature of life in the deep sea. If genetic diversity and the likelihood of finding novel and useful properties is generally higher among marine than terrestrial species, these elements are particularly prominent in deep-sea species.

The marine areas beyond national jurisdiction, of which the largest parts are deep seas, comprise two thirds of the total surface of the world's oceans and constitute four fifths of all marine waters measured in volume. Yet these parts of the oceans were long believed to be biological deserts.

[11] *Blue growth* has been the EU long term strategy for promoting sustainable growth in the marine and maritime sector. This has been the maritime contribution to the realization of the Europe 2020 strategy for smart, sustainable and inclusive growth, Communication from the Commission on Blue Growth – Opportunities for marine and maritime sustainable growth. (2012). See, for a specific explanation of the EU's marine biotechnology sector and thereto connected research, Green Paper on Maritime Policy [COM(2006) 275]: European Commission Background paper No. 10 on Marine Biotechnology (2006) as well as comprehensive information provided at the Commission Blue Biotechnology portal https://ec.europa.eu/maritimeaffairs/policy/biotechnology (site accessed November 30, 2020).

[12] Several research projects have been granted considerable contributions. For instance, *Pharma Sea* was during 2013 granted an EU financing amounting to over 9.5 million euros. The project focuses on bioprospecting and the development and commercialization of new bioactive substances from marine organisms, including deep sea sponges and bacteria, in order to investigate their potential for application in pharmaceuticals, nutrition or cosmetics (see: http://www.pharma-sea.eu/). The connecting project MaCuMBA was 2012 granted an EU financing of 9 million euros (see: http://www.macumbaproject.eu/) (sites accessed November 30, 2020).

Although the deep sea is still less explored than the surface of Mars, recent exploration and research has put paid to the idea that the deep sea is a lifeless zone. Expeditions conducted during the past two decades have established that life is not only abundant in the deep sea, but more diverse and endemic than in most places in the biosphere. It has been estimated that between 500,000 and 100 million species live in the deep-sea portions of the world's oceans.[13] For example, as much as ten per cent of the total living biomass on Earth exists as oceanic subsurface bacteria, most of it unidentified.[14] Similarly, the deep seafloor beneath the open ocean has a topography which is comparable in complexity to the terrestrial environment and hosts an abundant variety of organisms.[15]

The high seas conceal some of the world's most exceptional species and extraordinary habitats.[16] To a large degree, this can be explained by the conditions for life in the deep seas, which are among the most challenging of the entire biosphere. In order to exist in these areas, organisms have developed abilities to withstand immense pressure and complete darkness. As a result, life exhibits its most extreme forms in the deep sea. Indeed, the challenges for life in these environments has made evolution take turns not seen in other environments. One well-known example of this is the extremophiles living in the proximity of deep-sea vents at mid-ocean ridges which have developed unique properties. These include not only the ability to withstand extreme temperatures and pressures, but also complete independence from photosynthesis. Instead, some of these organisms depend on the sulfur cycle. If the sun turned out from one day to the next, these organisms would be completely unaffected. Another, less visually documented example is the dark biosphere, an entire ecosystem living without light or oxygen, flourishing beneath the ocean floor. Similarly based on chemosynthesis, it is potentially one of the planet's biggest ecosystems.

[13] While about three-quarters of the Earth is covered by water, only as little as 5% of the ocean has been systematically explored for life, JESSE H. AUSUBEL, et al., FIRST CENSUS OF MARINE LIFE 2010: HIGHLIGHTS OF A DECADE OF DISCOVERY (2010).

[14] McLaughlin. 2010.

[15] Robin Warner, Protecting the Oceans beyond National Jurisdiction: Strengthening the International Law Framework § Legal Aspects of Sustainable Development Series, No. 3, xxiv (2009), at 2-3.

[16] Roberto Danovaro, et al., *Challenging the paradigms of deep-sea ecology*, 29 TRENDS IN ECOLOGY & EVOLUTION (2014).

This high degree of genetic diversity and prevalence of useful functions, which is the result of deep-sea conditions, substantially increases the likelihood of valuable bioprospecting findings.

The prospects for deep-sea bioprospecting are further amplified by the lack of previous exploration. Areas beyond national jurisdiction, the vast majority of which are in the deep sea, represent the largest environments on the planet, yet they are also the least understood.[17] This world, beyond the jurisdiction of states, is largely unexplored. The ratio of new discoveries in the deep ocean is 1:1 for each of the samples taken.[18] The overwhelming majority of deep-sea species remain undiscovered and are yet to be described.[19] It is thus not surprising that the commercial interest in and potential for genetic exploration of deep-sea organisms is high and rising.

A.3. Approaching deep-sea bioprospecting in light of international law

Examining the legal status of deep-sea bioprospecting under international law is thus relevant not only because of the implications of the legal problem, but also considering the increasing commercial interest and scientific and technological aspects. In relation to international law, three elements of deep-sea bioprospecting appear particularly contentious.

A.3.1 Role of natural compound

In bioprospecting generally, the species origin and quantity of genes is less commercially relevant than the potential function of bioactive properties. Genetic diversity and lack of previous exploration are guiding indicators in targeting areas and ecosystems. Relevant samples may be retrieved from deep-

[17] Eva Ramirez-Llodra, et al., Deep, diverse and definitely different: unique attributes of the world's largest ecosystem, 7 BIOGEOSCIENCES (2010).

[18] Salvatore Arico, *Marine Genetic Resources in Areas beyond National Jurisdiction and Intellectual Property Rights*, *in* LAW, TECHNOLOGY AND SCIENCE FOR OCEANS IN GLOBALISATION: IUU FISHING, OIL POLLUTION, BIOPROSPECTING, OUTER CONTINENTAL SHELF (Davor Vidas ed. 2010).

[19] While about three-quarters of the Earth is covered by water, only as little as 5% of the ocean has been systematically explored for life, AUSUBEL, et al. 2010.

sea bacteria, fungus, fish or any other type of marine organism. In most cases, only the collection of a limited compound of biological material is required.

Bioprospecting thereby challenges the basic premise of international law rules for management of living resources of the seas. Largely, these rules focus on the harvesting of living resources for food consumption and have been developed with the purpose of maintaining a maximum catch of major stocks of larger fish species. Such traditional marine living resource extraction – fisheries – collects numerous individuals of the same species in bulk, which are then with a few intermediate steps sold as commercial products. Commercial prospects in fisheries thus essentially depend on quantity, and little consideration is paid to genetic diversity or bioactive properties beyond the quality of the flesh. Accordingly, the rules which have been developed for managing such activities are almost exclusively concerned with the interest of commercial fisheries and are based on the character of such activities. Yet the obligations have a general character and a broad scope of application, encompassing all utilization of marine living resources. This represents a considerable legal challenge for marine bioprospecting; such activities fall within and must comply with rules which have been developed for fundamentally different uses of marine organisms.

Moreover, in bioprospecting generally, the prospect for making novel discoveries of bioactive properties with potential for human use is the central guiding criterion in sampling operations. Species with these characteristics occur most frequently in the endemic ecosystems where even limited operations may have a detrimental environmental impact. In these areas, international environmental law rules also provide obligations on in situ conservation. In such cases, the objectives of the rules may be incompatible with the interest of bioprospecting.

A.3.2. Process aspects

Moreover, the bioprospecting process, as it has developed, and the different steps it involves lead to a range of additional challenges in relation to applicable rules of international law. The most burdensome and costly phases of bioprospecting development – and most relevant discoveries – are regularly performed after the relevant marine sample has been collected, in laboratories on land.

As will be discussed in Part B, it is increasingly common that the different steps of the bioprospecting process (such as physical sampling, identification of promising properties, patenting and product development) are conducted by different entities. It appears that in many cases, the entity conducting the physical sampling is not even aware that the compound may subsequently be used in the development of biotechnology products. Conversely, commercial actors often find it easier to access sample collections stored in research collections such as sample libraries or sequence data, than to engage in costly sampling operations. Yet the emphasis in applicable rules in international law is put on physical activities in the marine environment. Moreover, fundamentally different obligations are provided for resource extraction and scientific research. There is thus a discrepancy between the nature of marine bioprospecting processes and the rules applying to the activities involved.

A.3.3. Gene technology and the role of the physical natural element

Challenges in relation to international law are also posed by the implications of technology and methods employed in contemporary biotechnology. The natural genetic exploration in bioprospecting, as it is carried out today, regularly consists of only a minor collection of a genetic component which performs or has the potential to perform a useful function. Commonly in a laboratory environment, the active compound is then identified by DNA sequencing. According to the standard formula, the molecule performing the relevant function is subsequently patented and manufactured synthetically. Eventually, a commercial product is developed. In such cases, no physical component from the marine organism is used in the relevant product. Arguably, in this model, the genetic function of the natural organism merely serves as a source of inspiration for a function used in a product.

Does this lack of physical natural ingredient in the final product render international law rules on the use of natural resources inapplicable? Or is the connection to a natural genetic resource sufficient for regarding the full process, including the relevant function and the final product, as covered by such rules? It may be claimed that it is irrelevant whether any natural physical material is used directly; the origin of the active compound is what matters when deciding whether the product should be considered as containing genetic material with an origin in nature.

In any event, it is clear that even if the organism is not used in direct physical terms, a legal right connected to its bioactive function is declared insofar as exclusive rights in the form of patents are claimed by the developer. In essence, modern genetic technology employed in bioprospecting transcends and challenges the conventional divisions of processes as either organic or synthetic. Since in bioprospecting it is increasingly difficult to ascertain whether an element or process is natural, it is similarly difficult to determine whether if falls within obligations of international law which applies to natural (but not artificial) elements and processes.

A.4. Purpose and research question

This study aims to investigate whether public international law manages to function as a coherent system in the case of deep-sea bioprospecting, where rules in three regimes provide seemingly inconsistent obligations for states.

This study will thus examine international law *in the context of* bioprospecting of deep-sea genetic resources. Both sides of this relationship will be investigated. It is not merely an investigation of rules in international law relevant for deep-sea bioprospecting, but also an examination of what conclusions can be drawn on the nature and function of international law in light of how the latter relates to deep-sea bioprospecting.

The aim is addressed by the means of the following research question:

Could apparent inconsistencies between the three regimes be dissolved under treaty law rules on application and interpretation?

In order to reply to the principal research question, this study is divided into several themes:

At its core, this is an enquiry into the ability of international law to handle new activities. In order to understand the challenges this represents for the law, a closer look at bioprospecting as an activity is required. Part B therefore reviews what distinguishes bioprospecting for deep-sea genetic resources as an activity. It describes how bioprospecting has developed, as well as the technology and different phases that are involved, from the sampling of genetic resources originating in deep-sea organisms to product development.

Particular emphasis is devoted to the role of the natural compound in these development chains as well as the interconnections of actors involved in different stages of bioprospecting processes. Deep-sea bioprospecting will be described as a complex activity while focusing primarily on the characteristics that need to be considered when assessing the relationship to international law.

This presentation will serve as the basis for an examination in Part C of rules in public international law relevant to deep-sea bioprospecting, focusing on the United Nations Convention on the Law of the Sea, the Convention on Biological Diversity and the World Trade Organization Agreement on Trade-Related Aspects of Intellectual Property Rights. This will illustrate how the rules of these treaties provide different and seemingly inconsistent obligations to deep-sea bioprospecting.

This examination in turn serves as the starting point for Part D, which examines why the investigated treaties raise seemingly incoherent obligations for deep-sea bioprospecting, despite the fact that they are all part of public international law. Part D discusses how the substantive differences across the three treaties relate to their origin in different sub-fields or *regimes* of public international law with distinctively dissimilar perspectives on the appropriation of genetic resources. It is further investigated how these differences reflect underlying ideological divergences across these three regimes, as well as a lack of consideration for the rules in other regimes during treaty drafting and negotiation.

Part E considers the consequences of the difference between rules applying to deep-sea bioprospecting across the investigated treaties. The apparent inconsistency between the applicable rules is more closely examined. It is discussed if the *prima facie* norm conflict can be resolved on the basis of the principles on treaty application and interpretation under the Vienna Convention on the Law of Treaties.[20]

Finally, Part F discusses what conclusions can be drawn based on the case of deep-sea bioprospecting in the context of the debate on the fragmentation of international law and the development of new rules.

[20] Vienna Convention on the Law of Treaties, adopted in Vienna, 23 May 1969, 1155 U.N.T.S. 331, 8 ILM 679 (1969) [hereinafter the Vienna Convention].

Taken together, the study will thus firstly show how deep-sea bioprospecting has developed and is conducted, secondly explore the relevant rules in public international law for this activity, thirdly explain why different regimes have developed seemingly inconsistent rules, fourthly investigate if rules of treaty law are able to dissolve this inconsistency, and fifthly discuss the systemic implications.

A.5. Delimitation, material and method

This study can be regarded as an investigation into a new practical activity, what rules international law provides in relation to said activity *and* the reasons for and consequences of how rules of international law apply to this activity. It focuses on the relation between international law and bioprospecting based on genetic resources from marine organisms in the deep-sea areas of the oceans, beyond the jurisdiction of coastal states.

Bioprospecting is defined in this study as a process whereby commercially useful products are technologically derived, processed and developed based on the collection of marine genetic resources.[21] Rather than attempting to encompass all applications of bioprospecting, the investigation is primarily concerned with bioprospecting that aims to develop products in the pharmaceutical sector, which not only makes up the largest type of such operations, but also most clearly highlights the central legal issues involved. This does not necessarily render the investigation irrelevant to other types of bioprospecting. Indeed, many of the challenges involved are common across sectors. Similarly, much of the discussion on bioprospecting as a process and activity may also be relevant to bioprospecting in coastal waters, although the discussion on applicable rules principally is concerned with marine areas beyond national jurisdiction.

The study is based on a review in Part B of what characterizes marine bioprospecting; how it has developed, what distinguishes it from other uses of marine resources, conventional scientific research and synthetic approaches, as well as the role of the natural compound and technology in bioprospecting processes.

[21] The reasons for basing the study on this definition is further explained in Part B.

The review will thus encompass the full cycle of bioprospecting development and not be confined to the physical sampling of bioresources in the natural environment and the role of the natural compound. Apart from the collection of marine genetic resources, this process includes technological derivation, processing and development of commercially useful products.[22] Deep-sea bioprospecting is thus approached not as an isolated activity, but as a complex process, which may appear considerably different across cases. In addition to examining the bioprospecting process and its development, this review will thus investigate how modern genetic technology has transformed bioprospecting. In addition, the intricate relationships between different actors involved in bioprospecting processes will be particularly highlighted. Commonly, bioprospecting involves a multitude of actors, which may come from private enterprise as well as governmental and academic institutions. As regards material, this review uses the work of the OECD on marine biotechnology as a starting point.[23] In addition, it connects to an inventory of studies on the topic.

The review in Part B serves as the basis for an examination in Part C of the obligations under international law relevant for deep-sea bioprospecting which apply to states. This reflects the emphasis of this study on public international law, understood in a conventional sense as the body of legal norms that governs the relations between states and other subjects of international law.[24] However, not all norms of international law of potential relevance for deep-sea bioprospecting are considered. The material scope has been limited to three regimes of public international law, and in each respective regime a strong emphasis is put on one treaty. Even if also other regimes of international law contain rules relevant (although more remotely) for deep-sea bioprospecting, the law of the sea, international environmental law and international trade (or

[23] More specifically, the review is based on the work of The OECD Working Party on Biotechnology (WPB) and the Working Party on Biotechnology, Nanotechnology, and Converging Technologies (BNCT). See, in particular, OECD, MARINE BIOTECHNOLOGY: ENABLING SOLUTIONS FOR OCEAN PRODUCTIVITY AND SUSTAINABILITY § No. 43 (OECD Publishing. 2013); OECD, MARINE BIOTECHNOLOGY DEFINITIONS, INFRASTRUCTURES AND DIRECTIONS FOR INNOVATION (2017).

[24] IAN BROWNLIE, PRINCIPLES OF PUBLIC INTERNATIONAL LAW (Oxford : Oxford University Press 6. ed. ed. 2003); JAN KLABBERS, INTERNATIONAL LAW (Cambridge University Press. 2017).

WTO) law have been selected because treaties of all these regimes contain obligations which concern the appropriation of deep-sea genetic resources.[25]

Accordingly, domestic regulation and private law rules will only be indirect references in this study, as will patent data relating to marine bioprospecting. To further curtail the scope, as the result of the geographical limitation to activities in the deep sea, the focus is limited to rules applying in these marine areas. The term “deep seas” refers to the marine areas considered beyond national jurisdiction in international law, where the water column is referred to as the high seas and the seafloor and underlying sediments are referred to as the Area.[26] In line with the broad approach to bioprospecting as an activity, however, the full physical process of bioprospecting would not have to be carried out in these areas, as it rarely is in practice. Rather, the defining criterion for this investigation is that the genetic material originates in the deep seas.

Both the investigation of rules relevant for deep-sea bioprospecting in Part C and the discussion in Part E of how treaty law relates to potential inconsistencies across those rules are essentially investigations of legal norms. In line with the positivist approach used in these central parts of the study, the primary materials are legal sources and treaties in particular. Customary norms and case law are also investigated to a lesser degree.[27] The three investigated treaties providing rules directly relevant for deep-sea bioprospecting comprise the central material in Part C.

[25] Deep-sea bioprospecting could also be investigated from the perspective of for instance international criminal law based on the notion of deep-sea bioprospecting as unlawful, in connection to enforcement jurisdiction under the law of the sea. Similarly, provisions on benefit sharing relating to genetic resources are connected to international development law. Deep-sea sampling may also interfere with international rules of (underwater) cultural heritage or international labor law.

[26] See Article 86 and 1 of UNCLOS. In Article 86, the high seas are defined negatively, ‘all parts of the sea that are not included in the exclusive economic zone, in the territorial sea or in the internal waters of a State, or in the archipelagic waters of an archipelagic State.’ In Article 1, “the Area” is defined as “*the seabed and ocean floor and subsoil thereof, beyond the limits of national jurisdiction.”*

[27] As similarly will be discussed in the next section, this is in line with the positivist sources doctrine, often considered to be reflected in Article 38(1) of the ICJ Statute which instructs the ICJ what material ought to apply in disputes in accordance with international law. Statute of the International Court of Justice, United Nations 18 April 1946, 33 U.N.T.S. 993 [hereinafter ICJ Statute].

In Part E, the rules on treaty interpretation and application in the Vienna Convention on the Law of Treaties are used as a central analytical reference point.

Primarily concerned with the reasons for differences across the rules of different regimes, the investigation in Part D is based on secondary sources, such as *travaux préparatoires*, rather than treaty texts. Different perspectives and material are thus used to address the research question. This is also reflected in the theoretical approaches used in the analysis, as will be discussed in the next section.

A.6. Fragmentation as a theoretical reference point

As the result of the increasing division of public international law into different regimes, concerns started to become widespread at the end of the 1990s that specialized treaties, courts and institutions would "*develop greater variations in their determination of general international law*."[28] There was a fear that this increasing specialization would result in systemic inconsistencies not only in the incoherent practice of different tribunals but also in the development of conflicting norms across treaties. It was considered that this development would risk harming the coherence of public international law.[29]

The debate on fragmentation initially focused on understanding, conceptualizing and evaluating fragmentation and later began to concentrate more on developing principles and procedures for coordinating and harmonizing, i.e. solving and preventing the unwanted consequences of fragmentation in order to preserve the integrity of the system.[30] Largely, the observers involved in the discussion can be divided into two views.

[28] Jonathan I. Charney, Is international law threatened by multiple international tribunals? § 271 (Springer. 1999).
[29] Fragmentation of International Law: Difficulties Arising from the Diversification and Expansion of International Law - Report of the Study Group of the International Law Commission. No. A/CN.4/L.682(2006).
[30] As summarized by Peters, Anne Peters, *The refinement of international law: From fragmentation to regime interaction and politicization*, 15 INTERNATIONAL JOURNAL OF CONSTITUTIONAL LAW (2017), at 674.

A *fragmented view*, taken to its extreme, would suggest that international law is developing into several different systems, all of which are based on different logics and unable to cooperate across regime boundaries. The fragmented view is often contrasted with *the systemic view*, which would hold that international law, despite recent developments, remains a unitary legal system, composed of interconnected rules and principles.

In analyzing the concept, multiple causes have been referenced as contributing to fragmentation. On the functional side, three patterns of explanation are often referred to.

Firstly, it is claimed, such a development is essentially built into the decentralized structure that is international law.

Secondly, the concept is also connected to – and is a consequence of – arrangements on the domestic side: Different issue areas are divided between ministries and branches of government which are likely to take different positions in treaty negotiations. Even in efficient administrations, joint preparation rarely manages to counteract this problem.[31]

Thirdly, it has been stressed that fragmentation is a response to globalization. Global challenges have increased the demand for more international and more specific regulation.[32] On the political side, institutionalists have depicted fragmentation as the result of a deliberate agenda of powerful states. According to this conception, the bargaining power of weaker states is reduced by fragmentation, since only states with greater "agenda-setting power" can create new regimes which better suit their interests.[33] Fragmentation has also been divided into different types. As discussed by Peters, two relevant facets seem to be *institutional* fragmentation (different treaties, organizations, bodies, courts, etc.) and *ideational* fragmentation (different objectives and values).[34]

[31] Margaret A. Young, *The Productive Friction Between Regimes*, *in* REGIME INTERACTION IN INTERNATIONAL LAW - FACING FRAGMENTATION (Margaret A. Young ed. 2012), at 1. Birnie, Boyle and Redgwell has highlighted this lack of communication and consultation in the relation between TRIPS and the CBD, which were negotiated at the same time, see *PATRICIA W. BIRNIE, et al., INTERNATIONAL LAW AND THE ENVIRONMENT (Oxford University Press 3 ed. 2009)*, at 802.
[32] Peters, International Journal of Constitutional Law (2017), at 674.
[33] Eyal Benvenisti & George W. Downs, The Empire's New Clothes: Political Economy and the Fragmentation of International Law, 60 STANFORD LAW REVIEW 595 (2007).
[34] Peters, International Journal of Constitutional Law (2017).

How, then, does international law address issues of fragmentation? From the supporters of the systemic position there are mechanisms to prevent and to resolve inconsistencies resulting from fragmentation, embodied in the fundamental rules for treaty application and interpretation, as codified in Part III of the Vienna Convention on the Law of Treaties.[35]

Firstly, there is a conflict-solving element in the rules on *application of treaties*, foremost expressed in Article 30, which regulates the application of successive treaties relating to the same subject matter. As will be further explored, this provision establishes alternative problem-solving models to resort to in cases where several treaty norms overlap. For the purposes of this study, paragraph 2 of Article 30, which establishes that priority should be decided according to so-called conflict clauses of the respective agreements, is particularly relevant.

The rule indicates that preference should be given to treaty A in cases where treaty B, containing an overlapping norm, specifies that it is subject to, or not to be considered as incompatible with, treaty A. The rule in Article 30 thus makes clear that conflict clauses, provisions clearly articulating the relationship to other treaties, should be guiding in deciding what obligation applies in cases of norm conflict. This study will examine to what extent the investigated treaties contain provisions which can be regarded as such conflict clauses, and what material consequences they would yield under the rules for treaty application. As an alternative to the application of treaty conflict, Article 30 provides for application of *lex posterior*, a model whose consequences similarly will be evaluated in the case of deep-sea bioprospecting.

[35] Joost Pauwelyn, Bridging fragmentation and unity: international law as a universe of inter-connected islands, 25 MICHIGAN JOURNAL OF INTERNATIONAL LAW (2004); Ralf Michaels & Joost Pauwelyn, Conflict of norms or conflict of laws? Different techniques in the fragmentation of public international law, 22 DUKE JOURNAL OF COMPARATIVE & INTERNATIONAL LAW (2012);RÜDIGER WOLFRUM & NELE MATZ, CONFLICTS IN INTERNATIONAL ENVIRONMENTAL LAW (Springer. 2003).

Secondly, issues of potential inconsistencies across treaties may be approached based on the rules on *treaty interpretation* in Articles 31–33 of the Vienna Convention. Whereas the approach based on the rules on application attempts to resolve apparent conflicts between norms by establishing priority or hierarchies between the norms involved, approaching the matter from the perspective of interpretation implies considering if the seemingly inconsistent norms can be interpreted so that conflict is prevented. In the debate on fragmentation, the interpretation perspective has particularly focused on Article 31(3)(c), commonly referred to as the *Principle of systematic integration*.

The rule, which provides instruction for treaty interpretation, requires the interpreter to take into account "*any relevant rules of international law applicable in the relations between the parties.*" The rule essentially requires any interpreter of international law to strive for coherence.[36] According to the International Law Commission Study Group on fragmentation, this does not merely represent a possible way to interpret potentially conflicting obligations; rather, it is an obligation to interpret provisions of international law so as to preserve the coherence of the system.[37] The basic presumption of the principle of systemic interpretation is that all treaty provisions set up rights and obligations that exist alongside rights and obligations established by other treaty provisions and rules of customary international law. None of such rights or obligations has any *intrinsic* priority against the others. The question of their relationship can only be approached through a process of reasoning that makes them appear as parts of some coherent and meaningful whole.[38]

[36] For an extensive analysis on the principle of systemic integration, see Campbell McLachlan, *The Principle Of Systemic Integration And Article 31(3)(C) Of The Vienna Convention*, 54 INTERNATIONAL AND COMPARATIVE LAW QUARTERLY (2005).

[37] Fragmentation of International Law: Difficulties Arising from the Diversification and Expansion of International Law - Draft conclusions of the work of the Study Group Finalized by Martti Koskenniemi. No. A/CN.4/L.682/Add.1(2006), para. 43, at 15.

[38] As expressed by Matz-Lück, "international law, e.g. a partial overlap of subject matters or common points of reference, and legal interrelation, e.g. rules on interpretation like Article 31(3)(c) VCLT, may lead to the consideration of norms which were created by one regime by the institutions of another. In particular the interpretation of treaties either by the parties or adjudicatory bodies offers the opportunity to specify the meaning of treaty norms by referring to other international rules and regulations, i.e. 'extrinsic norms'. The consideration of such norms as normative guidance in the process of interpretation raises a variety of questions concerning the reasons, the legal foundations and limits, the competent actors, the results, legitimacy, and benefits and disadvantages." Nele Matz-Lück, Norm Interpretation across

As expressed by Koskenniemi in the report of the fragmentation study group, the provision operates like a "master key" to the house of international law. In case there is a systemic problem – an inconsistency, a conflict, an overlap between two or more norms – and no other interpretative means provides a resolution, then "*recourse may always be had to that article in order to proceed in a reasoned way*."[39] Under this understanding of the principle of systematic integration, it appears that conflicting norms can be stretched considerably. Accordingly, the ILC Study Group Report prognosticated that systematic integration would ensure coherence of the system of public international law, despite regime proliferation and differences. As already stated, it is noteworthy that it drew these conclusions regardless of having merely anecdotally tested the suggestion in practical cases. The fragmentation debate has generally paid less attention to the relevance of other elements of treaty interpretation rules in addressing potential inconsistencies. As will be further discussed, other elements of the Vienna Convention treaty interpretation rules provide obligations, which essentially set limits on how far interpretations can stretch the meaning of terms, relating to linguistic elements, as well as context and purposes of the relevant treaties.

In this study the possibility for dissolving apparent inconsistencies between norms relating to deep-sea bioprospecting will be discussed from the viewpoint of the rules on application and interpretation, including systemic integration. As previously mentioned, this case study principally aims to establish what rules apply to this specific activity. However, it can also be seen as a practical test (albeit a limited one) of the systemic qualities of international law, which may provide new perspectives on the concept of fragmentation.

International Regimes: Competences and Legitimacy, in REGIME INTERACTION IN INTERNATIONAL LAW - FACING FRAGMENTATION (Margaret A. Young ed. 2012).

[39] Koskenniemi, Fragmentation of International Law - Report of the Study Group of the International Law Commission. 2006., at 211.

B. The marine bioprospecting process

B.1. Marine bioprospecting – a multifold activity

There is no generally agreed definition of *marine bioprospecting* in international law. In domestic legislation, the term is occasionally used, but varies significantly in meaning.[40] In this study, the concept is defined as *a process whereby commercially useful products are technologically derived, processed and developed based on the collection of marine genetic resources*. Other definitions have been suggested in the literature, as well as by international organizations. For instance, bioprospecting has been described in some previous academic work as a process whereby commercially useful products are derived from living resources.[41] A considerable weakness in this description is that it would include activities which, according to ordinary language, would be considered as other activities. For instance, it can be claimed that the conventional fisheries industry derives commercially valuable products from living resources simply by fileting, packaging and commercially distributing fish. Accordingly, in order to distinguish bioprospecting from other uses of marine resources, the technological element which is central to bioprospecting must be considered.

The OECD has defined marine bioprospecting as "the application of science and technology to living organisms from marine resources, as well as parts, products and models thereof, to alter living or non-living materials for the production of knowledge, goods and services."[42] This definition captures many of the central elements of the definition used here (albeit in an overtly technical language); in particular, it foregrounds elements of the technological process, which were lacking in the previous example. Yet, like the previous example, the OECD definition suffers from a lack of precision. Foremost, it contains no reference to commercial motivations or product development.

[40] In some domestic legislations relating to access and benefit-sharing obligations bioprospecting has been defined.

[41] Joanna Mossop, *Marine Bioprospecting*, *in* THE OXFORD HANDBOOK OF THE LAW OF THE SEA (Donald Rothwell, et al. eds., 2015).

[42] OECD, Marine Biotechnology Definitions, Infrastructures and Directions for Innovation 2017.

Under the OECD definition, any information gathering from marine organisms employing science and technology would qualify as bioprospecting. This would include virtually all marine biological research. Including conventional research in the definition of bioprospecting in this manner would have at least one notable shortcoming, insofar as it would go against the established legal concept of marine scientific research. As will be discussed in section C.1.5, marine scientific research (as opposed to bioprospecting) is rigorously defined in the law of the sea, and explicitly excludes activities involving legal claims relating to deep-sea resources. Since it would fail to capture one of the legally most interesting characteristics of marine bioprospecting – namely the interaction between scientific and commercial activities – it would be impractical to utilize as broad and imprecise a definition as suggested by the OECD.

Although bioprospecting has not been defined in a treaty, the Subsidiary Body on Scientific, Technical and Technological, a body under the Convention for Biological Diversity, has defined the term as the "*exploration of biodiversity for commercially valuable genetic and biochemical resources, or the process of gathering information derived from the biosphere, regarding the molecular composition of genetic resources for the development of new commercial products.*"[43] By including process elements, and emphasizing commercial ambitions involved while excluding "pure" research, this definition is more in line with the definition used in this study. However, it appears to be limited to cases in which information is derived from genetic resources and excludes processes where physical components from the genetic resource are included in the developed product. As will be further explored, the genetic resource can have both roles in bioprospecting processes.

Implicitly, the definition employed in this study thus makes a distinction: Not all scientific research on marine genetic resources is bioprospecting. Rather, there is conventional, "pure" marine scientific research on the one hand, and commercially motivated operations on the other. The latter may qualify as bioprospecting provided that they include a process of technological derivation. However, as will be discussed extensively, this distinction is difficult to maintain in practice, since results from conventional research can

[43] Marine and Coastal Biodiversity: Review, further elaboration and refinement of the programme of work. (2003), para. 49; Doc. UNEP/CBD/COP/5/INF/7, 2000, section 6.

be used as the basis for commercially motivated projects. Yet, this does not alter the fact that most marine scientific research lacks commercial ambitions and is never used in product development and can thus hardly be regarded as bioprospecting by virtue of its legal definition.

From a legal standpoint, the definition of the concept of bioprospecting, which is central for the purposes of this investigation, is complex and raises challenges in at least four regards. Firstly, it relates to a *process* and not an isolated action, which cannot be delimited to a singular moment. Rather, bioprospecting involves a number of steps and actions with legal implications. The concept thus goes beyond the carrying out of activities in the marine environment and relates to a broader product development chain. The process aspect is also where emphasis is put in the definition of bioprospecting. It does not set limitations in terms of what organisms are utilized, nor does it define the process as such. Large species, biomolecules, DNA constructs and marine micro-organisms can be used in industrial processes, synthesized or replicated in a lab. They may also be modified by human intervention and take on characteristics that do not exist in nature. Irrespective of the species and method employed in the process, it constitutes bioprospecting. The importance of the process element of bioprospecting has been supported by the UN Secretary-General in his 2007 report to the General Assembly:

> *While there is no universally agreed definition of bioprospecting (…) the term is generally understood, among researchers, as the search for biological compounds of actual or potential value to various applications, in particular commercial applications. This involves a series of value-adding processes, usually spanning several years, from biological inventories requiring accurate taxonomic identification of specimens, to the isolation and characterization of valuable active compounds. As a mere prospecting activity, bioprospecting is only the first step towards possible future exploitation and stops once the desired compound or specific property has been isolated and characterized.*[44]

Secondly, bioprospecting typically involves the use of derivatives or genetic information of living resources in product development, as opposed to selling organisms or parts thereof in bulk.

[44] See Oceans and the Law of the Sea: Report of the Secretary-General, Addendum, UN doc. A/62/66/Add.1, of 12 March 2007, para. 150.

As will be discussed, this element of retrieving information or derivation can differ between cases, ranging from directly using parts of organisms in products to applying one of their functions as inspiration for an element in a commercial product. In any event, the derivation criterion would exclude products for conventional food consumption from bioprospecting. Rather, taken together the *process* and the *derivation* elements of the definition imply an element of value being added between the extraction of the living resource and the final development of a product.

Thirdly, the definition involves a requirement for the product to be based on the *collection* of a living resources. As will be examined, this collection usually consists of very minor extractions of natural compounds. Commonly, such collecting operations are undertaken in a manner which is more akin to sampling in marine scientific research than conventional resource extraction such as fisheries, oil exploitation or marine mining. This nature of resource collection in bioprospecting raises particular challenges when applying international law rules on the utilization of marine organisms, since these are based on large-scale operations, such as conventional fisheries. Although genetic material collection samples in bioprospecting are usually minimal when compared to fisheries, nevertheless their environmental impact should not be disregarded. As opposed to fisheries, the most endemic and unique ecosystems are regularly targeted in bioprospecting for the diversity represented, since this implies increased prospects for finding new and useful bioactive functions. In such ecosystems, even small human involvement may have significant detrimental impacts. The degree as well as impact of collections of genetic material thus vary considerably in marine bioprospecting. Yet the collection of marine living resources is a central element of the concept.

Fourthly, the definition refers to a *commercial ambition*. This excludes projects with the sole ambition of advancing scientific knowledge. However, in reality, as will be discussed, in many cases it is difficult to distinguish exactly when a commercial ambition is introduced. It often appears that a collection undertaken for scientific purposes may subsequently be used for commercial purposes. The challenge of legally distinguishing the interplay between scientific research and bioprospecting has been noted by the UN Secretary-

General in his report to the General Assembly.[45] From a legal standpoint, this intricate relationship between science and biotechnology is particularly interesting in relation to how the rules on marine scientific research under the law of the sea apply to bioprospecting. As will be further discussed in section C.1.5, there are arguments for considering that these rules preclude operations including commercial ambitions.

These four requisites of the definition of marine bioprospecting give rise to questions as to how such operations are carried out, as well as how they ought to be interpreted legally. This section will be devoted to the former issues, in order to facilitate discussion of the latter. The practical nature of marine bioprospecting will thus first be investigated, that is, how it has developed and is being carried out. The main focus will be on aspects of particular legal interest. These include why marine organisms have been the subject of bioprospecting interest and what sort of organisms have been used, how bioprospecting has developed, the technology of such operations and the relationship between scientific research and commercial ambitions. In particular, the value chain of contemporary bioprospecting will be dissected in order to distinguish the different elements of such process. Taken together, these elements will set the scene and serve as the basis for the subsequent examination of the relationship between marine bioprospecting and international law.

Although products in a multitude of sectors may be developed based on marine bioprospecting, emphasis in this part will be on pharmaceutical development. This delimitation is based on practical and legal relevance. The pharmaceutical sector is where the most biotechnological development related to marine organisms has been carried out so far. It is also where the bulk of growth in blue biotechnology is expected to be.

---

[45] 'It is difficult to differentiate scientific research from commercial activities involving genetic resources, commonly referred to as bioprospecting. In most cases, genetic resources are collected and analysed as part of scientific research projects, in the context of partnerships between scientific institutions and industry. It is only at a later stage that knowledge, information and useful materials extracted from such resources enter a commercial phase. The difference between scientific research and bioprospecting therefore seems to lie in the use of knowledge and results of such activities, rather than in the practical nature of the activities themselves' See Oceans and the Law of the Sea: Report of the Secretary-General, Addendum, UN doc. A/60/63/Add.1, of 15 July 2005, para. 202.

Furthermore, the role of marine genetic resources in pharmaceutical development is multifaceted and highlights contentious issues in relation to the rules of international law.

As previously discussed, the predominant focus in the general investigation of international law in this study is the deep-sea areas beyond national jurisdiction. This focus will be maintained in this part too. However, bioprospecting processes do not differ depending on which jurisdictional zone marine components are collected in. Similarly, the description of historical and technological aspects in this part are general in nature.

B.2. Marine genetic resources and the commodification of nature

Although marine bioprospecting also involves other aspects, the exploitation of genetic resources for commercial purposes is a central and defining element. Bioprospecting thereby entails the reservation and commodification of the living world. Such appropriation of marine living organisms is nothing new; indeed, it is as old as human history. Anthropological evidence indicates that the direct use of the nutritional value of marine organisms may explain sapiens' rapid domination over other *homini* species, as well as its migration from Africa.[46] Indeed, in many cases the very same species used in bioprospecting have long been used in fisheries. However, the use of living organisms for bioactive functions enshrined in their genetic components rather than in their physical bodies' value marks a shift in human exploitation of nature. As observed by Guilloux, it represents a transition from an extraction economy to a knowledge economy. It may have similarities with scientific research, which has explored marine organisms for a long time, but the commercial nature distinguishes it from such use. The concept of bioprospecting of genetic resources necessarily combines scientific and economic elements, but typically focuses on commercial value. It also requires the involvement of several disciplinary and semantic fields. Accordingly, for bioprospecting purposes,

[46] Antonieta Jerardino & Curtis W. Marean, Shellfish gathering, marine paleoecology and modern human behavior: perspectives from cave PP13B, Pinnacle Point, South Africa, 59 JOURNAL OF HUMAN EVOLUTION (2010); Heather Pringle, The Brine Revolution, HAKAI MAGAZINE OF COASTAL SCIENCE AND SOCIETIES (2015).

marine genetic resources can be interpreted as biological objects, biotechnological objects and legal objects.[47]

From a biological perspective, the relevance of marine genetic resources for bioprospecting is strongly connected to the concept of biological diversity, or biodiversity as it is commonly called. This is because the rate of potentially interesting bioactive functions is highly dependent on and increases with the rate of genetic diversity. As will be further discussed in Part D, biodiversity has been referred to as an "*umbrella term for the degree of nature's variety.*"[48] It is generally understood as it is defined in Article 2 of the Convention on Biological Diversity: "*variability among living organisms from all sources including, inter alia, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part: this includes diversity within species, between species and of ecosystems*." As such, biodiversity signifies not only signify diversity of species, but diversity within species.[49] Intraspecies genetic variability, between individuals or populations, can be considerable and is essential in enabling species to adapt to environmental pressures.[50]

Accordingly, biodiversity cannot be interpreted as a fixed concept; the map of life is continuously transforming, as species adapt to changing environments or become extinct as a result of failing to modify. The diversity of life on Earth is thus intrinsically connected to the environment, and is developed in relation to it. This explains why biodiversity is not evenly divided on earth. Rather, it is significantly higher in certain habitats. Several such habitats with a high degree of biodiversity and that, remain particularly unchartered in the deep sea. These include the abyssal areas of hydrothermal vents, deep seabed sediments, cold seeps of continental margins and polar areas rich in plankton. Marine life is generally characterized by its significant genetic diversity. The seas and oceans which cover 71 per cent of the surface of the planet harbor 32 of the 34 phyla discovered on Earth, including 12 that are exclusively marine.[51]

[47] Bleuenn Guilloux, Marine genetic resources, R&D and the law 1 Complex objects of use (London Hoboken, NJ : ISTE-Wiley. 2018), at xii.

[48] Jeffrey A. (ed.) McNeely, Conserving the world's biological diversity (1990).

[49] The concept of biodiversity will be further discussed in section D.2.1.

[50] Michael Bowman, *The Nature, Development and Philosophical Foundations of the Biodiversity Concept in International Law*, *in* INTERNATIONAL LAW AND THE CONSERVATION OF BIOLOGICAL DIVERSITY (Michael Bowman & Catherine Redgwell eds., 1996), at 5.

[51] GUILLOUX. 2018, at xii.

From a biotechnological standpoint, the interest in marine genetic resources is strongly connected to technological developments of the past 50 years, which have enabled humans to disentangle bioactive functions from their host organisms and use them autonomously. The recognition and the use of bioactive functions is certainly not new. Desired properties in organisms have been cultivated by humans by means of breeding long before the advent of modern pharmacology. Subsequently, first-generation biotechnologies, and particularly the second-generation biotechnology based on genetic engineering and molecular biology, enabled the transfer of foreign genes to a cell in a culture or a tissue to obtain the appearance of a new property linked to the gene transferred. An oftcited example is the transfer of an anti-freeze-producing gene from a winter flounder to strawberries. Isolated from their host organisms in order to be modified, replicated and inserted into new living organisms, the components of the genetic system can again take part in life, in new and artificial forms. Genetic resources thus relate to the genetic information of organisms rather than the organism carrying the information. Indeed, biotechnology has allowed the emancipation of genetic information from individual species, to a state of increasingly free transfer of properties between species. With technological progress, that transfer has become smoother and cheaper. This has formed a new biotechnological perspective of life, as carriers of genetic information which is distinct from the traditional biological focus on species. Bruno Latour has described this as a transformation of life science, which focused on the study and passive representation of a given, real world, into technoscience, creating worlds from reality.[52]

Biotechnology however, has not altered the instrumental perspective of marine organisms. Like traditional resource extraction activities, the retrieval of genetic information focuses on values for human use. Yet, it has broadened and fundamentally transformed the instrumental value into an open range of possibilities. This is reflected in the definition of biotechnology used in Article 2 of the Convention on Biological Diversity: Biotechnology refers to "*any technological application that uses biological systems, living organisms, or derivates thereof, to make or modify products or processes for specific use.*"

[52] Bruno Latour, Science in action : how to follow scientists and engineers through society (Cambridge, Mass. Harvard Univ. Press. 1987).

As will be discussed under section B.6.1, the use of marine genetic resources in biotechnology can be divided into chemical substances or material produced by marine organisms which are used as natural products on the one hand, and marine genetic information of biotechnological value on the other.

Many of the instruments, as well as domestic laws and other contexts, in which the expression *genetic resources* has been used subsequent to the CBD fail to capture both these strands of using genetic resources. Some definitions do not take into consideration the informative aspect and only regard these resources as genetic material of any biological origin containing functional units of heredity.[53]

B.3. Research, development and bioprospecting

Whereas bioprospecting has the appropriation element in common with conventional resource extraction such as fisheries or mining, its technical nature is, as already indicated, more reminiscent of scientific research. Foremost, bioprospecting is markedly different from conventional resource extraction by essentially being qualitative in nature. Whereas economically viable quantities would be a prerequisite for fisheries and mining, such aspects are largely irrelevant in bioprospecting. Since biotechnology enables the sequencing and replication of desired properties, quality in genetic material is the relevant criterion in bioprospecting.

Should bioprospecting, then, be regarded as a type of research operation? Research and development includes, according to the OECD definition, any creative systematic activity undertaken in order to increase the stock of knowledge, as well as the use of this knowledge to devise new applications.[54] It is often divided into three activities: Firstly, basic research, defined as "*experimental or theoretical work undertaken primarily to acquire new knowledge of the underlying foundation of phenomena and observable facts, without any particular application or use in view.*" Secondly, applied research, "*directed towards a specific practical aim or objective.*" Thirdly, experimental development that consists of "*systematic work, drawing on existing knowledge gained from research and/or practical experience, that is directed to*

[53] GUILLOUX. 2018, at xvii.

[54] Frascati Manual - Proposed Standard Practice for Surveys on Research and Experimental Development. pt. 254 (2002).

producing new materials, products or devices; to installing new processes, systems and services; or to substantially improving those already produced or installed."[55] The common use of the term "research and development" is in itself evidence of the difficulty of distinguishing these activities. It is not just problematic to draw a line between the activities of fundamental research, applied research and experimental development. As a result of the blurred lines between different stages involved, it is similarly challenging to distinguish these research and development activities from subsequent technological innovation.[56] As with many other activities in the nexus between research and development, it is difficult to establish a standardized map of bioprospecting development cycles (an attempt will be made in section B.6.3). It is more easily approached as a process, where at least central elements would qualify for the OECD definition.

In the context of UNCLOS and its Part XIII on Marine Scientific Research, which will be further discussed in section C.1.5, marine bioprospecting highlights the difficulty of distinguishing marine scientific research from other activities (exploration, exploitation, prospecting). Similarly, it underlines the challenges of distinguishing scientific research conducted "in normal circumstances" from "research directly linked to the exploration and exploitation of biological resources." Part XIII does not define marine scientific research, nor does it understand such research as an activity undertaken by any economic player, private company or public establishment. It primarily relates to and provides obligations for research undertaken by states and competent organizations.[57]

This emphasis in the rules of marine scientific research in UNCLOS can be explained by the focus during the negotiations on procedures to be followed to obtain administrative authorizations required for states' oceanographic vessels to conduct marine scientific research in marine areas of another state.[58] The considerable weight devoted to such procedures is connected to the basis for the regulation of marine scientific research under UNCLOS: the right of

[55] Ibid.

[56] GUILLOUX. 2018, at xxxi.

[57] David Leary, International Law And The Genetic Resources Of The Deep Sea (Leiden - Boston: Martinus Nijhoff Publishers. 2010).

[58] Alfred Henry Adriaan Soons, Marine Scientific Research and the Law of the Sea (Diss. Utrecht. 1982).

coastal states by virtue of their sovereignty and jurisdiction to regulate marine scientific research conducted within their marine spaces. When marine scientific research is conducted in areas beyond the limits of national jurisdiction, the law of the research vessel's flag state is applicable, in line with the principles of flag state jurisdiction in the law of the sea.[59]

Considering the organization of marine bioprospecting, its funding, logic and directed purposes, it is often a mixed public-private partnership. Commonly, public research vessels and equipment are used in bioprospecting operations, and it is often strongly connected to public research programs, to the extent that it is often difficult to tell where scientific research ends and commercial bioprospecting begins. Similarly, its technical nature – particularly how its sampling and laboratory phases are carried out – is strongly reminiscent of traditional marine scientific research. It uses not only the same tools but the same knowledge. Often the same individuals involved in marine scientific research are also involved in bioprospecting. However, marine bioprospecting is not limited to physical access to genetic material. It encompasses the whole research and development chain, from in situ sampling and collection of genetic material specimens to subsequent laboratory investigation and development, which may occur on board research vessels, on shore and across borders. Moreover, it is increasingly common that marine bioprospecting development chains do not start with sampling in the marine environment, but by accessing genetic material stored in collections or libraries. A distinction is often made in the relationship to the genetic resources between material stored *in vivo*, *in vitro*, and *in silico*. Whereas bioprospecting *in vivo*, *in vitro* and *ex vivo* requires the supply of genetic material collected *in situ* and its conservation *ex situ*, the use of genetic material *in silico*, which appears to be increasingly common, implies having access to the genetic and biomolecular data of marine organisms that were sampled and sequenced without connection to the bioprospecting operation.[60] Such *in silico* information may be held in databases, patent descriptions, scientific publications and research and development contracts. The use of such resources, which greatly facilitates bioprospecting by circumventing the costly requirement for the supply of genetic material, may be restricted by different intellectual property rights or

[59] GUILLOUX. 2018, at xxxii.

[60] Arianna Broggiato, et al., Fair and equitable sharing of benefits from the utilization of marine genetic resources in areas beyond national jurisdiction: Bridging the gaps between science and policy, 49 MARINE POLICY (2014), at 176-185.

scientific research law requirements.[61] However, increasingly such data has become freely available as part of attempts to promote biotechnological development, as will be discussed in section B.6.

It thus appears that marine bioprospecting can hardly be described as a genuine research operation. Rather, it is a genuine research *and* development activity and is best understood as such. Yet, perhaps counterintuitively, this does not necessarily imply that bioprospecting would be considered as marine scientific research under the definition used in UNCLOS. As will be discussed in section C.1.5, marine scientific research under UNCLOS is essentially confined to pure or basic research and excludes operations with commercial ambitions.

Rather, marine bioprospecting can be interpreted as a process in which the first steps are often identical to or indeed represented by marine scientific research, as it is conventionally understood under the law of the sea. However, bioprospecting also involves additional steps relating to product development and marketing. These additional steps, in particular the commercial element, make it problematic to approach under the law of the sea. The commercial ambition is not unimportant and can be assumed to strongly influence how bioprospecting activities are carried out. "Pure" marine scientific research expeditions (lacking commercial ambition) are guided by the agendas of precisely defined research programs, connected to traditions at academic institutions and/or personal interest among central researchers, which will usually have gone to considerable lengths in obtaining funding for such cruises, a notoriously costly form of research. Marine bioprospecting, by contrast, is increasingly seldom based on direct physical marine sampling. Often this costly step can be surpassed by examining library collections and sequence data obtained by publicly funded programs. To the extent that marine bioprospecting directly engages in sampling cruises, it does not collect genetic material randomly. Rather, it targets specific ecosystems and species where previous findings indicate there is a possibility of finding commercially relevant genetic material. In essence, the commercial ambition of marine bioprospecting missions thus renders such operations comparable to a treasure hunt based on at least a sketchy map rather than a random exploration of the seas.

[61] GUILLOUX. 2018, at xxxii.

In conclusion, it appears that marine bioprospecting falls within the OECD definition of research and development, as a typical cooperation between the public research sector and the private biotechnology sector. It would be more difficult to consider this activity as falling within UNCLOS rules on marine scientific research. In addition to the focus on jurisdiction in the convention, as discussed above, this can be explained by the narrow perspective of the negotiators of UNCLOS as to what activities represent scientific research. The regulation of marine scientific research in Part XIII of UNCLOS is predominantly focused on pure or basic research, i.e. physical research activities carried out in the marine elements.

This reflects not only a narrower perspective of what represents scientific research operations around the time of the negotiation of the convention. As will be discussed in section D.1.6, the general spirit at the time of the drafting of UNCLOS, particularly the Third conference, was influenced by the new economic paradigm of the 1970s. At that time, large parts of the world were still ostensibly "socialist" politically and economically, and developing countries, largely lacking the technical capabilities to engage in marine scientific research, were unwilling to include any element of commercial ambitions in the definition of marine scientific research. This would not only risk resulting in the freeriding of commercial actors on the freedom of marine scientific research in the high seas. It would also, they feared, enable such actors to bypass the sovereign rights of states to economic resources in their coastal waters by freeriding on a facilitated access of scientific research across maritime areas of developing states' coastal waters. As a result, activities with commercial elements were excluded from the scope of marine scientific research.

B.4. Evolution, diversity and the bioactive properties of marine organisms

Why, then, are marine organisms in the deep seas beyond national jurisdiction the subject of interest for biotechnological product development? Marine life is generally more diverse and less explored than terrestrial life. This is particularly true of deep-sea organisms. Moreover, life in these areas has developed distinct characteristics because of the conditions in the deep seas. This section will describe the biological diversity of the deep sea and set out the reasons for the bioprospecting interest in such organisms. The vast ocean expanse beyond waters under national jurisdiction of costal states may appear

quite uniform with only rare traces of the diverse species, habitats and ecosystems located in the large domain. Its relatively featureless exterior and the seeming monotony of the deep ocean has long led scientists to believe that these were biological deserts. But it has now been established that these endless wave patterns conceal some of the world's most exceptional species and extraordinary habitats.[62] Moreover, the uniform high sea surface stands in stark contrast to the underlying seabed. The deep seafloor beneath the open ocean has a topography which is comparable in complexity to the terrestrial environment and hosts an abundant variety of living and non-living resources.[63]

It has been estimated that between 500,000 and 100 million species live in the deep-sea portions of the world's oceans. The overwhelming majority of these species remain undiscovered and are yet to be described.[64] For example, as much as ten per cent of the total living biomass on Earth exists as oceanic subsurface bacteria, most of it unidentified. The microbial and prokaryote gene richness found in the oceans is expected to be orders of magnitude greater than the rest of the biosphere.[65] This world, beyond the jurisdiction of states, is largely unexplored. The ratio of new discoveries in the deep ocean is 1:1 for each of the samples taken.[66] Some deep-sea habitats appear to be particularly abundant in biodiversity and (consequently) of interest for bioprospecting purposes. These will be described in section B.6.

The fact that life in the deep seas is so rich in number of species and remains largely unexplored is one compelling reason for the growing interest in the deep seas, namely for biological discovery, for both scientific and commercial purposes. However, there is another factor which is even more important for the interest in deep-sea life forms. Life in the deep seas has developed characteristics which are unparalleled in other areas of the biosphere. These characteristics of deep-sea organisms consist of bioactive functions with a high potential for being sourced for human therapeutic applications.

[62] Danovaro, et al., Trends in Ecology & Evolution (2014).
[63] WARNER. 2009, at 2-3.
[64] Richard J. McLaughlin, "*Marine Genetic Resources Exploitation and Intellectual Property Rights Protection*" in Davor Vidas, Law, technology and science for oceans in globalisation: IUU fishing, oil pollution, bioprospecting, outer continental shelf (Martinus Nijhoff. 2010), at 372.
[65] VAN DEN HOVE & MOREAU. 2007; McLaughlin. 2010.
[66] Arico. 2010.

This has prompted scientists to identify organisms in these areas as most promising for bioprospecting.[67]

Although numerous circumstances contribute to the development of bioactive properties, all of them are connected to a single overarching explanatory factor: Evolution. Life was born in the oceans more than three billion years ago; life developed on Earth only two billion years later. This means that most marine organisms do not have a terrestrial counterpart.[68] Marine biodiversity contains most phylogenetic and genomic diversity on Earth – 34 of 36 animal phyla hitherto described, versus 17 on land.[69] Marine life is markedly more diverse than life on land, not only in terms of number of species but equally in the differences between the genomes across species. Not surprisingly, peculiar bioactive functions are thus more common and different in marine species. This is mainly because of the time aspect. Evolution has had three times longer to develop into new species and unique functions in the sea, compared to on land. Moreover, the often-challenging conditions for marine life, which in many respects are more varied than on land, have functioned as a vehicle for the development of distinct bioactive properties. Nowhere else is this more evident than in the deep seas, where extreme pressures, temperatures, chemical exposure and darkness have made it necessary for organisms to develop the abilities not just to withstand but to thrive under such conditions. The marine environment has thus allowed the formation throughout evolution of complex organismic interactions and exceptional mechanisms in order to survive in extremely hostile environments. This has established a rich biodiversity, not only in terms of number of species, but also in terms of genetic diversity across species and bioactive functions.[70]

In what form does marine bioprospecting include such bioactive functions? Most projects relate to the discovery and exploration of metabolites, i.e. substances, usually in the form of small molecules produced during or taking

[67] Marcel Jaspars, et al., *The marine biodiscovery pipeline and ocean medicines of tomorrow*, 96 Marine Biological Association of the United Kingdom. Journal of the Marine Biological Association of the United Kingdom (2016).
[68] Gaia Raffaella Greco & Marco Cinquegrani, *The Global Market for Marine Biotechnology: The Underwater World of Marine Biotech Firms*, *in* GRAND CHALLENGES IN MARINE BIOTECHNOLOGY (Pabulo H. Rampelotto & Antonio Trincone eds., 2018).
[69] Sophie Arnaud-Haond, et al., *Marine Biodiversity and Gene Patents*, 331 SCIENCE (2011).
[70] Jaspars, et al., Marine Biological Association of the United Kingdom. Journal of the Marine Biological Association of the United Kingdom (2016), at 151.

part in the metabolism of organisms. Such metabolites can have various functions, including fuel, structure, signaling, stimulatory and inhibitory effects on enzymes, catalytic activity, defense and interactions with other organisms (e.g. pigments, odorants, and pheromones). In organic chemistry, a distinction is commonly drawn between primary metabolites on the one hand, and secondary metabolites on the other. A primary metabolite is directly involved in normal "growth," development, and reproduction. A secondary metabolite is not directly involved in these processes, but usually has an important ecological function. Examples include antibiotics and pigments.[71]

Metabolites with bioactive properties in organisms have been developed at different stages of evolution and refined for more than one billion years. Some metabolites are common to entire kingdoms, while others are unique to certain organisms. As an example of the former, it has recently been revealed that there are metabolites with immunosuppressant properties which appears to be common to all multicellular animals (metazoan phyla), including sponges, insects and mammals. In such cases, there is a clear indication that the relevant property was developed early in evolution. During the evolution of multicellular organisms, continuous selection made primary metabolites form secondary metabolites. Gradually, the metabolites have refined their function and become more selective and active.[72] By means of evolution, metabolites have thereby undergone a process which has refined its characteristics.

The largest number of marine-derived secondary constituents, including some of the most interesting drug candidates, has been provided by marine invertebrates that are sessile or slow moving and mostly lack morphological defense structures such as sponges, tunicates and certain mollusks.[73] One such group of organisms are sessile filter feeders, organisms which have developed properties that are particularly interesting for bioprospecting purposes. These animals are immobile throughout their life cycle, permanently attached to the seafloor and constantly filtering water from the surrounding environment.

[71] Divya Arora, et al., *Pharmaceuticals from Microbes - Impact on Drug Discovery*, *in* PHARMACEUTICALS FROM MICROBES: IMPACT ON DRUG DISCOVERY (Divya; Sharma Arora, Chetan; Jaglan, Sundeep; Lichtfouse, Eric ed. 2019).

[72] Werner E. G. Müller, et al., *Traditional and Modern Biomedical Prospecting*, 1 EVIDENCE-BASED COMPLEMENTARY AND ALTERNATIVE MEDICINE (2004), at 72.

[73] Peter Proksch, et al., *Bioactive Natural Products from Marine Invertebrates and Associated Fungi*, 37 PROGRESS IN MOLECULAR AND SUBCELLULAR BIOLOGY (2003).

Commonly, these organisms live in areas with a high abundance of life and in immediate proximity to other organisms, such as coral reefs and hydrothermal vents.[74]

Filter feeders are thus continuously exposed to pathogens throughout their life cycle. Moreover, they are physically unable to move away from such exposure. As described by one observer, this evolutionary strategy could be successful only if these animals had effective protection mechanisms against pathogens.[75] Among the compounds that function as defense mechanisms against predators, the arguably most pharmacologically interesting findings have been made. These protection mechanisms are composed of secondary metabolites that they produce for different purposes, not only as a defense against predators, but also in order to find reproductive partners and to compete against other organisms for limited space and resources. Not only are these organisms dissimilar to terrestrial life; the metabolites they produce lack analogues on land and are unique in chemical structure and biological activity.[76]

The reason for using the functions of organisms in bioprospecting is practical. Employing properties which have proved efficient in a natural environment over an extensive period of time as the basis for the development of biotechnological products allows developers to bypass basic research which would have been costly, if not impossible, to conduct autonomously.

The unique constructions and powerful bioactivities found in marine-derived molecules are being investigated for a range of commercial uses, which ought to be mentioned despite the delimitation of the present investigation to pharmaceutical research. Resources of particular interest include: pharmaceutical compounds and molecular probes; enzymes derived from bacteria living in extreme conditions, which may have applications in similarly extreme industrial conditions; environmental remediation agents for oil or chemical spills or waste treatment; sunscreens, agrochemicals, anti-foulants, dyes, enzymes for industrial and technological applications and food additives;

[74] Leary, et al., MARINE POLICY (2009), at 185.

[75] Müller, et al., Evidence-based Complementary and Alternative Medicine (2004).

[76] Jaspars, et al., Marine Biological Association of the United Kingdom. Journal of the Marine Biological Association of the United Kingdom (2016).

agents for manipulating desirable genetic traits to improve animal and plant mariculture.[77]

Although the potential for blue biotechnology development has been increasingly highlighted in recent times, bioprospecting is far from new. What is more, its development has been far from consistent. As will be discussed in the next section, human use of bioactive functions from marine organisms has oscillated wildly throughout our recent history.

B.5. The development of marine biotechnology

> *3.8 billion years of evolution have produced a very rich library of natural products, and scientists have really only started exploring and understanding these in the last 50 years.*[78]
>
> *—Paul Wender, Stanford University*

The concept of marine bioprospecting is neither new nor static. Moreover, as discussed in section B.1, it relates to a process rather than an isolated activity. This process, in turn, has gradually involved more advanced technological tools. In light of these dynamic aspects, the concept is most easily approached by exploring its development. As will be established, the modern history of pharmaceutical bioprospecting has fluctuated, depending on technological developments and general trends, which from time to time have made synthetic approaches more popular. It will therefore be examined how the concept of marine bioprospecting has developed, with an emphasis on modern history before going into the nature of more contemporary activities.

B.5.1. The origin of pharmaceutical bioprospecting

Although biotechnology-based innovation in general and the application of marine genetic resources in particular have been subject to increasing interest in recent years, human use of marine living resources for other purposes than

[77] David Farrier & Linda Tucker, *Access to marine bioresources: hitching the conservation cart to the bioprospecting horse*, 32 OCEAN DEVELOPMENT AND INTERNATIONAL LAW (2001), at 213-239.

[78] Suzanne Elvidge, *Bioprospecting at the poles*, CHEMISTRY & INDUSTRY (2011).

food consumption is far from new. The history of human use of marine genetic resources is particularly long in the pharmaceutical field.[79]

Marine natural products have been used since at least ancient times as a source of bioactive metabolites for human benefit. Whereas the history of synthesized medicine is brief, the use of living organisms as sources of medical compounds is documented since antiquity. The use in China and Japan of iodine-rich seaweeds to prevent goiter is documented as early as 1400 BC. In Ireland, the red algae *Chondrus crispus* and *Mastocarpus stellatus* were used as a folk cure for colds, sore throats, chest infections and bronchitis for several centuries.[80] Hippocrates, the "father of modern medicine," who lived in the 400s BC, is recorded as describing the therapeutic effects of various marine invertebrates and their constituents on human health.[81] Ancient use of bioactive compounds strongly resembles modern bioprospecting, and was based on the very same principles: Organisms produce metabolites as a protection against pathogens and humans, by means of pharmacological technology, can extract and concentrate such metabolites.[82]

Already in our earlier recorded history, humans thus learned to search for similar and more pronounced properties in related species, once bioactive functions had been identified in one organism. For all practical purposes, humans thus successfully managed to conduct empirical biomedical prospecting for natural compounds based on evolutionary principles well before empiricism and evolution were formulated in the early modern period.

Even if pharmacology until the 1950s was almost exclusively based either directly or indirectly on bioprospecting, using marine organisms as the basis for drug development was uncommon.

[79] Although marine genetic resources historically as well as currently certainly are used also for other purposes, such uses will not be discussed here in line with the general focus on pharmaceutical use in this study.

[80] Jaspars, et al., Marine Biological Association of the United Kingdom. Journal of the Marine Biological Association of the United Kingdom (2016).

[81] Hafiz Suleria, et al., Marine-Based Nutraceuticals: An Innovative Trend in the Food and Supplement Industries, 13 MARINE DRUGS (2015), Eleni Voultsiadou, Therapeutic properties and uses of marine invertebrates in the ancient Greek world and early Byzantium, 130 JOURNAL OF ETHNOPHARMACOLOGY (2010).

[82] Müller, et al., Evidence-based Complementary and Alternative Medicine (2004).

Throughout the history of pharmacology, bioactive components have overwhelmingly been sourced from terrestrial organisms. Exploration in the deep sea is a more recent endeavor. Even if deep-sea exploration started at the end of the 19th century with the British Challenger research expedition, it was not until the end of the 1970s that the long-held view that the deep seas were biological deserts started to come under revision.[83]

B.5.2. The 1950s and onwards – oscillations between bio-based and synthetic drug development

Although pharmaceutical companies have long been interested in acquiring and examining exotic specimens that might yield interesting biochemical compounds, they did not begin to systematically invest in natural products research programs until the 1940s. It appears that the initiative for business involvement came from the state. In the wake of the Second World War, a major initiative was launched to encourage pharmaceutical companies to collect and test a wider variety of soil samples obtained both domestically and internationally for mold with more effective strains of antibiotic properties. Whereas interest initially focused on soil samples, natural products research programs gradually expanded, to include the collection of higher plants, animals, insects, and, increasingly, marine organisms. The natural source of origin was less relevant than the prospect of finding novel biochemical compounds. Large-scale investment in natural products research was mostly confined to the major pharmaceutical companies. Corporate collecting activities during this period has been described as informal. To a large degree, product development was from the start based on donations of material from public collections.[84]

It was only after 1950, with the advent of modern scuba diving and new sampling technologies that scientists began to systematically explore the oceans for useful therapeutics.[85] During this decade, two nucleosides were

[83] Salvatore Aricò, Emerging and unresolved issues: the example of marine genetic resources of areas beyond national jurisdiction (Cambridge: Cambridge University Press. 2015), at 200.
[84] Bronwyn Parry, Trading the Genome: Investigating the Commodification of Bio-Information (Columbia University Press. 2004), at 104.
[85] Jaspars, et al., Marine Biological Association of the United Kingdom. Journal of the Marine Biological Association of the United Kingdom (2016).

discovered in sponges, which would later serve as the basis for the development of commercially important anti-viral drugs.[86]

The two compounds, spongouridine and spongothymidine, would subsequently give rise to the synthetic molecules commercialized in various anti-viral medicines. These include AZT, the revolutionary first drug to treat HIV infection (marketed as Zidovudine and Retrovir), as well as Acyclovir, the active component in the blockbuster Zovirax which has long been the standard treatment for herpes simplex virus infections, chickenpox, and shingles.[87]

The 1950s did not just mark the development of technologies which enabled marine bioprospecting. During the same decade, synthetic medicines, which had existed since the 1910s, for the first time were placed on an equal footing with natural product drugs, which had previously dominated pharmacology.[88] From this decade, rapid technological advancement in both synthetic and bio-based drug development led to parallel and alternate developments between the two approaches to pharmaceutical research. Indeed, the modern history of pharmaceutical development is marked by increasing oscillations between these strands of drug development.

Gradual and sudden technological breakthroughs and sector trends have thus, in a pendular movement, shifted the focus back and forth between synthetic and bio-based drug development since the mid-1950s. As will be discussed in this section, this has not only greatly impacted product development in the pharmaceutical sector; it also has considerable legal implications, as will be subsequently examined.

[86] The first marine bioactive compounds, spongouridine and spongothymidine, were isolated from the Caribbean sponge Cryptotheca crypta in the early 1950s; in the mid-1960s, scientists proved that they had an anti-cancer and anti-viral activity, United Nations Informal Consultative Process on Oceans and the Law of the Sea - An Update on Marine Genetic Resources: Scientific Research, Commercial Uses and a Database on Marine Bioprospecting. (2007); Peter Proksch, et al., *Drugs from the Sea - Opportunities and Obstacles*, 1 MARINE DRUGS (2003).
[87] GUILLOUX. 2018, at xi.
[88] Jean-Yves Ortholand & A. Ganesan, *Natural Products and Combinatorial Chemistry: Back to the Future*, 8 CURRENT OPINION IN CHEMICAL BIOLOGY (2004), at 271.

Despite the emergence of synthetic pharmacology, bioprospecting remained the dominant basis for pharmaceutical research for most periods during the postwar decades. Initially, the organisms serving as the basis for drug development were almost exclusively terrestrial. As the result of increased accessibility of the marine environment and enhanced examination tools, commercial and academic actors started to actively pursue bioprospecting in the marine environment in the early 1960s, by searching for useful biomolecules by harvesting and analyzing living organisms.[89] Such expeditions, however, were relatively limited and largely confined to coastal waters. In the 1970s, research on marine products accelerated and began to appeal to different disciplines, including biochemistry, biology, ecology, organic chemistry and pharmacology.[90] Among the first pharmaceutical products based on marine bioprospecting to be approved and reach the market was a drug to treat leukemia and non-Hodgkin's lymphoma, based on a compound isolated from the Caribbean sponge, which to this day remains a standard treatment for these diseases.[91]

B.5.3. From the discovery of hydrothermal vents through the dawn of the genomics era to the launch of negotiations on bioprospecting treaties

In 1977, scientists on board the submersible Alvin discovered sites near the Galapagos Islands where high-temperature fluids rich in reduced compounds pour out into the water column and which are host to unique seabed, or benthic, ecosystems.[92] Later research led to the discovery of other benthic ecosystems characterized by energy sources other than light, such as sediment and seep communities. Other discoveries revealed a wealth of different benthic habitats

[89] Daria Firsova, *Current Status and Perspectives in Marine Biodiscovery*, *in* BIOPROSPECTING SUCCESS, POTENTIAL AND CONSTRAINTS (Russell; Lima Paterson, Nelson ed. 2017), at 30.

[90] United Nations Informal Consultative Process on Oceans and the Law of the Sea - An Update on Marine Genetic Resources: Scientific Research, Commercial Uses and a Database on Marine Bioprospecting. 2007.

[91] It was estimated that in 2007 the global revenues for cytarabine (and vidarabine) amounted to $93 million. Cytarabine, the active compound in the drug was originally isolated from the Caribbean sponge, Cryptotheca crypta., PABULO H. RAMPELOTTO & ANTONIO TRINCONE, GRAND CHALLENGES IN MARINE BIOTECHNOLOGY (Springer International Publishing, Cham. 2018), at 265.

[92] ARICÒ. 2015, at 200.

and biodiversity hot spots in the deep oceans, including seamounts and cold- and deep-water corals. Pelagic environments, which are found in the water column, were also found to host a wide range of micro- and macro-organisms.[93] These discoveries had important implications for bioprospecting. It implied a drastic shift in perspectives of deep-sea areas; previously these parts of the oceans had largely been considered biological deserts and thus uninteresting for any activity relating to living resources. It now became apparent that not only were they full of life; it also appeared that deep-sea ecosystems were more diverse and contained organisms with properties that were unlike any other ecosystem.

The discovery of hydrothermal and other ecosystems with promising compounds was the first of two breakthroughs in the 1970s, which together formed the basis for the first wave of bioprospecting. The realization that marine ecosystems were more diverse and contained more useful compounds than previously thought coincided with the advent of new tools for collecting and technology for analyzing bioactive organisms. In the 1970s, methods for sampling and exploring DNA began to develop, as part of broader advancements in organic chemistry. This marked a giant leap in the exploration of life in general and for bioprospecting in particular. In 1977, the first full DNA genome of an organism was sequenced. However, these early sequencing methods were costly and time-consuming. Among the tools which propelled progress in these early years of marine bioprospecting, the development of high-resolution nuclear magnetic resonance spectrometers was an important factor.[94] Other facilitating factors were the technological evolution of scuba diving and underwater exploration (in particular the introduction of remotely operated underwater vehicles), as well as the general progress made in molecular biology of the late 1970s.[95] Taken together, this enabled exploration of inaccessible areas and a research shift from large creatures to micro-organisms.

[93] Marine biological diversity beyond areas of national jurisdiction - Environmental, scientific and technological aspects. (2017) Marine biological diversity beyond areas of national jurisdiction Environmental, scientific and technological aspects http://www.un.org/depts/los/biodiversityworkinggroup/webapge_environmental,%20scientific,%20technological.pdf.

[94] Gu-Ping Hu, et al., Statistical Research on Marine Natural Products Based on Data Obtained between 1985 and 2008, 9 MARINE DRUGS (2011), RAMPELOTTO & TRINCONE. 2018, at 262.

[95] Rampelotto & Trincone. 2018 at 263.

B.5.4. The dawn of the genomics era

With the development of the second generation of high-throughput sequencing methods in the 1990s, DNA technology started to have a profound impact on commercial bioprospecting. This was chiefly because these new methods enabled entire genomes to be sequenced at once. In 1995, a major contribution to the field occurred with the availability of the complete genomic sequence of the first living bacterium. This marked the launch of microbial genomics.[96] Hundreds of microbial genomes have been completely sequenced and published since. The advent of functional genomics, which implies the study of DNA at the gene level with the aim of understanding the relationship between the genome and phenotype of an organism, enabled bioprospecting to go beyond merely describing genomes by actually *characterizing* whole genomes in detail. Such functional assessments are commonly conducted by employing large-scale studies of proteins.[97]

Moreover, they employ devices that integrate several laboratory functions on a single integrated circuit.[98] This marked a radical improvement for bioprospecting, since it was now possible to draw accurate manuals and not merely maps of organisms. In more concrete terms, the development of these technologies marked a breakthrough in three respects: quantity, quality, and flexibility. On the quantitative side, these new and refined methods enabled for the first time expedient analysis of large amounts of biological material. Where quality is concerned, these breakthroughs not only brought about greater reliability and precision in analysis, but also revealed the extent of diversity across selections of microbial species.[99] As regards flexibility, they facilitated the identification of genes that are turned on or off under different environmental conditions on a genome-wide scale. Moreover, advances in gene technology have facilitated expedient screening programs for new compounds through the development of more advanced *in vitro*[100] assays.[101]

[96] Ortholand & Ganesan, Current Opinion in Chemical Biology (2004).
[97] Commonly referred to as proteomics.
[98] Commonly referred to as microarray technologies or lab-on-a-chip.
[99] Karen E. Nelson, *Genomics*, *in* MICROBIAL DIVERSITY AND BIOPROSPECTING (Alan T. Bull ed. 2004).
[100] Cloned plants in vitro In vitro (meaning: in the glass) studies are performed with micro-organisms, cells, or biological molecules outside their normal biological context.
[101] ROLF D. SCHMID (Wiley. 2003); Leary, et al., MARINE POLICY (2009), at 189.

As the result of these and related scientific and technological breakthroughs in the late 20th century, many human metabolic processes became deciphered, enabling understanding or founding substantiated hypotheses not only about the cause of disease but also in relation to how metabolic processes in other organisms may prevent disease. This was a seismic shift for pharmaceutical bioprospecting. Useful functions of natural compounds could now be identified and understood to an unprecedented extent. These increased possibilities transformed the questions set out to be investigated in the screening of organisms. In classical pharmacological approaches of phenotypic screening, it is first established what eventual effect is searched for in the cells or the whole organism, and the assay is set up to read out on that phenotype, without considering how any given compound manages to do so.[102]

With the possibilities offered by the new technology, scientists as well as the pharmaceutical industry were no longer satisfied with the knowledge that a sample may evoke a desired biological response, the basic question of classical pharmacology. A growing number of projects started to investigate why and how organisms function in a certain way in laboratory analysis rather than merely establishing an effect. Analysis of bioactive compounds increasingly went beyond classical pharmacological approaches of phenotypic screening.[103] In addition, new biochemical mechanisms of screening were developed. These new methods were largely modeled in line with the "one drug – one target" paradigm for drug discovery, which came to dominate the development strategies of the biotechnology industry.[104] These target-directed screening methods are commonly guided by the ambition to affect a protein or pathway, which has been considered to have therapeutic potential in previous studies. Assays are then set up to specifically investigate that mechanism.[105] Among other things, the new methods enabled the isolation, measuring of activity and quantitative inhibition of enzymes from intact cells.

[102] G. Moffat John, et al., Opportunities and challenges in phenotypic drug discovery: an industry perspective, 16 NATURE REVIEWS DRUG DISCOVERY (2017).
[103] More precisely defined, phenotypic screening is a type of screening used in biological research and drug discovery to identify substances such as small molecules, peptides, or RNAi that alter the phenotype of a cell or an organism in a desired manner., Joanne Kotz, *Phenotypic screening, take two*, 5 SCIENCE-BUSINESS EXCHANGE (2012).
[104] Robert P. Borris, *Bioprospecting: An Industrial Perspective*, *in* BIOPROSPECTING SUCCESS, POTENTIAL AND CONSTRAINTS (Russell; Lima Paterson, Nelson ed. 2017).
[105] GRAHAM L. PATRICK, AN INTRODUCTION TO MEDICINAL CHEMISTRY (Oxford : Oxford University Press Sixth edition. ed. 2017).

The initial goal when conducting laboratory analysis in bioprospecting projects with these modern technologies is usually to separate the interesting small molecules from the rest of the biomass. Equipment to perform such operations soon became automatized and cheaper. This development of biochemical assays enabled natural product research in industrial environment. Large screening programs were now developed with extraction protocols optimized for different types of organisms. This level of standardization generated samples with comparability to all other similar samples in the extract collection, enabling a rapid increase in libraries of bioactive compounds. Some organizations chose to retain bulk samples of all extracts in a library, ready to be re-evaluated as new assays were developed. Others did not store physical samples, but retained digitalized analytical output.[106]

B.5.5. The bioprospecting momentum of the 1990s

These technological breakthroughs and the ensuing increase in bioprospecting generated widespread optimism in the commercial bioprospecting sphere as well as in academia. A review of scientific research interest in marine genetic resources also reveals a rapid rise in research interest and output. Whereas there had been 108 publications related to marine biotechnology by 1980, there were 700 scientific publications were published between 1994 to 1996 in USA alone.[107] This was paralleled with and contributed to increased interest in the protection of biodiversity on the political side, manifested by the Rio Summit of 1992. Although less instrumental concerns should not be disregarded, the greater political interest in biodiversity protection can be explained to a large degree by the realization that biological diversity constituted a substantial value. In particular, the agreement that Costa Rica had struck with Merck in 1991 on access to genetic resources within its jurisdiction had propelled the hopes among developing states for generating substantial income from pharmaceutical bioprospecting of their biodiversity.[108]

[106] Borris. 2017.

[107] Leary, et al., MARINE POLICY (2009), at 185; OECD, Marine Biotechnology: Enabling Solutions for Ocean Productivity and Sustainability. 2013, at 14.

[108] Sang Park, Biodiversity prospecting: Pharmaceutical investment in Costa Rica, 17 HARVARD INTERNATIONAL REVIEW (1995); Diane Gershon, If biological diversity has a price, who sets it and who should benefit? (Merck & Co's agreement with Costa Rican scientists), 359 NATURE (1992); Michele Zebich-Knos, Preserving Biodiversity in Costa Rica: The Case of the Merck-INBio Agreement, 6 THE JOURNAL OF ENVIRONMENT & DEVELOPMENT (1997).

The Rio Summit of 1992 marked the signing of the Convention of Biological Diversity, which can be regarded as the legal component of the biodiversity boom of the 1990s.[109] The dynamics and material development of these negotiations are discussed in more detail in section D.2. It is worth noting here, however, how the optimism in the biotechnology sphere in the years around the Rio Summit was the very impetus behind the negotiations in international law on rules on the use of genetic resources.

At the time of its negotiation, and in the decade after its adoption, there was a widespread belief that a boom for bio-based innovation was imminent.[110] Not least on the marine side, bioprospecting was expected to grow rapidly as a commercial sector. In 1996, Lyle Glowka published *The Deepest of Ironies*, which highlighted the potential value of the biodiversity of the deep seabed. Poignantly, Glowka argued that the deep-sea regime of UNCLOS, which had entered into force only two years earlier, was already outdated by focusing on managing the potential value of mineral rather than biological resources.

The call for the development of new legal frameworks to regulate the benefits of biological resources would, however, materialize in environmental law before the law of the sea. In 2002, ten years after the Rio Summit, the negotiation of what would become the Nagoya Protocol of the Convention on Biological Diversity would start and eventually be adopted another decade later. In parallel, the Ad Hoc Open-ended Informal Working Group to study issues relating to the conservation and sustainable use of marine biological diversity beyond areas of national jurisdiction was established in 2006 to, among other things, discuss the access to marine genetic resources under the law of the sea.[111]

[109] Borris. 2017.

[110] Fiona McConnell, The Biodiversity Convention: A Negotiating History (Kluwer Law International, 1996).

[111] United Nations General Assembly resolution 74/19, Oceans and the law of the sea, A/RES/74/19 (10 December 2019), available from undocs.org/en/A/RES/74/19 § 19 (United Nations General Assembly ed. 2019).

B.5.6. Downturn in bio-based drug development

The heyday of bioprospecting around the end of the 20th century was to be short-lived. Ironically, the launching of negotiations on the regulation of bioprospecting and genetic resources coincided with a sudden decline in commercial interest. This again was predominantly the result of a technological shift. Around the turn of the millennium, high-throughput screening technology outpaced the rate of compound supply for the first time.

This was not the result of a new type of technology; rather it grew out of the development, refinement and new application of the tools which had enabled the first generation of genome analysis. The same technologies which had facilitated the bioprospecting boom of the 1990s began to be deployed in a novel manner in the following decade. As sequence costs and process times decreased, it appeared more rational and cost-effective to screen large amounts of synthetic compounds for desired properties than expensive and often disappointing sampling of organisms. The rapid enhancement of screening caused product developers to question whether natural compounds were even necessary. Why bother collecting natural molecules with potentially interesting functions if synthetic molecules can be screened for the same function *en masse*?[112]

With the refinement of the high-throughput screening methodologies, it became possible to synthesize and test millions of molecular constructions for biological activity. This method, based on chemical library screening, is commonly referred to as *combinatorial chemistry*, and thus essentially prioritizes quantity in synthetic compound over quality in organic samples.[113] Whereas bioprospecting is built on the screening of natural sources, combinatorial chemistry is thus based on the screening of synthetic libraries against biological targets.[114] The basic approaches are thus converse. With the development of combinatorial chemistry, the pharmaceutical industry accordingly moved away from screening natural sources, in favor of setting up and screening huge synthetic compound libraries.[115]

[112] Borris. 2017.
[113] Ibid.
[114] Rampelotto & Trincone. 2018.
[115] Emma Marris, *Marine Natural Products: Drugs from the Deep*, 443 NATURE (2006); Ortholand & Ganesan, CURRENT OPINION IN CHEMICAL BIOLOGY (2004) at 271.

In an astonishingly short period of time, major pharmaceutical companies decided to cancel investments in collecting natural compounds and dismantle bioprospecting programs, projects which had been sites for costly investments during the previous years. Major pharmaceutical companies such as GlaxoWellcome, SmithKlineFrench and Pfizer phased out their natural product portfolios.[116] In the 2000s, most if not all in-house natural products programs in big pharmaceutical companies in the United States had ceased to exist.[117] These decisions were taken despite an increase in research output in marine biotechnology around the early years of the decade. Between 1999 and 2004, a host of scientific articles were published describing the anti-tumor and cytotoxic properties of numerous marine natural products. The marine pharmacology literature highlights that the discovery of novel marine anti-tumor agents continued at the same high level between 1998 and 2004.[118]

Other factors besides the advent of combinatorial chemistry also contributed to the difficulties of bioprospecting being able to compete with combinatorial chemistry.[119] Building up and maintaining high-quality collection of natural product extract was considered expensive. Bio-based drug development was also seen to be too time-consuming in light of the difficulties in identifying the active component, which persisted in light of technological developments. Another weakness was the lack of certainty that an active natural component would be novel, once it was isolated, which would rule out patentability. Similarly, the complexity of natural compound proved a challenge to product development since it made it difficult to scale up minor natural components.
Last but not least, legal intellectual property issues were raised as a hurdle to bioprospecting as many states became increasingly protective of their biodiversity and negotiations for access were often complex.[120]

[116] Some actors, such as Merck and Novartis did however not altogether abandon bioprospecting. Ortholand & Ganesan, CURRENT OPINION IN CHEMICAL BIOLOGY (2004) at 272.
[117] Borris. 2017.
[118] Leary, et al., MARINE POLICY (2009), at 185.
[119] These have been discussed extensively in Ortholand & Ganesan, CURRENT OPINION IN CHEMICAL BIOLOGY (2004) as well as in Russell T. Hill & William Fenical, *Pharmaceuticals from marine natural products: surge or ebb?*, 21 CURRENT OPINION IN BIOTECHNOLOGY (2010).
[120] Gordon M. Cragg & David J. Newman, *Natural Products: A Continuing Source of Novel Drug Leads*, 1830 BIOCHIMICA ET BIOPHYSICA ACTA (2013).

More generally, this backlash against bio-based development has been explained as a reaction to the inability of bioprospecting to deliver on the exaggerated expectations formulated during the genomics boom of the 1990s. At least in the short term, it proved harder to develop products based on bioprospecting despite the breakthrough in sequencing. Not only had corporate expectations been inflated, the expectations of financial returns in the source countries for biological resources had also been widely exaggerated. In particular, developing countries in tropical regions had started to regard their biodiversity as an asset that would yield substantial income. Lack of expedient clinical development thus led to disappointment with bioprospecting-based research and a sharp turn to combinatorial chemistry in pharmaceutical development. In the short run, the new technologies of the genomics era failed to deliver pharmaceutical output as expected, leading to a backlash.

Still, there were some success stories in the first wave of marine genetic resource-based drug development. Among marine biotechnology products developed, a considerable portion of which continue to be used, most were derived from invertebrates (sponges, tunicates, mollusks, and bryozoans).[121] The area of application for these products varies, but cancer, pain and inflammatory disease appear to be the most common.[122]

B.5.7. Unfulfilled promises of combinatorial chemistry and renaissance of bio-based development

The rapid increase in interest and investment in combinatorial chemistry bore some striking similarities to the bioprospecting boom of the 1990s. Ironically, it would also prove equally disappointing. It was assumed that provided that large enough libraries were screened, useful leads would emerge.
This placed emphasis on compound numbers rather than qualitative aspects.[123] However, this shift did not reverse the trend of reduced output of pharmaceutical research programs across the board. From the highpoint in the late 1980s, the trend in output of research programs of the pharmaceutical industry was disappointing. The number of new chemical entities per year went down by almost two thirds over the following 20 years.[124]

[121] Proksch, et al., MARINE DRUGS (2003).
[122] Leary, et al., MARINE POLICY (2009), at 186.
[123] Ortholand & Ganesan, CURRENT OPINION IN CHEMICAL BIOLOGY (2004), at 272.
[124] Cragg & Newman, BIOCHIMICA ET BIOPHYSICA ACTA (2013), at 3679.

This was paralleled by a decline in the number of new drugs approved, going down from about 40 per year in 1981 to 20 in 2007. As illustrated by the disappointing record of development of novel products, combinatorial chemistry did not manage to create the multitude of successful products envisaged.[125] One observer has described the challenge facing combinatorial chemistry as chemists having the building blocks but lacking the instructions to put them together in a manner that provides benefits.[126] Though various factors have been blamed for this downturn, declining interest in natural products on the part of major pharmaceutical companies, in favor of new chemical techniques such as combinatorial chemistry for generating molecular libraries, has been raised as a major explanatory factor.[127] In short, combinatorial chemistry failed to keep up with the capacity of nature to create new structures with complex molecular diversity.[128]

Two decades after the advent of combinatorial chemistry, half of the ten best-selling drugs in the US were still derived from secondary metabolites originally isolated from micro-organisms or plants.[129] The realization that combinatorial chemistry did not render nature-based pharmaceutical development irrelevant caused the pendulum to swing back, in favor of bioprospecting projects in the late 2000s and early 2010s. Increasingly, researchers and biotech development actors agreed that the natural world offers a manual for pharmaceutical development.

Whereas artificial combinatorial chemistry is efficient in exploring a multitude of potential functions, it does so seemingly at random. The natural organism, on the other hand, has conducted the same screening by means of natural combinatorial chemistry for hundreds of millions of years.[130]

[125] Ibid.
[126] "A small collection of smart compounds may be more valuable than a much larger hodgepodge collection mindlessly assembled", See Danishefsky in Bhargava Karumudi, Natural Product Drug Discovery, 2 JOURNAL OF PHARMACOGNOSY & NATURAL PRODUCTS (2015); Cragg & Newman, BIOCHIMICA ET BIOPHYSICA ACTA (2013).
[127] Cragg & Newman, BIOCHIMICA ET BIOPHYSICA ACTA (2013), at 3679.
[128] Garber Ken, *Peptide leads new class of chronic pain drugs*, 23 NATURE BIOTECHNOLOGY (2005).
[128] Leary, et al., MARINE POLICY (2009), at 190.
[129] Cragg & Newman, Biochimica et biophysica acta (2013).
[130] Karumudi, Journal of Pharmacognosy & Natural Products (2015).

This is illustrated by the South Pacific cone snail, which uses a highly effective peptide toxin to paralyze its prey. The toxin is a mixture of 100 or more venoms produced by the combinatorial mixture of amino acids that has taken place over 30 to 50 million years of cone snail evolution.[131] Moreover, there is not one but over 500 species of cone snails, each able to produce more than a hundred unique toxins, with the possibility of being used to treat as varied conditions as pain, epilepsy and incontinence.[132] As exemplified by the cone snails, evolution produces a gradual refinement of useful bioactive properties which are complex and difficult to develop synthetically. It has been increasingly recognized that in many cases, not even the highly efficient throughput of combinatorial chemistry can match this process of natural selection.[133] The anti-cancer drugs Halaven/Eribulin and Aplidine are other examples of successful bioprospecting drugs with big market potential.[134]

In addition to these success stories,[135] another factor contributed to a renewed discussion around 2010 of the benefits of approaches based on marine organisms: The disappointment with combinatorial chemistry development output. Although synthetic approaches were by no means abandoned, a widespread recognition emerged, as expressed by Faulkner, that even if pharmacological research involving marine organisms is slow and has other disadvantages, "*the number and quality of the leads generated more than justify research on marine pharmacology*."[136]

[131] Originating in the isolation of structurally unique secondary metabolites identified in the venom of the cone snail, the drug *Zicotonide* was made available on the market in 2004. Derived from the venom of the cone snail, Zicotonide is used for the treatment of severe chronic pain and pain management in general.

[132] Ken, Nature Biotechnology (2005).

[133] Leary, et al., MARINE POLICY (2009), at 190.

[134] After already having been used extensively on orphan basis, Halaven/Eribulin was given approval in 2010. The active substance originates in the demosponge *Halichondria okadai*. Aplidine was granted orphan status in 2003. This compound was isolated from the Mediterranean tunicate *Aplidium albicans* and has shown activity against certain types of tumour (medullary thyroid carcinoma, renal carcinoma, melanoma, and tumors of neuroendocrine origin) and has also been reported to inhibit the secretion of vascular endothelial growth factor related to angiogenesis. RUSSELL PATERSON & NELSON LIMA, BIOPROSPECTING: SUCCESS, POTENTIAL AND CONSTRAINTS § 16 (David L. Hawksworth, et al. eds., Cham: Springer International Publishing. 2017), at 9.

[135] Product development will be further discussed in section B.6.2.

[136] D. Faulkner, *Marine Pharmacology*, 77 ANTONIE VAN LEEUWENHOEK (2000).

In line with this shift in perspective, a second wave of marine bioprospecting began, pioneered by projects in the seas around Australia and New Zeeland, later spreading to other regions, including Ireland, Scotland and Norway.[137] In addition to being the result of disappointment with combinatorial chemistry, two major novelties facilitated the return to bio-based development.[138]

B.5.8. Blurring the line between synthetic and bio-based development: The introduction of genetic engineering

Firstly, the "renaissance" in marine drug discovery in recent years has, as discussed, occurred largely as the result of technological developments that have enabled developers to much faster determine the molecular structure of novel chemical and biochemical entities. Moreover, technological developments have facilitated screening and the use of marine microbial genomics to provide biosynthetic pathways for the production of marine natural products.[139] Metagenomic libraries and whole-genome shotgun sequencing (which makes it possible to search for genetic resources directly in "environmental samples" rather than in individual organisms) has led to rapid advances in biotechnology developed from marine genetic resources and has been described as the most important aspect of new technologies in spurring the current interest in marine bioprospecting.[140]

Moreover, further developed gene technology enabled more refined analysis of bioactive compounds. In particular, the return to bioprospecting was promoted by the advancement of recombinant DNA techniques, which enabled genetic engineering, gene cloning and synthetic biology.[141]

[137] Firsova. 2017, at 30.

[138] See, for a brief but succinct description of the causes for the renaissance in marine bioprospecting Marris, NATURE (2006).

[139] Keith B. Glaser & Alejandro M. S. Mayer, A renaissance in marine pharmacology: From preclinical curiosity to clinical reality, 78 BIOCHEMICAL PHARMACOLOGY (2009).
Jaspars, et al., Marine Biological Association of the United Kingdom. Journal of the Marine Biological Association of the United Kingdom (2016);Glaser & Mayer, Biochemical Pharmacology (2009), at 151.

[140] Leary, et al., MARINE POLICY (2009), at 185.

[141] Tadeusz F. Molinski, et al., *Drug development from marine natural products*, 8 NATURE REVIEWS DRUG DISCOVERY (2008).

Genetic engineering is the formation of combinations of heritable material by the insertion of nucleic acid molecules produced by whatever means outside the cell into (most frequently) virus or bacteria, so as to allow their incorporation into a host organism in which they are capable of continued propagation. Gene technology thereby implies the modification of the genetic properties of an organism by use of recombinant DNA technology.[142] These technologies are commonly used on the basis of naturally occurring compounds, which are modified by using an integrated combination of engineering, nanobiotechnology and genetics.[143]

Such tools have not only made bioprospecting less costly and time-consuming; they have also transformed the conditions for marine bio-based pharmaceutical research by bringing about new elements of flexibility. By enabling the manipulation of natural compounds at different stages of development, the new gene technology blurs the line between synthetic research and bioprospecting. The very term "synthetic" in synthetic engineering comes from the fact that the resulting natural product comes out of an organism where a desired compound has been articulated by synthetic methods. The compound is thus not entirely artificial. Rather, the genetic code of an organism has been manipulated so that the compound is exhibited in quantities or levels that are not found in nature.[144]

In fact, in most cases of successful drug development in marine bioprospecting, natural compounds have been modified by means of such technologies according to estimates.[145] From the eight compounds currently on the market, only three became drugs without any modification of the original natural molecule, while the rest suffered lead optimization, in different steps of their development.[146]

[142] Leary et al., "Marine Genetic Resources: A Review of Scientific and Commercial Interest, at 191.

[143] Warzecha H. Kayser O., Pharmaceutical Biotechnology (Wiley-VCH. 2012), at 9-11.

[144] Leary et al., "Marine Genetic Resources: A Review of Scientific and Commercial Interest, at 192.

[145] Ana Martins, et al., Marketed Marine Natural Products in the Pharmaceutical and Cosmeceutical Industries: Tips for Success, 12 MARINE DRUGS (2014).

[146] The only drugs where the natural compound appears in the marketed drug without such modification appears to be Prialt, Yondelis and Carragelose. Products developed are further discussed in section B.6.2.

As the result of these developments, the contemporary return to marine bioprospecting is in many ways different from the first wave of bioprospecting in the 1990s. When bioprospecting was first addressed as an activity in the 1990s, a clear distinction was made between purely academic and purely commercial ends concerning the use of biological diversity.[147] Since 2002, this distinction has become more and more blurred, as it has become increasingly common for academic and private activities to include commercial aims in collecting and conducting research on biodiversity.

Many research projects of the ongoing second wave contain elements of both bioprospecting and synthetic development. This has prompted some observers to suggest that these projects cannot be considered as bio-based, thereby implicitly questioning whether it qualifies as bioprospecting.[148]

On the other hand, for purposes of the definition of bioprospecting, operations including an increasing artificial component would not be disqualified from its scope: As long as the elements of genetic engineering are introduced after a naturally occurring biological component has been sampled, the basis for innovation remains unchanged. Still, it is clear that an increasingly blurred line between synthetic and biology-based pharmaceutical development calls for a reconsideration of traditional assumptions about pharmaceutical development as being either synthetic or based on bioprospecting.

A review of the basis for pharmaceutical product development in recent years supports the contention that it is becoming increasingly difficult to distinguish between bio-based and synthetic biotechnology development. In a survey of approved agents during the period of January 1981 to June 2006 for all diseases worldwide, efforts were made to distinguish between six categories of drugs, ranging from unmodified natural products to synthetic compounds with no natural product conception.

[147] Morten Walløe Tvedt, *Patent law and bioprospecting in Antarctica*, 47 POLAR RECORD (2011).

[148]Peter Glasner, et al., New Genetics, New Social Formations (Routledge. 2014).

While 66 per cent of the 974 small-molecule new chemical entities were formally synthetic, the analysis indicated that 17 per cent corresponded to synthetic molecules containing pharmacophores derived directly from natural products. Furthermore, 12 per cent were considered to actually model or mimic a natural product inhibitor of the molecular target of interest. Thus, only 37 per cent of the 974 new chemical entities were deemed to be truly synthetic (i.e. devoid of natural inspiration).[149]

Accordingly, in many biotechnology projects, the innovation chain contains synthetic elements although naturally occurring compounds are also involved. To make things even more complex, a substantial part of developed products contains elements which are synthetic but designed to imitate naturally occurring functions. As such, the line between bioprospecting research and synthetic pharmaceutical development is becoming blurred. As will be discussed in section B.6, this raises some challenges in the adoption of existing legal frameworks which are based on outdated perceptions of pharmaceutical research. Foremost, it connects to an increasingly important legal question – namely, whether a project in which the biological component or natural environment connected step is minimal and the lion's share of the value chain lies in the development should be interpreted differently compared to one in which the processing in the product development merely amounts to the packaging of a genetic resource.

B.5.9. An increasing role for publicly financed bioprospecting

The resurgence of bioprospecting was also facilitated by the fact that despite declining commercial interest in bioprospecting around the year 2000, publicly funded interest in sampling marine biodiversity persisted. Paradoxically, the dismantling of major commercial activities in the field notwithstanding, the rate of discovery of interesting natural compounds increased rapidly around the turn of the millennium, as persistent academic interest developed and used ever finer diving technology and molecular biology.

[149] In considering disease categories, close to 70% of anti-infectives (anti-bacterial, anti-fungal, anti-parasitic, and anti-viral) were classified as naturally derived or inspired, while in the cancer treatment area, 77.8% were in this category, ERNESTO FATTORUSSO, et al., HANDBOOK OF MARINE NATURAL PRODUCTS (Ernesto Fattorusso, et al. eds., Dordrecht: Springer Netherlands 2012 ed. 2012), at 1316.

For every year since, thousands of new active compounds from marine organisms have been extracted and described. Around 2006, a general database of marine natural products reported about 15,000 compounds derived from around 3,000 marine species. By 2009, the number of such findings had increased to 22,000.[150] As of 2016, the number of potential compounds isolated from marine organisms exceeded 28,000 with hundreds of new compounds being discovered every year.[151] It thus appears clear that the rate of description of new marine organisms with potentially interesting properties has been relatively constant, irrespective of the fluctuations of commercial interest in bioprospecting. Accordingly, the line of described compounds which have not been used in biotechnology product development trials has increased. It is therefore not surprising that during the recent return to bioprospecting, the actual sampling conducted by the pharmaceutical industry has been more limited. Since so many interesting compounds have already been collected, it may be more rational to harvest those collections than to undertake costly new sampling ventures. From a legal standpoint, this division of the innovation chain raises some thorny challenges.

Where an entity distinct from biotechnology product development undertakes sampling in the marine environment, years before any applied trials are initiated and without knowledge to what extent (if any) the compound will be used commercially, it appears reasonable to distinguish that activity as marine scientific research, as discussed in section B.3. However, as discussed in the same section, any ambition to appropriate the resource in question would render the rules on marine scientific research inapplicable. Conversely, this raises questions as to how to legally address product development which is based on bioprospecting but where the natural compound is retrieved in collections or databases, thereby bypassing the need for physical involvement in the natural environment from the side of the bioprospecting actor.

[150] Maria C. Baker, et al., The Status of Natural Resources on the High-Seas (2001), at 186.

[151] Chiara Lauritano, et al., Bioactivity Screening of Microalgae for Antioxidant, Anti-Inflammatory, Anticancer, Anti-Diabetes, and Antibacterial Activities.(Report)(Author abstract), 3 FRONTIERS IN MARINE SCIENCE (2016).

B.5.10. Public collections as a basis for biotechnological development

The relevance of these questions is highlighted by novel research infrastructure which has facilitated and articulated a division of marine bioprospecting into a sampling phase distinct from product development. In recent years, public and academic interest in marine genomic discovery has gone beyond isolated sampling and sequence projects. Research has become more systemic and coordinated. With the sponsoring of national research bodies supported by political prioritization of blue biotechnology, considerable sums have been allocated to setting up collections and libraries of marine organisms and compounds.[152] Similar initiatives have also been undertaken by international organizations.[153]

[152] These efforts have regularly been the result of emphasis on the potential for growth in the biotechnology sector in national or multilateral research and growth strategies. In addition to being emphasized in the Blue Growth Strategy of the European Union, marine biotechnology is one of the focuses for the marine joint programming initiative of the European Union (JPI Oceans). As the result of these priorities, the European Marine Biological Resource Centre (EMBRC) has been set up with ambitious goals to promote biotechnological development. The EMBRC aims to facilitate commercial as well as academic research and training at facilities across Europe and provides open access to marine biodiversity by means of biobanks as well as associated metadata. Similar infrastructure has been established in the United States under the auspice of the National Science Foundation (NSF) and the National Oceanic and Atmospheric Administration (NOAA). Likewise, Norway has enacted a national strategy for bioprospecting as part of the government's strategy for regional growth in its Arctic region, with emphasis on international cooperation. The key objective of the strategy is to regulate marine biological resources and make them more accessible to researchers, industry and international participants. This has manifested in the establishment of a national marine biobank, MARBANK for the preparation and long-term storage of biological samples as well as the establishment of a common database for marine organisms and samples, freely accessible to all cooperating institutions. Institutions with similar functions have been set up in other countries, such as the National Bio Resource Project (NBRP) in Japan, aiming to create a systematic and complete collection of all biodiversity in Japan, including from marine resources. RAMPELOTTO & TRINCONE. 2018, at 263; OECD, Marine Biotechnology: Enabling Solutions for Ocean Productivity and Sustainability. 2013, at 72.; OECD, Marine Biotechnology Definitions, Infrastructures and Directions for Innovation 2017, at 14-38.

[153] Among the more noteworthy multilateral collections of samples are The World Register of Marine Species (WORMS), hosted at the Flanders Marine Institute, VLIZ. The register was established as a global effort to register the names of all marine species. The project, which has involved 270 expert taxonomists from 185 institutions in 38 countries, have database describing 215 000 species. WORMS is freely accessible online and is broken down into sub-portals for different taxonomic groups. Similarly, publicly accessible, the UNESCO-IOC/IODE Ocean Biogeographic Information System (OBIS) is the largest source of information on the distribution of marine species. It was set up as the digital legacy of the ten-year Census of Marine Life (COML) program. OBIS contains 32 million records from 1000 datasets and over 100 000 marine species. The geographical coverage of OBIS has been described as good for highly populated regions but less so for remote regions such as the deep sea. OECD, Marine Biotechnology: Enabling Solutions for Ocean Productivity and Sustainability. 2013, at 72.

Marine biobanks are similar in function to other collections of biological resources. Large infrastructures with considerable resources started to be built up around 1999 as part of a broad OECD initiative to promote research and commercialization of results. Commonly, such collections focus on both tangible (physical resources) and intangible aspects (derived information or innovation) of genetic resources. Generally, the legal ownership of the biological samples of biobanks remains with the government. These may consist of cultivable or non-cultivable organisms represented by tissues, cells, or replicable parts of organisms, such as genomes plasmids, viruses, DNA or RNA, which is often stored in a national collection.[154]

Many national institutions and infrastructures also function as facilitators for marine biotechnology research by storing and promoting the dissemination of marine genome data libraries, thereby providing an even faster track for developers than biobanks.[155] As regards genome sequence data from marine organisms, it appears that development is moving even quicker than the expansion of libraries of sample collections. The rate of sequence submission to archival databases has increased at a speed which has challenged storage capacity.[156] Various databases of marine sequence data are accessible as part of broader research and development infrastructures.

These collections are often based on open-access principles. The decision not to set intellectual property related limitations on the use of their information has been motivated by their business promotion role in general.

[154] GUILLOUX. 2018, at 51.

[155] In the EU, the ELIXIR comprises a distributed and interlinked collection of core and specialized biological data resources, and aims to unite Europe's leading life science organizations in managing and storing the massive amounts of data. OECD, Marine Biotechnology Definitions, Infrastructures and Directions for Innovation 2017, at 20-21.

[156] Yuichi Kodama, et al., *The Sequence Read Archive: Explosive Growth of Sequencing Data*, 40 NUCLEIC ACIDS RESEARCH (2012), OECD, Marine Biotechnology: Enabling Solutions for Ocean Productivity and Sustainability. 2013.

The hindrances that such requirements would entail for small and new biotechnological companies have been noted.[157] Indeed, in assessments it has already been concluded that such publicly financed efforts have greatly facilitated biotechnology development, particularly among smaller pharmaceutical companies, by enabling access to samples of marine organisms without conducting costly expeditions. By establishing bio-bases and related research infrastructure as hubs, ecosystems of related activities including bioprospecting have been encouraged to grow.[158]

Setting up these collections and databases has thus been part of a widespread strategy to spur marine biotechnological development. In line with this business promotion emphasis, it has been commonplace not to set intellectual property related requirements for product developers utilizing genetic information therein. The open-access character of collections and databases set up by public bodies, without restrictions on using information therein as the basis for patent claims and product development may raise contentious questions in relation to rules on marine scientific research: for instance, how to deal with cases in which genetic material that was collected without any direct commercial ambition is subsequently used as the basis for commercial bioprospecting.

Indeed, the collections and databases developed as part of these efforts have made large amounts of marine biological compounds accessible, both as stored in sample collections and as sequence data. While there was also an abundance of promising compounds prior to the setting up of this infrastructure, the access provided by these tools has greatly facilitated bioprospecting. It is thus not surprising that contemporary bio-based marine pharmaceutical development focuses on these libraries rather than initiating new and costly expeditions for sampling of organisms. Rather than discovering and sequencing new organisms, the challenge in bio-based research of the 2010s has been to identify the function or bioactivity in organisms where the DNA has already been sequenced. Similarly, much of the effort on the technological side has been directed towards bridging that gap. It appears that this is where the major challenge is in contemporary bioprospecting – linking the genotype with the phenotype.

[157] Rampelotto & Trincone. 2018.

[158] OECD, Marine Biotechnology Definitions, Infrastructures and Directions for Innovation 2017, at 20-21.

In other words, the genetic makeup of the genomes of marine organisms is commonly established and publicly available. But distinguishing their characteristics remains a challenge.[159]

Successful attempts have been made to bridge the gap between genotype and phenotype by developing *in silico* models of organisms, but only for a limited number of marine species.[160] Increasingly, the application of synthetic biology is proposed as an alternative to the costly development of model organisms.[161] Genetic engineering is thus increasingly used in biotechnology development, not to replace the input of naturally occurring genetic material, but to facilitate the exploration of functions in that material. At a later stage of product development, genetic engineering may be used to improve desired functions.

Yet, so far, the increase in finding as the result of the explosion in availability of genetic material and data has not fully materialized in pharmaceutical output. Indeed, only a limited number of pharmaceutical products derived from marine organisms has reached the market. This is in line with a general relative decline for bio-based drug development. In the last century, most drugs approved by the US Food and Drug Administration (FDA) were from natural sources or derived from compounds first isolated in nature. However, in recent decades the proportion of approved drugs isolated from nature has decreased to just below 50 per cent.[162] At first glance there appears to be a paradox: Despite facilitated access to samples from marine genetic resources, the share of pharmaceutical products based in nature appears to be shrinking.

[159] Se-Kwon Kim, Springer Handbook of Marine Biotechnology (Springer Berlin Heidelberg. 2015), at 1-8, 957-965.

[160] A. Lerman Joshua, et al., In silico method for modelling metabolism and gene product expression at genome scale, 3 Nature Communications (2012); Nicole L. Fong, et al., Reconciling a Salmonella enterica metabolic model with experimental data confirms that overexpression of the glyoxylate shunt can rescue a lethal ppc deletion mutant, 342 FEMS Microbiology Letters (2013).

[161] OECD, Marine Biotechnology: Enabling Solutions for Ocean Productivity and Sustainability. 2013, at 74.

[162] This share includes drugs marketed which have been extracted directly from sources found in nature or synthesized from natural-product source material or templates, Li, J., Vederas, J., (2009) "Drug discovery and natural products: End of an era or endless frontier," Science, 325, 161-165.; National Research Council (US), From Monsoons to Microbes : Understanding the Ocean's Role in Human Health (Washington, D.C.: National Academies Press. 1999), at 73; Vidas. 2010, at 371.

However, these numbers do not account for differences between marine and terrestrial bioprospecting. Also, considering the notoriously long product development cycles in biotechnology, it is too early for the output of the second wave of bioprospecting to have materialized in product output.

B.5.11. Summary

To summarize the development of marine biotechnology, perspectives on marine bioprospecting have undergone pendular movements in recent decades. The hopes for a biotechnology boom after the breakthrough of large-scale gene sequence methods in the 1990s gave rise to widespread enthusiasm for bioprospecting. This also explains the focus on sovereign rights to genetic resources during the negotiation of the CBD, as well as the subsequent negotiations of the Nagoya Protocol. On the marine side, the discovery of deep-sea ecosystems and their extremophiles boosted hopes for a biotech bonanza, which was a major motivation for the launching of the biological diversity beyond national jurisdiction process under UNCLOS.

On the commercial side, an initial interest in investing in bioprospecting was quickly replaced with widespread disinterest, as combinatorial chemistry became heralded as providing a standard formula for all product development. However, public and academic interest would persist and manifest in the establishment of considerable library collections of marine samples.

As combinatorial chemistry and other artificial drug development methods would prove unable to reverse the disappointing product development trend in pharmacology, attention was again turned to bioprospecting. Moreover, some of the commercial pharmaceutical projects which had been initiated during the marine bioprospecting boom years of the 1990s, and which had not been abolished, started to bear fruit. Two of the more highlighted marine bioprospecting products developed in recent years, Halaven and Aplidine, discussed above, are good representations of this hibernation effect from the first wave of bioprospecting.[163]

[163] The compound in Aplidine was isolated from the Mediterranean tunicate *Aplidium albicans* and has shown activity against certain types of tumor (medullary thyroid carcinoma, renal carcinoma, melanoma, and tumors of neuroendocrine origin) and has also been reported to inhibit the secretion of vascular endothelial growth factor related to angiogenesis, United Nations Informal Consultative Process on Oceans and the Law of the Sea - An Update on Marine Genetic Resources: Scientific Research, Commercial Uses and a Database on Marine Bioprospecting. 2007.

As a result of the renewed interest in bioprospecting, the marine-related pre-clinical pipeline for drug development started to grow. By 2010, there were over 36 marine-derived drugs in clinical development, including 15 for cancers. Almost half of all ongoing anti-cancer discovery efforts focused on marine organisms. By 2012, seven marine-derived drugs had received FDA approval, 11 drugs were in clinical testing, and 1,458 were in the clinical pipeline.[164]

The current optimism connected to marine bioprospecting in the pharmaceutical sector is largely the result of technological developments such as genetic engineering which increases the practical advantages of basing product development on natural genetic resources. The benefit of bioprospecting in comparison with synthetic or combinatorial chemistry is that it enables humans to utilize the refinement and development performed by evolution, instead of having to start from scratch. Similarly, the advantage of basing pharmaceutical product development on bioprospecting, instead of synthetic or combinatorial chemistry, is that application has already been tried out in nature.

While the “proof of concept” for bioactivity of secondary metabolites is clearly evident in nature, this is not the case for chemicals produced through combinatorial chemistry. Secondary metabolites produced by living organisms are therefore commonly superior to compounds synthesized by combinatorial chemistry. The challenges involved in bioprospecting are often converse compared to synthetic or combinatorial chemistry. Whereas the function and effect of bioactivity in naturally occurring secondary metabolites are often evident, the scientific challenge often relates to identifying the mode of action. In synthetic or combinatorial chemistry, the major challenge is commonly connected to detecting potential bioactivity in large-scale high-throughput technology.[165] Although the challenges connected to the mode of action for bioactive function are still considerable, new technological tools have facilitated the solving of this puzzle.

[164] OECD, Marine Biotechnology: Enabling Solutions for Ocean Productivity and Sustainability. 2013;Glaser & Mayer, BIOCHEMICAL PHARMACOLOGY (2009), at 32.

[165] Müller, et al., Evidence-based Complementary and Alternative Medicine (2004), at 72.

B.6. Contemporary use of marine genetic resources in biotechnology

It has thus been established that although interest in bioprospecting has fluctuated throughout history, it is currently strong. Moreover, it appears that the role of natural components in bioprospecting has become increasingly complex and ambiguous in recent years. In the next section, these bioprospecting innovation chains will be explored. But before going into the question of how parts or functions of marine organisms are turned into products, the input and output of the bioprospecting innovation chains will be discussed.

In this section, it will firstly be described what type of genetic material comprise the primary subjects of contemporary bioprospecting interest. Secondly, estimates of what types of organisms are of interest to bioprospecting will be discussed. Thirdly, an inventory of products developed by means of marine bioprospecting will be presented.

B.6.1. Genetic material used in marine bioprospecting

As discussed in the previous section, marine bioprospecting for new products has increased significantly in recent years. The bioactive properties, which so far have been used in marine biotechnology product development, originate in an extensive number of organisms, belonging to all kingdoms of life: animal, plant, bacteria, fungi and protist species.[166]

Considering the nature of the regulation, as well as the complex process of bioprospecting, the main issue is not just the organisms from which such genetic material is sourced; it is equally vital to ascertain what type of genetic

[166] Until recently, marine invertebrates have been the most important source. Since the 1990s, the sponges (Porifera) account for almost half of new natural products. Corals and jellies (Cnidaria) for 30%, seastars and other Echinodermata, vertebrates (Chordata) and mollusk (Mollusca) for each 5%, according to estimates. Further compounds have been found in polychaetes (Annelida), moss animals (Bryozoa), flatworms (Platyhelminthes), acorn worms and relatives (Hemichordata), lamp shells (Brachiopoda) and crustaceans (Arthropoda). Miguel Costa Leal, et al., *Bioprospecting of marine invertebrates for new natural products - a chemical and zoogeographical perspective*, 17 MOLECULES (BASEL, SWITZERLAND) (2012); Ulrike Lindequist, *Marine-Derived Pharmaceuticals - Challenges and Opportunities*, 24 BIOMOLECULES & THERAPEUTICS (2016); Paul V. R. Snelgrove, *An ocean of discovery: biodiversity beyond the Census of Marine Life*, PLANTA MED. (2016).

material is being used. This is because it appears to be of considerable importance under both the law of the sea and international environmental law what type of material is actually extracted and to what extent it physically forms part of subsequent product development. Moreover, in the practical development of products based on bioprospecting, the type of genetic material used may in some cases be more relevant than the exact species in which it originates. This is because the same type of genetic material is commonly collected with similar methods and technologies, irrespective of species. The type of genetic material used also highly correlates with the category of product developed, as will be discussed.

What types of genetic material, then, are used in bioprospecting? In assessments of genetic material used in bioprospecting, as carried out by Jabour-Green and Oldham, a division has been made between three main categories:[167]

- *Genetic information (DNA, RNA and amino acid sequences and metabolic pathways performing particular functions);*
- *Chemical compounds;*
- *Raw extracts of marine organisms.*

The first category is probably most frequently associated with the term genetic resources. These resources are associated with bioprospecting that seeks to form the basis for the production of pharmaceuticals, medicines and enzymes. Normally, such bioprospecting involves the use of different research tools in order to decipher and analyze sequence data.

Resources in the second category are also regularly associated with pharmaceuticals and medicines. The difference in comparison to the first category is that bioprospecting of chemical compounds does not depend on analysis of the underlying genetic structure or interactions within the organism. Rather, it may require repeated collections of chemical compounds from the organism of interest until such time that a compound is fully characterized and a synthetic or semi-synthetic route is found to produce the compound of interest.[168]

[167] Julia Jabour-Green & Dianne Nicol, *Bioprospecting in areas outside national jurisdiction: Antarctica and the Southern Ocean*, 4 MELBOURNE JOURNAL OF INTERNATIONAL LAW (2003);Oldham. 2014.
[168] Oldham. 2014., at 150-151.

The third category of raw extracts from marine organisms differs markedly from the previous two in one important regard. Whereas the first two categories of resources are of interest primarily for analysis and the potential of reproducing certain functions, it is the physical compound itself that is of interest in the third category. The collection of raw extract seeks to use the resources as direct intermediate goods in the production of different products, which can range from nutritional products to pharmaceuticals or cosmetics. This implies that larger quantities are usually necessary in the development of products based on resources in the third category. Whereas the first two categories are commonly sampled in limited amounts, the third are collected in bulk.

Genetic information

The first category of marine genetic resources typically focuses on DNA and amino acid sequences used to encode information for the expression product of interest, such as an enzyme, which can then be synthesized in an industrial host organism such as yeast or bacterium. An example of this is Green Fluorescent Protein (GFP), as will be discussed in section B.6.2. The gene responsible for GFP was first isolated in the jellyfish *Aequorea victoria* and is now widely used in biotechnology as an expression marker, produced in the engineered bacterium *Escherichia coli*.[169]

Sampling of this category of resources has certain characteristics of legal importance, as will be discussed in section B.6.3. Foremost, the collection of DNA, amino sequences and similar genetic resources typically does not require large-scale and repeated consumptive use of a marine organism once the synthesis process has been developed.[170] But there are also cases of supply-side challenges.

[169] Id, at 151.

[170] For example, Green Fluorescent Protein (GFP) is widely used in biotechnology as an expression marker and is widely available as a synthesised commercial product for in the region of $250-300 per 300 micrograms (ug). The gene responsible for GFP was first isolated in the jellyfish Aequorea victoria but the protein is now produced in the engineered bacterium Escherichia coli. (Ibid, MARTIN CHALFIE & STEVEN R. KAIN, GREEN FLUORESCENT PROTEIN: PROPERTIES, APPLICATIONS, AND PROTOCOLS § 47 (John Wiley & Sons 2 ed. 2005).

Often the compound of interest is present only in low amounts and can be very difficult to isolate.[171] In the case of tissues of marine invertebrates, which present unique extraction-related problems due to their high water and salt content, this problem has been considered particularly challenging. Irrespective of what type of bioprospecting the compound is subsequently used for, several grams to hundreds of grams may be required for pre-clinical development, and multikilogram quantities for clinical phases.[172]

Although there are thus cases of marine bioprospecting development based on DNA, RNA, and amino acid sequences where larger quantities are necessary, normally only limited physical samples are required, at least in comparison with conventional resource extraction, such as fisheries. From an environmental standpoint, this form of marine bioprospecting may call for less concern than cases in which natural compounds constitute a more direct ingredient, as well as compared to other forms of living resource collection in general.

As discussed in section B.2, this type of marine bioprospecting often targets endemic species and fragile ecosystems, such as hydrothermal vents. This is because these areas and species are most likely to have extreme or unusual functions, useful for biotechnical product development. The same characteristics, however, make these ecosystems particularly sensitive to human activity. Even very limited operations may have a significant negative impact in areas comprising a high degree of endemism. The limited quantities sampled in bioprospecting operations does not necessarily mean that the collection of this category of genetic material can be conducted without the risk of causing detrimental environmental effects. The limited quantity of samples also has other consequences. Foremost, no continuous supply is necessary. This makes freeriding from legal requirements easier. Product developers less concerned with legal obligations connected to the use of marine genetic material can disguise sampling operations with relative ease.

[171] Molinski, et al., Nature Reviews Drug Discovery (2008).

[172] Martins, et al., MARINE DRUGS (2014).

This is closely connected to the second characteristic of sampling of DNA, amino sequences and similar genetic resources: Only in few cases can a developed product be traced back to a physical genetic component sampled at a specific time and location. As discussed in section B.5.10, the bioprospecting development chain has increasingly been divided and fragmented between different entities. Physical sampling is often conducted by academic scientific expeditions, with no direct commercial ambition. Commercial development may start directly once the bioactive function has been identified. However, it appears more common that the sample is deposited in a culture collection by the research institution and sourced from there by other entities for further study much later.[173] The bioactive function may already have been identified before the research project is finished, but not deemed commercially viable. Or, more commonly, the research institution conducting the sampling has no direct interest in commercial development. In any event, the culture collections of marine genetic resources that have been established in several countries and are commonly freely accessible for biotechnology developers do not have a standardized system for indicating where and when a sample was taken.[174] Similarly, such geographic indications are commonly lacking in patent data.[175] Taken together, this makes it particularly difficult to ascertain where the genetic material is sourced in bioprospecting based on DNA, amino sequences and similar genetic resources.[176] As will be discussed in section B.6, not being able to establish geographical origin for marine genetic resources poses a major challenge for the application of international law rules.

Chemical compounds

The bioprospecting interest connected to marine genetic resources is by no means limited to genetic information. There has been growing interest, both scientifically and commercially, in chemical compounds from marine organisms. An estimate in 2007 suggested that more than 15,000 molecules

[173] ARICÒ. 2015.
[174] OECD, Marine Biotechnology Definitions, Infrastructures and Directions for Innovation 2017.
[175] Oldham. 2014., at 17.
[176] Robert Blasiak, et al., Corporate control and global governance of marine genetic resources, 4 SCIENCE ADVANCES (2018).

from marine genetic resources had been isolated and described.[177] Although equally ambitious estimates appear difficult to find more recently, it can be assumed that the number has risen markedly in recent years. Just in 2012, 1,241 new compounds were reported.[178] This clearly identifies the marine environment as a rich source of bioactive molecules.

Bioprospecting based on chemical compounds differs considerably from the first category by having the physical compound from or produced by marine organisms as the main target, rather than an underlying genetic structure. Whereas DNA, RNA and amino acid sequences are often gathered during an isolated sampling expedition, chemical compounds commonly require repeated collections from the organism of interest. For chemical compounds, it appears that the development of products for cosmetic uses generally requires larger quantities of natural material than is the case for pharmaceutical development.[179]

Many natural products derived from marine organisms are complex organic compounds that possess unique structures, often molecularly arranged in complex three-dimensional formations. Such compounds cannot be duplicated by chemical synthesis in laboratories.[180] Attempts have been made to overcome supply-side barriers by developing synthetic or chemosynthetic analogues, derivatives with more manageable properties, or by design of a pharmacophore of reduced complexity which can then be synthesized. However, these approaches face considerable challenges. Although synthesizing relevant chemical compounds in marine bioprospecting of chemical compounds in many cases is possible, it may require considerable investment and is not always economically viable.[181] Total synthesis is by no means an easy undertaking, and chemistry has a very long way to go before it can make any molecule in a way that is practically feasible.[182]

[177] Richard J. McLaughlin, "Marine Genetic Resources Exploitation and Intellectual Property Rights Protection" in VIDAS. 2010, at 372.
[178] Martins, et al., MARINE DRUGS (2014).
[179] Ibid.
[180] Gregory L. Rorrer, *Bioprocess Engineering of Phototrophic Marine Organisms in* SPRINGER HANDBOOK OF MARINE BIOTECHNOLOGY (Se-Kwon Kim ed. 2015).
[181] Ira Bhatnagar & Se-Kwon Kim, Marine antitumor drugs: status, shortfalls and strategies, 8 MARINE DRUGS (2010).
[182] Martins, et al., MARINE DRUGS (2014).

In some cases, eventually a synthetic or semi-synthetic route is found to produce the compound of interest. But developing such alternatives to the use of natural compounds is often costly and may only be a viable option at a high market output, once a commercial product has already become successful.[183]

Genetic engineering has been suggested as a solution to supply-side problems in bioprospecting. The principle of this method is that genetic information for the desired compound is transferred into host cells, which can be more easily cultivated. In this manner, the genetic engineering operation facilitates sustainable and larger scale production of the compound in the host cells.[184] However, the technology faces considerable challenges. Not only does it require the exact knowledge of the genetic information of the natural organism producing the relevant compound and the isolation and expression of that organism's genes; it is also necessary to identify a viable host organism. Although this approach has been successfully realized on the research level, it has not yet been applied on an industrial scale for marine bioprospecting.[185]

Mariculture[186] and aquaculture[187] have also been attempted in order to solve the problem of sustainable supply of macro-organisms. In other cases, the marine organism itself may be used as a living cell factory for the biological synthesis of the desired compounds. The living cell factory may be made up of intact organisms, as well as of tissue or cell culture derived from the organism. Once set up, the cell factory can be used to produce compounds of active metabolites.[188]

However, the unique and sometimes exclusive conditions of the sea make cultivation or maintenance of the isolated samples very difficult and often impossible. For example, sponges and their microbiota are generally not suitable for cultivation. As a consequence, the only possible option for developers may be to extract and purify the compound of interest from

[183] George Frisvold & Kelly Day-Rubenstein, Bioprospecting and Biodiversity Conservation: What Happens When Discoveries are Made?, 50 ARIZONA LAW REVIEW (2008), at 546.
[184] Lindequist, Biomolecules & Therapeutics (2016).
[185] Ibid.
[186] The favoring by farming the growth of the organism in its natural milieu.
[187] Culture of the organism under artificial conditions.
[188] Rorrer. 2015.

specimens collected in the wild.[189] This type of issue is particularly prevalent in relation to organisms such as sea sponges and tunicates that produce highly complex compounds in low quantities, which even with advanced technology is difficult to copy synthetically. Oldham has discussed how this can raise conservation issues.[190] A recently discussed example of this is the substance shark squalene-based adjuvant used in vaccine production. Conservationist organizations have feared that production of vaccine for COVID-19 will require harvesting tissue from half a million sharks.[191] Supply-side constraints have been raised as a substantial challenge in the development of several marine bioprospecting-based pharmaceuticals.[192] Many species of micro-organisms produce specific metabolites at specific phases of their growth. A slight alteration in the culture parameters may lead to changes in the amount and type of metabolite produced, thus leading to insufficient supply of the compound.[193]

Bioprospecting of chemical compounds can be distinguished from DNA, RNA and amino acid sequences and metabolic pathways in certain key respects, which also have legal implications. Firstly, the requirement for repeated collection calls for higher quantities of the marine genetic resource. Secondly, as a result, the bioprospecting of chemical compounds may have a higher environmental impact. Thirdly, since physical chemical compound is the main target rather than an underlying genetic structure, the use of genetic technology and the questions it raises are less relevant in the case of chemical compounds.

[189] A relatively well-known example of this outside the marine realm is the best-selling cancer drug Taxol, derived from the endangered Pacific Yew (Taxus brevifolia), which required government incentives to promote the quest for a semi-synthetic and fully synthetic means to produce the compound that did not require repeated collection of the bark of this tree. Moreover, it took over 20 years before the first complete synthesis of the compound was reported. Miguel Leal, et al., *Bioprospecting of Marine Invertebrates for New Natural Products - A Chemical and Zoogeographical Perspective*, 17 MOLECULES (2012); Frisvold & Day-Rubenstein, ARIZONA LAW REVIEW (2008), at 555.
[190] Such as in the case with the Pacific Yew above, see Oldham. 2014., at 151.
[191] Katherine J. Wu, Coronavirus Vaccine Makers Are Not Mass-Slaughtering Sharks, NEW YORK TIMES, October 13. 2020.
[192] As discussed below in section B.6.2, lack of compound supply was raised as a major hindrance in the studies on the marine drug *Laurenditerpenol*. This does not appear to be uncommon.
[193] Bhatnagar & Kim, MARINE DRUGS (2010).

Fourthly, similarly to DNA, RNA and amino acid sequences, bioprospecting for chemical compounds relates to an isolated function of a marine genetic resource, rather than the direct consumption of an organism. Patenting may thus be possible in bioprospecting involving both categories of genetic material. This is particularly relevant in cases where methods are established to synthesize or otherwise refine chemical compounds. Much like when employing genetic technology on DNA, RNA and amino acid sequences, this may fulfill the requirement for an innovative step, as called for in patent law.

Raw extracts

The third category consists of raw extracts of organisms. The commercial use of products based on such resources usually depends on repeated harvesting. The best-known example of marine genetic resources is Omega-3 fatty acids that are extracted from fish, as well as Antarctic krill and marine mammals, to serve growing markets for Omega-3 products. As opposed to the use of DNA, RNA and amino acid sequences, as well as chemical compounds in bioprospecting, the use of the physical marine component is usually a central element in product development involving raw extracts.[194] Commonly, the concept of the product in this third category is human or other direct consumption of part of or the full marine organism, often by means of digestion. Raw extract product development thus lacks an equivalent to the sequencing and synthesizing components often used in the previous categories. Indeed, analysis relating to the active compound is often lacking entirely. It is thus often more difficult to obtain patent protection in the development of raw extract products. Moreover, for practical purposes, the direct consumption element in this category of product development makes it more akin to traditional uses of marine organisms, such as seafood.

Although product development involving raw extracts in many contexts is labeled as bioprospecting, these characteristics also make it questionable whether the definition of bioprospecting as set out in section B.1 encompasses such products. Raw product development based on raw extracts may entail a *process* as called for in the definition. It also includes a clear *commercial ambition*, commonly from the moment of collection (which is not always the case in marine bioprospecting).

[194] Oldham. 2014., at 150.

The *collection*, conducted in the marine environment, is often a central element in the product. Three of the four criteria for bioprospecting thus pose no challenge for product development based on raw extracts. The requirement for a *derivation* element, by contrast, raises considerable challenges. In raw extract product development, the analytical step is often minimal, particularly when compared to the first two categories. Indeed, it can be claimed that simply extracting fatty acids from fish has more in common with filleting fish meat than bioprospecting. This also means that for legal purposes, the collection of raw extracts qualifies and is managed as fisheries. Accordingly, this investigation will not focus on product development based on marine raw extracts, but instead will focus on the first two categories.

B.6.2. Products developed

It has thus been reviewed how the marine biosphere harbors an enormous variety of organisms, with fundamentally more diverse characteristics compared to those in the terrestrial environment. In order to survive in the challenging conditions of the sea, some have developed adaptation mechanisms in the form of specific secondary metabolites. The biological activities of these metabolites have increasingly been regarded as possible drugs for human use. It was also discussed how this interest in using the functions of marine organisms as the basis for biotechnology development has fluctuated over the years. After initial discoveries in the 1950s, research on marine products accelerated in the 1970s, and began to appeal to different disciplines, including biochemistry, biology, ecology, organic chemistry, and pharmacology. Much as the result of developments in genetic technology, interest in bioprospecting appears to be high at present, having recovered from a downturn during the 1990s when the industry favored synthetic approaches.

To a large extent, the pharmaceutical interest in bioprospecting is thus connected to secondary metabolites. Although this investigation focuses on pharmaceutical biotechnology, it should be borne in mind that marine bioprospecting is a broader concept, which includes a multitude of activities. It can be undertaken for the development of a broad range of products. Investigations into the unusual characteristics of organisms from the deep sea and seabed have already resulted in many patented inventions covering a

diverse range of applications, from the development of enzymes for industrial processes to skincare products.[195]

In the pharmaceutical field, a large portion of molecules from deep-sea organisms are still being clinically tested. Current pharmaceutical bioprospecting primarily focuses on potential drugs in the field of anesthesia, anti-inflammation, cancer and HIV/AIDS. However, some of the deep-sea molecules have led to the development of products already available on the market. About 30,000 compounds of marine origin are known and, since 2008, more than 1,000 compounds are newly discovered each year.[196] What sort of product development has this brought about? As of 2016, seven pharmaceutical drugs based on marine genetic resources had been approved by the FDA. The relatively low number reflects the difficulty of turning biotechnological discoveries into commercial drugs. Moreover, it can be explained by the notoriously long innovation chains in drug development.[197]

Cytostatic drugs

In recent years, improvements in the technology of deep-sea collection and culture and the growing understanding of marine biodiversity have increased interest in exploring the oceans as a potential source of new anti-cancer candidates.[198] The use of marine organisms in the development of cytostatic drugs is, however, far from new. As discussed in section B.5.2, the first marine bioactive compounds – spongouridine and spongothymidine – were isolated from the Caribbean sponge *Cryptotheca crypta* already in the early 1950s. In the mid-1960s, scientists proved that they had anti-cancer and anti-viral activity.[199] Based on this discovery, the synthetic analogue cytosine arabinoside *Cytarabine* was developed (marketed under the name cytarabine).

[195] Leary, et al., MARINE POLICY (2009), at 185.
[196] Paula Kiuru, et al., Exploring marine resources for bioactive compounds., 80(14) PLANTA MED (2014).
[197] Out of the seven approved drugs, four are used for the treatment of cancer. Each another one is applicated for treatment of viral diseases, chronic pain and to lower triglyceride level in blood. Some other products are of interest in diagnostic and as experimental tools, Lindequist, BIOMOLECULES & THERAPEUTICS (2016).
[198] Leary, et al., MARINE POLICY (2009), at 186.
[199] Cragg & Newman, Biochimica et biophysica acta (2013).

The drug was approved by the FDA in 1969 and is a potent anti-leukemic agent.[200] It is still used extensively in the treatment of acute myeloid leukemia.[201]

Similarly used for cytostatic treatment, Trabectedin (marketed as Yondelis) was isolated from the sea squirt *Ecteinascidia turbinata*. The drug was approved by the EU in 2007 and by the FDA in 2015. Living on corals in the Mediterranean, the ascidians from which Trabectedin was isolated produce the active compound as a defense against micro-organisms.[202]

Likewise proclaimed as a new type of drug by combining a highly cytotoxic compound with a tumor-specific antibody, Brentuximab vedotin (marketed as Adcetris) consists of the active compound monomethyl auristatin which functions as an antibody against tumor cells in Hodgkin lymphoma and systemic anaplastic large cell lymphoma. The active compound, Auristatin, is a synthetic analogue of the marine natural product dolastatin. The dolastatins are a series of cytotoxic peptides that were originally isolated in very low amounts from the Indian Ocean mollusk *Dolabella auricularia*.[203]

The already mentioned Eribulin mesylate (marketed as Halaven) is a synthetic analogue of halichondrin B, an active compound isolated from the marine sponge *Halichondria okadai* used in the treatment of locally advanced or metastatic breast cancer which has progressed after chemotherapeutic regimens for advanced disease.[204] Initially, the active substance of halichondrin was derived directly from the marine sponge.

[200] Leary, et al., MARINE POLICY (2009), at 185.
[201] Lindequist, BIOMOLECULES & THERAPEUTICS (2016), at 564.
[202] The active compound in Trabectedin has been described as representing a new class of anti-tumor drugs by acting both on cancer cells and on the tumor microenvironment. This cytostatic activity is represented by the prevention of transcription by preventing the binding of transcription factors to DNA, id. at 564.
[203] However, subsequently the discovery was made that producer of dolastatins are actually cyanobacteria of the genus Symploca. Since it is highly toxic, the drug is administered by direct injection into tumor cells. The FDA approved the drug in 2011 for cases of relapse of Hodgkins lymphoma after stem-cell transplantation. Id. at 564.
[204] The drug was approved by the FDA in 2010 and the EU in 2011.

This led to substantial supply-side challenges; one ton was required just to derive 300mg of active substance. Eventually direct natural sourcing was replaced by chemical synthesis.[205]

In addition to these approved drugs, many scientific articles have been published since 1999 describing the anti-tumor and cytotoxic properties of numerous marine natural products.[206] These substances have been considered to have a high potential for developing pharmaceuticals that can disrupt tumor-specific cell signaling, cell division, energy metabolism, gene expression, drug resistance and blood supply with the potential to revolutionize cancer treatment.[207]

Still, drug development based on marine bioprospecting in the cancer field has encountered considerable challenges and few drugs have reached the market. Plenty of reasons have been raised as explanatory factors. Some of these are not connected to the marine resource or technology as such, but relate to government policies, lack of infrastructure and insufficient capital investment.

[205] The chemo-preventive and potential anticancer activity of marine sponge-derived compounds could be explained by multiple cellular and molecular mechanisms, including DNA protection, cell-cycle modulation, apoptosis, and anti-inflammatory activities as well as their ability to chemosensitize cancer cells to traditional antiblastic chemotherapy. Cinzia Calcabrini, et al., *Marine Sponge Natural Products with Anticancer Potential: An Updated Review*, 15 MARINE DRUGS (2017).

[206] Largely, these belong to four main structural types, namely polyketides, terpenes, nitrogen-containing compounds and polysaccharides. The organisms yielding these bioactive marine compounds comprised a diverse group of marine animals (tunicates, nudibranchs, sponges, octocorals, bryozoans, etc.), algae, fungi, and bacteria. Boris Pejin, et al., *Novel and highly potent antitumour natural products from cnidarians of marine origin*, 28 NATURAL PRODUCT RESEARCH (2014).

[207] Prominent in the identification and development of novel anti-cancer agents from marine sources is the Spanish biotechnology company Pharma-Mar, which currently has a large number of oncology products in late pre-clinical and clinical development. In addition to the above described *Yondelis*, the anti-tumor agent isolated from the Caribbean tunicate *Ecteinascidia turbinate* which has been granted approval, a number of new products are in pipeline. These include *Aplidin* (*Aplidine*), a cyclopeptide cytotoxic agent derived from the Mediterranean tunicate *Aplidium albicans*. *Kahalalide F*, a depsi-peptide isolated from the Hawaiian mollusk *Elysia rufescens* has undergone Phase II clinical trials; and *ES-285*, a molecule isolated from the mollusk *Spisula polynyma.* Leary, et al., MARINE POLICY (2009), pp. 185-186.; Dale G. Nagle & Yu-Dong Zhou, *Mechanism-based Screening for Cancer Therapeutics with Examples from the Discovery of Marine Natural Product-based HIF-1 Inhibitors*, *in* HANDBOOK OF MARINE NATURAL PRODUCTS (Ernesto Fattorusso, et al. eds., 2012).

There are, however, also challenges relating to the use of marine genetic resources as the basis for development. These include lack of sufficient amount of natural product, difficulties in accessing the source of the samples, problems associated with harvesting of the product, troubles in synthesizing the necessary amounts of the compound, difficulties in isolation and purification procedures, high toxicity of the active compound.[208] Many species of micro-organisms produce specific metabolites at specific phases of their growth. A slight alteration in the culture parameters may lead to changes in the amount and type of metabolite produced, leading in turn to an insufficient supply of the compound.[209]

Anti-viral drugs

Together with *Cytarabine* described above, the anti-viral drug Vidarabine is the oldest pharmaceutical drug based on marine genetic resources that is still in use. Like *Cytarabine* it results from active functions in sponge nucleosides discovered in the 1950s. The drug inhibits the DNA synthesis of herpes and other viruses. In the EU, it is used in the form of eye drops for the treatment of acute eye infection, recurrent epithelial keratitis caused by herpes simplex type 1 and 2.[210]

Analgetic drugs

Among the relatively newly discovered chemical entities with biological activity is the conotoxin found in the cone snail, as discussed in section B.5.7, whose venom, which is usually lethal to humans, may be used for anesthesia, analgesics or as drugs for the treatment of conditions such as epilepsy, cardiovascular disease, and psychiatric disorders.[211]

[208] For example, studies om the promising marine HIF inhibitor Laurenditerpenol were hindered by a lack of compound supply. Dale Nagle & Yu-Dong Zhou, *Marine Natural Products as Inhibitors of Hypoxic Signaling in Tumors*, 8 PHYTOCHEMISTRY REVIEWS (2009) Bhatnagar & Kim, MARINE DRUGS (2010), at 2711.

[209] Bhatnagar & Kim, MARINE DRUGS (2010), at 2711.

[210] Martins, et al., MARINE DRUGS (2014).

[211] These molecules (conotoxins) have a strong commercial interest, and more than 100 patents and patent applications with the term ‘‘conotoxin’’ reflected in their title may be found in the patent database, Leary, et al., MARINE POLICY (2009), at 185.

The first conotoxin-based medicine, the pain medication Ziconotide (also marketed under the name Prialt), was approved by the US Federal Drug Agency in December 2004.[212] Many other molecules have shown similar successful potential applications.[213]

Antihyperlipidemic drugs

Whereas fish oil is used extensively as a food supplement, there are also approved drugs based on marine natural acids. The drug Lovaza is produced through derivation of natural acids and is used to normalize triglyceride levels in human blood after heart infarct.[214]

Diagnostic tools

Whereas all pharmaceuticals previously mentioned in this section are based on marine organisms that can be retrieved from marine areas relatively close to the coasts, hence in maritime areas under national jurisdiction, the important enzymes *Taq polymerase* and *Pfu* have been isolated from the bacterium *Thermus aquaticus* and the marine thermophile *Pyrococcus fuiosus* (an extremophilic species of Archaea). Both these types of organisms live around hydrothermal vents. As discussed in Part A, such vents are biological hotspots and commonly occur in mid-oceanic areas, at the intersection of tectonic plates, far from the continental shelves of coastal states. Both *Taq polymerase* and *Pfu* have become vital tools in polymerase chain reaction (PCR), a method for greatly amplifying the quantity of short segments of DNA. This method has been vital for developing modern genetic analysis. In such laboratory operations, the same bioactive function in the bacterium which enables it to thrive at extreme temperatures in the vicinity of deep-sea vents is employed to facilitate various forms of genetic sequencing and engineering.

[212] Developed as an alternative to conventional chronic pain treatments such as opioids, the active component of Ziconotide is a synthetic peptide derivative based on the toxin of the common Indo-Pacific marine cone snail *Conus magus*, originally collected from Indonesia. The snails use the peptide as toxin for defense and prey capture by injecting it into fish, resulting in paralysis. Ziconotide is approved for patients with severe chronic pain and is administered by direct injection into spinal fluid. A considerable advantage to morphine is that the analgetic effect maintains over months without causing tolerance. Equally important, it does not lead to dependency or respiratory depression. Lindequist, BIOMOLECULES & THERAPEUTICS (2016), at 566.

[213] Leary, et al., MARINE POLICY (2009), at 185.

[214] Alexandros Tsoupras, et al., Bioprospecting for Antithrombotic Polar Lipids from Salmon, Herring, and Boarfish By-Products, 8 FOODS (2019).

Similarly used as a tool in laboratory analysis, green fluorescent protein (GFP) has been isolated from the jellyfish *Aequorea victoria*. The protein functions as a biological marker for labeling cellular structures. Also commonly employed in laboratory analysis, *Phycoerythrin* and other pigments from *photoautotrophic cyanobacreria* can be used both *in vitro* and *in vivo* as a fluorescence-based indicator and for labeling antibodies.[215]

Current development pipeline

In addition to the developed products discussed above, there is a considerable number of potential products in the pipeline, as the result of the interest in marine bioprospecting in recent years. As already stated, current pharmaceutical bioprospecting primarily focuses on potential drugs in the field of anesthesia, anti-inflammation, cancer and HIV/AIDS.[216] Some marine products have been shown to have potent anti-inflammatory action. Many marine compounds have been investigated for such anti-inflammatory properties.[217] In the field of HIV/AIDS, more than 150 natural products with promising levels of anti-HIV activity have been isolated from marine organisms.[218]

In addition, outside the four categories of disease mentioned, marine organisms are being used in drug development. Anti-fungal functions in sponges have been considered useful in the treatment of certain infection disease.

[215] The substance *Limulus-Amoebocyte-Lysate* (*LAL*) originating in the crab *Limulus polyphemus* is also worth noting. It is used in standard tests for sensitive detection of pyrogenic lipopolysaccharides (LPS) from gram-negative bacteria. Moreover, *Keyhole limpet hemocyanin (KLH)* is a large metalloprotein which is harvested from cultures of the giant keyhole limpet *Megathura crenulata*, a marine mollusk living off the coasts of Western United States. It is used as a vaccine component and is also clinically used for the treatment of bladder carcinoma. Lindequist, BIOMOLECULES & THERAPEUTICS (2016), at 568.

[216] Marris, NATURE (2006).

[217] For instance *bolinaquinone* and *petrosaspongiolide M* are two marine products with potent anti-inflammatory action, which may have potential in treating intestinal inflammatory diseases. Jérôme Busserolles, et al., *Protection against 2,4,6-trinitrobenzenesulphonic acid-induced colonic inflammation in mice by the marine products bolinaquinone and petrosaspongiolide M*, 69 BIOCHEMICAL PHARMACOLOGY (2005).

[218] These includes proteins from alga, various sulfated polusaccharides from seaweeds, peptides from horseshoe crabs and sponge metabolites. Leary, et al., MARINE POLICY (2009), at 186.

Similarly, testing of compounds based on marine genetic resources is currently being carried out in the context of tuberculosis and for anti-bacterial, anti-parasitic and anti-coagulant agents. There appears to be a particular interest in research relating to the marine cyanobacteria, which are associated with hydrothermal vents. A derivate is already used in the treatment of migraine.[219]

B.6.3. The bioprospecting development cycle

As has been established, the way in which marine bioprospecting has been conducted has altered throughout history. Generally, the competition with other approaches in pharmaceutical development has caused the interest in bioprospecting to fluctuate. Likewise, the role of the physical genetic material in the final product has shifted. In the early years, organisms with useful properties were used more or less directly. Gradually, the physical organisms have become less directly used in bioprospecting products. In more recent product development, the marine genetic resource has in many cases merely provided information, which has subsequently been mimicked or re-engineered in bioprospecting processes. But this is not the case in all processes. Rather, contemporary bio-based pharmaceutical development is characterized by considerable variations. In some of the cases discussed in the previous section, the natural component merely represents a source of inspiration for biotechnology development. In other cases, large physical quantities of marine genetic resources are collected in bulk, to form a major part of or even the full substance in the final product. These differences in the role of the genetic resource in bioprospecting processes represent challenges in relation to law. In particular, cases where the connection between the final product and the natural genetic resource is remote could be complicated to address under legal rules focusing on natural source. In order to identify how international law rules apply to bioprospecting, further examination of the bioprospecting development cycle is necessary.

Attempts to track the path from the discovery of an organism with interesting properties to the final development of products and processes have been made in the past, but they have run into difficulties.[220]

[219] Id. at 187.
[220] Aricò. 2015, at 203.

Firstly, product and processes are often marketed under different names, with ambiguous references to the link to marine organisms. Secondly, transformation, manipulation and application of the material originating in marine organisms is seldom fully disclosed. Thirdly, companies are generally reluctant to publicize information relating to product development. Taken together, this situation poses considerable challenges to investigations of marine bioprospecting development cycles.

Indeed, in assessments of how these resources are turned into commercial products, the picture appears quite complex. Data indicates that as a main rule in contemporary development, the developer obtains the marine genetic resource through an intermediary.[221] That is to say, in most cases, the actual extraction stage of the bioprospecting process has been undertaken by a different entity than the one filing the patent application. This supports the suspicion expressed in section A.3.2 that the entity extracting a marine genetic resource may not be aware that the resource could subsequently become an input in the development of a commercial product, or even that the resource will be subject to bioprospecting.[222] In many cases, it can be assumed that the resource has been extracted during missions conducted for other purposes, such as marine scientific research cruises, or even fishing.[223]

In this section, the nature of contemporary marine bioprospecting will be examined more closely and its development cycle dissected. This relates to four problems connected to the status of deep-sea bioprospecting under international law: 1) the relationship of scientific research activities to bioprospecting; 2) at what stage of the bioprospecting development cycle the intention to privatize a biological function is introduced;[224] 3) how to relate to development which is in part synthetic and in part bio-based; 4) the scope of claims for exclusive rights to bioactive functions in deep-sea marine genetic resources by means of patents.[225]

[221] Oldham. 2014., at 147.
[222] Muriel Rabone, et al., Access to Marine Genetic Resources (MGR): Raising Awareness of Best-Practice Through a New Agreement for Biodiversity Beyond National Jurisdiction (BBNJ), 6 Frontiers In Marine Science, 2019, Vol. 6 (2019).
[223] Mossop. 2015.
[224] Is the aim to use findings commercially present from the first step in the bioprospecting cycle or is it introduced at a later stage, subsequent to the sampling?
[225] Aricò. 2015, at 201-205.

Before starting this examination, the relevance of pursuing this analysis for legal purposes will be briefly elaborated. The law of the sea, as discussed in section C.1.5, has an established framework for and far-reaching freedom of marine scientific research, which extends to the deep seas. However, as noted, this precludes appropriation and claims for exclusive rights.[226]

For marine bioprospecting, the commercial element (commonly connected to patent claims) is an integral part of what distinguishes it as an activity. The incompatibility between these elements of bioprospecting and the law of the sea has prompted some observers to argue that it would go against international law rules to base bioprospecting on the freedom to conduct marine scientific research, and that bioprospecting by virtue of its definition ought to be considered a distinct activity.[227]

Accordingly, it has been claimed that utilizing marine scientific research findings for bioprospecting purposes goes against international obligations. Moreover, it has been implied that there is a risk that commercial actors may disguise bioprospecting operations as marine scientific research to reap the benefits of the permissive rules on marine scientific research.[228]

One problem with the idea that these activities are separate is that it presupposes that bioprospecting as an activity can be distinguished from marine scientific research. In reality, it is difficult to identify what projects contain the defining commercial intention. Under the understanding of scientific research and bioprospecting as distinct legal concepts, an activity would lose its status as scientific research and legally be considered bioprospecting if or when an intention to patent a marine genetic resource and develop a patent is introduced.[229]

[226] The term *bioprospecting* is, as similarly discussed in Part C.1 however unfamiliar to the law of the sea.

[227] This issue, and in particular the difference between the rules of the high seas and the Area is further discussed in section C.1.5. See in particular Tullio Scovazzi, *Bioprospecting on the Deep Seabed: a Legal Gap Requiring to be Filled*, *in* BIOTECHNOLOGY AND INTERNATIONAL LAW (Tullio Scovazzi & Francesco Francioni eds., 2006).

[228] Also this issue is developed in section C.1.5, See foremost FERNANDA MILLICAY, A LEGAL REGIME FOR THE BIODIVERSITY OF THE AREA (Martinus Nijhoff Publishers. 2007).

[229] Scovazzi, among others, appears to be supporting this argument. See Scovazzi. 2006.

There is reason to investigate when such commercial motives are introduced in marine research projects, if it precedes or is introduced after the sampling of genetic resource and whether a clear-cut division can be made between marine scientific research and bioprospecting based on how contemporary development cycles actually function. As will be established, the general trend is one of increasing interaction and integration between what has traditionally been regarded as pure research and commercial development. It has become more common that the commercial intention is not introduced until after the physical operation in the marine environment has been carried out. In an increasing number of cases, bioprospecting is based on material in collections, which were sampled as purely scientific activities.

This development challenges the conception of bioprospecting and scientific research as distinct and separate activities. Rather, as will be discussed below, an investigation of contemporary development cycles in bioprospecting gives reason to suspect that even in cases where samples collected as part of scientific research expeditions are subsequently used for bioprospecting purposes, it is common that no commercial intention is present at the time of sampling. Should the activity in such cases up to the point where commercial ambitions are introduced[230] (but not after) be regarded as marine scientific research? Or does the commercial ambition retroactively transform the preceding activities in the value chain into bioprospecting? In other words, can the use in bioprospecting of a marine genetic resource sample collected in scientific research retroactively disqualify the sampling operation from benefiting from the scientific research regime? Or should the use of scientifically collected samples simply be prohibited from being used in bioprospecting? As will be discussed in this section, this would not be in line with the function of the bioprospecting development cycle, with its increasing and liberal exchange between publicly funded research and commercial development.

Rather than following the perceived distinction between marine scientific research and commercial activities in international law rules, bioprospecting effectively functions as applied research, building on and integrating pure research, which provides the basis for biotechnology innovation.

[230] For instance, by the filing of a patent application.

Moreover, deep-sea marine bioprospecting is often described as involving the appropriation of common resources, as discussed in section C.1.4. This appropriation can be made up by directly selling genetic material from deep-sea organisms as products. More commonly, however, such appropriation is made up by claiming exclusive rights to the bioactive function of marine organisms. The investigation of the bioprospecting development cycle will highlight the role of marine genetic resources in product development, ranging from natural ingredients to inspiration for synthetic development. The role of patents relating to marine genetic resources in bioprospecting product development will therefore be a particular focus of the discussion.

What, then, characterizes the process whereby a living resource is turned into a commercial product by means of derivation, as required by the definition of bioprospecting? As already indicated, the long journey from sampling of marine organism to putting a fully developed product on the market is rarely an exclusively private venture conducted by a single legal entity. Rather, it is ordinarily the result of an interaction between public research and private interests.

Although the process of bioprospecting for marine organisms may differ considerably from one case to the next, it can be divided into different phases. Examining the nature of this value chain, with particular regard to the involvement of private and public interests, will facilitate a discussion on its legal nature.[231]

Based on a procedural description, bioprospecting has previously been described as typically consisting of four steps occurring in a linear sequence: sampling, isolation, screening and product development.[232] Firstly, any bioprospecting venture would typically start with the collection of samples, although such operations may be preceded by years of identifying target organisms.

[231] In the present investigation, the emphasis will be less on the final parts of the bioprospecting cycle and more on the former, since the central legal issues are more connected to the first stages. In particular, the connection to the naturally occurring genetic resource will be discussed, both in terms of how it is retrieved (sampling) and explored (laboratory isolation and screening). Moreover, the role of patents in the development cycle will be discussed. Final product development and marketing are considered less relevant in this context.

[232] Jabour-Green & Nicol, MELBOURNE JOURNAL OF INTERNATIONAL LAW (2003), at 85-87.

Secondly, the relevant bioactive component is isolated, characterized and cultured. Usually, this is conducted in a laboratory environment. Thirdly, the bioactive component is screened for pharmaceutical activity. Fourthly, the often lengthy product development phase starts with the patenting of a function, development of a product, trials, marketing and sales.[233] Of these steps only the sampling is conducted in a natural environment. Isolation, screening and connected analytical work is undertaken in a laboratory environment. Final product development is undertaken outside of the laboratory environment, once a function of interest has been screened.[234]

In addition to these steps, prior to the sampling mission it is necessary to obtain the consent of the coastal state of the marine area where the activity is to be carried out in case it is located within national jurisdiction, in line with the Nagoya Protocol of the Convention on Biological Diversity.[235] For operations in the high seas, requirements for such procedures do not apply given the lack of coastal state sovereign rights. Depending on interpretation of the rules for the Area under the law of the sea, bioprospecting in the deep seabed may, however, involve a requirement for permit by the International Seabed Authority, as will be discussed in section C.1.4. From the perspective of bioprospecting actors, the possibility of avoiding the costs involved in negotiating coastal state access could represent an incentive to target deep-sea areas.[236]

Setting aside preparatory work and formal preparations, the bioprospecting development cycle *stricto sensu* has been estimated to last about 15 years all in all. Out of this period, the research part comprised of sampling, laboratory exploration and screening as well as clinical phases typically lasts around 13 years, leaving two years for the registration and marketing authorization, as well as licensing of the patent, production and launching of the product.[237]

[233] Ibid.

[234] GUILLOUX. 2018, p. xxvi.

[235] As discussed in Part C.2, bioprospecting requires the prior consent of the coastal state of origin of the genetic resource and negotiation regarding the access and fair and equitable sharing of benefits (which regularly ranges up to two years).

[236] However, potentially decreased costs relating to procedure and sharing of benefits must of course be balanced with the considerable investments required for research cruises far off shore.

[237] ARICO & SALPIN. 2005, at 19.

B.6.4. Phase 1 – Sampling

In the sampling phase, which can be regarded as the start of the bioprospecting cycle, parts of or whole marine organisms are gathered. Identification or collection of a sample is, however, commonly preceded by an extensive preparatory phase, where target function or organism may be identified. If the intent to use the sample for bioprospecting purposes already exists at the outset of the project, sampling is not conducted randomly, but with the aim of targeting habitats and ecosystems where there is an increased likelihood of finding organisms with pharmaceutically relevant functions. The targeting may be more or less specific. Many recent projects have been based on an indication that a group of species contains or is likely to contain bioactive functions with potential utility in a certain pharmaceutical field, such as pain, cancer or inflammation.[238]

Generally, it is recognized that organisms with bioactive functions with a potential to be used in pharmaceutical development are more likely to develop among organisms existing under extreme conditions, such as high pressure, acidity, darkness, or temperatures.[239] A large proportion of such areas are located beyond the bounds of national jurisdiction. This explains the high level of interest in bioprospecting in the deep seas. This is also part of the reason for this investigation focusing on these parts of the ocean, as set out in the introduction. However, bioprospecting in the deep seas did not start until recently, as both knowledge of their biodiversity and the technology to harvest their genetic resources are relatively recent developments, as discussed in section B.5.

The nature of the sampling may vary considerably across cases. Around the deep-sea hydrothermal vents, which have attracted considerable attention for their richness in organisms with interesting bioactive compounds, sampling has focused on microbial species.[240] In the sampling of micro-organisms, very limited quantities are regularly collected. In the collection of organisms for the purpose of extracting target compounds, the samples may be considerably larger.[241]

[238] KIM. 2015.
[239] Jabour-Green & Nicol, Melbourne Journal of International Law (2003).
[240] LEARY. 2010, at 165.
[241] Jabour-Green & Nicol, Melbourne Journal of International Law (2003).

Whereas sample collection is different across cases, the technical challenges are common to most marine bioprospecting. Foremost, depth, temperature, salinity and darkness set high technological requirements. In the case of deep-sea bioprospecting involving sampling from hydrothermal vents, such expeditions face additional difficulties. Most hydrothermal vents are located at depths greater than 1,500 meters (the average depth of the world's oceans is estimated to be 3,688 meters).[242] Only high-technology submersibles and remotely operated vehicles are able to collect samples of deep-sea microbes. Only a handful of research institutions have the necessary technology.[243]

Naturally, this means that such research can only be undertaken by countries with sufficient capital to invest in such technology. Moreover, it implies that most necessary equipment for deep-sea bioprospecting is owned by academic research institutions. As such, private companies conducting sampling for bioprospecting purposes must, in most cases, cooperate with public research institutions.[244] However, it appears that private sector involvement seldom starts before the laboratory stage (see phase 2, below). Private involvement in the sampling phase appears to be limited to funding, whereas the actual operation is conducted by public institutions.[245] Accordingly, it appears that in most cases, sampling is conducted as part of academic or other research projects, aiming to describe new species or explore the biological diversity of a certain marine region.[246]

It is not just the collection of deep-sea organisms that require sophisticated technology. Extracting samples of microbes from the deep sea requires adherence to strict protocols in order to prevent contamination of samples, which is a considerable risk when being brought to the surface and in the laboratory.

[242] Matthew A. Charette & Walter H. F. Smith, *The volume of earth's Ocean*, 23 OCEANOGRAPHY (2010)
[243] LEARY. 2010, at 165.
[244] ARICÒ. 2015, at 201.
[245] Jabour-Green & Nicol, MELBOURNE JOURNAL OF INTERNATIONAL LAW (2003), United Nations Informal Consultative Process on Oceans and the Law of the Sea - An Update on Marine Genetic Resources: Scientific Research, Commercial Uses and a Database on Marine Bioprospecting. 2007.
[246] Indeed, assessments indicate that the majority of activities are scattered, small-scale, independent research activities and programs, ongoing in many universities and research institutions in the world. See ARICO & SALPIN. 2005, at 15-17.

Scientific research expeditions in these parts of the ocean therefore have developed detailed protocols. Another challenge is represented by the actual sampling and cultivation of micro-organisms extracted from extreme environments. This challenge has been described as particularly burdensome in the development of enzymes from extremophiles, where it appears to represent the biggest obstacle to further developments in biotechnology.[247] Another challenge in biotechnology development is to mimic the extreme environments from which such microbes have been extracted.[248]

More ambitious programs relating to the exploration of deep-sea organisms are often built on extensive scientific cooperation, as well as joint ventures between public and private institutions, such as universities and private companies.[249] While most of these activities are of an exploratory nature and are not directly commercially oriented, the scientific information output of such projects represents the backbone of any commercial application of deep seabed genetic resources.[250] This supports the notion that samples extracted for "pure" scientific research purposes, without any commercial ambitions, are later employed in a bioprospecting context.[251]

All bioprospecting development cycles, by definition, involve a connection to genetic material which at some point has been sampled in the natural marine environment. But the connection to the physical sampling differs considerably across cases. In this regard, marine bioprospecting projects can be placed on a continuum ranging between two extremes: On the one hand, cases where the physical sampling *in situ* is an integral part of the bioprospecting development and carried out by the bioprospecting entity; on the other, cases where the bioprospecting developer uses genetic material information preserved *ex situ*.

[247] Chiara Schiraldi & Mario De Rosa, *The production of biocatalysts and biomolecules from extremophiles*, 20 TRENDS IN BIOTECHNOLOGY (2002).
[248] LEARY. 2010, at 166.
[249] One such example is the Census of Marine Life, which resulted in over 2,600 scientific publications, more than 6,000 potential new species, 30 million species involved 2,700 scientists, 80+ nations, 540 expeditions, US$ 650 million. See N. Vermeulen, *From Darwin to the Census of Marine Life: Marine Biology as Big Science*, 8 PLOS ONE (2013).
[250] ARICO & SALPIN. 2005, at 15-17.
[251] As will be discussed in section B.6.3, there are also indications that the bioprospecting chain is becoming increasingly fragmented as the result of biotechnology development being based on collections in libraries and databases, rather than project specific sampling.

Where genetic material *ex situ* is used in bioprospecting, this may have been retrieved in a collection, database or library. *Ex situ* genetic material can also be used in different forms, either *in vivo* (tested on whole, living organisms or cells), *in vitro* (samples to be tested are obtained from a repository), or *ex vivo* (on tissue from an organism in an external environment with minimal alteration of natural conditions).

It seems increasingly common that not even physical connection to genetic material *ex situ* is necessary. Where the genetic and biomolecular data of marine organisms have been sequenced in databases, electronic information of the marine genetic resource may be sufficient for bioprospecting development.[252] Marine bioprospecting projects often lack direct connection to physical sampling and instead are based on sampling conducted by other actors, often prior to the bioprospecting project.[253] Often the sampling has been conducted by public research projects, representing pure or basic research. Yet, it also appears commonplace that the line between public research institutions conducting sampling and bioprospecting actors becomes blurred, that bioprospecting represents a spin-off in relation to academic research, where the intellectual property rights connected to a bioactive finding may be kept by either actor, or licensed.[254]

B.6.5. Phase 2 – Laboratory exploration, isolation and screening

The laboratory phase of bioprospecting is important to distinguish for two reasons. Firstly, as discussed in the previous section, this is often where private sector involvement starts. Thus, in many cases, this is the phase where scientific research transcends into bioprospecting. Secondly, this is the phase in which the *refinement* component, one of the defining criteria for bioprospecting, is undertaken. This refinement can vary considerably. Increasingly, bioprospecting uses genetic engineering and related technologies which not only replicate bioactive functions in marine organisms, but modify them.

[252] GUILLOUX. 2018;Broggiato, et al., MARINE POLICY (2014), at 177.
[253] KIM. 2015, FATTORUSSO, et al. 2012.
[254] Jabour-Green & Nicol, Melbourne Journal of International Law (2003).

The use of methods involving technologies that modify the natural component raises questions as to whether it still should be regarded as bioprospecting, or purely synthetic development. Can the level of refinement in bioprospecting reach a threshold where the active function becomes so different compared to the naturally occurring bioactive function that the process and resulting product should no longer be regarded as bioprospecting, but rather as synthetic product development? Based on reviews of existing cases, it appears difficult to provide an unequivocal answer to this question. Most cases of product development relating to functions originally found in the marine environment contain both natural and synthetic elements, as discussed in section B.6.1. In order to explore at what stage, if any, the marine genetic resource component is so minimal or remote that a product should be considered as purely synthetic, it is necessary to assess the technologies employed. The level of procedure during the laboratory process can vary considerably across a broad spectrum, ranging from minimal to complete refinement. The role of the natural organism component can range across a broad spectrum:

- *raw genetic material;*
- *direct replica of naturally occurring bioactive functions;*
- *refined bioactive function;*
- *synthetic molecule inspired by a natural function.*

As already established in section B.1, products built on raw genetic material, which are lacking a refining component, should not be regarded as bioprospecting, by virtue of the definition used in this study.[255] In contrast, since there is no requirement for physical components from the genetic resource to be included in bioprospecting products, cases where the natural element merely consists of inspiration from a naturally occurring bioactive function would qualify under the definition used in this study.

The second phase of the bioprospecting development cycle starts with the transferring of the collected specimen to a laboratory. In the laboratory environment, the characteristics of the specimen are then analyzed. The analysis may employ various technologies and differ in focus. Microbes may be isolated, characterized and cultured.

[255] As discussed in that context, bioprospecting is defined in this study as a process whereby commercially useful products are technologically derived, processed and developed based on collection of marine genetic resources.

A common trait is that irrespective of the method employed, the aim is to isolate a part of the genome containing a function, which has been considered potentially useful, either when observing the organism in its natural environment or in the laboratory phase.[256] A bioactive function in a marine organism may be identified prior to the analytical laboratory process. But it is during the laboratory phase that the biological mechanism performing the relevant function is deciphered and the possibilities for repeating and scaling up the function are explored.

It usually contains advanced laboratory analysis of the bioactive compound of interest, by means of genetic sequencing or other biochemical method. As a result, information in the form of sequence data or a map of the chemical structure is retrieved. One study indicated that there are considerable differences in how the isolation, characterization and culture of deep-sea genetic resources are conducted, depending on whether they are used by a public research institution or by commercial interests.[257] Similar to the what was found in the case of sampling, it has become increasingly common that the isolation, characterization and culture of microbes are undertaken not by individual institutions, but as part of major collaborative research projects across different academic research institutions and across different countries.[258]

Often the laboratory phase is thus conducted as a collaboration between several research institutions without any private interest involvement, at least not before a commercially interesting component has been found.

[256] Mossop. 2015.

[257] Jabour-Green & Nicol, Melbourne Journal of International Law (2003).

[258] Such examples include the European Union research programs on extremophiles as part of the Biotechnology Program of the European Union, including 39 academic and industrial laboratories. The project yielded a substantial scientific output, including 270 scientific publications. More recently, the EU PharmaSea project, an SME-academia-driven project were initiated by 24 partners in 2012 to discover novel products based on deep-sea genetic resources. To date the PharmaSea project has cultivated and extracted more than 1400 microbial strains from extreme marine environments, with the majority being fungi and actinobacteria. Alfredo Aguilar, *Exploring the last frontier of life: R & D initiatives of the European Union*, 11 WORLD JOURNAL OF MICROBIOLOGY & BIOTECHNOLOGY (1995); Alfredo Aguilar, et al., *Thirty years of European biotechnology programmes: from biomolecular engineering to the bioeconomy*, 30 NEW BIOTECHNOLOGY (2013); LEARY. 2010; Jaspars, et al., MARINE BIOLOGICAL ASSOCIATION OF THE UNITED KINGDOM. JOURNAL OF THE MARINE BIOLOGICAL ASSOCIATION OF THE UNITED KINGDOM (2016), at 155-156.

There are, however, also cases where isolation, characterization and culture has been made in cooperation between academia and industry.[259] Whereas deep-sea sampling is almost exclusively conducted by public institutions, the isolation, characterization and culture of microbes and other organisms can occur in both academic institutions and commercial laboratories. Generally, the stage in the laboratory phase at which private interests become involved varies from case to case.[260]

Where this research is funded by the public sector, results are regularly made public through regular scientific publishing, and in line with academic tradition it is likely that specimens will be made available to other researchers on request.[261] In cases where the research is funded by the private sector, results are generally kept confidential and are regularly not disclosed until after the filing of patent applications.[262] Instead of publishing results, researchers in private financed research report discoveries and provide extracts cultured from micro-organisms to their commercial partner.[263] In some cases, patent applications are filed already after this initial laboratory step of isolation. However, this is limited to cases and jurisdictions where patent criteria can be fulfilled by mere characterization. As indicated in section C.3, in particular requirements for innovation and application in many jurisdictions call for more advanced refining actions than mere isolation of bioactive function.

Commercial interests commonly gain access to samples collected through publicly funded institutions, where comprehensive collections of samples are often collected. It is thus not only possible for any academic researcher to access such a collection of samples funded by the public sector. In most cases, access to samples is also granted to commercial interests.[264]

[259] Two examples of this is the Biotechnology Program of the European Union, which involves cooperative research between 39 academic and industrial laboratories and the European Union Platform for Microbiology. LEARY. 2010, at 167.

[260] Arico & Salpin. 2005; Jabour-Green & Nicol, Melbourne Journal of International Law (2003).

[261] Aguilar, World journal of microbiology & biotechnology (1995).

[262] Alfredo Aguilar, et al., *Perspectives on Bioeconomy*, 40 NEW BIOTECHNOLOGY (2017).

[263] LEARY. 2010, at 168.

[264] Jabour-Green & Nicol, MELBOURNE JOURNAL OF INTERNATIONAL LAW (2003), at 86.

Indeed, spurring commercial development in biotechnology has been raised as a principal reason for the setting up of collections of samples and data relating to marine genetic resources.[265] Marine compound and sequence data libraries have thus been established in several countries, and granted substantial funding as recognition of the potential for economic growth in bioprospecting has become more widespread.[266]

Many public institutions thus allow for open access to such libraries, without any limitations on developing patents or commercial products based on their resources. However, there are also cases where contractual arrangements have been set up, stipulating that ownership of any intellectual property created from the processes of isolating and extracting will be assigned to the commercial partner. In return, public institutions, researchers, or their employers may be entitled to a share in the royalties from future products. There are also contract models where the public institution retains the background intellectual property but licenses its use to the developer of bioprospecting-based products.[267]

[265] For instance, in the PharmaSea project referred to above, a major motivation for the program was to overcome bottlenecks in biodiscovery process by improving the quality of marine resources available for biotechnological exploitation, shorten time to market, and develop sustainable modes of supply of raw materials for industry. Similarly, the French public research institute Ifremer which has been extensively involved in deep-sea sampling and genetic exploration has the mission of promoting the development of technological and commercial applications related to the identification and sustainable exploitation of marine resources and explore possibilities for the economic development of maritime activities. Jaspars, et al., MARINE BIOLOGICAL ASSOCIATION OF THE UNITED KINGDOM. JOURNAL OF THE MARINE BIOLOGICAL ASSOCIATION OF THE UNITED KINGDOM (2016), at 155; ARICO & SALPIN. 2005, at 16.

[266] The biggest such collection is the Natural Products Repository of the Developmental Therapeutics Program at the US National Cancer Institute, which consists of over 600 000 natural compounds and samples of 10 000 marine organisms. Other important libraries for marine bioprospecting include the MARBANK, which has collections covering more than 1,200 species of marine invertebrates, 110 species of microalgae. Manoj Monga & Edward A. Sausville, *Developmental Therapeutics Program at the NCI: molecular target and drug discovery process*, 16 LEUKEMIA (2002); C. C. Thornburg, et al., *NCI Program for Natural Product Discovery: A Publicly-Accessible Library of Natural Product Fractions for High-Throughput Screening*, 13 ACS CHEMICAL BIOLOGY (2018); Kristin Rosendal, et al., *Access and Benefit Sharing Legislation for Marine Bioprospecting: Lessons From Australia for the Role of Marbank in Norway*, 19 JOURNAL OF WORLD INTELLECTUAL PROPERTY (2016).

[267] In spite of such arrangements, it is however regularly still possible for other researchers to independently access the original material in the library collection and isolate the same micro-

As such, it is clear that the isolation of bioactive functions in marine genetic resources has been largely carried out as part of broad public research initiatives and that a lot of effort and resources have been allocated to the setting-up of library collections of both isolated samples and sequence data relating to marine genetic resources. Furthermore, a major motivation behind such efforts has been the promotion of biotechnology development and the attempt to enable it to bypass the cumbersome first phases in the bioprospecting development cycle. As a result, bioprospecting increasingly starts in laboratories or library collections, rather than in sampling expeditions. Likewise, it is commonly the result of a close and complex interaction between public research and commercial actors. This goes against established conceptions of how bioprospecting is conducted, as well as basic assumptions in the regulation of relevant legal concepts. During the first wave of bioprospecting in the 1990s, when it was first addressed as an activity in discussions on international environmental law, a clear distinction concerning the use of biological diversity was made between purely academic and purely commercial ends. Based on how bioprospecting has developed since the turn of the century, this distinction has become increasingly blurred, as it has become more common for academic and private activities to include commercial aims, or at least facilitate commercial aims, in collecting and conducting research on biodiversity.[268]

Once isolation has been successful, the next step in bioprospecting development can be initiated: the screening of relevant bioactive functions. The aim with any screening process in bioprospecting is to identify the potential for a product to be developed from organism samples.[269] Whereas laboratory analysis until the screening stage is focused on investigation of the organic compound, screening contains an equal emphasis on targets, essentially attempting to pair functions in an isolated compound with the desired function.[270]

organisms. The regulation of micro-organisms deposited at library collections is regulated under the Treaty on the International Recognition of the Deposit of Micro-organisms for the Purposes of Patent Procedure, see also Jabour-Green & Nicol, MELBOURNE JOURNAL OF INTERNATIONAL LAW (2003), at 86.

[268] Tvedt, POLAR RECORD (2011).

[269] Sonia Giubergia, et al., *Screening Microorganisms for Bioactive Compounds*, *in* THE MARINE MICROBIOME (Lucas J. Stal & Mariana Silvia Cretoiu eds., 2016).

[270] Although methods vary, a standard sequencing procedure involves culturing samples in varied conditions before screening them for biological activity. For practical purposes, this is done by setting up a culture collection of relevant natural samples. The collection is then screened for a specific target, such as cytotoxic anticancer activities. Firsova. 2017.

Extensive numbers of natural extracts may be assessed in such processes, where merely one isolated compound is identified as potentially pharmaceutically active.[271] Increasingly, such procedures have become automatized. Screening methods which were first used to sequence extensive libraries of synthetic compounds are now being utilized for screening extensive collections of natural samples.[272] Whereas laboratory operations until this step, including isolation, characterization and culturing, are largely carried out by public research institutions, screening for pharmaceutical activity is in bioprospecting usually carried out by commercial actors using samples from the original material.[273] Companies attempting to develop products based on bioactive marine compounds have in many cases developed their own screening facilities on specific targets.[274] Although screening by private actors is more common, it may be carried out for a broad range of ends, ranging from strictly academic or taxonomic research to the highly commercial search for economically valuable traits for the biotechnological or pharmaceutical industry.[275]

B.6.6. Phase 3 – Patenting, trials and final product development

Successful screening of a marine compound is a major achievement in any bioprospecting project. Establishing that a function originating in a marine genetic resource achieves a desired target, such as a cytostatic or oranesthetic effect, has a huge potential value. In order to safeguard that value, and to ensure

[271] Jabour-Green & Nicol, MELBOURNE JOURNAL OF INTERNATIONAL LAW (2003), p. 87.

[272] Foremost, the application of high-throughput phenotype screening to bioprospecting, has greatly facilitated processes, as described in section B.5.8, and has now become the major methodological strategy. OECD, Marine Biotechnology: Enabling Solutions for Ocean Productivity and Sustainability. 2013, at 33; J.P. Hughes, et al., *Principles of Early Drug Discovery*, 162 (2011); Pooja Bhatia & Archana Chugh, *Role of marine bioprospecting contracts in developing access and benefit sharing mechanism for marine traditional knowledge holders in the pharmaceutical industry*, 3 GLOBAL ECOLOGY AND CONSERVATION (2015); Firsova. 2017.

[273] Giubergia, et al. 2016.

[274] These efforts and the investments involved have also resulted in an increasing will to finance expensive expeditions to investigate the world's oceans and collect a large diversity of marine species. Bhatia & Chugh, GLOBAL ECOLOGY AND CONSERVATION (2015); Firsova. 2017.

[275] Roberta L. Farrell & Shona M. Duncan, *Uniqueness of Antarctica and potential for commercial success*, *in* ANTARCTIC BIOPROSPECTING (Alan D.; Rogan-Finnemore Hemmings, Michelle & Michelle Rogan-Finnemore eds., 2005).

exclusive rights to product development, application for patent protection is usually filed after successful screening has been achieved, if such protection has not been established previously.

Patents

Among actors involved in bioprospecting, the notoriously high investments required to bring a bioprospecting-based pharmaceutical drug project through the development cycle can only be offset by the prospect for financial returns by means of exclusive rights to discovery.[276] Exclusive rights can subsequently be used to develop final products marketed as monopolists. Alternatively, the discovery may be licensed to other entities. The prospects of gaining exclusive rights to discoveries by means of patents is thus a central element of bio-based pharmaceutical development, as in most other bioprospecting product development.

Indeed, the intellectual property rights connected to bioactive functions retrieved in marine genetic resources are central in the marine bioprospecting development cycle, highlighting the significance of patent law. As discussed in section C.3, the requirements for achieving patent rights are usually divided into three criteria. The invention must be new (novelty), involve an inventive step (non-obviousness), and it must be possible to utilize the invention industrially (usefulness).

Although marine bioprospecting, like most product development, may face challenges involving all these criteria, the most controversial aspect of bioprospecting patents relates to the non-obviousness requirement. More specifically, the most debated aspect of bioprospecting in the context of intellectual property rights has concerned whether genetic material and functions should be patentable. At the heart of this discussion has been the question of whether the identification or discovery of naturally occurring functions or material, such as bioactive metabolisms, can be considered to represent an innovation. As will be further discussed in section C.3, the compatibility of such patents with international law essentially depends on what type of organism is patented.

[276] Richard J. McLaughlin, "Marine Genetic Resources Exploitation and Intellectual Property Rights Protection" in VIDAS. 2010, at 372.

As discussed in that context, Article 27 of TRIPS enables states to exclude from patentability "*animals other than micro-organisms, and essentially biological processes for the production of plants or animals other than non-biological and microbiological processes*."[277]

In light of this ambiguous rule, which enables states to exclude patentability for some but not all marine organisms, it appears particularly relevant to examine what types of marine organisms are referenced in patents. This connects to the broader discussion of how bioprospecting patents relate to marine genetic components and at what stages of bioprospecting development patents are filed. It can be assumed that the earlier in the development cycle patents are filed, the closer the discovery relates to the genetic resource.

The connection between marine organisms and bioprospecting can be addressed by investigating final marine biotechnology products marketed, as discussed in section B.6.2. However, products do not always openly declare their marine genetic component. Patent data may therefore be more informative for practically assessing the extent of claims for exclusive rights based on marine bioprospecting discoveries. The availability of patent information is a consequence of the disclosure requirement, sometimes referred to as the rationale of patent regulation; patent protection is granted in exchange for distributing knowledge by disclosing the invention in the application.[278]

The information, which is published under the disclosure requirement, connected to discoveries can be assumed to provide representative data about marine bioprospecting, at least of the projects that surpass preceding phases in the development chain. It could be expected that assessments of different aspects of marine bioprospecting can be made easily based on patent data. In reality, such analysis is difficult since there is no general consensus on how to describe biological material in patent filings. Moreover, patent data is not collected in a comprehensive manner globally. This leads to differences across jurisdictions.

[277] In reality, most industrialized states do not expressly exclude plants and animals either, although a number of European states exclude plant varieties. See Jabour-Green & Nicol, MELBOURNE JOURNAL OF INTERNATIONAL LAW (2003).

[278] Ane Jørem & Morten Walløe Tvedt, Bioprospecting in the High Seas: Existing Rights and Obligations in View of a New Legal Regime for Marine Areas beyond National Jurisdiction, 29 THE INTERNATIONAL JOURNAL OF MARINE AND COASTAL LAW (2014), at 333; Tvedt, POLAR RECORD (2011).

Trends over time are also difficult to discern for methodological reasons, such as changes in reporting. For instance, US patent data series do not take into account that the United States Patent and Trademark Office only published granted patents prior to 2001. From 2001 patent applications began to be used in statistics, leading to challenges with reporting effects.[279]

These challenges arise in part because patent law uses the term "disclosure" with two different meanings: the regular disclosure requirement as a basic principle in patent law; and the highly disputed requirement for disclosure of origin (source and legal provenance) for the biological material used in the invention.[280] Lacking a clear rule on disclosure of origin of biological material in domestic law, it can thus not be ascertained that biological components in patent applications are fully disclosed. Nor can geographical origin always be established. The ambiguities and differences in regulation of disclosure across national jurisdictions is paralleled in international law.[281] As will be discussed in section C.3, the disclosure requirement is vaguely formulated in TRIPS, calling on states to establish requirements for applicants to disclose the invention in a way that is adequately clear and exhaustive so that a person with skills in the art can execute the invention.[282]

It will now be examined what evaluations of patent data have provided on central issues addressed in this investigation. These include three elements of central importance for the legal status under international law rules: Firstly, relating to the criteria for patentable subject matter, it is relevant to investigate what types of marine organisms are referenced in patents as well as how such filings relate to the marine genetic components. Potentially, patent data could indicate to what extent direct samples or libraries have been used;

[279] Oldham. 2014., at 90-91.

[280] Tvedt, POLAR RECORD (2011), at 51.

[281] For long, discussion have however been ongoing on including a requirement for disclosure of geographic origin. See The Relationship Between the Trips Agreement and the Convention On Biological Diversity. (2002).

[282] See Article 29(1), Agreement on Trade-Related Aspects of Intellectual Property Rights (TRIPS). In addition to TRIPS, the Budapest Treaty enables applicants for patenting of living organisms to deposit biological material as a supplement to, and replacement for, the written description requirement. In reality, however, very few countries have implemented an obligation to provide such information in patent applications. Budapest Treaty on the International Recognition of the Deposit of Microorganisms for the Purposes of Patent Procedure, Signed in Budapest on April 28, 1977, and amended on September 26, 1980, 1861 U.N.T.S. ; Genetic Inventions, Intellectual Property Rights and Licensing Practices: Evidence and Policies. (2002).

Secondly, patent data could indicate to what extent sample origin in maritime zones within domestic jurisdiction versus the deep-sea areas of the high seas and the Area have been references in patent filings; Thirdly, it could show at what stages of the cycle patents are filed, as well as which actors file and own patents in marine bioprospecting. Moreover, patent data could evaluate the assumption that marine bioprospecting is generally increasing.

Marine organisms and genetic material in patent data

A survey, which involved a breakdown of marine bioprospecting patents into phylogenetic group, revealed sponges as the largest source (52%), followed by marine bacteria (16%), marine algae and fungi (respectively 6% each), tunicates, cnidarians, echinoderms and mollusks (5% each).[283] Another general assessment of marine species in patent applications conducted in 2014 counted the number of times specific species occurred in patent documents.[284] The results indicate that the most frequent species referenced was the yeast-like fungus *Aureobasidium pullulans* used extensively in the production of different enzymes as well as biological control of plant diseases.[285] The jellyfish *Aequorea victoria* was the second most referenced species, used as the source of two proteins involved in bioluminescence, as discussed in section B.6.1. Most of the frequently used species found in the study were fungi, which appear to go against the trend identified in the previous study. Although no distinction is made based on marine areas, some of the names are generally associated with deep-sea habitats, such as the marine hydrothermal vent thermophile *Pyrococcus fuiosus* (an extremophilic species of Archaea) which is the source for important enzymes used as diagnostic tools, as mentioned in section B.6.2.

It appears that many but far from all of the frequently used species highlighted in the investigation can be regarded as micro-organisms under the terminology used in TRIPS, depending on biological classification.[286]

[283] Montserrat Gorina Ysern, International law of the sea, access and benefit sharing agreements, and the use of biotechnology in the development, patenting and commercialization of marine natural products as therapeutic agents, OCEAN YEARBOOK (2006), at 236.

[284] Oldham. 2014.

[285] Zhenming Chi, et al., Bioproducts from Aureobasidium pullulans, a biotechnologically important yeast, 82 APPLIED MICROBIOL BIOTECHNOLOGY (2009).

[286] As will be discussed in section C.3.1, there is no generally agreed definition of the different types of species and biological processes referred in TRIPS Article 27, states thus appear to have

A growing number of patents have been filed for gene sequences and proteins derived from what are commonly regarded as micro-organisms. In some instances, even the micro-organisms themselves have been patented.[287] Generally, it seems that marine bioprospecting patents relate to a broad number of phyla. There are, however, reasons for not drawing too far-reaching conclusions based on the indicated species name, since it appears to be more common to include explicit references to higher species' name in patent data compared to less complex organisms.[288]

Distinguishing deep-sea bioprospecting patents from coastal patents

It is notoriously difficult to precisely assess how many patents are based on genetic material retrieved in the deep-sea areas because of the lack of stringent requirement for geotagging sample sites. In lieu of other sources, the information on marine genetic resource component disclosed in patent filings, paired with the known occurrence of the species, is the best available source for making such distinctions between bioprospecting within and beyond national jurisdiction. Indeed, studies indicate that at least rudimentary estimates can be made based on a combination of references to species names and known distribution of the same species. However, in many cases the organism reference is vague, entailing the family or genus rather than species. Moreover, marine organisms commonly migrate and occur in vast geographic areas. Thus, in many cases, referenced names can be assumed to provide limited indication of origin. The origin of marine genetic components in bioprospecting cannot be established with certainty on the basis of patent data.[289]

In the studies that have attempted to identify geographic origin of marine bioprospecting patents, it has been affirmed that most such innovations appear to be based on organisms collected from within national jurisdiction.[290]

considerable discretion in interpreting for instance micro-organisms. See CARLOS M. CORREA & ABDULQAWI A. YUSUF, INTELLECTUAL PROPERTY AND INTERNATIONAL TRADE : THE TRIPS AGREEMENT (3 ed. 2016), chapter 8.

[287] Irrespective of whether or not patents are taken out, the parties may be bound by confidentiality requirements to keep their discoveries secret. Jabour-Green & Nicol, MELBOURNE JOURNAL OF INTERNATIONAL LAW (2003).

[288] Arnaud-Haond, et al., SCIENCE (2011).

[289] Many observers have referred to these aspects as reasons for attempting to make such investigations. See for example Gorina Ysern, OCEAN YEARBOOK (2006), at 236.

[290] Arnaud-Haond, et al., SCIENCE (2011).

However, based on evaluations of Patent Office Databases, it is clear that several deep-seabed organisms also have been used for commercial application. One overview established that most of these inventions concern the genomic features of deep-seabed species, based on the isolation of active compounds and sequencing methods. Others relate to the isolation of proteins that present enzymatic activity of potential for industrial applications, as discussed in section B.6.2. Several inventions concern the cell components and biological compounds themselves, which offer interesting properties for use in biomedical applications. However, for many of these patents, it has been considered difficult to demonstrate whether and to what extent practical applications have been developed.[291] In another extensive survey it was established that references to deep-sea marine organisms are increasing in patent data.[292]

Both these studies generally found data on geographic origin of specific samples deficient or unspecific. This confirms the picture that the combination of a lack of geographic coordinates for sampling sites in patent applications and the fact that many marine organisms, including deep-sea species, occur in habitats across different sea areas acts as a major hindrance to determining the allocation between areas beyond and within national jurisdiction in samples used in bioprospecting patents.

In light of this lack of geographic information, as well as legal requirements to include such information, a second study considered that it would be difficult to prove with certainty in what maritime zone sampling used in bioprospecting had been conducted. Despite the lack of geographic indication in patent data, an attempt was made to distinguish patents related to deep-sea genetic resources by analyzing where species referenced in patent data were known to occur geographically.[293] Approximately 1,800 out of 4,759 marine species identified in patent data were identified as known to occur in the deep-sea areas beyond national jurisdiction. However, many marine species occur in different marine areas. Accordingly, only 42 of these species were identified as only occurring outside of national jurisdiction.

[291] ARICO & SALPIN. 2005, at 20.

[292] Oldham. 2014.

[293] In the study, information on distribution of species was retrieved from both the Global Biodiversity Information Facility and the Ocean Biogeographic Information System (OBIS).

Although geographic origin was difficult to ascertain in many cases, this evaluation based on the available taxonomic information supported the suggestion that species sampled were predominantly distributed in marine areas within national jurisdiction.[294]

Patenting in the bioprospecting development cycle

Based on indications in the lack of comprehensive data, it has been generally assessed that patents are not limited to inventions at the far-end of product development, but relate to discoveries at different phases of the bioprospecting development cycle. Many patents relate to bioactive functions of marine organisms with vague references to application. Distinction has been made between two types of patenting of genetic resources: Firstly, there is direct patenting of a source material, whereby the patent claims genetic resources or organisms obtained from a separate source as an invention on the basis of their novel physical, chemical or biological properties. For such discoveries, the patent system does not grant ownership in the traditional sense. Rather, it grants the exclusive use, by the patent holder, of that naturally occurring material or the products derived thereof for a limited time.[295]

Secondly, there is patenting of inventions derived from the source material, whereby a patent claims an invention derived from or using genetic resources or organisms.[296] A distinction has also been made between product-oriented and process-oriented patents.[297] Product-based patents relate to the isolation of compounds from deep-seabed samples and the creation (through molecular engineering techniques) of new organisms of potential use in pharmaceuticals and many other fields, such as food processing. Process-based patents relate to the isolation or creation (also through molecular engineering techniques) of compounds and derivates (usually proteins having an enzymatic function) that improve the pace of industrial processes and/or the quality of ensuing products. It is noteworthy that both types of patents can result in per se claims over the source organisms.[298]

[294] Oldham. 2014., at 86.
[295] Jabour-Green & Nicol, MELBOURNE JOURNAL OF INTERNATIONAL LAW (2003), at 88.
[296] ARICO & SALPIN. 2005, at 19.
[297] The relationship between the TRIPS Agreement and the Convention on Biological Diversity. (2002).
[298] ARICO & SALPIN. 2005, at 19.

Sequence-wise, patents are often filed in the wake of successful screening. This may seem self-evident, since the purpose of screening is to make a discovery of a biological function. However, as discussed, patents can be and indeed are filed during any of the phases of the bioprospecting development cycle. It appears that commercial actors in many cases delay patenting until pharmaceutically active products have been isolated. Patents and contractual confidentiality requirements commonly limit access by other researchers to basic research results.[299] Upstream patenting is generally more likely to secure a return on investment, as opposed to downstream patenting (patenting of a product such as a medicine). This is because it is more likely that an organism as close as possible to its natural state will be sought after for further investigation and licensing would be required for its use.[300]

Public and private patenting, actors and ownership

The marine bioprospecting patents identified in studies are held by private companies as well as by governmental and academic institutions.[301] Whereas private ownership of marine bioprospecting patents is more common, there has been increased expectations in certain countries for universities and public research institutions to live up to governmental pressure to justify public funding by developing a biotechnology patent portfolio.[302] In other regions, the trend has been reversed. As the result of explicit policy objectives of promoting growth in the private biotechnology sector, public research institutions have decided not to seek to patent their findings.[303]

[299] Irrespective of whether or not patents are taken out, the parties may be bound by confidentiality requirements to keep their discoveries secret. Jabour-Green & Nicol, MELBOURNE JOURNAL OF INTERNATIONAL LAW (2003).
[300] Charlotte Salpin & Valentina Germani, Patenting of Research Results Related to Genetic Resources from Areas beyond National Jurisdiction: The Crossroads of the Law of the Sea and Intellectual Property Law, 16 REVIEW OF EUROPEAN COMMUNITY AND INTERNATIONAL ENVIRONMENTAL LAW (2007).
[301] However, this is far from always the case. As will be discussed below, samples extracted in public research have increasingly become part of open-access collections, aimed to spur biotechnological development. Jannigje G. Kers, et al., *Trends in genetic patent applications: the commercialization of academic intellectual property*, 22 EUROPEAN JOURNAL OF HUMAN GENETICS (2014).
[302] Gorina Ysern, OCEAN YEARBOOK (2006), at 232.
[303] OECD, Marine Biotechnology Definitions, Infrastructures and Directions for Innovation 2017.

Actors and ownership

As regards ownership, the same study found that private claims associated with marine genes originate in just 31 of the 194 countries in the world. Among ownership deposited with marine genes, 90 per cent belongs to companies originating in ten countries, with 70 per cent of the associated patents belonging to companies in the top three states of the United States, Germany and Japan. [304]

In a study on ownerships of patents restricted to deep-sea bioprospecting, it was established that the companies owning patents were predominately North American and European-based. These include some of the world's largest biotechnology companies. Six of these companies already market products derived from deep-sea genetic resources sourced both within and beyond national jurisdiction.[305] In another evaluation focusing on patents connected to species associated with deep-sea ecosystems, it was estimated that the German company BASF alone had registered 47 per cent of all marine sequences included in gene patents, exceeding the combined share of 220 other companies.[306] Universities and their commercial partners registered 12 per cent. Actors located or headquartered in 10 countries registered 98 per cent of all patent sequences, and 165 countries were unrepresented.[307]

Sampling and library collection references in patenting

Similarly, it appears difficult based on patent data to ascertain to what degree samples used in marine bioprospecting are retrieved from direct sampling or libraries. In assessments it has been estimated that in the majority of cases it appears likely that applicants referencing deep-sea locations obtained genetic material or data from commercial sources, public collections or databases rather than field collections.[308] The difficulty of distinguishing connection to library collections relates to the lack of any requirement for indicating such connections.

[304] Arnaud-Haond, et al., SCIENCE (2011).
[305] Leary, et al., MARINE POLICY (2009), at 189.
[306] Blasiak, et al., SCIENCE ADVANCES (2018).
[307] Leary, et al., MARINE POLICY (2009).
[308] Arnaud-Haond, et al., SCIENCE (2011).

General trends

The number of patents filed based on marine organisms in general has grown steadily by 12 per cent each year, with 95 per cent of patent claims having been filed after 2000, according to a recent assessment. The same study found that among 677 international claims of marine gene patents deposited between 1991 and 2009, 8,648 sequences from 520 species were found. Gene patent claims from marine organisms make up only 2 per cent of the WIPO gene patents.[309] The rising trend is supported by another study published in 2014, indicating a steady rise from the year 2000, with a peak of 1,645 filings in 2008. In the wake of the global financial crisis, a temporary downturn was observed in patent filings in general and this is likely to be reflected in data for 2009–2010. Data from 2011 onwards will be affected by a lack of data arising from the delay in the publication of patent documents.

A more specific assessment of patent filings referencing species occurring in the deep-sea marine areas beyond national jurisdiction between 1990 and 2010 identified a rising trend in observable filings from the late 1990s with 369 filings records in 1999 rising to a peak of 731 filings in 2009 before declining to 643 in 2010.[310] However, since most of these species do not only occur in deep-sea areas, the number should not be mistaken as indicating cases where sampling has been conducted in the deep seas.

Moreover, in a closer examination of the patents referencing species occurring (but not necessarily exclusively) in deep-sea areas, the same study identified a trend of intensification of patent activity of the genetic component of a limited number of marine species rather than a dramatic increase in the number of new species entering the patent system.[311]

As regards application, one study assessed that the biological activity properties in marine bioprospecting patents issued in the pharmaceutical field include anti-cancer (50%), anti-fungal and anti-bacterial (9% each), anti-inflammatory (5%), anti-viral (4%) and other (23%).[312]

[309] Ibid.
[310] Oldham. 2014., at 86.
[311] Id. at 109.
[312] Gorina Ysern, OCEAN YEARBOOK (2006), at 236.

This appears to be in line with the areas of use for the final products identified in section B.6.2.[313] If these indications are correct, the interest in deep-sea genetic resource patenting has risen in recent years, as has marine bioprospecting patenting more generally. This is not surprising considering the returned interest in marine bioprospecting since the turn of the millennium, as discussed in section B.5.7. Moreover, it seems clear that many patents are controlled by a small number of private actors in an equally small number of countries.

Yet, it would be wrong to assume that positive screening results or patent protection is evidence of successful bioprospecting product development. As shown by the minuscule number of developed marine pharmaceutical products in comparison with patent numbers, the vast bulk of marine bioprospecting patents fail to reach commercial application. This is because two of the most cumbersome steps in the bioprospecting development cycle remain: trials and final product development.

Trials and product development

Like successful screening, attaining patent protection is often a major objective in bioprospecting development cycles. Intellectual property rights represent substantial values in marine bioprospecting.

[313] In another assessment which evaluated marine biotechnology patents more broadly, it was observed that certain patents pertain to scientific discoveries of bioactive compounds of biological properties, while others pertain to inventions related to technology and techniques such as scientific methods. Many of the patents describe scientific information such as a given genetic sequence or the structure of a given enzyme. The filing of patents on genetic sequences commonly anticipate the detection of the intellectual property of products likely to be developed from certain genetic sequences or enzymes, the functions of which are still unknown, but which hold potential for applications. Moreover, contrary to the assumption that pharmacological use is dominant it was established that the chemistry sector is characterized by the greatest number of patents 53.5 per cent, followed by the pharmacology sector with 32.2 per cent of the patents. The food sector corresponds to 5.7 per cent of the patents identified. In total, 1.7 per cent of the patents identified correspond to the agriculture sector. The cosmetics sector corresponds to 1.2 per cent of the patents found; the description of their potential applications was vague and therefore could not be reported. Around 5.7 per cent of the patents identified correspond to other applications such as devices allowing the sampling or rearing extracts of marine species. Several patents found concern species living in extreme environments such as Antarctica and the deep sea. Leary, et al., MARINE POLICY (2009), at 189.

However, far from all patents become applied in products. Bridging the gap between discovery and commercialized product is particularly difficult in pharmaceutical development.

Establishing that a function originating in a marine genetic resource achieves a desired target often has a value in itself, particularly if exclusive rights to such discoveries can be ensured by means of patents. Finding such links and connected intellectual property rights is, however, of more limited value unless pharmacological effect and safety can be validated in trials. Without success in trials, values connected to patent rights fail to transform into the much more valuable incomes from commercialized products.

But even before trials can be initiated, a difficult challenge is faced by the need to scale up the quantities of active compounds. The trials necessary in all pharmaceutical development require much larger supplies of the active compound than in previous laboratory steps. As discussed in phase 1 in this section, physical samples, whether collected in the marine environment or retrieved in libraries are often small. This scaling up regularly faces the same supply-side challenges as previously discussed, and the variety of different methods discussed in that context may be employed to overcome such challenges, which are not always manageable.[314]

Whereas preceding phases of product development deviate considerably from other forms of pharmaceutical development, the clinical trials element in marine bioprospecting is associated with the same challenges, aside from the particular challenges of scaling up active compounds. A recent data study of the success rate and duration in general clinical trials in pharmaceutical development estimated that almost 15 per cent of new compounds pass clinical trials.[315] Accordingly, a more specific assessment of trial success rate in marine pharmaceutical bioprospecting indicates that research interest does not always result in successful product development.[316]

[314] Attempt may be made to culture micro-organisms. Unless that already has been done prior to screening, the DNA of the relevant function is often sequenced. Jabour-Green & Nicol, MELBOURNE JOURNAL OF INTERNATIONAL LAW (2003).

[315] Chi Heem Wong, et al., Estimation of clinical trial success rates and related parameters, 20 BIOSTATISTICS (2019), at 273–286.

[316] Oldham. 2014., at 31.

Between 2004 and 2013, 28 marine natural products were in clinical trials but 18 of the trials were discontinued.[317] The main reasons for the withdrawals of development in clinical phases I–III were mainly a lack of efficacy (43%) and drug toxicity (33%).[318] Accordingly, in spite of the large number of active compounds isolated from marine organisms, many of them with pronounced biological activity, the great majority does not surpass the pharmaceutical pre-clinical trials and only a very few have been marketed as pharmaceutical products.[319] In order to safeguard the value of the few candidates, and to ensure exclusive rights to product development, application for patent protection is often filed as soon as successful screening has been achieved, if such protection has not been established previously. Indeed, not all patents result in commercialized products and subsequent profits. For example, in the field of pharmaceuticals, thus far, only 1–2 per cent of pre-clinical candidates have become commercial products.[320]

B.7. Conclusions on bioprospecting processes

The review of the development of marine bioprospecting has shown that the particular interest in the genetic resources of the deep-sea is recent, as the result of the late discovery of the pharmaceutical potential of deep-sea ecosystems in combination with the technological challenges associated with conducting activities in these parts of the oceans. The inhospitable nature of the deep seas also partly explains the relatively high prevalence of relevant bioactive properties. The challenges posed to survival in these environments, coupled with the longer history of marine life, have prompted organisms in the deep seas to develop unique functions by means of evolution. The commercial interest has been far from constant, but has fluctuated in recent decades. The advent of DNA technology in the 1990s created expectations for a boom in bioprospecting, which also explains the negotiations of central elements of TRIPS and the CBD. Yet, at least in the short run, the output turned out to be disappointing. This resulted in the abandoning of many bio-based projects in favor of synthetic approaches. Recent years have seen a renewed interest in marine bioprospecting.

[317] Martins, et al., MARINE DRUGS (2014).
[318] D. Schuster, et al., *Why drugs fail - a study on side effects in new chemical entities*, 11 CURRENT PHARMACEUTICAL DESIGN (2005).
[319] Martins, et al., MARINE DRUGS (2014).
[320] Arico & Salpin. 2005.

Contemporary bioprospecting is characterized by increasing involvement of genetic technology. In many cases, refinement and interaction with synthetic approaches have made the biological component in many projects less direct. This connects to the type of genetic material used in bioprospecting processes. Increasingly, genetic information is the only connection to the organism that forms the basis for the invention. Chemical compounds and raw extract from genetic material, however, also remain to be used, as the result of the difficulty in mimicking natural function. It has also become more difficult to distinguish pure scientific research projects from bioprospecting, as the result of greater exchange with and dependence on public research in bioprospecting development cycles. In particular, the establishment of biobank collections and sequence libraries as part of political ambitions to promote biotechnology has enabled developers to bypass costly sampling missions and base pharmaceutical development on samples originally collected without commercial intentions. This raises difficult issues in relation to law of the sea rules on marine scientific research. As will be further discussed in the next part, these rules provide far-reaching freedoms to carry out marine research missions but prevent their use as the basis for appropriation.

Many pharmaceutical products based on deep-sea organisms can be distinguished. In other cases, it is less clear in what marine area the genetic resource has originated. This is the result of the combination of a lack of requirement for geographic indication in patent data and the fact that the same species often occur in different locations, both within and beyond national jurisdiction. The challenges represented by the lack of geographic traceability also make it difficult to establish deep-sea origin in investigations of data from patent applications. Based on species name, it appears that a broad range of organisms are used in bioprospecting. A considerable share of species identified in patent data could be considered as micro-organisms. This has far-reaching implications for the application of TRIPS, as will be discussed in section C.3. Yet, it generally appears difficult to divide genetic material in patent data into different categories of organisms and biological processes in the TRIPS rule on patentable subject matter. Even if governmental and academic institutions hold patents connected to deep-sea genetic resources, the overwhelming majority of them remains in private ownership, with the lion’s share being controlled by companies in a small number of countries.
Among patents associated with deep-sea species, it is noteworthy that a single company alone controls almost a majority.

C. Rules on deep-sea bioprospecting under three regimes of international law

In the previous part it was established that marine bioprospecting should be regarded as a process, which encompasses an extensive research and development chain, ranging from physical sampling to marketed products. At all stages of this cycle, regulation sets conditions for such operations. By commonly involving many different legal entities, as well as cooperation between public and private actors, contractual relations are central in these development chains. Moreover, different strands of domestic public law regulation are applicable to the utilization of marine genetic resources, simultaneously or successively, complementarily or concurrently. With few exceptions, such rules have not been drafted with marine bioprospecting in mind. No regulation in a comprehensive manner considers the full development chain involved in bioprospecting, or the challenges raised by such use of marine genetic resources. This lack of a holistic approach in domestic legislation is paralleled by – and may partly be the result of – apparent normative inconsistencies in international law, where the three regimes of the law of the sea, international environmental law and WTO law all provide obligations for states in relation to bioprospecting for marine genetic resources.

The relationship between the obligations of these regimes appears to be particularly contentious in relation to deep-sea bioprospecting, genetic exploration and commercial use of functions from organisms *in areas beyond national jurisdiction* (an activity which will be further legally contextualized below). Not only do the rules of the three regimes relevant for bioprospecting in these areas appear to be inconsistent; in some regards they seem to be contradictory. These deep-sea areas are legally significantly distinguished from the marine areas where coastal states exercise varying degrees of exclusive or sovereign rights. Under one regime of international law; the law of the sea, two commons regimes with different geographical scope and material implications have also been established for resource extraction and scientific research in areas beyond national jurisdiction. Depending on physical location, and the scope of legal principles involved, such activities could be encompassed by the principle of high seas freedoms or the common heritage of mankind.

In this chapter, the rules relating to deep-sea bioprospecting in the law of the sea will be discussed and compared with the perspective of genetic resources in WTO law and international environmental law. As will be discussed, the commons regime of the law of the sea could be interpreted as conflicting with WTO law, which not only lacks restrictions on appropriating genetic functions in organisms by means of patenting, but also with some exceptions it even obliges states to allow for the protection of such intellectual property rights. International environmental law sets requirements for such claims, but only in areas within national jurisdiction. Beyond national jurisdiction, the regime appears to allow claims to genetic functions of organisms but imposes obligations applicable to bioprospecting, foremost relating to *in situ* conservation of biological diversity.

The peculiarities of deep-sea ecosystems, and the organisms with bioactive functions not found in other parts of the biosphere, on top of the resulting commercial interest as discussed in Part B, are thus matched by a similarly unique legal environment that is radically different from areas within national jurisdiction.

This potentially conflicting situation in international law – where three regimes of international law provide obligations relevant for parts of the bioprospecting cycle without any of them in a comprehensive manner considering the full development chain or the distinct qualities of marine genetic resources – has been referred to as legal compartmentalization.[321] It represents a practical example of the fragmentation of international law, as discussed in section A.6. The reasons for as well as consequences of the disintegrated regulation of bioprospecting in international law will be the focus of the investigation in Parts D and E respectively. But before entering into this discussion, the specific rules applicable to deep-sea bioprospecting in the three regimes will first be examined, in order to highlight what rules are applicable to deep-sea bioprospecting, as well as the material basis for potential conflict.

Whereas some of these rules explicitly instruct states how to deal with bioprospecting of genetic resources in a marine context, the application of other rules is perhaps less apparent based on their formulation. But considering their scope and impact, they can be equally important as more issue-specific norms.

---

[321] Guilloux. 2018.

It should also be borne in mind that the selection of legal regimes investigated in this study is not exhaustive. Rather, as stated in section A.5, the selection is the result of a qualitative assessment, based on what norms appear to be most influential in relation to states in these parts of the oceans.

C.1. The Law of the Sea

C.1.1. An operative constitution for the oceans – Regulation under UNCLOS

C.1.1.1 UNCLOS – a natural starting point for marine bioprospecting

Since this investigation is focused on bioprospecting of genetic resources in a *marine* context, there are two reasons which make it logical to start any discussion of relevant international law rules in the 1982 United Nation Convention on the Law of the Sea (UNCLOS). Firstly, it was the explicit ambition of the drafters of the convention to endow it with status as *the* relevant framework for regulating human activity in relation to the oceans. This follows already from the preamble of UNCLOS, where the ambition is clear:

> *Establishing through this Convention, with due regard for the sovereignty of all States, a legal order for the seas and oceans which will facilitate international communication, and will promote the peaceful uses of the seas and oceans, the equitable and efficient utilization of their resources, the conservation of their living resources, and the study, protection and preservation of the marine environment.*

Similarly, the UN General Assembly (UNGA) and individual states have on repeated occasions declared that UNCLOS "*sets out the legal framework within which all activities in the sea must be carried out.*"[322]

Not only does this aspiration make UNCLOS a natural starting-point for any investigation of marine activities in international law; it also indicates a

[322] The formulation has been standard language in the preamble of the yearly so-called omnnibus resolution of the Oceans and the Law of the Sea, most recently in United Nations General Assembly resolution 74/19, Oceans and the law of the sea, A/RES/74/19 (10 December 2019), available from undocs.org/en/A/RES/74/19. 2019.

presumption that all marine activities fall within the scope of the convention. Even if many marine activities, including marine bioprospecting, are not explicitly mentioned in the convention, there is thus reason for assuming that the rules also encompass such uses. As will be discussed, the general formulation of many of the central parts of the convention, which enables application also to uses not considered during the drafting phase, reflects the ambition to provide a complete law for the seas.

Moreover, the preamble indicates a holistic objective to consider ocean spaces as interrelated and as a whole. It can be questioned to what extent this holistic ambition is actually reflected in the convention. Whereas the preamble underlines the fundamental need for such approaches, it is poorly reflected in many of the operative provisions. Paradoxically, the convention came to cast in cement and even strengthen the pre-existing division of marine areas into different sectors, which involved limited regard for the need for holistic management.

Leaving little leeway for integrated approaches, UNCLOS thus established a handful of different maritime zones. In this division of the seas, the full sovereignty of coastal states in internal waters and territorial sea was complemented with exclusive rights for exploitation of economic resources in the exclusive economic zone and the continental shelf. Not only were integrated management approaches complicated by the clear division of sea areas between states. Even more challenging from this perspective is that the rules for the sea floor and pelagic waters beyond the territorial sea are markedly different, as if there were no connection between the ocean floor and the water on top of it. This lack of genuine overlap, not only between maritime zones but also in many other legal approaches under the convention, leads to challenges when addressing activities and resources such as bioprospecting of marine genetic resources, which transcend the conventional division of the seas into maritime zones as well as marine management into different activities.

It is thus clear that the drafters intended for UNCLOS to represent a *complete* framework for marine regulation that would also hold a status of *primacy* in relation to other, pre-existing norms of international law relating to the oceans. This ambition to provide the relevant rules for all marine activities, coupled with the general formulation of many rules, presents some challenges when addressing new activities such as bioprospecting, which was not considered at the time of negotiation, as will be further discussed in this part.

Does all this mean that UNCLOS is an exclusive and fully comprehensive treaty, which contains all relevant legal rules for all marine activities? Despite the negotiators' intention to bestow UNCLOS with a status as the comprehensive, holistic and primary convention for the law of the sea, other treaties, both beyond and within the law of the sea, provide relevant obligations for marine activities.[323] Moreover, even in cases where the convention provides no obligations relating to an activity specifically, this does not necessarily mean that UNCLOS lacks applicable rules for this use of the sea. Indeed, there is nothing indicating that the activities explicitly referred to in the convention are exhaustive. The convention may still contain rules which are relevant to activities not explicitly mentioned, by virtue of the general formulation of obligations. Potentially, rules drafted for other uses of the seas could also be relevant by means of analogy. The activity examined in this study, deep-sea bioprospecting, represents such a case of a new activity, not explicitly referred to in UNCLOS. As will be further discussed, the concept of biotechnology was certainly not unknown to science when UNCLOS was drafted in the 1980s. As discussed in section B.5, marine bioprospecting predates the convention. But bioprospecting was not foreseen to become a substantial commercial interest in the use of marine resources.

C.1.1.2 A framework convention

The law of the sea certainly existed prior to the 1980s, and already at that time contained a rich and diverse flora of treaties. The negotiators did not intend to terminate those obligations. Rather, in addition to developing new norms where there had previously been ambiguity and uncertainty, a major motivation for UNCLOS was to organize this pre-existing legal regime. Effectively, the convention was meant to function – and effectively functions – as a *framework convention* for this area of international law.

[323] It appears to have been a widely shared understanding among the negotiators, and is also expressed in the preamble, that UNCLOS "*establishes a comprehensive framework for the regulation of all ocean space, conscious that its problems are closely interrelated and need to be considered as a whole*." The status of UNCLOS as the relevant framework for all uses of the sea is also regularly stated in the UN General Assembly resolutions on Oceans and the Law of the Sea. Most recently, it was included in the Resolution (72/73) adopted by the General Assembly on 5 December 2017 ("*Emphasizing the universal and unified character of the Convention, and reaffirming that the Convention sets out the legal framework within which all activities in the oceans and seas must be carried out*.").

This role of UNCLOS in relation to the law of the sea has also been compared to that of a *constitution* in domestic law.[324]

The reference to constitution is in certain regards an appropriate description of the convention by virtue of its ambition, as discussed above, to be comprehensive in scope, without regulating all matters of the law of the sea in detail. Rather, like domestic constitutions, UNCLOS established principles with varying degree of specificity, allowing for detailed regulation to be drafted in other treaties and co-operations. However, unlike domestic constitutions, UNCLOS does not aspire to establish distinct hierarchies in relation to these other, more specific treaties. This circumstance, which is connected to the formal status of international law treaties as equal, disproves the occasionally expressed view that UNCLOS somehow should have precedence in relation to other treaties, as regards marine activities and phenomena. This point is relevant already at this stage, although the relationship between the law of the sea including UNCLOS and other regimes of international law will not be discussed extensively until Part E.

Rather than establishing hierarchies, UNCLOS brought pre-existing treaties under its umbrella by implicitly and explicitly referencing other co-operations and treaties as the relevant fora for certain issues. This was the case, for instance, with the management of marine mammals, where UNCLOS simply referenced the International Whaling Commission as the relevant organization for managing such activities. Correspondingly, UNCLOS acknowledged a strong regional dimension in marine management. Regional fisheries management organizations were thus implicitly granted an extensive role in the management of fish stocks migrating across boundaries. This was also the case in the rules for the protection of the marine environment, where a strong emphasis was put on regional cooperation.

[324] Tommy Koh, *'A Constitution for the Oceans'*, *in* The Law of the Sea - Official Text of the United Nations Convention on the Law of the Sea (1983), p. xxiii.

The comparison with domestic constitutions also has considerable weaknesses. In many areas UNCLOS functions as much more than an umbrella for issue-specific agreements and organizations. Indeed, in some areas the language is surprisingly operative. One such area is the rules for the management of living resources, which will be discussed in more detail in section C.1.5. Although these have been subsequently developed in the second implementing agreement to UNCLOS, the 1995 United Nations Fish Stocks Agreement (UNFSA)[325], as well as in rules under different regional fisheries management organizations (RFMOs), highly operative management rules relating to the concepts of maximum sustainable yield (MSY) and total allowable catch (TAC) are set out in UNCLOS. Primarily designed to deal with conventional fisheries, these rules arguably have implications for bioprospecting of marine genetic resources, and there are reasons for returning to these criteria.

More specific obligations are thus provided for some activities, in treaties focusing on a specific activity (often referred to as sectoral treaties) as well as regional agreements. For other activities, including bioprospecting, more detailed obligations in agreements outside UNCLOS are lacking. In these cases, the general obligations in UNCLOS may effectively provide the only set of binding law of the sea rules for states, in lieu of more detailed and operative agreements. The applicability to deep-sea bioprospecting of two such sets of generally formulated rules of UNCLOS, relating to marine scientific research and marine living resources, will be further elaborated in this part.

It is fair to say that in many regards – and certainly in the case of bioprospecting of marine genetic resources – UNCLOS functions as much more than a constitution for the oceans. Indeed, the convention contains very different types of obligations. It provides general principles, detailed operative rules, as well as implicit and explicit references to other agreements. The relationship between the rules in UNCLOS and deep-sea bioprospecting will now be investigated.

[325] Agreement for the Implementation of the Provisions of the United Nations Convention on the Law of the Sea of 10 December 1982 relating to the Conservation and Management of Straddling Fish Stocks and Highly Migratory Fish Stocks, 4 August 1995, 2167 U.N.T.S. 3 (UN Fish Stocks Agreement) (United Nations ed., United Nations 1997).

C.1.2. The maritime zone approach of UNCLOS

It has already been mentioned that a major challenge to the ambition of the convention to provide a holistic framework is the sharp division of the world's oceans into different maritime zones. This maritime zone approach, which is a central theme in the convention, is essentially the result of an act of balance between, on the one hand, exclusive and sovereign rights of coastal states and, on the other, the rights of other states. Throughout the history of the law of the sea, coastal states have expanded their claims for exclusive rights. This gradual development of exclusive coastal states rights, which has been referred to as creeping jurisdiction, will be further discussed in section D.1.

As a result of this balancing between the interest of coastal and other states, rules in UNCLOS thus differ across maritime zones. In this part, it will first be generally explained how this division, which essentially provides different sets of rules for bioprospecting across maritime zones, plays out in the convention. This will form the basis for a discussion on how marine bioprospecting relates to two central concepts or in the convention: The rules on marine living resources and marine scientific research. It will be discussed how and to what extent the rules provided for these two concepts apply to marine bioprospecting. This in turn will enable a more informed discussion on how the law of the sea relates to the genetic resources of the deep seas.

C.1.3. Marine areas within national jurisdiction

For reasons discussed in Part A, this investigation is confined to bioprospecting of genetic resources in the deep-sea areas beyond national jurisdiction. It is nevertheless necessary to briefly describe the rules for the maritime zones where coastal states exercise sovereign rights. Not only will this illustrate the differences across maritime sectors and the importance of the distinction between marine bioprospecting within and beyond national jurisdiction. It will also develop the explanation in relation to the particular interest in bioprospecting in zones beyond national jurisdiction, the high seas and the Area.

As the convention is drafted, the sovereign and exclusive rights of the coastal states essentially decrease for every maritime zone, viewed from the shoreline. The most relevant maritime zones for the purpose of bioprospecting are the 12 nautical mile territorial sea, the 200 nautical mile exclusive economic zone, the continental shelf, the high seas and the seabed beyond national jurisdiction, known as the Area.

C.1.3.1. Internal waters and territorial sea

Internal waters constitute the maritime zone closest to the shore, the waters "*which lie landward of the baseline from which the territorial sea is measured.*"[326] The baseline thus serves as the seaward limit of the internal waters. Conversely, it functions as the landward limit of the territorial sea, which extends 12 nautical miles measured from the baseline.[327] Within both internal waters and the territorial sea, the coastal state enjoys full sovereignty.[328] The difference between the two zones is that unlike internal waters, other states may exercise the right of innocent passage in the territorial sea.[329] For bioprospecting purposes, this difference appears to be of limited importance. It appears that any activity relating to bioprospecting of marine genetic resources would render a passage non-innocent.[330]

[326] As provided by Article 8(1) of UNCLOS. For legal purposes, internal waters under Article 7 thus include parts of the sea along the coast down to the low-water mark, ports and harbors, estuaries, landward waters from the closing line of bays. It also includes waters enclosed by straight baselines, which the coastal state is allowed to draw in localities where the coastline is deeply indented and cut into, or if there is a fringe of islands along the coast in its immediate vicinity.

[327] UNCLOS Article 2-3.

[328] UNCLOS Article 2(1).

[329] UNCLOS Article 17.

[330] By definition, innocent passage should be innocent, i.e. continuous and expeditious. Based on the criteria in Article 18 and 19, which includes a number of specified activities including fishing and carrying out of research and surveys as well as other activities not having a direct bearing on passage, it appears clear that carrying out sampling or similar activities for bioprospecting purposes would disqualify an activity from benefiting from the status as innocent passage. Potentially, legitimate uses of innocent passage could result in detriment environmental impacts affecting marine ecosystems and their genetic resources. Such detriment impacts could however be prevented by exercise of the coastal state's legislative jurisdiction relating to innocent passage, which includes *inter alia* measures aiming to conserve the living resources of the sea (Article 21(1)).

Accordingly, it is difficult to dispute that bioprospecting falls within coastal state sovereignty in internal waters and the territorial sea.[331]

C.1.4.1. The Exclusive Economic Zone and the continental shelf

Whereas the coastal state thus exercises full sovereign rights for bioprospecting purposes in internal waters and the territorial sea, the situation is different in the exclusive economic zone (EEZ) and the continental shelf. In these legal twilight zones, the coastal states do not enjoy full sovereignty, but exclusive rights in some (but not all) regards. The coastal state must thus tolerate a considerably higher degree of involvement by other states. It could even be questioned if it is accurate to describe the EEZ as a zone within national jurisdiction. It would be more accurate to describe the rules for these zones as providing a delicate balance between the interests of coastal and other states.

The limited spatial jurisdiction of coastal states in the EEZ

Not until rather late in the negotiations of UNCLOS did it become clear that the EEZ would become a distinct maritime zone. Many observers and negotiators had long held the view that the EEZ would essentially be the high seas with an exception for only certain, rather limited coastal state rights.[332] When the focus turned to a proposal for a text, a discussion unfolded on how extensive exclusive rights should be granted to coastal states and whether the EEZ should be considered a maritime zone under national jurisdiction.[333]

[331] State practice appears to be in conformity with these codified rules, although there are variations in how the right of innocent passage is implemented. See YOSHIFUMI TANAKA, THE INTERNATIONAL LAW OF THE SEA (Cambridge University Press. 2012), at 90-96.

[332] The gradual enclosure of oceans commons and the role of coastal states in this development is further discussed in Part D.1. See also MYRON H. NORDQUIST, et al., UNITED NATIONS CONVENTION ON THE LAW OF THE SEA, 1982: A COMMENTARY VOL. III [SECOND COMMITTEE: ARTICLES 86 TO 132, AND SUPPLEMENTARY DOCUMENTS] § III (1995), at 66.

[333] While the need for drafting special rules for the areas which would become EEZ was widely recognized early on in the negotiations, it was "*not at first sight clear whether the EEZ is essentially the high seas with a special EEZ regime superimposed upon it*" (this has been referred to as 'high seas minus' view) or whether the EEZ is a "*new […] [sovereign] zone of the coastal state in which the high seas freedoms are the equivalent of the right of innocent passage in the territorial sea*" (the 'EEZ minus' view). Philip Allott, *Power Sharing in the Law of the Sea*, 77 AMERICAN JOURNAL OF INTERNATIONAL LAW (1983); ALEXANDER PROELSS, UNITED NATIONS CONVENTION ON THE LAW OF THE SEA: A COMMENTARY (Hart Publishing. 2017).

The fact that the EEZ would eventually become considered as a *sui generis* zone, which was thus far from certain during the negotiations, had far-reaching implications.[334] Even if the material scope of the exclusive rights of coastal states was limited, creating the EEZ as a distinct maritime zone effectively gradually reinforced the understanding (initially only held by coastal states) that this zone, which would make up huge ocean spaces, ought to be considered as an area under national jurisdiction.[335]

Rights of coastal and other states in the EEZ

The creation of the EEZ as a zone *sui generis* did not mean that all high seas freedoms ceased to exist in those areas. Although the high seas were geographically diminished by the establishment of the EEZ, high seas freedoms persist in the EEZ, to a considerable degree.[336] As formulated in the convention, the freedoms of the high seas "*and other pertinent rules of international law apply to exclusive economic zone in so far as they are not incompatible with the rights and jurisdiction granted to coastal States in the EEZ*."[337]

[334] For a period, views remained quite divided between the high seas minus and the EEZ minus approaches. According to negotiation documents, the generally accepted view that emerged in the 1976 Revised Single Negotiating Text was that the EEZ 'is neither the high seas nor [an extension of] the territorial sea. It is a zone *sui generis'* and as such it was one in which the high seas regime applied to the extent it was not displaced by rights specifically allocated to the coastal state. UNCLOS III, Revised Single Negotiating Text (Part II), UN Doc. A/CONF.62/WP.8/REV.1/PART II (1976), OR V, 151, 153 (para. 17).

[335] In the debate and negotiations on the development of new rules for areas beyond national jurisdiction (which generally is considered to relate to the high seas and the Area, the maritime zones where coastal states have no special rights) the EEZ has together with the zones where coastal states exercise full sovereignty been excluded from the scope of discussions. This division of maritime zones as either within or beyond national jurisdiction has reinforced the perception of the EEZ as 'belonging' to the coastal state rather than representing a hybrid zone. Regarding the EEZ as a coastal state maritime zone involves an important change in presumption, as compared to considering it as high seas with special EEZ rights for coastal states as the exception. It may accordingly be theorized that the inclination among states to avoid risks to interfere with the rights of other states effectively has made states refrain from carrying out activities in the EEZ of other states to a higher degree than they might have, if these areas would have been considered as high seas with special coastal state rights.

[336] As provided in UNCLOS Article 58 and 86.

[337] Article 58(2) makes clear that (the high seas freedoms of) 'Articles 88 to 115 and other pertinent rules of international law apply to exclusive economic zone in so far as they are not incompatible with' the rights and jurisdiction granted to coastal states in the EEZ. See PROELSS. 2017, at 677.

Some observers consider the continued application of these provisions to the EEZ a safeguard to preserve the essential elements of the high seas regime, even if former freedoms of the high seas relating to natural resources became abrogated in favor of the coastal state.[338] However, for practical purposes, the continued application in the EEZ was only safeguarded for a limited set of specified freedoms.[339] As succinctly formulated by Treves, "*the EEZ has a specific legal regime that includes the application to it of a specified group of the freedoms of the high seas, but admits no presumption of a residual rule of freedom*."[340] Rather, as will be discussed below, only some of the high seas freedoms found in Article 87 (navigation, overflight and the laying of cables) apply in the EEZ.

As regards geographic scope, the EEZ may at a maximum extend 200 nautical miles from the baseline.[341] The right of coastal states to an EEZ does not follow *ipso facto* from the convention. Instead, coastal states must declare such a zone and publish its coordinates for it to have legal force.[342] This means that in some cases, marine areas which could potentially become EEZ have the legal status of high seas (and thus as an area beyond national jurisdiction), awaiting coastal state declaration.[343] However, the vast majority of coastal states have declared EEZs.[344]

[338] NORDQUIST, et al. 1995, at 70.

[339] In UNCLOS, this reference is made between Article 86 and 58.

[340] See Treves, Tullio, "High Seas" in RÜDIGER WOLFRUM, MAX PLANCK ENCYCLOPEDIA OF PUBLIC INTERNATIONAL LAW (MPEPIL) (Oxford : Oxford University Press. 2008).

[341] See Article 57. Effectively, this means that the breadth of the EEZ at a maximum could amount to 188 nautical miles, since it is situated outside of the territorial sea. In many cases, however, the EEZ will never reach its full potential extent since the configuration of the coastline of other states makes delimitation necessary. The modalities for such delimitation are provided in UNCLOS Article 74.

[342] UNCLOS Article 75

[343] In some regions, such as parts of the Mediterranean, political concerns have made states reluctant to make such declarations.

[344] Robin R. Churchill & Allan V. Lowe, The Law of the Sea (Manchester : Manchester University Press Yonkers, NY : Juris Publ. 3. ed. ed. 1999).

The concept of EEZ gained status as customary international law in the 1985 ruling in the Libya/Malta Case, where the ICJ stated that the "*institution of the exclusive economic zone, with its rule on entitlement by reason of distance, is shown by the practice of States to have become a part of customary law.*"[345]

Like the territorial sea, the sovereign rights of the coastal state to explore and exploit the resources of the EEZ appear to follow relatively clearly from the convention, as articulated in Article 56:

> *(a) sovereign rights for the purpose of exploring and exploiting, conserving and managing the natural resources, whether living or non-living, of the waters suprajacent to the seabed and of the seabed and its subsoil, and with regard to other activities for the economic exploitation and exploration of the zone, such as the production of energy from the water, currents and winds;*

The *sovereign rights* of the coastal state over the EEZ are thus essentially limited to economic exploration and exploitation.[346] With regards to other relevant interests, including marine scientific research (which will be further discussed below), as well as the protection and preservation of the marine environment, the right of coastal states is not formulated as exclusive but simply as *jurisdiction* in the same provision:

> *(b) jurisdiction as provided for in the relevant provisions of this Convention with regard to:*
> *(i) the establishment and use of artificial islands, installations and structures;*
> *(ii) marine scientific research;*
> *(iii) the protection and preservation of the marine environment;*

[345] Continental Shelf (Libya-Malta), ICJ Rep 13, ICGJ 118 (International Court of Justice 3 June), at 33, para. 34.

[346] As pointed out by *Tanaka*, it is important to distinguish sovereign rights from territorial sovereignty. Moreover, it may be argued that the sovereign rights in the EEZ essentially are exclusive in the sense that no one may undertake such activities or make a claim to the EEZ without the express consent of the coastal state. See TANAKA. 2012, at 127. As will be further discussed in the context of marine living resources other states may nevertheless have the right to natural resources in the EEZ under certain conditions. This is however conditional upon the agreement with the coastal state and does not challenge the character of the coastal state's exclusive jurisdiction, see UNCLOS Articles 62(2), 69 and 70, as further discussed below.

This duality relates to the legitimate interest of other states in the exclusive economic zone, which should be balanced against the rights of the coastal state:

> *2. In exercising its rights and performing its duties under this Convention in the exclusive economic zone, the coastal State shall have due regard to the rights and duties of other States and shall act in a manner compatible with the provisions of this Convention.*

The rights and duties of other states in the exclusive economic zone are spelled out in Article 58. Most importantly, the provision indicates that the coastal state must tolerate the exercise by other states of at least some of the freedoms of the high seas prescribed in Article 87.[347] None of these freedoms explicitly referred to as applicable in the EEZ include high seas freedoms of direct relevance for bioprospecting. In particular, the freedoms to conduct marine scientific research and fisheries, as will be discussed in section C.1.5, appear to be limited to the high seas.[348] Moreover, despite the rights of other states, the coastal state exercises both legislative and enforcement jurisdiction in the EEZ.[349] Although enforcement jurisdiction is more clearly articulated, the provision is regarded as also encompassing legislative jurisdiction, by virtue of the reference to "the laws and regulations by it."[350] It thus appears that even if the coastal state must accept the exercise of at least some of the high seas freedoms in its EEZ, the coastal state maintains influence over how those freedoms are carried out. What about other high seas freedoms, which are not explicitly mentioned in Article 58 as applicable in the EEZ?

[347] This reference to high seas freedoms applicable in the EEZ is thus not open-ended but limited to some of the freedoms, namely the freedom of navigation, overflight and laying of submarine cables and pipelines as well as other internationally lawful uses of the sea related to these freedoms.

[348] Article 58 also provides that in the exercise of the freedoms in the EEZ, exercising states shall have due regard to the rights and duties of the coastal state. The requirement for *due regard* works both ways, and any conflict over activities not falling within either exclusive and explicit rights of coastal states or other states should be resolved on the basis of equity and in light of all relevant circumstances, see Article 59.

[349] As provided in Article 73(1) The coastal state may, in the exercise of its sovereign rights to explore, exploit, conserve and manage the living resources in the exclusive economic zone, take such measures, including boarding, inspection, arrest and judicial proceedings, as may be necessary to ensure compliance with the laws and regulations adopted by it in conformity with this Convention.

[350] TANAKA. 2012, at 127.

It follows, albeit perhaps not clearly, that the list of high seas freedoms applicable in the EEZ, as referred to in Article 58, is exhaustive. This is not just because only some – though not all – high seas freedoms are explicitly mentioned as applicable in the EEZ. More importantly, the segments of the high seas rule in Article 87, which is not referred to as applicable within the EEZ, contains the central term *inter alia* in the chapeau. This term indicates that there may be other activities not mentioned, and that in the high seas also these fall within the scope of the high seas freedoms. For the EEZ, however, there is no indication that such other activities are included.[351] The lack of reference to *inter alia* in Article 58 thus implies a major legal difference between the two zones for activities such as bioprospecting. For the high seas, as will be discussed below, *inter alia* entails that the list of explicitly referred freedoms is not exhaustive. The presumption in the high seas thus appears to be that states are free to also carry out activities not mentioned. In the EEZ, on the other hand, *other* activities, not explicitly listed, such as bioprospecting, are implicitly excluded from applicable freedoms of other states.[352]

In conclusion, despite the preservation and analogous application of certain high seas freedoms, there is a clear preference for coastal state interests in the rules on the EEZ. Rather than establishing a balance between the interests of coastal and other states, the introduction of the EEZ transformed large ocean spaces into coastal state waters, with limited rights for other states which do not extend to bioprospecting or other activities not explicitly referred to.[353] The International Tribunal for the Law of the Sea appears to support a restrictive interpretation of the application of high seas freedoms in the EEZ.[354]

[351] Proelss. 2017, at 444-457.

[352] In other words, whereas freedom for activities of all states is the main rule in the high seas, it is thus the exception in the EEZ. Consequently, only a narrow selection from what is otherwise a non-exhaustive list of high-seas freedoms thus applies in the EEZ.

[353] This interpretation is further supported by the rules in the convention applicable in the event of conflict between coastal states rights and high seas freedoms in the EEZ. UNCLOS provides *prima facie* no clear presumption in favor of either coastal state rights or other states freedoms in the event of conflict but sets out a principle of 'due regard' (See Articles 56(2), 58(3) and Article 59). In reality, however, the EEZ rules still favors the coastal state in the event of conflict. This follows not only from the wording of Article 58(2) ("in so far they are not incompatible with" the EEZ regime). Alexander Proelss, *The Law on the Exclusive Economic Zone in Perspective: Legal Status and Resolution of User Conflicts Revisited*, 26 Ocean Yearbook Online (2012).

[354] In the "*The M/V 'Virginia G' Case*" the tribunal considered that the freedoms of other states in the EEZ did not even include bunkering of a fishing vessel. In the decision, the tribunal found

Although support may be widespread for this understanding of the nature of the EEZ, the status of high seas freedoms in the EEZ and its relationship to the high seas has by no means always been generally accepted.[355] However, after the entry into force of the convention, the understanding of the EEZ as an area based on an intricate dichotomy between high seas and coastal state economic zone rights appears to have gradually come to be replaced with an understanding of the EEZ as a maritime zone under national jurisdiction.[356]

In sum, the consideration of the EEZ as a maritime zone under national jurisdiction, as it has increasingly been referred to as, may give the impression that the rights of the coastal state amount to open-ended exclusivity or even full sovereign rights.

that the right of the coastal state to regulate fisheries includes refuelling of fisheries vessels, refusing to regard the bunkering as encompassed by the high seas freedoms applicable in the EEZ. The M/V "Virginia G" Case (Panama/Guinea-Bissau) (ITLOS Case 19) (International Tribunal for the Law of the Sea 14 April).

[355] Indeed, based on a reading of the opening provision in UNCLOS' part on the EEZ, Article 55 (The exclusive economic zone is (…) subject to the specific legal regime established in this Part, under which the rights and jurisdiction of the coastal State and the rights and freedoms of other States are governed by the relevant provisions of this Convention) it could be claimed that the EEZ should be interpreted as entailing more of a balance between rights of coastal and other states. Similarly, the provisions on the rights, jurisdiction and duties on coastal states and other states, Articles 56 and 58 respectively, prescribes due regard in the exercise of rights and duties in similar language, which also could be understood as prescribing more of a balanced regime. Based on negotiation documents, it also appears that at least a large group of states aimed for an EEZ concept less dominated by coastal state influence. Under this view, the language of Articles 56 and 58 reflects a widespread belief among negotiators that the EEZ would be a 'an overlay on the high seas' rather than a coastal state maritime zone. There are also observers who contend that the EEZ ought to be regarded as at the same time both high seas and a sui generis zone. The argument is made based on the observation that the sovereign rights and jurisdiction of the coastal state are not associated with the zone in a territorial sense, but mainly derive from its economic potential. This position thus contends that the EEZ ought to be interpreted as high seas solely in terms of territory whereas in terms of function it is a sui generis zone. An advantage with this interpretation is, as formulated by Proelss, that it "accommodates the risk that the economic dimension of the EEZ, taking into account the quality and quantity of the pertinent rights allocated to the coastal state may otherwise ultimately turn into a 'territorialisation' of the EEZ." Proelss, United Nations Convention on the Law of the Sea: A Commentary. 2017, at 408-436, 444-457. See also Tanaka. 2012, at 124-131; Bernard Oxman, *The third United Nations Conference on the Law of the Sea: the 1976 New York sessions*, 71 American Journal of International Law (1977); Proelss, Ocean Yearbook Online (2012).

[356] To use the terminology of Proelss, a 'territorialization' of the EEZ has occurred. Proelss, Ocean Yearbook Online (2012).

Rather, the EEZ regime is based on a delicate balance between the rights of coastal states and other states, which should not be mistaken for complete coastal state control. It would be most correct to refer to the concept of EEZ as a limited spatial jurisdiction, as suggested by Tanaka. The result of the negotiation between interests of coastal and other states, as provided by UNCLOS, is certain sovereign rights for coastal states, in the sense that other states cannot engage in associated activities without the consent of the coastal state. These are, however, limited *ratione materiae*, as defined by international law, essentially to natural resources and should thus be distinguished from territorial sovereignty.[357] The extent of high seas freedoms preserved in the EEZ regime are, however, limited and it is clear that bioprospecting does not fall within the applicable freedoms of other states.

The inherent coastal state continental shelf rights

Reference to the regime of the continental shelf is made already in the last part of the EEZ rules, implying that the rights and duties of the coastal as well as other states in the seabed and subsoil of the EEZ should be interpreted under a different set of rules than those relating to the EEZ. The rules for the continental shelf are provided in Part VI of UNCLOS.[358]

According to the opening provision of Part VI, Article 76, the spatial scope of the continental shelf is defined as:

> *the seabed and subsoil of the submarine areas that extend beyond its territorial sea throughout the natural prolongation of its land territory to the outer edge of the continental margin, or to a distance of 200 nautical miles from the baselines from which the breadth of the territorial sea is measured where the outer edge of the continental margin does not extend up to that distance.*

[357] Moreover, the rights are spatial in nature, and may only be exercised in the EEZ. In spite of these limitations and the rights of other states, the coastal state may exercise both legislative and enforcement jurisdiction over all people in the EEZ, regardless of nationality. The sovereign rights are thus not limited as regards personal jurisdiction, but open-ended *ratione personae*. TANAKA. 2012, at 128.

[358] As stated in Article 56, The rights set out in this article with respect to the seabed and subsoil shall be exercised in accordance with Part VI.

The continental margin, in turn, comprises "the submerged prolongation of the landmass of the coastal state, including the seabed and subsoil of the shelf, the continental slope and the continental rise." However, crucially, it does not include the deep ocean floor with its oceanic ridges or the subsoil thereof.[359] UNCLOS provides two alternative criteria for establishing the outer limits of the continental shelf: either to the outer edge of the continental margin (geological criterion) or a distance of 200 nautical miles (distance criterion).[360]

Unlike the EEZ, the coastal state does not have to proclaim a continental shelf. Rights over the continental shelf exist ipso facto ("by itself") and ab initio ("from the beginning").[361] There are areas where no EEZ has been proclaimed, but coastal state continental shelf rights apply in the underlying seabed. In such areas, a concurrent overlapping regime of continental shelf within coastal state jurisdiction and overlying high seas areas beyond national jurisdiction applies.[362] The same type of mixed regime arises in the more common cases in which the continental shelf extends beyond the 200 nautical mile line.[363]

[359] UNCLOS Article 76(3).

[360] Insofar as the distance criterion is applied, the continental shelf overlaps with the EEZ (or more correctly, underlaps). Coastal states thus have the legal right to a continental shelf up to 200 nautical miles, irrespective of the configuration of the seabed, which similarly has gained support as customary law by the ICJ. See Libya/Malta, ICJ Reports 1985, p. 33, para. 34.

[361] See Article 77(3). As a consequence, approximately 36 per cent of the total seabed is now under national jurisdiction of coastal states. It also follows logically that all EEZ for legal (but not geological purposes) has a corresponding continental shelf. CHURCHILL & LOWE. 1999, at 148.

[362] This is the result of the difference between the requirement for proclamation of the EEZ and the inherent nature of the continental shelf.

[363] The continental shelf may where the configuration of the seabed qualifies under the complex legal criteria in Article 76, extend well beyond the limits of the EEZ, although 350 nautical miles from the baseline is set as an absolute maximum. According to Article 76, the continental shelf extends at least 200 nautical miles measured from the baseline (irrespective if the geological continental shelf, as is the case in many areas, lies closer to shore). In cases where the continental shelf extends beyond that point, the same provision provides for two different methods for measuring its extent. The first method, commonly referred to as the *Gardiner* formula, is based on measurement of sedimentation and its distance from the foot of the continental slope. The second method, called the *Hedberg* formula, is based on a maximum distance of 60 nautical miles from the foot of the continental slope. These calculations are made difficult by the notoriously difficulty of ascertaining the foot of the slope. It appears that the coastal states have exercised a rather free application of these criteria in assessing the extent of their continental shelf.

As the result of overlapping claims and the unclear status of many submissions for continental shelf, the future status for extensive seabed areas remains unclear.[364] In cases where the continental shelf does not overlap with EEZ, Article 78 makes clear that the right of the coastal state over the continental shelf does not alter the legal status of the suprajacent waters or of the air space above those waters. Similarly, the exercise of the rights of the coastal state must not infringe or result in unjustifiable interference with navigation and other rights and freedoms of other states provided for under the convention.[365]

The continental shelf is thus a maritime zone distinct from the EEZ, even if it commonly lies under EEZ waters. In cases where coastal states either have the right to an extended continental shelf beyond the 200 nautical mile limit of the EEZ or have not yet proclaimed an EEZ, the continental shelf may, however, be overlapped by high seas.

As regards *ratione materiae*, the coastal state, similarly to the EEZ, has sovereign rights to explore and exploit the natural resources of the continental shelf, which should not be interpreted as territorial sovereignty.[366] The sovereign rights of the coastal state in the continental shelf, as formulated in Article 77, however, are more unconditional compared to the EEZ.

[364] Presently, the United Nations Commission on the Limits of the Continental Shelf is processing the scientific basis of submissions of extended continental shelf claims filed by a large number of coastal states. Due to the overwhelming workload, it will take long time before this commission has evaluated assessments hitherto submitted. Taken together, these submissions add up to vast areas. Moreover, the scope of the submissions in many cases overlap. Two additional factors further complicate this task. Firstly, submitted coastal assessments overlap in many areas. For instance, the geographic North Pole is considered by at least three coastal states to be within their continental shelf. Secondly, only state parties to UNCLOS have to make scientific assessments of their continental shelf and not all states with potential for extended continental shelf claims have ratified the convention. Among others, this leaves out the United States. Even if the US would become a party to UNCLOS, there is a 10 year-deadline for filing extended continental shelf claims connected to the date of ratification. The mandate for the Commission is provided in Article 4 of Annex II to UNCLOS.

[365] It is apparent that there is a potential for contention between activities in the continental shelf and the high seas in such areas, where the exclusive economic interests of the coastal states in the continental shelf overlaps with the open-access regime of the high seas (as will be discussed below).

[366] Article 77(1).

Whereas the coastal state under certain conditions should provide access to other states for resources in the EEZ, lack of exploitation of natural resources in the continental shelf does not result in corresponding rights to access for other states.[367] Natural resources, in the continental shelf context, include, firstly, mineral and other non-living resources of the seabed and subsoil.[368] Exploitation of hydrocarbons has accordingly been the most important exercise of continental shelf rights. The coastal states' exclusive right in the continental shelf, however, also extends to natural resources where such resources are situated in or beneath the seabed. For these so-called sedentary species – that is, "*organisms which, at the harvestable stage, either are immobile on or under the seabed or are unable to move except in constant physical contact with the seabed or the subsoil*" – the coastal state similarly has sovereign rights.

The definition of sedentary species may appear difficult to reconcile with the biological characteristics of the many species which spend part of their life cycle as sedentary species and other parts as pelagic. The sharp division between the seafloor regime of the continental shelf on the one hand and the rules for the overlying pelagic zone on the one raises challenges in the management of such organisms, which include species identified in section B.6 as interesting for bioprospecting purposes.[369] With respect to the rights of third states on the continental shelf, Article 79 establishes principles similar to the freedom of the seas-rights applicable in the EEZ.[370] As for legislative and enforcement jurisdiction in the continental shelf, such rights appear to follow from the sovereign rights of the coastal state to exploit natural resources, although this is less explicit than in the case of the EEZ.[371]

[367] Article 77(2).

[368] Moreover, but less relevant for the purposes of this investigation, the coastal state has exclusive jurisdiction over the construction of artificial islands, installations and structures as well as drilling on the continental shelf. See Article 80-81.

[369] Under the discussion on marine living resources in section C.1.5, this problem will be further discussed.

[370] Foremost, all states are entitled to lay submarine cables and pipelines, although this right is subject to coastal state consent as regards the delineation of the course. Similarly, the coastal state has the right to take reasonable measures for the exploration of the continental shelf, the exploitation of its resources and the prevention of pollution from pipelines.

[371] Also similar to the EEZ, the sovereign rights does not have any limits *ratione personae* and can be regarded as a limited spatial jurisdiction. TANAKA. 2012, at 142-143.

In conclusion, the EEZ and the continental shelf regimes can be regarded as the twilight zones of the law of the sea, where the coastal state in certain regards exercises unlimited powers and sovereign rights. Yet, these must be balanced with the rights of other states, which in comparison with the territorial sea must be regarded as far-reaching. Viewed from the other side, the freedoms of the seas apply in these areas, but are limited by an exhaustive list of exclusive coastal state interests. As regards the right to conduct marine bioprospecting, as will be further discussed in section C.1.5, this appears to be limited to the coastal states, in line with the exclusive right to harvest living organisms (in the EEZ) and sedentary species (in the continental shelf), as well as the limited possibilities of other states to conduct marine scientific research (and to conduct bioprospecting sampling as part of such operations).

C.1.4. Marine areas beyond national jurisdiction

In the previous section it was discussed how UNCLOS establishes far-reaching rights for coastal states, with exclusive rights to economic resources in the water column up to 200 nautical miles measured from the baseline and a maximum of 350 nautical miles on the seafloor and underlying sediments[372], which appear to encompass bioprospecting for genetic resources. Areas beyond those points were deliberately left beyond national jurisdiction. Under the convention, the water column beyond the EEZ (or beyond the territorial sea where no EEZ has been proclaimed) is referred to as *the high seas* and the seafloor beyond the continental shelf as *the Area*.[373] In lack of sovereign or exclusive coastal state rights, these deep-sea areas are collectively referred to as areas beyond national jurisdiction. The spatial relation between these areas largely correspond to the relationship between the EEZ and the continental shelf, as discussed in the previous section. As regards *ratione materiae*, however, the difference between the regime for the water column and the seabed is much larger beyond national jurisdictions, compared to the relationship between the EEZ and the continental shelf, as will be further discussed below.

[372] Where the continental shelf extends that far under the legal criteria, as discussed above.

[373] The high seas and the Area are regulated under Part VII and Part XI of the convention respectively.

From a scientific standpoint, much of the marine waters encompassed by EEZ and continental shelf zones discussed in the previous section would be regarded as deep seas. Conversely, coastal seas where no EEZ has been proclaimed would, from a legal standpoint, be regarded as beyond national jurisdiction, as discussed above. There is thus a considerable discrepancy between oceanographic and legal understanding of the deep seas.[374] This is due to an inability of the negotiators of UNCLOS to fully reflect the multifaceted oceanographic and other scientific aspects of the marine environment beyond national jurisdiction in the rules of the convention.

Instead, UNCLOS establishes a rigid dichotomy of marine spaces beyond national jurisdiction which largely but not fully reflect the configuration of the oceans; the pelagic realm of the deep seas roughly corresponds to *the high seas*. The seabed and ocean floor and subsoil of the deep seas, on the other hand, approximately corresponds to what under the convention is defined as *the Area.*[375] Neither the scope of the high seas nor that of the Area are positively defined under UNCLOS. Instead, these maritime areas are made up by what is left over once all other claims are subtracted. In the water column this can be assessed relatively easily. States can claim a maximum of 200 nautical miles of EEZ, measured from the baseline.[376] Effectively, once this proclamation has been made, the relevant sea area is appropriated and the high seas are delimited in a corresponding manner.

[374] The vast ocean expanse beyond waters which under normal circumstances would be under the jurisdiction of coastal states is classified by marine scientists and oceanographers as the open ocean and the deep seabed. Furthermore, the water column of the open ocean or pelagic realm is often divided into vertical layers and horizontal regions. The seabed has also been divided into zones based on depth from the surface and benthic fauna. The deep seafloor beneath the open ocean has a topography which is comparable in complexity to the terrestrial environment. WARNER. 2009, at 2.

[375] UNCLOS Article 1(1). A geological definition of the deep-seafloor would include larger parts of seabed area than the Area. This is the result of the formulation of the criteria for the continental shelf, as discussed in the previous section, which enables coastal states to include also areas beyond the geological continental shelf in the legal continental shelf. Similarly, an oceanographic perspective would consider large parts of EEZ areas as deep-seas.

[376] In line with Article 57, states can only claim 200 nm EEZ where the geographical circumstances so permit. In many cases, adjacent coastlines limit the geographic scope of EEZs. In case a state desires to proclaim an EEZ, the coordinates of the zone should be published in line with Article 75.

For the Area, the same assessment is in many areas much more complicated, as the result of the complex formula for ascertaining the extent of the continental shelf under the convention.[377]

Whatever the claims for continental shelves of coastal states add up to in total, the rest of the seabed will remain beyond national jurisdiction and referred to as *the Area* under the convention. In the areas beyond national jurisdiction, UNCLOS sets up distinct regimes, as compared to areas within national jurisdiction. For both the high seas and the Area, no state can claim exclusive rights. The rules for both these regimes thus contain elements of a *commons* regime. Still, the basic principles of the high seas and the Area are considerably different. As will be discussed, high seas resources are common (in the sense that they do not belong to any particular state and that every state can make use of them) and freedoms are exercised for the benefit of individual actors (although, admittedly, with due regard for the rights of others). For the resources of the Area, the situation could be regarded as the opposite. No state can claim sovereignty or sovereign rights over them.[378]

It would thus be wrongful to regard the marine areas beyond national jurisdiction as a *terra nullius* leftover, after all coastal states have grabbed their share of the seas. Rather, the high seas and the Area are distinct legal concepts, where the traditional principles of equal rights and access for all states have not been circumscribed by the creeping coastal state jurisdiction. Most of the rules relate to the challenge of managing resources where the rights of all states are equal. As will be established, in the two maritime zones beyond national jurisdiction, this fundamental *commons* problem has been approached very differently, with far-reaching implications for deep-sea bioprospecting.

[377] As discussed under the continental shelf above, the criteria for assessing the extent of the extended continental shelf are open to relatively subjective interpretation, and it is not easy to foresee how the precise final delineation will be established based on geographic or geological factors. To complicate things further, many claims for extended continental shelf will be scrutinized by the Commission on the Limits of the Continental Shelf for the foreseeable future. In some cases, submissions are disputed or overlapping, requiring delimitation. Some states with sizeable continental shelves, notably the United States have prepared but not yet submitted any claim for continental shelf, as the result of remaining a non-party to UNCLOS.

[378] Konrad Jan Marciniak, New Implementing Agreement under UNCLOS: A Threat or an Opportunity for Fisheries Governance?, 84 Marine Policy (2017)

C.1.4.1. The high seas

The relatively restrictive regime of marine areas within national jurisdiction stand in stark contrast to the high seas, which are governed by the principle of freedom. Yet, this does not imply that the high seas are a void lacking legal order. Rather, much of the rules in UNCLOS on the high seas aims to ensure an ordered management of this in principle free access regime. Instead of bestowing certain states legislative or enforcement jurisdiction to ensure that these rules on high seas management are upheld, UNCLOS establishes the principle of exclusive flag state jurisdiction as the basis for exercising rights and obligations in the high seas.[379]

The geographic scope of the high seas in relation to other maritime zones

In contrast to the pelagic maritime zones within national jurisdiction, which are established based on precise measures in relation to the baseline, the geographic scope of the high seas is defined negatively: "*all parts of the sea that are not included in the EEZ, in the territorial sea or in the internal waters of a state, or in the archipelagic waters of an archipelagic state.*"[380]

This geographical scope builds on the definition applied already prior to UNCLOS. During the drafting of the high seas regime of UNCLOS, the International Law Commission started from the widely accepted categorical position that "*the waters of the sea belong either to the high seas or to the territorial sea or to internal waters*."[381] With the advent of the exclusive economic zone regime in UNCLOS, the scope of the high seas was only further circumscribed. As described in Part D, this can be regarded as the biggest step in a long series of enclosures of oceans commons by coastal states.

[379] Tanaka. 2012, at 149.

[380] UNCLOS Article 86.

[381] ILC, Report of the International Law Commission: commentaries to the Articles Concerning the Law of the Sea, UN Doc. A/3159 (1956), GAOR 11th Sess. Suppl. 9, 12, 23 (Art. 26); Proelss, United Nations Convention on the Law of the Sea: A Commentary. 2017.

The commons regime of the high seas

Whereas coastal state influence is extensive within national jurisdiction, there is no preference for individual states in the high seas, which are to be reserved for peaceful purposes.[382] No state may validly purport to subject any part of the high seas to its sovereignty. This principle of non-appropriation, as formulated in Article 89, means that all claims of sovereignty over the high seas are invalid.

However, this does not imply that the high seas and its resources cannot be used by states. On the contrary, every state (both coastal and landlocked) has the right to sail ships flying its flag on the high seas.[383] Moreover, in Article 87 the convention provides that all states are free to carry out activities, including using high seas resources, as part of the high seas freedoms. Taken together, the principles of *non-appropriation* and *the freedom of the high seas* function as the legal basis for the high seas regime.

From a material standpoint, the principle can thus be divided into two parts: Firstly, the principle implies that the high seas are free from national jurisdiction;[384] Secondly, as a consequence of the freedom from state jurisdiction, the freedom of the high seas implies an equal freedom for all states to carry out activities in the high seas which are compatible with international law.[385] The consequences of these basic principles for the high seas regime will be further discussed below. First, however, the issue of regulating jurisdiction in the high seas, where all states as a matter of principle have equal rights, will be examined.

[382] UNCLOS Article 88.
[383] UNCLOS Article 90.
[384] UNCLOS Article 89.
[385] TANAKA. 2012, at 151.

The exclusive jurisdiction of flag states

By virtue of being open to all states, no state has the right to deny other states access to the high seas. It follows logically that all states have equally limited legislative and enforcement jurisdiction. Instead, states have exclusive jurisdiction over and responsibility for the behavior and actions of ships flying their flag in the high seas. Formulated in Article 92 of UNCLOS, the principle of the exclusive jurisdiction is also well established in customary international law:

> *Ships shall sail under the flag of one State only and, save in exceptional cases expressly provided for in international treaties or in this Convention, shall be subject to its exclusive jurisdiction on the high seas.*

The exclusive jurisdiction of the flag state may thus be subject to exceptions, but only as expressly provided in UNCLOS or other treaties. The principle comprises both legislative and enforcement jurisdiction over ships on the high seas. The flag state thus exercises enforcement jurisdiction over all people within ships flying its flag, irrespective of their nationality.[386] As pointed out by Tanaka, the principle of the exclusive jurisdiction of the flag state plays a dual role. Firstly, the principle hinders other states from interfering with vessels flying flags of other states. By ensuring this, the principle ensures the freedom of activities of vessels on the high seas. Secondly, the flag state has the responsibility to ensure compliance with national and international law concerning activities of ships flying its flag on the high seas.[387]

[386] As stated by ITLOS, 'the ship, every thing on it, and every person involved or interested in its operations are treated as an entity linked to the flag state. The nationalities of these persons are not relevant.' The M/V "Saiga" (Saint Vincent and the Grenadines v. Guinea) (ITLOS Case 2) (International Tribunal for the Law of the Sea 1 July), para. 106.
[387] In particular, the flag state is responsible for ensuring safety, in different regards, as well as prevention of marine pollution as provided in Articles 94 and Part XII of UNCLOS. See TANAKA. 2012, at 153. There are two explicit exceptions to the exclusive jurisdiction of flag states, relating to the right of visit and so-called hot pursuit, as provided in Articles 110-111. These are however of limited relevance for the purposes of this investigation. This does however not mean that enforcement by other states than the flag state is ruled out, only that it is limited to cases where there are legitimate grounds for the enforcing state to exercise jurisdiction in relation to the violating subject. This follows from Article 92, which clearly rule flag state as the exclusive jurisdictional basis in the high seas, "save in exceptional cases expressly provided in

States are thus free not only to exercise jurisdiction for violation of high seas regulations, but in relation to any other regulation, for that matter, in relation to vessels sailing under their flag.[388] Even if flag state may be the presumptive jurisdictional nexus on the high seas, a state can still assert jurisdiction to punish or regulate the conduct of its own nationals for acts committed aboard foreign vessels.[389]

The exclusive flag state jurisdiction has important consequences for bioprospecting, where sampling cruises commonly involve people and private entities from many different states. Insofar as the responsibility for activities in the high seas is concerned, UNCLOS puts the primary jurisdiction as well as the responsibility for such operations on the flag state of the relevant ship. Moreover, in line with the precedent, other states are not entitled to hamper such activities.

Another important consequence of the exclusive flag state jurisdiction is connected to restrictions of high seas freedoms, which will be further discussed below. Such restrictions may be decided in other treaties, according to UNCLOS Article 87. However, as the result of the exclusive flag state jurisdiction, enforcement of such restrictions is in principle only possible in relation to ships under the flag of state parties to the treaty containing the relevant obligation.[390]

international treaties." Flag states may thus effectively limit their exclusive jurisdiction by means of treaties. Moreover, they may of course wave their exclusive sovereignty in individual cases on a bilateral basis. They are also free to exercise enforcement in relation to state parties which in agreements have allowed such actions. Moreover, as noted by Proelss, despite its wording, Article 92 creates no absolute prohibition on states extending their prescriptive or regulatory jurisdiction to events occurring aboard a foreign vessel. PROELSS, United Nations Convention on the Law of the Sea: A Commentary. 2017.

[389] There is no rule in international law that two national judicial orders cannot exist in the same space at the same time. PROELSS, United Nations Convention on the Law of the Sea: A Commentary. 2017.

[390] As elaborated under *Limitations in other treaties* below, for non-parties to treaties limiting high seas freedoms, the general rules of unmodified high seas freedom will remain applicable. The difficulty of making obligations in such treaties effective also stems from the limitation of enforcement jurisdiction on high seas to flag states.

High seas freedoms

The freedom of the high seas was not introduced by UNCLOS, but was formulated already in the early 1800s.[391] That in turn was based on a much older, traditional understanding of the status of the seas, dating back to the dictum of Grotius from the early 17th century.[392] This idea, that the high seas are inalienable and open to all states, is commonly referred to as *mare liberum*, as discussed in section D.1.[393]

As a descendant of Grotius' concept, Part VII of UNCLOS spells out a far-reaching freedom of navigation and fishing. But the convention also expands the freedoms to activities that were not previously codified. Article 87 clarifies that the freedoms of the high seas, in addition to navigation and fishing, comprise the freedom of navigation, the freedom of overflight, the freedom to lay submarine cables and pipelines, and the freedom to construct artificial islands and other installations permitted under international law, as well as the freedom to carry out scientific research. There is nothing indicating that this list is exhaustive. In fact, as already discussed above in the context of the EEZ, the term *inter alia* in the chapeau of Article 87 indicates that the listed freedoms are merely examples of high seas freedoms.[394]

[391] CHURCHILL & LOWE. 1999, at 205.

[392] Heavily influenced by the Dutch commercial interests in trade with East India, Grotius formulated in reaction to claims by Spain and Portugal to domination over extensive marine areas his doctrine that "*The sea is common to all, because is it so limitless it cannot become become a possession of any one, and because it is adapted to the use of all, whether we consider it from the point of view of navigation or fisheries*." PROELSS, United Nations Convention on the Law of the Sea: A Commentary. 2017, at 679; HUGO GROTIUS, THE FREEDOM OF THE SEAS OR, THE RIGHT WHICH BELONGS TO THE DUTCH TO TAKE PART IN THE EAST INDIAN TRADE (Kitchener, Ont. : Batoche. 2000); Andrea Weindl, *Grotius's Mare Liberum in the Political Practice of Early-Modern Europe*, 30 GROTIANA (2009); Helen Thornton, *Hugo Grotius and the Freedom of the Seas*, 16 INTERNATIONAL JOURNAL OF MARITIME HISTORY (2004).

[393] The convention thereby confirms what followed from the 1958 Geneva Convention on the High Seas, that the water column beyond national jurisdiction is a global common. As a concept in international law, the high seas as well as the broader doctrine of the freedom of the seas thus date back to Hugo Grotius. WARNER. 2009, at 27.

[394] As already discussed in the context of the EEZ, where the list of freedoms to the contrary is exclusive.

The convention is thus open to the possibility that there may be other freedoms. Indeed, an examination of negotiation documents makes clear that the intent of the drafters was that Article 87 would provide a non-exhaustive list.[395] This is because the negotiators of UNCLOS considered the *freedom* concept of the high seas, including its restrictions, to be the default rule for activities in these areas.

The freedom of the high seas may thus entail much more than the enumerated activities. Indeed, several activities were discussed at the time of negotiation of Article 87. High seas tourism and activities in outer space conducted from the high seas, such as the launching of satellites, were both considered by the drafters of the convention. Not considered sufficiently relevant to be explicitly referenced in Article 87, the drafters still considered both to fall within the remit of the freedoms of the high seas. Similarly, uses of the high seas for military purposes, such as training and other military exercises, though restricted in other maritime zones, fall within the scope of the freedoms of the high seas.[396]

Based on preparatory works, there is a clear presumption that activities not mentioned are also encompassed by the scope of high seas freedoms.[397] There is reason to believe that this includes a freedom to conduct bioprospecting, to the extent that such activities are not already encompassed by the freedom of fishing and scientific research (these relationships will be further examined below). This is not simply because there is no indication to the contrary; the negotiating documents of the convention make clear that there was widespread agreement that future activities would be encompassed by the freedoms. This argument is supported by extensive state practice.[398]

[395] NORDQUIST, et al. 1995, at 73.
[396] Id., at 84-85.
[397] Alexander Proelss, *ABS in Relation to Marine GRs*, *in* GENETIC RESOURCES, TRADITIONAL KNOWLEDGE AND THE LAW (2009).
[398] For over 20 years, samples of marine genetic resources have been taken in areas beyond national jurisdiction that has never been questioned as unlawful in the framework of the diplomatic debate).

Under this freedom, marine genetic resources from the high seas would thus be possible to exploit on a first come first serve basis. Yet, this does not mean that the exploitation could be carried out in a completely unrestricted fashion.[399] Nor does it mean that UNCLOS lacks legal rules applicable to high seas bioprospecting. As will be discussed below, the freedom to conduct bioprospecting would be coupled with restrictions and obligations. Moreover, the free-access regime implies that each state may implement legal rules for marine bioprospecting in the high seas. However, the rules only apply insofar as states can assert jurisdiction, i.e. primarily in relation to ships under their flag, but also individuals and corporate entities, as discussed above.[400]

As regards the exercise of the freedoms of the high seas, UNCLOS explicitly provides, in line with the *commons* nature of the high seas regime, that it may be used by all states, whether coastal or landlocked.[401] Article 87 thus not only makes clear that high seas resources are common (in the sense that they do not belong to any particular state and that every state can make use of them). It also implies that the freedoms are exercised for the benefit of individual actors (with due regard for the rights of others).

Two important elements should thus be borne in mind when approaching the freedoms of the high seas: Firstly, the freedoms listed in the convention are not without limitations; Secondly, there is nothing indicating that the list of freedoms is exhaustive. The first reservation, that of conditions and obligations in the exercise of high seas freedoms, effectively restricts the exercise of the freedoms. The second element, the open-ended nature of activities encompassed by high seas freedoms, has a contrary function and expands the scope of the principle. These two countervailing forces in relation to the freedom of the high seas will now be discussed in turn.

[399] Natalie Y. Morris-Sharma, Marine Genetic Resources in Areas beyond National Jurisdiction: Issues with, in and outside of UNCLOS, 20 MAX PLANCK YEARBOOK OF UNITED NATIONS LAW ONLINE (2017).
[400] It should however be noted that the status of bioprospecting as falling within high seas freedoms is not undisputed. Within the BBNJ process, arguments of the contrary position have been raised on several occasions. See meeting reporting at https://www.un.org/bbnj/ (site accessed 12/11 2020).
[401] UNCLOS Article 87.

Limitations on high seas freedoms

The high seas freedoms are not without limitations. Firstly, high seas freedoms must be examined in light of the principle of non-appropriation. Secondly, a number of limitations are expressed as explicit exceptions to the listed freedoms. According to Article 87, the exercise of the freedoms is qualified by other rules in UNCLOS. Thirdly, as already noted, there is nothing in UNCLOS preventing further limitations of high seas freedoms in *lex specialis* treaties. Fourthly, limitation is expressed in paragraph 2 of Article 87 as a duty of due regard to the interests of other states, in the exercise of the freedom of the high seas as well as activities in the Area. This underlines that the high seas freedoms should by no means be interpreted as an absence of law (*vacuum juris*).[402] Rather, the extensive explicit qualifications by references to other parts of UNCLOS make clear that the freedoms are coupled with limitations and obligations.

Limitations resulting from the principle of non-appropriation

As discussed at the outset of this section, the commons management regime of the high seas is based on two principles: Firstly, the principle of the freedom of the high seas including the obligations to take into account explicit obligations and the requirement for due regard; Secondly, and equally relevant, Article 89 sets out the principle that "*no State may validly purport to subject any part of the high seas to its sovereignty.*" This second principle, which has been referred to as the principle of non-appropriation, complements the rules on the exercise of high seas freedoms.[403] The concept of non-appropriation of the high seas is central in the context of bioprospecting, since such processes involve legal claims relating to high seas resources. How far, then, does this principle go in preventing claims for legal rights to the high seas? Is it limited to sovereign or territorial claims, or does it include other claims for legal titles to marine resources?

[402] PROELSS, United Nations Convention on the Law of the Sea: A Commentary. 2017, at 679.
[403] David Joseph Attard, et al., The IMLI manual on international maritime law. Vol. 1, The law of the sea (Oxford : Oxford University Press. 2014).

Not only does the principle of non-appropriation prevent the annexation of high seas areas by states. Regarded in light of the high seas freedoms, the status of all states as equal on the high seas and the obligation to pay due regard to the activities of other states (as will be discussed below), the principle also invalidates claims of sovereign powers in a broader sense. This means that no individual state can exercise sovereignty by regulating how the freedoms of the high seas should be exercised by other states.[404] States are thus not allowed to control the activities of other states on the high seas.[405]

Thereby, effectively, even if Article 89 makes reference to *sovereignty* and not sovereign rights of natural resources (as used in corresponding regulations relating to the EEZ, the continental shelf and the Area)[406], the principle of non-appropriation in the high seas implicitly also prohibits claims of sovereign rights to control the use and exploitation of natural resources.[407] In the context of bioprospecting for genetic resources, no individual state can thus assess jurisdiction over the management or use of such resources in certain high seas areas, since it would go against the principle of non-appropriation to make such claims. Moreover, it would be counter to the principle of exclusive flag state jurisdiction if individual states set regulations or requirements for such activities in relation to other states.

The principle of non-appropriation can be regarded as a logical complement to the freedom of the high seas, since the freedoms would be circumscribed if the high seas or its resources were to be subjected to the judicial order of a particular state.[408] Accordingly, in lack of the principle of non-appropriation, the high seas would risk becoming gradually deprived of their status as a global common.

[404] PROELSS, United Nations Convention on the Law of the Sea: A Commentary. 2017, at 687.
[405] CHURCHILL & LOWE. 1999, at 205, 220.
[406] See articles 56, 77 and 193 respectively.
[407] NORDQUIST, et al. 1995, at 96.
[408] PROELSS, United Nations Convention on the Law of the Sea: A Commentary. 2017, at 689.

This is in line with the notion that the commons status of the high seas should not be interpreted as the result of a legal vacuum nor should the high seas freedoms be interpreted as the absence of regulation, as mentioned above. Rather, the exercise of sovereign powers, national claims and regulation are explicitly prohibited by the principle of non-appropriation.[409] The high seas regime, including its freedoms, should be regarded as a carefully designed balance between rights and duties for high seas utilization. The high seas are thus an area where activities may be exercised in line with regulated freedoms. Based on the explicit prohibition on raising sovereign claims, the UNCLOS rules of the high seas has been regarded as establishing what can be described as a minimally regulated space where states may act only if expressly '*authorized by international law*'.[410]

In sum, the principle of non-appropriation extends beyond merely preventing claims for territorial sovereignty over high seas areas. As a consequence of the high seas regime, also sovereign claims to special rights to resources or aspirations to regulate the extraction of resources are prohibited. Not only would such claims go against the principle of non-appropriation as well as the basic premise that all states are equal on the high seas; they would also compromise the principle of exclusive flag state jurisdiction. This implies that no state can make claims for concessions or other special rights to bioprospecting in certain areas. Nor is it compatible with UNCLOS to prevent or impose regulations on the bioprospecting activities of other states in the high seas.

Explicit exceptions

A second type of limitation of high seas freedoms follows from direct qualifications provided by UNCLOS. The second line of Article 87 first establishes that the high seas are open to all states, and that the freedom of the high seas is "*exercised under the conditions laid down by the convention.*" The high seas freedoms are thus not unqualified in the convention. There are explicit exceptions and interests that should be respected.[411]

[409] Id. at 688.

[410] DANIEL PATRICK O'CONNELL, THE INTERNATIONAL LAW OF THE SEA. VOL. 2 (Ivan Anthony Shearer ed., Oxford : Clarendon Pr. 1984), at 792.

[411] Article 87 explicitly makes clear that there are limitations to the freedoms of navigation and overflight, as well as the freedom to lay submarine cables and pipelines (Part VI), the freedom to construct artificial islands and other installations (Part VI), the freedom of fishing (Parts VI and XIII) and the freedom of scientific research, (Parts VI and XIII).

These requirements are not to be regarded as vague concerns to be considered by states engaged in operations in the high seas; the high seas freedoms cannot be exercised lawfully by states without observing these obligations.

Of these explicit obligations relating to the exercise of high seas freedoms, the exceptions on the freedom of fishing and scientific research on the high seas appear particularly relevant in the context of bioprospecting. These will be examined below, in the discussion of the general concepts of marine living resources and marine scientific research in the law of the sea. Also relevant are the limitations to the freedom of navigation, on which all ship-based bioprospecting activities in the high seas are dependent. The most relevant limitations in this respect are the duties to protect life (Articles 94 and 98), the environment (Article 192) and to control pollution (Part XII).[412] The obligations to prevent pollution of the marine environment may be particularly relevant in bioprospecting, which is often conducted in sensitive ecosystems, as discussed in Part B.

Limitations in other treaties

Aside from making reference to explicit conditions provided in other parts of UNCLOS, Article 87 provides that the high seas freedoms are exercised under the conditions laid down in other rules of international law. This makes clear that it is compatible with the convention to limit high seas freedoms by means of rules in other treaties. Such restrictions in other treaties will, however, apply only in relation between the parties to the relevant agreement.[413] The unmodified freedoms of the seas, as provided by UNCLOS, remains in force for non-parties purposes. The difficulty of making obligations restricting high seas freedoms in such treaties effective also stems from the limitation of enforcement jurisdiction on high seas to flag states.[414]

[412] PROELSS, United Nations Convention on the Law of the Sea: A Commentary. 2017, at 683.

[413] It follows already from the general international law maxim *pacta tertiis* that treaty obligations only apply to subscribing states. The regulatory challenges resulting from this principle are amplified by the limitation of enforcement jurisdiction on high seas to flag states. In so far agreements involving restrictions of high seas freedoms would be claimed to apply also to non-parties, it would arguably also violate the principle of non-appropriation.

[414] There is thus a risk that undertakings in such other treaties limiting high seas freedoms could be circumvented by means of flags of convenience. This calls for further examination of jurisdictional consequences of potential future high seas regulation of genetic resources.

Treaties limiting high seas freedoms have been entered into in different areas, but have in effect been most far-reaching in respect of the freedom of navigation.[415] Taken together, the two treaties MARPOL and SOLAS have streamlined global standards on pollution and safety, which apply to all ships conducting operations, including bioprospecting, in the high seas as well as in any other maritime zone. The freedom of fishing was substantially circumscribed in the UN Fish Stocks Agreement, which entered into force in 2001 as the second implementing agreement of UNCLOS.[416] The agreement, which will be further discussed under marine living resources below, limits the freedom of fisheries in several important regards, which are also highly relevant to bioprospecting. However, the other high seas freedom of most relevance to bioprospecting – namely, the freedom to conduct scientific research – has not been limited in special agreements.

A potential future implementing agreement on biological diversity beyond national jurisdiction (BBNJ) may provide additional obligations relating to deep-sea bioprospecting.[417] Within that agreement, but also separately, greater cooperation aiming to set up marine protected areas in the high seas may result in restrictions to the exercise of bioprospecting in the high seas, at least in some areas.[418] Such measures have already been implemented by groups of states in

[415] The International Convention for the Prevention of Pollution from Ships (MARPOL) seeks to achieve the complete elimination of international pollution of the marine environment by oil and other harmful substances and the minimization of accidental discharge of such substances (see the preamble of MARPOL). The International Convention for the Safety of Life at Sea (SOLAS) sets minimum safety standards in the construction, equipment and operation of merchant ships. See International Convention for the Prevention of Pollution from Ships, 2 November, 1973, 3407, 1340 U.N.T.S. 61 (MARPOL) ; International Convention for the Safety of Life At Sea (SOLAS), 1 November 1974, 1184 U.N.T.S. 3 § 1184 U.N.T.S. 3.

[416] United Nations Fish Stocks Agreement. 1997.

[417] Based on documentation from the negotiation process, these may include measures directly connected to bioprospecting, relating to management and conservation of deep-sea genetic resources. These measures may effectively limit the freedom of fishing or scientific research, or the implicit freedom of bioprospecting, depending on interpretation. Moreover, the agreement is expected to provide modalities for establishing marine protected areas beyond national jurisdiction to protect sensitive and fragile ecosystems. Declaration of marine protected areas may imply different levels of restrictions, including preventing or restricting bioprospecting. A broad inventory of documents from the BBNJ-process is available at https://www.un.org/bbnj/ (site accessed 12/11 2020).

[418] Declaring marine protected areas in high seas areas with particularly sensitive ecosystems is however not a novel concept. States have cooperated for well over a decade in establishing such measures. The development has been propelled by the cooperation under the Convention for

some areas.[419] A considerable limitation in such approaches is that in line with the *pacta tertiis* principle, high seas marine protected area measures only apply to the parties of the treaty upon which the measures have been based.

In line with the exclusive flag state jurisdiction, such measures cannot be applied in relation to ships flying the flag of non-parties, not even in cases where a very broad group of states agree to conserve marine biological diversity on the high seas by establishing a marine protected area.[420]

Biological Diversity. The CBD conference of parties stated in 2006 that "*marine protected areas are one of the essential tools to help achieve conservation and sustainable use of biodiversity in marine areas beyond the limits of national jurisdiction*." Subsequently, the 2010 COP adopted the Strategic Plan for Biodiversity 2011-2020 and the Aichi Biodiversity Targets. Among the strategic objectives, target 11 provided that '*by 2020, at least 17 per cent of terrestrial and inland water areas, and 10 per cent of coastal and marine areas, especially areas of particular importance for biodiversity and ecosystem services, are conserved through effectively and equitably managed, ecologically representative and well connected systems of protected areas and other effective area-based conservation measures, and integrated into the wider landscapes and seascapes*.' It can thus be expected, that marine protected areas will increase and encompass also considerable high seas areas. See Convention on Biological Diversity, COP Decision VIII/24, Protected Area, UNEP/CBD/COP/DEC/VIII/24, 15 June 2006, para. 38.; Convention on Biological Diversity, COP Decision X/2, Strategic Plan for Biodiversity 2011-2020, including Aichi Biodiversity Targets, UNEP/CBD/COP/DEC/X/2, 29 October 2010. Under the high seas regime provided by UNCLOS, establishing marine protected areas is however problematic since such measures may set limits for the exercise of a broader range of high seas freedoms, including the freedom of navigation. Accordingly, proposals for marine protected areas measures affecting the freedom of navigation have been met with opposition from naval powers. Stuart Kaye, *Implementing high seas biodiversity conservation: global geopolitical considerations*, 28 MARINE POLICY (2004).

[419] UNCLOS lacks specific reference to marine protected areas and other area-based measures for the protection of sensitive sea areas. It is therefore not surprising that objectives to establish high seas marine protected areas have been particularly challenging to implement in the high seas. In line with the possibility in Article 87 of UNCLOS to make exceptions from the freedoms of the high seas in other treaties, measures providing special rules for designated high seas areas have been based on specific treaties binding state parties to apply the measures insofar as their jurisdiction extends. Legal support for such measures has also been based on the general obligation to protect and preserve the marine environment in Article 192 of UNCLOS, as well as Article 194(5), which provides for measures necessary to protect and preserve rare or fragile ecosystems as well as the habitat of depleted, threatened or endangered species and other forms of marine life. States have also argued that such measures are allowed under the obligation to cooperate in the conservation and management of living resources under Articles 117 and 118 (as will be further discussed under marine living resources below).

[420] Erik Molenaar, *Managing Biodiversity in Areas Beyond National Jurisdiction*, 22 THE INTERNATIONAL JOURNAL OF MARINE AND COASTAL LAW (2007).

Both regional and sectoral instruments have been used as the basis for declaring marine protected areas.[421] Although such different measures for the protection of high seas areas rarely mention bioprospecting or genetic resources specifically, many contain measures which effectively involve restrictions of such activities. Of less direct effect for bioprospecting so far (but with the possibility of involving restrictions to bioprospecting), sectoral instruments with global scope of application also provide for measures which effectively function as the basis for high seas marine protected areas. Under the auspices of the IMO, the concepts of Special Areas (based on MARPOL) and the more far-reaching Particularly Sensitive Sea Areas have been developed, resulting in special measures for vast sea areas.[422]

[421] Examples of high seas areas where regional sea convention organizations have declared marine protected areas include *inter alia* the North East Atlantic and the Antarctic ocean. In the North East Atlantic, The Convention for the Protection of the Marine Environment of the North-East Atlantic (OSPAR) had already by 2010 declared six high seas marine protected areas comprising 286,200 square kilometers, within the OSPAR management area. This decision was preceded by the designation in 2009 by the Commission for the Conservation of Antarctic Marine Living Resources (the CCAMLR Commission) of The South Orkney Islands Southern Shelf MPA in the Antarctic Ocean, covering around 94,000 square kilometers high seas within which fishing, scientific research related to fishing, and discharges and dumping from fishing vessels are regulated. Also on the regional side, Regional fisheries management organizations (RFMOs), which will be further discussed under marine living resources below, have possibilities to apply area based measures which in effect limits the freedom to fish. Under the UN Fish Stocks Agreement, RFMOs are mandated to decide that certain areas, including high seas areas within the geographical mandate of the RFMO, are closed to fisheries. Importantly, such measures bind not only members to the RFMO, but also other states, insofar these are parties to UNFSA. This circumvention of the *pacta tertiis* principle follows from Article 19 of UNFSA which obliges flag states to ensure that vessels respect measures applied by RFMOs, including closed areas, as provided in Article 21. TANAKA. 2012, p. 331-332; Karen N. Scott, *Conservation on the High Seas: Developing the Concept of the High Seas Marine Protected Areas*, 27 THE INTERNATIONAL JOURNAL OF MARINE AND COASTAL LAW (2012).

[422] Annexes to MARPOL 73/78 define certain sea areas as Special Areas in which the adoption of special mandatory methods for the prevention of sea pollution and discharges is required. A PSSA, on the other hand, can be protected also by additional measures such as ships routing measures – including as an area to be avoided: an area within defined limits in which either navigation is particularly hazardous or it is exceptionally important to avoid casualties and which should be avoided by all ships, or by certain classes of ships. Whereas Special Areas rules apply to high seas areas of the Meditarrenan as well as the Antarctic Ocean, PSSAs have hitherto been limited to waters within national jurisdiction, even if there is nothing hindering from applying such measures to high seas areas. MARKUS KACHEL, PARTICULARLY SENSITIVE SEA AREAS: THE IMO'S ROLE IN PROTECTING VULNERABLE MARINE AREAS § 13 (Springer Berlin Heidelberg, Berlin, Heidelberg. 2008).

UNCLOS thus provides for far-reaching possibilities for making exceptions from high seas freedoms in other agreements. Such limitations have been adopted in relation to the freedom of navigation under the auspices of the IMO. Moreover, different area-based management measures, including marine protected area measures which may affect bioprospecting, are increasingly used to protect sensitive high seas areas based on regional instruments and sectoral treaties.

Although specific legal bases for such measures are lacking in UNCLOS, legal basis is commonly claimed in UNCLOS provisions on the protection of the marine environment. In addition to restricting the freedom of navigation, such treaties have resulted in limitations of the freedom of fishing in certain areas, as well as (less commonly) special rules for marine scientific research. More such restrictions of high seas freedoms are likely to follow from the expected BBNJ agreement. Agreements involving restrictions on high seas activities are highly relevant to bioprospecting, since much of the commercial interest relates to the diverse and endemic ecosystems which are also commonly subject to protective measures.

Due regard

In addition, the limitations resulting from the principle of non-appropriation and the explicit exceptions to the freedoms of the high seas listed in the first part of Article 87, paragraph 2 establish that "*these freedoms shall be exercised by all States with due regard for the interest of other States in their exercise of the freedom of the high seas, and also with due regard for the rights under this Convention with respect to activities in the Area*."

It is thus made explicit that a requirement for due regard not only applies in relation to other high seas activities, but is equally relevant in relation to activities on the underlying seafloor of the Area.[423]

[423] This is based on the logic that each state must accept restraints on its own freedom of action arising from other states having the same freedom of action. As formulated by the International Law Commission, "*Any freedom that is to be exercised in the interests of all entitled to enjoy it, must be regulated. Hence the law of the high seas contains certain rules… which are designed not to limit or restrict the freedom of the high seas, but to safeguard its exercise in the interests of the entire international community*." NORDQUIST, et al. 1995, at 80; PROELSS, United Nations Convention on the Law of the Sea: A Commentary. 2017, at 679.

It is far from certain what this duty to exercise due regard entails, and what standard is relevant. The International Law Commission has discussed this obligation as a norm of customary international law, which the commission appears to consider has been codified by UNCLOS (although the latter is not stated explicitly): "*States are bound to refrain from acts which might adversely affect the use of the high seas by nationals of other States*."[424] In equally general terms, Koskenniemi has defined the requirement for due regard as: "*The full determination of the duty of due regard is always necessarily referred to its application to the specific circumstances of a particular case, when the relevant competing interests can be taken into account and balanced.*"[425] More tangible definitions of the obligation to pay due regard appear to be lacking, and it has been described as notoriously elusive.[426]

In the context of bioprospecting, due regard thus indicates an obligation for states to conduct operations with regard given to the interest of other states. Importantly, this does not just relate to other states conducting bioprospecting but includes other activities too. Accordingly, due regard calls for bioprospecting to be conducted in a manner that does not compromise inter alia high seas shipping or fisheries.

A more difficult question is how the obligation of due regard applies in relation to measures applied by other states which do not directly concern exercise of high seas freedoms. As discussed above, an increasing number of states have in recent years called for declaring marine protected areas to ensure the protection of sensitive high seas ecosystems.

[424] NORDQUIST, et al. 1995, at 81.

[425] MARTTI KOSKENNIEMI, THE POLITICS OF INTERNATIONAL LAW (Hart Publishing. 2011), at 339. Other observers have discussed due regard as "*requiring a balancing of interests in the use of the seas*"; PROELSS, United Nations Convention on the Law of the Sea: A Commentary. 2017, at 681.

[426] GEORGE K. WALKER, DEFINITIONS FOR THE LAW OF THE SEA: TERMS NOT DEFINED BY THE 1982 CONVENTION (Martinus Nijhoff Publishers. 2011), at 179–188 (187). The question has been posed whether this is an obligation "*so indeterminate that its application by different decision makers will necessarily be unpredictable*." LOUIS B. SOHN & JOHN NOYES, CASES AND MATERIALS ON THE LAW OF THE SEA (Brill 2 ed. 2014); at 79; Julia Gaunce, *On the Interpretation of the General Duty of "Due Regard"*, 32 (2018).

Based on the *pacta tertiis* principle, discussed above, such measures only apply insofar as subscribing states can assert jurisdiction. However, it can be argued that the obligation of due regard would imply an obligation for other states not to undermine such measures.[427]

In conclusion, the commons regime of the high seas provides far-reaching freedoms to conduct a broad range of activities, including bioprospecting, which all states have equal rights to carry out. Yet, these freedoms are not without limitations. The principle of non-appropriation prevents individual states not only from raising territorial claims to high seas areas, but also from demanding preferential access to resources, including organisms relevant for bioprospecting. UNCLOS also provides specific limitations relating to the different freedoms, including scientific research and fishing. Moreover, the convention allows for high seas freedoms to be restricted in other treaties. This serves as the legal basis for several limitations relevant to bioprospecting, provided in regional and sectoral treaties. More are likely to follow in light of the BBNJ process, as well as political ambitions to set up high seas marine protected areas. The principle of due regard calls for exercising the freedoms without compromising the exercise of high seas freedoms by other states. It is unclear how far the obligation of due regard extends, but most likely it does not require non-parties to follow high seas measures adopted in separate treaties, such as instruments establishing marine protected areas.

Enforcement of violations of restrictions of high seas freedoms is limited by the principle of exclusive flag state jurisdiction. Accordingly, if limitations to the freedoms are agreed in special treaties, those will in principle only be enforceable in relation to flag states parties to the relevant instrument. This does not hinder states from enforcing violations based on other jurisdictional grounds, such as based on nationality. The value of restrictions in any future agreement relating to bioprospecting is thus highly dependent on ratification by relevant flag states, as well as on what jurisdictional nexuses are employed by parties in enforcing obligations.

[427] A literary reading of Article 87 would however limit the obligation of due regard to the exercise of high seas freedoms by other states, hence not encompassing all other interests of other states.

C.1.4.2 The Area

While the UNCLOS rules on the water column of areas beyond national jurisdiction have now been explored, it is time to turn to the seabed and underlying sediments beyond the continental shelf, which in UNCLOS are referred to as the Area. Based on the finding that much commercial interest relating to deep-sea genetic resources is related to seabed organisms, as discussed in Part B, the regulation of the Area is particularly relevant to bioprospecting.

Geographic extent

It appears as more than coincidental that the Area occupies the first subparagraph of the first Article of UNCLOS. No other concept introduced under the convention can be considered more innovative or indeed revolutionary than the regime for the deep-sea floor. The Area is defined under UNCLOS as the seabed and ocean floor and subsoil thereof, beyond the limits of national jurisdiction. This implies that like the High Seas regime of the water column, the Area is defined conversely: The Area is what is left over once all coastal states have made their legitimate claims for continental shelves.

However, as previously discussed, contrary to the EEZ which states must claim, the coastal states' right to continental shelf is inherent and does not need to be declared. Consequently, the geographic extent of the Area should in theory be easier to assess than that of the High Seas. In practice, however, at least for the foreseeable future, it is much more difficult to make that assessment because of the complex criteria for assessing the extent of the continental shelf, as well as the large number of unprocessed submissions.[428]

Implicitly, the extent of the Area is thus dependent of the definition of the continental shelf under UNCLOS, and what claims states make based on those rules.

[428] This situation has the consequence that it is uncertain what regime will apply in the long term for substantial parts of the sea floor between 200 and 350 nm from base lines. In such areas, which potentially but not with certainty will be regarded as part of the continental shelf it is doubtful whether coastal state continental shelf jurisdiction or the Area regime should apply.

Similar to the continental shelf, the Area is thereby based on a judicial rather than a geological definition, which implies that its extent does not necessarily overlap with the deep seabed, as the term commonly is used in a scientific context.[429]

Regulative origin

Whereas the drafting of UNCLOS Part VII on the High seas was an exercise in balancing different freedoms and interest, the corresponding negotiation on the deep seabed was more dominated by one interest: the assumed fortunes in the form of marine minerals. Part XI sets out a regime for supranational governance of the seabed and ocean floor beyond national jurisdiction and the equitable distribution of its resources among developed and developing states.[430]

For practical purposes, the relevant commercial interest in the deep seabed was until the relatively recent dawn of the bioprospecting sector considered as exclusively relating to minerals. Despite being based on considerations relating to the mining of marine minerals, the rules for the Area, as expressed in Part XI of UNCLOS were coined in a general manner, which could render the regime applicable also to other activities. [431]

The interest in commercial exploitation of the mineral resources of the deep-sea dates back at least to the 1960s. At the outset, the interest was confined to manganese nodules. Already at that time, well before the convening of the drafting conferences for the law of the sea convention, the legal status of these resources was debated, as will be further discussed in section D.1.[432]

[429] Alvar Braathen & Harald Brekke, *Characterizing the Seabed: a Geoscience Perspective*, *in* THE LAW OF THE SEABED - ACCESS, USES, AND PROTECTION OF SEABED RESOURCES (Catherine Banet ed. 2020).

[430] WARNER. 2009, at 40.

[431] Part XI is then in turn elaborated in the Part XI agreement, which constitutes the first so-called implementing agreement to UNCLOS.

[432] Developing states were of the opinion that merely the wealthier developed states had the capacity to engage in deep-sea mining. At the time, many developing states were also in the process of developing extraction of their own terrestrial mineral resources. Often regarded as key to economic development, there was a widespread conception that unregulated development of deep-sea mining would decrease world market prices for minerals.

The vision behind the system for the management of the seabed and its resources was presented by the Maltese ambassador Arvid Pardo at the third UNCLOS negotiation conference. As one of the more dramatic events of the negotiation of UNCLOS, he proposed that the seabed and the ocean floor beyond national jurisdiction be declared the common heritage of mankind.[433]

Although Pardo's proposal came to gain acceptance, it was by no means uncontested. The debate on the legal status of minerals was largely divided into three different positions.

Firstly, there were states emphasizing the notion of sovereign rights to the resources of the continental shelf. This position was essentially part of the same credo as the Truman Proclamation of 1945.[434]

A second position was more moderate with regards to the sovereign rights of the coastal states, limiting them to the geological continental shelf. This view held that the abyssal plains of the sea floor were *res communis*, meaning that the Area and its resources could be used by any state, but no state could appropriate or make claims for exclusive title or other rights to the Area.

Thirdly, there were states considering that the deep seabed should be treated as *res nullius*. In line with this reasoning, these states claimed that utilization of the seabed by mining states was not only a legal right, but also effectively gave the state legal title over the relevant seabed area.[435] Somewhat simplified, most industrialized states favored a free-access regime for deep seabed mining, with only limited international involvement. The developing country group G77, on the other hand, supported a centralized international authority which would control the access to the mineral resources of the deep seabed and distribute the profits fairly and equitably.[436]

[433] Malta: Request for the Inclusion of a Supplementary Item in the Agenda of the Twenty-Second Session, UN Doc A/6695 (18 August 1967).
[434] Stephen Vasciannie, *Resource entitlement in the Law of the Sea: some areas of continuity and change*, *in* THE REALITY OF INTERNATIONAL LAW: ESSAYS IN HONOUR OF IAN BROWNLIE (Guy S. Goodwin-Gill & Stefan Talmon eds., 1999).
[435] CHURCHILL & LOWE. 1999, at 225.
[436] Susan J. Buck, The Global Commons: An Introduction (Earthscan Publications Ltd. 1998), at 88.

Managing the Deep-Sea Floor – a global commons under the principle of common heritage of mankind

Despite the opposition, Pardo's vision for a new deep-sea regime prevailed in the lively debate on the management of the seafloor resources. A specific Seabed Declaration[437] was adopted by the UNGA, which essentially reflected the principles in Pardo's statement. The seabed and the ocean floor beyond the limits of national jurisdiction or "the Area" were declared as *the common heritage of mankind*. Furthermore, the declaration provided that no state or person, natural or juridical, was able to claim, exercise or acquire rights with respect to the Area or its resources which were incompatible with the international regime to be established for the Area. The Seabed Declaration made clear that exploration of the Area and the exploitation of its resources were to be carried out "*for the benefit of mankind as a whole taking into particular consideration the interests and needs of developing countries*."[438] This declaration came to serve as the foundation for the deep seabed mining regime in Part XI of UNCLOS, which came to be laid out in Section 2 of UNCLOS Part XI.[439] Accordingly, the pivotal Article 136 of the convention declares:

> **Article 136**
> *Common heritage of mankind*
> The Area and its resources are the common heritage of mankind.

Essentially a development of the same principle, Article 137 affirms that all claims or exercise of sovereignty or sovereign rights over any part of the Area or its resources are prohibited. All rights in the mineral resources of the Area are vested in mankind as a whole.[440]

[437] United Nations General Assembly resolution 2749 (XXV), Declaration of Principles Governing the Seabed and the Ocean Floor, and the Subsoil Thereof, beyond the Limits of National Jurisdiction, A/RES/25/2749 (12 December 1970) (1970).
[438] Ibid.
[439] WARNER. 2009, at 41.
[440] Article 138 provides that the general conduct of all states in relation to the Area must be in accordance with the provisions of Part XI. Article 140 also requires that such activities be carried out for the "*benefit of mankind*", while Article 141 obliges states to use the Area exclusively for peaceful purposes. The convention also makes clear, in Article 135, that neither Part XI nor any

Taken together, this provides strong *explicit* fundaments for a *commons* regime for the resources of the Area. The resources are not commons in lack of regulation: The common heritage of mankind principle does not provide that the resources of the area belong to no one. By no means should it be mistaken for the principle of *res nullius*. Rather, it explicitly states that these resources belong to all of mankind. As a logical consequence from this presumption, appropriation by individual states is impossible: The resources are already owned by all of mankind.

Whereas the sketch for the management of the deep seabed – notably the common heritage of mankind principle – was drawn out in UNCLOS when it was adopted in 1982, it was not until 1996, with the entry into force of Part XI agreement[441], that the full deep-sea mining regime was established.[442]

How, then, should the rules on the common heritage of mankind principle be interpreted in a broader context?[443] Some observers have considered that the principle should be understood as expressing a principal, symbolic legal status with limited operative normative content.[444]

rights granted or exercised pursuant to Part XI shall affect the legal status of the waters suprajacent to the Area.

[441] Agreement relating to the implementation of Part XI of the United Nations Convention on the Law of the Sea, 10 December 1982, 1836 U.N.T.S. 3.

[442] With the status of an implementing agreement to the convention, the Part XI Agreement has 150 parties and can thus be characterized as global. To a higher degree than the second implementing agreement to the convention, the UN Fish Stocks Agreement (which will be further discussed in the context of marine living resources in section C.1.5), the Part XI Agreement effectively functions as a part of the same treaty as the convention. It is also a globally applicable agreement for all practical matters, with the United States as a notable non-party.

[443] As provided in Article 136 and the subsequent provisions of Section 2 of UNCLOS Part XI.

[444] In the words of Vöneky and Höfelmeier, "given the substantial vagueness of Article 136 compared to the detailed provisions in the subsequent articles, it could be questioned whether it has more than a merely symbolic role." Adding to the description of the concept of common heritage of mankind as intangible, it has been claimed that it is still, despite its employment in several international instruments is "subject to vivid discussion as to its scope and elements. Thus, a clear normative content cannot be established, which is also reflected in the different terms used to describe the concept." PROELSS, United Nations Convention on the Law of the Sea: A Commentary. 2017, at 951; KEMAL BASLAR, THE CONCEPT OF THE COMMON HERITAGE OF MANKIND IN INTERNATIONAL LAW (Brill | Nijhoff. 1997).

Others disagree. For instance, *Wolfrum* appears to regard the common heritage of mankind principle as expressed in Article 136 as central in clarifying the aims pursued by the drafters in creating a regime for the deep seabed area: Instead of national or individual freedom of use, Part XI aims to internationalize the deep seabed and its utilization.[445]

If the discussion on its operational value is set aside and focus instead is put on its components, Vöneky and Höfelmeier have summarized the principle as encompassing five major elements: '*first, the prohibition of private and public appropriation or sovereignty; second, concerted management and exploitation by representatives from all nations; third, equal sharing of benefits acquired from exploitation of the region; fourth, the prohibition of military uses or installations; and fifth, the preservation for future generations'*.[446]

The preservation for future generations is more an objective than an operative rule.[447]

The principle has been interpreted as counter-balancing the freedom of the high seas in Article 87(1).[448] The latter ensures that all states have access to the high seas; however, according to the obligation of due regard in Article 87(2), this freedom is limited by the rights of other states in regard to both the high seas and the Area. Both regimes also share some features, such as the principle of non-appropriation.[449]

[445] See Rüdiger Wolfrum, *Hohe See Und Tiefseeboden* in Wolfgang Graf Vitzthum (ed.), Handbuch des Seerechts (2006) as referenced by Vöneky and Höfelmeier in PROELSS, United Nations Convention on the Law of the Sea: A Commentary. 2017, at 950.

[446] Scott J. Shackelford, The tragedy of the common heritage of mankind, 28 STANFORD ENVIRONMENTAL LAW JOURNAL (2009); Jennifer Frakes, The common heritage of mankind principle and the deep seabed, outer space, and Antarctica: will developed and developing nations reach a compromise?, 21 WISCONSIN INTERNATIONAL LAW JOURNAL (2003).

[447] All these normative elements can be found in the convention: while Article 136 proclaims the employment of the principle, the subsequent articles introduce the different aspects. John E. Noyes, *The common heritage of mankind: past, present, and future*, 40 DENVER JOURNAL OF INTERNATIONAL LAW AND POLICY (2011); Bradley Larschan & Bonnie Brennan, *The Common Heritage of Mankind Principle in International Law*, 21 THE COLUMBIA JOURNAL OF TRANSNATIONAL LAW (1983).

[448] Myron H. Nordquist, et al., United Nations Convention on the Law of the Sea, 1982: A Commentary Vol. VI [Second Committee: Articles 133 to 191, Annex I, Resolution II, Agreement relating to the Implementation of Part XI. Documentary Annexes] § VI (2002).

[449] PROELSS, United Nations Convention on the Law of the Sea: A Commentary. 2017, at 951.

However, in the more operative language of Article 137, the difference from the commons regime for the high seas becomes evident.

> **Article 137**
> *Legal status of the Area and its resources*
> 1. No State shall claim or exercise sovereignty or sovereign rights over any part of the Area or its resources, nor shall any State or natural or juridical person appropriate any part thereof. No such claim or exercise of sovereignty or sovereign rights nor such appropriation shall be recognized.
> 2. All rights in the resources of the Area are vested in mankind as a whole, on whose behalf the Authority shall act. These resources are not subject to alienation. The minerals recovered from the Area, however, may only be alienated in accordance with this Part and the rules, regulations and procedures of the Authority.
> 3. No State or natural or juridical person shall claim, acquire or exercise rights with respect to the minerals recovered from the Area except in accordance with this Part. Otherwise, no such claim, acquisition or exercise of such rights shall be recognized.

Article 137(1) prohibits the exercise of sovereignty over or appropriation of any part of the Area, both by states and natural or legal persons. The application of the principle of non-appropriation in the Area may be interpreted as a material outflow of the common heritage of mankind principle expressed in the previous article. Compared to the high seas, it is formulated differently and more broadly, including not only a prohibition to make sovereign territorial claims; the exercise of sovereignty or sovereign rights over any part of the Area or its resources is also prohibited.

In the Area, the principle of non-appropriation also has other material implications compared to in high seas. Articles 136 and 137 prevent all states from accessing the resources of the Area, unless permitted under the convention. As discussed above, the resources of the high seas are similarly described as a commons area by the convention. However, in the high seas regime, the material implication of the commons status is converse: entailing open access for all states (albeit with restrictions). Article 137 thus draws a major difference in the regime for the Area as compared to that of the high seas. Both maritime zones are oceans commons, but the legal status of their resources is radically different: high seas resources are open for anyone's appropriation, whereas no one can appropriate the resources of the Area.

In fact, the prohibition of appropriation of resources of the Area goes even further. Complementarily, Article 137 obliges state parties not to recognize any such act. This obligation of non-recognition provides a strong safeguard for the principle of non-appropriation in the Area. Moreover, all states (instead of merely state parties) are included in the group of addressees of Article 138.[450]

The International Seabed Authority and the bioprospecting of marine genetic resources

Already at the time of the drafting of the Convention it was decided that this new management regime for the deep sea would be spearheaded by a novel and fully dedicated international institution. As the managing institution for the resources in the Area encompassed by the common heritage of mankind principle, Part XI established the International Seabed Authority (ISA).[451]

Individual actors can, indeed, undertake "activities in the Area" but these shall be carried out for the benefit of mankind as a whole according to Article 140, which also provides that it is the ISA that shall provide for equitable sharing of economic benefits derived from activities in the Area. Under Article 157(1) the ISA shall "*organize and control activities in the Area, particularly with a view to administering the resources of the Area*". This formulation is important and will be examined more closely in the context of bioprospecting in the next section. First, however, the remaining guiding instructions for the ISA will be examined.

---

[450] In view of the limits imposed by the *pacta tertiis* principle of applying treaty obligations to non-parties, the use of the term (all) *states* may be interpreted as a reference to parallel customary international law provisions.

[451] Article 156 of UNCLOS establishes the International Seabed Authority (ISA) as a specific entity with responsibility for managing deep-seabed mining in the Area. It also provides that all parties to UNCLOS *ipso facto* are parties to the new authority. Consequently, also states that have been unwilling or unable to become parties to the Part XI agreement remain within the realm of ISA. UNCLOS is clear on the exclusivity of the Authority's role. The ISA acts on behalf of mankind as a whole, who has the rights to the resources of the Area according to Article 137(2). UNCLOS thus grants the ISA a far-reaching mandate.

How this objective is to be pursued is elaborated in more detail in Article 150 of UNCLOS.[452] This provision suggests that the ISA has a broad mandate, with almost indiscriminate abilities to regulate activities on the deep-sea floor beyond national jurisdiction.[453] In addition to its resource management mandate, the ISA has a responsibility to function as a focal point for marine scientific research in the Area and to ensure effective protection of the marine environment from harmful activities in the Area.[454] But how does this mandate, which seemingly extends to controlling activities in the Area, administering its resources, as well as central roles in scientific cooperation and environmental protection, apply to bioprospecting of marine genetic resources?

[452] Article 150 on '*Policies relating to activities in the Area'*, provides that 'Activities in the Area shall, as specifically provided for in this Part, be carried out in such a manner as to foster healthy development of the world economy and balanced growth of international trade, and to promote international cooperation for the over-all development of all countries, especially developing States, and with a view to ensuring: (a) the development of the resources of the Area; (b) orderly, safe and rational management of the resources of the Area, including the efficient conduct of activities in the Area and, in accordance with sound principles of conservation, the avoidance of unnecessary waste; (c) the expansion of opportunities for participation in such activities consistent in particular with articles 144 and 148; (d) participation in revenues by the Authority and the transfer of technology to the Enterprise and developing States as provided for in this Convention; (e) increased availability of the minerals derived from the Area as needed in conjunction with minerals derived from other sources, to ensure supplies to consumers of such minerals; (f) the promotion of just and stable prices remunerative to producers and fair to consumers for minerals derived both from the Area and from other sources, and the promotion of long-term equilibrium between supply and demand; (g) the enhancement of opportunities for all States Parties, irrespective of their social and economic systems or geographical location, to participate in the development of the resources of the Area and the prevention of monopolization of activities in the Area; (h) the protection of developing countries from adverse effects on their economies or on their export earnings resulting from a reduction in the price of an affected mineral, or in the volume of exports of that mineral, to the extent that such reduction is caused by activities in the Area, as provided in article 151; (i) the development of the common heritage for the benefit of mankind as a whole; and (j) conditions of access to markets for the imports of minerals produced from the resources of the Area and for imports of commodities produced from such minerals shall not be more favorable than the most favorable applied to imports from other sources.

[453] No doubt the ISA appears to maintain this position. The secretary general of the Authority has asserted that the ISA has a broad "*regulatory role with respect to the protection and preservation of the marine environment (including its biodiversity) in the Area generally*". See International Seabed Authority, Report of the Secretary-General of the International Seabed Authority under Article 166. Paragraph 4 of the United Nations Convention of the Law of the Sea, 7 June, 2002, UN Doc. ISBA/8/A/5, 12.

[454] See articles 143 and 145 respectively.

Does the phrase "*activities in the area*" imply a mandate to regulate not merely mining but *all* activities including other activities regulated in the convention, such as marine scientific research and activities not mentioned, including deep-sea bioprospecting? Based on a close reading of the UNCLOS provisions defining key concepts, arguments have been made against such an interpretation. Interestingly, the expression "*activities in the area*," which is used so liberally in many provisions of Part XI, is narrowly defined in the defining provisions in Part 1. Article 1(3) defines resources to mean "*all activities of exploration for, and exploitation of, the resources of the Area.*" Perhaps even more pointedly, resources are defined under Article 133(a) of UNCLOS as "*all solid, liquid, or gaseous mineral resources in situ in the Area at or beneath the seabed, including polymetallic nodules.*"

Many observers claim that the defining terms clearly indicate that the mandate is limited not only to mineral resources, but also to the exploration and exploitation of such resources. Despite declarations by ISA endeavoring to exercise its mandate more broadly, the same observers regularly claim that the facilitation and management of commercial mining of deep-sea mineral resources has also been the *de facto* objective of the ISA.[455]

Others consider that the mandate provided in Article 157 does not limit the role of the ISA to issues of marine mining. Supporters of this position agree that mineral mining was no doubt the main activity borne in mind by the drafters of Part XI of UNCLOS, but they were not so naïve as to believe that no other human activity would ever occur in these areas. Accordingly, the mandate for the ISA was not explicitly limited to mineral mining, but was rather formulated open-endedly. Thereby, it has been argued, the ISA should have an important role in organizing other activities in the Area, such as bioprospecting.

[455] Indeed, some have gone so far as to claim that until a wider mandate is bestowed upon the ISA, it may only regulate activities associated with the exploration for, and exploitation of mineral resources of the Area and not activities associated with bioprospecting or other activities relating to living organisms. Along the same lines, it can be argued that the mandate of ISA for environmental regulation would be limited to pollution resulting from the exploration and exploitation of mineral resources. See, for an inventory of these objections Lyle Glowka, *The Deepest of Ironies: Genetic Resources, Marine Scientific Research, and the Area*, 12 Ocean Yearbook Online (1996).

These arguments are in turn regularly refuted with the argument that the emphasis on the administration of *resources* in the second half of the mandate provision indicates an element of limitation in the mandate of the ISA. Taken together, this calls for a thorough investigation of what the central term *resources* actually entails under the convention. This is not only called for by the formulation of the mandate of the ISA; importantly, it also coincides with one of the questions left unanswered under the general discussion on the principle of common heritage of mankind. Moreover, in the context of that discussion, it was clear that the common heritage of mankind concept was closely tied to the term *resources*.

The definition of resources under UNCLOS Part XI – the applicability of the common heritage of mankind principle and the mandate of the ISA to marine genetic resources

In the previous section, the basic elements of the principle of common heritage of mankind and the mandate of the International Seabed Authority were discussed. A central question, however, remains unanswered, namely, what resources actually fall within the scope of application of this principle, and does the principle encompass bioprospecting for marine genetic resources? In other words, does bioprospecting for genetic resources fall within the scope of Part XI of UNCLOS?

This is central for the legal status of deep-seabed bioprospecting under the law of the sea, since the term *resources* is indicative of what is covered by the rules for the Area in general and the principle of common heritage of mankind in particular.[456] Investigating this matter is complicated by the lack of references to, for example, "*marine genetic resources*" as well as "*bioprospecting*" under UNCLOS, despite its ambition to provide comprehensive rules, for all uses of the seas, as discussed in section C.1.1.

Where genetic resources are found on the seabed and in the sediments of the Area, the legal status has been subject to a rather vivid dispute. Observers seem to be divided along two positions.

[456] Whether the International Seabed Authority (ISA), which (at least) is mandated to manage the mining for minerals in the Area would have a corresponding role for deep-sea genetic resources under this interpretation is equally dependent on the definition of *resources*.

Either genetic resources are comprised by the detailed regime of Part XI of UNCLOS.[457] Or they ought to be regarded as a global common in the meaning of open access, similarly to the resources in the overlying water column (the high seas).[458] The dispute primarily relates to the interpretation of the opening provision of Part XI:

> **Article 133**
> *Use of terms*
> For the purposes of this Part:
> (a) "resources" means all solid, liquid or gaseous mineral resources *in situ* in the Area at or beneath the seabed, including polymetallic nodules;
> (b) resources, when recovered from the Area, are referred to as "minerals".

At first glance, it appears that the convention defines the term *resources* in a manner that could appear counterintuitive linguistically. Article 133 both establishes that *resources* refer to the minerals situated in the Area and that resources recovered there are referred to as minerals. It could be argued that the drafters wanted to include all resources but made reference to minerals, since mineral resources were the only valuable resource known at the time and thus formed the main focus during the negotiation of the convention. The general ambition of UNCLOS as declared in its preamble, to encompass all uses of the sea, speaks in favor of this interpretation.[459] The terminological definition could, however, be used against this reasoning. Why specifically declare that the term resources means minerals if the aim was to include all resources?

The restrictive interpretation

Some observers thus claim that Article 133 implies that the regime merely encompasses the substances specified in (a) when geographically located in the Area and that these resources in line with (b) should be referred to as *minerals*.

[457] See UNCLOS Part XI and Agreement relating to the implementation of Part XI of the United Nations Convention on the Law of the Sea.
[458] The fundamental principle for the area is formulated in Article 136: "*The Area and its resources are the common heritage of mankind*."
[459] For an extensive review of the discussion, see PROELSS, United Nations Convention on the Law of the Sea: A Commentary. 2017; MILLICAY. 2007, at 936-942.

Accordingly, supporters of this restrictive interpretation of *resources* hold that the management provisions for the Area in Part XI, including the principle of common heritage of mankind, should be limited to mineral resources.[460] This implies, conversely, that the regime for the exploration and exploitation of resources of the Area is not applicable to the living resources of the deep seabed.[461]

Arguing that living resources should be included in this definition faces at least three difficulties.

Firstly, living resources can hardly be regarded as mineral. Even for living resources with biomass or shells relatively high in mineral content, such as clams and corals, it would be both counterintuitive and scientifically incorrect to refer to them as mineral resources. Marine living resources would be referred to as organic or biological. Accordingly, supporters of the restrictive understanding have claimed that it would be unreasonable to extend the application of the principle of common heritage of mankind to living organisms. Essentially, they claim, it would be manifestly absurd to interpret non-mineral resources such as marine genetic resources as included in the term "minerals" under Article 133.

The second argument against including living resources in the definition of minerals is essentially functional. There is clear evidence that the rules for the management of resources under the principle of common heritage of mankind are designed to handle minerals. Especially the provisions on the International Seabed Authority are in many regards ill-equipped to handle the management of living resources.[462]

[460] PROELSS, United Nations Convention on the Law of the Sea: A Commentary. 2017, at 941.

[461] The relationship between marine genetic resources and marine living resources will be further explored in section C.1.5.

[462] Moreover, the modalities for electing members to the principal organ of the ISA, the Council, is explicitly based on different kinds of mineral interests. The rules provide that the council should be composed of member states' representatives, in particular those states that have a leading role in the polymetallic nodule industry. See in particular Article 161, UNCLOS. As previously has been established, there is reason to believe that mining will be difficult to combine with bioprospecting in relevant areas. Rather, it can be assumed that these interests often will collide. Accordingly, observers of this position claim that it would be inappropriate to let a group elected solely based on concerns relating to mineral mining manage the bioprospecting and conservation of marine genetic resources. Angelica Bonfanti, *Environmental risks in biotech patent disputes: which role for ordre public before the European patent office*, 3 EUROPEAN JOURNAL OF RISK REGULATION (2012).

The third and most common argument invoked by observers who support a more restrictive interpretation of *resources* is that the only resources taken into consideration when UNCLOS was negotiated were indeed mineral resources.[463] The common heritage of mankind regime cannot encompass, it has been argued, issues which were unknown to the negotiators. This would rule out living resources from the scope of application of the principle.[464] Arguments against accepting an interpretation that includes genetic resources in the scope of the common heritage of mankind principle could also be built on the Lotus principle. Sovereign states have the freedom to act as they wish, unless they choose to bind themselves by a voluntary agreement or there is an explicit restriction in international law.[465] Under this understanding, it would be difficult to accept the notion that restrictive treaty rules could develop to encompass completely new activities, without explicit state consent.

Accordingly, Matz-Lück and Wolfrum interpret "resources" as defined in Article 133 of UNCLOS to mean only mineral resources.[466] They base this exclusion on the limited knowledge of deep-sea genetic resources and focus on polymetallic nodule extraction at the time of negotiation. This, they claim, explains the lack of a particular regime for marine living resources of the deep seabed.

[463] Most likely at least partly the result of exaggerated expectations of the economic potential of those resources, their legal status was one of the most contentious areas during the negotiation of the convention. The possible economic value of the living resources of the deep seabed and in many cases even their existence was unknown at the time. Tullio Scovazzi, *The negotiations for a binding instrument on the conservation and sustainable use of marine biological diversity beyond national jurisdiction*, 70 MARINE POLICY (2016); Angelica Bonfanti & Seline Trevisanut, *TRIPs on the high seas: intellectual property rights on marine genetic resources. (Agreement on Trade-Related Aspects of Intellectual Property Rights)*, 37 BROOKLYN JOURNAL OF INTERNATIONAL LAW (2011), at 194.

[464] Scovazzi, Tullio, "Is the UN Convention on the Law of the Sea the Legal Framework for All Activities in the Sea? The Case of Bioprospecting" in VIDAS. 2010, at 316.

[465] An Hertogen, *Letting Lotus Bloom*, 26 EUROPEAN JOURNAL OF INTERNATIONAL LAW (2015).

[466] According to Matz-Lück and Wolfrum, the reference to "*resources*" in this provision has to be understood in the light of the legal definition in Article 133 (a) of UNCLOS which limits the scope of Part XI, and, consequently, the jurisdictional power of the International Sea-bed Authority concerning the management of mineral resources.

As a result, they claim that the high seas regime on management and conservation of marine living resources should be regarded as the relevant regime for marine genetic resources, despite the challenges in applying these rules to deep-seabed organisms.[467]

Similarly, Scovazzi considers that the convention text excludes genetic resources. He further argues that UNCLOS cannot be considered to provide rules for activities and resources that were unknown during its negotiation.[468] Instead, he suggests that a legal gap exists for genetic resources, both in the high seas and in the Area.[469] Indeed, a reading of Article 133 *e contrario* supports this understanding: By defining resources as "all solid, liquid or gaseous *mineral* resources *in situ* in the Area at or beneath the seabed, including the polymetallic nodules," organisms are implicitly excluded.

[467] Rüdiger Wolfrum & Nele Matz, The Interplay of the United Nations Convention on the Law of the Sea and the Convention on Biological Diversity, 4 MAX PLANCK YEARBOOK OF UNITED NATIONS LAW (2000), at 455.

[468] (The convention) "cannot be supposed to regulate those activities that its drafters did not intend for the simple reason that they were not foreseeable in the period when the treaty was being negotiated. At that time (1973-1982), very little was known about the genetic qualities of deep seabed organisms. The term 'genetic resources' does not appear anywhere in the UNCLOS. If this perspective is followed, the conclusion can be that a legal gap currently exists for the genetic resources found in both the Area and the high seas." Scovazzi, Bioprospecting on the Deep Seabed: a Legal Gap Requiring to be Filled. 2006, at 93. In another context, referring to the negotiators, he has argued that "When they were discussing research of significance for natural resources, they had goods intended for consumption such fish, oil, polymetallic nodules and little else in mind." Furthermore, Scovazzi claims that "it is extremely difficult" to go against the plain text of Article 133 that excludes non-mineral resources, such as genetic resources, from the application of Part XI. However, some general principles of the UNCLOS should be taken into consideration when envisaging any future and more specific regime for marine genetic resources in areas beyond national jurisdiction."

[469] Scovazzi does thus not agree with Matz and Wolfum that the freedom of the high seas should apply to genetic resources on a "first come first served" basis since this "*would lead to inequitable and unacceptable consequences*." Rather, he claims that such approaches would go against central formulations in preamble of UNCLOS (in particular paragraph 5) on "*equitable economic order*" and "*the interests of mankind as a whole*." Similarly, he reminds that open and unrestricted access to genetic resources "*would go against the principle of fair and equitable sharing of the benefits arising out of the utilization of genetic resources set forth by the CBD*." PROELSS, United Nations Convention on the Law of the Sea: A Commentary. 2017, at 941.

The extensive interpretation

This view can be contrasted with a more extensive interpretation of Part XI and its management rules, which holds that it encompasses *all* resources, including not only minerals but also genetic resources of living organisms. It has thus been stressed by some observers that even if the central role of Article 133 in defining the scope of the resources of the Area is accepted (as suggested by the supporters of the restrictive interpretation), the reference in that provision to mineral resources is not necessarily exhaustive.[470]

Supporters of the extensive interpretation have also disputed the more restrictive interpretation based on Article 133 by noting that Article 134 explicitly states that "*Activities in the Area shall be governed by the provisions of this Part.*" Similarly, Article 136 declares that *both* the Area *and* its resources form part of the common heritage of mankind. The broad scope of the rules of the Area are further underlined by the formulation of Article 140, which states that "*Activities in the Area shall, as specifically provided for in this Part, be carried out for the benefit of mankind as a whole*" and that "*The Authority shall provide for the equitable sharing of financial and other economic benefits derived from activities in the Area*."

Independent of the definition of *resources* in Article 133, supporters of the extensive interpretation claim that these terms indicate that the regime of the Area is meant to apply extensively, by virtue of the open-ended reference to *activities*. According to this understanding, arguing that the definition in Article 133 rules out other resources than minerals from the regime would disregard the broader contextual arguments in favor of an extensive interpretation.

[470] As considered by *Oude Elferink*, the provision's reference to mineral resources cannot be read as excluding all other resources from its scope. Alex Oude Elferink, *The Regime of the Area: Delineating the Scope of Application of the Common Heritage Principle and Freedom of the High Seas*, 22 THE INTERNATIONAL JOURNAL OF MARINE AND COASTAL LAW (2007), at 152.

Furthermore, Article 133 is not the only provision containing a definition of central importance for assessing the status of genetic resources in the Area. As noted above, Article 1 of UNCLOS provides that the "Area" means the seabed and ocean floor and subsoil thereof, beyond the limits of national jurisdiction. The terms "seabed," "ocean floor" and "subsoil" are not defined in the Convention.[471] As pointed out by Oude Elferink,

> *In principle, the ordinary meaning of the terms "seabed", "ocean floor" and "subsoil" comprises the living and non-living resources that are found in those areas. These are general terms that have a specific spatial application that does not exclude certain natural components from that spatial scope of application because they differ from surrounding areas. The same applies to all other maritime zones. All resources located in a zone form part of that zone.*[472]

Accordingly, the declaration in the preamble of the Convention makes clear that it was the intention of states parties to establish "*a legal order for the seas and oceans*" which will, in particular, promote the equitable and efficient utilization of their resources, as well as the conservation of the living resources. The implication that genetic resources in UNCLOS would represent a *legal lacuna*, as suggested by supporters of the restrictive view, would also be incompatible with the notion of UNCLOS as a comprehensive convention, as discussed in section C.1.1.[473]

[471] As will be further explored in section E.5.2, it is therefore logical to resort to the principal rule of treaty interpretation under international law, that a treaty shall be interpreted in good faith in accordance with the ordinary meaning to be given to the terms of the treaty in their context and in the light of its object and purpose. Vienna Convention on the Law of Treaties of 23 May 1969 (1155 UNTS 331), Article 31(1).

[472] Oude Elferink, THE INTERNATIONAL JOURNAL OF MARINE AND COASTAL LAW (2007), at 150. See also Tullio Scovazzi, Mining, Protection of the Environment, Scientific Research and Bioprospecting: Some Considerations on the Role of the International Sea-Bed Authority, 19 see id. (2004), at 391.

[473] As stated in section C.1.1, it appears to have been widely shared among the negotiators, and also is expressed in the preamble, that UNCLOS '*establishes a comprehensive framework for the regulation of all ocean space, conscious that its problems are closely interrelated and need to be considered as a whole*.' As observed by Armas-Pfirter, "*pursuant to the convention, ocean space is divided into jurisdictional zones and different issues are governed on a geographical basis. This 'zonal approach' means that a specific legal regime applies, geographically, only to a given marine area.*" Frida Armas-Pfirter, *How Can Life in the Deep Sea Be Protected?*, 24 see id. (2009), at 281.

Under this understanding, Article 1 of UNCLOS thus defines the Area not as a specific concept for mineral resources but as a geographically defined space, much like other maritime areas.

This is further explicitly confirmed, it is claimed, by the reference to "the natural resources of the Area" in Article 145(b) of the Convention. The dual inclusion of references to the geographic area and its content was apparently considered so important by the negotiators that it was even given the priority of being reiterated in the relatively short preamble of the convention.[474]

The extensive view has been further supported by analogy to the continental shelf regime.[475] As will be discussed in section C.1.5, the rights of the coastal state over the continental shelf include rights with regard to sedentary species. It has been suggested that this definition could be applied by analogy to the living resources of the deep seabed beyond the continental shelf.[476]

Moreover, the drafting history of Part XI includes references to both living and mineral resources. By no means does it suggest that an agreement existed whereby the living resources of the Area would be excluded from the scope of application of Part XI of the Convention. Rather, as examined by Amras-Pfirter, many references to living resources of the Area as encompassed by the common heritage of mankind principle are found in the documentation of the negotiations on how to enforce the principles in UNGA Resolution 2749 (XXV).[477]

[474] The sixth preambular paragraph refers to the United Nations (UN) General Assembly (GA) Resolution 2749 of 19703 that declared, *inter alia*, that the area of the seabed and ocean floor and the subsoil thereof, beyond the limits of national jurisdiction, as well as its resources, are the common heritage of mankind. (G.A. Res. 25/2749, Declaration of Principles Governing the Sea-Bed and the Ocean Floor, and the Subsoil Thereof, beyond the Limits of National Jurisdiction (Dec. 12, 1970).

[475] F.M. Armas Pfirter, The Management of Seabed Living Resources in "The Area" under UNCLOS (Report presented at the Tenth Session of the ISA, 27 May 2004), at 26, as cited in Oude Elferink, THE INTERNATIONAL JOURNAL OF MARINE AND COASTAL LAW (2007), at 152.

[476] The implication of this argument would be that genetic resources, as living, sedentary species of the Area would fall under the regime of Part XI of UNCLOS and not under its Part VII.

[477] As discussed above, this resolution forms the basis for the rules relating to the common heritage of mankind-principle in UNCLOS. It is also referred in the preamble of the convention.

A number of delegations expressed that the seabed regime should cover both living and non-living resources, and that sedentary species should be included. The reason for the lack of explicit provisions on the matter does not appear to be disagreement with this position, but rather that no significant living seabed resources were considered to exist beyond the continental margin. This exclusion was thus approved, not based on a rejection of its material content, but because the existence of significant resources in the deep sea was then unknown. When hydrothermal vents and their ecosystem were discovered in 1977, the definition of "resources" in the Area regime had already been adopted.[478] Thereby, it is claimed, the common heritage of mankind principle, as well as Part XI generally, ought to be applied on *all* activities and resources in the Area, including marine bioprospecting on marine genetic resources.[479]

Indeed, the ambition of the negotiators of UNCLOS to create a comprehensive convention speaks against accepting the notion that living organisms would be regulated in a detailed manner in all other maritime zones but left in an anarchic state of *legal lacunae* in the Area. In light of the elaborate rules of marine organisms in all other sea areas, which include detailed rules on management and conservation[480], it would seem unreasonable to accept the notion of the living organisms of the deep seabed as left completely outside the scope of the convention.[481] It would be more in line with the intention of the negotiators to

[478] Armas-Pfirter, THE INTERNATIONAL JOURNAL OF MARINE AND COASTAL LAW (2009), at 303-304. As noted by Armas Pfirter, some countries also suggested an explicit inclusion of the living resources of the superjacent waters in the common heritage of mankind-principle. But as fisheries freedom might be affected, many delegations banned the inclusion of any living resources in the principle.

[479] Louise Angélique de La Fayette, *A New Regime for the Conservation and Sustainable Use of Marine Biodiversity and Genetic Resources Beyond the Limits of National Jurisdiction*, see id. at 268-170; MILLICAY. 2007, at 804-812; Oude Elferink, THE INTERNATIONAL JOURNAL OF MARINE AND COASTAL LAW (2007), at 147-154.

[480] As will be discussed in section C.1.5.

[481] Francioni supports the extensive interpretation based on practical implications by reasoning that the differences of bioprospecting compared to fishing precludes the application of the freedom of fishing to marine genetic resources of the high seas. Similarly, he considers bioprospecting as falling outside the marine scientific research regime since the latter prevents the legal claims involved in bioprospecting. Moreover, sovereign claims are precluded both in the high seas and the Area. The logical conclusion, of these three aspects, he argues, is to consider genetic resources the subject to the principle of common heritage of mankind. Francesco Francioni, *Genetic Resources, Biotechnology and Human Rights: The International Legal Framework*, *in* BIOTECHNOLOGIES AND INTERNATIONAL HUMAN RIGHTS (Francesco Francioni ed. 2007); Francesco Francioni, *International Law for Biotechnology: Basic*

provide a comprehensive framework for all uses of the oceans to consider UNCLOS as a dynamic treaty, which encompasses also activities and resources where the full potential was not fully considered at the time of drafting.[482] Under the approach of evolutionary interpretation, which has gained support in case law[483], it is claimed that where the parties have used generic terms in a treaty, the parties must be regarded as having been aware that the meaning of the terms was likely to evolve over time, and where the treaty has been entered into for a very long period, the parties must be presumed, as a general rule, to have intended those terms to have an evolving meaning.[484] Accordingly, it appears reasonable to claim that relevant terms have developed, by means of evolutionary interpretation, so as to clearly include bioprospecting within the regulation of the Area (to the extent this was not already included). It appears particularly fruitful to argue that the definition of resources of the Area ought to be considered as having developed by means of evolution to include genetic resources, since the value of bioresources has become evident subsequent to its formulation. Similarly, the common heritage of mankind principle was clearly drafted to encompass the economic values of the deep seabed. Since these values have turned out to be connected to genetic rather than mineral resources, it would from an evolutionary standpoint be unreasonable to exclude genetic resources from its scope.

Furthermore, the argument that the high seas regime should also be considered as encompassing genetic resources in the seabed would be difficult to reconcile with other parts of the convention. Foremost, such an interpretation would go against the logic of the UNCLOS maritime zone regime. The freedom of the seas is a high seas concept, which in certain regards explicitly applies *mutatis mutandis* in the exclusive economic zone. But extending the principle to the Area, where there is no mentioning of such freedoms would be unorthodox under the convention. The high seas and the Area are two distinct normative concepts and it appears difficult to accept the notion that a legal concept should be understood as implicitly transplanted from one maritime zone to another.

Principles, *in* BIOTECHNOLOGY AND INTERNATIONAL LAW (Tullio Scovazzi & Francesco Francioni eds., 2006), at 12.

[482] Evolutionary interpretation will be further discussed in Part E.5.1.

[483] Dispute regarding Navigational and Related Rights (Costa Rica v Nicaragua), Merits, ICJ Rep 2009, ICGJ 421 (International Court of Justice 13 July).

[484] EIRIK BJORGE, THE EVOLUTIONARY INTERPRETATION OF TREATIES (Oxford: Oxford University Press, Incorporated. 2014), at 2.

Detaching genetic resources from the regime of the Area would also go against the concept of sedentary species, which the negotiators of the convention made efforts to distinguish from other living resources, as will be further discussed in section C.1.5.[485] Moreover, seen in light of the rules of environmental protection, it would be difficult to accept an interpretation that the living resources of the Area would be disconnected from the activities related to the mineral resources in the same marine zone.[486] In further support of the extensive view, there are also more formal legal arguments for considering the mandate of the International Seabed Authority as extending to genetic resources.[487]

Another argument in favor of the extensive interpretation is based on the United Nations (UN) General Assembly (GA) Resolution 2749 of 1970.[488] In the preamble, the resolution declared, *inter alia*, that the area of the seabed and ocean floor and the subsoil thereof, beyond the limits of national jurisdiction, as well as its resources, are the common heritage of mankind.[489] Based on this language, it appears difficult to dispute that all resources of the Area are encompassed by the principle of common heritage of mankind. Effectively, the resolution can be regarded as a binding declaration under international law that genetic resources – like any other resource of the geographically defined Area – fall within the common heritage of mankind principle. As previously stated, the resolution is also cited in the preamble of the convention itself.

[485] As examined by Armas-Pfierter, it also follows from negotiation documents that as a consequence of extending coastal state sovereignty in the continental shelf to sedentary species, these organisms were also subtracted from the high seas-regime. Armas-Pfirter, THE INTERNATIONAL JOURNAL OF MARINE AND COASTAL LAW (2009), at 281.

[486] Francioni, Genetic Resources, Biotechnology and Human Rights: The International Legal Framework. 2007.

[487] As discussed under the International Seabed Authority, earlier in this section, the provisions on environmental protection and marine scientific research in the Area, as well as the explicit and implicit powers and functions of the International Seabed Authority allow it to take an active role in the protection of these resources. Indirectly, this also supports the perspective of bioresources as belonging to the Area.

[488] United Nations General Assembly resolution 2749 (XXV), Declaration of Principles Governing the Seabed and the Ocean Floor, and the Subsoil Thereof, beyond the Limits of National Jurisdiction, A/RES/25/2749 (12 December 1970). 1970.

[489] Marciniak, Konrad Jan, "Marine Genetic Resources: Do They Form Part of the Common Heritage of Mankind Principle?", in LAWRENCE MARTIN, et al., NATURAL RESOURCES AND THE LAW OF THE SEA: EXPLORATION, ALLOCATION, EXPLOITATION OF NATURAL RESOURCES IN AREAS UNDER NATIONAL JURISDICTION AND BEYOND (Juris. 2017).

In conclusion, the argument can be made – and indeed is regularly made – that the drafters of UNCLOS aimed to create a holistic regime for the Area including genetic resources in living organisms, where the ISA was bestowed the responsibility for management as well as other aspects of regulation, guided by the principles of non-appropriation and common heritage of mankind. The status of all resources as encompassed by this principle is further underlined by the reference in the convention to Resolution 2749 of 1970 and a contextual reading of relevant provisions in Part XI of UNCLOS. Furthermore, this extensive understanding is supported by an evolutionary interpretation of the convention, as well as preparatory works which clearly indicate that states did not intend the living resources of the seabed to be left outside the scope of UNCLOS.

State practice

In addition to academic discussion, the legal status of marine genetic resources in the Area has been debated in the BBNJ process of the UN General Assembly. In statements as well as written submissions, states have addressed the relationship between the common heritage of mankind principle and deep-sea genetic resources. When the subject for the discussions of the international regime was debated in the working group in 2006, some states took the position that the principle of common heritage of mankind ought to be interpreted as encompassing genetic resources.[490] Other states relied on the principle of the freedom of the high seas (Article 87), which in their understanding would imply a right of freedom of access to, and unrestricted exploitation of, deep seabed genetic resources.[491] These positions appear to have been relatively consistent since.

[490] "Several delegations reiterated their understanding that the marine genetic resources beyond areas of national jurisdiction constituted the common heritage of mankind and recalled article 140 of the Convention, which provides that the activities in the Area shall be carried out for the benefit of mankind and that particular consideration shall be given to the interests and needs of developing States, including the need for these resources to be used for the benefit of present generations and to be preserved for future generations.(…) A number of delegations also mentioned that the International Seabed Authority constituted an existing mechanism in this area and that consideration should accordingly be given to the possibility of broadening its mandate." United Nations General Assembly, Report of the Ad Hoc Open-ended Informal Working Group to study issues relating to the conservation and sustainable use of marine biological diversity beyond areas of national jurisdiction, UN Doc. A/61/65 (2006), para. 71.

[491] "Other delegations reiterated that any measures that may be taken in relation to genetic resources in areas beyond national jurisdiction must be consistent with international law,

Similarly divergent positions were expressed during the working group meetings of 2008 and 2010.

The statement of the co-chairs of the 2008 meeting succinctly formulates the division:

> *In that regard, divergent views were expressed on the relevant legal regime on marine genetic resources beyond areas of national jurisdiction, in particular whether those marine genetic resources were part of the common heritage of mankind and therefore fell under the regime of the Area, or were part of the regime for the high seas.*[492]

Although many states during the working group phase suggested that the implementation of existing agreements instead should be strengthened, the working group in the end suggested that a new treaty should be negotiated. The General Assembly endorsed this recommendation in 2015 and established a preparatory committee tasked with elaborating the elements of a draft treaty by addressing the 'package' of issues[493] which also had been the focus of discussions during the working group.[494] The preparatory committee phase has since turned into an intergovernmental conference, but the isolated positions have remained intact. Similar to the working group sessions, some delegations have supported common heritage of mankind-related concepts while others have favored the regime of living resources in the high seas as the starting point

including freedom of navigation. In their view, these resources were covered by the regime of freedom of the high seas, which provided the legal framework for all activities relating to them, in particular marine scientific research. These delegations did not agree that there was a need for a new regime to address the exploitation of marine genetic resources in areas beyond national jurisdiction or to expand the mandate of the International Seabed Authority." Id. at para. 72.

[492] Letter dated 15 May 2008 from the Co-Chairpersons of the Ad Hoc Open-ended Informal Working Group to study issues relating to the conservation and sustainable use of marine biological diversity beyond areas of national jurisdiction addressed to the President of the General Assembly, UN Doc. A/65/68 (2010), paras. 70-72.

[493] The utilization of genetic resources beyond areas of national jurisdiction and the sharing of benefits derived therefrom; marine protected areas and other area-based management tools; environmental impact assessment; capacity building and marine technology transfer.

[494] United Nations General Assembly resolution 69/292, Development of an international legally binding instrument under UNCLOS on the conservation and sustainable use of marine biological diversity of areas beyond national jurisdiction, A/RES/69/292 (9 June 2015) (2015).

for regulating genetic resources.[495] Draft texts do not indicate that states are getting any closer to an agreement on the issue.[496]

There are thus different positions on the matter, on both the political and the academic side, and it appears unlikely that a consensus in the interpretation will emerge in the foreseeable future.

Consequences for the status of genetic resources and bioprospecting

In determining the legal status of bioprospecting of seabed genetic resources under the law of the sea, interpretation of what resources fall within the scope of the common heritage of mankind principle is central. If genetic resources are considered as encompassed by the term resources within the meaning of Part XI of UNCLOS, the principle extends also to such resources. This would imply that private and sovereign appropriation of seabed genetic resources is precluded under the convention, which effectively would prevent seabed bioprospecting, possibly with the exception of cases in which a license has been granted by the International Seabed Authority.[497] It would also have important implications for bioprospecting associated with marine scientific research operations in the seabed, as will be further discussed in section C.1.5.

By contrast, if the restrictive interpretation were accepted, the consequence would be that the bioprospecting of seabed genetic resources should be considered a new activity under the convention, which falls beyond the scope of the common heritage of mankind-principle. As discussed above this could either imply that the convention lacks specific rules for this activity, and that it represents a *legal lacuna* under UNCLOS.

[495] Ornella Ferrajolo, The Common Heritage of Mankind in International Law: A Great Past but No Future?, MARITIME SAFETY AND SECURITY LAW JOURNAL (2018).

[496] See Revised draft text of an agreement under the United Nations Convention on the Law of the Sea on the conservation and sustainable use of marine biological diversity of areas beyond national jurisdiction, available at: https://www.un.org/bbnj/news/revised-draft-text-agreement-under-united-nations-convention-law-sea-conservation-and (site accessed November 13 2020).

[497] This could also imply that the comprehensive system for exploration and exploitation applied to mining in the Area also encompasses deep-sea bioprospecting. This includes a far-reaching and exclusive management regime for the ISA and the applicability of an extensive set of rules, provided in UNCLOS as well as the 1994 implementation agreement on the Area. Among other requirements, a granted license sponsored by a state would be required for any commercial actor, in line with Article 153.

The consequence would be that all states are able to access seabed genetic resources on a first come first served basis.

Alternatively, it would imply that bioprospecting falls within the scope of the high seas freedoms also when conducted in the seabed.[498] The implication of considering seabed bioprospecting as part of the high seas freedoms (by analogy or direct application of high seas rules) would be that all states are free to conduct such activities, although general obligations under the convention would apply, similar to what was described for the high seas under section C.1.4.

It should be underlined that even under the restrictive view, which considers deep-sea bioprospecting as compatible with UNCLOS, the exploitation could not be carried out in a completely unrestricted manner. The Area-regime contains general obligations, which arguably would remain applicable even if genetic resources would fall outside of the common heritage of mankind principle and be freely accessible on a first come first served basis.[499] Moreover, Article 145 provides a far-reaching responsibility for the ISA with regards to protection of the marine environment, which arguably remains applicable under the restrictive interpretation of *resources* and the scope of the common heritage of mankind-principle.[500] This broad environmental mandate indicates that the role of the ISA, in addition to its role as institution for managing mining in the deep sea, effectively extends to functioning as the

[498] This would be based on the presumption, as discussed under high seas, that the list of activities in Article 87 is not exhaustive by virtue of the term *inter alia* and that bioprospecting, as a new activity falls within the scope of high seas freedoms.

[499] These include *inter alia* the responsibility to ensure compliance and liability for damage (Article 139) and taking reasonable regard for other activities in the marine environment (Article 147).

[500] Article 145 provides that *"*Necessary measures shall be taken in accordance with this Convention with respect to activities in the Area to ensure effective protection for the marine environment from harmful effects which may arise from such activities. To this end the Authority shall adopt appropriate rules, regulations and procedures for *inter alia*: (a) the prevention, reduction and control of pollution and other hazards to the marine environment, including the coastline, and of interference with the ecological balance of the marine environment, particular attention being paid to the need for protection from harmful effects of such activities as drilling, dredging, excavation, disposal of waste, construction and operation or maintenance of installations, pipelines and other devices related to such activities; (b) the protection and conservation of the natural resources of the Area and the prevention of damage to the flora and fauna of the marine environment.

responsible body for deep-sea environmental protection.[501] Based on the formulation of Article 145, there is nothing indicating that the mandate of the ISA in this field is limited to marine mining or mineral resources.[502] It instead references *activities* in general.[503] Further support for an ISA mandate as regards environmental protection in relation to bioprospecting follows from the qualifying *inter alia* in the chapeau of Article 145.[504] Moreover, as regards the material scope of the mandate, paragraph (b) does not merely mention the marine environment in general. Rather, it makes reference to e.g. the natural resources of the Area and the flora and fauna of the marine environment.[505] Since it appears clear that genetic resources as living organisms fall within the scope of the flora and the fauna it can hardly be disputed that the environmental mandate of the ISA extends also to genetic resources and is relevant for deep-sea bioprospecting.[506] Yet, so far, the ISA has in principle confined its environmental program to the detrimental impact of mining.[507]

[501] Interestingly, no organization is mandated with a corresponding role for the High seas. There, adverse impact of human use was only remotely regulated by mechanisms such as flag state jurisdiction and port state control. WARNER. 2009, at 28.

[502] With regards to the mandate to protect the marine environment under Article 145, it appears difficult to ascertain to what extent these powers for the ISA are confined in geographic scope. In any event it appears clear that ISA can prescribe environmental rules on activities in the Area which are environmentally harmful, even if the harm affects other maritime areas. If nothing else this follows from the referencing of *the coastline* in Article 145.

[503] Moreover, under (a) it lists a number of potentially harmful activities. The list does not mention bioprospecting. Yet considering the extent of activities mentioned, it does not appear remote to consider that it would have been explicitly referenced if the activity had been considered during the drafting of the convention.

[504] Similar to the listing of freedom of the high seas, as discussed above, this indicates that the list is non-exhaustive and effectively includes new activities, such as bioprospecting.

[505] The term *natural resources* arguably imply a wider scope than *resources*, which is the usual term in other provisions in Part XI. By using this different, and broader term, it would even under the restrictive interpretation have to be admitted that the drafters desired a wide scope for this environmental mandate.

[506] As already has been mentioned, the secretary general of the Authority has asserted that the ISA has a broad "regulatory role with respect to the protection and preservation of the marine environment (including its biodiversity) in the Area generally." See International Seabed Authority, Report of the Secretary-General of the International Seabed Authority under Article 166. Pargraph 4 of the United Nations Convention of the Law of the Sea, 7 June, 2002, UN Doc. ISBA/8/A/5, 12. The consequence of this mandate for bioprospecting in the Area are difficult to foresee, and it depends on how willing the ISA will be to exercise it.

[507] But potentially, the Authority could set stringent environmental requirements for bioprospecting of marine genetic resources in the Area, whether in connection to or remote from mining areas. Based on the environmental mandate, requirements could be set up which

Moreover, the central role of the ISA in cooperation on marine scientific research in the Area is relevant to bioprospecting, and will be further discussed in section C.1.5.

In conclusion, the legal implications for deep-sea bioprospecting range widely, depending on the interpretation of *resources*, the scope of the common heritage of mankind principle and the more general applicability of the UNCLOS regime on the Area to genetic resources. Although there are strong arguments favoring a restrictive interpretation of the common heritage of mankind principle, foremost the declaration in Article 133 that *resources* mean mineral resources, it appears difficult to reject the arguments favoring an interpretation which includes bioprospecting for seabed genetic resources. Not only are there other, connecting provisions in Part XI indicating a wider scope of the regime of the Area which should be considered under contextual interpretation; the ambition of the drafters of the convention to encompass all uses of the sea would also be difficult to reconcile with regarding living resources as regulated in all other marine areas but left in a complete legal vacuum in the seabed. Likewise, it would be difficult to accept the notion of genetic resources as excluded, considering that preparatory works indicate no such intention among negotiating states and the references in the preamble of the convention, both to the implementation of the common heritage of mankind principle per se and to Resolution 2749 of 1970.

The application of the Area regime in general and the common heritage of mankind principle in particular represent a considerable challenge to deep seabed bioprospecting. By virtue of its commercial elements and central connection to appropriation of genetic resources by means of patenting, such activities would essentially be precluded under the law of the sea, save for cases where the International Seabed Authority, by virtue its central role in relation to different uses of the Area, would grant license.

effectively would give the ISA a central role in considering possible bioprospecting projects. This would for instance be the case if the ISA set mandatory licensing procedures connected to requirements for environmental impact assessments for bioprospecting in the Area. Such requirements have already been set in relation to deep-sea mining, and there appears to be nothing in Article 145 preventing the ISA from requiring similar measures for other activities. Laura E. Lallier & Frank Maes, *Environmental impact assessment procedure for deep seabed mining in the area: Independent expert review and public participation*, 70 Marine Policy (2016).

C.1.5. The rules on marine scientific research and living resources

The maritime zone regime of UNCLOS and its implications for bioprospecting has now been examined. Its differentiated balance between the rights of coastal and other states as well as commons concepts raise fundamentally different requirements and challenges depending on where genetic resources are retrieved. In addition to the maritime zone regime, there are general horizontal concepts in the convention of direct relevance to bioprospecting, which hitherto have been left out: The regulation of living resources and scientific research. Bioprospecting involves elements that are related to both concepts. The convention provides differentiated rules for scientific research and living resources across maritime zones, but there are also distinct elements which apply in all areas. The rules for these concepts will now be examined in order to assess their relevance for bioprospecting. The examination will cover both the general rules for these concepts, and the specific rules applying in different maritime zones.

As discussed in Part B, the line between sampling conducted for bioprospecting and scientific purposes has become blurred. Increasingly, samples collected for scientific purposes subsequently serve as the basis for biotechnology development. Moreover, it would be impossible to distinguish these forms of sampling based on technological differences. Rather, marine bioprospecting can be characterized by the purpose or objective of the operation. In this part, the nature of the regulation of marine scientific research in UNCLOS will be explored. It will be discussed to what extent these rules apply to bioprospecting. A central question in this regard is whether the commercial elements of bioprospecting render the rules inapplicable or if bioprospecting nevertheless ought to be regarded as scientific research as defined in the convention. The consequences will be evaluated, to the extent that bioprospecting falls within the scope of this concept.

Secondly, UNCLOS provides a set of rules for marine living resources, relating to management and conservation, as well as the rights of states to harvest such resources across different zones. As will be discussed, these rules were drafted based on the limited perspective of conventional fisheries.

As a result, the UNCLOS rules for living resources establishes formulas for management which are difficult to adapt to other uses of marine organisms, such as bioprospecting. Yet it appears that the drafters aimed for a wider scope, encompassing all uses of marine organisms. Like the discussion on marine scientific research, the implications of the rules on marine living resources for marine bioprospecting will be examined.

C.1.5.1. Bioprospecting and scientific research

As discussed in Part B, by virtue of its nature, marine bioprospecting has similarities with both conventional resource extraction, such as fisheries or mining, and scientific research. In both contexts, physical compounds are regularly extracted. But at least the technical way in which bioprospecting is carried out, with elements of sequencing and laboratory processes, arguably shares more in common with marine biological exploration than fisheries or mining. Both marine bioprospecting and scientific research relate to the exploration of the seas. Compared to conventional *pure* marine scientific research, however, there is a considerable difference in that bioprospecting involves a commercial element, most commonly manifested as a desire to patent, develop products, and make profits on innovations based on findings. This commercial motivation is more reminiscent of other types of resource extraction. There is a reason why bioprospecting is often referred to as genetic mining.[508] It is not only in a legal context that there are similarities between bioprospecting and marine mining. Importantly, some of the hotspots for marine genetic resources, notably the hydrothermal vents, also overlap with mining interests. But marine bioprospecting also differs in important regards from conventional marine resource extraction. Perhaps the most significant difference is that bioprospecting rarely involves an interest in collecting large quantities of marine genetic resources in bulk. Small samples are regularly collected, and then sequenced. In this regard, there are apparent areas of commonality with marine scientific research.

The *technological aspects* of bioprospecting – how it is carried out – thus recall marine scientific research more so than other activities referred to in UNCLOS. Yet, bioprospecting also diverges from traditional marine scientific research in some key respects. One apparent difference is that bioprospecting is

[508] See for instance Kristie Tanner, et al., *Bioprospecting challenges in unusual environments*, 10 Microbial Biotechnology (2017).

undertaken in order to attain economic gain. This is rarely the primary goal in marine scientific research.[509] As regards *purpose*, bioprospecting has more in common with mining or fishing.

The right to conduct marine scientific research under UNCLOS

Early on in the negotiations of UNCLOS, a strong separation was established between different forms of resource extraction on the one hand, and marine scientific research on the other.[510] As discussed in sections C.1.3 and C.1.4, resource extraction, whether relating to living or other resources, is generally regarded as a sovereign or exclusive right of the coastal state in the maritime zones where it exercises jurisdiction. Beyond national jurisdiction, extraction of such resources is either part of the high seas freedoms or highly regulated by the common heritage of mankind principle, depending on interpretation and whether it is retrieved in the deep seabed or the water column.

There are two challenges in examining how the rules on marine scientific research in UNCLOS relate to bioprospecting. Firstly, it is obvious that a major reason for the difficulties in positioning bioprospecting in relation to marine scientific research under the convention is that marine bioprospecting is a research and development *process* in which the actual extraction element is a limited part of the operation. The UNCLOS regime on marine scientific research, on the other hand, focuses on activities conducted *in situ* and does not encompass the full research and development chain.[511] The provisions on

[509] See, for a discussion on the difference between marine bioprospecting and marine scientific research Glowka, Ocean Yearbook Online (1996); Jørem & Tvedt, The International Journal of Marine and Coastal Law (2014).

[510] Whereas most issues relating to resource extraction and the jurisdictional issues involved were discussed in the Second Committee, marine scientific research was together with the marine environment negotiated in the Third Committee. This explains why both marine scientific research and the protection of the marine environment resulted in dedicated parts in UNCLOS, rather than just being integrated in the respective chapters of the maritime zone regime. See Myron H. Nordquist, et al., United Nations Convention on the Law of the Sea, 1982: A Commentary Vol. IV [Third Committee: Protection and Preservation of the Marine Environment, Marine Scientific Research, and Development and Transfer of Marine Technology] § IV (Dordrecht : Nijhoff. 1990).

[511] Guilloux. 2018, at xxx.

marine scientific research are thus predominantly aiming at a distribution of jurisdictional powers.[512]

A second problem in investigating how the rules on marine scientific research apply to bioprospecting is that UNCLOS lacks a general definition of marine scientific research in spite of numerous rules on how and under what conditions such activities may be conducted.[513] Instead of establishing a clear scope of the concept, negotiating states focused on jurisdictional aspects, where widespread agreement could be reached.[514] Strangely, the convention essentially provides a detailed framework for marine scientific research, without clarifying what it is.[515] It is thus uncertain what activities are encompassed by marine scientific research, and in particular if bioprospecting is covered by the concept.[516]

Even if marine scientific research is not defined in UNCLOS, the convention does provide indications for the nature of such activities. According to some observers, the purpose of marine scientific research may be inferred from its Article 246. This provision, which applies to the exclusive economic zone and the continental shelf, distinguishes between two types of marine scientific research projects: Those carried out "*to increase scientific knowledge of the marine environment for the benefit of all mankind*" (Article 246(3)) and those "*of direct significance for the exploration and exploitation of natural resources, whether living or non-living*" (Article 246(5)(a)).

[512] Based on this reasoning, it could be claimed that the convention is simply not concerned with what marine scientific research findings are used to, once the findings are remote from the physical marine environment. See Article 239, Wolfrum & Matz, MAX PLANCK YEARBOOK OF UNITED NATIONS LAW (2000), at 458.

[513] Indeed, the negotiation documents indicate that the drafters of the convention were intentionally vague as regards the material extent of marine scientific research, as the result of lack of agreement on the matter. SOONS. 1982.

[514] NORDQUIST, et al. 1990. As pointed out by *Wolfrum*, "*the provisions of the Convention on the Law of the Sea on marine scientific research are predominantly aiming at a distribution of jurisdictional powers rather than at the protection of the research object and at the distribution of benefits resulting from such research.*", WOLFRUM & MATZ, Conflicts in International Environmental Law. 2003, at 28.

[515] Still, different observers have attempted to define the concept more precisely. *Tanaka* thus claims that marine scientific research "*covers any scientific investigation, however and wherever performed, which concerns the marine environment as well as its organisms*" but that it should "*be distinguished from the exploration of marine natural resources, because the latter is governed by a legal framework different from that regulating marine scientific research.*" TANAKA. 2012, at 336.

[516] PROELSS, United Nations Convention on the Law of the Sea: A Commentary. 2017, at 994.

Firstly, as observed by Wolfrum and Matz, this provision indicates that it was not just basic fundamental research that was considered during drafting.[517] Although this provision only applies to the exclusive economic zone, it dismisses the notion of applied scientific research as falling entirely outside the scope of the convention.

Whatever the concept includes, all states may conduct marine scientific research.[518] Although the convention imposes conditions and possibilities for states to hinder such projects within their jurisdiction, the convention generally encourages marine scientific research.[519]

Non-recognition of marine scientific research activities as the legal basis for claims

Among the rights and duties established in Part XIII of UNCLOS, which provide the rules for marine scientific research, Article 241 in particular appears to raise potential challenges to bioprospecting, by declaring that "*Marine scientific research activities shall not constitute the legal basis for any claim to any part of the marine environment or its resources.*" In this way, the provision is similar to and complements the principle of non-appropriation of the high seas in Article 89 and the Area in Article 137, as discussed above.

In cases where bioprospecting is based on samples retrieved during scientific research operations, as was increasingly found to be the case under Part B, it would have far-reaching consequences if Article 241 were considered to prevent private claims for exclusive rights by means of patents. As discussed in Part B, patenting and other claims for private rights to genetic resources form an integral part of most bioprospecting projects.

[517] Wolfrum & Matz, MAX PLANCK YEARBOOK OF UNITED NATIONS LAW (2000), p. 470.

[518] In Article 238, the opening provision of the UNCLOS part XIII on marine scientific research, it is declared that all States, irrespective of their geographical location, and competent international organizations have the right to conduct marine scientific research subject to the rights and duties of other States as provided for in this Convention.

[519] According to article 239, "States and competent international organizations shall promote and facilitate the development and conduct of marine scientific research in accordance with this Convention." Similarly, UNCLOS encourages cooperation for promoting such activities, as well as the publication and sharing of results (Articles 242-244).

Negotiation documents indicate that rather than aiming to provide rules for intellectual property rights claims, the states involved in drafting the provision primarily considered more extensive claims for sovereign rights to physical resources in the marine environment found during research operations. In fact, no concrete proposals to include a reference to prohibiting intellectual property rights into Article 241 were raised during the negotiation.[520] Even if preparatory work indicates that the legal rationale of the provision was to prevent sovereign claims based on marine scientific research, some observers support a more extensive interpretation, claiming that the principle also encompasses intellectual property rights claims. Indeed, the subject remains debated.[521]

If the prohibition applies to intellectual property rights, "patents and other means of protection of the commercial value of applying human intellect to findings from marine scientific research would effectively be void," as observed by Mossop.[522] Gorina-Ysern holds that Article 241 also prohibits the exclusive exploitation of data and samples which are related not to marine resources but to the marine environment, regardless of whether this data is used for commercial purposes.[523] However, as noted by Matz-Lück, who appears to favor a more restrictive interpretation of the scope of Article 241, to make such claims effectively amounts to filling a gap in the convention by widening the scope of a provision beyond what is allowed for under established treaty law, since "neither the wording nor the drafting history give indications as to conclude that any subsequent result of research or development which is based upon data or samples must be included in the scope of Article 241 and hence prevents any intellectual property rights."[524]

[520] Montserrat Gorina-Ysern, *Marine Scientific Research Activities as the Legal Basis for Intellectual Property Claims?*, 22 MARINE POLICY (1998), at 343. As established by *Matz-Lück*, the purpose of Article 241 is rather to make explicit that marine scientific research activities, irrespective of where they are carried out, "*cannot form the basis for legal titles of occupation of territory, nor for the delineation of maritime boundaries, nor for legally relevant claims to the exploitation of living or non-living resources*". See PROELSS, United Nations Convention on the Law of the Sea: A Commentary. 2017, at 1625.

[521] See in particular Gorina-Ysern, MARINE POLICY (1998);PROELSS, United Nations Convention on the Law of the Sea: A Commentary. 2017.

[522] Mossop. 2015.

[523] This would mean that the provision prevents any kind of proprietary title or rights to exclusive use of results of marine scientific research. Gorina-Ysern, MARINE POLICY (1998), at 345.

[524] PROELSS, United Nations Convention on the Law of the Sea: A Commentary. 2017, at 1629.

Although there is considerable support for this restrictive interpretation, which would consider patent claims as falling beyond the scope of the provision, it has considerable weaknesses according to its opponents. Firstly, it appears to ignore that UNCLOS establishes a clear-cut separation between marine scientific research and resource extraction. Under the extensive interpretation of the scope of Article 241, this dichotomy is safeguarded by making clear that activities aiming to collect resources to make legal claims fall outside the scope of marine scientific research.[525]

Francioni appears to consider that the convention provides little guidance on the material content of marine scientific research. Rather, the rules on marine scientific research relate to an activity, in the sense that they establish rights and obligations applicable to the *conduct* of marine scientific research activities.[526] Indeed, based on negotiation documents, there appears to be considerable support for understanding the rules as primarily relating to how this activity is to be carried out. In the context of bioprospecting, Article 241 should thus be interpreted as underlining this emphasis; that the rules relate to the conduct and do not establish a legal status of genetic resources in the high seas and the Area.[527] Article 241 simply ensures that marine scientific research cannot be conducted so as to make sovereign claims.

A more extensive interpretation of Article 241 would also be problematic since it would go against the generally accepted view that the legal ownership of physical samples belongs to the researching state. Under the conventional understanding of the provision, claims for exclusive intellectual property rights over the exploitation of samples, data, and results would be compatible with the regulation in Article 241.[528] Formal legal titles to samples collected during marine scientific research operations are thus not excluded, at least not in state practice. Importantly, however, they cannot be used to exclude other states from accessing the findings, according to Articles 242 and 244.[529]

[525] SOONS. 1982.

[526] Francioni, International Law for Biotechnology: Basic Principles. 2006, at 12.

[527] SOONS. 1982.

[528] Ibid; CHURCHILL & LOWE. 1999, at 411.

[529] This is because UNCLOS establishes a clear principle of transparency in relation to research findings. As discussed above, Article 242 establishes that states are under obligation to "*promote international cooperation in marine scientific research for peaceful purposes*." Similarly, according to Article 244 states should make available knowledge from marine scientific research. These provisions clearly indicate that excluding access to results from marine scientific

The use of the terms *knowledge* and *results* in these provisions make clear that the understanding of the marine scientific research regime under UNCLOS as only encompassing fundamental basic research is wrong. At least the principle of transparency clearly has a wider scope, encompassing applied research too.

However, obliging states to be transparent about research findings is not the same thing as preventing exclusive rights to applications of marine scientific research findings, such as exclusive intellectual property rights. As discussed in Part B, the research forming the basis for biotechnological innovations is commonly freely accessible; practical cases of marine bioprospecting operations are often the result of cooperation between academic and commercial sectors, based on freely accessible data. Indeed, in many cases, samples collected for genuine scientific research purposes become stored in collections and libraries, and are subsequently used as the basis for biotechnological development. As such, the principle of transparency in research does not stand in conflict with, but often effectively functions as the basis for bioprospecting. Moreover, patenting does not imply secrecy. To the contrary, publication of patent data aims to promote transparency in relation to the invention.

Thereby, requirements for transparency in the convention can hardly be used as evidence for claiming that intellectual property rights claims are generally incompatible with the law of the sea. Nor would the understanding that collecting states have the right to claim legal titles to samples be incompatible. In line with the principle of transparency, such ownership is accepted, provided that free access is granted.

Taken together, it appears difficult to accept the notion that making claims for intellectual property rights based on marine scientific research is precluded by the rule on non-recognition of marine scientific research activities as the legal basis for claims. Rather, this provision and other general rules on marine scientific research are focused on the conduct of such activities, and the promotion of transparency regarding research results, which increasingly forms the basis for marine bioprospecting.

research would go against the convention. Within national jurisdiction, states do however have the possibility to maintain exclusive rights to scientific research of marine resources and the possibility to exclude the access to such resources to researchers from other states. Authorization by the coastal states is required in the territorial sea as well as in the exclusive economic zone and the continental shelf (See articles 245 and 246).

Marine scientific research across maritime zones

The remainder of Part XIII provides the rights and duties for the exercise of scientific research. Similar to the rules on other activities in the convention, a considerable part of the rules concerns the relation between exclusive rights of coastal and other states.[530] UNCLOS thus provides that the coastal state has the exclusive right to regulate, authorize, and conduct marine scientific research in their territorial sea.[531]

In the exclusive economic zone and the continental shelf, on the other hand, coastal state rights are more balanced with the interests of other states. Compared to marine living resources, which clearly are part of the exclusive right of coastal states within these zones (as will be discussed below), foreign states should in normal circumstances be granted consent for scientific research activities in the EEZ and the continental shelf.[532] However, a number of grounds for withholding coastal state consent are provided.[533] These include *inter alia* projects involving exploration and exploitation of natural resources, drilling, and other activities with high environmental impacts. Wolfrum and Matz see the objective of this provision as to ensure that the regime on marine scientific research is compatible with the rules on the use of resources in the EEZ and the continental shelf.[534] It indicates that the negotiators of the convention intended to preclude the use of marine scientific research as a backdoor to resource extraction.[535]

[530] Section 3, Articles 245-257.

[531] According to Article 245, "Marine scientific research therein shall be conducted only with the express consent of and under the conditions set forth by the coastal State." As will be discussed in the next section, this rule is similar to the regime on marine living resources, which also is part of the coastal state sovereignty over its territorial sea.

[532] According to Article 246, the coastal state has "*the right to regulate, authorize and conduct marine scientific research*" also in these zones. Furthermore, A distinction is made in Article 246 between on the one hand projects "*to increase scientific knowledge of the marine environment for the benefit of all mankind*", where the coastal state in normal circumstances shall grant consent (Article 246(3)). For those "*of direct significance for the exploration and exploitation of natural resources, whether living or non-living*" (Article 246(5)(a), on the other hand, states may withhold consent (under certain conditions).

[533] Subparagraph 5 a-d in Article 246.

[534] Wolfrum & Matz, MAX PLANCK YEARBOOK OF UNITED NATIONS LAW (2000), at 457-458; Gadtan Verhoosel, *Prospecting for Marine and Coastal Biodiversity: International Law in Deep Water?*, 13 THE INTERNATIONAL JOURNAL OF MARINE AND COASTAL LAW (1998), at 100.

[535] Farrier & Tucker, OCEAN DEVELOPMENT AND INTERNATIONAL LAW (2001); Scovazzi, Bioprospecting on the Deep Seabed: a Legal Gap Requiring to be Filled. 2006.

It has been argued by Tanaka as well as Churchill and Lowe that this provision indicates a dichotomy in the convention between *fundamental scientific research* (where consent should be granted) and *applied scientific research* (where consent may be withheld).[536] Other observers have claimed that if exploration activities aiming to commercially exploit resources, such as bioprospecting, fall within the rules on marine scientific research, they represent the latter type of scientific research and are more dependent on the consent of coastal states than pure scientific research.[537] In any event, it is clear that the exploration and exploitation of natural resources, which are necessary elements in bioprospecting, provide a legal basis for coastal states to withhold consent and thereby prevent scientific research operations of foreign states with bioprospecting purposes in the EEZ and continental shelf.[538]

The rules for marine scientific research in the high seas are considerably less complex. There, the right of all states to conduct marine scientific research is unconditional.[539] This provision reiterates the status of marine scientific research as part of the freedoms of the high seas.[540]

The liberally regulated regime for marine scientific research in the high seas stands in stark contrast to the corresponding rules for the deep seabed and underlying sediments.

[536] States would have far-reaching possibilities for carrying out the former type of operations in the EEZ and continental shelf of other states. Operations of the latter type, on the other hand, may only be conducted with the consent of the coastal state in the EEZ and continental shelf of other states. See TANAKA. 2012, at 337; CHURCHILL & LOWE. 1999, at 405.

[537] Tullio Scovazzi, *Is the UN Convention on the Law of the Sea the Legal Framework for All Activities in the Sea? The Case of Bioprospecting*, *in* LAW, TECHNOLOGY AND SCIENCE FOR OCEANS IN GLOBALISATION : IUU FISHING, OIL POLLUTION, BIOPROSPECTING, OUTER CONTINENTAL SHELF (Davor Vidas ed. 2010), at 312.

[538] After all bioprospecting operations necessarily involves elements of exploration and exploitation of natural resources. However, even if these exceptions provide the coastal state some discretion, it does not alter the default rule that permission should be granted to scientific research of other states. Rules are also set up for cooperation, communication and conditions between the coastal and other states in such projects. For the exclusive economic zone and the continental shelf, a rather delicate balance between the rights of coastal and other states is thus provided. It should also be underlined that it is not because of the commercial nature of bioprospecting coastal state consent is necessary.

[539] Article 257.

[540] As declared in Article 87.

All states have the right to conduct marine scientific research also in the Area.[541] However, this liberty is conditioned on a requirement for it to be carried out exclusively for peaceful purposes and for the benefit of mankind as a whole, in accordance with the special regime on the Area provided in Part XI. Scientific research is thus encompassed by the principle of common heritage of mankind, similar to the general rules on the use of deep-seabed resources, as discussed above. Moreover, since mankind includes all living humans as well as future generations, the provision entails an obligation to consider long-term implications and different aspects of sustainable development when conducting marine scientific research in the Area, as noted by Vöneky and Beck.[542] Moreover, Article 143(2) provides that the International Seabed Authority has the central role not only in the management of resources of the Area, but also as regards coordination and promotion of scientific research.

In discussions on whether the marine scientific research reference to the common heritage of mankind principle extends to bioprospecting, observers appear to be divided along the same lines as for the application of the same principle to resource extraction, even if an overlap in the meaning of the terms between the two contexts cannot be taken for granted. Some observers have thus claimed that marine bioprospecting, by definition, falls outside the scope of marine scientific research.[543] There is, however, a clear indication that basic fundamental research was not the only consideration during the drafting process.[544] Indeed, preparatory works indicate that the negotiators also

[541] As provided by Article 143 and 256.

[542] As discussed in PROELSS, United Nations Convention on the Law of the Sea: A Commentary. 2017, at 997.

[543] Foremost, the position that all activities involving elements of bioprospecting falls beyond the scope of the rules on marine scientific research has been based on the argument that bioprospecting involves legal claims. Based on this, it has been argued, marine bioprospecting is an activity that is distinctly different from marine scientific research. Consequently, it would be without specific regulation under the existing framework. See Arianna Broggiato, *Marine Genetic Resources beyond National Jurisdiction - Coordination and Harmonisation of Governance Regimes*, 41 ENVIRONMENTAL POLICY AND LAW (2011); Glowka, OCEAN YEARBOOK ONLINE (1996); Jørem & Tvedt, THE INTERNATIONAL JOURNAL OF MARINE AND COASTAL LAW (2014).

[544] As discussed in the context of the EEZ and the continental shelf above, see Wolfrum & Matz, MAX PLANCK YEARBOOK OF UNITED NATIONS LAW (2000), at 470.

intended to include applied research within its scope. As a type of applied research, bioprospecting should be considered as included.[545]

It appears difficult to dispute that this rules out scientific research for commercial or other private purposes in the Area. As noted by Vöneky and Beck, "*as long as the primary aim of bioprospecting is not a serious and systematic attempt to achieve knowledge and as long as there is not the primary aim to disseminate this knowledge to a scientific community, bioprospecting does not constitute marine scientific research that can be carried out for the benefit of mankind as a whole, as required by Article 143(1).*"[546] Yet, as similarly noted by Vöneky and Beck, this does not mean that "*any intent of economic gain*" or "*any time there are prospects of profit*" automatically changes the "*nature of the marine scientific research activity*" under the regime of the convention, as has been suggested by Scovazzi.[547] Rather,

> *the decisive factor for deciding whether an activity is marine scientific research or not is the main or primary purpose of the activity: that is, whether it is to increase human knowledge or to achieve financial gain. If the main intent is to increase human knowledge, the discovery of commercially valuable information does not change the character of the activity: that is, whether it is to increase human knowledge, the discovery of commercially valuable information does not change the character of the activity.*[548]

In line with this reasoning, it appears that Article 143 precludes research operations with commercial intent, such as bioprospecting, in the Area.[549] But this does not imply that the convention categorically prevents bioprospecting on the basis of findings from scientific research operations, as was considered increasingly common in Part B. Indeed, it may appear more difficult to consider cases where information or material from samples collected in operations without such commercial ambitions have been collected in biobanks and databases and subsequently used in bioprospecting.

[545] Scovazzi, Is the UN Convention on the Law of the Sea the Legal Framework for All Activities in the Sea? The Case of Bioprospecting. 2010, at 312.
[546] Proelss, United Nations Convention on the Law of the Sea: A Commentary. 2017, at 994.
[547] Scovazzi, The International Journal of Marine and Coastal Law (2004), at 402.
[548] Proelss, United Nations Convention on the Law of the Sea: A Commentary. 2017, at 994.
[549] See, for instance, Millicay 2006, Millicay. 2007.

As established in section B.6, it is increasingly common that material or information in such collections form the basis for bioprospecting. Oude Elferink considers that the limitation of scientific research operations in the Area to projects conducted for the common heritage of mankind does not necessarily rule out the subsequent use in bioprospecting of discoveries made in a scientific context.[550]

In line with this reasoning, it appears to assume that Article 143 does not rule out the subsequent use of findings in bioprospecting (or other commercial projects) as long as the scientific operation has been carried out on the basis of scientific (and not commercial) motives. Regarded conversely, however, it follows logically that if it is an ambition of the research operation to promote commercial development, it could be considered as precluded in the Area. This is problematic for many of the contemporary research and development initiatives discussed in section B.6. Indeed, many of the large-scale efforts to build biobanks and library collections of genetic resources material and information are intrinsically connected to the promotion of blue biotechnology and bioprospecting. Under the law of the sea, sampling operations with such purposes would be precluded in the deep seabed.

For the Area, it is thus clear that states have a right to carry out marine scientific research, but only so long as it is compatible with the principle of common heritage of mankind and respects the coordinating role of the ISA. Similar to what was established in the context of the extraction of resources, the common heritage of mankind principle thus prevents operations with commercial objectives. This seemingly precludes scientific research operations in the Area aiming to form the basis for bioprospecting, since the development of patents or other claims to resources would qualify as private ends.

In conclusion, by entailing a broad understanding of research, including different types of applied research, the rules on marine scientific research under UNCLOS may appear beneficial to bioprospecting. The convention generally promotes and calls upon states to encourage scientific research. Even within the exclusive economic zone and continental shelf of other states, under normal circumstances it should be permitted to conduct such operations according to the convention.

[550] States appears to have different positions on the implications of Article 143 in this regard. Oude Elferink, The International Journal of Marine and Coastal Law (2007), at 158.

However, even if bioprospecting would not formally fall beyond the rules on marine scientific research, different operative provisions limit the possibility of conducting bioprospecting sampling under a scientific research pretext. The element of exploitation of natural resources, which is an intrinsic element of bioprospecting, permits coastal states to withhold consent to such operations in the EEZ and continental shelf.

Similarly, beyond national jurisdiction, the consequences of falling within the marine scientific research regime appear less conducive to bioprospecting when examined closer. In the high seas, this would imply that bioprospecting falls within the far-reaching freedom to conduct marine scientific research. However, as indicated under C.1.4, if the bioprospecting is not considered scientific research, the alternative is no different: Freedom of the high seas is the default rule for activities not mentioned and the implicit freedom to conduct bioprospecting would be no less extensive than that of scientific research.

In the Area, all states formally have the possibility to conduct scientific research. However, this right is conditioned on the principle of common heritage of mankind, which effectively prevents operations aiming to conduct bioprospecting, by virtue of the commercial element involved. Importantly, however, it does not appear that the subsequent use in bioprospecting of findings from scientific missions in the deep seabed without commercial motives is precluded by the same principle. Thus, it does not appear that the rules on marine scientific research exclude the development of commercial products based on findings from research cruises *per se*.

The interlinkages between scientific exploration and commercial ventures, which appear increasingly common in bioprospecting development, as discussed in section B.6.3, do not appear to be precluded by the convention. Rather, there is nothing preventing samples collected during a research endeavor aimed at enhancing human knowledge to be used as the basis for biotechnological product development. Deep-seabed research operations with a commercial intent, as is the case in many contemporary research initiatives aiming to promote commercial biotechnology, on the other hand, appear to be incompatible with the law of the sea.

From the perspective of actors involved in biotechnological development based on marine organisms, it can thus be concluded that the law of the sea prevents bioprospecting of genetic resources in the Area, not merely under the rules on resource extraction, but also based on the rules on scientific research operation with commercial purposes. In the high seas, bioprospecting operations would be permitted under the freedoms of scientific research. Within the EEZ or territorial sea of coastal states, consent would be required.

C.1.5.2. Bioprospecting and marine living resources

How to approach the concept of marine organisms and human exploitation of such organisms is central in the law of the sea. Bioprospecting of marine genetic resources represents one form of such exploitation. However, in many respects, such as how it is carried out as well as what organisms are targeted, it differs from more conventional exploitation of marine living resources. This is particularly apparent in relation to fisheries, the most important form of exploitation of marine organisms. Compared to fisheries, the purpose of bioprospecting is distinctively different. Whereas marine bioprospecting searches for genetic resources contained in marine organisms for their biotechnological value, organisms are exploited for nutritional purposes in fisheries.[551]

Not only do the two activities differ in purpose, but they also represent different forms of appropriation. A catch of a fish bestows the fisherman with the legal title to the fish. Yet, it does not, as pointed out by Francioni, "*entail appropriation of the wealth of genetic information the catch may yield; any more than the purchase of a house designed by an architect entails the appropriation by the buyer of the talent and know-how that the architect bestowed in it*."[552]

As the result of technological development, often only limited samples of organisms are required to retrieve the genetic information relevant in bioprospecting.[553]

---

[551] Scovazzi, Is the UN Convention on the Law of the Sea the Legal Framework for All Activities in the Sea? The Case of Bioprospecting. 2010, at 312.
[552] Francioni, International Law for Biotechnology: Basic Principles. 2006.
[553] Scovazzi, Bioprospecting on the Deep Seabed: a Legal Gap Requiring to be Filled. 2006, at 83.

As discussed by Scovazzi, "*for this kind of almost non-consumptive activity there is normally no need to harvest large quantities of living resources.*"[554]

Accordingly, the qualitative aspects of genetic resources are determinative in bioprospecting whereas quantity remains largely irrelevant.[555] As discussed in Part B, most of the energy and costs entailed in bioprospecting relate to the added value work on genetic material, which is commonly carried out in a laboratory setting. In fisheries, on the other hand, the quantity of stocks and species is central for the commercial viability. Moreover, the relevant species for biotechnological exploitation, where novel bioactive properties are the central elements, is commonly (if not always) different compared to fisheries. Whereas bioprospecting may be conducted in relation to any part of the ecosystem, encompassing all marine phyla, fisheries are only conducted in relation to a limited number of fish and shellfish species used as food commodities, either directly or indirectly.

In approaching the concept of bioprospecting under the law of the sea, these differences from fisheries raise a number of challenges, foremost because the convention has one set of rules, arguably encompassing all exploitation of marine organisms, irrespective of purpose, referred to as *marine living resources*. This is clearly one of the central concepts in UNCLOS. Yet the term *marine living resources* is, like *marine scientific research*, undefined in the convention. Different approaches have been taken in suggesting definitions of the concept.[556]

[554] Scovazzi, Is the UN Convention on the Law of the Sea the Legal Framework for All Activities in the Sea? The Case of Bioprospecting. 2010, at 312.

[555] Typically, the active substances used in bioprospecting constitute a miniscule part of the organism. In such cases, a single specimen or sample is often sufficient, for enabling the scaling up in laboratories. In some cases, however, as discussed in under raw extracts in section B.6.1, genetic resource material cannot be reproduced artificially but must be collected in bulk. Such species include sponges, which are difficult to cultivate or conserve. To obtain 300 mg of pure halichondrin B, one ton of sponges of the species Halichondria okadai is needed. See Report of the workshop on bioprospecting in the high seas. (2005).

[556] Similar to marine living resources, the for bioprospecting central term marine scientific research, discussed in section C.1.5 is similarly not defined in UNCLOS. In fact, not even an explicit definition of 'fish' is provided by UNCLOS. A definition is however included in Article 1(1)(c) of the UNFSA).

A broad definition suggested by Sands refers to "*bony fish, sharks and rays, cephalopods, crustaceans, and other invertebrates, such as corals*" as well as "*birds, turtles, and marine mammals*."[557] A narrower notion emphasizes the denomination as "resources," stressing economic exploitation and monetary value. This perspective excludes many birds and other species which depend upon marine ecosystems, but are not of commercial interest (e.g. polar bears).[558]

The establishment of one set of rules which, at least according to conventional understanding of *marine living resources*, encompasses all marine organisms is in line with the ambition of the convention to include all uses of the sea within its scope. However, the objective to establish a general regime for the management of marine organisms was not paralleled with the introduction of generic rules. Paradoxically, despite the wide scope of the rules for marine living resources, the management provided by the regime was exclusively based on considerations relating to fisheries. This is evident when studying negotiation documents, which are essentially focused on the extent of exclusive coastal rights to fisheries.[559] It is therefore hardly surprising that the rules on marine living resources do not appear to be well adapted to bioprospecting and other interests relating to genetic quality rather than quantity.

Moreover, the regime on marine living resources is not merely based on a narrow form of use: namely fisheries. It reflects the understanding of how fish stocks ought to be efficiently managed at the time of the drafting of UNCLOS.[560]

[557] PHILIPPE SANDS, PRINCIPLES OF INTERNATIONAL ENVIRONMENTAL LAW (Cambridge University Press 4 ed. 2018) Another broad definition is provided by 1980 Convention on the Conservation of Antarctic Marine Living Resources, Art 1(2).

[558] Nele Matz-Lück & Johannes Fuchs, *Marine Living Resources*, *in* THE OXFORD HANDBOOK OF THE LAW OF THE SEA (Donald Rothwell, et al. eds., 2015), at 493.

[559] As is evident when studying the preparatory works as well as convention commentaries, such as NORDQUIST, et al. 1995.

[560] Article 2 of the Convention on the High Seas, adopted in Geneva, 29 April 1958, 450 U.N.T.S. 11 establishes a link between marine living resources and marine food products, and focuses on the prevalence of "*a supply of food for human consumption.*" In UNCLOS, fisheries is the only activity explicitly mentioned in referral to the exploration, exploitation and conservation of marine living resources. No less than thirty articles refer to fisheries (notably Articles 56, 60 and following, Article 277 etc). Moreover, Article 69 mentions "the nutritional needs of the populations of the respective States. See GUILLOUX. 2018, at 59.

Most biologists would describe this scientific basis, which importantly is reflected in central formulas on management, as overly simplified and inaccurate. As a result, central elements of the rules for the management of marine living resources, which will be discussed in more detail below, are from a scientific standpoint unsatisfactorily functioning as the basis for modern fisheries management. This situation risks creating decisions on viable harvest levels that are inaccurate or unsustainable in the long term.

For bioprospecting of marine genetic resources, the implications of these rules on management of marine organisms are even worse, and in many regards completely inapt. The shortcomings include an exclusive focus on major harvested species, disregarding the consequences and side-effects on species less relevant to fisheries. This includes a lack of concern for systemic interaction with other species, but also a lack of consideration of the side-effects of fisheries, such as the impact of trawling on the benthic and sediment species, organisms which in recent years have been at the center of bioprospecting interest due to their bioactive properties. Moreover, the UNCLOS regime on marine living resources generally fails to consider genetic diversity within species.

The lack of functionality in relation to bioprospecting has led some observers to deem it illogical to apply the fisheries-based rules on conservation and management of the living resources to activities directed at the genetic material of the sea.[561] The primary argument against applying the regime on marine living resources to bioprospecting thus relates to the difference in use of the organism between the two activities, where bioprospecting regularly requires only small samples, as discussed above.[562]

This argument is commonly supported by claims that the limited perspective of UNCLOS is the result of other uses of living resources not known at the time of the convention's drafting.

[561] See for instance Scovazzi, Bioprospecting on the Deep Seabed: a Legal Gap Requiring to be Filled. 2006, at 83.

[562] Scovazzi and others considers it unreasonable to apply the regime on marine living resources, rules which are based on large scale harvesting: "*(...) it would be totally unreasonable to apply, to activities directed at the genetic materials of the sea, the law of the sea convention regime relating to fishing and conservation and management of the living resources, which is based on the concept of allowable catches*." Scovazzi, Is the UN Convention on the Law of the Sea the Legal Framework for All Activities in the Sea? The Case of Bioprospecting. 2010, at 312.

True, in the preparatory work discussions on fisheries are certainly dominant. Although their scientific and economic value was demonstrated as early as the 1970s, marine genetic resources did not draw the attention of the states at the third United Nations Conference on the Law of the Sea.[563] Similarly, little consideration was given to genetic resources in the development of the deep-seabed regime of the Area, which instead came to focus on marine mining.[564]

There are thus a number of essentially functional aspects against applying the regime on marine living resources to bioprospecting. There are, however, also arguments supporting the contrary position. Foremost, the terminology used in the convention is an argument for including the bioprospecting of organisms in the scope of the rules on marine living resources. Indeed, the use of *living resources* instead of fisheries makes clear that the negotiators strived to encompass all uses of living organisms by this part of the convention, irrespective of use. Indeed, the regime for marine living resources in UNCLOS was intentionally drafted generically, disregarding the use of or purpose for harvesting organisms. This is also in line with the general holistic ambition to include all uses of the oceans in the regulation of the convention, as declared in its preamble. Irrespective of what uses of *living resources* were envisaged by the negotiators, as well as the lack of adaptation to the peculiarities of bioprospecting, there are thus convincing arguments for interpreting the term to include all uses, including bioprospecting of marine genetic resources.

Similarly, it appears that widespread state practice has developed for regarding marine living resources as including most (if not all) species of the marine ecosystem. Accordingly, the argument could be made that even if other aspects of living resources than fisheries, such as genetic resources, were not considered during the drafting of the convention, the negotiation of the Convention on Biological Diversity, to which state parties to UNCLOS are also parties, has resulted in an evolutionary interpretation of marine living resources.[565] Accordingly, the term has come to encompass all aspects of marine biodiversity.[566]

[563] GUILLOUX. 2018, at 63.

[564] The irony of basing the regulation of the Area on marine mining instead of the more valuable genetic resources later came to be criticized by Glowka, OCEAN YEARBOOK ONLINE (1996).

[565] Evolutionary interpretation is extensively discussed in BJORGE. 2014.

[566] See, on the relationship between UNCLOS and its rules on living resources and the connecting rules in CBD and the Nagoya Protocol, CHARLOTTE SALPIN, CHAPTER 5. THE LAW OF THE SEA: A BEFORE AND AN AFTER NAGOYA? § 1 (Elisa Morgera, et al. eds. 2013); PATRICIA

Moreover, even observers holding that bioprospecting should not be considered regulated as marine living resources agree that "also the search for, and collection of, organisms for genetic purposes may cause some risk to the preservation of biodiversity in the deep seabed."[567] The relevance of the argument that even limited sampling may result in substantial impact is amplified by the sensitivity of many of the ecosystems where marine genetic resources are collected. Many of the relevant deep-sea ecosystems have not previously been subject to human activity and may be very sensitive. Moreover, the endemic character of many of the deep-sea biodiversity hotspots increases the risk of detrimental impacts. For certain species, the impact of even a small sampling may be as detrimental as large-scale harvesting of more numerous species.[568]

Moreover, for some product development in bioprospecting, sampling can hardly be regarded as limited. There are bioprospecting cases which deviate considerably from the stereotype of a small sample being developed into a biotechnology in a laboratory environment. For some marine biotechnology development, considerably larger amounts of natural raw materials are collected, as discussed in section B.6.1.

As such, there are reasons to disagree with the notion that genetic resources should be excluded from the scope of *marine living resources*, as regulated in UNCLOS. There is indeed some merit to the argument that these rules in certain regards are ill-suited for bioprospecting. Observers attempting to exclude bioprospecting from the regime on marine living resources, however, make the mistake of claiming that this dysfunctionality in itself is evidence of inapplicability of the rules.

W. Birnie, International law and the environment (Alan E. Boyle & Catherine Redgwell eds., Oxford : Oxford University Press 3. ed. ed. 2009), at 750; Yoshifumi Tanaka, A dual approach to ocean governance: The cases of zonal and integrated management in international law of the sea (2009).

[567] Scovazzi, Is the UN Convention on the Law of the Sea the Legal Framework for All Activities in the Sea? The Case of Bioprospecting. 2010, at 312.

[568] There is thus no evidence that the impact of bioprospecting always is negligible. The notion that bioprospecting somehow should be excluded from the management of marine living resources because of its innocent character is thus difficult to support. It would also undermine the prospects for a holistic management of marine organisms and ecosystems to allow some types of use to go unnoticed, in particular if bioprospecting increases as projected. These aspects have previously been discussed by Leary. 2010.

Lack of functional precision, however, cannot in itself disqualify treaty rules from being binding. This is underlined by the lack of exclusion by the drafters of the convention. All documentation of the negotiation process indicates that the states involved sought a holistic regulation of all marine organisms.[569]

Indeed, the harvesting of marine genetic resources for biotechnology purposes is, and will most likely remain, encompassed by the rules on marine living resources of UNCLOS, akin to more conventional uses of marine organisms. What implications does this yield for bioprospecting? Firstly, it means that such activities must relate to the division in the convention between the exclusive rights of coastal states to living resources within national jurisdiction on the one hand, and the commons rules provided for living resources beyond such areas on the other. Secondly, it implies that bioprospecting must fulfill obligations relating to the management and conservation of marine living resources.

Development of the rules on marine living resources

Establishing that marine bioprospecting is encompassed by the rules for managing marine living resources yields not a singular, but a multifold answer as to what rules apply to such activities. This is because the rules applying to the use of marine living resources, and the right to harvest living organisms, vary depending on what maritime areas they are retrieved from. The rules for the management of living resources in the law of the sea are based on the fundamental principle that coastal states have exclusive rights to such resources in sea areas under their jurisdiction, including the EEZ and continental shelf, and conversely that all states have equal access to such resources in areas where no state exercises sovereign rights. The differences between the general principles of the respective maritime zones of UNCLOS have already been discussed in section C.1.2. The implications for the management of marine living resources will be further discussed below.

[569] See Proelss, United Nations Convention on the Law of the Sea: A Commentary. 2017, at 480-542. It would be more correct to perceive the development of biotechnology and the challenges it raises in the application of established rules as evidence for the necessity of reforming or updating certain rules in the law of the sea. Advanced suggestions for new rules on marine genetic resources are have also been tabled within the BBNJ process. A new implementing agreement may result in more precise rules on marine genetic resources. It is however unlikely that those negotiations will result in a fundamental revision of the fundamental concepts of marine living resource management under the convention.

However, despite the differences across maritime zones, the rules on marine living resources are based on the same general concepts. Foremost, these include how long-term conservation can be ensured in the management of these resources.

In order to understand the functioning of these concepts as well as the rationale for the differences in balancing the rights of coastal and other states across maritime zones, it is necessary to first briefly examine the development of regulatory approaches to living resources under the law of the sea. As will be further discussed in Part D, throughout the history of the law of the sea, the balance between these interests has changed. Foremost, coastal state claims for – and recognition of – exclusive rights have increased dramatically. Coastal states have, over a long period, gradually increased the geographic extent of their claims for exclusive rights to regulate the exploitation of marine organisms. The underlying drive behind this gradual enclosure of ocean commons has been an ambition among coastal states to expand areas where they sovereignly can harvest and manage living resources. While initially being contested by other states, these growing claims for sovereign rights to living resources have repeatedly gained subsequent recognition and been upheld in international law, both in case law and treaties. The Bering Fur Seals arbitration[570] and the *Anglo-Norwegian Fisheries*[571] case represent important examples of the former; the development of the exclusive economic zone regime under UNCLOS III is the most important representation of the latter. Economic interests connected to living resources have thus been the pivotal driver behind the development of the maritime zone regime of the law of the sea.

Since the concept of coastal states' sovereign rights to living resources within the 200 nautical mile exclusive economic zone gained recognition in UNCLOS, most coastal states have declared such zones. This means that in most oceans, coastal states have special right to all marine living resources in sea areas within 200 nautical miles from the baseline of the coastline. The implications of these rights, and their limitations, will be further discussed below.

[570] Award between the United States and the United Kingdom relating to the rights of jurisdiction of United States in the Bering's sea and the preservation of fur seals (Bering Sea Arbitration).
[571] Fisheries (United Kingdom v Norway), Merits, ICJ Rep 116, ICGJ 196 (International Court of Justice 18 December).

Beyond the EEZ, the convention provides that the freedom of fisheries remains applicable in the high seas. Even if the high seas areas of the world's oceans have decreased relative to the declaration of EEZ areas, the high seas remain by far the biggest part of the oceans, both in area and volume (50 per cent of the surface area of the planet, 64 per cent of the ocean's surface and 95 per cent of its volume). Important for the purpose of this investigation, these vast high seas areas include the overwhelming parts of the deep seas and their biodiversity hotspots.

For living resources on the seafloor and underlying sediments, coastal state declaration is not necessary. Instead, the sovereign rights of the coastal states to living resources in the continental shelf are regarded as inherent. As regards living resources in the Area, it remains disputed whether these are encompassed by the common heritage of mankind principle, as discussed in section C.1.4.

Managing living resources under the law of the sea

The sovereign right of coastal states to regulate the management of living resources within their jurisdiction, as well as the freedom of fisheries in the high seas, is not unlimited. It builds on management concepts which are commonly applicable within as well as beyond national jurisdiction. As articulated in Articles 61 and 62 of the convention (relating to the conservation and utilization of living resources, respectively), it is a sovereign right of the coastal states to make decisions on allowable catch – commonly referred to as total allowable catch (TAC) – within marine areas under its jurisdiction. If coastal states are unable to harvest the entire TAC, there is an obligation to allow access for other states. In reality, this does not happen, since states lack an incentive to set the TAC higher than their own ambition to harvest.

Coastal states are, however, not entirely free to exercise this right to establish TAC as they please. Instead, UNCLOS provides an explicit obligation to base the management on scientific evidence and ensure that the maintenance of the living resources is not endangered by over-exploitation. Moreover, it establishes a formula which should be the basis for decisions on allowable catch.

This premise, commonly referred to as the maximum sustainable yield (MSY), seeks to maintain the productivity by taking the number of fish from a stock which is replaced by the annual rate of new recruits entering the stock.[572] It is built on the notion that fish stocks regenerate most effectively if a certain share is caught annually. The concept of MSY is strongly connected to the principle of optimum utilization. This calls for all living resource management under UNCLOS to strive for the maximum output. Indeed, if the coastal state itself is not able or willing to harvest all surplus of resources according to the MSY formula, it should allow other states access to the surplus. According to Article 119, these concepts apply also to the management of living resources of the high seas in relevant parts, with the difference that no state has sovereign rights to set allowable catch in high seas areas. Instead, states whose nationals exploit identical living resources, or different living resources in the same area, shall enter into negotiations with a view to taking the measures necessary for the conservation of the living resources concerned.

The basis for the regime on marine living resources in UNCLOS reflects a productivity focus among its negotiators.[573] The realization that overfishing risked the long-term viability of marine life did not become generally accepted before the 1970s, when the law of the sea negotiations was already well underway. Moreover, a widely shared criticism of the regime for living resources in the convention is that it reflects a largely outdated scientific understanding of the behavior of living organisms. It disregards the complexities of interactions in marine ecosystems, ecological relationships of species as well as migration patterns and stock fluctuations, which makes it much more difficult to make stock assessments than anticipated by the negotiators of UNCLOS.[574] Even in areas where states can afford such costly assessments, the collection and analysis of reliable scientific data, which is a prerequisite for determining the total allowable catch, is notoriously difficult and has often been proven to be imprecise and of insufficient quality.[575] As observed by Harrison and Morgera, the provision has also been criticized for not being precise in terms of what unit is

[572] Birnie. 2009, at 591; Gl Kesteven, *MSY Revisited. A Realistic Approach to Fisheries Management and Administration*, 21 Marine Policy (1997).
[573] See Guilloux. 2018, at 60.
[574] Birnie. 2009, at 591.
[575] Tanaka, The International Law of the Sea. 2012, at 223.

subject to the obligation (stock, species, biomass).[576] Similarly, it is unclear at what level it is to be maintained.[577]

As a consequence, the concept of maximum sustainable yield is particularly challenging to implement practically.[578] This, in turn, results in an often unsatisfactory scientific basis for the determination of the total allowable catch. The duty to base decisions on allowable catch on scientific evidence can also be questioned for its lack of requirement for the scientific review to be independent. The regulation also lacks the possibility for third states to review or challenge decisions on allowable catch, since the sovereign rights of coastal states to manage living resources is exempted from the compulsory dispute settlement procedure in Part XV of UNCLOS.

Another point of criticism against the rules for the management of living resources under UNCLOS is that populations of marine organisms commonly occur and are harvested both in the waters of the coastal state and in other areas. As a result, the assessment of the coastal state of the allowable catch within its zone must take due account of catches, not only within its own maritime zones, but also harvesting in waters within the jurisdiction of other states, as well as in the high seas. Yet UNCLOS contains no mechanism for how to relate to harvesting beyond domestic maritime zones when deciding on allowable catch.[579] Instead, Article 63 merely calls for cooperation between states in such cases.

Moreover, even in cases where scientific evidence indicates that catches should be limited, the coastal state has broad discretion in maintaining fisheries opportunities at unsustainable levels.[580] With the exception of the duty not to endanger living resources by over-exploitation, the coastal state is free to establish allowable catch according to its preferences, which may be guided by concerns other than the long-term health of stocks. Another consequence of the coastal autonomy in setting allowable catch is, as already indicated above, that the level is never set beyond what the coastal state is able or willing to harvest.

[576] Proelss, United Nations Convention on the Law of the Sea: A Commentary. 2017, at 484.
[577] Marion Markowski, The International Law of EEZ Fisheries (2010).
[578] Richard Barnes, The Convention on the Law of the Sea: An Effective Framework for Domestic Fisheries Conservation? (2006).
[579] Tanaka, The International Law of the Sea. 2012, at 223.
[580] Proelss, United Nations Convention on the Law of the Sea: A Commentary. 2017, at 485.

The obligation to allow other states access to surplus has thus been largely irrelevant for practical purposes.[581]

One challenge in applying these concepts to bioprospecting, as well as other types of extraction of living resources not confined to traditional fisheries, is that Article 61 seems to impose conservation measures only regarding "populations of harvested species" directly commercialized and not species likely to be exploited (paragraph 3). This provision raises questions in relation to bioprospecting, since it appears to imply that the central management concept of MSY does not necessarily have to be set in relation to species which are not considered as "harvested." It is not clear what the term "harvested" implies in this context. It would, however, be reasonable to assume that small-scale sampling of organisms, as is commonly the method employed in bioprospecting, would not qualify. Hence, for bioprospecting activities which only amounts to small-scale sampling of organisms rarely used by humans, it would not be necessary to establish management measures in line with the MSY formula. Importantly, this would not mean that such organisms fall outside the scope of marine living resources, as discussed above, but merely that a procedure to assess MSY in line with procedures indicated in the convention need not be initiated, in lack of harvesting in a broader sense. This is also the case in state practice. Similarly, the obligation in paragraph 4 to take effects on species associated with or dependent on targeted species appears to be limited to stocks which are considered harvested, within the meaning of the convention.

Unlike the obligation to establish MSY and consider the impact on other species, the obligation to set TAC in paragraph 1 is not confined to harvested species. Accordingly, under Article 61, the coastal state is under obligation to set TAC also for genetic resources used on a small scale. In state practice, this obligation is not respected. The European Union, for instance, only makes assessments of MSY for commercially fished stocks.

Moreover, there are other obligations relating to the conservation of living resources, unrelated to the concepts of allowable catch and maximum sustainable yield, which are also highly relevant for bioprospecting. Paragraph 2 provides an obligation to ensure through proper conservation and management measures that the maintenance of the living resources in the

[581] TANAKA, The International Law of the Sea. 2012, at 223.

exclusive economic zone is not endangered by over-exploitation, taking into account the best scientific evidence available. This entails, in line with Article 62, measures such as licensing of operators, vessels, and equipment, size and age of individual organisms that may be caught, as well as season and aerial regulations. There is nothing indicating that this provision does not apply in relation to bioprospecting. Hence, states are under obligation to take different measures to ensure that such activities do not result in over-exploitation of genetic resources. Moreover, this obligation is connected to an obligation to cooperate with relevant international organizations in this regard. This calls for coordinating measures with fisheries organizations: the Food and Agricultural Organization of the UN at the central level, but in particular the Regional Fisheries Management Organizations (RFMOs) in an operational context. These will be further discussed below. As similarly observed by Harrison and Morgera, there is nothing indicating that the obligation to cooperate is limited to fisheries organizations. It may also apply in relation to recommendations provided by environmental organizations. Thereby, the provision builds a bridge to conservation measures enacted beyond the regime of the law of the sea. There is thus reason to argue that, for instance, decisions by the CBD conference of parties relating to conservation measures of marine biodiversity would also be binding under the law of the sea, by virtue of Article 61(2).[582]

Further development

The entry into force of UNCLOS did not manage to prevent growing pressure being exerted on fish stocks. The intensification of fishing efforts caused catches to increase nearly five-fold between 1950 and the turn of the millennium.[583] Eventually, the realization that the pressure on stocks had led to over-exploitation brought about initiatives to promote more sustainable management.

This development, with increased awareness of the functioning of marine ecosystems, coincided with the advent of a new form of fisheries. Whereas until the Second World War, fisheries were almost exclusively aimed at providing fisheries products for consumers, industrial fishing enterprises to an

[582] PROELSS, United Nations Convention on the Law of the Sea: A Commentary. 2017, at 487.
[583] Global catches of fishing resources went from around 19,000,000 to 90,000,000 during the period 1950-2000, see FAO, THE STATE OF WORLD FISHERIES AND AQUACULTURE 2018 - MEETING THE SUSTAINABLE DEVELOPMENT GOALS (2018).

increasing degree during the second half of the 20th century began harvesting marine living resources to produce fishmeal and oil for fertilization, animal feed, and as an input commodity for aquaculture.[584] Like bioprospecting, the development of fish as an input commodity, and the magnitude of the resulting expansion of industrial trawling, was not foreseen during the negotiation of the convention.

Although the emphasis on exploitative aspects historically has been predominant, rudimentary ideas of sustainability had been expressed already in agreements relating to fisheries during the first half of the 20th century.[585] The focus on economic utilization did not begin to become balanced with ecological sustainability until the negotiation of the UN Fish Stocks Agreement, which was adopted in 1995.[586] UNFSA brought about important improvements in management. The general ambition of the agreement has been described as seeking to ensure a harmonious development of coherent conservation and management measures for the high seas and the exclusive economic zone, based upon cooperation.[587]

Particularly noteworthy among the improvements is the ecosystem approach, which calls for more holistic management, as well as the focus on regional management under the auspice of regional fisheries management organizations (RFMOs) and the precautionary principle. In this regard, the terminology of the UNFSA expresses a deeper awareness than UNCLOS as regards genetic diversity. States must thus take into account the biological unity and other biological characteristics of the stocks and the relationship between the distribution of the stocks, the fisheries, and the geographical particularities of the region concerned. In particular, the reference to the notion of "biological unity" emphasizes that the Agreement is more clearly based upon the ecosystem approach than the Convention on the Law of the Sea.[588]

[584] Matz-Lück & Fuchs. 2015, at 492.
[585] Id. at 491.
[586] United Nations Fish Stocks Agreement. 1997.
[587] See Articles 7 and 8, Wolfrum & Matz, MAX PLANCK YEARBOOK OF UNITED NATIONS LAW (2000), at 453.
[588] Ibid.

The importance of the reforms of the UNFSA should not be dismissed. However, it did not modify the fundamental management concepts for living resources in UNCLOS, which remain unaltered. Although the role of sustainability in the rules for the management of marine living resources has since expanded, the original emphasis on exploitive economic aspects has persisted to a surprisingly high degree.[589]

The growing recognition of the deterioration of fish stocks, which was the basis for the negotiation of the UNFSA, was paralleled by increasing awareness of the general loss of biological diversity, resulting in the adoption of the 1992 Convention on Biological Diversity, as discussed in Part C.2. At the same time, the concept of sustainability began to feature not only in treaties, but also in environmental law and policy generally. These developments outside the law of the sea helped shift the focus of fisheries management from a purely exploitation-oriented approach to one that included considerations of long-term sustainability of stocks. Moreover, broader concerns of ecologically sustainable development, not only with regards to commercially exploited fish stocks but also broader ecosystem implications started to be reflected in policy and regulation. For the first time, the complexities and interconnections of marine ecosystems were being incorporated into the management of marine living resources. Still, management measures were focused on a number of commercially lucrative fisheries.

Marine living resources management across maritime zones

Whereas the general rules in UNCLOS for utilization and conservation of living resources thus have been discussed in the context of the genetic resources used in bioprospecting, it will now be examined how these general concepts unfold in the different maritime zones. Much like other concepts in the convention, the differentiated approach to the balance between jurisdiction and exclusive rights of coastal and other states results in different sets of rules, across maritime zones.

[589] The perhaps most evident example of the persisting emphasis on economic exploitation aspects is the objective of "*proper conservation of whale stocks*" to "*make possible the orderly development of the whaling industry*" in the Preamble to the 1946 International Convention for the Regulation of Whaling (ICRW) which still to this day functions as the central instrument for the regulation of whaling., see Matz-Lück & Fuchs. 2015, at 491.

The exclusive coastal state rights of internal waters, territorial sea and the exclusive economic zone

The internal waters as well the territorial sea, as discussed under section C.1.3, are under the territorial sovereignty of states. The exclusive jurisdiction of coastal states in these areas comprises all marine resources, including the management and conservation of living organisms even if UNCLOS lacks explicit obligation to conserve marine living resources in these areas. In the EEZ and the continental shelf, it is equally clear under Articles 56 and 77 that the coastal state has sovereign rights for exploring and exploiting living resources. This implies that no one may undertake activities such as bioprospecting, which involves explorations and exploitation of organisms, without the explicit consent of the coastal state. As discussed above, the convention establishes clear formulas and obligations for how such resources should be managed and conserved.[590]

Continental shelf rights and legal challenges relating to sedentary species

In line with the general approach to marine spaces as divided between the water column and the seabed in the maritime zone regimes, UNCLOS provides a special set of rules for sedentary species of the continental shelf. According to Article 77(4) the term sedentary species relate to "*organisms which, at the harvestable stage, either are immobile on or under the seabed or are unable to move except in constant physical contact with the seabed or the subsoil.*" These include many of the organisms targeted in deep-sea bioprospecting, as discussed in Part B. According to Article 68, such species does not fall within the EEZ regime. Instead, they are considered as falling within the rights of the coastal state to resources in the continental shelf.

[590] In addition to the obligations relating to utilization and conservation, the convention sets up additional regulation based on type of species in articles 63-68. For marine mammals, so-called shared, straddling, highly migratory, anadromous, catadromous and sedentary species the convention provides special rules on cooperation, management as well rights and responsibility for certain states based on the migration patterns of the species. Although bioprospecting potentially could be exercised in relation to all of these categories of species, the regulation on sedentary species appears particularly relevant for bioprospecting. This is because such organisms, which according to *Maggio* includes chanks, clams, oysters, mussels, scallops, sponges, corals, and crustaceans such as shrimps, prawns lobsters and crabs legally are not regarded as part of the exclusive economic zone, but instead belong to the continental shelf. See PROELSS, United Nations Convention on the Law of the Sea: A Commentary. 2017, at 613.

In bioprospecting, as with any use of living organisms, the result is that different maritime zones and conditions apply depending on whether an organism is in direct physical contact with the seafloor or found in the water column. In areas where a coastal state has extended continental shelf, and the overlying water column thus has status as high seas, which may result in an uncertain legal status for some organisms, depending on their life cycle and "harvestable stage."[591]

From the perspective of management of marine genetic resources, this can lead to substantial challenges.[592] The requirement for states exploiting such resources as part of the freedoms of the high seas to pay due regard in their exercise to the interest of other states calls for cooperation with coastal states.[593] If, however, the relevant ecosystem is located within the EEZ of coastal states, the practical implication of whether an organism falls within or outside the scope of the sedentary species definition is less important.[594]

[591] An obvious example of this is jellyfish, where the largest part of the life cycle (the larva, ephyra and medusa phases) are spent in the pelagic water column, hence under the high seas regime. After the larva phase, however, the organism settles onto a firm surface and develops into a polyp. In this phase, it is thus legally considered a sedentary species, hence within the sovereign right of coastal states.

[592] Observers have described the differences between legal regimes for deep-sea ecosystem depending on location as an illustration of a fractured regulatory approach regarding management and conservation of such ecosystem and their associated biological resources. These shortcomings of the convention is to a large extent the result of the inflexible division of organisms into different rigid categories of species, which is ill-adapted to the real functioning of deep-sea ecosystems. The negative consequences of the division into different categories of species are then multiplied by the rigid maritime zone regime. See HORST KORN, et al., DEEP SEA GENETIC RESOURCES IN THE CONTEXT OF THE CONVENTION ON BIOLOGICAL DIVERSITY AND THE UNITED NATIONS CONVENTION ON THE LAW OF THE SEA (Bundesamt für Naturschutz (BfN). 2003).

[593] An obvious example of this is jellyfish, where the largest part of the life cycle (the larva, ephyra and medusa phases) are spent in the pelagic water column, hence under the high seas regime. After the larva phase, however, the organism settles onto a firm surface and develops into a polyp. In this phase, it is thus legally considered a sedentary species, hence within the sovereign right of coastal states.

[594] In these areas, the coastal state has sovereign right to explore and exploit marine genetic resources, irrespective if they are found on the seafloor, sediments or in the water column. In line with previous discussions, this right follows from the sovereign rights under Article 77 to sedentary species in the continental shelf and the corresponding sovereign right to living resources in the EEZ under Article 56.

High seas freedoms and conservation of living resources

On the high seas, all states enjoy the freedom of fishing under Article 87. Compared to the freedom to conduct marine scientific research, however, as discussed above, this freedom is more regulated and by no means absolute.[595] States are thus under obligation to set up cooperation mechanisms in cases where their nationals exploit identical living resources or different living resources in the same area. UNCLOS provides little as to how this cooperation is to be carried out, but more detailed rules are provided by the UNFSA.

The obligation to cooperate in the harvesting of high seas living resources is important in a bioprospecting context. The obligation entails that where several states are interested in conducting bioprospecting in a specific hotspot for marine genetic resource, they are legally bound to enter into negotiations in order to ensure sustainable management. This also involves a duty to set up formal arrangements to prevent unviable exploitation of living resources. States shall, as appropriate, cooperate to establish sub-regional or regional fisheries organizations to this end.

In the context of fisheries, this obligation has led to the formation of regional fisheries organizations (RFMOs). Across the world oceans, such organizations now have a central role in fisheries management cooperation and have enacted management rules for fisheries not merely on the high seas but also under national jurisdiction. The mandate of these organizations is commonly limited to either a specified geographic area or a specific stock in a geographic area. So far, no RFMO has adopted specific management or conservation rules for marine genetic resources of for species primarily used in such activities.[596] Rather, across regions the focus of RFMOs lies exclusively with fisheries management. Some observers as well as NGOs have voiced criticisms against RFMOs for the perceived inability to adopt sufficient measures for the protection of particularly sensitive ecosystems of interest for bioprospecting purposes.

[595] According to Article 116 and 119, the obligations relating to the management and conservation of living resources in the EEZ applies *mutatis mutandis* also in the high seas. Moreover, states are under a far-reaching obligation to cooperate in the conservation and management, in line with Article 117-118.

[596] Jørem & Tvedt, THE INTERNATIONAL JOURNAL OF MARINE AND COASTAL LAW (2014), at 326.

Partly as a result of this criticism, the legal obligation to protect deep-sea ecosystems was developed by the United Nations General Assembly via the adoption of two resolutions[597] in the 2000s, with the purpose of increasing support for vulnerable marine ecosystems from bottom trawling.

Accordingly, although not amounting to direct regulation of bioprospecting of marine genetic resources, fisheries management measures have lately adopted some measures which protect prolific deep-sea marine ecosystems with high abundance of species relevant for bioprospecting.[598] The importance of such measures should not be underestimated, since the most substantial threat to the hotspots for marine genetic resource do not necessarily stem from bioprospecting or any other form of direct harvesting. Rather, in the evaluations that have been undertaken, the most substantial pressure on such ecosystems seems to be comprised of collateral effects of high seas fisheries. Bottom trawling has in many areas damaged benthic habitats with high degree of endemic biodiversity.[599] Despite the measures taken by RFMOs in recent years, the collateral effects of fisheries on marine genetic resources remain difficult to address legally under UNCLOS.[600] Generally, the disconnection

[597] United Nations General Assembly resolution 61/105, Sustainable fisheries, including through the 1995 Agreement for the Implementation of the Provisions of the United Nations Convention on the Law of the Sea of 10 December 1982 relating to the Conservation and Management of Straddling Fish Stocks and Highly Migratory Fish Stocks, and related instruments, A/RES/61/105 (8 December 2006), available from undocs.org/A/RES/61/105 § 24 (United Nations General Assembly ed. 2007); United Nations General Assembly resolution 64/72, Sustainable fisheries, including through the 1995 Agreement for the Implementation of the Provisions of the United Nations Convention on the Law of the Sea of 10 December 1982 relating to the Conservation and Management of Straddling Fish Stocks and Highly Migratory Fish Stocks, and related instruments, A/RES/64/72 (4 December 2009), available from undocs.org/A/RES/64/72 § 24 (United Nations General Assembly ed. 2007).

[598] Some (but not all) RFMOs have prescribed measures relating to the protection of vulnerable marine ecosystems. The North East Atlantic Fisheries Commission has for instance listed five areas as closed areas for fisheries, with the explicit aim of protecting deep-sea ecosystems.

[599] Joanna Mossop, *Protecting Marine Biodiversity on the Continental Shelf Beyond 200 Nautical Miles*, 38 OCEAN DEVELOPMENT & INTERNATIONAL LAW (2007).

[600] These difficulties are to a high degree the result of a disregard of the broader effects of fisheries on the marine environment during the negotiations of UNCLOS. In working document proposals for the Second Committee at the UNCLOS III negotiations there was actually a proposal for a provision 149: "*All states shall be obliged to comply with international regulations designed to prevent, reduce or eliminate any damage or risks arising from pollution or other effects detrimental or dangerous to the ecological system of the international seas, water quality and use, living resources and human health.*" This proposal was however

between Part VII on the high seas freedoms and Part XII on the protection and preservation of the marine environment has been criticized.[601]

Moreover, an important difference between Article 87 and Article 116 and subsequent provisions conditioning the use of high seas living organisms is that whereas the freedom of fisheries uses the term *fish*, the subsequent paragraphs make reference to the broader term *living resources.* This seems to underline an ambition to include extraction of all organisms in the conditions set out in Section 2. Why, then, do Articles 87 and 116 not similarly relate to living resources?

The explanation appears to be that fisheries were the only living resource extraction considered relevant during the drafting of the convention, but that the negotiators wanted to underline broader ecosystem concerns as regards conservation.[602] It can thus be concluded that irrespective of whether bioprospecting is encompassed by the freedom of fisheries (or represents a freedom of its own, as discussed above), conservation and cooperation obligations provided by the convention for high seas living resources also apply in respect of bioprospecting of genetic resources.[603]

The disputed status of living resources of the Area

The concept or term *living resources* is not used in the rules of UNCLOS for the Area. As discussed in section C.1.4, the status of living organisms including

dismissed by the Second Committee, because it was considered that the regulation for the preservation of the marine environment of the high seas should be left to Third Committee. Similar proposals, or references to undertakings relating to the protection of the marine environment outside the scope of UNCLOS was also suggested. In the final text of Part VII, however, no specific obligation relating to the protection of the marine environment was included. Official Records of the Third United Nations Conference on the Law of the Sea, UN Doc A/CONF.62/C.2/WP.1, Draft Provisions, Part VII (15 October 1974). Provision 149.

[601] WARNER. 2009, at 34.

[602] PROELSS, United Nations Convention on the Law of the Sea: A Commentary. 2017, at 791-849.

[603] Or to be more exact, it should be underlined that the provisions relating to the conservation of high seas living resources oblige states to take measures, individually or jointly, not with regard to living resources *per se*, but towards their nationals (that is, entities that are under their jurisdiction; for example, individuals that are on fishing boats that fly the flag of a given State). Hence, it has been claimed, these provisions establish a standard for regulating the conduct of nationals, not one that would be directly applicable to the legal status of living resources of the High Seas. Marciniak, at 381.

genetic resources, and the compatibility with UNCLOS of bioprospecting in the Area is highly debated.[604] As established in that section, the arguments favoring an interpretation of the regime of the Area and the common heritage of mankind principle that includes genetic resources of living organisms appear more persuasive than the contrary position. Even if the language of the convention can be interpreted either way, depending on what provision is emphasized, there are other arguments supporting an inclusive scope. Not least, it would be difficult to accept that organisms of the Area would be left entirely unregulated, in light of the far-reaching rules on marine living resources of other maritime zones. If this interpretation is accepted, what management and conservation rules would then apply to the living resources of the Area and how should organisms of the Area be distinguished from those of the high seas?

In addition to the general rules of the Area, discussed in section C.1.4, it has been suggested by Armas Pfirter that the rules on sedentary species of the continental shelf *mutatis mutandis* could be applied by analogy to the living resources of the deep seabed of the Area.[605] In line with Article 77, this would include living organisms belonging to sedentary species, that is to say, organisms which, at the harvestable stage, either are immobile on or under the seabed or are unable to move except in constant physical contact with the seabed or the subsoil, in the scope of the rules of the Area. Deep-sea organisms which fall beyond these criteria would conversely be considered as falling within the rules for the high seas. It appears reasonable to assume a dichotomy between the rules of the water column (the EEZ and the high seas) and the seabed (the continental shelf and the Area), so that the same distinction applies between seabed and water column species. There are not merely practical arguments for applying this distinction also in relation to the living resources of the Area. As already established in section C.1.4, the lack of references to living resources in the Area appears to rather be the result of a lack of knowledge of their economic potential than reflecting an intention among negotiators to exclude such resources from the rules on the Area.

[604] Broggiato, ENVIRONMENTAL POLICY AND LAW (2011).

[605] Frida Armas Pfirter, The Management of Seabed Living Resources in "The Area" under UNCLOS (Report presented at the Tenth Session of the ISA, 27 May 2004), at 26 as cited in Oude Elferink, THE INTERNATIONAL JOURNAL OF MARINE AND COASTAL LAW (2007), at 151. This suggestion has however been disputed by other observers, such as Scovazzi (Scovazzi, THE INTERNATIONAL JOURNAL OF MARINE AND COASTAL LAW (2004), at 400-401).

It has thus been established that the genetic resources used in bioprospecting fall within the scope of the rules on marine living resources of UNCLOS, and that any bioprospecting activity would have to respect the relevant obligations, even if these in certain regards may be ill-suited to manage other activities than commercial fisheries. The rules on marine living resources thus imply that extensive conservation measures, also those developed in international cooperation beyond the law of the sea, in principle have to be applied in relation to bioprospecting. This foremost implies an obligation for states to ensure proper conservation and implement management measures such as decisions on total allowable catch based on best scientific evidence also for species targeted for their genetic resources.[606] These elements of the rules on living resources apply to bioprospecting, even if the species would be of limited interest to fisheries and irrespective of where the operation is carried out. Similarly, bioprospecting activities would have to be included in the calculation of maximum sustainable yield.

Whereas any use of living resources within coastal state jurisdiction requires consent, it is comprised by the open-access principle of the high seas freedoms in the water column beyond national jurisdiction. The legal status for living resources in the Area is more contested, but there are arguments for considering that these can be distinguished from the living resources of the high seas by the criteria provided for sedentary species in the continental shelf.

C.1.6. Conclusions on the law of the sea

The rules of the law of the sea relevant for deep-sea genetic resources thus provide a multitude of obligations relevant for bioprospecting. Irrespectively how bioprospecting is considered as an activity under the UNCLOS framework, it is clear that coastal state consent is necessary for such operations in areas within national jurisdiction. Beyond such areas, the high seas rules provide far-reaching freedoms, for fisheries, scientific research as well as activities not explicitly mentioned in UNCLOS. It is thus clear that the convention does not prevent the extraction of genetic resources in the water

[606] If a species or stock is only subject to small-scale sampling, it is not certain if the maximum sustainable yield procedure would be necessary. However, in some cases, as is the case with endemic deep-sea species, the sensitive character of ecosystems may call for application of such mechanisms also where only limited operations are carried out.

column beyond national jurisdiction, or the use of high seas resources in bioprospecting processes aiming to develop patents.

The rules for marine scientific research in UNCLOS do not *per se* preclude the use of samples collected in scientific operations as the basis for private claims, such as the patenting of genetic resources. General rules for the protection of the marine environment would however have to be respected, as well as obligations relating to the use of living resources, irrespective where bioprospecting is carried out.

It has further been considered that genetic resources in the seabed beyond national jurisdiction ought to be regarded as encompassed by the rules for the Area, and that the common heritage of mankind-principle applies to deep-seabed bioprospecting. This in principle prevents private appropriation of genetic resources of the Area and deep-seabed bioprospecting, with the possible exception of cases where samples collected in research operations without commercial intentions are stored (*e.g.* in collections or biobanks) and subsequently used in bioprospecting. The deep-seabed genetic resources of the Area may be distinguished from the high seas based on the behavior and life cycle of the organisms, along the criteria developed for sedentary species.

C.2. International Environmental Law

Whereas the law of the sea, compared to other areas of international law, stands out by its high degree of codification in a unitary convention, there is no treaty in international environmental law with the same central and comprehensive role. To a higher degree, discussions on international environmental law relate to principles and other elements of customary law. In many cases these norms are codified, but with varying formulations across treaties. Accordingly, the investigation on rules applying to deep-sea bioprospecting in international environmental law will concern customary principles, in addition to treaty rules of the Convention on Biological Diversity.

C.2.1. General principles of international environmental law

Considering the multitude and proliferation of international treaties and cooperation within the field of international environmental law, it is in its modern form, a surprisingly novel field. The 1972 Stockholm Conference on Environment and Development has traditionally been described as the spark

that ignited modern international environmental law.[607] Even if the declaration did not use the term *sustainable development*, it has been widely regarded as laying the foundations for its subsequent acceptance as a core principle of international environmental law and policy.[608] The most widely accepted definition of sustainable development was expressed in the Brundtland Report of 1987:

> *Development that meets the needs of the present without compromising the ability of future generations to meet their own needs.*[609]

By articulating the concept of sustainable development, the Brundtland Report introduced an innovative concept into international law, with implications that hardly could have been foreseen at the time.

Not only did it introduce the concept of intra-generational responsibility; it also defined a number of challenges for civilization: population, food security, species extinction, genetic resources, energy production, industrial pollution and human settlement. Of course, all these challenges had been recognized before. The major contribution of the report was rather that it did not approach these topics in isolation but as part of a common agenda.[610]

[607] The conference was attended by 114 states, as well as the important international institutions and non-governmental organizations. The conference resulted in the Stockholm Declaration, containing 26 principles, an Action Plan containing 109 recommendations as well as three non-binding instruments, including a resolution on institutional and financial arrangements. This must strike any observer with experience of the relatively slow speed of contemporary multilateral cooperation in the environmental field as a remarkable achievement. Of the outcomes, the Stockholm Declaration was by far the most significant.

[608] BIRNIE, et al. 2009, at 53-54.

[609] Report of the World Commission on Environment and Development: Our Common Future. United Nations General Assembly document A/42/427 (1987). Report of the World Commission on Environment and Development: Our Common Future. United Nations General Assembly document A/42/427 (1987).

[610] Even more radical in its ambition, the institutional and legal analysis of the report challenged the fundaments of the global economy, the managing of global commons, as well as established truths on the interplay between peace, security and development. Among the key challenges for the development of international law identified in the report, areas beyond national jurisdiction were described.

Importantly, the Brundtland Report did not merely provide a broadly accepted definition of sustainable development. It also drew a map suggesting how to achieve it. To a surprisingly high degree, subsequent development of international law in the field followed this map.

Sustainable development has been at the center of this development.[611] As a consequence, the central rules in international environmental law applying to genetic resources reflects the sustainable development principle. Closely related to the notion of sustainable development is the *principle of intergenerational equality*, which can also be traced back to the Stockholm conference. Essentially intergenerational equality implies an idea of fairness, which requires "that present generations not leave future generations worse off by the choices we make today regarding the environment."[612] Current generations must thus, under this principle, ensure that they use natural resources sustainably and avoids irresponsible environmental damage.

How, then, do the key outcomes of the Stockholm conference – the principles of sustainable development and intergenerational equality – apply to deep-sea bioprospecting? Firstly, and most evidently, they entail that short-sighted exploitation in disregard of long-term preservation should be prevented. This implies regarding open-access rules based on commons principles as unviable, unless conservation is ensured. Secondly, the integration of social and economic objectives, as will be further discussed in Part D.2, calls for an instrumental perspective of genetic resources, emphasizing their potential as a means to promote economic development. As will be discussed below, these perspectives of conservation and the instrumental value in fostering economic development are central elements in the rules on genetic resources of the Convention of Biological Diversity, which thus reflect the outcome and agenda set by the Stockholm conference and the Brundtland declaration. Indeed, described in the Brundtland Report, the principles are not only philosophical but instrumental in their ambitions.[613]

[611] It was at heart of the outcomes of the 1992 United Nations Conference on Environment and Development in Rio de Janeiro, as well as the development of treaties such as the Convention on Biological Diversity. WARNER. 2009, at 275.

[612] David Hunter, et al., International Environmental Law and Policy (Foundation Press 5 ed. 2015);Leary. 2010, at 31.

[613] Moreover, developing international law relating to areas beyond national jurisdiction is explicitly mentioned as an ambition. WARNER. 2009.

Another central reference point when discussing the relationship between human activities and the environment is the *precautionary principle*. The most generally accepted definition of the Precautionary Principle is that contained in Principle 15 of the Rio Declaration:

> *In order to protect the environment, the precautionary approach shall be widely applied by States according to their capabilities. Where there are threats of serious or irreversible damage, lack of full scientific certainty shall not be used as a reason for postponing cost-effective measures to prevent environmental degradation.*[614]

The principle has been reflected in extensive state practice, numerous international treaties and other sources of international, as well as domestic law. However, there has not been general agreement as to whether it should become part of customary international law.[615] Moreover, the material content of the precautionary principle also remains debated. It appears to be at least relatively widely agreed that the precautionary principle alters the burden of proof from those who, based on environmental concerns, oppose a proposed activity, to those who want to conduct such activity.[616] The principle has attained a particularly important role in cases where there are scientific uncertainties and legal gaps, as in the case of activities relating to deep-sea biodiversity. In essence, the call for precaution increases with the level of uncertainty and is accordingly higher in the parts of the biosphere that are less known, such as the deep seas.

These three legal concepts are described as *principles*. This indicates some level of legal standing.

[614] Report of the World Commission on Environment and Development: Our Common Future. United Nations General Assembly document A/42/427 (1987).

[615] It does at least not seem to be universally accepted. International courts and tribunals have refrained from explicitly conferring it such status. See the Southern Bluefin Tuna, New Zealand v Japan, Provisional Measures, ITLOS Case No 3, (1999) 38 ILM 1624, ICGJ 337 (International Tribunal for the Law of the Sea 27 August).

[616] However, far from everyone agrees with the view that the principle has the power to turn the burden of proof on its head. Some observers contend that it is more appropriate to describe the legal effect of the principle as merely raising the requirement of proof. See Daniel Bodansky, *Precaution*, *in* The Oxford Handbook of International Environmental Law (Jutta Brunnée, et al. eds., 2008).

A fourth concept, which is an equally relevant point of reference, albeit one with a considerably vaguer legal status, is the *ecosystem approach*. Perhaps it is not even appropriate to describe it as a legal principle, but rather as a way of reasoning legally. At the heart of the concept lies a holistic ambition, to look beyond the needs of individual species or locations, and consider the broader systems. This has been formulated in various ways across different instruments.[617] Compared to general international environmental law, the law of the sea was early in incorporating the ecosystem approach in treaties. When the UN Fish Stocks Agreement (UNFSA) was negotiated in the 1990s, the ecosystem approach, which is lacking in UNCLOS, was not merely transposed; indeed, it appears to have been one of the motivations for the treaty.[618] Similarly, the ecosystem approach can be retrieved in both regional seas convention instruments as well as agreements forming regional fisheries management organizations.[619] The law of the sea, in both multilateral and regional agreements, thus calls for an application of the ecosystem approach. This implies an emphasis on integrated ecological dimensions.

[617] Under the auspice of the CBD, the concept of the ecosystem approach was specified in the 1998 Malawi principles. Workshop on the Ecosystem Approach (Lilongwe, Malawi, 26-28 January 1998), whose report was presented at the Fourth Meeting of the Conference of the Parties to the Convention on Biological Diversity (Bratislava, Slovakia, 4-15 May 1998, UNEP/CBD/ COP/4/Inf.9).

[618] Consider, in particular its preamble: "Conscious of the need to avoid adverse impacts on the marine environment, preserve biodiversity, maintain the integrity of marine ecosystems and minimize the risk of long-term or irreversible effects of fishing operations." Moreover, the ecosystem approach found its way into the treaty's general principles, as formulated in Article 5: "(d) assess the impacts of fishing, other human activities and environmental factors on target stocks and species belonging to the same ecosystem or associated with or dependent upon the target stocks (…) (g) protect biodiversity in the marine environment;" The UNFSA thus places an obligation upon coastal states and states fishing on the high seas to protect biodiversity in the marine environment. Tanaka, The International Law of the Sea. 2012, at 237.

[619] The Biodiversity Committee of the 1992 Convention for the Protection of the Marine Environment of the North-East Atlantic (OSPAR) defined the approach as: "*the comprehensive integrated management of human activities based on the best available scientific knowledge about the ecosystem and its dynamics, in order to identify and take action on influences which are critical to the health of marine ecosystems, thereby achieving sustainable use of ecosystem goods and services and maintenance of ecosystem integrity.*" Meeting of the Biodiversity Committee (BDC), Dublin, 20-24 January 2003, Summary Record BDC 2003, BDC 03/10/1-E, Annex 13, p. 1, para. 6.; Article 4(a) of the 2006 Southern Indian Ocean Fisheries Agreement provides that "*measures shall be adopted on the basis of the best scientific evidence available to ensure the long-term conservation of fishery resources, taking into account the sustainable use of such resources and implementing an ecosystem approach to their management*."; id. at 237-239.

However, whereas application is concerned, at least four major points of objection have been raised.[620] Firstly, there appears to be ambiguities in the material content of the approach. Since there is a lack of principles for deciding specific measures to conserve species, the ecosystem approach may be interpreted differently based on context. Likewise, it appears dubious whether the approach effectively legally constrains the behavior of states, in other words, to what extent states actually consider the ecosystem approach in decision making. Secondly, it appears questionable whether the ecosystem approach can be regarded as an independent rule for adjudication. It is a presumption under the ecosystem approach that decisions on appropriate measures should be based on considerations relating to scientific, political, economic, and social factors which essentially are matters for national policy. Any international examination of individual states' application of the ecosystem approach is thus rendered difficult. Thirdly, and especially relevant for the purposes of this investigation, questions arise with regard to the compatibility of conservation measures on the basis of the ecosystem approach between marine spaces within and beyond national jurisdiction. Fourthly, as far as the instruments under the law of the sea are concerned, the ecosystem approach appears to lack precision in some important respects, for instance in terms of how to delimit ecosystems.

Some guidance and perhaps even clarity on these important questions can be provided by retreating to the instruments of general international environmental law. The conference of parties to the Convention on Biological Diversity has established a definition of the ecosystem approach, connecting it strongly to sustainable development, scientific aspects and adaptability.[621]

[620] Yoshifumi Tanaka, Zonal and Integrated Management Approaches to Ocean Governance: Reflections on a Dual Approach in International Law of the Sea, 19 THE INTERNATIONAL JOURNAL OF MARINE AND COASTAL LAW (2004), at 483-514.

[621] See decision V/6 of the 2000 conference of parties to the Convention on Biological Diversity "(1). The ecosystem approach is a strategy for the integrated management of land, water and living resources that promotes conservation and sustainable use in an equitable way. Thus, the application of the ecosystem approach will help to reach a balance of the three objectives of the Convention: conservation; sustainable use; and the fair and equitable sharing of the benefits arising out of the utilization of genetic resources. (2). An ecosystem approach is based on the application of appropriate scientific methodologies focused on levels of biological organization, which encompass the essential structure, processes, functions and interactions among organisms and their environment. It recognizes that humans, with their cultural diversity, are an integral component of many ecosystems. (3). This focus on structure, processes, functions and interactions is consistent with the definition of "ecosystem" provided in Article 2 of the Convention on Biological Diversity: "'Ecosystem' means a dynamic complex of plant, animal and micro-organism communities and their non-living environment interacting as a functional unit." This definition does not specify any particular spatial unit or scale, in contrast to the Convention definition of "habitat" Thus, the term "ecosystem" does not, necessarily, correspond to the terms "biome" or "ecological zone", but can refer to any functioning unit at any scale. Indeed, the scale of analysis and action should be determined by the problem being addressed. It could, for example, be a grain of soil, a pond, a forest, a biome or the entire biosphere. (4). The ecosystem approach requires adaptive management to deal with the complex and dynamic nature of ecosystems and the absence of complete knowledge or understanding of their functioning. Ecosystem processes are often non-linear, and the outcome of such processes often shows time-lags. The result is discontinuities, leading to surprise and uncertainty. Management must be adaptive in order to be able to respond to such uncertainties and contain elements of "learning-by-doing" or research feedback. Measures may need to be taken even when some cause-and-effect relationships are not yet fully established scientifically. (5). The ecosystem approach does not preclude other management and conservation approaches, such as biosphere reserves, protected areas, and single-species conservation programmes, as well as other approaches carried out under existing national policy and legislative frameworks, but could, rather, integrate all these approaches and other methodologies to deal with complex situations. There is no single way to implement the ecosystem approach, as it depends on local, provincial, national, regional or global conditions. Indeed, there are many ways in which ecosystem approaches may be used as the framework for delivering the objectives of the Convention in practice."

Irrespective of the challenges in practical application, the ecosystem approach, at least as a concept, must be regarded as an important reference point when discussing the legality of bioprospecting marine genetic resources. Regarding organisms targeted in bioprospecting not as individual species but as part of broader ecosystems calls for adaptive and more holistic management approaches.

C.2.2. The Convention on Biological Diversity

C.2.2.1. Marine Genetic Resources under the CBD

Whereas general principles of international environmental law may provide some indication of what norms states should consider in relation to deep-sea genetic resources, codified rules provide more precise obligations. Although international environmental law lacks a convention with the comprehensive scope UNCLOS has for the law of the sea, the 1992 Convention on Biological Diversity (CBD), which entered into force in 1993, has at least a central role

as regards genetic resources.[622] The position of the CBD in relation to the broader regime of international law is more comparable to the role of the TRIPS agreement in relation to WTO law, as will be discussed in the next section.[623] The CBD contains extensive provisions on different aspects of biodiversity conservation, which in part develops customary principles. Of central important for the purpose of bioprospecting, it addresses the issue of sovereign rights and legal claims to genetic resources. Already among the objectives formulated in Article 1 it is made clear that the CBD sets out not only to provide rules for genetic resources, but to do so with the explicit aims of ensuring sustainable use, equitable sharing of benefits and technology transfer. The purpose of the convention is thus not limited to the protection of biodiversity. In addition to the conservation of biological diversity, the sustainable use of its components and the fair and equitable sharing of the benefits derived from the utilization of genetic resources are set out as primary objectives.

By obliging state parties to adopt and implement the principle of sustainability in the use of biological resources, the CBD reflects an integrated approach for the protection of biological diversity, which encompasses both the conservation of biological resources and the protection of ecosystems, in the terrestrial as well as the marine environment.[624] Moreover, the definition of central concepts in the CBD reflects a focus on the ecosystem approach. According to Article 2, biological diversity means the variability among living organisms, including the diversity within species, between species and of ecosystems.

[622] The intention with the CBD was never to systematically codify all international environmental law in one treaty. International environmental law is thus more disintegrated than the law of the sea and codified rules are found in many different treaties.

[623] In relation to the regime of international trade law, TRIPS is only one of a number of treaties. However, since the central treaties were negotiated in concert during the same Marrakech round, the regime remains more coherent than international environmental law. Another obvious deficit in comparison with the law of the sea and international trade law is that international environmental law lacks a dedicated dispute settlement body and process, with the ability to provide coherence., see Alan Boyle, *Relationship Between International Environmental Law and Other Branches of International Law*, *in* THE OXFORD HANDBOOK OF INTERNATIONAL ENVIRONMENTAL LAW (Daniel Bodansky, et al. eds., 2008).

[624] Wolfrum & Matz, Max Planck Yearbook of United Nations Law (2000), at 459.

In the context of the marine environment, it refers to the variability of organisms as indicated and to the diversity of the marine ecosystems in a state, a region or the world.[625] However, based on negotiation documents, it appears that the drafting phase almost exclusively focused on terrestrial biological diversity. Only late in the negotiating process were marine and coastal biodiversity introduced and even then they were not intensively discussed.[626]

In the same provision, the Convention also provides a precise definition of genetic resources, a considerable strength in comparison with UNCLOS. According to Article 2 of the CBD, "*genetic resources"* means "*genetic material of actual or potential value*." It further defines "*genetic material*" as "*any material of plant, animal, microbial or other origin containing functional units of heredity.*"

The definitions of genetic resources and genetic material are thus unconcerned with the use of the resource or material and make no exception for organisms traditionally used for purposes other than their genetic composition. This means that commercially targeted fish stocks are also encompassed by the definition of marine genetic resources. All marine species, regardless of taxonomic origin (animal plant, microbial or other) and size (whether microscopic or not), are considered a genetic resource under the convention.[627]

The convention also makes clear in Article 3 that it regards the legal status of genetic resources in line with the traditional understanding according to which natural resources are subject to the sovereignty of the state in whose territory they are located. The preamble of the convention proclaims that "*[s]tates have sovereign rights over their biological resources.*" The same concept, in slightly different language, is expressed in Article 15(2). If it is considered that the convention has been ratified by the vast majority of the states[628], that its text does not allow reservations (Article 37) capable of diminishing its normative character, the reasonable conclusion is that the CBD provides that states have the sovereign right to exploit natural resources within their territorial

[625] Christopher C. Joyner, *Biodiversity in the marine environment: resource implications for the law of the sea*, 28 VANDERBILT JOURNAL OF TRANSNATIONAL LAW (1995), at 635-638.

[626] Verhoosel, The International Journal of Marine and Coastal Law (1998), at 91.

[627] GUILLOUX. 2018, at 62.

[628] 196 states were parties to the CBD the 10th of December, 2020. (https://www.cbd.int/information/parties.shtml)

jurisdiction, including genetic resources.[629] Moreover, Article 15 affirms, as a part of this sovereign right, the authority to regulate foreign access to these resources, by public as well as private institutions.

Two mandatory principles govern access to genetic resources. Firstly, the access to genetic resources is subject to the prior and informed consent of the national authority of the state under whose territory or jurisdiction the resource is located (Article 15(3)). Secondly, the terms that authorize access are agreed upon between the provider state and the user (Article 15(4)). The content of the terms comprising the second principle is left to the discretion of the parties. Nonetheless, the terms should ensure that benefits arising from the economic exploitation of the resources are fairly and equitably shared between the user and the provider state (Article 15(7)). States are instructed to "*endeavour to create conditions to facilitate access to genetic resources*" by other states. The Convention also encourages the establishment of mutually agreed terms for access, transfer of technology under favorable terms, and the exchange of information (Article 15–18).

The convention thus calls upon states to facilitate access to genetic resources. Importantly, however, this should not be interpreted as an obligation for states to open up the genetic resources to outside actors. State sovereignty is maintained and there is no need for states to indicate reason for rejecting access. Still the request in Article 15 of the CBD marks a difference in relation to the rules in UNCLOS. Under the law of the sea, coastal state sovereignty over living resources in territorial waters or the exclusive economic zone is equally unconditional. However, under Article 62 of UNCLOS, states are under the obligation to give other states access to surplus in case the coastal state does not have the capacity to harvest the entire allowable catch.[630]

Due to the vagueness of the notion of "*fair and equitable sharing of benefits*," which the CBD does not define precisely, and considering that neither a model contract nor standard clauses are provided by the convention, the objectives of this part of the Convention were notoriously difficult to implement.

[629] Francioni, International Law for Biotechnology: Basic Principles. 2006, at 9-10.

[630] As discussed under section C.1.5, it is however very unlikely and appears not to have happened historically that coastal states in stock assessments have set maximum sustainable yield levels at higher levels than can be caught by domestic resources, and then allowed the surplus to be harvested by other states.

Indeed, practice demonstrates that the corresponding obligation was seldom fulfilled in the first decade after the entry into force of the convention.[631] In the central provisions in the benefit-sharing part of the CBD, the Clearing House mechanism, it was even explicitly stated that the parties should decide at a later date how it should be established.[632]

As a result, the CBD framework was subsequently expanded with the adoption of the Protocol on Access to Genetic Resources and the Fair and Equitable Sharing of Benefits Arising from Their Utilization ("Nagoya Protocol"), which aimed to ensure the implementation of the benefit-sharing elements of the CBD.

In addition to the benefit-sharing elements relating to genetic resources, Article 8 of the CBD imposes obligations on states to take steps to protect biological diversity *in situ* where possible. Amongst other things, the convention requires its parties to, as far as possible and as appropriate, maintain viable populations in natural surroundings. A "viable" population can be defined as one which maintains its genetic diversity, its potential for evolutionary adaptation and faces minimal risk of extinction from demographic fluctuations, environmental variation and potential catastrophe, including over-use.[633]

Preservation of the natural state is referred to in the Biodiversity Convention as "*in situ conditions*" or "*in situ conservation.*"[634] The conception that there is an inherent value in conservation *in situ* is central to CBD. The convention is based on the premise that biodiversity is best preserved in its natural state. Such steps might include establishing a system of protected areas, rehabilitating degraded ecosystems, and managing biological resources to ensure conservation and sustainable use. In the marine context, the CBD places responsibility for protection of biological variability in offshore areas squarely upon the shoulders of the coastal states.

[631] Bonfanti & Trevisanut, BROOKLYN JOURNAL OF INTERNATIONAL LAW (2011), at 206-207.

[632] See Article 18.3 of the CBD ("The Conference of the Parties, at its first meeting, shall determine how to establish a clearing-house mechanism to promote and facilitate technical and scientific cooperation.")

[633] Doc. UNEP/CBD/COP/2/12 para. 39.

[634] See Article 2 of the CBD.

In essence, the convention does not make any distinction between terrestrial and marine organisms in this regard, nor between marine and land areas under state jurisdiction.[635]

Moreover, the CBD establishes in Article 8 how this *in situ* conservation is to be ensured: states should establish a system of protection areas or areas where special measures need to be taken to conserve biological diversity and promote the protection of ecosystems, natural habitats and the maintenance of viable populations of species in natural surroundings. Contracting parties are also required to rehabilitate and restore degraded ecosystems and to promote the recovery of threatened species. These obligations have been referred to as an area where the CBD overlaps with the regime for management of living resources under UNCLOS. Both require states to enact management measures for living organisms. Under the CBD this obligation refers to the marine life in general under the principle of viable populations. Under UNCLOS it refers to harvested stocks only, which are to be managed according to the principles of optimum utilization and maximum sustainable yield.[636]

As a central element of the CBD, these obligations for the protection of biodiversity are balanced with a system aimed at ensuring that states which grants access to its genetic resources gain benefits derived from their use.[637] This bargaining element represents a trade off in the convention: states with genetic resources have accepted obligations to conserve them and ensure sustainable use in return for financial incentives. This intrinsic link between the conservation of genetic resources and the sharing of benefits from their use can be regarded as the engine of the CBD. It is built on the premise that biotechnological use of genetic resources will yield substantial incomes. Implicitly, biotechnology thus lies at the heart of the convention.

[635] Joyner, Vanderbilt Journal of Transnational Law (1995), at 649.

[636] Wolfrum & Matz, Max Planck Yearbook of United Nations Law (2000), at 465.

[637] See Arts 15, 16 and 19. Such benefits is not limited to monetary benefits but may also include participation in scientific research (article 15 para. 6); the fair and equitable sharing of research results (article 15 para. 7); participation in commercial and other benefits derived from genetic resources (article 15 para. 7); access to, and transfer of, technology making use of the genetic resources provided (article 16 para. 3) and access to the results and benefits arising from biotechnologies based upon genetic resources provided (article 19 para. 2). The providing of access for and transfer for technology that is relevant to the conservation and sustainable use of biological diversity (article 16 para. 1) has been described as "*not as a matter of benefit sharing but rather as an undertaking under the common responsibility of all States parties to promote the protection of biological diversity*", see id. at 460.

C.2.2.2. Scope of application

There is thus no shortage of obligations under the CBD with material implications for bioprospecting of marine genetic resources. However, there is a limitation in the scope of the convention which seemingly prevents its provisions from being directly applicable to bioprospecting of genetic resources in areas beyond national jurisdiction. This is because the territorial scope of the CBD, as articulated in Article 4(a), is limited to the national jurisdiction of its parties, insofar as components of biological diversity are concerned. As regards processes and activities carried out under the control or jurisdiction of its parties, on the other hand, the scope is, according to Article 4(b), universal and the convention applies irrespective of where the effects occur. The "processes and activities" referred to are, however, only those undertaken under the jurisdiction (not necessarily territorial) of the given state. The decisive element of Article 4(b) of the CBD is that it distinguishes between where the process or activity took place and the place of its impact.[638]

> **Article 4**
> *Jurisdictional scope*
> Subject to the rights of other States, and except as otherwise expressly provided in this Convention, the provisions of this Convention apply, in relation to each Contracting Party:
>
> (a) In the case of components of biological diversity, in areas within the limits of its national jurisdiction; and
>
> (b) In the case of processes and activities, regardless of where their effects occur, carried out under its jurisdiction or control, within the area of its national jurisdiction or beyond the limits of national jurisdiction.

This dual approach based on a distinction between components of biological diversity on the one hand and processes and activities on the other has been considered arbitrary by some observers.[639] There is, however, a rationale for this division, in that it reflects the twofold material scope of the convention. The CBD contains both provisions relating to benefits of genetic resources and provisions relating to sustainable use.

[638] Id. at 462.

[639] Lyle Glowka, A Guide to the Convention on Biological Diversity (IUCN Gland and Cambridge. 1994), at 27.

The jurisdictional scope in Article 4 is divided along the same lines. Moreover, the limitations of the scope of provisions on components of biological diversity to areas under national jurisdiction reflect the territorial sovereignty under the law of the sea, which enables coastal states to determine rules concerning management and use of resources within the maritime areas under their jurisdiction. As regards the global scope of effect of processes and activities, parallels can also be drawn to the law of the sea, which provides an obligation for states to protect and preserve the marine environment, including marine biological diversity and not to transfer damages or hazards from one jurisdictional area to another.[640]

This intricate regulation of the scope of application of the CBD has been subject to considerable debate. As regards the effect of processes and activities, it is undisputed that the CBD applies in areas beyond as well as within national jurisdiction, and that states ought to apply jurisdictional nexuses at their disposal to implement the obligations of the convention. With regards to components of biological diversity as regulated in paragraph (a), the situation appears less clear.

The reference to areas within national jurisdiction makes clear that the CBD applies to components of biological diversity in all areas within the limits of states' national jurisdiction – on land as well as at sea – and thus applies to the outer limits of the continental shelf and EEZ. It is, however, debated whether the reference implies that application to genetic resources beyond national jurisdiction is excluded. In this regard, some observers support a restrictive interpretation, claiming that the limitation of the jurisdictional scope regarding components of biological diversity in Article 4(a) precludes direct application to marine genetic resources in the water column of the high seas or on the deep seabed. Taken to its extreme, this would imply that there is no obligation under the CBD for states to provide for the protection of marine genetic resources in the high seas and the Area.[641] Other observers dispute this reasoning and argue in favor of an extensive interpretation, suggesting that it rather implies that state parties (only) may regulate the activities of their own nationals to achieve the objectives of the CBD.[642]

[640] WOLFRUM & MATZ, Conflicts in International Environmental Law. 2003, at 463.
[641] Proponents of this view includes Matz and Wolfrum, see id. at 471.
[642] Bonfanti & Trevisanut, BROOKLYN JOURNAL OF INTERNATIONAL LAW (2011), at 52.

As a result of the limitation of the scope of the CBD under the restrictive view, the regulation of marine genetic resources in areas beyond national jurisdiction would be left to other treaties – notably the UNCLOS regulations on the high seas and the Area, as discussed under section C.1.4. Supporters of the extensive view, on the other hand, do not dispute the validity of the UNCLOS regime, including the high seas freedoms. But in contrast to the restrictive view, they claim that states are able to exercise jurisdiction as regards marine bioprospecting also in these areas based on the customarily accepted application of extra-territoriality. Although the exercise of the freedom of the high seas is not limited to parties of UNCLOS, the basic presumption of flag state jurisdiction has attained customary status.[643] The implication of this requirement is that the vessel is subject to the exclusive jurisdiction of the flag state, which in turn is obliged to exercise "its jurisdiction and control" over it.[644]

Based on this concept of flag state jurisdiction, the argument goes, states could – and are ultimately obliged to – ensure that their vessels do not undermine their CBD obligations in any marine area.[645] The discussions within the CBD subsequent to the convention's entry into force also appear to support the view that the obligations of the state of nationality of private actors or even the state sponsoring the private activity apply in relation to activities in areas beyond national jurisdiction. Not only have issues relating to biodiversity conservation and management continuously been part of the working program; the scientific advisory body of the CBD[646] has even urged the parties to take measures to manage activities in deep-sea ecosystems to ensure conservation and sustainable use of resources, including reporting of measures taken.[647]

[643] On the requirement for vessels to fly flag, see UNCLOS Articles 90-91.
[644] See UNCLOS Article 92, CHURCHILL & LOWE. 1999, at 203.
[645] This discussion is complicated by the fact that many activities affecting marine genetic resources – and indeed bioprospecting itself – can be carried out by private as well as public actors. As already has been discussed, Article 15 of the CBD makes no distinction in this regard and international law also have clear criteria for the nationality of private actors. As far as the nationality of legal persons is concerned, the main international law criteria were stated by the Barcelona Traction, Light and Power Company, Limited (BeIgium v. Spain), ICJ Rep, ICJ GL 50 (International Court of Justice 5 February)
[646] Subsidiary Body on Scientific, Technical and Technological Advice of the CBD ("SBSTTA").
[647] 'Concerned about the threats to genetic resources in the deep seabed beyond national jurisdiction, requests Parties and urges other States, having identified activities and processes under their jurisdiction and control which may have significant adverse impacts on deep seabed ecosystems and species in these areas, as requested in paragraph 56 of decision VII/5, to take

Moreover, as will be discussed in the next section, the Nagoya Protocol recognizes the need to find an "*innovative solution*," addressing "*the fair and equitable sharing of benefits derived from the utilization of genetic resources … for which it is not possible to grant or obtain prior informed consent*." This expression seems to target marine genetic resources beyond national jurisdiction, supporters of the extensive have claimed, arguing that it presumes that the CBD applies indirectly to marine genetic resources in areas beyond national jurisdiction.[648]

In sum, it appears undisputed that the CBD applies to marine bioprospecting in areas beyond national jurisdiction as regards the effects of processes and activities. It appears less certain if the jurisdictional scope of the provisions on components of biological diversity applies in such areas.[649]

As such, as long as bioprospecting does not risk endangering the conservation of deep-sea organisms, or go against other environmental requirements set by the CBD, the convention appears to raise no hindrance to the sampling of genetic resources outside national jurisdiction.[650] Yet, it should be cautioned that even limited human involvement in deep-sea ecosystems could have a significant detrimental impact, as discussed in section B.4.

Some observers claim that this circumstance effectively means that the logic which otherwise underpins the CBD, the access to genetic resources as an incentive for their protection, is undermined, in at least two ways. Firstly, under the logic of the CBD, the interest in preserving biological resources beyond national jurisdiction decreases if there is no requirement for benefit sharing connected to access. Secondly, it indirectly distorts the system set up under the CBD and the Nagoya Protocol within national jurisdiction.

measures to urgently manage such practices in vulnerable deep seabed ecosystems with a view to the conservation and sustainable use of resources, and report on measures taken as part of the national reporting process.' (Eleventh Meeting of the Subsidiary Body on Scientific, Technological & Technological Advice [SBSTTA], Montreal, Canada, Nov. 28-Dec. 2, 2005, Recommendation XI/8: Marine and coastal biological diversity: conservation and sustainable use of deep seabed genetic resources beyond the limits of national jurisdiction, 4(c) (2005), available at http://www.cbd.int/recommendation/sbstta/?id=10967.)

[648] Bonfanti & Trevisanut, BROOKLYN JOURNAL OF INTERNATIONAL LAW (2011), at 213.

[649] In any event it appears clear that the rules on access to genetic resources has little relevance beyond national jurisdiction since they regulate situations of national sovereignty.

[650] Wolfrum & Matz, Max Planck Yearbook of United Nations Law (2000), at 471.

If bioprospecting can be carried out on the high seas without requirements for benefit sharing and technology transfer, as would have been required for resources under national jurisdiction, the functioning of the CBD system can be circumvented by consistently targeting resources beyond national jurisdiction. As a result, opportunities for making profits by preserving genetic resources within national jurisdiction would decrease, as would the incentives for states to protect genetic resources under their sovereignty.[651]

C.2.2.3. The Nagoya Protocol

By virtue of representing a treaty with the purpose of implementing certain parts of the Convention on Biological Diversity, it is logical that the Nagoya Protocol as a starting point reiterates the CBD declaration that states have sovereign rights over their natural resources, and the authority to determine access to their genetic resources in accordance with the applicable national legislation, on mutually agreed terms, and subject to the prior informed consent of the state providing access.[652]

The primary purpose of the Nagoya Protocol, as set out in Article 1, is to define the modalities according to which the parties shall enforce the principles of prior and informed consent and the fair and equitable benefit-sharing obligations, as set out in the CBD. It thus applies to genetic resources within the scope of Article 15 of the CBD, and also includes within its scope derivatives, which are defined as naturally occurring biochemical compounds resulting from the genetic expression or metabolism of biological or genetic resources, even if they do not contain functional units of heredity.[653] With regards to application, the protocol in Article 3 makes reference to the corresponding provision in the convention, as discussed in section C.2.2.

The benefits from genetic resources which are to be shared under the protocol are broadly formulated. According to Article 5, benefits may include monetary and non-monetary benefits. For resources originating within national jurisdiction, it is provided that these shall be shared in a fair and equitable way with the party providing such resources upon mutually agreed terms.[654]

[651] Verhoosel, The International Journal of Marine and Coastal Law (1998), at 102.

[652] See, in particular, the preamble of the CBD, as well as Articles 3 and Art. 19.

[653] CBD Article 2.

[654] The country of origin of such resources or a Party that has acquired the genetic resources in accordance with the Convention.

C.2.2.4. The bilateral benefit-sharing clearing house

The benefit-sharing mechanism for genetic resources under the Nagoya Protocol is built on the issuance of internationally recognized certificates by competent national authorities.[655] It provides for their notification to the *Access and Benefit-Sharing Clearing House*, a mechanism established by the Protocol, as an implementation of the Clearing House mechanism set out in Article 18.3 of the CBD.

Such certificates shall show that the genetic resource has been obtained, accessed, and used in accordance with prior informed consent, and that mutually agreed-upon terms have been entered into.[656] There is thus a formalized system under the protocol in cases where a country uses genetic resources retrieved within the national jurisdiction of another state.

C.2.2.5. The multilateral benefit-sharing mechanism

Article 10 of the Nagoya Protocol addresses issues that could not be resolved during the negotiation of the Protocol and for which further discussion was required. The provision calls on states to consider the need for and modalities of a global multilateral benefit-sharing mechanism.[657]

[655] CBD Article 6.3(e).

[656] CBD Article 6(3)(e) and 14(2)(c) The certificates shall contain basic information, such as the identities of the issuing national authority, the provider, and the user. Moreover, they shall specify the subject matter covered and the geographic location of the access activity, the uses permitted and the correspondent restrictions, as well as the conditions of transfer to third parties. Finally, the certificates shall contain a link to the mutually agreed terms regulating the benefit sharing. See CBD Article 17.4.

[657] Article 10 of the Protocol states that "Parties shall consider the need for and modalities of a global multilateral benefit-sharing mechanism to address the fair and equitable sharing of benefits derived from the utilization of genetic resources and traditional knowledge associated with genetic resources that occur in transboundary situations or for which it is not possible to grant or obtain prior informed consent. The benefits shared by users of genetic resources and traditional knowledge associated with genetic resources through this mechanism shall be used to support the conservation of biological diversity and the sustainable use of its components globally."

The mechanism is supposed to support the conservation of biological diversity and the sustainable use of its components globally, based on the sharing of benefits that arise from the utilization of genetic resources in transboundary situations or from uses for which it is not possible to grant or obtain prior informed consent.[658]

In substance, Article 10, which is yet to become practically operational, may come to involve obligations relevant for deep-sea bioprospecting: The mechanism implied would be of a "multilateral" character and thus distinct from the bilateral approach to access and benefit-sharing established by the CBD and the operational provisions of the Nagoya Protocol. The focus is on "*transboundary situations*" and also on situations "*for which it is not possible to grant or obtain prior informed consent*." This latter aspect has been interpreted broadly by some observers and more narrowly by others. In a broader interpretation, this provides a basis for arguing in favor of an unlimited temporal or geographical scope of the Nagoya Protocol. Under a narrower reading, it could help in resolving situations where genetic resources in user jurisdictions are of unclear origin or legal status, or perhaps it might also help in addressing benefit-sharing for material in ex situ collections.[659]

Depending on how and if this global arrangement under the Nagoya Protocol is implemented, it could be considered applicable to deep-sea bioprospecting. It can hardly be disputed that such activities represent clear cases of situations for which it is not possible to grant or obtain prior informed consent. However, it appears unclear if the geographic scope of a future operationalization of the multilateral benefit-sharing mechanism will extend to areas beyond national jurisdiction.[660]

[658] Therefore, notwithstanding the fact that many parties opposed the inclusion of marine genetic resources in the application of the Protocol, it eventually applies also to their exploitation. Bonfanti & Trevisanut, BROOKLYN JOURNAL OF INTERNATIONAL LAW (2011), at 217.

[659] Matthias Buck & Clare Hamilton, The Nagoya Protocol on Access to Genetic Resources and the Fair and Equitable Sharing of Benefits Arising from their Utilization to the Convention on Biological Diversity.(Report), 20 REVIEW OF EUROPEAN COMMUNITY & INTERNATIONAL ENVIRONMENTAL LAW (2011), at 60.

[660] Studies and submitted views in CBD discussions on Article 10 provide limited guidance in this regard. See https://www.cbd.int/abs/art10.shtml (site accessed November 15, 2020).

C.2.3. Conclusions on international environmental law

In conclusion, it appears that international environmental law, as foremost expressed in CBD, does not preclude deep-sea bioprospecting. Indeed, the generally liberal approach to the use of genetic resources in areas beyond national jurisdiction stands in stark contrast to the detailed regulation for genetic resources within national jurisdiction. General environmental obligations, as also expressed in the CBD, foremost the obligation to ensure in situ conservation of species, as well as arguably obligations relating to benefit-sharing, are, however, also relevant to bioprospecting in areas beyond national jurisdiction. Compared to the law of the sea, international environmental law thus appears to take a considerably more liberal approach, not only by being generally permissive towards deep-sea bioprospecting. Depending on how the multilateral benefit-sharing mechanism of the Nagoya Protocol becomes operationalized, it could involve obligations relevant for deep-sea bioprospecting, but there are no signs of a conclusion to these discussions in the near future. Under existing rules, the obligation on states to conserve biological diversity *in situ*, which also applies to processes and activities in areas beyond national jurisdiction, appears to be the most relevant for deep-sea bioprospecting. Parties to the CBD are thus required to ensure the protection, conservation and maintaining of viable populations in natural surroundings of organisms targeted and affected by bioprospecting operations in the deep seas.

C.3. International Trade Law

C.3.1. International Law and the Patenting of Biotechnology

Irrespective of how the term “marine genetic resources” should be defined legally, no observer would contest that it *ipso facto* refers to living resources. As has been established, the main value of, and indeed the reason for, exploiting such resources relates to the exploration of their genetic functions. Marine bioprospecting, in turn, involves an ambition to use the findings in the exploration for purposes of biotech innovation. In a commercial context, this implies an interest in protecting intellectual property gathered in this process.

Although biotechnology may appear as a relatively novel phenomenon, international law has at least attempted to settle the difficult questions on the patenting of inventions based on natural compounds for decades. In the area of intellectual property rights law, several different treaty co-operations have approached the issue. Of these, the World Trade Organization regulation in the Agreement on Trade-Related Aspects of Intellectual Property Rights (TRIPS) has exercised the greatest degree of influence on domestic legislation. As will be established, relevant rules in that treaty do not just relate to inventions based on biological material, including deep-sea genetic resources; they also provide obligations for the use of information and data applying to bioprospecting.

Depending on the type of marine bioprospecting related innovation, the genetic resource component in intellectual property can vary broadly. As discussed in Part B, in some cases, an innovation can have only part of its origin based in findings in a marine organism, which at a later stage has been sequenced or even modified in a laboratory environment, and then combined with other components to attain certain properties. In other cases, the innovation may lie much closer to the marine genetic source, essentially consisting of its functions or utilities. Where the actual bioprospecting development is done, and the extent to which the original marine genetic resource sample is an ingredient, are of great importance for the application of the law of the sea and biodiversity law frameworks. For intellectual property law application, however, this seems to be less important. As will be discussed, the conditions for intellectual protection rights law seem to be little concerned with the origin of biological components.

C.3.2. The WTO TRIPS

In international trade law, the central agreement for regulation of intellectual property rights is the TRIPS.[661] The agreement was negotiated and concluded as part of the Uruguay-round of trade agreements which founded the World Trade Organization. As of 2011, 153 states are members of the WTO and parties to TRIPS. Of these, approximately 130 are also parties to UNCLOS.[662]

---

[661] Agreement on Trade-Related Aspects of Intellectual Property Rights (TRIPS).

[662] Peter Van Den Bossche, The Law and Policy of the World Trade Organization : Text, Cases and Materials (Cambridge : Cambridge University Press. 2005), at 741.

TRIPS is thus broadly accepted among states, but it is not a comprehensive treaty which should be viewed in isolation. Rather, it ought to be regarded as the intellectual property rights component of a family of trade agreements, negotiated in parallel during the Uruguay round and entering into force by the finalization of the round and the resulting transformation of the GATT into the WTO. This also explains the widespread ratification by developing countries, in spite of their reluctance during the negotiation of intellectual property rights during the trade round: To become a member of the WTO, acceptance of all of the Uruguay Round agreements, including the TRIPS agreement was required.[663] Compared to international environmental law discussed in the previous section, WTO treaties collectively appears to function more coherently, with a formalized structure, which facilitate interpretation, including an elaborate dispute settlement system. Moreover, a major institutional advantage compared to both the law of the sea and international environmental law is that international trade law is anchored by a central organization with a clear mandate: the WTO secretariat.[664]

Although also other areas of intellectual property rights law are relevant for bioprospecting, private claims connected to genetic resources foremost connect to claims for exclusive rights based on patent law. In most biotechnology ventures, the prospects for lucrative patents is the driving force for bioprospecting, as discussed in Part B.

Patents confer on their holders more or less extensive and exclusive rights to offer their invention for sale, in exchange for publication of or information on their invention, including the right to exclude others from "*making, using, or selling or importing the protected invention into a jurisdiction where the patent protection is in force, or to charge others for any uses or purposes involving the protected invention within such jurisdiction*" (i.e. through licensing).[665]

[663] By accepting the Final Act Embodying the Uruguay Round and the WTO Agreement, states become parties to virtually all of the legal instruments negotiated during the round. See McLaughlin. 2010, at 376. The dynamic of the TRIPS negotiation and the reasons for acceptance by developing states in spite of their reluctance will be further discussed in section D.3.4.

[664] Boyle. 2008.

[665] Salpin & Germani, Review of European Community and International Environmental Law (2007), at 12-23.

Like many other treaties of international law, TRIPS establishes minimum levels of protection, and a significant degree of legal autonomy is left to the individual states. Similarly, the aim of TRIPS is not to create a unitary global regulation of patents. Rather, TRIPS provides a standardization of rules for intellectual property protection to help trade, i.e., to establish conditions in which intellectual property standards are harmonized to facilitate trade in (intellectual property rights) goods. In this way WTO Members will know what standards to expect when they trade their goods with other WTO Members.

TRIPS thus functions as a lowest common denominator for WTO Members in their implementation of patent laws. Still, patent law remains primarily a matter of national jurisdiction: national law must be in accordance with international obligations, such as TRIPS, but it is the patent law of the state where the patent was registered and granted that applies. The patent holder, therefore, can only enforce its rights to exclusive use in the jurisdiction where the patent has been registered.[666]

Article 8 of TRIPS lays down two principles that allow WTO Members to adjust intellectual property protection to particular concerns and to take appropriate measures within their jurisdiction. Firstly, members may, in formulating or amending their laws and regulations, adopt measures necessary to protect public health and nutrition, and to promote the public interest in sectors of vital importance to their socio-economic and technological development, provided that such measures are consistent with the provisions of TRIPS. Secondly, states can take appropriate measures, provided that they are consistent with the provisions of TRIPS, to prevent the abuse of intellectual property rights by right holders or prevent the resort to practices which unreasonably restrain trade or adversely affect the international transfer of technology.

The agreement's pivotal Article 27 states that unless one of the specified exceptions apply, patents should "*be available for any inventions, whether products or processes, in all fields of technology, provided that they are new, involve an inventive step and are capable of industrial application*."

[666] Petra Drankier, et al., *Marine Genetic Resources in Areas beyond National Jurisdiction: Access and Benefit-Sharing*, 27 The International Journal of Marine and Coastal Law (2012), at 386.

Some authors have questioned whether inventions derived from marine genetic resources fulfil patenting criteria, in particular whether they can be considered as novel under the wording of TRIPS.[667] This is connected to the position that in particular many developing states maintained during the negotiation of TRIPS, that the patenting of genetic functions should be rejected, not only because it would be inappropriate to allow for the patenting of nature but also because such functions have been developed by evolution rather than humans, as will be further discussed in section D.3.[668] The mainstream of observers however consider the highly technical and knowledge intensive processes discussed in Part B used to screen, identify and reproduce genetic materials capable of commercial use fulfil the requisites in Article 27.[669] In addition, there are procedural requirements for patent applications in Article 29: "*an applicant for a patent shall disclose the invention in a manner sufficiently clear and complete for the invention to be carried out by a person skilled in the art.*"

Once a patent has been granted, it endows its owner with a series of exclusive rights. According to Articles 28 and 33, this protection enables the owner of the patent for at least twenty years from the filing date, to prevent third parties, not expressly authorized to the contrary, from making, using, offering for sale, selling, or importing the product or the process covered by patent. Patent protections were thereby significantly strengthened by TRIPS.[670] Regarding benefit-sharing, TRIPS does not appear to limit or condition the rights conferred on the patent owner with requirements to share benefits. Conversely, the owner is bestowed exclusivity. It is up to the owner to which extent the exclusive rights conferred on the patent holder are to be shared with others. In the wording of Article 28(2), patent owners have the right to assign, or transfer by succession, the patent and to conclude licensing contracts.

[667] Kirsten E. Zewers, Bright Future for Marine Genetic Resources, Bleak Future for Settlement of Ownership Rights: Reflections on the United Nations Law of the Sea Consultative Process on Marine Genetic Resources, 5 Loyola University Chicago International Law Review (2008).

[668] Carrie P. Smith, *Patenting life: the potential and the pitfalls of using the WTO to globalize intellectual property rights*, 26 North Carolina Journal of International Law and Commercial Regulation (2000), at 146.

[669] McLaughlin. 2010.

[670] See Article 33 of TRIPS.

At first glance it appears that the parties to TRIPS are obliged to uphold intellectual property rights for inventions based on marine genetic resources in areas beyond national jurisdiction. There seems to be no hindrance to base patents on such resources. Moreover, there appears to be no compulsory requirement to share benefits under the agreement.

C.3.3. Patentability of Biotechnology

However, the interpretation of the obligation to patent "*any inventions*" raises many important policy issues, such as the extent to which parties are bound to confer patent rights over discoveries, particularly over substances found in nature such as genes.

> **Article 27**
>
> *Patentable Subject Matter*
>
> 1. Subject to the provisions of paragraphs 2 and 3, patents shall be available for any inventions, whether products or processes, in all fields of technology, provided that they are new, involve an inventive step and are capable of industrial application(…)
>
> 2. Members may exclude from patentability inventions, the prevention within their territory of the commercial exploitation of which is necessary to protect ordre public or morality, including to protect human, animal or plant life or health or to avoid serious prejudice to the environment, provided that such exclusion is not made merely because the exploitation is prohibited by their law.
> 3. Members may also exclude from patentability:
>
> (a) diagnostic, therapeutic and surgical methods for the treatment of humans or animals;
>
> (b) plants and animals other than micro-organisms, and essentially biological processes for the production of plants or animals other than non-biological and microbiological processes. However, Members shall provide for the protection of plant varieties either by patents or by an effective sui generis system or by any combination thereof. The provisions of this subparagraph shall be reviewed four years after the date of entry into force of the WTO Agreement.

Although it is regularly argued that Article 27.1 is intended to permit the patentability of any subject matter that meets the patentability criteria, the text employs the substantive notion of "invention," which is rather imprecise.

If a broader scope was intended, some observers contend, another less ambiguous formulation could have been used, such as "any *subject matter* that is new, involves an inventive step and is capable of industrial application." In any event, parties to TRIPS are not obliged to grant patents to what is not ordinarily considered an "invention." But since the agreement only establishes minimum standards, parties to TRIPS can adopt a more generous approach domestically.[671]

Moreover, by virtue of paragraphs 2–3 of Article 27, it is clear that there are three permissible exceptions to the rule on patentability: (1) for inventions contrary to *ordre public* or morality (including inventions dangerous to human, animal or plant life or health or seriously prejudicial to the environment); (2) for diagnostic, therapeutic, surgical methods for the treatment of human beings and animals; and (3) for plants and animals other than micro-organisms and biological processes for the production of plants or animals other than non-biological and microbiological processes. It is important to note that although states may exclude plants and animals from patentability, micro-organisms cannot be excluded. This is of particular relevance to deep-sea bioprospecting since a large part of the genetic resources identified in Part B as relevant in such projects are considered as micro-organisms.

It follows that marine genetic resources considered as micro-organisms not only are patentable under TRIPS but in fact cannot be excluded from patentability. It should also be underlined that in order for the other categories of organisms referred in paragraph 3 to be exempted from patentability, states would have to make a formal exception. In lack of such a declaration, the general rule of patentability applies.

The WTO's dispute settlement system has so far not rendered a conclusive interpretative explanation of the criteria in Article 27. Domestic implementation also varies. Still, some general observations can be made on how inventions based on bioprospecting relate to these requirements.

[671] Carlos Correa, Trade related aspects of intellectual property rights: a commentary on the TRIPS agreement (2007), at 272.

Firstly, paragraph 2 of Article 27 enables member states to exclude certain inventions from patentability, namely those relating to "*the commercial exploitation of which is necessary to protect ordre public or morality including the protection of human, animal or plant life or health or to avoid serious prejudice to the environment*."[672] This implies mandatory rules, where application cannot be neglected. *Ordre public*, in this context, refers to basic values prevailing in society, including interests such as public safety, the physical integrity of individuals, and the protection of the environment. *Morality,* on the other hand, is based on ethical norms accepted and deeply rooted in a specific culture.[673] Article 27(2) does not enable parties to TRIPS to obstruct certain technological developments or prohibit the exploitation of research results within the context of patent law, by prohibiting exploitation. It is only the patenting of such inventions that can be hindered under this provision, provided that the party in question also refrains from exploitation of such inventions. This is the result of two mechanisms built in Article 27.2: Firstly, the explicit requirement for a ban on commercial exploitation in the relevant member country; and, secondly, that such prohibition is necessary in order to protect the interests described in detail in Article 27.2.[674] Secondly, parties are enabled to prevent patentability of "*diagnostics, therapeutic, and surgical methods for the treatment of humans and animals*".[675] Thirdly, and of central importance in the context of deep-sea bioprospecting, Article 27 provides in paragraph 3(b) a particularly detailed possibility for excluding patentability relating to biotechnology. Members may exclude from patentability "*plants and animals other than micro-organisms*" as well as "*essentially biological processes for the production of plants or animals other than non-biological and microbiological processes*."

This exception significantly affects certain types of biotechnology, such as hybridisation or biogenetically-engineered crops and livestock. It does however not exempt the molecular screening and manufacturing processes involved in screening and designing pharmaceuticals and other biotechnological products, as discussed in Part B.

[672] …provided that such exclusion is not made merely because the exploitation is prohibited by their law.

[673] Bonfanti, European journal of risk regulation (2012).

[674] Daniel J. Gervais, The TRIPS Agreement: Drafting History and Analysis (Thomson Reuters 4 ed. 2012), at 434-435.

[675] See paragraph 3(a).

Many observers have considered the multi-sequenced processes involved in screening and designing pharmaceuticals and other commercial products from marine genetic resources as clearly patentable under Article 27.[676]

It is important to point out that TRIPS does not require its parties to preclude the patenting of biological material or biotechnological inventions relating to the categories for which exceptions are provided. Rather, states are free, if they desire, to prevent patentability for the species and processes for which paragraph 3(b) enables exception. However, the last part of Article 27(3) sets outer limits in this regard, effectively functioning as an exception to the exception, implying that inventions relating to '*micro-organisms*' as well as a "*microbiological process or other technical process or the product of such a process*" may not be excluded from patentability.[677] Since there is no generally agreed definition of the different types of species and biological processes referred in TRIPS Article 27, states appear to have considerable discretion in interpreting what organisms fall within the scope of these categories, for which the parties to TRIPS must allow patenting.[678] The exceptions in Article 27(3) have been collectively described as more "focused" exceptions that do not need to be justified in the same way as exceptions under Article 27(2). The only condition here is to qualify for the category mentioned. Interestingly for the purposes of this study, exceptions which have been made on the basis of this paragraph relate primarily to concerns in relation to biotechnological inventions. Largely, justifications for applying such exceptions can be divided into two groups: firstly, the reason for such exclusions may be ethical or moral, as is the case in certain European countries; secondly, and notably claimed by developing countries, are arguments relating to biodiversity and the appropriation of genetic resources.[679]

Thus, TRIPS generally grants its parties discretion to determine within its sovereignty which inventions, including biotechnology, to prevent from patentability based on *ordre public* or moral concerns.

[676] See McLaughlin. 2010;Smith, North Carolina Journal of International Law and Commercial Regulation (2000).
[677] Lionel Bently, Intellectual property law (Brad Sherman ed., Oxford: Oxford University Press 4. ed. ed. 2014), at 499.
[678] Correa & Yusuf. 2016, chapter 8.
[679] See, for a discussion on the difference between such exceptions Gervais. 2012, at 442-443.

In particular, states may prevent the patentability of the active functions of organisms relevant in bioprospecting, with the exception of micro-organisms, as well as non-biological and microbiological processes. Most but far from all of the genetic resources identified in contemporary marine bioprospecting in the review in Part B would fall within the "*micro-organism*" or "*microbiological process or the products thereof*" categories. At least organisms involved would be considered as such under a conventional biological understanding.[680] Accordingly, states are by virtue of TRIPS under obligation to enable patentability of inventions relating to such genetic resources.[681] Conversely, there is nothing preventing parties to TRIPS excluding from patentability inventions relating to higher species and processes not considered as non-biological or microbiological.[682]

From a functional perspective, this approach to biotechnological patents in TRIPS has been criticized. Foremost, exclusions from patentability in one state may be bypassed by filing patents for biotechnology in less restrictive jurisdictions. From the perspective of commercial bioprospecting interests, this possibility would appear especially attractive given that advanced industrial economies, which also represent the most important patent jurisdictions, do not raise objections to biotechnological patents based on subject matter relevant for deep-sea bioprospecting, as will be discussed in section C.3.5. Furthermore, the semantic uncertainty connected to the categories of species and processes may make it difficult to challenge how patentable subject matter is regarded in domestic law.[683]

C.3.4. Disclosure of marine genetic origin

When applying for patent protection, the applicant must under Article 29 of TRIPS disclose the invention in a manner sufficiently clear and complete for the invention to be reproduced by a person skilled in the art.

[680] Zewers, Loyola University Chicago International Law Review (2008).
[681] There is however little reason to suspect that states stretching these terms to exclude a broader scope of biotechnology from patentability would be challenged.
[682] Zewers, Loyola University Chicago International Law Review (2008), at 164.
[683] Giuseppe Cataldi, *Biotechnology and Marine Biogenetic Resources: The Interplay between UNCLOS and the CBD*, *in* Biotechnology and International Law (Tullio Scovazzi & Francesco Francioni eds., 2006); Francioni, International Law for Biotechnology: Basic Principles. 2006, at 22;

The applicant may also be required to indicate the best mode for carrying out the invention known to the inventor at the filing date, or, where priority is claimed, at the priority date of the application.

This requirement may raise difficulties for bioprospecting generally, since it is often easier to identify the effect or application of a bioactive function than its basic mechanism. Moreover, this may raise challenges where basic taxonomy is difficult to distinguish, which is not uncommon in the context of little-explored deep-sea organisms. To meet patentability requirements, the inventor must disclose the invention fully, so that others reading the patent document will have enough information to reproduce the invention. This may entail, for instance, giving the full botanical name of plants used in the claimed invention, or references to deposits of micro-organisms in recognized international collections.[684] Since some recently discovered marine genetic resources have unique properties and their taxonomy has not been settled, establishing a sufficiently precise reference in a patent document can be problematic.[685] As things currently stand, there is no explicit requirement for disclosure of origin of genetic material. Under TRIPS, there is thus no obligation for states to set requirements in patent applications for disclosure of geographic origin of marine genetic resources. Discussions about introducing such a requirement have been ongoing within the World Intellectual Property Organization (WIPO) for more than a decade without any concrete measures materializing.[686]

Effectively, this enables states to have permissive patent rules relating to bioprospecting of deep-sea genetic resources. For some types of genetic resources, in particular micro-organisms, as discussed above, parties to TRIPS are even bound to allow patenting. Similarly, TRIPS sets no requirement to disclose geographic origin in patent data.

[684] Procedures for this is provided in the Budapest Treaty, Budapest Treaty on the International Recognition of the Deposit of Microorganisms for the Purposes of Patent Procedure.

[685] Zewers, Loyola University Chicago International Law Review (2008).

[686] The WIPO Intergovernmental Committee on Intellectual Property and Genetic Resources, Traditional Knowledge and Folklore has compiled a table over regulations in different member states, WIPO Intergovernmental Committee on Intellectual Property and Genetic Resources, Traditional Knowledge and Folklore - Genetic Resource Disclosure Requirements Table. (2017); Leary, et al., MARINE POLICY (2009).

As will be further evaluated in Part E, this may be interpreted as inconsistent with the perspective of deep-sea genetic resources provided by UNCLOS and the CBD. It also raises practical challenges. For instance, in the myriad of cases where a species may occur in many jurisdictions, it is difficult to ascertain if a patent applicant has violated the rights of other states by using genetic resources within their sovereignty. Similarly, in lack of a requirement for disclosure of genetic origin, it is difficult to establish to what degree bioresources from areas beyond national jurisdiction are used in applications, as was shown in section B.6.[687]

C.3.5. State practice

Under traditional concepts of intellectual property rights law, bioprospecting is difficult to characterize, in particular in relation to the traditional division between scientific discoveries and inventions. States have taken different approaches in this regard.[688] States have regarded the patenting of genetic resources differently under discovery and invention-criteria.[689] The patent law of most countries comprises three basic requirements for determining whether a claimed innovation is possible to patent. These are that the invention, whether it is in relation to a product or a process, must be: new (or novel); involve an inventive step (or not be obvious); and be capable of industrial application (or have utility).[690]

[687] As discussed in section B.6, several studies of geographic origin for marine genetic resources in bioprospecting based on patent application data have been conducted, but the results are inconclusive as the result of the lack of requirement for geotagging in important jurisdictions. This does not only make it difficult to ascertain whether the result are conclusive, it is also difficult to ascertain statistically representativity. See, as discussed in section B.6 for instance Oldham. 2014.; RACHEL WYNBERG, MARINE GENETIC RESOURCES AND BIOPROSPECTING IN THE WESTERN INDIAN OCEAN: WESTERN INDIAN OCEAN (2016).

[688] Smith, North Carolina Journal of International Law and Commercial Regulation (2000), at 146-147.

[689] The Nuffield Council, a UK-based independent charitable body, which examines and reports on bioethical issues raised by new advances in biological and medical research, has stated that: "*genes are naturally occurring entities that are there to be discovered, like new species or new planets. They are not invented. In our common usage of the term, a "discovery" is the acquisition of knowledge of a new nut already existing fact about the world. An "invention", on the other hand, is something that someone creates or develops which did not previously exist. Thus, on the usual interpretation of the words, it seems apparent that the identification of a gene is a discovery, since genes exist in the world, in our bodies.*" *THE ETHICS OF PATENTING DNA (Nuffield Council on Bioethics. 2002)*, at 23.

[690] WIPO, WIPO Intellectual Property Handbook (WIPO Publication. 2004).

However, even if these requisites are similarly formulated across jurisdictions, they have been differently applied in relation to biotechnology. As discussed in Parts A and B, the general trend across different jurisdictions is that patent protection for biotechnological innovations has been increasing over the past few decades.[691]

As regards patentable subject matter, states have generally pursued different courses based on the possibility of making exceptions to patentable subject matter under TRIPS Article 27. With regards to the possibility of precluding patentability applied for ethical or moral considerations, the European Union has made reference to this ground in rejecting imports and patenting of genetically modified organisms.[692] Developing countries have used this provision to prevent patentability on biological resources, justified by biodiversity interests and the prevention of appropriation of genetic resources.[693] Some have explicitly claimed incompatibility of Article 27 of TRIPS with the CBD as the reason for their derogation.[694] As regards the different categories of organisms in paragraph 3, approaches appear to be largely divided across north-south lines.

In EU patent law, it is made clear that an invention shall not be considered unpatentable solely on the ground that it concerns a product consisting of or containing biological material or a process by which biological material is produced. More specifically, the European Patent Convention states that it is possible to patent inventions for plant and animals, so long as they comply with the general requirements of patentability.[695]

691 OECD, Genetic Inventions, Intellectual Property Rights and Licensing Practices: Evidence and Policies. 2002.

692 GERVAIS. 2012, at 224.

693 The status of such general exceptions to biotechnology patents in apparent inconsistency with paragraph 3 has not yet been judicially decided. Rohini Acharya, *Patenting of Biotechnology: GATT and the Erosion of the World's Biodiversity*, 25 JOURNAL OF WORLD TRADE (1991); Andrew T. Mushita & Carol B. Thompson, *Patenting Biodiversity? Rejecting WTO/TRIPS in Southern Africa*, 2 GLOBAL ENVIRONMENTAL POLITICS (2002); Arvind Subramanian, *Genetic Resources, Biodiversity and Environmental Protection - An Analysis, and Proposals Towards a Solution*, 26 JOURNAL OF WORLD TRADE (1992).

694 GERVAIS. 2012, at 420-458. The compatibility of these treaties will not be examined here but under Part E.

695 See Article 3, Directive 98/44/EC of The European Parliament and of the Council of 6 July 1998 on the Legal Protection of Biotechnological Inventions (Biotech Directive) ; BENTLY. 2014, at 499.

In 1998 the EU Biotech Directive[696] was approved, banning patenting of the human genome, including modifications thereof.[697] In relation to non-human genetic resources, as will be further discussed in section D.3.3, the Biotech Directive establishes a comparatively permissive, open-ended approach to patentability, explicitly stating that a previous occurrence in nature of a biological material does not prevent it from being the subject of an invention.[698] As regard scope of protection, the Directive provides that "*the protection conferred by a patent containing or consisting of genetic information shall extend to all material(…) in which the product is incorporated and in which the genetic information is contained and performs its function."*[699]

In common law generally (and not only in the United States), the 1980 decision of the US Supreme Court in *Diamond vs. Chakrabarty*[700] is commonly referred to as a landmark case. In its ruling, the supreme court essentially held that inventions involving biological materials and some life forms were patentable under US law. This decision spurred a rapid increase in the number of patents granted in relation to biotechnology. As a result, a new field of patents covering "*genetic inventions*" emerged, comprising nucleotide DNA or RNA sequences that may encode genes or fragments of genes and their application).[701] This development extended well beyond the US, and inspired the Biotech Directive, although many states disputed far-reaching possibilities for patenting life forms.

696 Directive 98/44/EC of The European Parliament and of the Council of 6 July 1998 on the Legal Protection of Biotechnological Inventions (Biotech Directive).

697 In Article 5, the Biotech Directive bans the patenting of '*the entire human body in all its development phases*' as well as processes for cloning and modifying the DNA of humans.

698 For genetic subject matter not related to the human body the Biotech Directive expressly declares in Article 3(2) that "biological material which is isolated from its natural environment or produced by means of a technical process may be the subject of an invention even if it previously occurred in nature." As regard scope of protection, Article 9 provides that "the protection conferred by a patent containing or consisting of genetic information shall extend to all material(…) in which the product is incorporated and in which the genetic information is contained and performs its function."

699 Article 9.

700 Sidney A. Diamond, Commissioner of Patents and Trademarks, v. Ananda M. Chakrabarty, et al., 447 U.S. 303 (United States Supreme Court 16 June).

701 OECD, Genetic Inventions, Intellectual Property Rights and Licensing Practices: Evidence and Policies. 2002.

Broadly speaking, the patenting of biotechnology is now an accepted and integrated part of the intellectual property rights law of most jurisdictions, but the extent to which genetic resources found in nature can be patented varies considerably.

Certain jurisdictions have ascertained relatively unequivocally that isolated genes are patentable. However, lately the pendulum has swung back slightly, at least with regards to the possibilities of patenting whole or partial strands of DNA and RNA. The US for long generally permitted patentability of genetic sequences, provided a specific utility was disclosed (merely identifying the existence of a sequence was not considered sufficient). But lately a trend has developed in US case law[702] and legislative action[703] towards more restrictive patentability standards.[704]

In particular, the case *the Association for Molecular Pathology v. Myriad Genetics*[705] together with the ruling in *Mayo Collaborative Services v. Prometheus Laboratories*[706] clarified US patent law in important regards, as will be further discussed in section D.3.3. As a consequence of these rulings, all patent claims directed to isolated genomic DNA were invalidated.[707]

Under current jurisprudence in the US, it appears clear that substances occurring freely in nature cannot be claimed as patent. However, an isolated or purified form thereof is patentable.[708] Hence only a very thin line separates invention from discovery, and many patents have been granted on purified or crystallized products obtained from a natural source of impure material.[709]

[702] See for instance, *In re Dane K. Fisher et al*., No. 04-1465. In Federal Circuit, 7 September 2005, which held that genetic markers, known as "*expressed sequence tags*", lack substantial and specific utility unless the underlying gene function is identified, as discussed by Zewers. Zewers, LOYOLA UNIVERSITY CHICAGO INTERNATIONAL LAW REVIEW (2008).

[703] Such as the bill presented in the US Congress in February 2007 to prohibit the patenting of human genetic material.

[704] Zewers, Loyola University Chicago International Law Review (2008).

[705] Association for Molecular Pathology v. Myriad Genetics Inc., 569 U.S. 576 (United States Supreme Court).

[706] Mayo Collaborative Services v. Prometheus Laboratories, Inc., 566 U.S. 66 (United States Supreme Court).

[707] As a consequence of Myriad procedures, primers, or probes of particular genes, also became ineligible.

[708] Drankier, et al., The International Journal of Marine and Coastal Law (2012).

[709] CORREA. 2007, at 272.

Similarly, the regulation in the European Union provides that '*biological material which is isolated from its natural environment or processed by means of a technical process may be the subject of an invention even if it already occurred in nature*.'[710] However, even if genes are patentable under these jurisdictions, they do not become an "invention" by the mere process of isolation.[711] An inventive step is also required, under US and EU law. There are also significant differences between US and EU jurisprudence. In Europe patent protection allows for experimentation with patented material, including for commercial purposes. US patent law, on the other hand, restricts the use of protected material for further research and variation, and hence offers the exclusive rights attached to the use and exploitation of the patented material in its entirety for a limited period. The possibilities for exceptions to patentability have also been used differently across jurisdictions in other regards. The European Patent Convention permits exclusion of plant varieties from patentability and European states have accordingly excluded these, in contrast to the US, Australia and Japan where plant varieties can be patented.[712]

Other states have explicitly excluded genes from patentability even if isolated. A large number of Latin American states exclude in different terms the patentability of substances that exist in nature.[713] Some states seeking to deny patent protection to gene sequences or compounds isolated from genetic material found in their jurisdiction have used the ambiguous division between micro- and macro organisms under Article 27(3)(b) to argue that genes are not micro-organisms within the meaning of TRIPS, but rather components of animals or plants. Commonly, this third exception has been invoked in parallel with the first exception, relating to *ordre public*, as discussed above.[714] The developing country rejection of patentability of innovations based on living resources has been largely principal. Patents for forms of life have consistently been granted in other states, and, indeed they are granted in countries such as the US and the EU, as discussed above.

[710] Article 3.2, The Biotech Directive Directive 98/44/EC.

[711] CORREA. 2007, at 272.

[712] Drankier, et al., The International Journal of Marine and Coastal Law (2012), at 389.

[713] CORREA. 2007, at 273.

[714] Acharya, Journal of World Trade (1991); Mushita & Thompson, Global Environmental Politics (2002); Subramanian, Journal of World Trade (1992).

On the issue of disclosure of geographic origin, there are similarly significant differences across states. [715] The largest group of states set no such requirements in patent applications. Many states provide requirements to disclose if a genetic resource originates within the state's own jurisdiction. Others provide a more general requirement to indicate in what country genetic material has originated. Only a small group of states sets generic requirement for place of origin, which would also implicitly involve cases where the genetic resource originates in deep-sea areas beyond national jurisdiction.[716]

It is thus clear that the right to make claims for exclusive rights to inventions or discoveries based on deep-sea genetic resources cannot be considered universally accepted. Nor does it follow automatically from TRIPS. WTO members have in some cases exercised their legitimate right under Article 27 to exclude the patentability of genes as found in nature, even if isolated or purified from higher organisms and processes.[717] However, the commercially most relevant patent jurisdictions of the EU and the US have not made such exceptions. Moreover, categorical exceptions from patentability for genetic resources, as appears to apply in some countries, are arguably incompatible with TRIPS, insofar as the most central types of deep-sea genetic resources are concerned.[718] However, this notion could be disputed by these states by reference to ethical or moral considerations based on paragraph 2 as the ground for exception instead of paragraph 3. Moreover, state practice indicates that geographic indication of genetic material is only required by a small number of states.

TRIPS thus provides complex and partly ambiguous rules for the patentability of genetic resources. In particular, there appears to be uncertainty as to how to consider the different types of organisms and processes for which states are obliged to enable patentability or able to exempt from patentability.

[715] Francioni, International Law for Biotechnology: Basic Principles. 2006 Tullio Scovazzi & Francesco Francioni, Biotechnology and International Law (Bloomsbury Publishing. 2006), at 22.

[716] The WIPO Intergovernmental Committee on Intellectual Property and Genetic Resources, Traditional Knowledge and Folklore has compiled a table over regulations in different member states, WIPO Intergovernmental Committee on Intellectual Property and Genetic Resources, Traditional Knowledge and Folklore - Genetic Resource Disclosure Requirements Table. 2017.

[717] Correa. 2007, at 273.

[718] Genetic resources encompassed by the terms micro-organisms and non-biological and microbiological processes, as described above.

It is however clear that for microorganism genetic resources, which are highly relevant in deep-sea bioprospecting, states parties are under obligation to enable patentability. In domestic law, rules on patentable subject matter differ considerably.

The different positions on these issues are far from new. The patent section of the TRIPS Agreement was notoriously difficult to negotiate.[719] It appears unlikely that a WTO Panel or the Appellate Body would clarify the scope of central terms, not only because of the general difficulties WTO dispute settlement is currently facing. The competence of such bodies to clarify WTO rules is also formally limited.[720]

C.3.6. Conclusions on international trade law

TRIPS generally requires states to ensure the protection of intellectual property rights, including patents to bioactive functions of organisms. States may however preclude the patenting of inventions or discoveries based on genetic resources. In line with the limitations to the possibility of making exceptions from patentability, such exceptions cannot extend to micro-organisms, or non-biological and microbiological processes.

[719] The difficulty can be explained by the large number of key North-North as well as North-South issues involved. See Gervais. 2012, at 428-445.

[720] They are not permitted to resolve ambiguities deliberately left in the text by the drafters of the agreements and transform the balances in agreed rules. There appears to be widespread agreement that the existence of gaps and ambiguities in the TRIPS Agreement indicates that members retained a certain amount of room for maneuver at the national level, which should not be limited by interpretations by panels or the Appellate Body Correa has considered that in spite of the ambiguities, the result is impressive in that the scope and coverage of the section are comprehensive. TRIPS overcame the main weakness of its predecessor the Paris Convention by not merely relying on domestic law, but actually defining the scope of a patent. Correa. 2007, at 273; Article 3.2 of the WTO DSU expressly prevents panels and the Appellate Body from adding rights and obligations when adjudicating disputes. In Canada-Patent Protection for Pharmaceutical Products, WT/DS114/13, Panel Report (World Trade Organization Panel 18 August), the Panel alerted against interpretations that '*would be equivalent of a renegotiation of the basic balance of the Agreement*.' (para. 7-26); John H. Jackson, The jurisprudence of GATT and the WTO : insights on treaty law and economic relations (Cambridge : Cambridge University Press. 2000), at 184-186.

In domestic law, states have related to these possibilities for exceptions differently, and can largely be divided across global north/south-lines, with developed countries setting no limits to the patentability of genetic resources while developing countries have claimed both moral and ethical considerations as well as the plants and animals-exception as the basis for rejecting patents on genetic resources.

Essentially, the rules in TRIPS imply patentability as a general rule. For bioprospecting involving genetic resources of microorganisms, states are even unable to make exception from patentability. As discussed in Part B., many of the existing deep-sea projects appear to fall within this category. Moreover, the rules on patentability do not make any distinction based on geographic origin of genetic resources. Nor do the rules require information on genetic provenience to be provided in patent data. In lack of such information, it is difficult to distinguish both where genetic resources have been sampled in individual cases and how common deep-sea origin is compared to other marine areas.

Of particular importance to this study, as a result of the lack of such requirements in TRIPS it is difficult to establish if biotechnological inventions and discoveries have complied with requirements in the law of the sea and international environmental law, since these largely are based and depend on territorial origin, with significant differences between the rules for areas within and beyond national jurisdiction, as well as the seabed and pelagic realm.

D. Underlying perspectives on the legal status of deep-sea genetic resources

In the previous part, it was discussed how the law of the sea, international environmental law and WTO law relate differently to bioprospecting and deep-sea genetic resources. In Part E, it will be further discussed how the apparent inconsistencies across the three regimes in relation to this activity should be considered under treaty law. But before investigating the consequences of these differences, the reasons will be examined: How can it be explained that three sub-regimes of the same system of public international law formulate rules with dissimilar or potentially irreconcilable implications for the same activity? After all, the lists of parties to the three investigated treaties overwhelmingly overlap and these treaties have been negotiated in the same legal system of public international law, roughly during the same period.[721]

This investigation is based on the assumption that rules on central concepts in treaties of international law reflect underlying norms in the relevant regimes. In this regard, this part of the study is based on the observation made by the International Law Commission on the effect of the "speciality" of a regime. As expressed by the ILC, "*the significance of a special regime lies in the way its norms express a unified object and purpose. Thus, their interpretation and application should, to the extent possible, reflect that object and purpose*."[722]

It is hypothesized that the differences in rules applying to deep-sea bioprospecting can be explained by fundamentally dissimilar perspectives on legal claims to deep-sea genetic resources across the three regimes. Moreover, it is assumed, these different conceptions can be exposed by examining the development of the relevant treaties, as well as the historical context and political dynamics of negotiations. Unravelling the reasons for these dissimilar perspectives may provide an explanation for potential inconsistencies between the rules of the three treaties in this specific case.

---

[721] The subjective element as well as temporal aspects of the treaties and their negotiation is further discussed in section E.3.2 and E.3.3.

[722] Koskenniemi, Fragmentation of International Law: Difficulties Arising from the Diversification and Expansion of International Law - Draft conclusions of the work of the Study Group Finalized by Martti Koskenniemi. 2006., para. 13, at 7.

It may also illustrate differences in the underlying ideological basis of the three regimes. Accordingly, this part of the study will attempt to unearth the underlying purpose, ideology or ethos of the three regimes, which explain the different perspectives of appropriating deep-sea genetic resources.

D.1. The law of the sea

D.1.1. From *res omnium communis* to common heritage of mankind

The status of legal claims to the seas and their resources has been at the heart of debate in international law ever since the origin of the law of the sea. Over the years, the legal arguments and basis for states and private actors to claim exclusive rights to marine spaces and resources have developed.
Indeed, the history of the law of the seas has been described as a story of creeping jurisdiction, where coastal states have gradually expanded their sovereign and exclusive rights, step by step enclosing and consuming global commons.[723] As will be discussed below, this depiction is partly accurate. But this development has not gone uncontested. There have always been theorists as well as states defending the contention that the seas and their resources are – and ought to remain – global commons, with either equal rights for appropriation for all actors or global management under common(s) institutions.

It is difficult to present an account of the conception of appropriation under the law of the sea without seeking its origins. As with many concepts in the law of the sea, the theories of Hugo Grotius reverberate in the modern iterations of this concept and provide a good starting point for addressing it. When Grotius formulated his treaty on the Freedom of the Seas in 1609, the oceans had already been a de facto synonym for freedom for centuries.

[723] Ross D. Eckert, The Enclosure of Ocean Resources: Economics and the Law of the Sea (1979); Churchill & Lowe. 1999; Lewis M. Alexander, *The ocean enclosure movement: inventory and prospect. (Law of the Sea XV)*, 20 San Diego Law Review (1983); Philip E. Steinberg, The Social Construction of the Ocean (Cambridge University Press. 2001).

Since the oceans could be neither bounded nor exhausted by use, they should in Grotius' view be freely accessible to all and shared amongst nations.[724] Under his doctrine of *mare liberum*, which since has shaped the legal regime of the high seas, the oceans should be regarded as common property in perpetuity, for navigation as well as fisheries.[725]

His treaty and ideas should not be read in isolation, but as a reply amid a lively academic debate of the early 17th century. Foremost, it was written as a rebuttal to the maritime policy of Portugal, which had claimed exclusivity of traffic to the East Indies for trade purposes. The position that oceans could be enclosed by states has often been considered as part of the Spanish and Portuguese imperialist projects. The opposition to the freedom of the seas was however more widespread. John Selden's *Mare Clausum*, largely considered to reflect the British position at the time, claimed a monopoly over fishing rights in the North Sea. Selden maintained that the resources of the sea were just as abundant – and just as exhaustible – as land resources. The treaty was written as a vigorous defense for the British seizure of some Dutch ships that were returning from Greenland waters with a catch of walrus in 1617. However, Selden did acknowledge the freedom of navigation and was thus more liberal than the Iberic position: He proposed the concept of inoffensive passage (not dissimilar to the innocent passage concept included in UNCLOS[726] some 350 years later).[727]

Nevertheless, Grotius' *Mare liberum* understanding of the seas as free commons largely prevailed in this debate, albeit in a form modified by his compatriot Bynkershoek, who forged a compromise with the *Mare Clausum* camp by suggesting that parts – but only parts – of the sea can be possessed by occupation.[728]

[724] Hugo Grotius, The Freedom of the seas or The right which belongs to the Dutch to take part in the East Indian trade (Ralph Van Deman Magoffin & James Brown Scott trans., The Lawbook Exchange. 2001).
[725] Richard Barnes, *Entitlement to Marine Living Resources in Areas Beyond National Jurisdiction*, *in* THE INTERNATIONAL LEGAL REGIME OF AREAS BEYOND NATIONAL JURISDICTION: CURRENT AND FUTURE DEVELOPMENTS (Alex G. Oude Elferink & Erik Jaap Molenaar eds., 2010), at 87.
[726] United Nations Convention on the Law of the Sea (UNCLOS). 1997.
[727] Mónica Brito Vieira, Mare Liberum vs. Mare Clausum: Grotius, Freitas, and Selden's Debate on Dominion over the Seas, 64 JOURNAL OF THE HISTORY OF IDEAS (2003), at 361.
[728] Clyde Sanger, Ordering the Oceans: The Making of the Law of the Sea (Zed. 1986), at 12.

In *realpolitik* terms, the success of the concept of the seas as essentially free areas can be explained by the British Empire's increased dependence on free navigation for its increasing intercontinental trade.[729]

The struggle of early modern Europe between different positions on the possibility for appropriating seas thus ended with the freedom of the high seas prevailing. The high seas parts of oceans thus became – and have remained – common resources, "free and open for all" in the words of Grotius.[730]

Yet, even if the legal regime of the high seas has largely remained intact since Grotius' days, the geographic scope of those areas has decreased. Without challenging the legal content of the high seas, coastal states have continuously cut away high seas areas by gradually expanding their jurisdiction. This development, which was particularly strong during the 20th century, has been referred to as creeping jurisdiction and encompasses not only the high seas, but increasingly the seafloor of the continental shelf.[731] But despite this gradual expansion of coastal state jurisdiction, the common areas of the high seas and the Area, beyond national jurisdiction, still represent about 64 per cent of the surface of the oceans, and around 95 per cent of the ocean's volume.[732]

The roots of the legal regime of these areas, as spelled out in UNCLOS, can thus be traced back to Grotius' treaty. Interestingly, Grotius' thinking was not confined to the legal status of the high seas in the broad sense. Rather than merely theorizing on the freedom of the seas, Grotius and other contemporary lawyers also discussed the legality of property rights to marine resources.

[729] Hans-Jürgen Wagener, *Free Seas, Free Trade, Free People: Early Dutch Institutionalism*, 26 HISTORY OF POLITICAL ECONOMY (2007).
[730] GROTIUS, The Freedom of the seas or, The right which belongs to the Dutch to take part in the East Indian trade. 2000.
[731] Erik Franckx, The 200-mile limit: between creeping jurisdiction and creeping common heritage? Some law of the sea considerations from Professor Louis Sohn's former LL.M. student, 39 GEORGE WASHINGTON INTERNATIONAL LAW REVIEW (2007), at 469.
[732] As part of the Earth's total surface, these areas make up around 40 per cent. Measured as share of habitable space, areas beyond national jurisdiction make up around 95 per cent of the habitat occupied by life on Earth in all its forms. the biodiversity of these areas includes more of the major divisions of the forms of life than land ecosystems. THE FIRST GLOBAL INTEGRATED MARINE ASSESSMENT: WORLD OCEAN ASSESSMENT I (Cambridge University Press. 2017).

In the contemporary debate, different views on the extent of sovereignty and jurisdiction were expressed, based on the presumption that jurisdiction should be in the form of trusteeship.[733] Largely, coastal states' claims to a territorial sea (Grotius called it "the small sea") were accepted, but only on the condition that coastal states managed these seas as trustees, and not owners. Concepts of exclusive fisheries zones were also proposed and discussed in that context. This can be interpreted as a forerunner of modern ideas of sustainable management.

Interestingly, Grotius recognized that discovery did not automatically confer property rights: "discovery *per se* gives no legal rights over things unless before the alleged discovery they were *res nullius*." [734] The second principle from Grotius is closely related, expressing that anything that can be used without loss to anyone else is *res omnium communis.* If constituted by nature in a way that, in serving one person, it still suffices for the common use by all, it is common property. As an example, Grotius offered, "*seas were forever exempt from such private ownership on account of their susceptibility to universal use*."[735] This theory of appropriation of common goods can be regarded as the basis for the regulation of resources in marine areas beyond national jurisdiction under the modern law of the sea.

In treaty law, the high seas were first recognized as *res omnium communis* in the first International Convention on the Law of the Sea, held in Paris in 1856. Subsequent diplomatic conferences at the turn of the 20th century confirmed this notion.[736] Commonly, this confirmation of Grotian principles of an open high seas regime in early treaty law is explained by navigational and commercial interests of influential states, i.e. the same logics as 200 years earlier.

[733] Ingo Klaus Heidbrink, The Oceans as the Common Property of Mankind from Early Modern Period to Today, 6 HISTORY COMPASS (2008).
[734] GROTIUS, The Freedom of the seas or, The right which belongs to the Dutch to take part in the East Indian trade. 2000, at 13.
[735] James B. Morrell, The Law of the Sea: A History of the 1982 Treaty and Its Rejection by the United States (McFarland Publishing. 1992).
[736] The Hague Conferences of 1899 and 1907.

The material content of these early attempts at regulating the highs seas should not be exaggerated. The regime in this early treaty can by no means be considered a developed management concept. Rather, freedom of the seas meant essentially non-regulation and *laissez-faire* which was in the interest of the big maritime powers. Historians have shown how this lack of law under the freedom of the seas doctrine was often used in the 19th century by European powers to threaten small states and obtain concessions from them or simply to subjugate them.[737]

Still, it is not fair to refer to the high seas regime of these early days of treaty codification as conceptually not reasoning on issues of resource management. The open-access principle applied not only to the high seas as a navigational resource, but also to the natural resources therein. It was based on the understanding that ocean resources were inexhaustible. Essentially, the regime was one of regarding the high seas and its resources as public goods, rather than common goods: The risk of overexploiting high seas resources was not yet recognized.

In essence, the understanding and legal status of the deep-sea areas beyond national jurisdiction for a long time changed little from Grotius' principles. Indeed, the paradigm of the deep seas as being governed by the high seas freedoms under the *res omnium communis* was not challenged before the emergence of real interests in appropriating and enclosing deep-sea resources in the latter half of the 20th century.

What were the reasons for this sudden rupture from the established understanding of high seas resources as *res omnium communis*? It will now be discussed, firstly, how these gradual attempts at appropriating and enclosing the deep seas by coastal states evolved. Thereafter, it will be investigated how the negotiation of UNCLOS can be regarded in part as a reaction to this process of enclosure and appropriation of deep-sea resources. In particular, it will be discussed how a counter-movement against enclosure during the UNCLOS negotiation process emerged and ignited radical new legal concepts for managing common marine resources, which made its way into the negotiation outcome.

[737] R.P. Anand, *Changing Concepts of Freedom of the Seas: A Historical Perspective*, *in* Freedom for the Seas in the 21st Century: Ocean Governance and Environmental Harmony (1993).

D.1.2. UNCLOS I and II - Resource depletion and enclosure of the deep seas

Not until the end of the First World War was there evidence that contradicted the view that high seas resources were unlimited in supply.[738] In certain regions with high fisheries pressure, it became evident that stocks were becoming depleted. As a result, the League of Nations initiated international regulation of high seas fisheries, with the aim of preventing extinction of commercially important fisheries. The issue was handled at the Hague Conference for the Codification of International Law held in 1930. Among other issues, the conference dealt with the territorial waters. Even if it was unable to reach agreement on the breadth of the territorial sea, it presented 13 draft articles in its report, setting out foundations for material rights in the territorial sea.[739] At the time, fish was the only resource considered commercially relevant in the deep sea. But the discourse was more general. These early attempts to manage deep-sea fisheries mark an important shift from the perception of high seas resources as a public good to a common-pool resource.[740] Still, these early foundations of fisheries management linked access to preservation of the resource base. Rather than setting up a regime privatizing the fisheries, the regulation continued to be based on the *res omnium communis* principle. Instead of privatizing the resource, the aim was to ensure a sufficient supply for all.[741]

Even if the management principles for the high seas remained intact, the geographic scope of the high seas was transformed in subsequent decades. The apparent first act for enclosing the seas was made by US President Harry Truman, who in 1945 declared that the United States had the exclusive right to

[738] That is to say the resources of what was considered high seas at the time. As discussed below this included areas now considered part of exclusive economic zones as well as parts of the territorial sea.

[739] Tommy Koh, The origins of the 1982 Convention on the Law of the Sea, 29 Malaya Law Review (1987).

[740] In economic theory, public goods and common pool resources are both non-excludable. The main difference is their rivalry property: public goods can be consumed without reducing availability for others, while consuming common pool resources will decrease the available resources for others. See, for instance Jose Apesteguia & Frank P. Maier-Rigaud, *The Role of Rivalry: Public Goods Versus Common-Pool Resources*, 50 Journal of Conflict Resolution (2006).

[741] Morrell. 1992, at 176-177.

exploit all resources in its territorial waters, defined as on or under the continental shelf. From 1945 to 1957, 41 other enclosure declarations or laws were enacted by various countries.[742] The freedom of the high seas also slowly became more of a "relative" freedom as the international community increasingly cooperated to regulate activities.

The decades after the Truman declaration were thus marked by increased enclosures. Whereas the Truman declaration and the ensuing discussion of the 1940s and 50s had focused on the continental shelf, political events in the high seas and resulting enclosures soon set the breadth of exclusive coastal state rights to the water column in focus. In the North Sea, the coastal states Norway and Iceland started to challenge foreign fisheries in the vicinity of their coasts. In December 1951, the International Court of Justice recognized Norwegian claims for exclusive fisheries rights in an area which by domestic decree had been declared as their territorial sea.[743]

Bolstered by this coastal state success, Iceland soon started to pursue legal activism against foreign trawlers operating off their coast. In 1952, Iceland unilaterally extended the limits of their exclusive fishery zone from 3 to 4 nautical miles. This was disputed and resulted in trade sanctions by the United Kingdom, until they finally accepted the Icelandic claim in 1956 as the result of pressure by the United States, which was in turn motivated by Iceland's strategic position in the Cold War.[744]

Against this backdrop, where sovereign declarations for enclosures as well as the acceptance of such declarations increased, the First United Nations Conference on the Law of the Sea (UNCLOS I) was convened in 1958. Lasting for only two months but standing on the shoulders of extensive preparatory work of the International Law Commission, the conference adopted the four conventions, which are commonly known as the 1958 Geneva Conventions: The Convention on the Territorial Sea and Contiguous Zone; The Convention on the High Seas; The Convention on Fishing and Conservation of the Living Resources of the High Seas; and The Convention on the Continental Shelf.

[742] Shigeru Oda, *Some reflections on recent developments in the Law of the Sea*, 27 THE YALE JOURNAL OF INTERNATIONAL LAW (2002).
[743] ICJ, Fisheries (United Kingdom v Norway).
[744] Gudni Thorlacius Jóhannesson, How 'cod war' came: the origins of the Anglo-Icelandic fisheries dispute, 1958–61, 77 HISTORICAL RESEARCH (2004).

While in many regards laying the foundations for the 1982 Law of the Sea Convention, the 1958 conventions failed to bring about agreement on central issues. Foremost, like the Hague Conference of 1930, it did not manage to establish a maximum breadth of the territorial sea. The 1958 Geneva Convention on the High Seas addressed what can and cannot be controlled in international waters, e.g. piracy, pollution, and the activity of warships.[745]

However, the material obligations were limited and the convention did little to prevent coastal state appropriation of high seas territory. The legality of the enclosure of common marine areas was regarded as an issue of prime interest, with conflicting views arising in response to it. During the conference, several coastal states, including Iceland, insisted, albeit with limited success, on extending the right for territorial waters.[746] Still, the conference outcome in important regards was a victory for coastal states at the expense of the high seas. More than 60 jurisdictional extensions were confirmed. The 1958 Continental Shelf Convention essentially confirmed the Truman Proclamation. However, instead of full territorial sovereignty over the continental shelf, coastal states were granted "sovereign rights for the purpose of exploring it and exploiting its natural resources."[747] These rules were subsequently upheld in UNCLOS.

In the years after UNCLOS I, increased pressure on high seas resources created new efforts for coastal states enclosure. The Torrey Canyon disaster of 1967 off the coast of England called into question whether the freedom of navigation should not be curtailed for environmental purposes.[748] Similarly, the freedom of fishing was increasingly called into question. Technological progress enabled a rapidly increasing fishing effort at a cheaper price.

[745] Convention on the High Seas.; Convention on the High Seas (Geneva, 29 April 1958, in force 30 September 1962), 450 UNTS 11.
[746] Jóhannesson, HISTORICAL RESEARCH (2004).
[747] See Article 2, Convention on the Continental Shelf, 29 April 1958, 499 U.N.T.S. 311 (1958); MORRELL. 1992, at 6.
[748] TANAKA, The International Law of the Sea. 2012, at 254-257; Z. Oya Özçayir, *Illegal Oil Discharges from Shipss and Implementation Failures in the International Convention System*, *in* LAW, TECHNOLOGY AND SCIENCE FOR OCEANS IN GLOBALISATION: IUU FISHING, OIL POLLUTION, BIOPROSPECTING, OUTER CONTINENTAL SHELF (Davor Vidas ed. 2010); CRAIG WILSON, THE IMPACT OF THE TORREY CANYON DISASTER ON TECHNOLOGY AND NATIONAL AND INTERNATIONAL EFFORTS TO DEAL WITH SUPERTANKER GENERATED OIL POLLUTION: AN IMPETUS FOR CHANGE? (ProQuest Dissertations Publishing. 1973).

Factory freezing ships for the first time enabled large-scale distant-water fishing. The annual worldwide fish catch doubled between 1955 and 1967. As a reaction, only four months after UNCLOS I, Iceland decided to unilaterally expand their fishery zone from 4 to 12 nautical miles. This marked the start of the first Cod War, where UK trawlers protected by war ships, under the pretext of the high seas freedoms, would dispute the Icelandic claim.[749]

These increased political tensions caused by the enclosures, as well as the reactions to such declarations, prompted the United Nations General Assembly to once again consider the key unresolved question of the extent of territorial seas, together with that of fishing limits, worthy of a further effort to reach agreement. These were tabled as the main items on the agenda of the Second United Nations Conference on the Law of the Sea, which was summoned for one month in Geneva in 1960. However, this Conference also failed to fulfill the objective of bringing about agreement on these issues.[750]

But at least tacitly, the conference did accept the Icelandic claims during the Cod Wars, thereby legitimizing extensive enclosures. Following the UNCLOS II, a settlement was reached, albeit combined with interim measures.[751] In spite of this apparent victory for coastal state ambitions, as we will see below, this was not the end of these states' ambitions to enclose high seas based on fisheries interest.

The period up to the second conference on the law of the sea was thus marked by enclosures of vast marine areas and appropriation by states of the resources therein. This did not pass unnoticed, but sparked reaction and in some cases outright conflict between states. Meanwhile, the international law system failed to reach agreement on central issues, such as the extent of relevant maritime zones. Importantly, the negotiations of UNCLOS I and UNCLOS II, however implicitly, accepted and legitimized enclosures.

[749] Jóhannesson, HISTORICAL RESEARCH (2004).

[750] Among the various proposals, ranging from 3 to 200 miles maximum limits, a proposal for a 6 miles breadth of the territorial sea plus a 6 miles fishery zone immediately adjoining it was accepted in the Committee of the Whole but did not obtain the necessary two-thirds majority in plenary. 1958 Geneva Conventions on the Law of the Sea. (2008).

[751] For a vivid account of the cod wars, as well as subsequent negotiations see HANNES JONSSON, FRIENDS IN CONFLICT: ANGLO-ICELANDIC COD WARS AND THE LAW OF THE SEA (C Hurst & Co Publishers Ltd 1982).

Even if different opinions were voiced on how far-reaching coastal state maritime zones should be in codification, existing claims were not questioned during the negotiations but rather treated as a *fait accompli*. The most evident example of this is that by the time UNCLOS II started, the UK had already been forced to accept Icelandic appropriation of high seas and the claim was never disputed during the negotiations. Acceptance of such claims was thereby already implicit in the basis for the negotiations, which in itself was an important victory for coastal states keen on increasing their maritime zones. The fact that concrete codified agreements in this regard did not materialize was less important for coastal states, since the *status quo* was working in their favor.[752] This tacit acceptance of enclosure amounted to a rather radical transformation of the law of the sea. Material rules for the high seas, including its freedoms and the conception of *res omnium communis*, were left unaltered. But the geographical scope for those rules was effectively shrunken by coastal states.

D.1.3. The development of the common heritage of mankind principle

The period between UNCLOS I and UNCLOS II did not just see renewed efforts for enclosure by coastal states. Many states opposed this movement. Up until the late 1960s, such objections against enclosure had always been formulated based on the interest of protecting the freedom of the seas. However, after UNCLOS II a new strain of argument against the enclosure of oceans commons unfolded. In 1967, arguments were for the first time raised based on the contention that oceans commons should not be free in the notion of free from restrictions, but rather free from appropriation by coastal (or any other) state. Under this new approach, common marine resources should be regarded as belonging to all of humanity and be managed for mankind collectively, in particular to promote development and equality in resource allocation among states.

The first time this concept was articulated in a law of the sea context was at the UN General Assembly at the 22nd session, in 1967. The proposal was tabled by Malta.

[752] ECKERT. 1979, at 116-153.

It was titled: "*Declaration and treaty concerning the reservation exclusively for peaceful purposes of the seabed and of the ocean floor, underlying the seas beyond the limits of present national jurisdiction, and the use of their resources in the interest of mankind*."[753] The central principle embodied in the proposal came to be referred to as the principle of the common heritage of mankind.[754]

The proposal was accompanied by an explanatory memorandum in which Malta raised the fear of national appropriation of the ocean floor beyond the continental shelf because of rapid technological development, and as a result a militarization of the ocean floor and the exploitation of its immense resources by a few technologically advanced countries.[755] States supporting the Maltese proposal contended that there existed a legal vacuum in the deep seabed. The concept of the common heritage of mankind, they claimed, transcended *res nullius*, *res communis* and other concepts, and sought to fill that vacuum. As presented by Malta, the common heritage of mankind proposal did not include any effort to provide a definition of the concept.[756] This resulted in considerable confusion as to the content of the principle among states (a confusion which, to a substantial degree, persists to this day).

Some explanation was, however, provided. The major implications of the concept, as presented by the Maltese ambassador Arvid Pardo, were firstly that the common heritage can be used but not owned. In this sense there are communalities between common heritage and *res communis*. The reason for using *heritage* rather than *property* was because, in the opinion of Pardo, property was a form of power and since the time of Roman Law it had implied *jus utendi et abutendi* (right to use and misuse). *Heritage* implied a distinction in that regard, namely that the resource should be carefully managed. Secondly, the use of common heritage requires a balanced system of management. This is different from the management of a *res communis*, which can be fulfilled by each individual state or person.

[753] United Nations, 22nd Session, First Committee, 1515th Meeting, 1 November 1967, Doc A/6695, available at https://www.un.org/Depts/los/convention_agreements/texts/pardo_ga1967.pdf, at 1.
[754] Morrell. 1992, at 18; Noyes, Denver Journal of International Law and Policy (2011).
[755] Sanger. 1986; Koh, Malaya Law Review (1987).
[756] Said Mahmoudi, The Law of Deep Sea-bed Mining: A Study of the Progressive Development of International Law Concerning the Management of the Polymetallic Nodules of the Deep Sea-bed (Dissertation Stockholm University. 1987), at 119-124.

Thirdly, common heritage implies an active sharing of benefits, which again is different from the case of a *res communis.* Fourthly, the concept implies reservation for peaceful purposes, and finally it promises preservation for future generations.[757] This original vision of Pardo has been interpreted as implying that common heritage entailing a notion of common use of or access to a certain property but not common ownership.[758]

Malta's proposal indeed marked a rupture from conventional legal perspectives of marine resources. Not only was it radical in a contemporary context. It also marked a shift from the *res omnium communis* principle, that ever since Grotius' days had been the basis for managing common marine resources. Foremost, the proposal can be regarded as a reaction to the enclosure which had increased in the years leading up to the Maltese proposal. Yet, there are two other factors that explain the timing and rationale of the common heritage of mankind principle, as well as the widespread support it attracted by developing states during the negotiations of the Third United Nations Conference on the Law of the Sea (UNCLOS III). Foremost, the principle forms part of a broader movement criticizing established models of resource distribution among states in international law. Moreover, the principle was a reaction not just to enclosure, but also to resource depletion in the oceans commons. It will be examined below how both these aspects played out during UNCLOS III. First, however, the reaction to the Maltese proposal will be discussed, in order to illustrate the different perceptions that states had on the appropriation of common resources in the period leading up to UNCLOS III, as well as during its negotiation.

D.1.4. Initial objections to the common heritage of mankind principle

Even proponents of the concept of common heritage of mankind agreed that it was alien to international law as developed over centuries. Indeed, some delegations even stressed this as an advantage; the proposal would mark a rupture in relation to established unjust resource distribution principles.[759]

[757] Arvid Pardo, Before and after. (Symposium: The Law of the Sea - Where Now?), 46 Law and Contemporary Problems (1983).
[758] Alexandra Merle Post, Deepsea mining and the law of the sea (M. Nijhoff Publishers. 1983), at 112; Mahmoudi. 1987, at 124.
[759] Noyes, Denver Journal of International Law and Policy (2011).

It therefore came as little surprise that the proposal did not go uncontested. The opponents can largely be divided into two groups. The first group consisted of capitalist industrialized countries with deep-sea mining technology. The second group consisted of the Soviet Union and other socialist states.

The argument of the first group was essentially that the freedoms of the high seas should also apply to deep-sea resources. Without making aspirations for sovereign or exclusive rights to the deep-sea resources, these countries insisted on affirming the freedom to access and use the resources without any discrimination in the new treaty. Referring to similar positions in negotiations in space law[760] around the same time, this group of states argued that there should "*be a clear distinction between non-appropriation of the sea-bed*" on the one hand and "*the exploitation or use of it on the other*."[761]

[760] Space law generally is characterized with a high degree of parallelism in relation to the law of the sea. In the 1967 Outer Space Treaty, Article 2 declares "*Outer space, including the moon and other celestial bodies, is not subject to national appropriation by claim of sovereignty, by means of use or occupation, or by any other means*.", Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, Including the Moon and Other Celestial Bodies, 27 January 1967, 610 U.N.T.S. 205 (1967). Similarly, the 1979 Moon agreement declares that "*the exploration and use of the moon shall be the province of all mankind and shall be carried out for the benefit and in the interests of all countries, irrespective of their degree of economic or scientific development. Due regard shall be paid to the interests of present and future generations as well as to the need to promote higher standards of living and conditions of economic and social progress and development in accordance with the Charter of the United Nations*" (Article 4). The Moon Agreement also provides more direct application of the common heritage of mankind principle. "*The moon and its natural resources are the common heritage of mankind, which finds its expression in the provisions of this Agreement, in particular in paragraph 5 of this article. 2. The moon is not subject to national appropriation by any claim of sovereignty, by means of use or occupation, or by any other means. 3. Neither the surface nor the subsurface of the moon, nor any part thereof or natural resources in place, shall become property of any State, international intergovernmental or non-governmental organization, national organization or non-governmental entity or of any natural person. The placement of personnel, space vehicles, equipment, facilities, stations and installations on or below the surface of the moon, including structures connected with its surface or subsurface, shall not create a right of ownership over the surface or the subsurface of the moon or any areas thereof.*" (Article 11), Agreement governing the Activities of States on the Moon and Other Celestial Bodies, 5 December 1979, 1363 U.N.T.S. 3 (1979).; See also RICKY LEE, LAW AND REGULATION OF COMMERCIAL MINING OF MINERALS IN OUTER SPACE (Springer Netherlands. 2012), at 203-271 for an investigation of the relationship between common heritage of mankind in law of the sea and space law.

[761] U.N. Doc. A/AC.138/18, p. 9, as cited in MAHMOUDI. 1987, at 125.

Whereas many states in the group consistently rejected the equation of the term *heritage* with *property* and the notion that the resources of the deep seabed *belong* to the world community, some members of the group appear to have been open to at least part of the common heritage vision. However, that came with a different interpretation compared to developing countries. Apart from the principal objections, this group of states also objected to the common heritage of mankind concept as proposed by Malta on the ground that it would be difficult to formulate legal norms based on the lofty language.[762]

The second group, dominated by socialist states, reacted surprisingly similarly to the capitalist states. They rejected *a priori* the common heritage concept as a notion lacking clarity and precision from the standpoint of international law. Perhaps counterintuitive in light of this group of states being socialist, they contended that interpreting common heritage as common property or collective ownership would be utopian in light of the realities of the world. Contrary to the supporters of the common heritage principle, they claimed that a regulation implying collective ownership would not prevent but stimulate appropriation of deep-sea resources.

In fact, the socialist group went further in opposing the common heritage proposal than capitalist industrialized countries by disputing the suggestion that there was a legal lacuna for the deep seas, a notion that capitalist industrialized countries at least implicitly appeared to accept. Rather, the socialist states contended that the Charter of the United Nations, as well as the high seas freedoms, provided sufficient regulation for deep-sea resources, which should not be regulated differently compared to the high seas.[763] Once the principle had gained acceptance by the General Assembly in the Seabed Declaration despite facing some opposition[764], as discussed in section C.1.4, the socialist states made clear that they interpreted the principle to mean that "*the seabed is at the general disposal of all states and not subject to any appropriation.*"[765]

[762] U.N. Doc. A/AC.138/SR.28, p. 118; A/AC.138/SR.72; U.N. Doc. A/AC.138/SR.58, p. 201.; U.N. Doc. A/C.1/PV.1788, para. 53, as cited in id. at 125.

[763] U.N. Doc. A/AC.138/SC.1/SR.12-29, pp. 26.27 (The Soviet Union), as cited in id. at 125.

[764] United Nations General Assembly resolution 2749 (XXV), Declaration of Principles Governing the Seabed and the Ocean Floor, and the Subsoil Thereof, beyond the Limits of National Jurisdiction, A/RES/25/2749 (12 December 1970). 1970.

[765] U.N. Doc. A/C.1/PV.1798, para. 59, as cited in MAHMOUDI. 1987, at 125.

As observed by Mahmoudi, this equates the concept of the common heritage of mankind with the *res communis omnium* and the principle of the freedom of the high seas.[766] For all but formal purposes, this group of states reserved themselves against respecting the principle.

D.1.5. UNCLOS III - the reaction to enclosure

How then, did the proposal of building deep-sea management on the basis of the common heritage of mankind-principle and the approval of the Seabed Declaration alter the dynamics of the negotiation of UNCLOS?

Once the Third United Nations Conference on the Law of the Sea (UNCLOS III) was formally started in 1973, the debate over the legal status of deep-sea resources, including the common heritage of mankind became part of the agenda. But the conflict between states promoting and objecting to enclosure in UNCLOS III was not confined to the issue of ownership or appropriation of deep-sea resources or the principle of common heritage of mankind. The conflict on the issue of enclosure, largely between coastal and other states, went deeper and encompassed more areas. Nor was it, as we have seen, a new disagreement; rather, it reflected one of the fundamental disputes of law of the sea being brought to a new arena. The opening of the conference marked the start of a *negotiation* – a more open and formal competition between two distinct evolutionary processes of international law aiming to forge new property arrangements in the oceans. In the process, historical dynamics also influenced the negotiations. The enclosure movement of the oceans was the older and more decentralized process of the two. For coastal states, high seas freedoms were partly regarded as ambiguous or even obsolete parts of international law. From their perspective, coastal states could legitimately make claims for new enclosures of high seas for a number of reasons, one being that scientific evidence indicated that resources were becoming depleted in areas of common and free access. This, they effectively claimed, disproved the notion of a functioning *res omnium communis*.[767]

States geographically disabled from benefiting from enclosures, on the other hand, entered UNCLOS III with the objective of drafting the new treaty as a reaction to the development which had been ongoing at least since the Truman

[766] Id. at 126.

[767] MORRELL. 1992, at 51-91.

declaration: Landlocked countries desired to prevent further territorial claims, which (they perceived) effectively marked a rapid enclosure of the high seas. For these states, the treaty making process in the form of UNCLOS III should thus aim to safeguard the freedoms of the high seas, as well as the geographic integrity of common marine areas. Indeed, for geographically disadvantageously located states the coming treaty was seen as a last chance to halt sovereign claims for enclosure, which regularly, albeit unpredictably, occurred (as was the case with Iceland's unilateral expansions of its territorial sea).

Compared to this movement of gradually transforming international law to facilitate enclosure, the negotiation of UNCLOS was more comprehensive, in at least three ways. Firstly, the treaty negotiation was not limited to coastal states, but encompassed all interested states. Landlocked states came to play an important role. This affected the dynamics of the negotiation: Right from the start it was clear that a large group of states would object to increased rights for coastal states. Secondly, the negotiations of UNCLOS aimed to encompass *all* activities and uses of the seas. This marked a substantial change in relation to the enclosure movement as well as previous treaties, which in principle had been limited to addressing issues of navigation, offshore hydrocarbons and fisheries. UNCLOS negotiations aimed to regulate also other issues. Some were explicitly mentioned in the mandate, such as marine scientific research and marine mining. Indeed, the scope of the treaty negotiation was open ended: As discussed under Part A, even new, i.e. as yet unknown, activities were supposed to be covered by the treaty. Thirdly, soon after the launch of the conference it became evident that other options than state ownership of resources would be considered as possible options for management regimes, such as administration of resources by the United Nations.[768]

Once the first negotiation conference started, however, it became clear that coastal states would strive for a broad range of exclusive rights under the new treaty. In many regards the convention also came to extend the jurisdiction of coastal states. By 1978 it appeared that the conference would yield a treaty which reinforced the enclosure movement rather than reversed it.[769]

[768] ECKERT. 1979, at 261.

[769] Robert H. Manley, Developing nation imperatives for a new law of the sea: UNCLOS I and III as stages in the international policy process, 7 OCEAN DEVELOPMENT & INTERNATIONAL LAW (1979).

The principle of the freedoms of the high seas was certainly recognized in the convention, but it was cut short by a number of derogations, as explained in Part A. Landlocked countries and in particular developing countries expressed objections to this development during the conference.[770] Against this backdrop, it was not surprising that Pardo's proposal for a deep-sea regime for the benefit of the common heritage of mankind was greeted with so much enthusiasm by these states. It can be regarded as a reaction to the disappointment from developed and landlocked states in light of the enclosures that coastal states had managed to reach during the previous stages of negotiations.[771]

This provides an important explanatory factor for the proposal to declare the deep seabed as the common heritage of mankind. Developing countries wanted to ensure that the resources of the deep sea were not appropriated by the more powerful and technologically advanced states. Also, the common heritage of mankind principle can be regarded as an operationalization of Grotius' heritage. The pillar of his argument for freedom relied on the idea of sharing a common domain: the sea. The desire to regulate these traditionally unregulated areas as common heritage of mankind was not occurring in a Mare Clausum type of policy, but rather following a growing recognition that there was a further need to share the resources provided by the planet. This realization contributed to calls for international cooperation and regulation in order to put the adequate frameworks in place within which such sharing can happen in a peaceful and harmonized way.[772]

D.1.6. The New International Economic Order

The proposal to manage resources of areas beyond national jurisdiction under the common heritage of mankind principle can thus at least partly be interpreted as a reaction to the perceived enclosure of marine resources by coastal states. Non-coastal and developing states had hoped that the creeping advancement of coastal state jurisdiction would be halted by the negotiation of UNCLOS.

[770] ECKERT. 1979, at 262.
[771] MORRELL. 1992, at 18.
[772] Arianna Broggiato, et al., *Mare Geneticum: Balancing Governance of Marine Genetic Resources in International Waters*, 33 THE INTERNATIONAL JOURNAL OF MARINE AND COASTAL LAW (2018), at 5.

But in important regards the first part of the negotiations instead ended up confirming coastal state aspirations. This only increased developing countries' calls for a more balanced outcome.

The reaction to the enclosure movement development did not simply comprise a desire to halt enclosure. To a larger degree, it formed part of a more profound critique of the equity of the global economic system and in particular the allocation of resources. The discussion on how to manage the resources of the deep sea started at the time of increased and dynamic cooperation among developing states, with shared aspirations to challenge established principles in the global economic system.[773] This movement is commonly referred to as the New International Economic Order, and associated with a General Assembly resolution with the same name as well as the Charter of Economic Rights and Duties of States'of 1974.[774]. This movement was strongly supported by developing countries sharing both the experience of colonization and the consideration that their challenges to catch up with industrialized, technologically advanced countries was the result of the policy of exploiting developing countries' resources.[775] There was a widespread commitment among these states to strive for a remodeling of the international system, to reverse the perceived mechanisms of exploitation.[776] More than just a strain of thought or political conviction, the ideology of the New International Economic Order offered developing countries an interpretation of the existing "old" international order, largely predicated on the principles of the Western ideology of economic liberalism, and it rallied them in their struggle for a more equitable new international order.

In international relations, the New International Economic Order had its strongest support around the time of the Third International Conference on the Law of the Sea (UNCLOS III).[777]

[773] MAHMOUDI. 1987, at 127.
[774] United Nations General Assembly resolution 3201 (S-VI), Declaration on the Establishment of a New International Economic Order, UN Doc A/RES/S-6/3201 (1 May 1974) (1974); United Nations General Assembly resolution 3281 (XXIX), Charter of Economic Rights and Duties of States, A/RES/3281 (6 November 1974) (1974).
[775] Ferrajolo, Maritime Safety and Security Law Journal (2018).
[776] Boleslaw Boczek, *Ideology and the Law of the Sea: The Challenge of the New International Economic Order*, 7 BOSTON COLLEGE INTERNATIONAL AND COMPARATIVE LAW REVIEW (1984).
[777] See MORRELL. 1992, pp. 51-91 for a detailed account on the influence of new international economic order at UNCLOS III.

Its culmination thereby coincided with the negotiations of the deep-sea regime. From the perspective of developing countries, it was only natural to attempt to implement the New International Economic Order ideology in the negotiations of UNCLOS III, which encompassed management principles for previously unregulated resources. Several delegations openly declared that a key objective was to prevent the colonial injustices incurred in the management of terrestrial resources from being repeated in the management of deep-sea resources.[778] Indeed, two reasons made the negotiations of UNCLOS III a particularly fertile ground for the New International Economic Order discourse. Firstly, there was a widespread belief that the oceans contained enormous quantities of exploitable resources, as will be discussed in section D.1.7. The discussion focused on but was not limited to minerals. Secondly, from a management perspective the deep seas were regarded as pristine land. This made it particularly suitable for testing new concepts. Here, the lack of regulation made it possible to counter colonial and historical injustices and ensure a more equitable distribution of wealth. In particular, New International Economic Order advocates considered that deep-sea resources should be prevented from being appropriated by private or individual state actors, and instead used to enable development in poorer states. The law of the sea thus became an arena in which the traditional Western international order was challenged by the ideology of the New International Economic Order.

In the common heritage of mankind principle, developing countries thus not only saw an opportunity to prevent colonial domination from being repeated in the deep sea; based on optimistic predictions about the riches of deep-sea resources, they also hoped that the benefits of deep-sea resources could be used to reduce the inequalities between rich and poor states.[779]

Moreover, the negotiating objectives of the supporters of the New International Economic Order were not limited to the management of the deep sea. The purpose was rather to let all parts of the convention reflect the ambition to change the fundaments of the world economy.

[778] Boczek, Boston College International and Comparative Law Review (1984).

[779] See, for instance, U.N. Doc A/C.1.PV.1788, para. 7; U.N. Doc A/C.1.PV.1673, para. 69; U.N. Doc A/C.1.PV.1850, para. 67 as cited in as cited in MAHMOUDI. 1987, at 127.

Accordingly, the impact can be seen across the convention.[780] Already in the preamble of UNCLOS, the influence of the New International Economic Order can be distinguished.[781]

> *Bearing in mind that the achievement of these goals will contribute to the realization of a just and equitable international economic order which takes into account the interests and needs of mankind as a whole and, in particular, the special interests and needs of developing countries, whether coastal or land-locked.*

Similarly, operational provisions aiming to use UNCLOS as a vehicle for promoting New International Economic Order values can be found in Part XIII dealing with marine scientific research, as well as Part XIV dealing with the transfer of marine technology.

Apart from the obvious influence of the New International Economic Order in the management regime of deep-sea resources, Part XI of the Convention also contains obligations to critically evaluate how successful the convention has been in bringing about equity.[782]

As shown by Mahmoudi, the introduction of the Maltese proposal in 1967 also coincided with concrete challenges to economic development of developing countries. [783] Moreover, around the same time developing countries had, with increasing success, started to act in concert in the UN, as the Group of 77. The formation of the G77 is intimately bound up with the development of the UN Conference on Trade and Development during the 1960s (UNCTAD).[784]

[780] For a more elaborated investigation of how the new international economic order is reflected in different parts of UNCLOS see John Gamble & Maria Frankowska, *International law's response to the New International Economic Order: an overview*, 9 BOSTON COLLEGE INTERNATIONAL AND COMPARATIVE LAW REVIEW (1986).

[781] Preamble of UNCLOS, para. 5.

[782] See, for instance, Article 155 para. 2: "The Review Conference shall ensure the maintenance of the principle of the common heritage of mankind, the international regime designed to ensure equitable exploitation of the resources of the Area for the benefit of all countries, especially the developing States."

[783] MAHMOUDI. 1987, at 127.

[784] John Toye, Assessing the G77: 50 years after UNCTAD and 40 years after the NIEO, 35 THIRD WORLD QUARTERLY (2014).

The formation of UNCTAD provided a developing country driven counterweight to the Bretton Woods institutions, including attempts to set up an international trade organization. But more importantly, it propelled the New International Economic Order concept and restored confidence among developing states. Previously divided along Cold War lines, the formation of the G77 for the first time made developing states act in concert with force in UN negotiations.[785] This spirit of collectivism and sentiment of joint interest among developing countries was particularly strong during UNCLOS III and can be regarded as the main reason why proponents of the common heritage of mankind principle were successful in gaining acceptance for the proposal.[786] Or rather, the relationship between these concepts was circular: The push for the common heritage of mankind principle was in line with and closely connected to the values reflected in UNCTAD, which in turn had enabled the formation of the G77, which also provided the necessary platform for developing states during the negotiations of UNCLOS III.

Often heralded as one of the greatest triumphs for developing countries in international law, a closer investigation of the negotiation history carried out by Mahmoudi, however, reveals that support for the common heritage of mankind concept was actually more widespread. Several developed states, notably the Nordic countries, Switzerland and Australia supported the principle.[787]

With regards to interpretation of the principle, these states contended that common heritage implied a notion of ownership, a property owned by mankind in the sense that unlike *res communis*, none might take any part of it without the consent of all. Initially this assertion was combined with several different proposals for implementation. There was, however, widespread agreement that there should be equitable participation of all states in the administration of the common heritage. Common ownership and common administration would logically lead to the sharing of benefits on an equitable basis.

[785] An examination of the negotiation documents, in particular from the proceedings of the first committee of UNCLOS III dealing with seabed resources, shows that in many regards the consistency of developing country unity in many regards was considerably higher compared to non-socialist industrialized states, NORDQUIST, et al. 2002., at 103-111.

[786] Edward L. Miles, Global Ocean Politics: Decision Process at the Third United Nations Conference on the Law of the Sea, 1973-1982 (Kluwer Law. 1997).

[787] MAHMOUDI. 1987, at 126.

In addition, claims for preferential rights for developing states were raised. On the institutional side, developing states also contended that common management made common representation necessary, and that a specific management organization had to be set up, to act on behalf of mankind for the management of its property. This would later become the International Seabed Authority.[788] In sum, these states called for common ownership, common management and equitable distribution of benefits, in order to ensure a de facto and genuine equality of states instead of the prevailing de jure equality.[789]

After extensive debates, the principle of common heritage of mankind eventually gained acceptance. After having tabled the issue for three sessions, the United Nations General Assembly established that the use of the seas was for the benefit of humanity, equitably shared. The seabed, ocean floor, and subsoil were declared "*the common heritage of mankind … [The] exploitation of its resources shall be carried out for the benefit of mankind as a whole, irrespective of the geographical location of states, whether landlocked or coastal, and taking into particular consideration the interests and needs of the developing countries … [It ensured] the equitable sharing [of its] benefits.*"[790] This declaration is the regulative origin for the common heritage of mankind principle later included in UNCLOS. The dominance of developing countries within the general assembly explains why proponents of the principle pursued the strategy to adopt a resolution, rather than addressing the issue at the UNCLOS negotiations. The subsequent treaty negotiation of the deep-sea regime was effectively bound by the resolution and spelled out operative provisions in line with its ambition.

D.1.7. Increased human involvement in the deep seas

It has now been discussed how both enclosure and the discourse of the New International Economic Order affected the discussion and negotiation relating to the appropriation of deep-sea resources.

[788] A. V. Lowe, The international seabed: a legacy of mistrust, 5 MARINE POLICY (1981).

[789] As expressed by Yugoslavia in U.N. Doc A/c.1/PV.1784, para.62, as cited in MAHMOUDI. 1987, at 128.

[790] The resolution passed by 108 to 0 with 14 abstentions. United Nations General Assembly resolution 2749 (XXV), Declaration of Principles Governing the Seabed and the Ocean Floor, and the Subsoil Thereof, beyond the Limits of National Jurisdiction, A/RES/25/2749 (12 December 1970). 1970.

A similarly important explanatory factor for the central role that the concept of the common heritage of mankind attained in the negotiations was the resource depletion in the oceans commons, which accelerated during the time of UNCLOS III, as well as the increase in knowledge of deep-sea resources generally. In both cases, technological improvements played a major role.

Fisheries management is not the focus of the present study, but the enhancement of fisheries technology and the ensuing competition for and depletion of fisheries resources around the years of the negotiation of UNCLOS are still relevant in this context. Firstly, the depletion of fish stocks and increased competition for remaining resources provide important explanations for high seas enclosure, which in turn sparked the reaction to which the common heritage of mankind principle forms part. Secondly, fisheries' depletion transformed the perception of marine resources generally, making it obvious that they were exhaustible. This sentiment would provide a solid argument for not letting the freedom of the seas extend to deep-sea resources, once UNCLOS started to negotiate the subject.

The depletion of living resources thus sparked discussions over how regulation in the high seas would be pursued, a discussion that would transform fundamental conceptions of appropriation in the law of the sea. The common heritage of mankind principle can be regarded as part of this discussion, and at least in part as a reaction to the resource depletion.

Long-distance fisheries in the high seas had commenced prior to the start of the negotiations of UNCLOS. It has already been discussed how that development found the basis for the expansion of Iceland's territorial sea in the 1950s. But it was during the years leading up to the negotiation of UNCLOS III that technology for the first time enabled a rapid growth in extraction of a substantial part of these resources: The total world catch trebled in 20 years, from 20 million tons in 1950 to 70 million in 1970. The improvement in techniques for finding and capturing fish, and processing the catch at sea, with trawlers and factory-freezer ships, rang alarm bells in some coastal states, as stocks in nearby waters soon shrank.[791]

[791] SANGER. 1986, at 2, 136.

In addition to empirical evidence of decreasing fish stocks, commons regimes in general came under increased scrutiny in economic theory around the end of the 1960s, when Hardin published *Tragedy of the commons*.[792] The paper and the ensuing debate casted light on the inherent problems of open-access management of common resources. As observed by Hardin, '*the inherent logic of the commons remorselessly generates tragedy'*, as free access and availability to resources leads to over-exploitation and minimizes the interest of any individual state in conservation and restraint.[793] Gradually, the adverse consequences of open access for the sustainability and effective exploitation of marine living resources became recognized.[794] As a result, it became increasingly evident that to prevent the resources of the deep seas from becoming depleted, it was no longer viable to effectively manage them as *res nullius* under the *mare liberum* principle. This widespread realization of the unviability of unrestrained access to common resources worked to the advantage of coastal states, which used the argument to promote further enclosures, based on their desire to increase their maritime claims, as discussed in section D.1.2. In the Icelandic Fisheries Cases in 1974[795], the ICJ also expressed observations on the character of high-seas fishing resources as common property. As observed by Birnie, Boyle and Redgwell:

> *While the decision confirmed that established fishing states continued to have high-seas rights beyond the twelve-mile limit of coastal state fisheries jurisdiction, the court also found that all the states concerned had an obligation of reasonable use which required them to take account of the needs of conservation and to allow coastal states preferential rights in the allocation of high-seas stocks. In the court's view, there was an obligation on all parties to negotiate in good faith with a view to reaching an equitable solution.*[796]

Moreover, during UNCLOS III, a rudimentary management model for deep-sea fisheries was therefore included in the part governing the high seas.

[792] Garrett Hardin, *The Tragedy of the Commons*, 162 SCIENCE (1968).
[793] BIRNIE, et al. 2009, at 195.
[794] Barnes, Entitlement to Marine Living Resources in Areas Beyond National Jurisdiction. 2010, at 87.
[795] Fisheries Jurisdiction (United Kingdom v Iceland), Merits, Judgment ICJ Rep 3, ICGJ 142 (International Court of Justice 18 December).
[796] BIRNIE, et al. 2009, at 195-196.

Essentially, the regulation of high seas fisheries was based on the same maximum sustainable yield and total allowable catch concepts as in marine areas within national jurisdiction (see section C.1.5.2). But as compared to fisheries management within national jurisdiction, an obvious weakness of the high seas fisheries management, as provided by UNCLOS III, was that it did not bring about any mechanism enforcing the rules. Whereas coastal states were given the exclusive mandate to implement and enforce the modalities for fisheries management within enclosed marine areas, the same modalities were combined with an unaltered open-access concept in the high seas.[797] For practical purposes, the implications of the high seas rules on fisheries were thus limited. The status quo effectively persisted, and frustration with the continued depletion of stocks eventually resulted in renewed negotiations, leading up to the UN Fish Stocks Agreement of 1995.[798] As previously discussed, the UNFSA did not privatize or enclose high seas fish stocks. Instead, this implementing agreement to UNCLOS provided for interested states to set up cooperation institutions to set maximum sustainable yields and allocate quotas. Such regional fisheries management organizations have been set up for many high seas areas. Despite the development of high seas management of fisheries, it should be borne in mind that it still resides on the *mare liberum* concept. Even under the regional approach of the UNFSA, there are possibilities for new states to enter regulated fisheries. Moreover, many fisheries remain unregulated.[799]

Although the common heritage of mankind principle was not formulated as extending to high seas fisheries, whether in the 1970 declaration or in UNCLOS, this can partly be explained by the realization that deep-sea resources were becoming depleted by unviable extraction on the part of states. During the years leading up to UNCLOS III, it became evident that the deep sea was not an infinite resource; rather, human technology could empty its resources. As a reaction, ideas of setting up management institutions for deep-sea resources under commons principles gained ground.[800]

[797] Up until the 200 nautical mile limit of the exclusive economic zone, see Part A.1.
[798] United Nations Fish Stocks Agreement. 1997.
[799] Sarika Cullis-Suzuki & Daniel Pauly, Failing the high seas: A global evaluation of regional fisheries management organizations, 34 MARINE POLICY (2010).
[800] Heidbrink, HISTORY COMPASS (2008).

The increased knowledge of and human involvement in the deep sea was not limited to fisheries. Development of technology enabling deep-sea research increased knowledge of other deep-sea resources than fish during the latter half of the 20th century. States started to become aware of the potential for extraction of valuable deep-sea minerals. There was scientific excitement set off by discoveries starting in the late 1950s which widely increased the knowledge of the deep seafloor and found extensive deposits of manganese nodules.[801] Predictions in 1965 foresaw that by 1985 operations would be processing 50 million tons of nodules annually.[802] In hindsight it is clear that these predictions were widely exaggerated, not in respect of the mineral wealth or the ability of technology to mine the resources, but rather in terms of the economic feasibility of deep-sea mining.[803] But it illustrates that the discussion on how deep-sea resources should be managed and divided was not theoretical, but based on genuine interests. Indeed, the insight in the potential value of resources beyond national jurisdiction transformed the perception of the deep seas as containing little besides fish of commercial value, into an area of potential and uncharted treasures. Essentially, the assumption of the deep sea as *res nullius* was disproved also in this regard.

The course from the realization of the extent of value of deep-sea resources to the establishment of the common heritage of mankind regime was by no means straight. As discussed previously, a number of states, led by the United States, consistently objected to the concept that the deep seas should be governed as commons under specific global institutions. These states contended that the realization that there were more resources than previously assumed essentially boosted their argument: Why would a restrictive regime have to be put in place for a resource which was not scarce? [804] The Reagan administration, in office during the final years of the negotiation of UNCLOS, contended that the freedom of the high seas, recognized by all for navigation, could be extended to the exploitation of minerals, and that seabed minerals should open to all on a “first come” basis.[805]

[801] SANGER. 1986.
[802] Richard J. Payne, Mining the Deep Seabed: The Political, Economic and Legal Struggle, 40 THE JOURNAL OF POLITICS (1978).
[803] Carol B. Thompson, International Law of the Sea/Seed: Public Domain versus Private Commodity, 44 NATURAL RESOURCES JOURNAL (2004), at 846.
[804] To this day, the common heritage of mankind principle is often cited as the primary reason against ratifying UNCLOS in the United States, see McLaughlin. 2010, at 379-380.
[805] Ted L. McDorman, UNCLOS III and the LOS Convention (Oxford University Press. 2009).

This argument was disputed by developing countries, which argued conversely: The increased prospects for accruing large profits from deep-sea resources made a regime ensuring equitable distribution of this wealth even more necessary. Otherwise, developing states claimed, these resources would become appropriated and privatized by the industrialized states with the relevant technologies.[806]

D.1.8. The trade-off between freedom of the seas and the common heritage of mankind

The realization that living resources could be – and were being – depleted, as well as the recognition that there were non-living resources in the deep seas amounting to vast potential values, prompted states to call for transforming the deep-sea regime. With regards to high seas living resources, the combination of empirical evidence of decreased stocks and recognition of the tragedy of the commons-problem illustrated in economic theory, as discussed in the previous section, made it apparent that unrestrained application of the freedom of the seas would result in mismanagement, and greater depletion of living organisms. This bolstered both the argument for increased high seas enclosure, and for regulating the freedom of seas in the remaining high seas.[807] The renewed calls for enclosure of high seas areas built on the decision in the Icelandic Fisheries Cases[808], as discussed in the previous section. The case opened the way for a much more radical transfer of marine areas with high seas status to the coastal states state. This had far-reaching implications: much of the world's fishing resource were no longer common property but fell under the exclusive rights of coastal states.[809] Whereas high seas enclosure was eventually halted at 200 nautical miles, the decision in the Icelandic Fisheries Cases also circumscribed the freedoms in remaining high seas-areas. The decision stated that had a customary law obligation not only to allocate common resources equitably, but also to promote sustainable utilization and

[806] Heidbrink, HISTORY COMPASS (2008).
[807] Vaughan Lowe, *Was it Worth the Effort?*, 27 THE INTERNATIONAL JOURNAL OF MARINE AND COASTAL LAW (2012).
[808] Fisheries Jurisdiction (United Kingdom v Iceland).
[809] For highly migratory species and straddling stocks, which migrate across the maritime zones of several states and/or the high seas, coastal states were not granted full autonomy but an obligation to cooperate.

conservation for future benefit.[810] As a development of these principles, UNCLOS developed conservationist obligations for high seas fisheries, which later would be further elaborated in the UNFSA. The operational provisions on high seas fisheries in UNCLOS effectively implied that a range of obligations had to be observed when exercising the freedom of fisheries. The central elements of the mare liberum-approach to high seas fisheries were however left intact. In the high seas, a regime contributing to both over-exploitation and inefficient use was thus solidified.[811]

With regard to other deep-sea resources than fisheries, the same trade-off yielded a very different result. In the negotiation of a deep-sea regime, the common heritage of mankind principle advocated by developing states prevailed. This can be interpreted, as has been discussed, firstly a reaction to the enclosure movement. Secondly, it can be explained by the influential standing of the new international economic order at the time of negotiation. Thirdly, and intimately connected to the previous point, a previously unseen cooperation of developing states gave force to these arguments.

Essentially, the rules relating to areas beyond national jurisdiction in UNCLOS can be interpreted as being built on different strains of thought; Firstly, the claims for expanded coastal state rights which were reflected in recognition of increased maritime zone entitlements. Secondly, the new international economic order which resulted in the common heritage of mankind-principle. Thirdly, the freedoms of the high seas, which came to persist largely intact in remaining high seas areas. The conclusion of the negotiations of UNCLOS III can be regarded as a trade-off between the first two of these movements. With regards to fisheries in what used to be high seas, coastal state appropriation of vast areas and exclusive claims for the resources in those areas gained acceptance, in return for a new radical regime for other deep-sea resources, in line with the New International Economic Order. The advancement of both these conceptions, enclosure and common heritage of mankind, was made at the expense of the high seas-freedoms, where the old *res omnium communis* regime was substantially cut short by exceptions, and geographically curtailed by enclosures.

[810] BIRNIE, et al. 2009, at 196.
[811] Barnes, Entitlement to Marine Living Resources in Areas Beyond National Jurisdiction. 2010, at 86.

D.2. International environmental law

Whereas the underlying perceptions of appropriation of resources in the law of the sea can be traced back to Medieval Europe, tracing the corresponding values of international biodiversity law predominantly relate to relatively recent events. Like the investigation of the law of the sea, the examination here will primarily concern one central treaty: The Convention on Biological Diversity.[812] As discussed in section C.2, in relation to the regime of international environmental law, CBD has a status comparable to the role of UNCLOS in the law of the sea. But unlike UNCLOS, CBD does not aspire to the same status as a framework convention – or implicit constitution – of a regime. If it is the ambition of UNCLOS to encompass all uses of the sea, the CBD can be regarded as the first international law treaty explicitly aiming to address all aspects of biodiversity, ranging from the conservation of biological diversity and sustainable use of biological resources to access of biotechnology and the safety of activities related to modified living organisms. The scope of the CBD is thus broad as regards rules on biodiversity, but it does not purport to codify the full spectrum of international environmental law. Whereas UNCLOS effectively incorporated pre-existing law of the sea treaties by means of references and also provided for negotiation of new special treaties, the CBD lacks such a comprehensive ambition. Compared to UNCLOS it is more streamlined, and important environmental obligations are provided by other treaties. As will be further discussed, the negotiation processes of the treaties were also, as will be discussed, very dissimilar. Yet there are important similarities between the two conventions.

A considerable difference from law of the sea is that biodiversity law is notoriously difficult to delimit. Especially when historically examining international rules relating to biological diversity, it is more fruitful to regard the field as part of a broader regime of international environmental law. Indeed, most modern environmental treaties share a common legal history. There may be considerably different orientation in specific purposes, aiming to protect widely different interests, such as climate, biodiversity or the integrity of the ozone layer. Still, the treaties of international environmental law are rooted in a common legal history and relate to the same overriding purpose of preventing

[812] The Convention on Biological Diversity (CBD).

the depletion of the natural environment and its resources.[813] Not only can the different treaties be regarded as offspring with common ancestry, but they are also strongly connected to principles which encompass all of them, as discussed in section C.2.1.

Before getting into how international biodiversity law relates to the appropriation of common bioresources, a central term for this area of international law needs to be briefly examined: How should the defining term *biological diversity* be approached? What is the rationale behind a terminology addressing different species collectively, emphasizing their differences?

D.2.1. Biological diversity as a legal interest

The perception of the variety of life forms is as old as the self-consciousness of the human species. Since pre-historic times, humans have been aware of the interest in maintaining biodiversity, in order to ensure sufficient food supplies. The first Neolithic revolution, around 10,000 years ago, was itself dependent on breeding, which conceptually overlaps with the knowledge of intra- and extra-species diversity. The reason for diversity among – and the origin of – species was one of the most captivating riddles of science for a long time. A gradual – and rather linear – setting out of a puzzle can be traced back to the Age of Enlightenment, following the discoveries of Linné, Mendel, Darwin all the way to Watson and Crick's discovery of the map for the structure of DNA in 1953. Yet the concept of evolutionary differences was not conceptually referred to as biodiversity before 1985, when an American scientist was planning a forum on biological diversity. The timing was not coincidental. In the mid-1980s, interest in the knowledge of the diversity of life and concerns about its conservation, both among scientists and among a considerable portion of society, was gaining momentum. A consensus emerged among scientists – as well as a more general popular awareness – that species were becoming depleted or extinct at an increasing speed.[814] Biodiversity – or biological diversity – (the terms are used interchangeably) has since been described in a number of ways.

[813] Kyu Sung Woong, How did they become law? A jurisprudential inquiry about the outcome principles of historic United Nations environmental conferences, 45 GEORGIA JOURNAL OF INTERNATIONAL AND COMPARATIVE LAW (2016).

[814] Anna Deplazes-Zemp, *'Genetic resources', an analysis of a multifaceted concept*, 222 BIOLOGICAL CONSERVATION (2018).

Broadly, biodiversity has been referred to as "*an umbrella term for the degree of nature's variety.*"[815] More specifically, CBD came to codify a definition entailing a three-fold concept, encompassing: 1) the diversity of ecosystems; 2) the diversity of species; and 3) genetic diversity within species.[816]

Out of these elements, Bowman argues that the concept of *diversity of ecosystems* appears to be most important, since individual species depend on the function of ecosystems and preservation of entire ecosystems is the most effective way to conserve biodiversity.[817] *Species diversity* has been regarded as the basis for taxonomic classification of living organisms, and has been the traditional focus for conservation efforts.[818] *Genetic diversity* can be regarded as the most fundamental element. It is closely connected to resilience of biodiversity, and its adaptability to changing conditions such as climate change.[819] The genetic variety within and between species also represents the instrumental value for bioprospecting.

D.2.2. The roots of biodiversity regulation in international law

How, then, did the concept of biological diversity find its way into international law? And based on what fundamental conceptions did regulation of biodiversity unfold?

In international law, the term *biological diversity* was first referred to in the CBD, signed at the Rio Summit of 1992. The CBD was not the only instrument produced by the Rio Conference. The conference resulted in a number of instruments but only the CBD and the United Nations Framework Convention on Climate Change were adopted as treaty texts open for signature at the meeting.

[815] McNeely. 1990.
[816] See Article 2, CBD.
[817] As observed by Bowman, "all living organisms exist and function not in isolation but as part of a wider environment, occupying a particular niche within their appropriate ecosystem, and it is through the preservation of entire ecosystems that diversity can most effectively be secured.", Bowman. 1996, at 5.
[818] Edward Osborne Wilson, The diversity of life (Harvard University Press. 1992), at 35-45.
[819] International Union for Conservation of Nature and Natural Resources (IUCN), World Conservation Strategy: living resource conservation for sustainable development (UNEP(02)/C6). (1980), sections 1 and 3; Bowman. 1996.

The CBD was thus part of a broader shift of momentum in international environmental law in the final years of the 20th century. Accordingly, the ethos underpinning CBD form part of a broader paradigm of international environmental law, which was at its peak in the golden years of international relations in the years after the fall of the Berlin Wall.

But the idea of international law rules on biodiversity was not conceptually invented in 1992. Proposals for negotiating such a treaty predates the Rio Summit by at least three decades. Many of the principles reflected in the CBD originate in international wildlife treaties drafted already a century or more ago. Already in early treaties relating to wildlife conservation, it was effectively accepted that biodiversity protection is best effected *in situ*, i.e. through the conservation of natural habitats in a way which preserve entire ecosystems and the species they contain.[820]

Such instruments concerned with habitat protection and the control of or reduction in activities that adversely affect species and habitat date back to at least 1900, when the Convention for the Preservation of Wild Animals, Birds and Fish in Africa[821] was signed by the European colonial powers.[822] This convention and similar wildlife treaties, such as the International Convention for the Protection of Birds Useful to Agriculture[823], which were negotiated during the beginning of the 20th century can be regarded as the first generation of environmental treaties.[824] These instruments are however predated by *Bearing Fur Seals* arbitration, which in 1892 provided the first international judicial determination of an international conservation dispute.[825]

[820] See also Jeffrey A. McNeely, Conserving the world's biological diversity (IUCN Publications Services. World Bank. 1990); Bowman. 1996, at 6.
[821] The Convention for the Preservation of Wild Animals Birds and Fish in Africa, 19 May 1900, 94 BFSP 75.
[822] The objective of the Convention was 'to prevent the uncontrolled massacre and to ensure the conservation of diverse wild animal species in their African possessions which are useful to man or inoffensive', Michael Bowman, et al., Lyster's international wildlife law (Cambridge University Press 2 ed. 2011), at 262.
[823] The International Convention for the Protection of Birds Useful to Agriculture, 19 March 1902.
[824] Michael J. Bowman, The 1902 Convention for the Protection of Birds in Historical and Juridical Perspectiveal, 61 Ardeola (2014).
[825] See Bering Sea Arbitration. The decision was however not fully successful in resolving the matter, and in 1911 a convention for preserving the fur seals was concluded. See Bowman, et al. 2011, at 4; Anita M. Halvorssen, *The origin and development of international environmental*

It can thus be claimed that regulation of biological diversity, at least elements of it, has a long history in international law.[826] But this older generation of environmental agreements were limited in both scope and ambition, generally focusing on conservation of one specific species, or one geographic location. They generally lacked consideration of species as part of ecosystems and the dependency on habitats.

The conception that countering depletion of biodiversity generally, without limitations to specific species, is a task which ought to be regulated in treaty law is a considerably younger idea, connected to the modern generation of international environmental law.[827] Explicit attention to biodiversity as a legal interest is a modern concept. The reason for its relatively short history is that it was only recently that the scale of the threat posed to the natural environment by human activities became recognized. Awareness of biodiversity loss as well as the magnitude of the environmental degradation in general did not become widespread until the 1960s, when Rachel Carson's book Silent Spring was published and sparked extensive debate, first in the US and then in other parts of the world.[828] The publication and the ensuing discussion contributed to the development of the first legislation on pesticides in the US, as well as the formation of civil society organisations pressuring governments for protection of nature.[829]

Agreement within the international community that global action was necessary in order to halt the high rate of extinction was also made difficult by the traditional understanding that exploitation of natural resources forms part

law, *in* ROUTLEDGE HANDBOOK OF INTERNATIONAL ENVIRONMENTAL LAW (Shawkat Alam, et al. eds., 2013), at 28.

[826] A. Gillespie, The long road to sustainability: The past, present, and future of international environmental law and policy (2018).

[827] Michael Bowman & Catherine Redgwell, *Introduction*, *in* INTERNATIONAL LAW AND THE CONSERVATION OF BIOLOGICAL DIVERSITY (Michael Bowman & Catherine Redgwell eds., 1996).

[828] RACHEL CARSON, SILENT SPRING (Boston : Mariner Books, Houghton Mifflin Harcourt Fortieth anniversary edition ed. 2002).

[829] Edith Brown Weiss, International environmental law: contemporary issues and the emergence of a new world order. (Symposium: International Law for a New World Order), 81 GEORGETOWN LAW JOURNAL (1993); Halvorssen. 2013, at 29.

of national sovereignty, to be managed by the individual states as part of their sovereign jurisdiction.[830]

This also remains the central problem of management of biodiversity and a central explanatory factor for its depletion; even if wild organisms migrate across borders, the basic presumption of international law is that each state is free to exploit wildlife within its territorial jurisdiction, on land as well as in the sea.[831]

An early landmark in international cooperation relating to biological diversity was the 1968 Intergovernmental Conference in of Experts on the Scientific Basis for Rational Use and Conservation of the Resources of the Biosphere. The program document adopted at the conference underlined humanity's place in the natural order and the importance of a holistic, ecosystem approach to nature conservation.[832]

The 1972 United Nations Conference on the Human Environment (The Stockholm Conference on Environment) is usually described as the spark that ignited international environmental law. The conference was attended by 114 states, as well as important international institutions and non-governmental organizations. The conference resulted in the Stockholm Declaration, containing 26 principles, an Action Plan containing 109 recommendations as well as three non-binding instruments, including a resolution on institutional and financial arrangements. [833] The declaration has been considered a remarkable achievement, in particular in comparison with the relatively slow speed development of contemporary multilateral cooperation in the environmental field. In more concrete terms, there was no direct reference to the biodiversity concept as such in the Declaration.[834] There were however references to the need for conservation among the outcomes.

[830] Bowman. 1996, at 6-7.

[831] As already has been discussed in the context of the law of the sea, states have enjoyed free and equal access to exploiting living resources in the high seas.

[832] Maureen Reed, The contributions of UNESCO Man and Biosphere Programme and biosphere reserves to the practice of sustainability science, 14 SUSTAINABILITY SCIENCE (2019); Bowman. 1996, at 6-7.

[833] Halvorssen. 2013, at 31-32.

[834] Bowman. 1996, at 6-7.

In particular, Principle 4 of the Stockholm Declaration declared that '*Man has a special responsibility to safeguard and wisely manage the heritage of wildlife and its habitat, which are now gravely imperilled by a combination of adverse factors. Nature conservation, including wildlife, must therefore receive importance in planning for economic development.*'[835] There is no doubt this ambition strongly connects to what would later become the objective of the CBD. Equally importantly, sustainable development, a concept that would later deeply influence biodiversity regulation, dates back to the Stockholm conference. Even if the Stockholm Declaration similarly did not use the term sustainable development, it has been widely regarded as laying the foundations for its subsequent acceptance as a core principle of international environmental law and policy.[836]

It was not until 1980, with the adoption of the World Conservation Strategy (WCS)[837], formulated by the International Union for the Conservation of Nature (IUCN) in collaboration with UNEP, WWF, FAO and UNESCO, with its explicit references to diversity of life forms, that the basis for the biodiversity concept was established.[838] The WCS articulates one of the three fundamental objectives of living resource conservation as the preservation of genetic diversity.[839]

In the Strategy, genetic diversity was defined as the '*range of genetic material found in the world's organisms), on which depend the functioning of many of the above processes and life-support systems, the breeding programmes necessary for the protection and improvement of cultivated plants,*

[835] Also connected to biodiversity, Principle 2 emphasized that 'The natural resources of the earth, including the air, water, land, flora and fauna and especially representative samples of natural ecosystems, must be safeguarded for the benefit of present and future generations through careful planning or management, as appropriate.' Principle 3 declared that "The capacity of the earth to produce vital renewable resources must be maintained and, wherever practicable, restored or improved."

[836] BIRNIE, et al. 2009, at 106-127.

[837] International Union for Conservation of Nature and Natural Resources, United Nations Environment Programme, World Wildlife Fund, Food and Agriculture Organization of the United Nations and Unesco, World Conservation Strategy: Living resource conservation for sustainable development. (1980).

[838] Bowman. 1996, at 8.

[839] The others being (a) to maintain essential ecological processes and life-support systems and (c) to ensure the sustainable utilisation of species and ecosystems. World Conservation Strategy. 1980;World Conservation Strategy (1980).

domesticated animals and microorganisms, as well as much scientific and medical advance, technical innovation, and the security of the many industries that use living resources.'

The concept of biodiversity as a vital interest was further developed in the 1982 World Charter for Nature[840], and the Second World Conservation Strategy, Caring for the Earth (1990)[841]. In the latter document, the emphasis is on the need to conserve the "*vitality and diversity of the Earth.*" In relation to the WCS, this terminology marks a substantial modification: For the first time there was a call for the conservation of biodiversity, including the range of genetic stocks within each species, and the variety of ecosystems.[842]

D.2.3. Biodiversity law as part of sustainable development

In parallel to these first soft law appeals to protect biodiversity, a broader concept of sustainable development unfolded. As we will see, the sustainable development concept would eventually come to have a vast impact on the development of environmental regulation in international law, encompassing and qualifying environmental conservation, including biological diversity. In order to examine the interplay between sustainable development and biological diversity, it is necessary to complement the account of the origin of biodiversity regulation in international law with a description of where sustainable development originated.

As a legal interest, sustainable development was partly developed in the same World Conservation Strategy documents which identified biological diversity as a concept. Sustainable development not only included environmental policy, but also implied a new normative perspective. Sustainable development entails a holistic understanding of economic, social and environmental policy. It implies interconnectivity and maintains that having regard to all three aspects of sustainability is necessary for development.

[840] United Nations General Assembly, Draft World Charter for Nature, A/RES/35/7 (30 October 1980).

[841] Caring for the Earth - A Strategy for Sustainable Living - Second World Conservation Strategy (IUCN. 1991).

[842] Bowman. 1996.

The implications of environmental – including biodiversity – conservation becoming part of this broader concept were far-reaching and would subsequently affect the rules of the CBD, as well as its perspective of appropriation of genetic resources.[843]

Like biological diversity, sustainable development as a legal interest is regularly traced back to the 1972 Stockholm conference. However, with sustainable development the reference is not entirely accurate. Rather, sustainable development would come about later, mainly as the result of the disappointment with the limited success of the conference's objectives. As a result, ten years after the conference, the UN General Assembly at the request of the General Secretary decided to set up an ad hoc commission, to focus on environmental and developmental problems and solutions. Chaired by Gro-Harlem Brundtland, the World Commission on Environment and Development, which started its work in 1984, had a relatively open mandate.[844]

The Brundtland Commission came to base its analysis primarily on the needs and interests of humans. Foremost, it was concerned with securing a global equity for future generations by redistributing resources towards poorer nations to encourage their economic growth in order to enable all human beings to meet their basic needs. In its report, the commission declared that social equity, economic growth and environmental maintenance are simultaneously possible. The report thereby highlighted the three fundamental components of sustainable development: the environment, the economy, and society. The concluding sections focused on the need to apply integrated, sustainable solutions to a broad range of problems related to population, agriculture and food security, biodiversity, energy choices, industry, and more. Although it was largely optimistic about the prospects of bringing about such a holistic perspective, the Brundtland Report did acknowledge the potential for tension between economic growth and environmental protection. However, reasoning about detrimental impacts of integrating environmental with economic and social development was largely lacking.[845]

[843] Alan Boyle, The Rio Convention on Biological Diversity, see ibid.

[844] Anne E. Egelston, Sustainable Development: A History (Springer Netherlands. 2013).

[845] Jacobus A. Du Pisani, *Sustainable development – historical roots of the concept*, 3 ENVIRONMENTAL SCIENCES (2006).

When the report of the Brundtland Commission was eventually released in 1987, species and ecosystems were explicitly declared resources for (sustainable) development.[846] Even more interestingly, the Brundtland Commission called for a new approach to species and ecosystem conservation based upon the notion of "anticipate and prevent" and for the negotiation of a properly funded "Species Convention" along the lines of UNCLOS. The original call for negotiation of the CBD was thus made with direct reference to UNCLOS as a source of inspiration. Moreover, this call was part of a broader new paradigm of sustainable development, which in a novel way integrated environmental conservation and protection with other aspects of development.

Indeed, by articulating the concept of sustainable development, the Brundtland Report introduced a revolutionary new concept into international law, with implications that could hardly have been foreseen at the time. Not only did it introduce the concept of intra-generational responsibility, it poignantly defined the challenges for civilization: Population, food security, species extinction, genetic resources, energy production, industrial pollution and human settlement. Of course, these challenges had been recognized before. The revolutionary impact of the report was rather that it did not treat these topics in isolation but as part of a common agenda. Even more radical in its ambition, the institutional and legal analysis of the report challenged the fundaments of the global economy, the managing of global commons, as well as established truths on the interplay between peace, security and development. Among the key challenges for the development of international law identified in the report, areas beyond national jurisdiction were described.[847]

Moreover, the Brundtland Report did not merely provide a broadly accepted definition of sustainable development; it also drew a map indicating how this might be achieved.

[846] Report of the World Commission on Environment and Development: Our Common Future. United Nations General Assembly document A/42/427 (1987).; Michael Bowman, *The Nature, Development and Philosophical Foundations of the Biodiversity Concept in International Law*, *in* INTERNATIONAL LAW AND THE CONSERVATION OF BIOLOGICAL DIVERSITY (Michael; Redgwell Bowman, Catherine ed. 1996).

[847] Philippe Sands, Sustainable Development: Treaty, Custom, and the Cross-fertilization of International Law (Oxford University Press. 1999); Nico Schrijver, The evolution of sustainable development in international law: inception, meaning and status (Leiden : Martinus Nijhoff. 2008); Alan Boyle & David Freestone, International Law and Sustainable Development: Past Achievements and Future Challenges (Oxford University Press 2001).

To a surprisingly high degree, the subsequent development of international law in the field followed this map. Sustainable development has been at the center of this development. It was at the heart of the outcomes of the 1992 United Nations Conference on Environment and Development in Rio de Janeiro, as well as the development of treaties such as the Convention on Biological Diversity.[848]

It is thus clear that biological diversity has recently been recognized as an important value and necessary to protect. Its legal development originates in the 1972 Stockholm Declaration and is deeply rooted in the sustainable development concept launched in the Brundtland Report of 1987.

D.2.4. Rationales for negotiating a biodiversity treaty

What motivated this proposal, namely to undertake a complex negotiation for a global framework for biodiversity? Foremost, it reflected a growing recognition of the need for a global convention to remedy the perceived defects of the previously fragmented approach to the conservation of global diversity.[849] In its analysis, the Brundtland Commission highlighted the patchwork nature of international environmental law, regulating either particular types of ecosystems (e.g. the Ramsar Convention on Wetlands of International Importance), particular species (e.g. the Convention on the Conservation of Migratory Species of Wild Animals) or particular threats to endangered species (e.g. the regulation of wildlife trade in the Convention on International Trade in Endangered Species of Wild Fauna and Flora).[850]

Based on the conclusions of the Brundtland Commission, the Governing Council of UNEP decided to establish an ad hoc working group to examine "the desirability and possible form of an umbrella convention to rationalize current activities in this field and to address other areas which might fall under such a convention."[851]

[848] WARNER. 2009.
[849] Veit Koester, The Nature of the Convention on Biological Diversity and its Application of Components of the Concept of Sustainable Development, 16 THE ITALIAN YEARBOOK OF INTERNATIONAL LAW ONLINE (2006).
[850] Iris Borowy, Defining Sustainable Development for Our Common Future (Routledge. 2016).
[851] MCCONNELL. 1996.

Within this working group, consensus had been achieved by 1990 on launching negotiations on what would later become CBD. The primary stated motivation for launching the CBD negotiation was thus to fill the perceived lacunae of the existing fragmented regime and bring about a comprehensive global approach to the protection of the planet's biodiversity.[852] However, in line with the sustainable development mandate for the preparation of the CBD, the treaty negotiation would go beyond conservationist aspects, and include other issues of development, in particular economic equity and distributional aspects. To a surprisingly high degree, these other elements of sustainable development, in particular economic distribution, came to dominate the negotiation and indeed the final treaty, overshadowing the conservationist ambitions which were claimed as the reason for initiating negotiations in the first place.

The major motivation for negotiating the CBD can thus be traced to the conclusion of the Brundtland Report that a comprehensive global regulation was lacking, and in its absence loopholes in the regulation were expected to persist. Although it is true that the CBD lacks a predecessor with an equally comprehensive scope, it is inaccurate to say that there were no treaties of relevance for the regulation of genetic resources prior to the CBD.

Among the pre-existing treaties, some addressed the issue of ownership of genetic resources. Of particular interest in this context was the FAO International Undertaking on Plant Genetic Resources[853] of 1983, which declares as a universal principle that all plant genetic resources are a heritage of mankind and consequently should be available without restriction.[854] Although the undertaking was without applicability to marine organisms, the approach illustrates that prior to the adoption of the CBD, at least developing states were inclined to consider genetic resources, including such resources within national jurisdiction, not to be part of the sovereignty of states, but encompassed by the common heritage of mankind.[855]

[852] BIRNIE, et al. 2009, at 612-620.
[853] The International Undertaking on Plant Genetic Resources for Food and Agriculture 31 I.L.M. 822 (1992)
[854] Verhoosel, The International Journal of Marine and Coastal Law (1998), at 96.
[855] Gregory Rose, *The International Undertaking on Plant Genetic Resources for Food And Agriculture: Will the Paper be Worth the Trees?*, *in* ACCESSING BIOLOGICAL RESOURCES: COMPLYING WITH THE CONVENTION ON BIOLOGICAL DIVERSITY (Natalie P. Stoianoff ed. 2004).

The approach of the FAO undertaking, which essentially applies the same principle as for seabed resources of the area under the law of the sea to all plant resources, irrespective of jurisdiction, was already controversial at the time.[856] The main criticism was that some considered it incompatible with Principle 21 of the Stockholm Declaration, which recognizes that states have the sovereign right to exploit their own resources pursuant to their environmental policies.[857]

The rules in the FAO undertaking illustrates that not only were issue of ownership to genetic resources contemplated and indeed to a certain extent regulated in international environmental law prior to the CBD. This disproves the notion that the new convention was negotiated in a legal lacuna as regards biotechnology. Moreover, it is particularly noteworthy that the pre-existing rules in the FAO undertaking were based on a conception contrary to what would become the basis for the approach of the CBD. Because once negotiations for the CBD started, the proposition that biodiversity should be considered as the "common heritage" of humankind was rejected at an early stage, in spite of a suggestion in the Brundtland report that a new global convention on wild species should be drafted based on the concept of '*common concern of all countries*'.[858]

Instead, the negotiators of the CBD unconditionally put biological resources under the sovereign rights of the states where they occur.[859] This was decided already at the second session of the Working Group in 1990, where the Executive Director of UNEP had stressed that the agreement should not infringe the sovereignty of states over their resources.[860] Whereas the negotiators thus actively rejected the common heritage approach, the CBD would come to include the linguistically similar principle of common concern for humankind.

[856] Verhoosel, The International Journal of Marine and Coastal Law (1998), at 96.
[857] GLOWKA, A Guide to the Convention on Biological Diversity. 1994, at 3.
[858] BIRNIE, et al. 2009, at 129.
[859] See Article 3 of the CBD, which reproduces *verbatim* Principle 21 of the Stockholm Declaration. Moreover, Article 15 recalls the sovereign rights of states over their natural resources as a basis for the authority to determine access to genetic resources.
[860] As accounted by Boyle, the Executive Director further stated 'that it must protect the interest of States in which the resources are located and must provide the incentives for the conservation of biological diversity without inhibiting growth or sustainable development.' Alan Boyle, *The Rio Convention on Biological Diversity*, *in* INTERNATIONAL LAW AND THE CONSERVATION OF BIOLOGICAL DIVERSITY (Michael Bowman & Catherine Redgwell eds., 1996), at 35.

The choice of language was the result of political compromise, since initial proposals for using the common heritage of mankind had met considerable opposition.[861]

The material content is however different. *Common concern* was not employed in international law prior to the Rio conference, but came to be reflected in both the CBD and UN Framework Convention on Climate Change.[862] In many regards its legal implications appear vague, but according to Birnie, Boyle and Redgwell, it appears to indicate "*a legal status for climate change and biological resources which is distinctively different from the concepts of permanent sovereignty, common property, shared resources, or common heritage which generally determine the international legal status of the natural resources.*"[863]

As expressed in the preamble of the CBD, the common concern approach does not relate to the ownership of genetic resources but is only concerned with conservationist aspects: It implies a common responsibility on the part of the entire international community to preserve biological diversity.[864] As observed by de Lucia, "*The concept of 'common concern*' *has a more delimited normative and operational scope than 'common heritage' because it does not involve the 'internationalisation' of areas or resources.*"[865] When the FAO undertaking in 2001 became developed into the International Treaty on Plant Genetic Resources for Food and Agriculture[866], the common concern approach of CBD was favored over the common heritage of mankind principle of the FAO undertaking.

[861] BIRNIE, et al. 2009, at 129-130.
[862] The common concern for humankind-concept is also used in the UN Framework Convention on Climate Change, 9 May 1992, 1771 U.N.T.S. 107 (UNFCC), preamble para 1.
[863] BIRNIE, et al. 2009, at 129.
[864] GLOWKA, A Guide to the Convention on Biological Diversity. 1994, at 10.
[865] Vito De Lucia, The Concept of Commons and Marine Genetic Resources in Areas beyond National Jurisdiction, MARITIME SAFETY AND SECURITY LAW JOURNAL (2018), at 129. As similarly noted by Birnie, the CBD does not "internationalize biological resources in the manner UNCLOS relates to seabed mineral resources; still it does not turn them into common property accessible for exploitation by all states", BIRNIE, et al. 2009, at 129, and 190-205.
[866] International Treaty on Plant Genetic Resources for Food and Agriculture, 3 November 2001, 2400 U.N.T.S. 303.

Equating territorial jurisdiction with sovereign rights for genetic resources in this manner may appear self-evident today, but the approach marked a notable shift in comparison to previous undertakings.

Once negotiations for the CBD started, the work progressed with a remarkable speed. Compared to the decades of negotiations of UNCLOS, the period leading up to the final negotiations of CBD was incredibly short: Already in February 1991 a first draft of a convention was presented, to serve as a basis for launching formal negotiations. The formal negotiation would then ensue for only 15 months before the adoption in Nairobi in May 1992. One month later, it was opened for signature and already in December 1993 it entered into force after its thirtieth ratification.

D.2.5. The ethos of the CBD: Conserving biodiversity for human purposes?

It has already been discussed how CBD defines biodiversity, encompassing diversity of ecosystems, species, as well as diversity within species. Of similar importance, the convention defines genetic resources as genetic material of actual or potential value.[867] The purpose of ensuring long-term conservation of the biodiversity of living organisms runs like a thread through the convention. The way the regulation is drafted, it is considered axiomatic that biodiversity protection can be most efficiently carried out *in situ*, that is, through the conservation of natural habitats in such a way as to preserve entire ecosystems and the species they contain. It is, however, also recognized that *ex situ* conservation, such as captive breeding and gene banks, can be used for conservation purposes.[868]

What, then, is the underlying purpose of the aim to conserve genetic diversity under the CBD? Values of nature are often divided into different categories, distinguished as *instrumental*, *inherent* or *intrinsic*. These different strands of valuing nature are reflected as the purpose or ethos of environmental conservation have shifted over time. They will now be briefly described, in order to enable us to define the CBD in this context and categorize its ethos.

[867] See Article 2, CBD.
[868] Bowman, The Nature, Development and Philosophical Foundations of the Biodiversity Concept in International Law. 1996.

The instrumental value of a particular entity lies in the use to which it may be put, as in any case of a natural resource being extracted for an economic purpose, such as food or input goods in production. Inherent value, by contrast, is the value that an entity possesses on account of being prized for itself, rather than for its utility. Perhaps most commonly, natural resources can be appreciated for esthetical values, but cultural or religious considerations may be equally relevant. Both instrumental and inherent value depend upon the existence of an element of external assessment of value. Intrinsic value, on the other hand, is interpreted as the value that objects have of and for themselves. Consequently, intrinsic value does not presuppose the existence of any external assessment of value.[869]

All three different notions of value can be distinguished as primary motivators in different bodies of international law relating to environmental protection. Early attempts at nature conservation were primarily motivated by utilitarian and material considerations. This essentially *instrumental* motivation is reflected in the first generation of treaties to protect species that we today aim to safeguard for biodiversity purposes. Commonly, even the names of these treaties of the early 20th century contain utilitarian references, such as the 1902 Convention for the Protection of Birds Useful to Agriculture. References were made to preserving species that were “useful to man or inoffensive.” Conversely, species considered harmful to human interests were excluded from protection. In some cases, treaties even provided for their destruction. Early environmental treaties can thus be regarded as genuinely anthropocentric. Human interests were also the basis for early management regimes for species such as whales, seals and fish.[870]

An assessment of the success of the early environmental treaties and management regimes for living resources yield disappointing results, even in light of the limited objectives of the treaties concerned. For instance, the regulation of whaling catch levels and quotas under the International Convention for the Regulation of Whaling appears to have been mainly concerned with commercial and market regulation aspects of whaling.

[869] Donald S. Maier, What's So Good About Biodiversity?: A Call for Better Reasoning About Nature's Value § 19 (Springer Netherlands, Dordrecht. 2012), Edward Osborne Wilson, et al., Biodiversity (Washington, D.C. : National Academy Press. 1988).
[870] Birnie, et al. 2009.

The ecological state of whale stocks seems to have been largely disregarded, and the treaty cooperation failed to prevent the continued depletion of large marine mammals.[871]

A second consideration, which appears to have been a major motivation of early international environmental treaties, was the esthetic value of the natural world. From this perspective, which focuses on the *inherent* value of the environment, nature was to be regarded in a manner similar to a work of art. Whereas instrumental motivations are most apparent in conservation treaties in then colonized parts of the world, the inherent motivations appear to have been more prevalent in early treaties protecting certain regions of North America. Inherent value arguments were repeated in the preambles of many later conventions, frequently in combination with other justifications such as economic and scientific aspects.[872]

Motivating international regulation on the inherent value of nature can in many regards be just as anthropocentric as the instrumental perspective, for in both settings the environment should be protected for qualities appealing to humans. But there are also some key differences. The inherent motivation does not relate to consumption, but is based on preserving its subject in an untransformed state in perpetuity, simply for enabling humans to continue to enjoy it. Moreover, the inherent motivation commonly had a geographically defined conservationist ambition that the materially motivated treaties lacked. In certain regards, this has similarities with – and can be regarded as the basis for – modern area-based management measures. In some of these treaties, knowledge and recognition of the interdependence between species within the geographic site can be distinguished. However, this should not be exaggerated. There was certainly no ecosystem analysis behind this reasoning. Nevertheless, it does have some similarities with such modern approaches: Important areas should be preserved, including all the species interacting in that location.[873]

[871] Cameron S. G. Jefferies & John Norton Moore, Marine Mammal Conservation and the Law of the Sea (Oxford: Oxford University Press USA - OSO. 2016).
[872] Bowman, The Nature, Development and Philosophical Foundations of the Biodiversity Concept in International Law. 1996, at 17.
[873] Ibid.

Thirdly, there are international environmental treaties based on a different form of environmental ethics – promoting conservation or sustainable management for the *intrinsic* value of nature itself. This motivation is surprisingly new and was lacking in the first generation of environmental treaties.[874] The Berne Convention[875], signed in 1979, appears to be one of the first instruments where such motivations are dominating. In its preamble, the convention states that European wildlife constitutes a natural heritage possessing intrinsic value. The World Charter for Nature, signed in 1982, is another instrument where such motivations stand in the foreground.

In its preamble, the Charter states that "Every form of life is unique, warranting respect regardless of its worth to man, and, to accord other organisms such recognition, man must be guided by a moral code of action."[876] Compared to the first generation of environmental treaties, regarding nature's intrinsic value as a major motivation for conservation marked an important step: For the first time, at least seemingly non-anthropocentric values were added to the anthropocentric values which had hitherto been the reason for international commitments.

One could perhaps have assumed that this development would progress in a linear manner, with increased emphasis on non-anthropocentric values in subsequent treaties. But a critical examination of the references to underlying motivations of the 1992 Rio Declaration yields a different conclusion. Its Principle 1 declares that human beings are at the center of concerns for sustainable development. Moreover, there is no recognition of the intrinsic value of natural ecosystems and wild species anywhere in the document.[877] Accordingly, rather than marking a continuation of a development with greater emphasis on the intrinsic values of environment, the 1992 Rio Declaration marked a backlash against these non-anthropocentric values.

[874] John A. Vucetich, et al., Evaluating whether nature's intrinsic value is an axiom of or anathema to conservation, 29 CONSERVATION BIOLOGY (2015).
[875] The Council of Europe's Convention on the Conservation of European Wildlife and Natural Habitats, 19 September 1979, 1284 UNTS 209 (Berne Convention) (1979).
[876] A/RES/37/7 48th plenary meeting 28 October 1982, available at https://digitallibrary.un.org/record/39295.
[877] Marc Pallemaerts, International Environmental Law from Stockholm to Rio: Back to the Future?, in GREENING INTERNATIONAL LAW (Philippe Sands ed. 1994).

In part, this return to the instrumental value of nature as a motivation can be explained by the introduction of the sustainable development concept, into which environmental conservation objectives were integrated, starting with the Rio Declaration. This resulted in an increased tendency to merge environmental management and conservationist motivations with the purpose of promoting development. This approach was set out relatively early in the process leading up to the CBD. As noted in the previous section, the Executive Director of UNEP already at the second session of the Working Group in 1990 set the stage by stressing that the agreement should not infringe the sovereignty of states over their resources and '*that it must protect the interest of States in which the resources are located and must provide the incentives for the conservation of biological diversity without inhibiting growth or sustainable development.*'[878]

This should not come as a surprise: Promoting economic development for humans is inherently anthropocentric and merging environmental considerations with developmental ones naturally results in a move towards instrumental perspectives. This idea to see environmental conservation as a vehicle for economic development was at the heart of the Brundtland Report. While the sustainable development concept meant a more holistic approach to development, including economic as well as social and environmental values, it also changed the way in which nature conservation was perceived in treaty law. Prior to the Brundtland Report, the intrinsic values of nature had been guiding. After the Brundtland report, nature primarily was referred to as an instrumental value, to be used for human development.[879]

This is perhaps most striking in Principle 4 of the Rio Declaration, which states: "*In order to achieve sustainable development, environmental protection shall constitute an integral part of the development process and cannot be considered in isolation from it.*" This formulation has been criticized for subordinating environmental protection entirely to the needs of the development process.[880]

[878] Boyle, The Rio Convention on Biological Diversity. 1996, at 35.
[879] Michael Bowman, et al., Research Handbook on Biodiversity and Law (Edward Elgar. 2016).
[880] Bowman, The Nature, Development and Philosophical Foundations of the Biodiversity Concept in International Law. 1996, at 20.

Nevertheless, in the CBD, which was drafted at the same conference, and forms part of the Rio paradigm as previously discussed, intrinsic motivations are not only mentioned, but seem to be of prime importance, at least in the non-operative parts of the convention. The first paragraph of the preamble of the CBD clearly reflects the regard to non-instrumental values:

> *Conscious of the intrinsic value of biological diversity and of the ecological, genetic, social, economic, educational, cultural, recreational and aesthetic values of biological diversity and its components.*

Intrinsic values are thus not just mentioned, but actually referred to in the first line of the CBD. Thereafter, a number of instrumental values are noted, including finally a reference to inherent (esthetic) values. When approaching the values underpinning the CBD, this is important to bear in mind. The CBD is thus different from earlier environmental law treaties, as well as the contemporary Rio Declaration, in that it at least sets out to reflect instrumental *and* inherent and intrinsic values.[881]

How, then, were these values reflected in the operative parts of the convention, including how the convention would regard appropriation of genetic resources?

Already during the preparatory stage, at the second session of the Working Group in 1990, before formal negotiations were launched, the Executive Director of UNEP stressed that the agreement should not infringe the sovereignty of states over their resources, that it must protect the interest of states in which the resources are located, and that it must provide incentives for conservation of biological diversity without inhibiting growth or sustainable development.[882] It was thus clear at an early stage that the CBD would not only leave the sovereign rights of states to their resources intact; the new convention would also protect their interests. Moreover, incentives for conservation would be provided but only to the extent that doing so would not inhibit economic growth.

[881] Michael Bowman, Biodiversity, Intrinsic Value, and the Definition and Valuation of Environmental Harm (Oxford University Press. 2002).
[882] Bowman, The Nature, Development and Philosophical Foundations of the Biodiversity Concept in International Law. 1996, at 20.

This deviates considerably from the spirit of the preamble, as discussed above, and marks a step closer to Principle 4 of the Rio Declaration, i.e. the concept of not only merging environmental purposes with developmental ones, but also giving economic development interests preference. Accordingly, it can be concluded that already at the working group stage, it was established that instrumental, economic development purposes would take precedence in the new convention.

Relatively early on in the negotiations, there was also a consensus among participants, not only that those who benefited most from the economic benefits of biological diversity (developed states) would have to transfer economic means for the preservation and conservation of biodiversity (in developing states). There was also rather widespread support for the notion that genetic resources should in some form be accessible to all and that technology and information on their use should be transferable to all.[883]

The subsequent negotiation appears to have been relatively straightforward compared to other framework conventions. Essentially, the central area of contention related to how cooperation could be built on an agreement which both gene-rich developing countries and technology-rich developed countries could be built. In 1991, the basic negotiation objectives were formulated as ensuring both the conservation of biological resources and the rational use of biological resources as integral and inseparable elements of the convention.[884] However, bridging the gap between developed and developing states was far from easy. In the negotiations, there was a considerable element of suspicion among developing states that the convention as well as the 1992 Rio Summit generally would be used to facilitate developed countries' access to developing countries' resources and curtail the latter's ability to pursue an independent development agenda by means of environmental requirements.[885] It became a key objective among developing states to prevent this from happening.

[883] Alan Boyle, *The Convention on Biological Diversity*, *in* THE ENVIRONMENT AFTER RIO: INTERNATIONAL LAW AND ECONOMICS (Tullio Treves, et al. eds., 1994); Alan E. Boyle, *The Rio Convention on Biological Diversity*, *in* INTERNATIONAL LAW AND THE CONSERVATION OF BIOLOGICAL DIVERSITY (Michael; Redgwell Bowman, Catherine ed. 1996), at 35.

[884] MCCONNELL. 1996;Andronico O. Adede, *The Road to Rio: The Development of Negotiations*, *in* THE ENVIRONMENT AFTER RIO: INTERNATIONAL LAW AND ECONOMICS (Tullio Treves, et al. eds., 1994).

[885] Boyle. 1996, at 36.

Therefore, they required that the new convention would bring about a special system of intellectual property rights and appropriate mechanisms for compensating the south for the biological resources provided by it. Moreover, developing states wanted to establish mechanisms giving the south access to the biotechniques developed through the use of the genetic resources that it provides, as well as funding to facilitate the implementation of the convention and access to technology. Any observer examining the final convention would find that these objectives largely appear to have been met. In some respects, the convention expresses recognition of the intrinsic value of biodiversity and of the conservation of biodiversity as a "common concern of humankind."[886] These references and the fact that all components of biological diversity (not only those considered valuable) are encompassed by the measures calling for protection under the convention have been cited by some observers as evidence of a dual ethos of the CBD, including not only instrumental perspectives of living organisms, but also intrinsic values, manifested by broad undertakings relating to long-term species and habitat preservation.[887]

But in its central elements, the CBD can be regarded as the result of a trade-off, whereby developing states have undertaken to preserve their natural genetic resources on the condition of economic incentives.[888] This conditioning of conservation based on economic benefits runs like a red thread through the convention. The reference to "*sustainable use*" as "*the use of components of biological diversity*" in Article 2 of the CBD is further evidence that the convention is not primarily concerned with the preservation of biodiversity, but instead "assumes human use and benefit as the fundamental purpose for conserving biodiversity, limited only by the requirement of sustainability and the need to benefit future generations."[889]

[886] See in particular the preamble of the CBD where intrinsic values are referred in a long list of interests relating to biological diversity and its components, including also ecological, genetic, social, economic, scientific, educational, cultural, recreational and esthetic values., Catherine Redgwell, *Biotechnology, Biodiversity and Sustainable Development: Conflict or Congruence?*, *in* BIOTECHNOLOGY AND INTERNATIONAL LAW (Tullio Scovazzi & Francesco Francioni eds., 2006), at 66.

[887] See for instance Wolfrum & Matz, MAX PLANCK YEARBOOK OF UNITED NATIONS LAW (2000), at 464.

[888] Id. at 469.

[889] 'Sustainable use' is defined in Art 2 as "the use of components of biological diversity in a way and at a rate that does not lead to the long- term decline of biological diversity, thereby maintaining its potential to meet the needs and aspirations of present and future generations." At

As regards underlying values, the convention is thus closer to agreements regulating human use, such as fisheries agreements, than conservationist treaties.[890] Essentially, the CBD thus marked a step away from the perspective of preserving the inherent value of nature as an aim of the convention, as formulated in its objective, in favor of a rather radical instrumentalist approach. The references to intrinsic values are limited to the preamble and in the operative parts no attempts are made to balance the instrumental perspective of biological resources.[891] This way of conditioning conservation on economic benefits may appear natural since such models are now frequent in environmental agreements.[892] It is worth noting that the validity of this "dual rationale" for promoting bioprospecting, creating incentives to conserve endangered environments by demonstrating the economic benefits that could accrue from their exploitation, which forms the logical basis for the CBD regime, appears to have never been tested.[893]

What, then, is the origin of this approach? How is it that environmental protection has been conditioned on economic incentives? As shown in the previous discussion, this development can be traced back to the birth of the concept of sustainable development. The concept, as formulated in the Brundtland Report, essentially entails merging economic development with environmental protection.[894] This discourse was based on the premise that economic development policies had to be intrinsically connected to environmental protection, for a range of reasons. Foremost, it was based on the presumption that without such a connection, detrimental environmental impacts risked becoming disregarded in economic development. Moreover, there was a sentiment among developing states that they, who harbored the majority of wilderness and biological diversity, ought to be compensated for undertaking the lion's share of conservationist action. Effectively, the impact in international law, as manifested in the CBD, of the sustainable development concept was that

COP V (2002, Decision V/24), sustainable use was adopted as a cross-cutting issue under the Convention, and at COP 7 (2004) the Addis Ababa Principles and Guidelines for the Sustainable Use of Biodiversity were adopted, Boyle, The Convention on Biological Diversity. 1994, at 115.

[890] Redgwell. 2006, at 65.

[891] Wolfrum & Matz, Max Planck Yearbook of United Nations Law (2000), at 461.

[892] For instance, the Paris Agreement under the United Nations Framework Convention on Climate Change has a large number of provisions reflecting an instrumentalist approach.

[893] PARRY. 2004, at 122.

[894] SANDS, Sustainable Development: Treaty, Custom, and the Cross-fertilization of International Law. 1999; SCHRIJVER. 2008; BOYLE & FREESTONE. 2001.

environmental protection would be regarded not as an end-goal, but rather as a transactional value for developing states to attain a transfer of economic resources. This has been described as a reductionist, utilitarian and commercial mark on the environmental approach of the living world, at the expense of biodiversity conservation and the sustainable use of its resources.[895]

The final round of negotiations took place during the actual Rio Summit. In order to reach an agreement before the end of the summit, some suggested commitments were removed.[896] Among these, one proposal which was scrapped at the final stages of negotiation is particularly worth mentioning: The responsibility for damage to biodiversity. The last draft before the final negotiation contained a provision providing that those responsible for activities which damaged or threatened biodiversity would be responsible for the costs of avoiding or remedying the damage.[897]

That this proposed commitment was scrapped is telling in that it substantially decreases the opportunities for holding states accountable for biodiversity degrading activities. Not only did it mark a missed opportunity for developing the rudimentary principles of state responsibility for environmental harm. It would also have been one of the more important commitments for state activities in areas beyond national jurisdiction.[898]

The final outcome of the negotiation – the treaty text of the CBD – was far from globally welcomed.[899] Among developing states, the clear declarations of

[895] GUILLOUX. 2018, at xxix.

[896] MCCONNELL. 1996; Adede. 1994.

[897] Boyle, The Convention on Biological Diversity. 1994; Boyle. 1996, at 37.

[898] MCCONNELL. 1996.

[899] In particular the United States the outcome received a more lukewarm reception. The US initially criticized the convention, mainly for its perceived adverse impact on biotechnology development as well as the perceived general attitude of the Convention towards intellectual property rights. In many regards this position was in line with the US critique of the common heritage of mankind principle under UNCLOS. But with regards to the CBD, the US criticism went beyond economic and resource distribution aspects, encompassing also the conservationist component; provisions on environmental impact assessments and the scope of obligations affecting the marine environment were raised as areas of concern. Moreover, the US believed that the convention failed to recognize the positive role that intellectual property rights could play in the conservation of biodiversity. Accordingly, the US did not sign the convention until the Clinton administration, and it remains to be ratified. The European Union expressed little concern with the transfer of technology and access to biotechnology, although it is clear that

exclusive rights for the state of origin of genetic resources were heralded as an important principal victory. Dissatisfaction with the lack of operational precision was, however, also expressed. Similarly, with regards to capacity building and transfer of technology, many states had wished for more.[900] Eventually, this would form the basis for the negotiation of the Nagoya Protocol[901].[902]

It can thus be established that although the negotiation was set out on a different, conservationist approach, reflecting at least in part intrinsic environmental values, the negotiation as well as the resulting treaty would focus on transactional aspects of economic distribution in relation to biological resources.[903] In its central respects, the convention reflects an instrumentalist approach to the environment and its resources, which can largely be explained by the merging of environmental and development interests during the years leading up to the Rio Summit and the negotiation of the convention. Since the entry into force of the CBD, this instrumental perspective of biodiversity has evolved into even more integrated sustainable development concepts.[904] By being based on a profoundly anthropocentric view of the marine environment and its resources, the underlying values of the CBD thus bear similarities with those behind UNCLOS. There are, however, also some key differences between the instrumental perspectives of the two treaties, primarily in terms of their temporal and holistic perspectives on resources. As a result, as will be discussed in Part C, the CBD emphasizes the needs of future generations, seeking to provide comprehensive long-term efforts that protect all components of biological diversity and not just those that are momentarily considered valuable. UNCLOS, on the other hand, aims at short-term efforts to secure stocks valuable for human consumption. Accordingly, UNCLOS has been described as more myopically resource-oriented, whereas the CBD – generally speaking – focuses more on long-term species and habitat preservation.[905]

they had hoped for higher ambitions generally. See Ian Walden, *Intellectual Property Rights and Biodiversity*, *in* INTERNATIONAL LAW AND THE CONSERVATION OF BIOLOGICAL DIVERSITY (Michael; Redgwell Bowman, Catherine ed. 1996), at 172.

[900] Boyle, The Rio Convention on Biological Diversity. 1996.

[901] Nagoya Protocol on Access to Genetic Resources and the Fair and Equitable Sharing of Benefits Arising from their Utilization to the Convention on Biological Diversity, 29 October 2010, 3009 U.N.T.S. (Nagoya Protocol).

[902] MCCONNELL. 1996.

[903] GUILLOUX. 2018, at xxviii.

[904] Redgwell. 2006, at 66.

[905] Wolfrum & Matz, Max Planck Yearbook of United Nations Law (2000).

It will now be examined more closely how this instrumentalist approach is reflected in the operational parts of the CBD, whether there are exceptions to it, and how the relationship between biological diversity and economic development plays out.

D.2.6. Rules on genetic resources under the instrumentalist approach

With regards to objectives of the CBD, its Article 1 reflects a twofold ambition: Both the interest of conserving biodiversity and the interest of developing states to use the convention as a vehicle for development are reflected:

> *The objectives of this Convention, to be pursued in accordance with its relevant provisions, are the conservation of biological diversity, the sustainable use of its components and the fair and equitable sharing of the benefits arising out of the utilization of genetic resources, including by appropriate access to genetic resources and by appropriate transfer of relevant technologies, taking into account all rights over those resources and to technologies, and by appropriate funding.*

Already the first operative provision of the convention thus sets the course away from the intrinsic values referred in the preamble, in favor of predominantly instrumental values. It assumes human use and benefit as the fundamental purpose for conserving biodiversity, limited only by the requirement of sustainability and the need to benefit future generations.[906] It is thus clear that despite the preambular references to the intrinsic values of nature as previously discussed, in operative parts the CBD is not primarily a preservationist convention. This can be interpreted as the result of the insistence by developing states that references to conservation should be combined with sustainable use of its components.

However, the objective can also be read the other way around. The emphasis on sharing benefits and technology as well as promoting access entails that permanent sovereignty over biological resources is no longer a basis for the exclusion of others.

[906] Boyle. 1996, at 38.

Rather, it entails a "*commitment to cooperate for the good of the international community at large*."[907] An examination of the treaty reveals that the operative obligations of cooperation are limited. In any event, these parts of the convention do not alter the principal base of the regulation: biological and genetic resources are regarded as a national resource with relatively indiscriminate state sovereignty, save for certain cooperative obligations. This concept of state sovereignty, which is central to the CBD, will now be examined more closely.

D.2.7. State sovereignty over biological resources

Already when discussions started on a broad global framework convention on biodiversity, they were based on the assertion that biodiversity is a national resource, with exclusive rights for states to regulate and manage, based on territorial jurisdiction. The notion of basing the new convention on alternative conceptions of property, such as commons regimes as partly employed in UNCLOS, was rejected early on.[908] This decision was based partly on conventional notions of state sovereignty over economic resources, but also on the contention that principles such as the principle of common heritage of mankind left natural resources open for the taking.[909] Consequently, unlike minerals on the international deep seabed, living marine resources within a state's national jurisdiction are sovereign biological resources belonging to that state. In line with this notion, the CBD clearly declares that states have sovereign rights over their own biological resources.

The convention provides that "States have, in accordance with the Charter of the United Nations and the principles of international law, the sovereign right to exploit their own resources pursuant to their own environmental policies" (provided that those activities do not harm the environments of, e.g., other states). As discussed in section C.2, this stipulation essentially reiterates Principle 21 of the 1972 Stockholm Declaration, and thus reflects the modern conceptual foundation for international environmental law.[910]

[907] Günther Handl, Environmental Security and Global Change: The Challenge to International Law, 1 YEARBOOK OF INTERNATIONAL ENVIRONMENTAL LAW (1991).
[908] MCCONNELL. 1996; Adede. 1994.
[909] Joyner, Vanderbilt Journal of Transnational Law (1995), at 648-649.
[910] GLOWKA, A Guide to the Convention on Biological Diversity. 1994.

Thus, for the purposes of this investigation, the CBD clearly brings biodiversity and genetic resources – whether terrestrial or marine – within a state's jurisdiction and under national control, insofar as the resource is retrieved within its territorial scope.

Moreover, to the extent that the convention entails conservationist obligations, there is no doubt that the responsibility for protection of biological variability in offshore areas under national jurisdiction accordingly is put on the coastal states. On the marine side, the convention thus builds on the division of marine spaces into sovereign and exclusive rights under the maritime zone regime of UNCLOS and obliges its parties to implement a number of obligations for the protection of biodiversity in the areas where they exercise those rights.[911] Essentially, the convention thus makes no distinction between the obligations of states in terrestrial and in marine spaces: Sovereign jurisdiction over biodiversity applies equally for marine coastal resources as it does for land-based natural resources, both as regards rights and duties under the convention.[912]

Furthermore, the concept of conserving biodiversity for the purpose of human benefit is connected to another basic assumption of the CBD: That the sovereign right of states over their biological resources, includes the right to exploit these resources pursuant to their own environmental policies. No other state has the right to influence how a state pursues the conservation of its biological resources. The obligation in relation to other states extends only to endeavor to create conditions to facilitate access to genetic resources by other parties. But this entitlement does not amount to a right of free access for other states. Rather, prior informed consent by the relevant state controlling the genetic resource is required, and the relevant state by virtue of jurisdiction has authority to determine access to genetic resource by means of national legislation.[913] This approach has striking similarities with the law of the sea rules on marine scientific research in the exclusive economic zone, where the coastal state can exercise similar discretion with regard to foreign activities, and cooperation is called for but not mandatory.[914]

[911] In Part A.2. it was discussed what these obligations entail for states.
[912] Joyner, Vanderbilt Journal of Transnational Law (1995), at 649.
[913] See the preamble, as previously discussed, as well as Articles 3 and 15.
[914] As further discussed in section C.1.5.

The clearly established rights of states to control their biological resources encompass marine genetic resources. This answers the question regarding the possibilities of states to appropriate such resources unequivocally. It is apparent that the CBD regards such resources as belonging to states, based on their territorial jurisdiction, and that the ability of other states to access the resources in principle is left to the discretion of the state in possession of the resource. In this regard, states can opt for a more open or restrictive regime. Essentially, the convention thus divides up the genetic resources of the world between states in a similar manner to any other regulation of resources under international law. The CBD thereby introduced a legal basis for – or rather, it confirmed that the old doctrine of sovereign rights extends to – the appropriation of all genetic resources within the geographic borders of states, by those states.

Again, a natural point of reference is the provisions entailing exclusive economic rights of coastal states within their respective maritime areas under UNCLOS, which essentially provide the same answer. Are there, then, no references to common interests or common management under the CBD? Compared to UNCLOS, these are considerably weaker, but by no means non-existent. The preamble describes the conservation of biological resources as a "*common concern of humankind.*" But while there are apparent linguistic similarities with the principle of common heritage of mankind under UNCLOS, the reference in the CBD preamble should not be interpreted analogously. Rather, the option of using the exact same term as under UNCLOS was rejected during the negotiation in order to avoid misrepresentations that a commons regime was being set up.

From the operative provisions it is evident that the CBD does not seek to internationalize or create a commons regime for biological resources similar to deep-sea resources under UNCLOS. The conditions for access to the resource are also fundamentally different between the two regimes. In the CBD, there is a lack of references to institutions to regulate common resources, as is the case with the International Seabed Authority under UNCLOS. In the case of the CBD, the right to grant or refuse access clearly lies with the relevant state exercising geographic jurisdiction. Yet, there are similarities in that both conventions are based on the premise that benefits of access to the resource must be shared equitably.

However, in the CBD, this obligation is much more limited than under UNCLOS, and in no case does it affect the legal status of the resource itself.

Rather than serving as a basis for a common management regime, the reference to "common concern" in the CBD is significant in legitimizing international interest in the conservation and use of biological resources otherwise within the territorial sovereignty of other states. In that sense, the CBD reference to *common concern* has more in common with human rights regulations; domestic state jurisdiction is not questioned, but an aim to strive for a common goal is added on.[915]

But are these sovereign rights of the states possessing the genetic resource unconditional and open-ended? And how does the CBD relate to appropriation of genetic resources in areas beyond national jurisdiction? Foremost, as has been discussed, the CBD is a convention which provides rights and duties for states over biological resources within their territorial jurisdiction. With regards to components of biological diversity, Article 4 establishes the jurisdictional scope as areas within the limits of its national jurisdiction.

Within national jurisdiction, state sovereignty is far-reaching. Rules relating to the access of biological resources by other states, and the contracts to address such transactions, are further provided in the Nagoya Protocol.[916] There are, however, a number of conditions that states must comply with in the exercise of their sovereignty, including foremost the obligations to ensure conservation and sustainable use.[917] Whereas states are granted unlimited rights to genetic resources within their territorial jurisdiction, states are not without restraints on how to manage such resources. How, then, does the CBD relate to genetic resources located beyond national jurisdiction?

---

[915] Alan Boyle, International law and the protection of the global atmosphere: Concepts, categories and principles, in INTERNATIONAL LAW AND GLOBAL CLIMATE CHANGE (1994).
[916] As discussed in section C.2., Nagoya Protocol; ibid.
[917] As set out in Article 6-9 of the CBD.

D.2.8. Obligations beyond state borders - The Janus face of the CBD rules on biological resources

At first sight, it appears that the scope of the CBD is limited to areas under national jurisdiction. The convention clearly establishes that in the case of direct management of components of biological diversity, the direct application of the CBD is limited to areas within the limits of its national jurisdiction.[918] While the CBD foremost entails operative obligations relating to biological resources within the territorial jurisdiction of its parties, there are also obligations relating to areas beyond national jurisdiction. In the case of processes and activities affecting biological diversity, the convention applies regardless of where their effects occur, carried out under its jurisdiction or control, within the area of its national jurisdiction or beyond the limits of national jurisdiction.[919] The convention thus makes a distinction between jurisdictional entitlements of biological resources and connected economic rights, where the application is limited to national jurisdiction. With regards to "*processes and activities*," essentially human interference of biological diversity, the regulatory scope extends beyond state borders.

Among the obligations applying to states irrespective of jurisdictional area, there is an explicit obligation not to cause damage to other states or to areas beyond national jurisdiction.[920] Moreover, there is a duty to cooperate, directly or through competent international organizations, in relation to conservation and sustainable use of biodiversity in areas beyond national jurisdiction.[921] The reference to competent international organizations in this context can be interpreted as indicating that the drafters of the CBD wished to avoid norm conflict or overlap with institutions or agreements with a clearly expressed mandate in areas beyond national jurisdiction. According to this interpretation, the CBD reference to these organizations essentially makes clear that the CBD calls for its parties to participate in such cooperation, and that it should be carried out within those organizations, according to their rules, and not under the auspice or regulation of the CBD.

[918] See Article 4(a) of the CBD.
[919] See Article 4(b) of the CBD.
[920] See the preamble, Articles 3 and 15 of the CBD.
[921] Article 5 of the CBD.

However, such an interpretation is far from certain. The reference could also be interpreted as merely a recognition that there may be other organizations and treaties with a mandate to regulate the management of biodiversity beyond national jurisdiction, but that the cooperative parts of the CBD apply equally in these areas, as they do in areas within national jurisdiction.

There are also other explicit references to areas beyond national jurisdiction in the convention, which clearly establishes that in at least certain regards, the drafters intended its obligations to apply equally beyond state borders. States are expected to promote arrangements for the consultation, notification, and exchange of information relating to activities that might adversely affect the biological diversity of other states or areas beyond the limits of national jurisdiction.[922]

Moreover, other conservationist provisions in the convention equally apply irrespective of location. These include taking biological resources beyond state borders into account in the development of national conservation plans and strategies, as provided in the general measures for conservation and sustainable use.[923] The same goes for the obligation relating to identification and monitoring. Similarly, there is nothing indicating that the central provisions on *in situ* and *ex situ* conservation or the obligation to sustainable use do not apply equally to areas beyond national jurisdiction.[924]

Looking at the work program carried out under the auspice of the CBD, it has also related to both areas within and beyond national jurisdiction. This is particularly apparent in the work with protected areas of the convention, which accelerated with the Johannesburg Plan of Implementation, decided at the second Earth Summit in 2002.[925]

[922] Article 14(1) of the CBD.
[923] See Article 6 of the CBD.
[924] Articles 8, 9 and 10 CBD respectively.
[925] The Johannesburg Plan of Implementation (JPOI), confirmed the need to "maintain the productivity and biodiversity of important and vulnerable marine and coastal areas, including in areas within and beyond national Jurisdiction" and provided explicit targets for the "application by 2010 of the ecosystem approach" and the "establishment of marine protected areas consistent with international law and based on scientific information, including representative networks by 2012", see UN Report of the World Summit on Sustainable Development, Johannesburg, South Africa, 26 August–4 September 2002, A/CONF.199/20, sections 30(d) and 32(c).

The Programme of Work on Protected Areas[926] clearly aims to extend beyond state borders.[927] When the program was decided, questions were actually raised on what mandate the CBD had for carrying out work in areas beyond national jurisdiction. However, the focus on scientific criteria and inclusive approach in relation to other organizations made states consider that there was no hindrance to the agenda under CBD.[928]

It thus appears clear that not only does the convention apply and provide a mandate for engagement in areas beyond national jurisdiction, but in addition, in practice, that mandate has been used for a rather ambitious work program.

But how do the work and the legal obligations relevant in areas beyond national jurisdiction under the CBD compare to the provisions applying within state borders? Interestingly, the obligations relating to areas beyond national jurisdiction accordingly have a markedly different character compared to other parts of the convention, in at least two ways.

[926] The Convention on Biological Diversity's (CBD) Programme of Work on Protected Areas (PoWPA) was agreed in 2004 and reaffirmed with additional elements in 2010 in Nagoya, Japan. PoWPA aims to encourage parties to the CBD to develop and manage ecologically representative networks of protected areas on land and sea. Unusually for the CBD, it contains many (over 90) specific actions for countries or others to take, with deadlines. It includes many social safeguards and promotes a range of management approaches and governance types within protected areas, see UNEP/CBD/WGRI/1/2 Implementation of the Convention and the Strategic Plan and progress towards the 2010 Target and UNEP/CBD/WGRI/1/9 Framework for monitoring implementation of the Convention and achievement of the 2010 target, and the connected review of the thematic programmes of work.

[927] "In addition, the establishment and management of protected area systems in the context of the ecosystem approach should not simply be considered in national terms, but where the relevant ecosystem extends beyond national boundaries, in ecosystem or bioregional terms as well. This presents a strong argument for and adds complexity to the establishment of transboundary protected areas and protected areas in marine areas beyond the limits of national jurisdiction", SECRETARIAT OF THE CONVENTION ON BIOLOGICAL DIVERSITY (2004) PROGRAMME OF WORK ON PROTECTED AREAS (CBD PROGRAMMES OF WORK) (Secretariat of the Convention on Biological Diversity. 2004).

[928] Daniel C. Dunn, et al., The Convention on Biological Diversity's Ecologically or Biologically Significant Areas: Origins, development, and current status, 49 MARINE POLICY (2014);Daniel C. Dunn, et al., The Convention on Biological Diversity's Ecologically or Biologically Significant Areas: Origins, development, and current status, 49 MARINE POLICY (2014).

Firstly, the cooperative nature of the parts of the CBD applying to areas beyond national jurisdiction seemingly makes it less likely that it will have a substantial legal impact. Indeed, there is no shortage of unheard calls for cooperation in international environmental law. Yet, in reality, despite less solid ground in terms of mandate, a considerable portion of the work program under the CBD has related to areas beyond national jurisdiction. This is especially true with the work relating to protected areas already discussed. Indeed, there is nothing indicating that the cooperative nature of provisions relating to areas beyond national jurisdiction has made them any less efficient.

Secondly, and more importantly, the obligations in the CBD relating to areas beyond national jurisdiction reflect a different ethos as compared to the provisions applying within state borders. As we have found, the CBD can be seen as being founded on the conception that biodiversity ought to be conserved for human purposes, reflecting a predominantly instrumental perspective on natural resources. At its heart lies the contention that states have exclusive sovereignty over biological resources within their territorial realm, and that they should be adequately compensated for supplying and conserving those resources. These conclusions are certainly valid for the regulation applying within state borders, where economic perspectives of resources take precedence.

However, in provisions as well as work programs relating to areas beyond national jurisdiction, the convention is based on a different perspective. Beyond state borders, the CBD is, as we have seen, little concerned with appropriation of resources or distribution of benefits. Instead, the emphasis is predominantly on conservation. In these areas, the instrumental perspective of biological resources is replaced by provisions reflecting a conception of conserving biological diversity as an end in itself, an essentially intrinsic value approach, as discussed under D.2.5.

Moreover, the difference between CBD regulation within state borders and beyond national jurisdiction extends beyond reflecting different perceptions and perspectives of biological resources. For practical purposes, the regulation in areas beyond national jurisdiction is actually converse to the general regulation of biological resources within state borders.

As discussed under D.2.7, the regulation within state borders can be summarized as granting the state unlimited rights to appropriate genetic resources within its territorial jurisdiction, so long as certain conservationist obligations are fulfilled. Beyond national jurisdiction, the legal effect of the convention is the opposite: States are obliged to fulfill conservationist obligations relating to biological resources without any provisions entailing possibilities for appropriation.

In this way, international biodiversity law regulation of biological resources, including marine genetic resources, displays a Janus face, with converse regimes depending on where resources are located. Within their borders, states are rather unconstrained in appropriating such resources. Beyond areas of national jurisdiction, conservationist obligations limit states, not only from appropriating such resources, but even from carrying out activities affecting their conservation status.

D.3. International trade law

It has now been discussed firstly how the UNCLOS rules relating to areas beyond national jurisdiction can be regarded as the result of a trade-off between the *res omnium communis* principle of the high seas freedoms and the common heritage of mankind principle of the Area. Or to be more exact, under UNCLOS, living resources can be freely appropriated by states within national jurisdiction. Beyond those areas, they are considered global commons, but depending on their location they are managed under two different regimes. In the high seas water column, individual organisms are free for anyone to appropriate under the *res omnium communis* principle of the freedom of the seas. However, no state can claim territorial jurisdiction over these areas. In the seafloor and underlying sediments of the Area, both individual appropriation and claims for territorial jurisdiction are unlawful. Instead, the deep-sea resources in these areas are managed collectively, by multilateral institutions, for the benefit of all of mankind.

Secondly, it was illustrated how the CBD seemingly rejects many of the fundamental concepts of UNCLOS. Instead, much of CBD is devoted to putting biodiversity under national jurisdiction, facilitating for the states to regulate genetic resources as they consider appropriate.

Mechanisms are provided by the CBD for enabling access to other states against compensation, thereby providing economic incentives for conservation of biological diversity, which can be regarded as the central logic of the CBD in areas within national jurisdiction.

Beyond national jurisdiction, the logic of the CBD was considered distinct in some key respects. In these areas, CBD emphasizes preservation instead of appropriation, requiring states to ensure *in situ* conservation of genetic resources, seemingly based on a broader interest of preventing depleting biodiversity. As regards the purposes for preserving the biodiversity beyond national jurisdiction under the CBD, it was not formulated in terms of human use, but rather built on theories of inherent and intrinsic values of nature. These parts of the CBD were thus considered to be built on a different logic, not only compared to the common heritage of mankind principle of UNCLOS, but also compared to the operative provisions of the CBD relating to areas within national jurisdiction. Rather, for CBD purposes, conservation of living resources was considered an end in itself in areas beyond national jurisdiction, including in the deep seas.

How, then, do the rules of the third regime of international law investigated in this study, international trade law, relate to the appropriation of deep-sea genetic resources? What underlying logics can explain its rules on how legal claims can be made in relation to such resources? As will be discussed in this section, WTO law, as manifested in TRIPS[929], like the CBD, rejects the concept of the common heritage of mankind, but for entirely different reasons. It effectively disregards the notion of state sovereignty over living resources, perhaps the most fundamental concepts of both UNCLOS and the CBD. Instead, TRIPS establishes a unitary regime enabling the appropriation of living resources by means of patenting, applicable irrespective of where the living resource was retrieved. This disregard of state sovereignty is particularly noteworthy, since TRIPS was negotiated in parallel and immediately after the CBD. Still, it completely disregards the CBD notion of exclusive rights of states to regulate living organisms within their realm. Instead, TRIPS has a permissive view of what inventions or discoveries relating to genetic resources should be granted exclusive rights by means of patenting.

[929] Agreement on Trade-Related Aspects of Intellectual Property Rights (TRIPS).

The agreement sets no restrictions on the patentability of genetic resources, irrespective of origin. It generally opens the door for legal claims to genetic resources by means of patenting, seemingly in disregard of both UNCLOS and the CBD. The patentability of genetic resources is, however, formulated in an ambiguous manner, distinguishing between different forms of organisms and processes, opening the way for derogations by individual states for some but not all of these categories.

It will now be examined what underlying understandings and considerations can explain how a treaty negotiated only a decade after UNCLOS and in parallel with the CBD could come up with such a different concept of genetic resources and the possibility of making legal claims to such resources.

D.3.1. The patentability of genetic resources under TRIPS revisited

Although there are other agreements providing rules for intellectual property rights, this investigation on the underlying perspectives is like other elements of international trade law in principle delimited to the World Trade Organization agreement on Trade Related Intellectual Property Rights (TRIPS).[930]

The material implications of these rules for deep-sea bioprospecting have already been discussed in section C.3. In order to contextualize the examination of underlying values, central features will nevertheless be briefly recapitulated in this section. In the operative treaty provisions, the material rules on biotechnology patents are relatively straight-forward. Inventions obtained from genetic resources, including deep-sea genetic resources, can be patented, which provides minimum standards of intellectual property protection, provided that standard criteria for patenting are met.[931]

[930] As already discussed in Part A, this delimitation is legitimate for two reasons. Firstly, TRIPS has in many regards engulfed preceding treaties on intellectual property rights, increasingly regarded as having attained the status of a framework convention for international intellectual property rights law, with similarities to the status of UNCLOS in the international law of the sea and the CBD in international environmental law respectively. See also Ian Walden, *Intellectual Property Rights and Biodiversity*, *in* INTERNATIONAL LAW AND THE CONSERVATION OF BIOLOGICAL DIVERSITY (Michael Bowman & Catherine Redgwell eds., 1996).

[931] According to Part II, Section V of TRIPS. Article 27 of TRIPS moreover establishes that 'patents shall be available for any inventions, whether products or processes, in all fields of technology, provided that they are new, involve an inventive step and are capable of industrial application'.

Patents should thus be granted to any inventions if the three essential conditions of novelty, inventive step and usefulness are simultaneously fulfilled. Moreover, as a necessary condition, applications shall contain invention descriptions sufficiently clear and complete for the invention to be carried out by a person skilled in the art.[932] If all of these requirements are fulfilled, a patent confers on its owner a series of exclusive rights for at least twenty years, including the right to prevent third parties, not expressly authorized to the contrary, from making, using, offering for sale, selling, or importing the product or the process covered by patent.[933]

There are however exceptions to the obligations for states to grant patents. Firstly, pursuant to Article 27, there are possibilities for states to preclude patentability based on *ordre public* concerns and morality.[934] Secondly, parties may consider diagnostic, therapeutic, and surgical methods for the treatment of humans and animals as nonpatentable subject matter.[935] Thirdly, it is possible for states to exclude plants and animals from patentability, as well as essential biological processes for the production of plants or animals. However, patentability may not be precluded for micro-organisms as well as non-biological and microbiological processes.[936]

Whereas the second possibility for exception from patentability is generally considered to have little relevance for biotechnology inventions, the third exception has condensed all the tensions and sensitivity relating to the issue of patentability of life.[937] Based on a peculiar distinction between macro- and microbiology, the third exception endows states with the possibility to enact domestic legislation which prevents the patenting of macro-organisms. For micro-organisms, on the other hand, there is not even a possibility for states to preclude patentability, according to the main rule, as discussed in section C.3.3.

[932] Article 29 of TRIPS.

[933] In line with Article 28 of TRIPS.

[934] *Ordre public* and morality are composed of mandatory rules, the application of which cannot be neglected. *Ordre public* refers to those basic values prevailing in society and is meant to include public.

[935] See paragraph 3(a) of TRIPS Article 27.

[936] See paragraph 3(b) of TRIPS Article 27.

[937] Review of Article 27.3(B) Under TRIPs Agreement: A Critical Analysis. (2010).

State parties to TRIPS are obliged to grant patent protection to applications relating to micro-organisms fulfilling the standard patent criteria.

How deep-sea genetic resources should be interpreted in this context is, as previously discussed, far from certain. But as was established in that part, it appears that most commercial interest to deep-sea genetic resources relates to what is generally considered micro-organisms, resources that TRIPS essentially obliges states to accept patent claims, provided that standard patent criteria are fulfilled.

The formulation of the exceptions in Article 27 was the result of one of the most difficult compromises of the TRIPS negotiations. Essentially, the presumption of Article 27 that living resources should be open for patenting unless states decides otherwise builds on the position which was upheld in US practice and had gained support in many other developed countries at the time of negotiation, that innovations built on living resources generally, and micro-organisms in particular should be patentable. The third exception, as provided in Article 27(3)(b) which enables states to derogate from that obligation, as regards plants, animals and certain biological species and processes, was a requirement by developing countries in the negotiation. However, that the US and EU position became the main rule and the developing country position an exception that requires express legislation is itself evidence of the dynamics of the negotiation.[938]

D.3.2. Underlying perceptions of patentability of genetic resources

Patent law generally relies on the social contract whereby an inventor or applicant publicly reveals the technical learning or invention, in return for recognition of a temporary exclusive right of exploitation. As the result of developments of knowledge economies, some consider that the balance of this relationship has shifted and that patents are now increasingly designed as a strategic defense weapon for the protection of industrial investments and profitability in relation to research and development.[939]

[938] Daniel Barben, The Political Economy of Genetic Engineering: The Neoliberal Formation of the Biotechnology Industry, 11 ORGANIZATION & ENVIRONMENT (1998).
[939] GUILLOUX. 2018, at 79.

Regardless of commercialization of the patented product or process, the patent holder can earn an income from their invention by transferring it or by granting licenses. The scope of the exclusive rights claimed for the patent is specified by the applicant and may involve several independent claims. In biotechnology, two main types of inventions are relevant: On the one hand, process inventions, where the protection concerns the invention that has been developed based on studies of a genetic resource; on the other, composition of matter inventions, where the protection concerns a produced substance or its application.[940] Deep-sea bioprospecting can involve both these types.

By commonly involving claims for exclusive rights to bioactive functions discovered in living organisms, biotechnology is sometimes referred to as the patenting of life. This suggests a gradual reservation of the living and genetic material through biotechnological invention. A more accurate description of the relationship between patent law and living organisms is that it does not involve claims for the full organisms. Rather, it is only concerned with certain manifestations of the living and genetic material.[941] In biotechnology, genetic resources or functions thereof become incorporated by and into the immaterial property represented by patents. As such, patents have become accepted, the functions and genetic material of organisms have thus gradually become appropriated by patent owners, whereas the legal status of the physical representation of the organism of origin remains unaltered. The genetic functions of the living world in all its forms have thus become open for appropriation by the private sector and part of the market. This represents an instrumental view of nature which is not dissimilar to how international environmental law has developed with the CBD and the Nagoya Protocol. The possibilities for making patent claims based on genetic resources, however, differ across jurisdictions, as discussed in section C.3.5.[942] This reflects different positions among states concerning the patentability of genetic resources, and implicitly different degrees of an instrumental view of nature.

[940] Hanns Ullrich, Traditional Knowledge, Biodiversity, Benefit-Sharing and the Patent System: Romantics v. Economics?, in BIOTECHNOLOGY AND INTERNATIONAL LAW (Francesco Francioni ed. 2006).
[941] GUILLOUX. 2018, at 79.
[942] As discussed in section C.3, TRIPS Article 27 enables states to make exceptions to the general rule of patentability of genetic resources.

The premise of TRIPS is that states can and – provided that certain conditions are fulfilled – should protect and grant exclusive rights for intellectual property in their jurisdiction, and that such protection can be extended across borders.[943] TRIPS thus sets requirements for what states must regard as patents as well as patentable matter, but implementation is left to the parties, by means of national legislation. TRIPS is thus similar to the approach of the UNCLOS and the CBD in that it accepts the notion of exclusive rights of states to regulate the use of genetic resources within the sovereignty afforded to them by international law. Yet, there is a major difference insofar as TRIPS does not make a distinction based on territorial jurisdiction, which is a central theme of UNCLOS and the CBD. Whereas TRIPS thus respects the integrity of the legislative and enforcement sovereignty of states, it undermines their sovereignty in another respect: the exclusive right of states to manage and utilize living organisms within their territorial sovereignty is not left intact. As discussed under Part C, one of the fundamental components of UNCLOS and the CBD is that living resources within the territory of states, including maritime zones, are enclosed by the states. By disregarding geographic origin of organisms involved in patent claims, TRIPS disregards this allocation of sovereign rights. Moreover, the lack of geographic considerations in the agreement opens the way for conflicts in areas beyond national jurisdiction. As discussed under section C.1, the common heritage of mankind principle rules out any form of appropriation of deep-seabed resources. Yet, TRIPS allows for and even obliges states to allow for the patenting of certain types of such resources. Indeed, the discretion for states to decide on patentability in the context of genetic resources is not unlimited under TRIPS. Patentability must be provided for micro-organisms as well as non-biological and microbiological processes, which involve most important deep-sea genetic resources.

Part of the aim of TRIPS was to streamline national patent laws, but it did not intend to put patent procedures at a supranational level. Rather, this streamlining is pursued by means of obligations, which effectively function as mandatory requirements for the domestic patent laws of states. In addition to the lack of concern for geographic origin of organisms in patent applications, no requirements for prior or informed consent to access to the relevant organism by the state which has exclusive competence to grant such consent according to

[943] G. Kristin Rosendal, Impacts of Overlapping International Regimes: The Case of Biodiversity, 7 GLOBAL GOVERNANCE (2001).

UNCLOS and the CBD are set. Similarly, there is no reference in TRIPS to the fair and equitable sharing of benefits, as provided by the CBD.[944] The ability to make legal claims for exclusivity by means of patenting to genetic resources as called for by TRIPS is thus seemingly inconsistent with how such resources are perceived by other regimes, as will be discussed in Part E.

This can be explained by the rather limited perspective of TRIPS, under which the granting of patents is solely conditioned on technical requirements. CBD and even more so UNCLOS have a broader scope, considering different aspects of human use of the environment and genetic resources. TRIPS, by contrast, does not seek to regulate a broad scope of activities affecting the physical environment. It rather has a singular scope, focused on defining the issue of invention, and establishing under what conditions inventions ought to be granted protection.

TRIPS thus provides obligations for states to enable patentability of bioresources, including deep-sea genetic resources, irrespective of where such resources are retrieved, with an obligation to permit such patents as the main rule, albeit combined with possibilities for certain exceptions. Save for micro-organisms as well as non-biological and microbiological processes, for which patentability is mandatory, TRIPS implicitly refers the central question to the states, allowing them to decide if legal claims by means of patents can be made in relation to living organisms. However, it should be underlined that it not only permits such patenting, but even calls for it, as a main rule. How did this conception gain acceptance in international law, despite apparent discontent among a large group of developing countries?

It is logical to start the examination of how these values gained acceptance in the unexpected developments of US domestic legal practice in the 1980s, which was briefly described in section C.3.5, and look closer into the circumstances whereby the US patent system in a short period of time went from regarding living organisms as ineligible for patents to granting patents, not only for cells or micro-organisms, but for animals including mammals. This legal development came to influence other states too.

[944] Bonfanti & Trevisanut, BROOKLYN JOURNAL OF INTERNATIONAL LAW (2011), at 190.

Once negotiations for TRIPS got underway, it became a key interest for the US and allied states to make the new treaty reflect this newly adopted conception of living organisms and genetic resources as patentable. Developed states opposing this view did not manage to hinder this notion from being included in the final agreement, but reluctantly accepted the patentability of life as the main rule on the condition of a future review, which so far has not materialized.[945] It will now be examined how these events unfolded.

D.3.3. Reflection of transformed practice under domestic law

The widespread use of biotechnology in various sectors, which has increased in recent years builds on a long history, as discussed in Part B. Yet the question of the patentability of living resources, or the components thereof, has arisen relatively recently.[946] But at least since the early 1980s patent offices in the Western world have been granting patents on genes, cell lines, proteins, antibodies, hormones, micro-organisms and in some states even animals and plants, in line with well-established national laws. The extension of patents to life is based on the common law's recognition of biological and organic matter as patentable subject matter.[947] In particular, it connects to development of US case law starting in the 1980s which would influence the approach to biotechnology patents in many countries, and subsequently form the basis for the rules in TRIPS on patentability of genetic resources.

The case which established the foundations for the area of patenting of genetic material in the United States was *Diamond v. Chakrabarty*[948] in 1980, relating to the first ever patent application on a man-made living thing. The background of the case was an application of a patent on a strain of bacterium that a chemist had transformed with plasmids to promote hydrocarbon digestion.

[945] James Watson, The WTO and the Environment - Development of competence beyond trade (Routledge. 2013), at 116.
[946] Smith, North Carolina Journal of International Law and Commercial Regulation (2000), at 146-147.
[947] Daniel J. Kevles, A history of patenting life in the United States with comparative attention to Europe and Canada (Science European Group on Ethics in & Technologies New eds., Luxembourg : Office for Official Publications of the European Communities. 2002).
[948] Diamond v. Chakrabarty, 447 U.S. 303.

In 1973, the patent application had been rejected because living organisms were not patentable subject matter. After a long series of lawsuits, the Supreme Court eventually revoked the decision, and awarded Chakrabarty his patent. In the case, which gave rise to the dictum that "*anything under the sun that is made by man*" is patentable, the Supreme Court held that a claim to a genetically engineered bacterium was a "*manufacture*" and/or a "*composition of matter*."[949] In its opinion, the Court based much of its argumentation on the perceived intention of congress to give the patent laws a wide scope.[950] Importantly, the Court held that the distinction between living and inanimate things was not relevant for subject matter eligibility. Thus, the Court decided that living subject matter with markedly different characteristics from any found in nature, such as the claimed bacterium produced by genetic engineering, is not excluded from patent protection.[951] This was the first occasion in which a patent had been granted for a living organism. It should be added that the case concerned bacteria which were capable of breaking down crude oil in cleaning processes, and thus certainly useful for legal purposes. In the decision, the Court furthermore stated that:

> *… the patentee has produced a new bacterium with markedly different characteristics than any found in nature… His discovery is not nature's handiwork, but his own; accordingly, it is patentable subject matter under patent law.*[952]

The *Diamond v. Chakrabarty* decision thereby overturned the "product of nature" principle, which previously had precluded patents of living resources. Under this principle, laws of nature, natural phenomena, abstract ideas, and products of nature have long been deemed ineligible for patent protection.[953]

[949] Jacob S. Sherkow & Henry T. Greely, *The History of Patenting Genetic Material*, 49 Annual Review of Genetics (2015).
[950] In particular, the court made reference to the use by the Congress of "such expansive terms as 'manufacture' and 'composition of matter,' modified by the comprehensive' and 'any'". See also Dan L. Burk, Patents and Related Rights: A Global Kaleidoscope, in The Oxford Handbook of Intellectual Property Law (Rochelle Dreyfuss & Justine Pila eds., 2017), at 471.
[951] United States Patent and Trademark Office Manual of Patent Examining Procedure (83 FR 4473) (United States Patent and Trademark Office 9 ed. 2018).
[952] Diamond v. Chakrabarty, 447 U.S. 303.
[953] Although courts sometimes have struggled to give those terms concrete meaning, see Jacob S. Sherkow, *The Natural Complexity of Patent Eligibility*, 99 Iowa Law Review (2014).

Accordingly, the US Patent and Trademark Office had prior to 1980 in principle interpreted the US Patent Law as excluding living things such as laboratory-created micro-organisms from patenting, since they were considered to fall outside the definition of patentability. Section 101 of the law provides that utility patents are available for '*Whoever invents or discovers any new and useful process, machine, manufacture, or composition of matter, or any new and useful improvement thereof, (…), subject to the conditions and requirements of this title.*"[954] The product of nature principle had held that living subject matter was not eligible for patenting, either because such subject matter did not fall within one of these statutory categories, or because it was a judicial exception to patent eligibility.[955]

However, even if the *Diamond v. Chakrabarty* case thus opened the door to patentability of living resources, the Court's statement still made clear that there was a need for human action upon the genetic material as a key element for obtaining the patent. Gradually, however, this requirement for human action was de-emphasized.[956]

Patentability was first admitted for process inventions using micro-organisms and then for product inventions obtained through microbiological processes. In subsequent cases, patentability was extended to microorganic organisms of plant and animal origin, as well as to non-essential biological processes.[957] In the years following the *Diamond v. Chakrabarty* decision, the U.S. Patent and Trademark Office consistently granted patents on micro-organisms, including unicellular organisms, bacteria, yeast, fungi and other living organisms, and on non-biological and microbiological processes.[958] This transformation of US patent practice was thus not the result of a legal reform by lawmakers. Rather, it was the consequence of new interpretations by courts, administrative officers and patent law practitioners.

[954] Verma. 2010.

[955] John M. Conley & Roberte Makowski, *Back to the future: rethinking the product of nature doctrine as a barrier to biotechnology patents*, 85 JOURNAL OF THE PATENT AND TRADEMARK OFFICE SOCIETY (2003); United States Patent and Trademark Office Manual of Patent Examining Procedure (83 FR 4473). 2018, at 2105 Patent Eligible Subject Matter — Living Subject Matter [R-08.2017].

[956] Walden, Intellectual Property Rights and Biodiversity. 1996.

[957] GUILLOUX. 2018, at 81-99.

[958] Daniel S. Hodgins, Life forms protectable as subjects of US patents--microbes to animals (perhaps), 16 APPLIED BIOCHEMISTRY AND BIOTECHNOLOGY (1987).

Largely, observers regard this change in the interpretation of the US patent law as extremely unexpected.[959] The issue of human involvement was subsequently extensively discussed in the *Onco mouse* case of 1988, where the successful implantation of cancer-causing genes in mice was granted a US patent.[960] The same patent spurred more controversy elsewhere. In Canada, the *Onco mouse* patent was rejected on the grounds that higher life forms could not be considered inventions.[961] In Europe on the other hand, patent was granted, on the ground that European law forbade the patenting of animal varieties but not animals, in spite of arguments against the patent based on the '*ordre public*' and '*moral'* provisions of the European Patent Convention[962].[963] Gradually, the common law approach to the patentability of genetic resources became mainstream among developed countries. Largely, this was motivated based on the highly technical and knowledge intensive processes used to screen, identify and reproduce genetic materials capable of commercial use, as discussed in Part B.

Starting in *Diamond v. Chakrabarty*, the development in common law which enabled biotechnology patents thus gradually became more permissive. During the 1990s, there was considerable discussion concerning human patents, which eventually made the US Congress prohibit patents containing '*a claim directed to or encompassing a human organism.'* In the EU, similar laws were put in place. In parallel, discussion became lively over the patenting of genetically modified crops.[964] In 1998 the EU Biotech Directive[965] was approved, banning patenting of '*the entire human body in all its development phases*' as well as processes for cloning and modifying the DNA of humans.

[959] Verma. 2010.

[960] Scovazzi & Francioni. 2006, at 17.

[961] Eventually, the patent was issued in Canada but excluding the mouse itself. Burk. 2017, at 470-471; *Sherkow & Greely, ANNUAL REVIEW OF GENETICS (2015).*

[962] Convention on the Grant of European Patents, 5 October 1973, 1065 U.N.T.S. 199 (European Patent Convention).

[963] Article 53(b) of the European Patent Convention states that no protection is available for 'plant or animal varieties or essentially biological processes for the production of plants or animals; this provision does not apply to microbiological processes or the products thereof.' See also MATTHEW RIMMER, INTELLECTUAL PROPERTY AND BIOTECHNOLOGY: BIOLOGICAL INVENTIONS (Edward Elgar. 2008).

[964] Sherkow & Greely, ANNUAL REVIEW OF GENETICS (2015).

[965] Directive 98/44/EC of The European Parliament and of the Council of 6 July 1998 on the Legal Protection of Biotechnological Inventions (Biotech Directive).

For genetic subject matter not related to the human body the Biotech Directive took a considerably more permissive approach, expressly declaring in Article 3(2) that '*biological material which is isolated from its natural environment or produced by means of a technical process may be the subject of an invention even if it previously occurred in nature*'.[966] As regard scope of protection, Article 9 provides that '*the protection conferred by a patent containing or consisting of genetic information shall extend to all material(…) in which the product is incorporated and in which the genetic information is contained and performs its function'*.

In the US, the issue of gene patents remained controversial in the wake of the *Onco Mouse* decision until 2013, when the issue again would become scrutinized *in the Association for Molecular Pathology v. Myriad Genetics*.[967] The case concerned certain patent claims covering isolated DNA sequences, methods to diagnose cancer by looking for mutated DNA sequences and identify drugs using isolated DNA sequences. In its ruling, the Supreme Court held that merely isolating genes that are found in nature does not make them patentable. '*separating [a] gene from its surrounding genetic material is not an act of invention(…)* '*A naturally occurring DNA segment is a product of nature and not patent eligible merely because it has been isolated, but that cDNA is patent eligible because it is not naturally occurring.*' The Myriad decision thus invalidated the patents relating to the identification of genes, but upheld the patents relating to DNA created through artificial process.[968] When the Myriad patents eventually were tried in the EU, only limited protection was granted, although gene patents were not altogether ruled out.[969] In Australia, the claims were considered patentable.[970]

[966] This builds on the traditional understanding in European patent law that all biological inventions in principle are patentable. In principle, under European patent law there no distinction is made between the patentability of naturally occurring as opposed to artificial genetic material. See Walden, Intellectual Property Rights and Biodiversity. 1996, at 174.

[967] Association for Molecular Pathology v. Myriad Genetics Inc., 569 U.S. 576.

[968] Sherkow & Greely, ANNUAL REVIEW OF GENETICS (2015).

[969] Anja von der Ropp & Tony Taubman, *Bioethics and Patent Law: The Case of Myriad*, WIPO MAGAZINE (2006).

[970] D'Arcy v. Myriad Genetics Inc., FCAFC 115 (Federal Court of Australia).

Taken together with the ruling in *Mayo Collaborative Services v. Prometheus Laboratories*[971], decided in parallel, the Supreme Court decision the Myriad case marks a turn in a considerably more restrictive approach to gene patents compared to previous practice. As a broader consequence of the *Myriad* procedures, all patent claims directed to isolated genomic DNA were invalidated.[972] Instead, DNA sequences generally became regarded as products of nature, ineligible for patenting, under US practice.[973] Moreover, as the result of the partly connected ruling in *Mayo*, patent claims directed to methods of conducting genetic risk-assessments became ineligible.[974] The US rejection of Myriad's patents was followed in Australia, with a majority in the High Court considering that such molecules constituted "information" which was not of human manufacture, and were otherwise unsuited to protection having regard to the purpose and coherence of patent law.[975] The turn taken in US patent law by the Myriad and Mayo decisions have however so far not been followed by a corresponding more restrictive approach in the EU, where the more liberal approach of the Biotech Directive still applies.[976] Effectively, EU law on patentability of genetic resources has thus effectively become less restrictive than US law under current practice.

It is important to note that the US Supreme Court decisions in the Myriad and Mayo cases, which made the US approach to gene patents more restrictive, came a decade after the conclusion of TRIPS. The starting point for the US in the Uruguay round negotiations on intellectual property rights was thus not the approach to patentability which is now accepted, but the unadjusted and much more liberal approach to biotechnology patents which was prevalent in the years after the *Diamond v. Chakrabarty* ruling.

[971] Mayo Collaborative Services v. Prometheus Laboratories, Inc., 566 U.S. 66.

[972] As a consequence of Myriad procedures, primers, or probes of particular genes, also became ineligible.

[973] Burk. 2017, at 471-472.

[974] Mayo Collaborative Services v. Prometheus Laboratories, Inc., 566 U.S. 66,

[975] See Burk. 2017, at 471-472.

[976] Includes isolated and purified genetic molecules within patentable subject matter, while it also limits the scope of protection for genetic products to the product when performing the specific function for which it is patented. Directive 98/44/EC of The European Parliament and of the Council of 6 July 1998 on the Legal Protection of Biotechnological Inventions (Biotech Directive)., arts 3(2) and 9. See also Burk. 2017, at 471.

Indeed, the US, as well as the European Community, who together formed the driving force behind TRIPS entered into its negotiation against the backdrop of a domestic regulation which gradually had embraced the idea that inventions could be built on biological resources and granted patent rights. It should therefore not come as a surprise that they pursued an international regulation in line with this conception. As will be further discussed below, this agenda came largely to prevail in the negotiations of TRIPS, which thus came to reflect the approach to patenting of life at its permissive high-point, a perspective even the US since has abandoned.

It must also be noted that the approach taken to patentability in relation to genetic resources under the *Diamond v. Chakrabarty* ruling never was universally recognized but largely confined to OECD-countries. Developing countries rejected these liberal approaches to biotechnology patenting, and regarded the development with great skepticism, not least in relation to the patenting of plants and seeds.[977] Accordingly, developing states in general more reluctantly entered the negotiation of TRIPS. This is connected to dissimilar perspectives on the more fundamental issue of the privatization represented by the patenting of genetic resources.[978] Many developing states have considered that the patenting of genetic functions is unacceptable, not only based on principal objections against the patenting of nature but also because such functions have been developed by evolution rather than humans. Since the value under this understanding has been provided by nature, accepting intellectual property rights claims to genetic resources has also been rejected based on legal material grounds, in addition to the ethical and political objections.

[977] Ali M. Nizamuddin, The Patenting of Life, Limiting Liberty, and the Corporate Pursuit of Seeds (Lexington Books. 2017); Thompson, Natural Resources Journal (2004), at 850.
[978] Smith, North Carolina Journal of International Law and Commercial Regulation (2000), at 146.

D.3.4. Globalization of patentability of living organisms and reaction to the CBD

When negotiations for an agreement on protection on intellectual property rights started within the General Agreement on Tariffs and Trade (GATT), both the United States and the European Community demanded that discoveries involving recombinant DNA (rDNA) should be declared intellectual property, admissible for patenting, in line with their domestic regulation. Based on this approach, micro-organisms (such as bacteria) as well as biological processes eventually would become patentable under the agreement.[979] It will now be discussed how these and likeminded states managed to find acceptance in the new global regime for their relatively new conception of living organisms as patentable.

This notion was based on two presumptions, which were also the basis for the patentability of living organisms in their domestic laws. Firstly, that the possibility of appropriation and exclusive rights is a precondition for innovation. Secondly, that such rights can extend also to cases of discovery of naturally occurring functions, i.e. where the inventive step is the result of evolutionary processes and the human contribution is limited to the discovery of that function and its potential use. Based on this rationale, these states argued that innovation is driven by economic incentives, and that discoveries involving recombinant DNA should be considered intellectual property, admissible for patenting.[980] The concept of regarding DNA as intellectual property as proposed by these states was wide, encompassing micro-organisms (such as bacteria) as well as biological processes.

The Uruguay round of trade agreement negotiations, which would lead to the formation of the WTO, started already in 1987. The inclusion of intellectual property rights in the negotiation round was not the result of a request by all states, but rather that of a limited group, led by the US and supported by the EC and Japan. In addition to the US interest in bringing about a global treaty in line with its national regulation of intellectual property rights, as discussed in the previous section, concerns had also started to emerge on the perceived

[979] GERVAIS. 2012, at 420-458.
[980] Thompson, NATURAL RESOURCES JOURNAL (2004), at 850.

cost of intellectual property right violations for the US economy.[981] This prompted a broad coalition of corporations involved in knowledge-based industries, as well as the US Chamber of Commerce, to put considerable lobbying efforts into making the US and other developed states prioritize the prevention of such violations in the Uruguay round. As part of this movement, the Intellectual Property Committee, consisting of enterprise federations in the US, Japan and the EC, was formed.[982]

This committee amplified and spread the efforts for the inclusion of an ambitious platform for the protection and globalization of intellectual property rights in the round. It also came to play an important role as a lobbyist throughout the negotiations. What corporate stakeholders sought in the suggested agreement was thus more than merely deterrents to international trade in goods which violated intellectual property rights.[983] They also called for the global adoption and implementation of adequate and effective, but not necessarily harmonized, rules protecting patents in all fields, including biotechnology inventions, irrespective of organism.[984]

As already mentioned, the developing countries' Group of 77 were critical of the suggestion to include intellectual property rights issues. As shown by Smith, this connects to fundamentally different views on intellectual property rights in developing countries. Whereas most developed states for long had subscribed to the logic of intellectual property right protection, this had not been generally accepted in developing states.[985]

[981] In a widely discussed report by the US International Trade Commission issued in 1986, intellectual property rights violations had been estimated to cost the US $61 billion dollars.

[982] Derrick Purdue, Hegemonic trips: World trade, intellectual property and biodiversity, 4 ENVIRONMENTAL POLITICS (1995), at 96; Peter Drahos, Global Property Rights in Information: The story of TRIPS at the GATT, 13 PROMETHEUS (1995), at 6-19; Cary Fowler, Unnatural selection: technology, politics, law and the rationalization of plant evolution (1993) Diss. Uppsala University), at 176.

[983] Susan K. Sell & Aseem Prakash, Using Ideas Strategically: The Contest Between Business and NGO Networks in Intellectual Property Rights, 48 INTERNATIONAL STUDIES QUARTERLY (2004).

[984] Drahos, PROMETHEUS (1995), at 12-13.

[985] The logic of intellectual property rights is commonly described as creating private property rights for developers of new knowledge to compensate for the labor and resources expended during the creative process. By rewarding research and development, intellectual property rights aim to promote the creation of new knowledge, as well as its dissemination, since patents require publication. Thereby, it is claimed, intellectual property rights benefit both society in general and inventors. Smith, NORTH CAROLINA JOURNAL OF INTERNATIONAL LAW AND COMMERCIAL REGULATION (2000), at 145.

Rather than accepting this individualistic approach, knowledge is commonly considered communal and not private property in developing country societies, where there is a widespread recognition of invention as an intergenerational, rather than individual achievement which extend existing ideas and discoveries.[986] As discussed in the previous section, the concept that exclusive rights could be claimed to species or the components of life was particularly alien to G77 members.

Still the developing states did not manage to prevent the issues which would become codified in TRIPS from becoming a central element in the negotiation round. This has been explained in different ways. Sutherland has attributed it to the lack of expertise and resources among developing states.[987] McLaughlin has explained the inclusion of intellectual property rights as a trade-off: Despite their reluctance, developing countries had to accept the negotiation of these issues in the Uruguay round, in order to enable the negotiation of trade liberalizations.[988] Venbrux has described it as the result of external pressures from the United States and the European Union to force intellectual property legislation in other member states, which involved threats of trade sanctions unless the protection was strengthened.[989]

The negotiation group on trade-related aspects of intellectual property rights, including in counterfeit goods thus became part of the Uruguay round negotiations from the start. In the initial years, work progressed slowly. The first period of negotiations focused on identifying lacunae in existing intellectual property rights conventions and national law.[990]

[986] Lakshmi Sarma, Biopiracy: Twentieth Century imperialism in the form of international agreements, 13 TEMPLE INTERNATIONAL AND COMPARATIVE LAW JOURNAL (1999), at 107-108 Rosemary Coombe, Intellectual property, human rights and sovereignty: new dilemmas in international law posed by the recognition of indigenous knowledge and the conservation of biodiversity, 6 INDIANA JOURNAL OF GLOBAL LEGAL STUDIES (1998).

[987] Johanna Sutherland, *TRIPS, Cultural Politics and Law Reform*, 16 PROMETHEUS (1998), at 294.

[988] McLaughlin. 2010.

[989] Greg K. Venbrux, When Two Worlds Collide: Ownership of Genetic Resources unde rthe Convention on Biological Diversity and the Agreement on Trade-Related Aspects of Intellectual Property Rights, 6 PITTSBURGH JOURNAL OF TECHNOLOGY LAW AND POLICY (2006).

[990] GERVAIS. 2012 at 13.

However, already by the end of 1987, a range of participants, notably the US and the European Community had expressed their desire for a far-reaching agreement on intellectual property rights.[991] These calls did not go uncontested. Developing countries expressed serious concern about possible over-protection of intellectual property rights.[992] This resulted in a stalemate, and at the mid-term meeting of the Uruguay round in Montreal in 1988, the ministers limited themselves to a short statement concerning TRIPS. It was not until 1990 that proposals for a treaty text started to materialize, again led by the US and the European Community supported by allies like Japan, Australia and Switzerland.[993]

Already at the outset of the negotiations it had been clear that the US, EU and likeminded states wanted a narrow and ambitious agreement, which did not allow for a multitude of exceptions. By the end of 1991, it appeared clear that a future agreement would require patentability of inventions in all fields. The G77, however, still insisted on the exclusion of plants and animals.

In 1992, the dynamics of the TRIPS negotiation changed by the adoption of the CBD at the Rio Summit. The CBD, which had been negotiated and adopted in parallel to the first years of the TRIPS negotiation, gave rise to considerable controversy in the area of intellectual property rights. Across the US intellectual property business sector there was considerable disappointment with the negotiation outcome. In particular Article 16 of the CBD on the *Access to and Transfer of Technology* (as discussed in section C.2.2) was cited by the US government as one of the reasons behind their decision to initially not sign the CBD.[994] Generally, the US considered that the CBD focused on intellectual property rights as a constraint to the global economy.[995] The CBD provisions on technology transfer were regarded as potentially permitting countries to restrict the intellectual property rights of companies that develop products based on resources obtained from the country.

[991] See proposals tabled by the United States Trade Representative (USTR), document MTN.GNG./NG11/W/14 (October 20, 1987) and the European Community, document MTN.GNG/NG11/W/16 (November 20, 1987).
[992] Gervais. 2012, at 3-32; Terence P. Stewart, The GATT Uruguay round: A Negotiating History (1986-1992) § 2 (Kluwer. 1993).
[993] GERVAIS. 2012, at 19.
[994] In the end the US signed the CBD, but not until 1993, one year after the Rio summit, where other participating states had signed the treaty.
[995] Walden, Intellectual Property Rights and Biodiversity. 1996, at 178.

Moreover, the US objected to the calls to set up compulsory licensing regimes as well as the provision in Article 22(1) that opened for the possibility to affect preceding intellectual property rights agreements in case of serious damage or threat to biological diversity.[996]

The upshot was that the US position in the TRIPS negotiation became fiercer. It no longer merely sought to gain international acceptance for the US regulation, but also to a considerable degree came to reflect the disappointment with the outcome of the CBD negotiations. The debate among intellectual property rights stakeholders in the US in the wake of the disappointment with the outcome of the CBD negotiations increased the interest for, and consequently the mobilization of lobbyists in relation to the negotiation of TRIPS. In particular major pharmaceutical companies realized that there were considerable interests at stake.[997]

In the wake of the adoption of the CBD, negotiations of the most contentious issues of TRIPS would continue through 1993 and eventually the TRIPS agreement was adopted in 1994.[998] Judging by the negotiation documents, only developing states appear to have expressed concerns that the proposals for including patentability of living organisms would go against what had been agreed as fundaments of the CBD at the Rio Summit. These calls for exploring connections to other treaties were however voiced rather late in the negotiations. The developing countries' opposition to regarding living organisms as patentable was founded on the same concerns that had guided their positions in the negotiations of the CBD: namely a fear that the gene-poor North would be robbing the gene-rich South of germplasm as a resource for biotechnology and then commercialize products without adequate compensation for the state of origin for the gene.[999] For developing countries, it was central to maintain the sovereign rights to their genetic resources which had been affirmed by the adoption of the CBD at the Rio Summit in 1992.

[996] Melinda Chandler, *The Biodiversity Convention: selected issues of interest to the international lawyer*, 4 COLORADO JOURNAL OF INTERNATIONAL ENVIRONMENTAL LAW AND POLICY (1993), at 150.
[997] David Tyfield, *Enabling TRIPs: The pharma–biotech–university patent coalition*, 15 REVIEW OF INTERNATIONAL POLITICAL ECONOMY (2008).
[998] Ibid, at 30-31.
[999] Klaus Bosselmann, *Plants and politics: the international legal regime concerning biotechnology and biodiversity*, 7 COLORADO JOURNAL OF INTERNATIONAL ENVIRONMENTAL LAW AND POLICY (1996), at 132.

The US, EC and likeminded states rejected these proposals for exploring the connections to other treaties and limiting the patentability of living organisms by referring to the limited mandate of the negotiations, which did not include possibilities for including non-trade aspects. In any event, these states contended, issues of connections to other treaties should not be allowed to halt the adoption of the agreement. After all the TRIPS negotiation was part of the broad multilateral round of WTO agreements of the Uruguay round, they considered, and was thus bound by tight deadlines. Moreover, as previously stated, an all-inclusive definition of patentable matter was central to the US and EC positions.[1000]

With regard to the patentability of living organisms, as would finally be provided in Article 27 of TRIPS, the US had initially been categorically opposed to possibilities for excluding of plants and animals. It finally agreed to allow states to derogate from that obligation for two reasons. Firstly, the exceptions provided in Article 27, for methods for the treatment of humans and animals as well as for plants and animals other than micro-organisms and essentially biological processes were only optional and not mandatory. This permitted the US, the most important patent jurisdiction, to maintain its legal practice of regarding living resources as patentable. Secondly, the US in the final rounds of negotiations declared, as a requirement for their acceptance of possibilities for exceptions for plants and animals, that micro-organisms would not be part of that exception.[1001] The US, supported by the EC and other OECD-states, thereby managed to bring about a mandatory acceptance of the patentability of micro-organisms as an "exception to the exception." Some observers have disagreed with the description of Article 27 as a reflection of US interests. For instance, Walden has based on the possibilities for exceptions claimed that Article 27 should be interpreted as a balance between the broad protection under US law of the time and the public interest concerns of developing countries, which had been more reflected in the CBD.[1002] In any event, the agreed compromise of Article 27 was not formulated as a definitive solution to the matter.

[1000] For a vivid account of these parts of the negotiations, see GERVAIS. 2012, at 420-458.
[1001] Friedrich-Karl Beier & Gerhard Schricker, From GATT to TRIPs : the Agreement on Trade-Related Aspects of Intellectual Property Rights § 18 (Max Planck Institute for Foreign and International Patent, Copyright and Competition Law. 1996).
[1002] Walden, Intellectual Property Rights and Biodiversity. 1996, at 179.

Instead, the parties agreed to postpone the decision on critical issues by including a review mechanism in Article 27(3)(b). According to the mandate for this review, a process starting five years after the agreement should handle the issue of whether plants and animal inventions should be covered by patents, and how to protect new plant varieties. This review procedure, together with the possibilities for exception made developing countries accept patentability as the main rule. However, the review procedure would not solve the conflict; indeed, it has still not solved the conflict. Developing country proposals for adjusting the regulation of patentability of living organisms have consistently been rejected. The scope for the review was eventually expanded in the 2001 Doha Declaration, by also including the relationship between the TRIPS Agreement and the CBD.[1003] The review discussion has since continued in the TRIPS council. In 2008 a group of parties called for a procedural decision to negotiate a provision including geographic disclosure requirements. Members however remain divided over this idea.[1004] As a consequence of the inability to make progress on the issue, the original conception of macro-organisms as patentable according to the main rule, and micro-organisms as patentable under any event, remain intact.

In conclusion, the US, EC and allied states succeeded in bringing about an ambitious treaty, with a broad regulation of patentability, encompassing living organisms as a main rule and micro-organisms as a mandatory requirement. This was in line with, and can partly be explained by, legal development, foremost in US domestic law. Powerful interests within the business sector lobbied effectively for a corresponding multilateral regulation. Moreover, these actors were disappointed with substantial parts of the newly adopted CBD and wanted to ensure that their interests were better upheld in TRIPS. The approach to patentability of TRIPS can thus also be regarded as a reaction to the CBD. As for developing states, they did not manage to bring about leverage in favor of their objection to include living organisms as patentable subject matter.

[1003] See Paragraph 19 of the 2001 Doha Declaration, World Trade Organization, Ministerial Declaration of 14 November 2001, WTO Doc. WT/MIN(01)/DEC/1, 41 ILM 746 (2002) (Doha Declaration); Frederick M. Abbott, *The Doha Declaration on the TRIPS Agreement and Public Health: Lighting a Dark Corner at the WTO*, 5 JOURNAL OF INTERNATIONAL ECONOMIC LAW (2002).
[1004] World Trade Organization, Draft modalities for TRIPS related issues, WTO Doc. TN/C/W/52, 19 July 2008.

Instead, they reluctantly accepted patentability of living organisms as the main rule, in return for possibilities for exceptions on a national basis, as well as a review mechanism. Yet, the review procedure ßfailed to advance the question. Developing country calls for a modified definition of patentability, as well as for geographic declaration of origin for genetic material, have so far failed to gain acceptance.

The new treaty thus came and continues to reflect and continues to manifest the conception of patentability of living organisms under US practice, as it had evolved during the years leading up to the finalization of the negotiations, which coincided with the period highly permissive in relation to biotechnology patents, in the wake of *Diamond v. Chakrabarty.*[1005] This explains why TRIPS generally accepts the appropriation of living organisms by means of claims for exclusivity based on patenting, irrespective of the origin of genetic components, and only provides limited possibilities for exceptions. Whereas US case law since has become more restrictive in relation to gene patents, TRIPS remains a reflection of the period before the Myriad[1006] and Mayo[1007] cases.

D.4. Conclusions on underlying perspectives

The study has now examined how the international law of the sea, international environmental law and international trade law, as manifested in UNCLOS, the CBD and TRIPS, relate to the appropriation of deep-sea organisms, and what underlying values explain these different conceptions. A multitude of explanatory factors have been established, relating to such diverse aspects as contemporary political movements, particular dynamics of negotiations, involvement of private interests and regulative origin.

In the examination of the rules applicable to the appropriation of genetic resources under *the law of the sea* it was established that these can be interpreted as built on differentiated conceptions of appropriation across maritime zones. Firstly, the claims for expanded coastal state rights gradually increased maritime zone claims, including exclusive rights for living resources within those areas. This amounted to a substantial enclosure of marine areas which used to be global commons.

[1005] Diamond v. Chakrabarty, 447 U.S. 303.
[1006] Association for Molecular Pathology v. Myriad Genetics Inc., 569 U.S. 576.
[1007] Mayo Collaborative Services v. Prometheus Laboratories, Inc., 566 U.S. 66.

Secondly, in remaining areas beyond national jurisdiction the regulation in UNCLOS was built on a dichotomy between two widely different conceptions of appropriation of common resources. In the high seas, the medieval freedoms of the high seas-principles remained relatively intact. This implies a *res communis*-conception of the living organisms, open for individual appropriation by anyone, provided that certain conditions are met, albeit without possibilities for collective enclosure by assertions of sovereignty.

As regards resources in the seafloor and underlying sediments of the Area, their regulative regime was based on the revolutionary new concept of the common heritage of mankind, providing common management under global institutions, prohibiting appropriation. This concept was considered strongly connected to the New International Economic Order movement, which was particularly influential in the international system around the time of the negotiation of this part of UNCLOS. It was also established that the dichotomy of the regime for areas beyond national jurisdiction, based on partly opposing concepts of appropriation in the high seas and the Area, was the result of a trade-off between the movements of enclosure and the New International Economic Order movement. With regards to the management of living resources in what used to be the high seas, coastal state appropriation of vast areas and exclusive claims for the resources in those areas gained acceptance, in return for the new deep-seabed regime of the common heritage of mankind. The advancement of both these conceptions – enclosure and common heritage of mankind – was made at the expense of the high seas freedoms, where the old *res omnium communis* regime was substantially cut short by exceptions and geographically curtailed by enclosures.

In investigating *international environmental law*, a partly overlapping and equally interesting duality was found in the CBD. The convention essentially establishes two different regimes, one applying in areas within and another one beyond national jurisdiction, based on fundamentally different perspectives of appropriation of living resources. It was established that the CBD generally can be regarded as being based on the conception that biodiversity ought to be exploited and conserved for human purposes, reflecting a predominantly instrumental perspective towards natural resources.

At its heart lay the contention that states have sovereignty over biological resources within their territorial realm, including exclusive rights to regulate their appropriation, and that they should be adequately compensated for supplying and conserving those resources, in particular when granting access to others.

However, in the investigation of the provisions relating to areas beyond national jurisdiction, it was found that the convention appeared to shift perspective: Beyond state borders, the CBD is less concerned with appropriation of resources or distribution of benefits. Instead, emphasis is put on conservation. In these areas, the instrumental perspective of biological resources is replaced with provisions reflecting a view that conserving biological diversity is an end in itself, an essentially intrinsic value approach. Like the case of the law of the sea, this dichotomy reflects different perceptions and perspectives of appropriation of biological resources within the same convention. The regulation within state borders can be summarized as granting unlimited rights to the states to appropriate genetic resources within their territorial jurisdiction, so long as certain conservationist obligations are fulfilled. By qualifying the access of other states on benefit-sharing, incentives are created for conservation. Beyond national jurisdiction, the effect of the convention is the opposite: States are obliged to fulfill conservationist obligations relating to biological resources without any provisions entailing possibilities for compensation.

The exploration of *international trade law* rules on patentability, as manifested by TRIPS, established that the regime disregarded the UNCLOS and CBD notion of exclusive rights for states to appropriate genetic resources within their territorial scope. Instead, TRIPS was found to be built on an all-inclusive conception of patentability, including living organisms and genetic resources according to the standard rule. This conception, has its roots in an increasingly permissive practice in domestic US application of patentability criteria. The success and resulting reflection of this conception in the negotiations was explained by a chain of events. A powerful industrial lobby had been assembled already before the negotiations, calling for an intellectual property rights treaty to be part of the Uruguay round of trade agreements. Initially, this call was based on frustration with increasing instances of counterfeiting and piracy.

However, as negotiations for TRIPS were launched, the same interests started to pursue a globalization of US conceptions of patentability. After the adoption of the CBD at the Rio Summit in 1992, disappointment with the summit outcome within the industry, which considered that the CBD would put US intellectual property rights interests at risk, bolstered the engagement in TRIPS, aiming to make it a counterweight to CBD. Developing countries, which wanted to protect gains made at Rio, disputed US claims for an unlimited definition of patentability, including living organisms.

This opposition was eventually bought off in return for trade liberalizations and by the inclusion of a review mechanism. In the review discussion, developing states have called for an exploration of connections to the CBD and have proposed requirements for declaration of origin for living organisms used in patent applications. However, these proposals have received a lukewarm reception by the US and likeminded states, and the originally adopted text of the TRIPS thus remains intact. It is noteworthy that the rules applicable to the patenting of genetic resources under TRIPS reflect an approach in US law which has since in part has been revoked. Taken together, these dynamics explain how TRIPS ended up adopting rules entailing unlimited patentability, enabling the appropriation of living organisms and genetic resources by legal claims for exclusivity by means of patenting, irrespective of geographic origin.

E. The interaction of rules in different regimes of international law – integration, coherence or fragmentation

Under Part C it was examined how norms in three international law treaties, representing three distinct regimes, regulate the appropriation of deep-sea living resources in different ways. Under Part D the concerns, motivations and ideologies behind these rules were investigated. It was discussed how substantive differences can be explained by fundamentally dissimilar underlying ideologies and perceived assumptions of purpose across the three regimes. The differences encompass the most basic elements of the rules, including how the regimes conceptually interpret appropriation of genetic resources.

These fundamental underlying disparities between the regimes, it was argued, explain why they relate differently to the legal status of claims to deep-sea genetic resources. To the law of the sea, organisms within national jurisdiction are resources which are to be managed and allocated between states according to their sovereign rights and interests. Beyond such areas, the resources of the oceans are global commons, either open for appropriation by anyone under the freedoms of the high seas or unlawful to appropriate under the common heritage of mankind principle of the Area. Under international environmental law, the same organisms are regarded as biodiversity which states have the sovereign rights to appropriate within their jurisdiction. Beyond state jurisdiction, they are safeguarded by conservation measures and other tools for environmental protection. For international trade law, the same organisms are generally considered as matter which can be appropriated by means of patents, which, according to the main rule, should be granted protection, irrespective of where the organism is retrieved.

So far, the rules applicable to deep-sea bioprospecting provided by each respective regime have been approached in isolation, without fully considering areas of overlap and impact across regime boundaries. In this part, these rules will be compared and combined to see what rules should be given priority or if an aggregated set of norms can be distinguished, representing not one treaty or regime, but the full spectrum of international law.

Although the conclusions would be relevant also in other contexts, such as in settlements of judicial disputes involving deep-sea bioprospecting, this will foremost be viewed from the perspective of the primary subject of international law: the state. It will thus be investigated if it would be possible for a state to implement in good faith its obligations in all three regimes when faced with practical cases of deep-sea bioprospecting or when attempting to draft domestic legislation for the use of deep-sea genetic resources. This implies an assessment of whether the rules can be practically applied in concert, despite their origins in different branches of international law. Or, if there appears to be a material overlap, which would prevent states from being able to simultaneously implement relevant norms from all three regimes. This will enable a more precise identification of inconsistencies between the rules of the different regimes.

Thereafter, it will be developed how international law addresses inconsistencies between treaties. Possible means to prevent and resolve norm conflicts, primarily based on treaty law rules on application and interpretation, will be examined. This will serve two purposes.

Firstly, these rules will be tested in the context of potential conflicts identified relating to deep-sea bioprospecting and biogenetic resources. Thereby, it will be established if this case represents a genuine, irreconcilable norm conflict, or merely a *prima facie* problem, which the rules in international law would be able to prevent or resolve. From the perspective of the state, this would clarify if it would be possible to interpret or apply relevant obligations in a manner that would enable it to implement the undertakings of all three regimes

Secondly, this will serve as the starting point for a discussion on systemic implications on international law. If the rules that aim to maintain international law as an integrated, coherent system of law fail to fulfill this objective in practical cases such as that of deep-sea bioprospecting, can international law still be regarded a unitary system of law? Or could the ability of treaty law rules to address such difficult cases serve as an indication of fragmentation into different regimes, which have become incapable of functioning coherently?

E.1. Areas of contention between UNCLOS, CBD and TRIPS

To start with the law of the sea, marine genetic resources in the high seas and the Area are regarded as global commons. As regards genetic resources of the high seas, it appears that states are free to use these in bioprospecting by virtue of the high seas freedoms and the principle of *res omnium communis*. Generally, the open-access regime of the high seas gives all states access, and the limitations to appropriation principally relate to territorial claims. General obligations of the high seas regime must, however, be respected in bioprospecting. Similarly, the rules on marine living resources remain applicable, calling for their different approaches to management to be considered. For genetic resources in the high seas, it is less relevant whether sampling operations are considered to represent marine scientific research, since the legal material implication is the same, irrespective of how the activity is considered.

In the Area, the legal status of genetic resources is less clear. Whereas there is no consensus regarding the legal status of bioprospecting in the seafloor and underlying sediments, it was considered that there are powerful arguments for considering the genetic resources of the seabed as encompassed by the scope of the Area regime, and as falling within the scope of the principle of common heritage of mankind, although the issue remains contested.[1008] As a consequence of the consideration that the common heritage of mankind principle is applicable to seabed genetic resources, it was found that legal claims to these resources are precluded under UNCLOS.[1009]

[1008] As was found under section C.1., this question essentially boils down to interpretation of the resource definition under UNCLOS. Either, resources should be interpreted extensively, thus bringing marine genetic resources within the scope of the common heritage of mankind principle. Or, the scope of that principle is limited to mineral resources, thus leaving marine genetic resources outside the remits of the principle. Ultimately, this determination is decisive with regards to the legality of bioprospecting in the seafloor and underlying sediments. As was established in section C.1.4., the arguments favoring an extensive position are considered more powerful in this study. This understanding implies that genetic resources geographically located in the seabed are part of the Area-regime and falls within the scope of the common heritage of mankind-principle.

[1009] See Article 137 of UNCLOS. “No State shall claim or exercise sovereignty or sovereign rights over any part of the Area or its resources, nor shall any State or natural or juridical person

This is connected to an integral part of this principle: if the resource is owned by all of mankind collectively, individual or sovereign appropriation would represent a violation. Effectively, this implies that all forms of appropriation – including by means of bioprospecting – of genetic resources in the seabed are unlawful.

From the perspective of international environmental law, as articulated by the CBD, the investigation in Part C established that the regime provides far-reaching rights for states to appropriate genetic resources within national jurisdiction. In contrast, beyond national jurisdiction, the convention is not concerned with the legal status of such resources. States are, however, bound to respect a number of obligations relating foremost to the preservation and in situ conservation of bioresources as well as the sharing of benefits from bioprospecting activities relating to organisms beyond national jurisdiction. It could be argued that these obligations, in particular relating to conservation, go further than the corresponding conditions imposed by UNCLOS. Hence, it could be alleged that CBD could potentially limit the possibilities for freely exercising the high seas freedoms and the use of the Area provided by UNCLOS.

Based on the ordinary meaning of treaty terms, it appears that WTO law, as provided by TRIPS is inconsistent in relation to both the rules of UNCLOS and the CBD by declaring as a main rule that marine genetic resources are patentable subject matter, and thus can be appropriated, irrespective of where such living resources are retrieved, as discussed in section C.3. States are however able to exempt plants and animals from patentability. For some bioresources on the other hand, in particular micro-organisms, which includes most relevant deep-sea genetic resources identified in section B.6, state parties to TRIPS are even under obligation to enable patentability.

If patents are based on genetic resources retrieved within the national jurisdiction of other states, such claims would represent a violation of the sovereign rights of these states to control and manage bioresources within their territorial jurisdiction under both UNCLOS and the CBD, unless consent has been granted.

appropriate any part thereof. No such claim or exercise of sovereignty or sovereign rights nor such appropriation shall be recognized.”

Where patent claims are accepted involving genetic resources sampled beyond national jurisdiction, as is the focus of this study, the bioprospecting involved could be considered as not being fully in line with the CBD, to the extent that obligations relating to conservation are violated or benefits-sharing obligations not fulfilled. If this area of contention may appear hypothetical, it appears less remote to consider the allowance of legal claims by means of patenting to seabed genetic resources as violating the common heritage of mankind principle of UNCLOS, as well as other law of the sea rules for the Area. At least an inconsistency appears to be at hand where genetic resources have been sampled for bioprospecting purposes.

Where deep-seabed genetic resources have been sampled as part of scientific research operations without commercial purposes, and stored, either by means of sequence data in libraries or in biobank collections only to subsequently be used as the basis for bioprospecting, the rules in UNCLOS do not appear to preclude patenting.[1010] In the law of the sea rules on the high seas, on the other hand, there is no rule precluding patent claims to genetic resources, as discussed above. There thus appears to be full coherence between the obligations under UNCLOS and TRIPS relating to bioprospecting in the pelagic realm of the deep seas. Where such activities are conducted in relation to deep-seabed genetic resources, there appears to be a considerable risk of conflict between the obligations of these treaties. In particular, this is the case for the types micro-organism resources for which TRIPS prevents states from making exceptions from patentability.

In conclusion, a preliminary reading, based on the ordinary meaning of terms involved, suggests that the three treaties provide inconsistent rules for some but not all types of deep-sea bioprospecting. In some areas, foremost relating to bioprospecting of deep-seabed genetic resources, located beyond national jurisdiction, these obligations could result in conflict, implying that one obligation under international law cannot be fulfilled without violating another.

[1010] This model, which may appear to be remote and theoretical has become increasingly common in bioprospecting processes, as discussed in Part B. The compatibility of this model with the rules in UNCLOS is due to the more generous access to non-commercial marine scientific research in the seabed as compared to other activities under the Area regime, and the lack of rules in UNCLOS on how samples collected in scientific research missions subsequently are used, as discussed in section C.1.5.

In particular, this is the case for bioprospecting of deep-seabed micro-organisms, where contrary obligations put states in a legal dilemma: Rejecting patent claims as called for by the rules of the Area under the law of the sea would represent a violation of the obligation to enable patentability under TRIPS.

Identifying this norm conflict does not imply that the discrepancies between these regimes extend to all legal issues involving bioprospecting. As identified, in many regards the rules of the three regimes remain compatible, despite the fundamental differences discussed in Part D. But in the specific case of deep-sea bioprospecting, treaty provisions in the three regimes in some regards appear difficult to apply in concert. These potential norm conflicts are not merely theoretical but relate directly to practical aspects of the growing bioprospecting sector. Such conflicts are likely to become more relevant under current industry trends, in particular since the conflict is most articulate in relation to the deep-seabed micro-organisms which are the focus for much of the commercial interest, as discussed in Part B.

Where life in the deep seas is exploited for bioprospecting purposes, conflicts can thus arise between obligations in the three regimes. The law of the sea in certain regards prohibits the appropriation of naturally occurring genetic resources, whereas intellectual property rights elements of WTO law obliges states to enable patenting of the same organisms. International environmental law in turn sets requirements not only for conservation but also for the sharing of benefits. How, then, does international law relate to such situations?

E.2. Approaching cases of conflicting obligations

Considering the different perspective on deep-sea bioresources identified in Part D, it is not surprising that rules vary across these legal regimes. In this and subsequent sections, the consequences of these differences will be explained. Firstly, it will be examined how overlaps and conflicts of norms in international law have been interpreted. As will be discussed, scholarly positions on the possibility of preventing or resolving such conflicts largely correlate with the perspective of central systemic elements. Those who contend that international law remains a coherent system, despite its proliferation into different regimes, generally hold that treaty law rules are able to prevent and resolve conflicts.

Taken to its extreme, this understanding would suggest that even conflicts between norms that appear entirely irreconcilable *prima facie* will function in concert once treaty law rules for conflict prevention and solution have been applied. Under this argument, genuine norm conflicts would be inconceivable in international law since the system is constructed to self-repair, or rather to prevent conflicts from even arising.

This position can be contrasted with that of observers who claim that the system has fragmented. According to this understanding, the once monolithic public international law has not only developed different regimes; these have also become largely independent systems of laws, which function according to internal logics and regime objectives. As a result, norm conflicts may be bridgeable within regimes. But where incompatible obligations originate in different regimes, it is less certain that treaty law rules for preventing and resolving conflicts will provide a viable course of action. Under this argument, the incoherence would in itself be evidence of the fragmentation of the system of international law.

Once this discussion has been explored, it will be complemented with a practical investigation, which despite the lively theoretical debate appears to have been carried out only rarely. The elements of treaty law, which according to the systemic position preserves the integrity of international law as a coherent system, will be contextualized in the case of deep-sea genetic resources. Would applying treaty law rules for preventing and resolving conflicts in this specific case provide orientation as to what norm states should implement? This investigation will serve two purposes. Firstly, it will be examined whether international law establishes priority among the different treaty obligations relating to deep-sea bioresources or ways to interpret them which prevent conflict. Secondly, the outcome of this examination will serve as the basis for reapproaching the question of the systemic elements of international law. If the rules claimed to preserve the integrity of the system fail to bridge treaty conflict in a practical case such as that of deep-sea bioprospecting, how does that change the perspective of international law?

This implies a practically oriented perspective which is different from most investigations of norm conflicts in international law, which seem to be inclined to assume the viewpoint of an international tribunal setting out to decide an unspecified difficult case involving conflicting norms.[1011] Contrary to what one might be led to believe when following academic debate, norm conflicts are not most acute or relevant as potential disputes between states. In reality, few international disputes on norm conflicts have arisen.[1012] This investigation is based on the contention that these problems are most relevant at the more fundamental stage where norms of international law become operationalized by means of state implementation.

Rather than that of an international arbitrator, the perspective in this analysis is that of the central subject of public international law, namely the state: How should a state willing to carry out its obligations under international law in good faith act in situations where it is bound to implement conflicting obligations, such as bioprospecting of deep-sea genetic resources?

E.3. Norm conflicts under international law

International law, with some exceptions, lacks a clear hierarchy.[1013] Often it will yield a straightforward answer to questions of what norm is decisive in a given situation. But there are many cases where the material content of two or more norms in international law overlap.

[1011] The same observation has been made by Young, Regime interaction in creating, implementing and enforcing international Law. 2012, at 89. Albeit the discussion is more general, also the ILC study group on fragmentation appears to have focused on the role of the international judge, Koskenniemi, Fragmentation of International Law - Report of the Study Group of the International Law Commission. 2006.; See also James Crawford & Penelope Neville, *Relations between International Courts and Tribunals: The 'Regime Problem'*, *in* REGIME INTERACTION IN INTERNATIONAL LAW - FACING FRAGMENTATION (Margaret A. Young ed. 2012).

[1012] The most famous of these cases is the United States – Import Prohibition of Certain Shrimp and Shrimp Products, WT/DS58/AB/R (The Appellate Body of the World Trade Organization 12 October). The case is discussed elsewhere in this investigation. Studies based on state perspective of norm conflicts have been carried out, see for instance MARGARET A. YOUNG, TRADING FISH, SAVING FISH: THE INTERACTION BETWEEN REGIMES IN INTERNATIONAL LAW (Cambridge University Press. 2011).

[1013] Exceptions have traditionally been considered to include *jus cogens*, obligations *erga omnes* and Article 103 of the United Nations, Charter of the United Nations, 24 October 1945, 1 UNTS XVI (UN Charter), see ERIKA DE WET, HIERARCHY IN INTERNATIONAL LAW (Cary: Oxford University Press. 2012).

In some cases, rules appear to be contradictory, at least at first glance. Such cases are referred to as *prima facie* norm conflicts. Rules in international law may provide recourses to avoid or solve conflict by means of certain interpretative approaches, an issue which will be further investigated in subsequent sections.

The fact that regimes of international law are built on different basic assumptions and occasionally provide materially inconsistent rules, resulting in norm conflict, is not a revolutionary insight. The theoretical side of this problem strongly connects to an academic debate on – and represents an example of – the *fragmentation of international law*, as discussed in Part A.[1014] The term refers to the dynamic growth of new and specialized sub-fields of international law which accelerated after the Cold War. In particular, in the context of the proliferation of international courts and tribunals, a fear soon developed that greater variations in the determination of general international law would damage the international system. But as stated in Part A, the argument is equally valid for the development of new sub-fields of international law, referred to here as regimes. That international law has developed in this way is not contested. However, there are different interpretations as to what implications this development has for public international law as a system.

Taken to its extreme, a *fragmented view* would suggest that international law is developing into several different systems, all of which are based on different logics and unable to cooperate across regime boundaries. The fragmented view is often contrasted with *the systemic view*, which maintains that international law, despite recent developments, remains a unitary legal system, composed of interconnected rules and principles.

Prima facie norm conflicts produce a blurred picture of what norm applies in a given situation. The motive looks different, depending on the perspective taken. In lack of useful tools to apply in such cases, international law can be different things.

[1014] For a discussion of the positions and overview of literature on the fragmentation of international law, Martti Koskenniemi & Päivi Leino, *Fragmentation of International Law? Postmodern Anxieties*, 15 LEIDEN JOURNAL OF INTERNATIONAL LAW (2002).

Depending on what treaty or regime of international law is prioritized in national implementation or policy, markedly different rules can be developed across states, despite the latter being parties to the same obligations. Similarly, any observer's perspective of applicable norms would vary depending on what regime of international law is in focus for the investigation.

As formulated by Michaels and Pauwelyn, this is not surprising:

> *the fiction of the unitary lawmaker (…) becomes increasingly implausible in the modern context of highly specialized, functional regimes. International trade, investment, environment, and human rights law, with each of their own international institution and/or club of negotiators, enforcement mechanisms, epistemic communities, related national ministries, NGOs, and even academics, make it increasingly difficult to assume a unitary lawmaker with a sufficient sense of institutional coherence, continuity, and memory across these different branches.*[1015]

There are different views as to how big a problem fragmentation constitutes. Gilbert Guillaume, then president of the ICJ, expressed concern about the substance of proliferation at speeches given on successive days to the plenary and the Sixth Committee of the General Assembly in 2000. To the plenary, Judge Guillaume spoke about the emerging prospect of forum-shopping that may "*generate unwanted confusion*" and "*distort the operation of justice*." All this, he felt, "*exacerbates the risk of conflicting judgments*" and gives rise to a serious risk of conflicting jurisprudence as the same rule of law might be given different interpretations in different cases.[1016] Others have expressed the concern that if individual regimes do not consider general international law, in addition to its own rules, this opens the door for powerful actors to use fragmentation to their advantage. Pauwelyn has considered this risk as particularly acute in relation to international trade, where powerful export interests could circumvent domestic legal constraints such as environmental rules by "*insulating their goals and concerns in a trade-only WTO cocoon*."[1017]

[1015] Michaels & Pauwelyn, DUKE JOURNAL OF COMPARATIVE & INTERNATIONAL LAW (2012), at 367.

[1016] Address by H.E. Judge Gilbert Guillaume, President of the International Court of Justice to the United Nations General Assembly, 26 October 2000, cited in Koskenniemi & Leino, LEIDEN JOURNAL OF INTERNATIONAL LAW (2002).

[1017] Pauwelyn, MICHIGAN JOURNAL OF INTERNATIONAL LAW (2004).

Koskenniemi and Leino, in contrast, consider the fear of a dissolution of an integrated system of international law as a predominantly theoretical discussion, referring to it as a postmodern anxiety.[1018]

E.3.1. Causes of fragmentation

The causes of fragmentation are multifold, and observers have not agreed on what factors are most important in contributing to this development.[1019] The discussion is closely connected to the debate on the concept of regimes in international law, as discussed in section A.6.5. As discussed by Peters, two relevant facets seem to be *institutional* fragmentation (different treaties, organizations, bodies, courts) and *ideational* fragmentation (different objectives and values). At the functional side, two patterns of explanation are often referred to.

Firstly, such a development is essentially built into the decentralized structure that is international law. The increasing decentralization, in turn, is a response to globalization. Global challenges have increased the demand for more international and more specific rules.[1020] The occurrence of norm conflicts can thus be explained by the organic growth of international law. Sub-fields of public international law, referred to here as regimes, have been bestowed with the mandate of regulating certain activities, such as the protection of laborers, international aviation or intra-state trade. Despite frequent overlaps with rules beyond regime boundaries applying to aspects of such concepts, legal regimes develop in relative isolation, often disregarding the potential of conflict with norms in other regimes.[1021]

[1018] Koskenniemi & Leino, LEIDEN JOURNAL OF INTERNATIONAL LAW (2002).

[1019] As regards the causes of fragmentation, see Joel P. Trachtman, *Fragmentation, Coherence and Synergy in International Law*, 2 TRANSNATIONAL LEGAL THEORY (2011).

[1020] Peters, INTERNATIONAL JOURNAL OF CONSTITUTIONAL LAW (2017), at 674.

[1021] Although the challenge of fragmentation certainly was discussed before that date, the issue was highlighted and became *en vogue* after the "proliferation"-speech given by the then President of the International Court of Justice (ICJ), Gilbert Guillaume, before the UN General Assembly in 2001. (See H.E. Judge Gilbert Guillaume, President of the International Court of Justice, Speech to the General Assembly of the United Nations (Oct. 30, 2001), http://www.icj-cij.org/ les/press-releases/5/2995.pdf. A broader orientation of the development of regimes of international law, and connected problems, was presented by Koskenniemi (before he took on the International Law Commission project on the same topic). See, in particular Martti Koskenniemi, *The Fate of Public International Law: Between Technique and Politics*, 70 MODERN LAW REVIEW (2007).

This may be connected to simplistic understandings of mandate, lacking consideration of overlaps in relation to equally valid norms provided by other regimes.

Secondly, fragmentation can be explained by sociological elements of fragmentation, as suggested by Young.[1022] This own-regime bias often appears to correlate with professional identity.[1023] Legal professionals within regimes of international law commonly identify themselves as lawyers of the regime at hand.[1024] Different regulative objectives in combination with the project of building a new sub-body of international law in line with the objective have resulted in the development of specific languages, unique to individual regimes, with a vocabulary reflecting the common project.[1025] Koskenniemi has described this as "*managerialism*":

> *Differentiation does not take place under any single political society. Instead it works though a struggle in which every interest is hegemonic, seeking to describe the social world through its own vocabulary so that its own expertise and its own structural bias will become the rule.*[1026]

[1022] Young, The Productive Friction Between Regimes. 2012.

[1023] In the particular relationship between trade and environment, Perez has demonstrated how the different discursive and institutional structures of these domains have influenced the contours of conflict. OREN PEREZ, ECOLOGICAL SENSITIVITY AND GLOBAL LEGAL PLURALISM—RETHINKING THE TRADE AND ENVIRONMENT CONFLICT (Hart Publishing. 2004).

[1024] Fischer-Lescano and Teubner have discussed own-regime bias and the reproduction of structural conflicts between regimes. Andreas Fischer-Lescano, et al., *Regime-collisions: the vain search for legal unity in the fragmentation of global law (Diversity or Cacophony? New Sources of Norms in International Law Symposium)*, 25 MICHIGAN JOURNAL OF INTERNATIONAL LAW (2004).

[1025] The development of such intra-regime features has been further discussed by Uruena, with particular focus on the use of technical indicators. See Rene Uruena, *Indicators as the working language for interaction among regimes*, 106 PROCEEDINGS OF THE ANNUAL MEETING-AMERICAN SOCIETY OF INTERNATIONAL LAW (2012). Similarly, Messenger has discussed the role of causal language in the same context. Gregory Messenger, *The Development of International Law and the Role of Causal Language*, 36 OXFORD JOURNAL OF LEGAL STUDIES (2016).

[1026] Martti Koskenniemi, International Law: Between Fragmentation and Constitutionalism, The Australian National University 12–14 (Nov. 27, 2006), as cited in Peters, INTERNATIONAL JOURNAL OF CONSTITUTIONAL LAW (2017), at 700.

This is also reflected in arrangements on the domestic side: Different issue areas are divided between ministries and branches of government, which often lack coordination or a holistic perspective of the comprehensive system of public international law. As a result, the same states are likely to take positions in international cooperation, in treaty negotiations as well as in the work of international institutions, which result in conflicting ambitions and norms. Even in efficient administrations, joint preparation rarely manages to countervail this problem.[1027] This is thus connected to the differences in perspectives of fundamental concepts referred to as ethos in Part B. These different languages have shaped the way in which observers of different regimes of international law view concepts as only relevant to the project of *their* particular regime.[1028] In many cases, this tunnel vision blinds the observer of any specific regime from conflicting rules beyond the regime boundary, preventing them from even investigating relevant instruments in other regimes.[1029]

This does not just result in overlapping rules, viewed through the multifaceted prism of public international law; it also misleads any observer who limits their investigations to one regime of international law. Any such regime-specific investigation will of course provide a reply in line with that regime and its logic, but so long as applicable obligations in other regimes are disregarded, established conclusions have no validity as regards the totality of international law. However, the fragmented position, with its emphasis on inconsistencies between different treaties and regimes, is not generally accepted.

[1027] Young, The Productive Friction Between Regimes. 2012, at 1.

[1028] Koskenniemi has discussed the influence experts in international law, as has Kennedy more broadly in global governance. Similarly, Young has called for considering the central role of other actors than states in the formation of regimes and the influence of 'professional mindsets' on regime interaction. See Koskenniemi, MODERN LAW REVIEW (2007);Young, The Productive Friction Between Regimes. 2012;David Kennedy, *The Mystery of Global Governance*, 34 OHIO NORTHERN UNIVERSITY LAW REVIEW (2008).

[1029] See Gunther Teubner & Peter Korth, *The Productive Friction Between Regimes*, *in* REGIME INTERACTION IN INTERNATIONAL LAW - FACING FRAGMENTATION (Margaret Young ed. 2012) The question of difficulties as the result of differences across regimes of international law has been addressed by many authors, perhaps most succinctly by Bruno Simma, see for instance Bruno Simma & Dirk Pulkowski, *Of Planets and the Universe: Self-contained Regimes in International Law*, 17 EUROPEAN JOURNAL OF INTERNATIONAL LAW (2006). The issue of different ethos across regimes of international law has been profoundly investigated by Pulkowski, using the example of trade in cultural products DIRK PULKOWSKI, THE LAW AND POLITICS OF INTERNATIONAL REGIME CONFLICT (Oxford University Press 1 ed. 2014).

The contention that international law remains a coherent system of law despite its development into different sub-branches is far from a marginal view. The systemic view is prominently supported by the International Law Commission, which in its first conclusions of the Study Group on the Fragmentation of International Law declared that "*International Law is a legal system*."[1030] As will be discussed later, this conclusion was based on the Koskenniemi report which argued in favor of the ability of the system to remain intact and functioning.

At least insofar as conflict of norms in treaties is concerned, which is the focus of this investigation, there are reasons for considering this formulation as unfortunate. Foremost, the description of international law as a legal system risks reinvigorating the widespread misunderstanding that international law is comparable to domestic systems of public law, where the same coherent rules apply to all subjects insofar as jurisdiction can be asserted, with norms for establishing a hierarchy between different rules, based on the status of certain laws as *lex specialis*, *superior* or other principles expressing hierarchy.

Already in 1953 Jenks observed:

> *in the absence of a world legislature with a general mandate, "law-making" treaties are tending to develop in a number of historical, functional and regional groups which are separate from each other and whose mutual relationships are in some respects analogous to those of separate systems of "municipal law."*[1031]

By virtue of lacking any central authority, it may appear particularly helpful to compare treaty law to contract law. Like states in treaty law, parties may in contract sign up to a broad variety of obligations; identical obligations seldom apply to several persons and (in some cases) parties seek to carry out undertakings that are incompatible with other undertakings. But such comparisons to domestic legal systems have considerable weaknesses.

[1030] Koskenniemi, Fragmentation of International Law - Report of the Study Group of the International Law Commission. 2006.

[1031] C. Wilfred Jenks, *The Conflict of Law-Making Treaties*, 30 BRITISH YEARBOOK OF INTERNATIONAL LAW (1953), at 403.

As Young has observed, contrary to domestic law,

> *there has never been a single global legislature or appellate court to mold a unified body of international law. Nor has there ever been a uniform will for such a system by sovereign states. Instead, states have implicitly or explicitly conceived of particular issues and problems – often at key historical moments of transition and often strategically – and responded by agreeing to new laws and supporting international organizations.*[1032]

Moreover, basing an investigation of treaty law on the conception that it functions in the same way as domestic legal systems results in an inclination of observers to strive for coherence. As implied by Michaels and Pauwelyn, there exists a widespread normative preference for coherence over fragmentation. As a result, "*scholars often want to see international law as a system (rather than a pluralist or fragmented agglomeration)*."[1033] Under this understanding, any comparison to domestic legal systems risks misleading the observer into assuming that international law is more systemic than it really is.

Not only does international law contain a vast quantity of treaties which states in many cases appear to have developed in disregard of pre-existing rules. There are also norms that have been developed by other subjects. As is particularly apparent in a study involving the role of regimes in international law, states are not the only relevant actors in international law. In most problems involving regimes, international organizations are actors of central importance.[1034] International governmental organizations are often explicitly mandated in constitutive instruments to make institutional arrangements with other regimes. In other cases, as observed by Young, international governmental organizations have implicit powers to act without express orders of state parties.[1035]

[1032] Young, The Productive Friction Between Regimes. 2012, at 2.

[1033] Michaels & Pauwelyn, DUKE JOURNAL OF COMPARATIVE & INTERNATIONAL LAW (2012), at 249.

[1034] In international relations there is an extensive scholarship involving studies of the role of expanded sets of actors, referred to as 'epistemic communities', strongly associated with Haas. Peter M. Haas, *Introduction: epistemic communities and international policy coordination*, 46 INTERNATIONAL ORGANIZATION (1992).

[1035] Young, Regime interaction in creating, implementing and enforcing international Law. 2012.

This role of international governmental organizations as actors in the international system has developed based on the *UN Reparations case*[1036], in which the ICJ established that international governmental organizations may have legal personality. International law may thus, in addition to states, be developed by the vast number of international governmental organizations, which in many cases have been bestowed with far-reaching mandates to act without express consent of its parties.

The lack of central authority, as well as broad range of actors, involving not only states but international organizations, means that international law falls short of any comparison to domestic legal systems. Rather, it is tempting to subscribe to the position that international law should be regarded as an accumulation of legal norms which, as further articulated by Michaels and Pauwelyn, with the "*increased maturity and complexity of international law and its unique, hybrid features*," has developed into a "*sui generis type of legal order*."

International law may, therefore, be a system at some level (in the sense, for example, that all of its rules and branches interact and are governed by certain general rules without there being so-called self-contained regimes), but a universe of different systems, sub-systems or branches at another level (…) The outcome is not chaos and anarchy but a more sophisticated legal landscape.[1037]

The cases of overlap and conflict appear to be particularly frequent in relation between certain regimes. As pointed out by Sands, the intense proliferation among environmental treaties has already led to an increasing number of factual cases of overlap or conflict between two or more treaties.[1038]

More generally, such cases do not appear randomly but can be divided into four forms, all commonly represented in connection to international environmental law:

[1036] Reparation for injuries suffered in the service of the Nations, Advisory Opinion, ICJ Rep 174, ICGJ 232 (ICJ 1949) (International Court of Justice 11 April).

[1037] Michaels & Pauwelyn, DUKE JOURNAL OF COMPARATIVE & INTERNATIONAL LAW (2012), at 374-376.

[1038] SANDS, Principles of international environmental law. 2018, at 113.

Firstly, the risk of norm overlap is high in the interface of international trade and environmental law, such as the relationship between the growing number of environmental treaties which seek to ensure environmental protection measures by restricting trade in certain goods, and the WTO and regional trade treaties which aim to prevent trade barriers. The example of the regulation of trade in living modified organisms represents such a case: It should be allowed under WTO rules, but states are still mandated to restrict such products based on the Cartagena protocol[1039].[1040]

A second area with high potential for overlap is where global and regional agreements relate to the same subject matter. This is common in relation to the marine environment, where regional seas conventions regularly duplicate norms in global treaties. The global and regional regulation of marine dumping represents one such case.

Thirdly, norm overlap is common in areas regulated by both general framework conventions and more specific treaties. Many such cases are provided by international fisheries law, where general rules are established in UNCLOS, developed in the United Nations Fish Stocks Agreement and further adapted in regional fisheries treaties.

Fourthly, and particularly relevant in the context of deep-sea bioprospecting, new issues are likely to become subject to overlapping rules by treaties in different areas of international environmental law. Treaty cooperation in different fields of international environmental law has a tendency to interpret mandates extensively, expanding the field of cooperation by amending treaties to include new issues in line with the theory of organic growth of international law, as discussed in Part A. Such issues include novel technological challenges, as well as areas which have been set in focus due to policy priorities or external events. This is also much in line with the functionalist theory of international organizations and has been explained by Klabbers as the result of the inherent will of international organizations to be relevant for new challenges.[1041]

[1039] Cartagena Protocol on Biosafety, 29 January 2000, 2226 U.N.T.S. 208.

[1040] See, for an extensive discussion on the relationship between WTO law and the Cartagena Protocol, DAVID LANGLET, PRIOR INFORMED CONSENT AND HAZARDOUS TRADE: REGULATING TRADE IN HAZARDOUS GOODS AT THE INTERSECTION OF SOVEREIGNTY, FREE TRADE AND ENVIRONMENTAL PROTECTION (Kluwer Law International. 2009).

[1041] Functionalism and international organizations has been extensively discussed by Jan Klabbers, see Jan Klabbers, *The transformation of international organizations law*, 26 EUROPEAN JOURNAL OF INTERNATIONAL LAW (2015); JAN KLABBERS, AN INTRODUCTION TO INTERNATIONAL ORGANIZATIONS LAW (Cambridge University Press 3 ed. 2015).

One area in which an increasing number of such norm overlaps between different areas of international environmental law can be expected is regulation of climate change mitigation. Notable in this regard is ocean fertilization, which has been regulated in treaties relating to climate change, biodiversity and ocean dumping.[1042]

With the growing number of environmental agreements relating to the same subject matter, the question has also arisen as to the conditions under which a party is entitled to invoke the dispute settlement provision under one treaty as opposed to another, as similarly observed by Sands.[1043] For example, the issue has been addressed judicially under the law of the sea in the Southern Bluefin Tuna cases, as will be discussed in the following sections.[1044] In the case, Australia and New Zealand litigated on the basis of UNCLOS rather than under the 1993 Convention on the Conservation of Southern Bluefin Tuna.[1045] Norm conflicts between treaties of international law are thus not merely a theoretical concern but have also become subject to judicial decision.

E.3.2. The material element of norm conflict

In order to establish that a prima facie norm conflict is at hand, a number of elements must be fulfilled. These relate to material, subjective and temporal aspects. The most apparent of these is the material element, which relates to the contradiction itself. The material element can be defined narrowly or widely.

For a case to qualify for this material element according to the standard, narrow definition, it must be established that a state cannot fulfill one obligation without violating another. According to an often-used definition by Jenks, "*A conflict in the strict sense of direct incompatibility arises only where a party to the two treaties cannot simultaneously comply with its obligations under both treaties.*"[1046]

[1042] David Freestone & Rosemary Rayfuse, *Ocean iron fertilization and international law*, 364 MARINE ECOLOGY PROGRESS SERIES (2008).

[1043] SANDS, Principles of international environmental law. 2018, at 113.

[1044] ICJ, Southern Bluefin Tuna.

[1045] SANDS, Principles of international environmental law. 2018, at 113.

[1046] Jenks, BRITISH YEARBOOK OF INTERNATIONAL LAW (1953).

This classic narrow definition later became confirmed in dispute settlement decisions.[1047] It has also been supported by more contemporary observers.[1048] Alternative and wider definitions of the material element of norm conflicts have been suggested. Rather than regarding the subject matter as the central element, Bartels proposes focusing on the *object and purpose*, arguing that two treaties should be regarded as conflicting if the latter defeats the object and purpose of the former.[1049] Even if this interpretation still ought to be regarded as unconventional, a wider understanding of conflict has gained support from other observers. Vranes points to situations where permissive norms conflict with prescriptive or prohibitive norms, which would be excluded under the narrow definition.

He argues that such cases should also be regarded as material conflicts, since the prescriptive or prohibitive norm limits the application of the permissive norm, or conversely (even if the norms in principle may be mutually applicable, with the permissive norm in confined form). Moreover, Vranes argues that a wider understanding of material conflict in international law would be more in line with the established understanding of norm conflict in legal theory, as formulated by Kelsen and Engisch.

[1047] Guatemala—Anti-Dumping Investigation regarding Portland Cement from Mexico (WT/DS60/AB/R), Appellate Body Report (The Appellate Body of the World Trade Organization 25 November), at para. 65. The same narrow definition was also used in Indonesia—Certain Measures Affecting the Automobile Industry (WT/DS54, 55, 59 and 64/R), Appellate Body Report (The Appellate Body of the World Trade Organization 23 July), at paras 14.29-14.36 and 14.97-14.99.

[1048] Danilenko and Czapliński considers that "[o]ne can speak of the conflict of treaties when one of the treaties obliges party A to take action X, while another stipulates that A should take action Y, and X is incompatible with Y". see Wladyslaw Czapliński & Gennady M. Danilenko, Conflicts of Norms in International Law, 21 NETHERLANDS YEARBOOK OF INTERNATIONAL LAW (1990), at 12-13. See also WOLFRUM & MATZ, Conflicts in International Environmental Law. 2003, at 4.

[1049] See Roland Bartels, The Relationship between Treaties, Paper for CIEL, 2001 as cited in Gabrielle Marceau, *Conflicts of Norms and Conflicts of Jurisdictions The Relationship between the WTO Agreement and MEAs and other Treaties*, 35 JOURNAL OF WORLD TRADE (2001), at 1085. As described by Marceau, "*for Bartels, this interpretation of treaty conflict is confirmed by Article 41 of the Vienna Convention, which would prohibit parties to a multilateral treaty from concluding any treaty inter se that is incompatible with the effective execution of the object and purpose of the main treaty as a whole. For him, this broad definition of a conflict is also confirmed by Article 18 of the Vienna Convention, which obliges a State that has signed but not ratified a treaty to refrain from acts which would defeat the object and purpose of a treaty.*"

In particular, he claims that a wider interpretation would be in line with Kelsen's "test of violation," which provides that a "*conflict between two norms occurs if in obeying or applying one norm, the other one is necessarily or possibly violated*."[1050] Similarly, Pauwelyn appears to call for a wider definition, encompassing incompatibilities between permissive norms and obligations.[1051]

As was the case with the narrow interpretation, there are dispute settlement cases which can be interpreted as supporting the wider definition. In the *EC—Bananas III* case, the Panel saw treaty conflict not only in cases where the narrow definition is fulfilled but also in situations where a rule in one agreement prohibits what a rule in another agreement explicitly permits.[1052] In some cases, the materially conflicting element appears evidently when studying two norms. Potential for norm conflict may be established *in abstracto* by means of logical reasoning; standard treaty interpretation rules would provide that the material element of two norms relating to the same subject matter yield incompatible obligations for states.

[1050] Vranes discusses Kelsen and Engisch positions on the matter. Vranes interprets Kelsen's perspective in the following: "*If one has to recognize that 'prescribing' and 'permitting' constitute two different normative functions, one cannot deny that a permission and a prescription mutually exclude each other.*" According to Engisch's definition, there is a conflict "if a given behaviour appears in abstracto or in concreto as prescribed and not prescribed, or as prohibited and not prohibited, or even as prescribed and prohibited." See HANS KELSEN, GENERAL THEORY OF NORMS (Oxford University Press. 1991) and Karl Engisch, Die einheit der rechtsordnung (1935), at 46 and Karl Engisch, Einführung in das juristische Denken (1977), at 162 as cited in Erich Vranes, The Definition of 'Norm Conflict' in International Law and Legal Theory, 17 EUROPEAN JOURNAL OF INTERNATIONAL LAW (2006), at 402, 406, 409, 414.

[1051] JOOST PAUWELYN, CONFLICT OF NORMS IN PUBLIC INTERNATIONAL LAW: HOW WTO LAW RELATES TO OTHER RULES OF INTERNATIONAL LAW (Cambridge University Press. 2003), at 176-199.

[1052] See European Communities—Regime for the Importation, Sale and Distribution of Bananas, WT/ DS27/R(US) (EC—Bananas III), Panel Report (World Trade Organization Panel 22 May). "*As a preliminary issue, it is necessary to define the notion of "conflict" laid down in the General Interpretative Note. In light of the wording, the context, the object and the purpose of this Note, we consider that it is designed to deal with (i) clashes between obligations contained in GATT 1994 and obligations contained in agreements listed in Annex 1A, where those obligations are mutually exclusive in the sense that a Member cannot comply with both obligations at the same time, and (ii) the situation where a rule in one agreement prohibits what a rule in another agreement explicitly permits.*"

In other cases, the conflicting material element may become evident only in the context of certain practical concepts or situations. Norms may co-exist in all but certain circumstances when they give rise to conflict. Even where there appears to be a considerable potential for norm conflict, where several treaties provide different obligations relating to the same case, states may be able to pursue a course of action which fulfills all relevant obligations, thereby avoiding conflict.

It should be underlined that even prima facie cases of material norm conflict are exceptions in international law. It is not uncommon that many norms apply in a certain situation, but in most cases norms do not overlap but merely consider different aspects or implications of state action. Moreover, there are plenty of cases where several norms indeed overlap without necessarily resulting in conflict.[1053]

Such cases include overlaps between so-called multi-sourced equivalent norms (MSEN), a term denoting rules which are binding upon the same international legal subjects, similar or identical in their material content and have been established through different international instruments, legislative procedures or are applicable in different substantive areas of law.[1054] These types of norm overlap are common within regimes of international law, such as in international trade law, where rules on national treatment may be found in central WTO treaties and regional trade agreements. Similarly, in the law of the sea, there are many cases of MSEN overlaps between UNCLOS, regional and/or special agreements.[1055]

[1053] Commitments by states may indeed be parallel without being contradictory. As formulated by Marceau, "Ultimately, only when there is a conflict between two treaty provisions must one of them be set aside (either as suspended or abrogated). In all other situations, because good faith is to be presumed and States are obliged to implement their international obligations accordingly, it can be concluded that all States' obligations are cumulative and must be complied with simultaneously.", Marceau, JOURNAL OF WORLD TRADE (2001), at 1084; LO CHANG-FA, TREATY INTERPRETATION UNDER THE VIENNA CONVENTION ON THE LAW OF TREATIES (2018), at 94.

[1054] Tomer Broude & Shany Yuval, Multi-Sourced Equivalent Norms in International Law (Hart Publishing. 2011), at 5.

[1055] One example is rules on marine dumping, where general rules follows from Article 210 in UNCLOS and the London Convention Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter, 29 December 1972, 1046 U.N.T.S. 120 (London Convention) as well as the Convention for the Protection of the Marine Environment of the North-East Atlantic, 22 September 1992, 2354 U.N.T.S. 67 (OSPAR Convention).

Even if norms in MSEN cases may be differently formulated, they point in the same direction. Thereby, this type of norm overlap lacks the material element and does not represent norm conflict, irrespective of whether the narrow or wider definition is applied.

In the case of deep-sea bioprospecting, it has already been shown how rules in treaties applying to genetic resources point in different, partly conflicting directions as the result of the underlying differences discussed in Part D. As such, the material element of norm conflict appears to be fulfilled, at least based on a preliminary reading of relevant treaty provisions.

E.3.3. The subjective element of norm conflict

The evolution of public international law into different regimes has thus increased the number of material norm conflicts. Yet, there is a second element to norm conflicts which is as necessary as the material aspect. Differences in what treaties states are parties to creates another dimension to the problem. Two materially conflicting treaties do not result in a norm conflict unless the same state is party to both instruments.[1056] This aspect, which can be regarded as the *subjective element* of norm conflict, follows from one of the basic presumptions of treaty law: a state is not bound by an obligation in a treaty unless it has expressed its consent to be bound by it. Accordingly, a material conflict between two treaties is practically irrelevant unless there is an overlap of state parties.

For a treaty conflict to practically occur, both the material and the subjective elements must be fulfilled. Accordingly, the International Law Commission study group on fragmentation has contended that the question of what constitutes a conflict in public international law may be approached from two perspectives: the subject matter of the relevant rules or the legal subjects bound by them.[1057]

[1056] The implications of the subjective element has for instance been discussed in LANGLET. 2009, at 263-274.

[1057] Koskenniemi, Fragmentation of International Law - Report of the Study Group of the International Law Commission. 2006., at 17.

In the context of the overlap of norms relating to deep-sea genetic resources, the subjective element is not unproblematic. Some states have not become parties to all three investigated treaties. In particular, the United States – which globally is the most active state in bioprospecting, both measured in capability and registered patents – has signed but not yet ratified UNCLOS.[1058] The same is the case for Colombia, among other countries. There is also a group of large countries, including Turkey, Peru and Venezuela, which have not even signed the convention. Taken together, 168 states are parties to UNCLOS. All 164 WTO members are parties to TRIPS. This leaves a group of developing states outside, of which most are negotiating accession. The CBD is the only of the three investigated treaties that has near universal ratification with 193 parties.[1059]

As a result of the subjective element, the norm conflict discussed in this investigation plays out differently for states that are not parties to all three treaties. For the US, Colombia, Turkey, Peru and Venezuela, the only area of contention would be that between TRIPS and the CBD, qualified for the obligation for the former two as UNCLOS signatory states to refrain, in good faith, from acts that would defeat the object and the purpose of the treaty under Article 18 of the Vienna Convention. For Ethiopia and Iran, which are party to neither UNCLOS nor TRIPS, but only to the CBD, the subjective element is not fulfilled. Consequently, these two states are not concerned by the norm conflict in a subjective sense. The overwhelming number of states, however, are parties to all three of the treaties investigated here. The emphasis in this investigation will accordingly be put on the material element of norm conflicts. It should, however, be borne in mind that the requirement for the subjective element means that the conflict applies differently, or not at all, in relation to some states.

Another reason for focusing more on the material element is that it is in these aspects of norm conflicts that central systemic functions of public international law are tested. That said, as a consequence of the subjective element, the norm conflict on deep-sea bioresources may appear differently across states, depending on what treaties states are bound by.

[1058] Oldham. 2014.

[1059] Information retrieved from the United Nation Treaty Collection (treaties.un.org), The WTO (wto.org), CBD (cbd.int) and UN Division for Oceans and the Law of the Sea (un.org/Depts/los) 14 October, 2020.

Accordingly, if there is a material norm conflict between two treaties, that conflict lacks practical relevance for states only party to one or neither of the treaties. This effect increases exponentially with the number of treaties involved in the norm conflict. Although this may appear complex, it is a logical consequence of the systemic nature of international law: Insofar as treaty obligations are concerned, international law can be many different things, depending on obligations for individual states.

E.3.4. The temporal element of norm conflict

Closely connected to the subjective element, which essentially concerns *to whom* obligations apply, is the question of *when* obligations arise, generally, as well as in relation to particular states. The temporal element is central first for establishing that the materially conflicting treaties apply not only to the same party, but also at the same time. Secondly, it is particularly relevant in cases of treaty conflict, since many of the rules establishing priority among treaties appears to be based on which treaty came first, as will be discussed in section E.5.

How, then, should this central element of time be measured? What criterion should be decisive in establishing what treaty is prior and what is subsequent? This connects to the broader question of when an obligation of an international treaty comes into existence. Wolfrum and Matz conclude that four potentially different dates could be relevant in this regard: the date of adoption as well as the dates for signature of relevant states, ratification or entry into force.[1060] In the context of establishing priority under the Vienna Convention, Borgen has concluded that "*although originally a cause of some disagreement, states now generally agree that determining the time of the earlier treaty is based on date of adoption, not entry into force.*"[1061]

Since all elements of norm conflicts are cumulative and must be fulfilled for a factual norm conflict to be at hand, it appears difficult to establish what date should be decisive without considering the subjective element.

[1060] Wolfrum & Matz, Conflicts in International Environmental Law. 2003, at 126.

[1061] Christopher Borgen, *Resolving treaty conflicts*, 37 The George Washington International Law Review (2005), 601. Anthony Aust, Modern Treaty Law and Practice (Cambridge University Press. 2000), at 183.

After all, no factual norm conflict exists before the conflicting legal obligations apply in relation to the relevant state. Neither the date of adoption of a treaty, nor its entry into force *per se* confer any obligation on individual states.[1062] It would therefore appear more rational to base the selection on the date when the conflicting obligation arises for individual states. This requires not only for the treaty to have entered into force, but also that the relevant state has become bound by it.

To include the subjective element when establishing the temporal order in this manner, however, raises additional problems, as will be examined in section E.5. A logical consequence of establishing the temporal element based on the date of entry into force for states involved is that the temporal order also becomes subjective. The order may differ between individual states depending on when different treaties became binding for them. Furthermore, individual states would not always be able to foresee how this order would turn out. This is most evident in the case of ratification of treaties before entry into force.

These implications are particularly problematic in cases such as deep-sea bioprospecting where treaties involved were ratified by large groups of states and entered into force within a short period. UNCLOS became binding for the around 60 states which had ratified it when it entered into force on November 16, 1994. Around 100 states have, however, ratified the treaty at different dates since its entry into force. Similarly, TRIPS only became legally binding for a minority of its current parties when it became effective on January 1, 1995.[1063] The CBD, on the other hand, became effective already on 29 December 1993 but only for under 50 states. A large group of states became parties to the convention in a short period after its entry into force.[1064]

[1062] The signature of treaties does however have legal implications. According to Article 18 of the Vienna Convention, states may no longer engage in activities which go against the object and purpose of the treaty. It is however not until states are completely bound by the treaty that specific rights and obligations apply.

[1063] It is a requirement for WTO members to become party to TRIPS. Out of the current 164 WTO parties, 76 states and the European Community were founding members of the organization.

[1064] Information retrieved from the United Nation Treaty Collection (treaties.un.org), The WTO (wto.org), CBD (cbd.int) and UN Division for Oceans and the Law of the Sea (un.org/Depts/los) 14 October, 2020.

Treaty conflicts could thus not only appear different in relation to individual states based on what treaties the state is party to. Differences between states in relation to what order and at what time the treaty obligations became binding raise additional complications in the assessment of treaty conflicts, particularly as regards applications. This is especially apparent in the case of deep-sea bioprospecting where all the three relevant treaties entered into force within a three-year period and were ratified by states in different order.

E.4. Preventing and resolving treaty conflicts under the systemic position

The material, subjective and temporal elements of treaty conflict have now been discussed and it appears that the prima facie conflict relating to deep-sea bioresources fulfill these elements in relation to a large number of states. Under the fragmented view, this would render it difficult if not impossible to implement relevant obligations from all three regimes in parallel.

Supporters of the systemic view would, however, maintain that this may not be as bad as it may seem at first glance. Certain elements of treaty law, it has been suggested, have been drafted precisely to address these types of situations, as means to address issues of material overlap and *prima facie* conflicts between norms in different treaties or regimes.[1065] These observers have a positive perspective on such overlaps of norms and claim that there is an inherently pragmatic element in international law – reflected in concepts such as the principle of harmonization and the theory of systemic integration – which prevents or bridges conflicts.[1066]

In this section, these elements of treaty law, which under the systemic understanding could be described as a cure or vaccine to fragmentation, ensuring the integrity of the system of public international law, will first be explored. Secondly, these rules will be contextualized by discussing how they would apply to the prima facie norm conflict of deep-sea bioresources.

[1065] Michaels & Pauwelyn, DUKE JOURNAL OF COMPARATIVE & INTERNATIONAL LAW (2012).

[1066] Peters, INTERNATIONAL JOURNAL OF CONSTITUTIONAL LAW (2017).

In the previous section, the fragmentation of international law into different regimes was suggested as an explanation for the increasing number of norm conflicts under international law. The reasons for and consequences of this development were discussed, as well as the outlook for solving conflicts of norms across regimes.

However, not all observers agree that the proliferation of treaties and sub-branches of international law represents such a challenge to the integrity of international law. An extensive argument in defense of the systemic position was put forth in the International Law Commission study group report on fragmentation.[1067] The conclusions of the report were presented by Martti Koskenniemi in 2006.[1068] The report had been commissioned on the basis of a perceived threat to the integrity of public international law and an increasing scholarly debate on fragmentation at the turn of the century. In particular, the study group was commissioned to investigate five topics, which all relate to the potential of different rules in treaty law and other established hierarchies to prevent and resolve treaty conflict.[1069]

After having first examined the nature and prevalence of fragmentation, the report concluded that public international law indeed has grown into different regimes.

[1067] Koskenniemi, Fragmentation of International Law - Report of the Study Group of the International Law Commission. 2006. Other observers had previously made some of the same observations as the report without the same impact, see for instance Jenks, BRITISH YEARBOOK OF INTERNATIONAL LAW (1953); Czapliński & Danilenko, NETHERLANDS YEARBOOK OF INTERNATIONAL LAW (1990).

[1068] Koskenniemi, Fragmentation of International Law: Difficulties Arising from the Diversification and Expansion of International Law - Draft conclusions of the work of the Study Group Finalized by Martti Koskenniemi. 2006.

[1069] (a) The function and scope of the *lex specialis* rule and the question of self-contained regimes; (b) The interpretation of treaties in the light of "any relevant rules of international law applicable in the relations between the parties" (Article 31 (3) (c) of the Vienna Convention on the Law of Treaties), in the context of general developments in international law and concerns of the international community; (c) (Article 30 (d) (Article 41 The application of successive treaties relating to the same subject matter of the Vienna Convention on the Law of Treaties); (d) The modification of multilateral treaties between certain of the parties only of the Vienna Convention on the Law of Treaties); and (e) Hierarchy in international law: *jus cogens*, obligations *erga omnes*, Article 103 of (e) the Charter of the United Nations, as conflict rules.

However, in its conclusion, the report appears to consider that treaty law rules on application and interpretation of treaties have the possibility to prevent this development from resulting in the decomposing of public international law as a comprehensive system. While recognizing the challenges of fragmentation, the report thus essentially supports the systemic view: the tools inherent to public international law prevent its fragmentation. This alleged cure to fragmentation (or mechanism to prevent it) is thus foremost based on treaty application and interpretation principles codified in the Vienna Convention on the Law of Treaties.[1070]

The universal application of these principles to treaty conflicts has not been uncontroversial. It has been questioned whether these principles can be used in relation to agreements where the conclusion predates the Vienna Convention, since the latter states in its Article 4 that it does not apply retroactively. This may appear problematic in cases involving treaties which predate the Vienna Convention. In the present case, however, all treaties involved were both adopted and entered into force after the Vienna Convention.[1071] This has however commonly been overlooked by virtue of the generally considered status of the Vienna Convention as in relevant parts reflecting customary international law.[1072]

Essentially, the systemic view as formulated by the ILC Study Group Report is based on the contention that central elements in the Vienna Convention can be used to apply and interpret conflicting norms in a way that promotes coherence and harmonization across treaties.

[1070] Vienna Convention on the Law of Treaties.

[1071] It could be claimed that this problem still is relevant in relation to UNCLOS. Although the Vienna Convention was adopted in 1969 it did not enter into force before 1980, i.e. during the negotiations of UNCLOS. Most states however ratified the Vienna Convention after the conclusion of UNCLOS. As discussed in the previous section, Borgen has argued that rather than the date of entry into force, the date of adoption of treaties should be decisive. See GÜNTHER JAENICKE, LIBER AMICORUM GÜNTHER JAENICKE (Springer. 1999) as cited in Wolfrum & Matz, MAX PLANCK YEARBOOK OF UNITED NATIONS LAW (2000), at 473; Borgen, THE GEORGE WASHINGTON INTERNATIONAL LAW REVIEW (2005), 601. AUST. 2000, at 183.

[1072] MARK E. VILLIGER, THE RULES ON INTERPRETATION: MISGIVINGS, MISUNDERSTANDINGS, MISCARRIAGE? THE 'CRUCIBLE' INTENDED BY THE INTERNATIONAL LAW COMMISSION (Oxford University Press. 2011).

This is based on four basic presumptions. Firstly, that all treaty provisions set up rights and obligations that exist alongside rights and obligations established by other treaty provisions and rules of customary international law. Secondly, that none of such rights or obligations has any *intrinsic* priority against the others and that there is no general hierarchical structure of international law.[1073] Thirdly, that both treaty and customary law are basically of equal legal validity.[1074] Fourthly, that all treaties are equally binding, with Article 103 of the UN Charter as the only exception.[1075]

The report of the ICJ Study Group accordingly claims that in lack of hierarchical structure, the question of the relationship between conflicting norms can only be approached through a process of reasoning that makes them appear as parts of some coherent and meaningful whole.[1076] The systemic approach would thus call for any interpreter of public international law to strive for coherence, thereby supporting the logics of it as a meaningful system.[1077]

This has been referred to as *the principle of harmonization*. As stated in the conclusions of the Fragmentation report, "*It is a generally accepted principle that when several norms bear on a single issue they should, to the extent possible, be interpreted so as to give rise to a single set of compatible obligations.*"[1078] This implies that there is an obligation for a state which is bound by several potentially conflicting norms to pursue an interpretation that avoids violation. In order to enable such harmonious interpretations, the ICJ Report points to two different approaches based on the Vienna Convention on the Law of Treaties.

[1073] WOLFRUM & MATZ, Conflicts in International Environmental Law. 2003, at 120.
[1074] Karol Wolfke, *Treaties and custom: aspects of interrelation*, *in* ESSAYS ON THE LAW OF TREATIES - A COLLECTION OF ESSAYS IN HONOUR OF BERT VIERDAG (Jan Klabbers & René Lefeber eds., 1997), at 36.
[1075] UN Charter.; Ignaz Seidle-Hohenveldern, *Hierarchy of Treaties*, *in* ESSAYS ON THE LAW OF TREATIES - A COLLECTION OF ESSAYS IN HONOUR OF BERT VIERDAG (Jan Klabbers & René Lefeber eds., 1997).
[1076] Koskenniemi, Fragmentation of International Law - Report of the Study Group of the International Law Commission. 2006.
[1077] GABRIEL ORELLANA ZABALZA, THE PRINCIPLE OF SYSTEMIC INTEGRATION: TOWARDS A COHERENT INTERNATIONAL LEGAL ORDER (LIT Verlag. 2012), at 237.
[1078] Koskenniemi, Fragmentation of International Law: Difficulties Arising from the Diversification and Expansion of International Law - Draft conclusions of the work of the Study Group Finalized by Martti Koskenniemi. 2006., at 5.

These two approaches, as reflected in Articles 30 and 31–33 of the Vienna Convention, are, as previously stated, widely considered to reflect customary international law.[1079]

Firstly, the problem can be solved by applying rules on conflict which give priority to one agreement over another. This perspective perceives norm conflict as a problem of *application* rather than interpretation. It implies solving such problems based on the instructions indicating what treaty should be given priority in application of successive treaties relating to the same subject matter in Article 30 of the Vienna Convention. As a general rule, Article 30 provides for application in line with the principle of *lex posterior*. However, it makes exception for cases where a treaty indicates how it should relate to another treaty. Such provisions, commonly referred to as *conflict clauses* (but also referred to as savings clauses or compatibility clauses), should be respected according to paragraph 2 of Article 30. Under this perspective, conflict clauses thus trump *lex posterior*.

Secondly, tools can be used that try to uphold as much of the content of the legal rules of both treaties, harmonizing them as much as possible without fully derogating from either one. This approach builds on treaty interpretation rules generally, as provided in Articles 31–33 of the Vienna Convention. In particular, the second approach bases its argumentation on Article 31(3)(c), which provides that in treaty interpretation, any relevant rules of international law applicable in the relations between the parties shall be taken into account, together with the context. Unlike the first approach, the second approach discusses the *interpretation* of conflicting norms, and uses that as the basis for attempting to prevent conflict, rather than how they should be applied. Also in contrast to the first approach, which in principle is concerned with the hierarchy of conflicting norms rather than their material content, the second approach avails itself of the opportunity to materially adjust the reading of a rule in consideration of an overlapping provision, provided that other obligations in treaty interpretation are met.[1080]

[1079] Mark Eugen Villiger, *The Rules on Interpretation: Misgivings, Misunderstandings, Miscarriage? The 'Crucible' Intended by the International Law Commission*, *in* THE LAW OF TREATIES BEYOND THE VIENNA CONVENTION (Enzo Cannizzaro ed. 2011).
[1080] MARK EUGEN VILLIGER, COMMENTARY ON THE 1969 VIENNA CONVENTION ON THE LAW OF TREATIES (Martinus Nijhoff Publishers. 2009).

The second approach thus attempts to shy away from deciding what rule should be given priority in norm conflicts by employing an interpretation which prevents the *prima facie* conflict from materializing. This is based on the basic conception that treaties should not be read in isolation, but as part of the system of public international law, and that the system of public international law inherently strives to remain coherent. It also implies that the two perspectives have different emphases: While the first approach accepts the notion of conflict and attempts to solve it, the second approach aims to prevent the conflict from occurring.

The International Law Commission summarizes the difference between the two approaches as the first (the application approach, Article 30) seeking resolution by establishing a firm priority between treaties. The second (interpretation approach, Articles 31–33), avoids a clear priority and instead seeks to coordinate the simultaneous application of the two treaties.[1081]

According to Wolfrum and Matz, the general preference under the law of treaties in cases of norm conflict is to favor the first approach. Only if certain circumstances are fulfilled does the law of treaties provide for maintaining two diverging agreements, as may be the consequence of the second approach.[1082] Seemingly, this position is based on the wording of the convention text which seems to favor the application approach in deciding priority between treaties. This observation, however, appears to overlook that under the interpretative approach, the norm conflict never materializes and, as observed by Pauwelyn, there is a presumption in international law against conflict.[1083] If interpretative tools manage to establish a reading which reconciles the overlapping norms, there is no conflict and hence no reason for establishing hierarchies. Under this argument, it would appear most rational to first attempt to prevent norm conflict by means of interpretation before resorting to application tools. As a third position, it could be claimed that the application approach at least should be preferred in some cases, namely where the parties by means of conflict clauses clearly have expressed instructions on priority in relation to other treaties.

[1081] Koskenniemi, Fragmentation of International Law - Report of the Study Group of the International Law Commission. 2006. at 18, 130 and 138.

[1082] Wolfrum & Matz, Conflicts in International Environmental Law. 2003, at 133.

[1083] Pauwelyn, Conflict of Norms in Public International Law: How WTO Law Relates to Other Rules of International Law. 2003, at 240-244.

Favoring conflict prevention by means of interpretation in such cases would amount to ignoring the will of the parties. In line with this position, Borgen declares that (only) "*if there are no such express provisions of priority within the four corners of the agreements, or if any such clause is ambiguously worded, one would turn to principles of treaty interpretation.*"[1084]

In light of the fundamentally different ways of regarding the concept of norm conflict, where rules of application can be used to resolve the problem and interpretation rules aim to prevent it, it appears most pragmatic to regard these two approaches as alternative. In fact, there is nothing preventing regarding them as equally relevant recourses in cases of *prima facie* norm conflict.

E.5. Resolving norm conflicts by means of priority in application

The first approach, as provided in the rules on treaty application of the Vienna Convention thus attempts to resolve treaty conflict by deciding what treaty should be given priority. Unlike the interpretation approach, it accepts the existence of the conflict and attempts to resolve rather than prevent conflict. Article 30 provides several alternative courses in such situations. It thus deals with the priority between prior and subsequent norms, cases of dissimilar parties and the relevance of treaty provisions on the relationship to other treaties.

> **Vienna Convention on the Law of Treaties Article 30**
>
> *Application of successive treaties relating to the same subject-matter*
>
> 1. Subject to Article 103 of the Charter of the United Nations, the rights and obligations of States parties to successive treaties relating to the same subject-matter shall be determined in accordance with the following paragraphs.
>
> 2. When a treaty specifies that it is subject to, or that it is not to be considered as incompatible with, an earlier or later treaty, the provisions of that other treaty prevail.
>
> 3. When all the parties to the earlier treaty are parties also to the later treaty but the earlier treaty is not terminated or suspended in operation under article 59, the earlier treaty applies only to the extent that its provisions are compatible with those of the latter treaty.

[1084] Borgen, The George Washington International Law Review (2005), at 587.

> 4. When the parties to the later treaty do not include all the parties to the earlier one:
>
> (a) as between States parties to both treaties the same rule applies as in paragraph 3;
>
> (b) as between a State party to both treaties and a State party to only one of the treaties, the treaty to which both States are parties governs their mutual rights and obligations.
>
> 5. Paragraph 4 is without prejudice to article 41, or to any question of the termination or suspension of the operation of a treaty under article 60 or to any question of responsibility which may arise for a State from the conclusion or application of a treaty, the provisions of which are incompatible with its obligations towards another State under another treaty.

Before discussing these, however, the significance of the heading of the provision must be assessed. A literal reading suggests that the provision regulates not all cases of application of successive treaties, but such cases where the treaties relate to the same *subject matter*. It must therefore first be established whether it is a precondition for employing Article 30 that the *prima facie* conflicting provisions actually relate to the same subject matter.

E.5.1. The same subject matter criterion and the applicability of Article 30 to treaty conflicts

As formulated in the heading of Article 30, the provision was negotiated to regulate the application of "*successive treaties relating to the same subject-matter*," which is not necessarily the same thing as different treaties with overlapping or conflicting norms.

There are different views on how "*same subject-matter*" should be interpreted.[1085] It can be claimed that a norm conflict between two or more treaties *per se* implies that the instruments relate to the same subject matter. Under this *liberal interpretation*, the conflict in itself is evidence of overlap between the treaties, hence relation to the same subject matter. This view is disputed by other observers who favor a more *restrictive interpretation*, claiming that Article 30 cannot be applied in cases when the material scope of treaties diverges.

[1085] For a discussion of 'same subject matter' under case law, see id. at 605.

For instance, Aust argues that "*[t]he meaning of the expression 'relating to the same subject-matter' is not clear but should probably be construed strictly, so that the article would not apply when a general treaty impinges indirectly on the content of a particular provision of an earlier treaty.*"[1086] It must thus, according to the restrictive perspective, be an overlap of treaties, not merely of individual norms for Article 30 to apply. In norm conflicts between treaties falling outside of the *same subject-matter* criterion, resolution should instead be sought in general principles, such as *lex specialis*, according to the restrictive position, as represented by Schulz and Borgen.[1087] Under this understanding, Article 30 is not applicable in cases when treaties have overlapping issue areas but different *foci*. Similarly, Wolfrum and Matz dismiss the liberal interpretation of the *same subject matter* criterion when addressing conflicts of environmental treaties and agree that Article 30 must be considered inapplicable when dealing with overlapping norms where the material scope of the treaties concerned is different, such as different aspects of environmental protection. They raise UNCLOS and CBD as examples, claiming that the two agreements "*cannot be regarded to be successive treaties on the same subject matter, even if their focus on the protection of the marine environment overlaps to some extent; the scopes and primary aims of both agreements are too different*."[1088] Accordingly, these supporters of the restrictive view would consider it out of the question to apply the principles in Article 30 in cases of norm conflicts between treaties originating in different regimes of international law.

Despite numerous scholars favoring the restrictive view, the Study Group of the International Law Commission, when addressing Article 30 in the context of fragmentation, reasoned more in line with the liberal view. In the view of the study group, too much emphasis in the discussions of Article 30 has been put on the problematic title of the article, which seems to limit its scope to conflict between treaties "*relating to the same subject-matter*." If the limitation implied in the title is to be interpreted strictly, then it seems to leave most of the important cases – for instance, conflicts between environmental and trade

[1086] AUST. 2000, at 183.

[1087] Borgen, THE GEORGE WASHINGTON INTERNATIONAL LAW REVIEW (2005), at 603, 605 and ANDREA SCHULZ, THE RELATIONSHIP BETWEEN THE JUDGMENTS PROJECT AND OTHER INTERNATIONAL INSTRUMENTS, cited in Borgen.

[1088] Wolfrum & Matz, MAX PLANCK YEARBOOK OF UNITED NATIONS LAW (2000).

treaties, or conflicts between human rights and humanitarian law treaties – outside of the scope of Article 30.

The ILC Study Group rejects this idea based on several arguments. Most importantly, it holds that limiting the application of Article 30 to treaties "*dealing with the same subject*" would allow states to deviate from their obligations "*simply by qualifying a novel treaty in terms of a novel 'subject'*." Under the restrictive view, the Study Group contends, states "*might for example derogate from their obligations under refugee instruments simply by concluding an instrument in an allegedly novel subject of 'the law of human movement'*." Instead, the Study Group suggests testing if two treaties deal with the *same subject matter* by assessing whether the fulfillment of the obligation under one treaty affects the fulfillment of the obligation of another. Moreover, in the test, the Study Group considers that "affecting" should be interpreted generously; it should not be necessary to establish that one obligation strictly prevents the fulfillment of the other obligation. The undermining of the object and purpose of the other obligation in one or another way should suffice.[1089] By formulating this test for assessing whether the relationship between two treaties qualifies for applying Article 30, the Report of the Study Group of the ILC in clear language dismisses the restrictive view and instead opens the door for applying the provision in the numerous cases where a treaty obligation undermines the object and purpose of another treaty.

Furthermore, the Report of the ILC Study Group considers that "the question of the relationship between two treaties cannot be resolved completely in abstraction from any institutional relationship between them." This could be interpreted as indicating that when assessing norm conflicts, it should be a relevant consideration whether treaties involved belong to different regimes. In line with this argument, it should be less complicated to establish that Article 30 applies if a conflict concerns two treaties within the same regime. The Study Group, however, does not exclude application of Article 30 if the conflicting rules lack an institutional relationship. In fact, in line with the general rejection in the ILC Study Group Report of the notion that public international law has fragmented into different incoherent systems, the Study Group appears to consider that any difference between regimes cannot in itself prevent the

[1089] Koskenniemi, Fragmentation of International Law - Report of the Study Group of the International Law Commission. 2006., at 129-135.

application of Article 30. There is nothing in the preparatory works of the Vienna Convention supporting that notion, according to the Study Group, which refers to it as "pigeon-holing."[1090] Rather, the ILC Study Group Report concluded, the negotiators of the convention did not consider the notion of regime boundaries but regarded international law as being constituted of treaties with formally similar status, which in itself is an argument for not reading treaties from different regimes as excluded from the scope of Article 30. Institutional relation and regime divisions are thus considered of secondary interest by the ILC Study Group Report, even if close connections may make it easier to apply Article 30. Rather than determining in abstracto when two treaties deal with the same subject matter, the interpretation of Article 30 suggested by the ILC Study Group calls for a practical approach to assessing whether the same subject matter criterion is fulfilled. This is in line with an observation made by Vierdag prior to the ILC Study Group Report, namely that the same subject matter may appear more difficult to approach in theory than in practice:

> *The requirement that the instruments must relate to the same subject-matter seems to raise extremely difficult problems in theory, but may turn out not to be so very difficult in practice. If an attempted simultaneous application of two rules to one set of facts or actions leads to incompatible results it can be safely assumed that the test of sameness is satisfied.*[1091]

Essentially, the ILC Study Group thus argues in favor of a liberal interpretation of the *same subject matter* criterion and calls for a practical approach in applying Article 30 to treaty conflicts. Before contextualizing this practical approach to the case of deep-sea bioprospecting, it is necessary to discuss an aspect favoring the liberal interpretation of Article 30 which appears to have been overlooked by ILC as well as in academic discussions. As has already been mentioned, Article 30 calls for applying *lex posterior* (third paragraph) save for cases where the parties have indicated how to relate to another treaty (according to the second paragraph).

[1090] Id. at 18.

[1091] Bert E. W. Vierdag, *The time of the 'conclusion' of a multilateral treaty: Article 30 of the Vienna Convention on the Law of Treaties and related provisions*, 59 BRITISH YEARBOOK OF INTERNATIONAL LAW (1988), as cited in PAUWELYN, Conflict of Norms in Public International Law: How WTO Law Relates to Other Rules of International Law. 2003, at 365.

Where such instructions have been provided by the parties, Article 30 establishes that they should be followed. This is not surprising. Respecting an express request from parties as to how agreements should be applied is in line with treaty law rules on interpretation (which will be discussed in section E.6) as well as case law. As pointed out in the *Namibia* case, the ICJ maintains "*the primary necessity of interpreting an instrument in accordance with the intentions of the parties.*"[1092]

The rule providing that instructions in treaties on how to apply its obligations in relation to other treaties is thus declared as the primary recourse in Article 30. Declaring that Article 30 is inapplicable in some cases (as called for by the restrictive interpretation) would have the consequence of setting aside this rule providing that instructions by the parties should be respected. There are functional arguments for instead considering this principle, as well as other elements of Article 30 as applicable also in cases where treaties do not fully overlap, including where they originate in different regimes. Indeed, the general character of the operational provisions of Article 30 appear to be drafted for more general purposes, and not only for fully overlapping treaties.

Several arguments thus favor not interpreting the *same subject matter* criterion restrictively. Rather, than as a restrictive criterion which in operative language indicates that the provision applies in relation between some but not all treaties there appears to be reasons for regarding the term for what it appears to be at first sight: the heading of a Vienna Convention provision declaring that it contains the rules for deciding issues of application in cases of conflict between treaties.[1093] Supporters of the restrictive view use the ambiguous formulation of the heading of Article 30 to construct an interpretation that goes against the purpose of the operative content of central parts of the provision. From a functional standpoint, what must be guiding in approaching Article 30 is that if there are instructions on how to apply a treaty in relation to other treaties, those should be respected. In the next section, the characteristics of such instructions, commonly known as "*conflict clauses*," will be discussed before investigating such elements in the three treaties that are the focus of this investigation.

[1092] Legal Consequences for States of the Continued Presence of South Africa in Namibia (South West Africa) notwithstanding Security Council Resolution 276, Advisory Opinion, ICJ GL No 53, ICJ Rep 16, ICGJ 220 (International Court of Justice 21 June); Right of Passage over Indian Territory (Portugal v. India), ICJ Rep 125, ICGJ 173 (International Court of Justice 26 November), at 142.

Establishing that such conflict clauses should be respected in any event does not render the practical approach suggested by the ILC Study Group Report to test the applicability of Article 30 any less relevant. This is because there are also cases where treaties do not contain such instructions on their application in relation to other treaties, for which the other parts of Article 30 establish priority under the application approach. Testing whether the fulfillment of the obligation under one treaty affects the fulfillment of the obligation of another as suggested by the ILC Study Group also provides helpful guidance in establishing if a treaty conflict is actually at hand. Conversely, in failing to fulfill this criterion, it would be doubtful if Article 30 can be applied since the substantive difference across the treaties would merely represent an overlap, not an actual conflict.

Would, then, the norm overlap between UNCLOS, the CBD and TRIPS in the case of deep-sea bioprospecting qualify as a treaty conflict in the test set by the ILC for assessing the applicability of Article 30? The central criterion in the test is whether the fulfillment of the obligation under one treaty affects the fulfillment of the obligation of another or undermines the object and purpose of the other obligation.[1094] It appears difficult to dispute that at least some of the inconsistencies between the treaties identified in E.1 qualify for both these alternative criteria. Three treaties – which regarded in concert at the same time prevent the appropriation of deep-sea genetic resources under the principle of common heritage of mankind, call for states to enable private appropriation of the same resources by means of patenting, and request their protection based on biodiversity concerns – can hardly be regarded as fully compatible. For bioprospecting activities based on micro-organisms in sensitive deep-seabed ecosystems the three treaties raise particularly conflicting obligations. Elements of the treaties involved not only appear to undermine the object and purpose of another treaty; from a state perspective it also seems impossible to simultaneously fulfill the obligations of all three treaties.

It thus appears that the contentions between the three treaties represent a treaty conflict and qualifies for the criterion suggested by the ILC Study Group for assessing the applicability of Article 30.

[1094] Koskenniemi, Fragmentation of International Law - Report of the Study Group of the International Law Commission. 2006., at 19 and 130.

Hence, it should also, in line with the reasoning of the group, lack relevance that UNCLOS, the CBD and TRIPS, as discussed in Part B, not only originate in different regimes of international law, but are based on different rationales and follow dissimilar logics. Under the approach suggested by the ILC, the *same subject matter* criterion is fulfilled functionally and the principles expressed in Article 30 still applies in the case of deep-sea bioresources.

In sum, there are arguments for considering that the rules in Article 30 on how to apply overlapping treaties ought to be applied also to cases of conflict where the material overlap of treaties is not complete.

Although this conclusion is in line with the reasoning in the report of the ILC Study Group, there are reasons for criticizing the analysis of the Study Group. On the principal question as to how to interpret the *same subject matter* criterion, it is claimed that the ILC Study Group (even if it sides with a more liberal interpretation) essentially makes the same mistake as the observers of the restrictive position, namely by reading the article heading as an operational requisite.

Still, the test suggested by the ILC Study Group for establishing the applicability of Article 30 may be helpful, since it provides functional criteria for establishing when a conflict is actually at hand. Under this test, the practical case of deep-sea bioprospecting represents a conflict for which Article 30 would be applicable. How, then, do the rules on treaty application relate to treaty conflicts? And what instructions would they yield in the conflict between UNCLOS, CBD and TRIPS relating to deep-sea bioprospecting?

E.5.2. Treaty conflicts under the rules on treaty application

Comprising several different approaches for resolving issues of overlapping treaties depending on their relation and content, the different elements of Article 30 will now be discussed in order to establish how treaty application rules may be used to resolve treaty conflicts in general. This will then serve as the basis for a discussion on how this approach to treaty conflict applies to the case of deep-sea bioprospecting. In this part the investigation will not follow the order of the paragraphs of the article, but rather the implicit hierarchy of the provision.

E.5.2.1. Supremacy of the UN Charter

Paragraph 1 of Article 30 first affirms the overriding principle of supremacy of the UN Charter, which in its Article 103 states:

> *In the event of a conflict between the obligations of the Members of the United Nations under the present Charter and their obligations under any other international agreement, their obligations under the present Charter shall prevail.*

Paragraph 1 of Article 30 thus effectively reaffirms Article 103 of the UN Charter as a general exception to the applicability of the Vienna Convention rules on treaty application. This should not only be regarded as an exception for the cases of norm conflict involving the UN Charter. It also implies that there is one exception to the lack of hierarchy between treaties of international law: the UN Charter takes precedence in questions of application in relation to other treaties.

E.5.2.2. The subjective element and pacta tertiis

There are not merely material aspects of treaty conflicts, although such elements are the main focal points for the discussion in this part. Rather, as discussed in section E.3.1, a treaty conflict is the result of a combination of two factors. Equally necessary as the material element (a conflict between the content of the norms) is the *subjective element*: that the materially conflicting treaties are binding in relation to at least one state. If the materially conflicting treaties lack common parties, then this subjective element is lacking and no conflict is at hand. Paragraph 4 provides the rules on how to approach cases where the subjective component *in part* is lacking: "*when the parties to the later treaty do not include all the parties to the earlier one*":

> *(a) as between States parties to both treaties the same rule applies as in paragraph 3; (b) as between a State party to both treaties and a State party to only one of the treaties, the treaty to which both States are parties governs their mutual rights and obligations.*

In cases where not all states are parties to the materially conflicting treaties, paragraph 4(b) thus makes clear that the otherwise determining *lex posterior* rule provided in paragraph 3 (which will be discussed below) is set aside in

favor of the least common denominator. This is much in line with the general principle of *pacta tertiis* under international law: A state cannot be considered bound by obligations it has not subscribed to. Or, in other words, for a factual treaty conflict to be at hand, a material conflict between treaties is not sufficient; rather, states must also subscribe to the relevant obligations.

This may appear self-evident. However, based on case law it is far from certain that *pacta tertiis* precludes interpretation with references to agreements with dissimilar lists of parties.[1095] More liberal interpretations of this criterion, disregarding dissimilar lists of parties, were made in the *Bluefin Tuna Case*[1096] of the International Tribunal of the Law of the Sea. In the case, Australia and New Zealand claimed that Japan had failed to take necessary measures for the conservation and management of the southern bluefin tuna in the high seas and had thereby breached its obligations under UNCLOS. Japan, on the other hand, claimed that a separate 1993 Convention for the Conservation of Southern Bluefin Tuna[1097] prevailed over those of UNCLOS.[1098] Japan further argued that the 1993 Convention was to be considered not only *lex posterior* but also *as lex specialis* vis-à-vis UNCLOS and therefore should override it. The tribunal considered that the case indeed was a dispute concerning the implementation of UNCLOS by making two important findings. Firstly, based on an examination of a number of provisions in UNCLOS[1099] the tribunal claimed that states have a duty to cooperate directly or through appropriate international organizations to ensure the conservation and optimum utilization of highly migratory species such as southern bluefin tuna.[1100] According to ITLOS, the conduct of the parties within the 1993 Convention regime, as well as their relations with non-parties, was relevant in the evaluation of states' compliance with UNCLOS and that lack of cooperation under the 1993 regime could lead to a violation of UNCLOS.[1101]

[1095] Daniel Bethlehem, et al., The Oxford Handbook of International Trade Law (Oxford University Press. 2009), at 321-341.
[1096] ICJ, Southern Bluefin Tuna.
[1097] Convention for the Conservation of Southern Bluefin Tuna, 10 May 1993, 1819 U.N.T.S. 359.
[1098] For a more detailed account of the background to the case, see Simon Marr, *The Southern Bluefin Tuna cases: the precautionary approach and conservation and management of fish resources*, 11 European Journal of International Law (2000).
[1099] Article 64 of UNCLOS, read together with Articles 116 and 199.
[1100] ICJ, Southern Bluefin Tuna, Provisional Measures Order, para. 48–49.
[1101] Id. at para 50.

Secondly, the tribunal found that the fact that the 1993 Convention applied to the parties did not exclude their right to invoke the provisions of UNCLOS. As observed by Romano, ITLOS interpreted UNCLOS and the 1993 Convention "*as Chinese boxes, where the former includes the latter; the exegesis of the latter can only be done within the framework of the former*."[1102] Importantly, the tribunal established this relationship between UNCLOS and the 1993 Convention despite highly dissimilar lists of parties. It appears that ITLOS considered it sufficient that all parties to the dispute were parties to the 1993 Convention.[1103]

In *the US-Shrimp* case, the Appellate Body used other rules of international law to establish if sea turtles could be considered an exhaustible natural resource, within the meaning of GATT Article XX, or whether the term only related to non-living resources. With reference to the ruling in the *Namibia* case, the Appellate Body considered that certain terms in international law may be inherently adaptable to development, and that the objective of sustainable development in the Preamble of the WTO agreement indicated that "exhaustible natural resource" was such a term.[1104] Based on this argument, the Appellate Body went on to define the meaning of "exhaustible natural resource" with reference to a number of international environmental law treaties, including UNCLOS and the CBD, concluding that "*measures to conserve exhaustible natural resources, whether living or non-living, may fall within Article XX(g)*."[1105] In making these references, the ruling did not require all WTO members to be party to the other treaties. It did, however, note that all parties to the dispute had at least expressed consent to be bound by the norms.[1106]

[1102] Cesare Romano, *The Southern Bluefin Tuna Dispute: Hints of a World to Come... Like It or Not*, 32 Ocean development and international law (2001).
[1103] In fact, the parties to the dispute were the only parties to the 1993 Convention.
[1104] Compare Appellate Body, United States – Import Prohibition of Certain Shrimp and Shrimp Products, at para 130 with the decision of the ICJ in ICJ, Legal Consequences for States of the Continued Presence of South Africa in Namibia.
[1105] Appellate Body, United States – Import Prohibition of Certain Shrimp and Shrimp Products, at para 131 (original emphasis).
[1106] The Appellate Body thus implicitly required some degree of consent among all parties to the dispute in relation to the norm of other treaties guiding the interpretation of WTO law. This consent could according to the ruling however fall short of being party to the relevant treaty. In the case, three of the parties to the dispute (Malaysia, India, and Pakistan) were formally bound—i.e. had signed and ratified at least one of the instruments cited by the AB. Of the remaining two parties, United States had declared that it considered itself bound by the relevant

In the *EC-Biotech Case*[1107], the decision of the WTO Panel rejected the EC's argument that the Panel should take the 1992 Convention on Biological Diversity (CBD) and the 2000 Cartagena Protocol on Biosafety (Biosafety Protocol) into account when interpreting the relevant WTO rules in this specific case. The Panel found that, according to the Vienna Convention on the Law of Treaties, it was not required to take these treaties into account when interpreting WTO rules since not all parties to the dispute were parties to the CBD and the Biosafety Protocol.[1108] Based on the finding of the Panel, this appears to imply a requirement of full overlap between the lists of parties to treaties involved in conflict:

> *Indeed, it is not apparent why a sovereign State would agree to a mandatory rule of treaty interpretation which could have as a consequence that the interpretation of a treaty to which that State is a party is affected by other rules of international law which that State has decided not to accept.*[1109]

norms in one of the instruments (UNCLOS) as a matter of customary law. In the case of Thailand, it had signed but not ratified two of the instruments. The central argument of the Appellate Body appears to be that among all parties to the dispute there was broad acceptance of the norm in question, overlapping between the various instruments to which there were differing degrees of formal state consent among different disputants. As observed by Howse, "*what was at stake was not determining whether a rule was applicable between the parties in the sense of "binding" in positive law, but whether the norm, as among these parties to this dispute, could be applied as a legitimate community norm or standard*." The Use and Abuse of other "Relevant Rules of International Law" in Treaty Interpretation: Insights from WTO Trade/Environment Litigation. (2007).

[1107] European Communities – Measures Affecting the Approval and Marketing of Biotech Products, WT/DS291/R, Panel Report (World Trade Organization Panel 21 November).

[1108] See id. at paras. 7.67-7.71. The panel based this conclusion on three arguments. Firstly, it considered that the VCLT the expression '*parties*' generally is used to refer to parties to a treaty not to a dispute and that the definition of 'party' in 2.1(g) of the VCLT is "*a State which has consented to be bound by the treaty and for which the treaty is in force*." The second argument claimed that *"requiring that a treaty be interpreted in the light of other rules of international law which bind the States parties to the treaty ensures or enhances the consistency of the rules of international law applicable to these States and thus contributes to avoiding conflicts between the relevant rules*." (para. 7.70) Thirdly, the panel observed "*it is not apparent why a sovereign State would agree to a mandatory rule of treaty interpretation which could have as a consequence that the interpretation of a treaty to which that State is a party is affected by other rules of international law which that State has decided not to accept.*" (para. 7.71).

[1109] See id. at 7.71.

As observed by Jackson, under the understanding expressed by the Panel, Article 31(3)(c) does not give the interpreter the discretion to decide whether to apply other treaties. If the conditions are met, the interpreter has no other option than to take account of international law.[1110]

In comparing the seemingly contrasting positions between the Appellate Body in *US-Shrimp* and the Panel in *EC-Biotech*, Howse has considered the finding in *EC-Biotech* to be incoherent in relation to *US-Shrimp*, suggesting that the decision by the Panel in the latter decision to grant treaties of environmental law more limited importance reflects the larger influence of the insider perspective of the WTO secretariat bureaucracy in panel decisions. This explanation is in line with the discussion in Part D.[1111] The argument that the ruling in *EC-Biotech* is conflicting with the finding in *US-Shrimp* may, however, be criticized for understanding the Panel decision in the former as more restrictive than it actually is. Read closely, the decision of the Panel does not exclude the use of other treaties as points of reference, as will be further discussed in section E.5.1. Instead of reading the Panel decision as a radical shift from the previous dictum of the Appellate Body, it could be regarded as foremost underlining the *pacta tertiis* requirement.[1112]

[1110] JOHN H. JACKSON, SOVEREIGNTY, THE WTO AND CHANGING FUNDAMENTALS OF INTERNATIONAL LAW (Cambridge University Press. 2006).

[1111] Howse. 2007.

[1112] In spite of the restrictive approach to '*applicable in relations between the parties'*-element applied in EC-Biotech, as will be further discussed in section E.6.1, the Panel declared in its decision, that even if there is no obligation to take other agreements into account, such considerations could nevertheless be made by using other treaties as references when interpreting 'ordinary meaning' of terms, in light of their object and purpose, under paragraph 1-2. The other agreement would thus not be referenced as a legally binding rule, but rather for being linguistically informative. As declared by the Panel in paragraphs 7.92-93: "*We think that, in addition to dictionaries, other relevant rules of international law may in some cases aid a treaty interpreter in establishing, or confirming, the ordinary meaning of treaty terms in the specific context in which they are used. Such rules would not be considered because they are legal rules, but rather because they may provide evidence of the ordinary meaning of terms in the same way that dictionaries do. They would be considered for their informative character. It follows that when a treaty interpreter does not consider another rule of international law to be informative, he or she need not rely on it. In the light of the foregoing, we consider that a panel may consider other relevant rules of international law when interpreting the terms of WTO agreements if it deems such rules to be informative. But a panel need not necessarily rely on other rules of international law.*" Panel Reports, European Communities – Measures Affecting the Approval and Marketing of Biotech Products, 2006.

In the case of the treaty conflict between UNCLOS, CBD and TRIPS, the *pacta tertiis* requirement would raise challenges if interpreted restrictively. The lists of parties are not completely overlapping, as discussed under the subjective element in section E.3.2, although the overwhelming number of states are parties to all three treaties. As of 2019, the number of parties is 168 for UNCLOS, 193 for the CBD and 164 for TRIPS.[1113] Still, this leaves out a number of states of which some, in particular the United States, which has not ratified UNCLOS, are important global players. Of note is the fact that in the US political debate on ratification, rules relevant to deep-sea bioprospecting have been raised as an important cause of objection; the common heritage of mankind principle has been raised as a major hindrance to ratifying UNCLOS.[1114] In other cases, aspects less directly but still connected to deep-sea bioprospecting have been raised as reasons for not ratifying. Accordingly, Colombia, Peru and Venezuela have not ratified due to disagreement on the maritime delimitation regime.[1115] The CBD, by contrast, has almost universal acceptance. As previously discussed, TRIPS is an integral part of a broader set of WTO agreements which states are required to ratify in the process of becoming members to the organization. More than political objections to the material content of TRIPS, it has been the complexities of this process and the required administrative capacities that have hindered some developing states from becoming parties.

The lack of global acceptance of treaties does not just raise challenges to the global application of relevant norms in the individual treaties. It could also lead to different consequences of regime conflicts between states, whereby not all states are parties to all relevant obligations. Accordingly, in the case of deep-sea bioresources, the treaty conflict is not relevant or applies differently in relation to certain states, in line with the previous discussion on states that have not signed, ratified or acceded relevant conventions. Some states are only bound by obligations in one or two of the treaties, and thus either they are not

[1113] Information retrieved from the United Nation Treaty Collection (treaties.un.org), The WTO (wto.org), CBD (cbd.int) and UN Division for Oceans and the Law of the Sea (un.org/Depts/los) October 14, 2020.

[1114] Elizabeth M. Hudzik, *A treaty on thin ice: debunking the arguments against U.S. ratification of the U.N. Convention on the Law of the Sea in a time of global climate crisis*, 9 WASHINGTON UNIVERSITY GLOBAL STUDIES LAW REVIEW (2010).

[1115] Eduardo Ferrero Costa, *Latin America and the Law of the Sea*, *in* REGIONS, INSTITUTIONS, AND LAW OF THE SEA (Harry N. Scheiber & Jin-Hyun Paik eds., 2013), at 392.

directly concerned by the norm overlap, or the norm conflict is different from their perspective, depending on commitments. The question of *pacta tertiis* in relation to treaty conflict may be further complicated by the uncertain customary status of relevant norms. Some states may not be parties to all relevant treaties and yet still be bound by corresponding norms in customary international law. Under the decision in the *Namibia* Case, the ICJ made clear that customary principles of international law may serve as a point of reference similar to other treaties.[1116]

It has not been fully explored to what extent norm conflicts involving customary norms differ from those involving only treaty obligations.[1117] In the case of the US, which has not ratified UNCLOS, it has expressed that it considers much of the convention, as reflecting corresponding customary norms.[1118] As regards Part XI on the Area, which includes the common heritage of mankind regulation for deep-seabed resources, the US is of the contrary position.[1119] Indeed, objection to Part XI appears to have been the major reason for the refusal of the Reagan administration to sign the treaty.[1120] This example illustrates that in light of the *pacta tertiis* principle, it would be premature to speculate on the consequence of practical cases of norm conflicts before first establishing what obligations apply in relation to specific states. As discussed in section E.3.3, applicable rules may differ between states depending on what obligations it is bound by. However, in this investigation, the emphasis is predominantly on the material aspects of treaty conflict seen from the perspective of the overwhelming majority of states bound by the three

[1116] ICJ, Legal Consequences for States of the Continued Presence of South Africa in Namibia, 1971.

[1117] The issue has however been discussed by Isabelle Van Damme, *Jurisdiction, Applicable Law, and Interpretation*, *in* THE OXFORD HANDBOOK OF INTERNATIONAL TRADE LAW (Daniel Bethlehem, et al. eds., 2009).

[1118] The US has accordingly declared that it considers the rules on navigational as reflecting customary law, as well as other areas, such as rules on sovereign immunity, rules on the continental shelf and the high seas, and at least part of the rules on living resources. See J. Ashley Roach, *Today's Customary International Law of the Sea*, 45 OCEAN DEVELOPMENT AND INTERNATIONAL LAW (2014).

[1119] Ewa Kurlanda, *Exploitation of sea resources and the territorial application of the law of the sea*, 4 JOURNAL OF POLITICS AND LAW (2011).

[1120] Bernard Gwertzman, *U.S. Will Not Sign Sea Law Treaty*, THE NEW YORK TIMES, July 10. 1982, at 5; See also Van Damme. 2009.

investigated treaties and the consequences of the subjective criterion will not be fully developed.[1121]

E.5.2.3. Lex posterior

For cases where the *pacta tertiis* principle does not lead to different application for some states in line with paragraph 4(b), paragraph 3 of Article 30 provides that the earlier treaty applies only to the extent that its provisions are compatible with those of the latter treaty. For areas where there is conflict, there thus appears to be a strong preference in favor of more recent treaties in the provision. According to paragraph 4(a), the same rule also applies in relation between states parties to both treaties in cases where there is not a complete overlap of parties.

This approach, which essentially establishes precedence in line with the principle of *lex posterior*, has also been regarded by many observers as generally having preference in treaty conflict cases. In the case of incompatibilities relating to deep-sea bioprospecting, *lex posterior* would *prima facie* establish priority for TRIPS before undertakings in UNCLOS and put the CBD third, since the treaties became effective in 1995, 1994 and 1993 respectively. If priority instead is based on the date of adoption, as suggested by Borgen, discussed in section E.3.4, TRIPS would still be given precedence since UNCLOS was adopted in 1982, the CBD in 1992 and TRIPS in 1994.

Yet, it should be noted that this group of observers who favor a rather categorical application of *lex posterior* in treaty conflict cases largely appears to overlap with those who maintain a restrictive view of the *same subject matter* criterion, as discussed in E.5.1.[1122] Moreover, all rules on priority, which requires establishing the temporal order of treaties such as *lex posterior*, may be complicated by several factors, as discussed in section E.3.3. In particular, as was discussed in the context of the subjective element of norm conflict, establishing hierarchy between rules directly based on adoption or entry into force disregards the fact that potential treaty conflicts are only relevant in relation to states once both the treaty in question has become effective *and* the relevant state has become bound by it.

[1121] Ratification of TRIPS overlaps with membership in the World Trade Organization, currently 164 states are members, UNCLOS has 150 and the CBD 196 parties (2019).
[1122] WOLFRUM & MATZ, Conflicts in International Environmental Law. 2003, at 133.

As similarly established in section E.3.3, it therefore appears more reasonable to consider when obligations arose in relation to relevant states. This understanding would, however, result in different chronologies across states, depending on the order in which relevant treaties have become ratified.

Indeed, resolving conflicts based on chronology generally appears problematic. Foremost, and this is a general point of criticism of the categorical application of *lex posterior*, it would be based on the presumption that new agreements are negotiated with existing treaties in mind, and/or that the negotiators intend to give the new treaty precedence in cases of overlap. This may be true of successive treaties with identical material scope. However, in most cases of overlap between treaties in different regimes, such as in the case of deep-sea bioprospecting, neither of these assumptions appear to be fulfilled. Based on the relevant treaties and their preparatory work, there is an indication of only limited consideration by negotiators of the potential for overlap in relation to these treaties of other regimes, as discussed in Part D. The signing of UNCLOS in 1982 predates the launch of the Uruguay round which resulted in TRIPS by six years and the start of the CBD negotiation by seven years. It is thus not surprising that no reference to the latter two treaties can be found in the negotiation documents of UNCLOS. CBD, on the other hand, clearly acknowledged the potential for conflict in relation to UNCLOS, but also included special instructions that sought to clarify this relationship in Article 22 and avoid application of *lex posterior*, as will be discussed in the next section. Despite their parallel negotiation, the CBD and TRIPS were little concerned with their internal relationship.[1123] It was not until the launch of the Doha round, after the entry into force of both treaties, that the WTO initiated a discussion to address the areas of communalities. A range of proposals concerning the connection to CBD have since been proposed, including an amendment on disclosure of origin of biological resources, but these have so far failed to materialize.[1124]

Thus, to the extent that the potential for overlap in the relation between these treaties was considered during their drafting, the negotiators did not aim for or foresee the establishment of treaty hierarchies based on *lex posterior*. Rather, the rules relevant for deep-sea bioresources in the three treaties examined in

[1123] BIRNIE, et al. 2009, at 802.
[1124] GERVAIS. 2012, at 76-100.

Part C with few exceptions appear to have been drafted in disregard of applicable commitments in other regimes of international law. Largely, the rules appear to have been constructed independently, in line with the objectives of their own regime (as discussed in Part D).[1125]

At the general level, the negotiators of the three respective treaties at least in some regards considered their internal relationship. Provisions as well as preparatory works of UNCLOS, CBD and TRIPS indicate that such considerations were made, albeit as a matter of principle and not in the specific context of the rules relevant for deep-sea genetic resources. Accordingly, there is no evidence that the negotiators intended to modify the material content of pre-existing rules in other regimes when the relevant treaties were drafted. To the extent that internal hierarchies were established in relation to other treaties, those were not based on *lex posterior*. In the next section, these provisions in the three treaties indicating priority in relation to other treaties, commonly referred to as *conflict clauses*, will be examined, both in general terms and in the specific case of the three treaties investigated in the case of deep-sea bioprospecting.

Even if these conflict clauses were set aside, there are strong arguments against rigidly relying on *lex posterior*. Foremost, in light of the unforeseen consequences it yields in most cases, there is no indication that either the negotiators of these three treaties, or state parties in general would desire the application of *lex posterior* in case conflict arises with other treaties. Rather, there is reason to believe that state parties would prefer to solve the conflict via more pragmatic means. Chiefly, this is because treaty conflict is seldom intended or foreseen. In cases where it nevertheless arises, it can be assumed that the parties to treaties concerned would prefer to solve the conflict by attempting to propose an application or interpretation that bridges the conflict. Supporters of the restrictive view advocating the use of *lex posterior* thus make the mistake of forgetting "*the primary necessity of interpreting an instrument in accordance with the intentions of the parties*," as pointed out by the ICJ in

[1125] As observed by Birnie, Boyle and Redgwell, "*The TRIPS Agreement and the Biodiversity Convention were developed, albeit at the same time, by different delegations, in different forums, with different objectives and with almost no consultation or even communication between the two negotiations*." BIRNIE, et al. 2009, at 802.

the *Namibia case*.[1126] The importance of respecting the interest of the parties was similarly stressed under E.4.1 in the critique of the restrictive view of the *same subject matter* criterion, since express treaty instructions on how to relate to other treaties (conflict clauses, as discussed below) otherwise would have been disregarded. In the context of *lex posterior* the criticism against a strict application of the rule provided by the Vienna Convention is not based on express provisions, but rather the assumption that treaty parties would favor a more flexible approach to the resolution of treaty application problems in cases of treaty conflict.

Based on this inflexibility whereby Article 30 bestows *lex posterior* primacy in the model for solving treaty application, other observers have also voiced criticism against the position taken by Wolfrum and other supporters of the principle.[1127] These include the International Law Commission, which appears to agree that a rigid application of the *lex posterior* rule should be avoided in cases of overlapping norms across treaty regimes. Despite its criticism of "pigeon-holing" international law into different regimes, the ILC Study Group agrees in its report that the practical utility of arguments under *lex posterior* or *lex specialis* are "more powerful" between treaties within the same regime than between treaties in different regimes. Indeed, despite stark criticism of more or less artificial divisions of international law into different fields, the ILC Study Group Report generally considers that using Article 30 is often fruitless in relations between treaty regimes such as those in trade and environmental law.

Whereas it may be reasonable to resort to such principles in cases of conflicting treaties within the same family of agreements, the ILC Study Group contends, it may yield arbitrary results in cases of overlapping treaties from different regimes. Based on this essentially practical argumentation, the ILC Study Group Report considers that a straightforward priority of one treaty over another in conflicts between norms in different regimes (that is, in fact, of one regime over another) cannot be reasonably assumed on a merely chronological basis. Instead, they call for a more nuanced approach.[1128]

[1126] ICJ, Legal Consequences for States of the Continued Presence of South Africa in Namibia, 1971.

[1127] Borgen, THE GEORGE WASHINGTON INTERNATIONAL LAW REVIEW (2005), at 219-220; Vierdag, BRITISH YEARBOOK OF INTERNATIONAL LAW (1988), at 92-108.

[1128] Koskenniemi, Fragmentation of International Law - Report of the Study Group of the International Law Commission. 2006., at 138.

The conclusions of the ILC Study Group thus support resorting to other tools than *lex posterior* in the case of norm conflicts between treaties of different regimes, if there are legal grounds available. It appears reasonable to support this position and reject a rigid application of *lex posterior* in cases where there is no evidence that the parties intended or envisaged priority established in this principle. Without strong reasons for making such an exception, however, it appears difficult to ignore that paragraph 3 unequivocally establishes that the *lex posterior* principle is decisive in cases where obligations in several treaties overlap. It will therefore be investigated what options Article 30 provides to derogate from *lex posterior*, as well as how it would apply in the case of deep-sea genetic resources.

E.5.2.4. Conflict clauses as an exception to lex posterior

It has thus been established that there are strong arguments against orthodoxly relying on the *lex posterior* rule: in particular, the rigid consequences and the lack of connection to an expressed intention of the parties to solve inconsistencies in line with the principle. Paragraph 2 of Article 30 provides a legal recourse by establishing that when a treaty specifies that it is subject to, or that it is not to be considered as incompatible with, an earlier or later treaty, the provisions of that other treaty prevail. This indicates a preference for express declarations in treaties on how they should relate to other treaties, commonly referred to as conflict clauses. According to paragraph 2, it is thus undisputed that if there is an explicit treaty provision prescribing the relationship to another treaty, that provision should be given priority over *lex posterior*.[1129]

The Draft Conclusions of the Study Group of the ILC does not just favor the application of conflict clauses, as provided in Article 30(2), and considers it "*advisable that when States enter into treaties that might conflict with other*

[1129] PULKOWSKI. 2014; Jan Mus, *Conflicts between Treaties in International Law*, 45 NETHERLANDS INTERNATIONAL LAW REVIEW (1998). According to Wolfrum and Matz, the preference for conflict clauses is not primarily the consequence of the indication in Article 30(2). They consider that only if "*conflict clauses do not clarify the relationship between the two colliding agreements are the provisions of the Vienna Convention invoked in an attempt to settle conflicts between treaties.*" Under this understanding, conflict clauses should be applied even before resorting to the Vienna Convention for guidance. See WOLFRUM & MATZ, Conflicts in International Environmental Law. 2003, at 122.

treaties, they settle the relationship between such treaties by adopting appropriate clauses in the treaties themselves."[1130]

In its report, the ILC Study Group also contends that treaty indications of a more general harmonizing intention ought to be regarded as having preference over *lex posterior*.[1131] Only if both are lacking, the ILC Study Group Report suggests, should *lex posterior* be turned to as a presumption of intent to derogate from previous treaties.[1132] In the absence of a conflict clause, the issue of priority should thus, in the opinion of the ILC Study Group, be resolved by interpreting the expressed intent of the parties: had they intended that the latter treaty should supplement or derogate from the earlier one?[1133] This emphasis on the expressed intent of the parties seems to be much in line with the arguments against a strict application of the *same subject matter* requisite as well as a strict application of *lex posterior*. It could however be objected that the opening term "*when a treaty specifies*" in Article 30(2) indicates that a clearly expressed indication of priority in the treaty is required for a reference to qualify as conflict clause. Accepting vague harmonizing intentions as conflict clauses could be considered as transcending into addressing treaty conflict as a problem of interpretation rather than application.[1134]

Indeed, there is reason for generally considering the concepts of application and interpretation as separate approaches under treaty law, entailing different

[1130] Koskenniemi, Fragmentation of International Law: Difficulties Arising from the Diversification and Expansion of International Law - Draft conclusions of the work of the Study Group Finalized by Martti Koskenniemi. 2006., para. 32, at 12.

[1131] Koskenniemi, Fragmentation of International Law - Report of the Study Group of the International Law Commission. 2006., para 229 at 118-119.

[1132] The ILC considers that his may be the case for example when the treaties deal with wholly different topics and were negotiated by officials from different administrations.

[1133] Koskenniemi, Fragmentation of International Law - Report of the Study Group of the International Law Commission. 2006., at 119.

[1134] It could thus be argued that the suggestion by ILC Study Group blurs *approaches of application* to treaty conflict (Article 30) with *approaches of interpretation* (Article 31, which will be discussed below). Whereas the preference for conflict clauses and *lex posterior* (in lack of conflict clauses) is provided in Article 30, the suggestion of preference for *harmonizing intent* is essentially an argument of treaty interpretation, an issue which is regulated in Article 31. More specifically, it relates to evolutionary interpretation and the principle of systemic integration, as will be discussed in section E.6.1. In essence, the inclusive view of what may represent conflict clauses suggested by the ILC Study Group Report could be considered using a tool for resolving treaty interpretation problems to solve an issue of treaty application.

approaches under the Vienna Convention.[1135] Nevertheless, interpretative methods may have to be resorted to in order to distinguish indications of priority. As noted by Pauwelyn, "*conflict clauses may be straightforward in that they provide which norm prevails in the event of conflict*."[1136] There may however also be more discrete expressions of intent on what to do in case of conflict, e.g. in preambles and preparatory works. Implicit expressions may be used in the interpretation of the norms in order to prevent conflict.[1137] Such discrete indications may however be influential "*also in the event of genuine conflict, i.e. where interpretation did not lead to a harmonious reading*".[1138] Respecting the intention of the parties in establishing priority between treaties, expressed clearly or in more discrete terms, may indeed require interpretative approaches.

In conclusion, the treaty application rules as provided in Article 30 provide *lex posterior* as the default solution for application in cases of treaty conflicts. However, in cases where there are preferences in the relevant treaties for how they should be applied in relation to other treaties, such conflict clauses have preference over *lex posterior*. The nature and function of such *conflict clauses* will now be investigated. Thereafter, it will be examined to what extent such elements can be distinguished in the three treaties in focus for this investigation.

E.5.3. Conflict clauses and treaty communication

Since conflict clauses according to Article 30(2) should have preference over other principles for establishing how treaties apply in cases of conflict, it is in practical cases necessary to examine to what extent such clauses can be

[1135] See, on the distinction between approaches of application and interpretation under treaty law Anastasios Gourgourinis, *The Distinction between Interpretation and Application of Norms in International Adjudication*, 2 JOURNAL OF INTERNATIONAL DISPUTE SETTLEMENT (2011);Joshua Paine, *The Judicial Dimension of Regime Interaction beyond Systemic Integration*, *in* REGIME INTERACTION IN OCEAN GOVERNANCE: PROBLEMS, THEORIES AND METHODS (Seline Trevisanut, et al. eds., 2020).

[1136] PAUWELYN, Conflict of Norms in Public International Law: How WTO Law Relates to Other Rules of International Law. 2003, at 329.

[1137] In this study, such strategies will form part of a broader discussion of harmonization by means of treaty interpretation and the principle of systemic integration in section E.6.

[1138] PAUWELYN, Conflict of Norms in Public International Law: How WTO Law Relates to Other Rules of International Law. 2003, at 330-331.

distinguished in the relevant treaties. As established in the previous section conflict clauses are expressions of party intent. It should therefore lack relevance whether treaties belong to the same or different regimes. The approach of solving treaty conflicts by means of principles of application, of which conflict clauses form part, can be conducted irrespective of institutional relationship.

However, there are, as also established in the previous section, different opinions as to how explicitly formulated such expressions or instructions on the relationship to other treaties must be. In this regard, it appears reasonable to interpret such formulations liberally, and to assume that parties in most cases want to establish a functioning relationship between treaties rather than inconsistencies. As will be discussed in the following, conflict clauses can serve different purposes and may come in different forms.

E.5.3.1 Purpose

In an often-used definition by the International Law Commission, formulated long before the Fragmentation report, a conflict clause is regarded as:

> *a clause [in a treaty] intended to regulate the relation between the provisions of the treaty and those of another treaty or of any other treaty relating to the matters with which the treaty deals. Sometimes the clause concerns the relation of the treaty to a prior treaty, sometimes its relation to a future treaty and sometimes to any treaty past or future. Whatever the nature of the provision, the clause has necessarily to be taken into account in appreciating the priority of successive treaties relating to the same subject-matter.*[1139]

Conflict clauses, sometimes also referred to as savings clauses, can thus be defined as treaty provisions expressing how a treaty (or part thereof) should relate to other treaties.[1140] Conflict clauses thus declare the will of state parties on whether the treaty will take priority over another treaty in the event that a conflict occurs.[1141]

[1139] YEARBOOK OF THE INTERNATIONAL LAW COMMISSION 1966, VOL. II (A/CN.4/SER. A/1966/ADD. 1) (United Nations. 1966), at 214.

[1140] Borgen, THE GEORGE WASHINGTON INTERNATIONAL LAW REVIEW (2005).

[1141] Mus, NETHERLANDS INTERNATIONAL LAW REVIEW (1998), at 214; Volker, ROEBEN VOLKER & RÜDIGER WOLFRUM, DEVELOPMENTS OF INTERNATIONAL LAW IN TREATY MAKING (Springer-

Such clauses can appear very different, in both nature and effect. Generally, conflict clauses may serve different purposes. They may aim to prevent that treaties covering similar or at least partially overlapping subject matters contradict each other by clarifying their relationship and hierarchies. Conflict clauses can thus be regarded as the result of a concern for ensuring the general coherence of public international law, or at least contributing to the function of the system. They may, however, also serve other purposes. If an agreement is considered comprehensive, conflict clauses may be designed to ensure that the overriding principles of the comprehensive treaty will prevail or – in other words – not be derogated by more specific treaties, thus aiming to ensure the primacy of a specific treaty.[1142] Also frequent in framework conventions are conflict clauses designed to bestow subsequent agreements with certain mandates which fill gaps in the rules in the convention, thereby calling for further development of regulation in other treaties, which commonly function as *lex specialis* in relation to the former. As noted by Russo, "*the impact on the treaty of clauses recognizing special rules can be controversial. By virtue of the principle of speciality they could partially replace the treaty while leaving it applicable as a residual basis, or they could apply in addition to it.*"[1143]

The *lex specialis* approach is frequently used in UNCLOS. In some contexts, it represents an implicit reference to pre-existing treaties, while in others it can signal a call to negotiate detailed rules in new treaties. For example, Article 211 paragraph 1 calls upon states to establish international rules and standards to prevent, reduce and control pollution of the marine environment. Those rules, which are contained in the MARPOL convention, are thus from the perspective of UNCLOS aimed to implement and function in conformity with UNCLOS.

Verlag Berlin Heidelberg. 2005); Deborah Russo, *Addressing the relation between treaties by means of 'saving clauses.'*, 85 BRITISH YEARBOOK OF INTERNATIONAL LAW (2015).

[1142] PAUWELYN, Conflict of Norms in Public International Law: How WTO Law Relates to Other Rules of International Law. 2003, at 327.

[1143] Russo further contends that "Assuming the relation of speciality, (lex specialis clauses) do not address conflict among rules of international law. They merely indicate that certain aspects of the subject matter of the treaty could be regulated by way of according priority by other agreements concluded by the parties to the treaty but, as a rule, they do not exclude the concurrent or residual operation of the treaty." Russo, BRITISH YEARBOOK OF INTERNATIONAL LAW (2015). Also other observers, such as Jan Mus, do not consider provisions indicating priority according to lex specialis as conflict clauses in the proper sense, see Mus, NETHERLANDS INTERNATIONAL LAW REVIEW (1998), at 218.

This relationship is clarified not only in UNCLOS but regularly also in the relevant implementing agreement.[1144] Conflict clauses may thus aim to both provide and prevent the application of *lex posterior* as well as *lex specialis*. In any event, they strive to prevent treaty conflicts. It will be assessed how successful they are in this regard once the form of conflict clauses has been discussed.

E.5.3.2 Types and function of conflict clauses

The general purpose of conflict clauses is thus clear. However, the form of such clauses can differ considerably. Wolfrum and Matz[1145] have identified six categories: Firstly, no provision in the agreement; secondly, preambular language; thirdly, clauses providing for the suppression of the referring agreement in the body of the treaty; fourthly, *specific savings* clauses that provide for the prevalence of existing treaties in the body of the agreements; fifthly, *general savings* clauses in the body of the agreement; and sixthly, *qualified savings* clauses. Although this grouping illustrates the broad spectrum of potential clauses, it is of limited value since it focuses on form as much as material content.

Without exploring the concept in theoretical terms, the ILC Study Group anecdotally provides a number of different examples of explicit conflict clauses.[1146] Firstly, the ILC refers to clauses which prohibit the conclusion of incompatible subsequent treaties. This can be regarded as an express exception to the *lex posterior* rule, designed to guarantee the normative power of the earlier treaty. As a second example, the ILC Study Group Report mentions treaties expressly permitting subsequent "compatible" treaties. Thirdly, clauses in the subsequent treaty providing that it "shall not affect" the earlier treaty are highlighted.

[1144] See, in addition to MARPOL for instance Article 4 of the 1995 UN Fish Stocks Agreement, which reads "Nothing in this Agreement shall prejudice the rights, jurisdiction and duties of States under the Convention. This Agreement shall be interpreted and applied in the context of and in a manner consistent with the Convention." The status of conflict clauses and the relationship between UNCLOS and implementing agreements, see WOLFRUM & MATZ, Conflicts in International Environmental Law. 2003, at 121.

[1145] Id. at 122-124.

[1146] Koskenniemi, Fragmentation of International Law - Report of the Study Group of the International Law Commission. 2006., at 135-137.

This essentially represents a call for interpreting the treaty in harmony with, and thus not to materially deviate from, the other treaty. Fourthly, the ILC Study Group cites clauses in subsequent treaties providing that among the parties, it overrides the earlier treaty. This is considered as a modification of the previous agreement, *inter se* the parties to the latter. As a fifth type, clauses in subsequent treaties which expressly abrogate earlier treaties are mentioned. Furthermore, as a sixth category, clauses in subsequent treaties may expressly maintain earlier compatible treaties. An example of this type would be provisions stating that a convention shall not alter the rights and obligations of states parties which arise from other agreements. The ILC Study Group Report inventory illustrates the wide difference in function of conflict clauses. Still, the value of the account is limited since it is non-exhaustive and the division between the categories appears to be unclear.

Russo distinguishes between different clauses based on effect. Under this perspective, which differs considerably from that of Wolfrum and Matz, "delineation clauses" are distinguished from "subordination clauses" dealing with conflict or inconsistency between treaties by arguing that the former, rather than addressing conflict, aim to define the scope of application of treaties. Delineation clauses, such as supplementation clauses, which merely reserve the right of contracting states to enter into agreements in order to supplement or develop the treaty regime, or the already mentioned *lex specialis* clauses, differ from actual conflict clauses by lacking impact on the obligations stemming from the treaty and not concerning conflicts among treaties. Russo considers that delineation clauses "*describe the 'bounds' of the treaty and clarify that the treaty does not prejudge States' freedom of action in certain matters related to, but not necessarily covered by the treaty. They characteristically entail States' ability to adopt provisions applicable to particular aspects of the subject matter that would apply in addition to the treaty or that integrate the content of the treaty*."[1147]

As regards "genuine" conflict clauses addressing the risk of overlap and inconsistency between different treaties, Russo divides these into subordination and harmonization clauses. Subordination clauses address the relationship among contracting parties only and give prevalence to other treaties in case of overlap, entailing mutually exclusive approaches in relation to other treaties.

[1147] Russo, BRITISH YEARBOOK OF INTERNATIONAL LAW (2015), at 137.

This may involve priority to other treaties which are in force between some of the contracting parties. It also involves clauses providing that states are free to choose which treaty to apply in their mutual relations, as well as "disconnection clauses" which exclude a priori the application of the treaty in the *inter se* relations between those parties which are also parties to another treaty.

Harmonization clauses, on the other hand, call for their reciprocal co-ordination. These clauses call for evaluation of the various obligations at stake. In most cases, they aim to prevent possible incompatibilities between treaties embodying competing goals, in order to ensure a functional relationship.[1148]

Conflict clauses appear to be most commonly formulated as preambular language specifying the relationship to other treaties. Especially frequently, preambles of treaties contain *without prejudice* clauses, which indicate priority for specified prior treaties. The main challenge with applying such clauses, giving priority to existing or previous treaties, has to do with the varying scope of the treaties involved, as is often the case. Clarifying language on difference in mandate between treaties would be one way of solving the problem. However, the general language of conflict clauses commonly used rarely addresses this matter.[1149]

A more problematic case is represented by conflict clauses containing reference to other treaties, providing that they should be mutually supportive, without clearly indicating preference.[1150] Such clauses bring little clarity in cases of overlap between the two agreements. So-called *suppression* clauses, which establish priority both over existing and future agreements, similarly raise complex issues. It is difficult to foresee the consequences of such undertakings, where states curtail their sovereign treaty-making capacity in future negotiations.

[1148] Ibid.

[1149] Vranes, EUROPEAN JOURNAL OF INTERNATIONAL LAW (2006).

[1150] As noted by Wolfrum and Matz, this type of reference is included in the preamble of the Cartagena Protocol as well as the Stockholm Convention on Persistent Organic Pollutants, WOLFRUM & MATZ, Conflicts in International Environmental Law. 2003, at 122. See also Riccardo Pavoni, *Mutual Supportiveness as a Principle of Interpretation and Law-Making: A Watershed for the 'WTO-and-Competing-Regimes' Debate?*, 21 EUROPEAN JOURNAL OF INTERNATIONAL LAW (2010).

As will be discussed below, UNCLOS provides an example of this type of conflict clause in Article 311(6), providing that "*there shall be no amendments to the basic principle relating to the common heritage of mankind set forth in article 136 and that they shall not be party to any agreement in derogation thereof*."

Conflict clauses may thus have considerably different functions. That said, two elements are generally common. Firstly, all conflict clauses make reference to other treaties. Such reference may be specific (specifying the relation to a certain element or provision of another treaty) or general in nature (specifying the relation to other treaties in general) or anywhere in between. Especially common are conflict clauses relating to either past or future treaties.

Secondly, it has been made clear that the reference to the other treaty or treaties indicates an element of priority or hierarchy. This may be expressed as precedence or subordination in different forms. It may also abrogate other treaties, or parts thereof. In conflict clauses making reference to previous treaties, conflict clauses regularly express preference in line with *lex anterior* or *lex posterior*. Apart from these two general characteristics, conflict clauses may also express other material content. This includes clauses indicating *lex specialis* of the other or in relation to the other treaty. Suppression clauses, which establish the priority of the new agreement over both existing and future agreements, or restrain the parties' sovereign rights to enter new treaties in certain regards, appear to be less common.[1151]

Conflict clauses may also differ in scope, relating to other treaties drafted by all or some of the parties. According to an assessment of conflict clauses in environmental treaties, the most common function of conflict clauses is to provide preference for pre-existing treaties.[1152] Such clauses are often expressed in the preambular paragraph of treaties, providing that existing rights and obligations of states under other treaties take priority. *Without prejudice* is a commonly used term to express such precedence of *lex anteriori*. As observed by the ILC Study Group, also more discrete expressions in a treaty on how it is intended to relate to other treaties may arguably qualify as a

[1151] PAUWELYN, Conflict of Norms in Public International Law: How WTO Law Relates to Other Rules of International Law. 2003.
[1152] WOLFRUM & MATZ, Conflicts in International Environmental Law. 2003, at 122.

conflict clause. In order to distinguish such intentions, it may be necessary to use different treaty interpretation approaches, as discussed in section E.6.

Whereas the general form and function of conflict clauses have now been identified, such elements of the treaties central for the regulation of deep-sea bioprospecting will be distinguished.

E.5.3.3 Conflict clauses of TRIPS

Considering the many areas of existing and potential overlap in relation to other treaties, TRIPS in general provides little guidance on how it relates to other treaties of international law. Among the limited provisions addressing the matter, Article 2(2) of the TRIPS agreement provides a conflict clause which gives preference to prior treaties, but only in relation to three specific intellectual property treaties.[1153] Apart from this limited reference, the TRIPS agreement itself does not express any other instructions on how to deal with issues of application in relation to previous treaties. A conflict clause relating to future treaties is similarly lacking. TRIPS is, however, as previously discussed, not an isolated treaty but forms part of the broader family of agreements of the international trade law regime, where it has a particularly close kinship to the other treaties negotiated as part of the Uruguay round. This is the result of these WTO treaties having been adopted in concert, as components of the same trade round package.[1154]

Among the treaties that were negotiated as part of this round, the Marrakesh Agreement Establishing the World Trade Organization (hereinafter referred to as the Marrakesh Agreement[1155]) has the role of a framework convention, although it is considerably shorter than the central treaties of many other regimes. Formally, the other WTO treaties function as annexes to the Marrakesh Agreement. In the agreement, instructions are provided for clarifying the relationship to central aspects of general public international law as well as other treaties generally. Importantly, these instructions clarify the position of all WTO treaties and not only for the Marrakesh Agreement itself.

[1153] GERVAIS. 2012.
[1154] On the relationship between the treaties of the WTO round, see, for instance Marceau, JOURNAL OF WORLD TRADE (2001).
[1155] WTO Agreement: Marrakesh Agreement Establishing the World Trade Organization, 15 April 1994, 1867 U.N.T.S. 154 (WTO Agreement).

According to Articles IX(2) and X, such clarification can be provided by declaring authoritative interpretations of WTO rules, either by granting wavers or by amending WTO rules.

Similarly, central WTO organs can adopt guidelines in this regard, in line with Article V(1) of the Marrakesh Agreement. Accordingly, many WTO provisions explicitly allow for WTO organs to define more clearly the relationship between the WTO and other international organizations. The primary approach to potential treaty conflicts in WTO law, including TRIPS, is thus not to prescribe conflict clauses in its treaties. Instead, procedures are established for addressing such matters by developing soft law measures, if necessary, on an ad hoc basis.[1156]

However, such procedures to clarify the application of WTO treaties in relation to treaties outside the regime have not been fully tested. As regards the relation between WTO treaties and multilateral environmental treaties (which would be considered to encompass both UNCLOS and the CBD in this context), a specific Declaration on Trade and Environment[1157] was drafted in 1994 as part of the final act in the Uruguay round (which founded the WTO and also gave birth to many of its treaties, including the WTO agreement and TRIPS, as discussed above). The declaration did not express a conflict clause, but instead established the WTO Committee on Trade and Environment, and tasked it with the job of examining the relationship between WTO treaties and other treaties of international law. So far, however, the mandate of the committee has not resulted in any explicit conflict rules.[1158]

Accordingly, neither TRIPS specifically nor the connecting Marrakesh Agreement contain conventional conflict clauses, with the exception of the reference to certain pre-existing intellectual property rights treaties in Article 2(2) of TRIPS, as previously discussed. All there appears to be is an untested procedure for clarifying issues of application in relation to other treaties.

[1156] PAUWELYN, Conflict of Norms in Public International Law: How WTO Law Relates to Other Rules of International Law. 2003.
[1157] Decision on Trade and Environment. Adopted by ministers at the meeting of the Uruguay Round Trade Negotiations Committee in Marrakesh on 14 April 1994.
[1158] PAUWELYN, Conflict of Norms in Public International Law: How WTO Law Relates to Other Rules of International Law. 2003, at 344.

Does this mean that TRIPS as well as WTO treaties in general simply do not relate to issues of application in relation to other treaties? In the sense of conventional treaty conflict clauses, the answer would be affirmative. However, it could be argued that WTO as a regime of international law approaches the issue of application differently. Whereas the international environmental law and the law of the sea (as will be discussed below) address the issue of application in relation to other treaties by formulating intricate conflict clause provisions in the treaties, WTO law provides for ad hoc solutions of application issues. The first of these, which is referred to as the procedural approach, has already been mentioned. There is also a second, *judicial procedure* for deciding issues of application.

Under international trade law, the material content of WTO treaties has on many occasions been decided by the dispute settlement procedures of the WTO, which is mandated to deal with all issues encompassed by WTO treaties, including the elements of TRIPS relevant for this study. The mandate as well as procedure for this judicial resolution is provided in the Dispute Settlement Understanding of the WTO[1159] (hereinafter referred to as the DSU). Like the Marrakesh Agreement, the provisions of the DSU are thus relevant for deciding matters of all WTO treaties, including TRIPS. Among its provisions, two in particular are relevant for discussing relations between treaties.

> **Article 3**
> *General Provisions*
> (…)
> 2. The dispute settlement system of the WTO is a central element in providing security and predictability to the multilateral trading system. The Members recognize that it serves to preserve the rights and obligations of Members under the covered agreements, and to clarify the existing provisions of those agreements in accordance with customary rules of interpretation of public international law. Recommendations and rulings of the DSB cannot add to or diminish the rights and obligations provided in the covered agreements.
> (…)

[1159] Understanding on Rules and Procedures Governing the Settlement of Disputes, Marrakesh Agreement Establishing the World Trade Organization, Annex 2, 1 June 1995, 1869 U.N.T.S. 401 (WTO Dispute Settlement Understanding).

> **Article 19**
> *Panel and Appellate Body Recommendations*
> (…)
> 2. In accordance with paragraph 2 of Article 3, in their findings and recommendations, the panel and Appellate Body cannot add to or diminish the rights and obligations provided in the covered agreements.

In providing recommendations and rulings, Article 3(2) of the DSU mandates panels and the Appellate Body to "clarify the existing provisions of those agreements in accordance with customary rules of interpretation of public international law."

Although the provision is relating more directly to issues of interpretation, as discussed in section E.6, it makes clear that WTO law forms part of the broader system of public international law, and that common rules of public international law also apply to WTO disputes.[1160] Not only does this dismiss the conception of WTO law as a *sui generis* regime that is different from general public international law;[1161] it also obliges panels as well as the Appellate Body to apply the customary principles reflected in the Vienna Convention on how to relate to treaty conflicts.[1162] Article 19(2) of the DSU also has important implications in a treaty conflict context by stating that the Panel and the Appellate Body "*cannot add or diminish the rights and obligations provided in the WTO covered agreements*." In combination with the reference in Article 3(2), this has been regarded as a conflict clause, by virtue of indicating a general preference for WTO treaties in relation other treaties.[1163]

[1160] For an extensive discussion on the relationship between WTO law and general international law, see JACKSON, Sovereignty, the WTO and Changing Fundamentals of International Law. 2006.
[1161] As noted in other sections, the WTO Appellate Body has also ruled that WTO agreements should not be read "*in clinical isolation from public international law*", United States – Standards for Reformulated and Conventional Gasoline, WT/DS2/AB/R, Appellate Body Report (The Appellate Body of the World Trade Organization 20 May), at 16.
[1162] PAUWELYN, Conflict of Norms in Public International Law: How WTO Law Relates to Other Rules of International Law. 2003, at 465.
[1163] L. Bartels, Applicable law in WTO dispute settlement proceedings § 35 (2001);Joel P. Trachtman, *The domain of WTO dispute resolution.(World Trade Organization)*, 40 HARVARD INTERNATIONAL LAW JOURNAL (1999).

Based on a strict reading of Article 19(2), there are arguments supporting such an interpretation; tribunals under the WTO can hardly give preference to the application of other treaties in cases of conflict, without affecting (and effectively downgrading) norms under WTO treaties, thus going against Article 19(2).[1164]

However, other observers contest this view, claiming that Articles 3(2) and 19(2) do not address the issue of applicable law relevant for a particular dispute. Rather, according to this understanding, based on a contextual reading, these provisions relate to the inherent limits of WTO dispute settlement procedures in *interpreting* WTO agreements.[1165] This latter view thus claims that the instruction not to add or diminish rights and obligations is limited to issues of judicial interpretation, not of applicable law in general nor applicable treaties (in cases of conflict).[1166] Another reason for objecting to an interpretation of Articles 3(2) and 19(2) as indicating priority in relation to all other treaties is that it would be unreasonable to assume that the parties to what would become the WTO intended to bestow the treaties of the new organization unconditional precedence before all other obligations of treaty law. Rather, the reference in Article 3(2) to customary rules of interpretation should be read in light of its context: indicating the creation of new rights and obligations as outer limits of the interpretative mandate of WTO judicial organs.

Under this reading, the formulation in Article 19(2) also appears more rational: "*cannot add or diminish the rights and obligations provided in the WTO covered agreements*" should not be regarded as a conflict clause giving WTO treaties priority over all other treaty law, but rather as establishing the outer limits in interpretations of rights and obligations.

[1164] Van Damme. 2009.
[1165] PAUWELYN, Conflict of Norms in Public International Law: How WTO Law Relates to Other Rules of International Law. 2003, at 353, 465; Lorand Bartels, *Applicable Law in WTO Dispute Settlement Proceedings*, 35 JOURNAL OF WORLD TRADE (2001).
[1166] See, on the importance of maintaining the distinction between approaches of application and interpretation under treaty law, Gourgourinis, JOURNAL OF INTERNATIONAL DISPUTE SETTLEMENT (2011). In the Fragmentation Report, the ILC Study Group appears to consider that the difference between the two positions should not be exaggerated, Koskenniemi, Fragmentation of International Law - Report of the Study Group of the International Law Commission. 2006., at 90.

In conclusion, for relevant purposes neither TRIPS nor connected WTO treaties can be regarded as containing explicit conflict clauses, in the meaning of Article 30(2) of the Vienna Convention. In lack of formal conflict clauses in relation to treaties of other regimes, such issues of application are generally handled by judicial approaches in the WTO. For practical purposes, such judicial approaches may be a more pragmatic way of addressing treaty conflicts than conflict clauses. But even under an understanding where also more discrete elements are accepted as indications of priority in application in relation to other treaties, such procedures for making judicial decisions can hardly be regarded as qualifying as an expression of priority in the meaning of Article 30(2) of the Vienna Convention. Rather than functioning as conflict clauses, rulings in WTO dispute settlement procedures involving reasoning on application in relation to other treaties only apply on an ad hoc basis. The lack of clear conflict clauses further implies that regarded from the application approach under the Vienna Convention, there is no legal basis in TRIPS for arguing that other principles than *lex posteriori* should apply in cases of conflict. A consequence would be that unless the relevant state became party to the treaties involved in a different order in line with the subjective element suggested in section E.3.3, TRIPS would have priority before UNCLOS and the CBD in establishing application hierarchy between treaties involved.

If the application approach provided by the Vienna Convention is set aside and the matter of conflict is regarded from the treaty conflict perspective of TRIPS, however, the matter could potentially be decided differently. As will be discussed in section E.6.2, the tendency of the WTO Appellate Body in *US-Shrimp* to attempt to interpret provisions in WTO agreements so that they do not conflict with other treaty obligations indicates that at least in cases where conflicts between CBD and TRIPS would be decided along WTO dispute settlement practice, obligations in CBD could take precedence.[1167] Paradoxically, findings in WTO dispute settlement rulings involving questions of priority of treaties could thus indicate a more subordinate position for TRIPS than would be the consequence of basing the hierarchy on the provisions of TRIPS under the Vienna Convention.

[1167] Alan E. Boyle & Christine Chinkin, The making of international law (Oxford University Press. 2007). As is also further discussed below, the approach taken in Appellate Body, United States – Import Prohibition of Certain Shrimp and Shrimp Products has arguably been constrained in subsequent cases.

E.5.3.4 Conflict clauses of the CBD

In the CBD, the central provision regulating the relation to other treaties is Article 22 paragraph 1.

> **Article 22**
> *Relationship with Other International Conventions*
>
> 1. The provisions of this Convention shall not affect the rights and obligations of any Contracting Party deriving from any existing international agreement, except where the exercise of those rights and obligations would cause a serious damage or threat to biological diversity.
>
> 2. Contracting Parties shall implement this Convention with respect to the marine environment consistently with the rights and obligations of States under the law of the sea.

Thus, in the event of a conflict between the Convention and an earlier treaty, the latter would take precedence save for cases where "*the exercise of the rights and obligations contained therein would cause a serious damage or threat to biological diversity*." As observed by Russo, the reference to a "serious threat" indicates that the clause was designed to "*address the relation between treaties having different subject matter and to allow the States parties to implement protective measures in derogation of prior agreements if there was risk of a serious threat to biological diversity*."[1168]

The provision combines many of the problems with conflict clauses, providing first that CBD provisions shall not affect the rights and obligations of any party deriving from any existing treaty. The provision suffers from a lack of precise language on the role or mandate in relation to specific treaties. Secondly, and arguably more problematic, the paragraph contains a qualification: an exception to the general priority of existing rights and obligations is contained in the subordinate clause of paragraph 1. The general priority of the other treaty does not apply where the exercise of those rights and obligations would cause a serious damage or threat to biological diversity. The provision thus seemingly gives priority to previous treaties in the language of a conventional *without prejudice* clause.

[1168] Russo, British Yearbook of International Law (2015), at 161.

However, read from the exception, the priority is actually reversed, indicating priority for the CBD on all cases where exercise poses a threat to the interest of the CBD. The latter (and closer) reading is more in the spirit of a *suppression* clause, as discussed above. Another evidently problematic aspect of its formulation is the lack of criteria on what represents "serious damage or threat to biological diversity," as is required to make an exception. In light of the aim of the CBD, it appears clear that existential threats to species would qualify. It is more difficult to ascertain what other risks could be considered.

The complexities of the conflict clause of the CBD, however, do not end with the combined priority and subordination provided in paragraph 1 of Article 22. In paragraph 2 there is a specific reference to the law of the sea, declaring that the "*Contracting Parties shall implement this Convention with respect to the marine environment consistently with the rights and obligations of States under the law of the sea.*"

Two elements in this second paragraph are particularly noteworthy. Firstly, it relates to the law of the sea in general and not specifically to UNCLOS. Although UNCLOS is generally considered as the framework convention of the law of the sea, reflecting customary international law in central regards, this opens the door for making claims that obligations in other law of the sea treaties, as well as customary norms of the law of the sea, may have precedence in relation to the CBD. Secondly, the priority of the law of the sea according to paragraph 2 is not comprehensive but limited to *rights and obligations*. Thus, not all provisions of the law of the sea take precedence over the CBD. Arguably, more general elements of UNCLOS prescribing approaches, principles and organizational matters would not fall within the scope of rights and obligations and thus would not have priority before the CBD under this provision. Thereby, despite the reference to the law of the sea in paragraph 2, the CBD implicitly aspires for priority over UNCLOS on central matters such as the approaches and principles for the protection and preservation of the marine environment contained in Part XII of UNCLOS. Wolfrum and Matz consider the formulation in paragraph 2 as rational given the purpose of the CBD. In their view, a more general prejudice of UNCLOS on all matters of regulation would have made it impossible to complement the regulation of living resources in UNCLOS.

Formulations enabling a more complex interaction between the two treaties were necessary to enable supplementation by a new framework on biological resources of the CBD.[1169] While it is correct to say that such an approach represents a pragmatic solution to this problem, the lack of guidance on the central *rights and obligations* criteria risks opening the door to other problems.

The intricate conflict clause in paragraph 2 thus clarifies the relationship of the CBD to UNCLOS. Insofar as rights and obligations of UNCLOS are concerned, UNCLOS takes precedence. Where the conflict concerns law of the sea rules which do not amount to rights or obligations, CBD would claim priority. For the purposes of deep-sea bioprospecting, it appears clear that much of the overlap between the three treaties relates to central principles of UNCLOS which have the status as rights and obligations. In particular, this includes the common heritage of mankind principle, as discussed in section C.1, which is also the central conflicting element of UNCLOS. However, if read cautiously, it can be argued that paragraph 2 should in fact not be applied as a conflict clause but merely as an instruction in matters of interpretation, as will be discussed in section E.6. Even if this argument is supported, the paragraph can still be regarded as a clear declaration by the drafters of the CBD that in cases of conflict with UNCLOS, CBD takes a subordinate position according to the main rule.

In relation to TRIPS, the conflict clause of the CBD provides less guidance since it merely applies to pre-existing treaties. Since TRIPS was adopted and entered into force subsequent to the CBD, the precedence for CBD in cases of serious damage or threat to biological diversity as expressed in Article 22(1) does not apply. In lack of provisions in CBD addressing the relationship, it thus appears that TRIPS would take precedence in line with the general *lex posterior* principle in the application rules of the Vienna Convention, unless the subjective element is applied and CBD was ratified subsequent to TRIPS.

[1169] WOLFRUM & MATZ, Conflicts in International Environmental Law. 2003, at 125.

E.5.3.5 Conflict clauses of UNCLOS

In UNCLOS, the relationship to other treaties is established in Article 311, which provides an extensive and multifaceted conflict clause.

> **Article 311**
> *Relation to other conventions and international agreements*
> 1. This Convention shall prevail, as between States Parties, over the Geneva Conventions on the Law of the Sea of 29 April 1958.
> 2. This Convention shall not alter the rights and obligations of States Parties which arise from other agreements compatible with this Convention and which do not affect the enjoyment by other States Parties of their rights or the performance of their obligations under this Convention.
> 3. Two or more States Parties may conclude agreements modifying or suspending the operation of provisions of this Convention, applicable solely to the relations between them, provided that such agreements do not relate to a provision derogation from which is incompatible with the effective execution of the object and purpose of this Convention, and provided further that such agreements shall not affect the application of the basic principles embodied herein, and that the provisions of such agreements do not affect the enjoyment by other States Parties of their rights or the performance of their obligations under this Convention.
> 4. States Parties intending to conclude an agreement referred to in paragraph 3 shall notify the other States Parties through the depositary of this Convention of their intention to conclude the agreement and of the modification or suspension for which it provides.
> 5. This article does not affect international agreements expressly permitted or preserved by other articles of this Convention.
> 6. States Parties agree that there shall be no amendments to the basic principle relating to the common heritage of mankind set forth in article 136 and that they shall not be party to any agreement in derogation thereof.

Firstly, priority of UNCLOS is established in relation to the Geneva Conventions on the law of the sea. This is uncontroversial since these treaties are generally considered as predecessors of UNCLOS.

Secondly, the relation to other treaties in general is established in a more complex manner. Paragraph 2 provides that the rights and obligations of states under other treaties are not altered. However, this general precedence for prior treaties only applies provided that two criteria are fulfilled.

Firstly, the relevant norms must be compatible with UNCLOS. Secondly, the application of norms of other treaties must not "*affect the enjoyment by other state parties of their rights or the performance of their obligations*" under UNCLOS. Read conversely, paragraph 2 thus effectively only give priority to the application of other treaties over UNCLOS provided that both these criteria are fulfilled. Like the regulation in Article 22(2) of the CBD, Article 311 paragraph 2 of UNCLOS contains a qualification, which entails that some but not all obligations under UNCLOS have precedence in relation to other treaties, provided also that the obligation in the other treaty is compatible with UNCLOS. The second criterion may appear superfluous, but includes potential cases where an obligation in another treaty affects other states' rights or obligations under UNCLOS without necessarily being incompatible with UNCLOS.

Thirdly, according to paragraph 5, Article 311 does not apply in relation to "*agreements expressly permitted or preserved by other articles*" of UNCLOS. This relates to the function of UNCLOS as a framework convention, and the commonly used method in the convention of mandating certain treaties the role of *lex specialis* in different fields. Examples of this is the reference to the International Whaling Commission provided in Article 65, to MARPOL in Article 211 and the London Convention in Article 210. Treaties referenced in these provisions, which effectively represent more specific conflict clauses, are thus generally prioritized under Article 311(5). Hence, the strict criteria provided in Article 311(2) do not need to be fulfilled in such cases of reference in UNCLOS to *lex specialis* treaties.

Fourthly, there is no doubt that UNCLOS was drafted as a framework convention with supreme status in regulation of matters within its mandate. Yet paragraph 3 of Article 311 enables states to conclude agreements "*modifying or suspending the operation*" of provisions of UNCLOS, applicable in relation between them. However, the provision contains a number of qualifications and requirements, which effectively limit the possibilities for entering into such agreements. Firstly, provisions in the latter agreement are applicable solely in relation between the parties entering into that agreement. This is an expression of the fundamental *pacta tertiis* principle of treaty law. Secondly, the derogation must not be "*incompatible with the effective execution of the object and purpose of*" UNCLOS. Thirdly, it should not affect the application of the basic principles embodied in the convention.

Fourthly, the derogation must not affect the enjoyment by other parties of their rights or the performance of their obligations under UNCLOS. Moreover, paragraph 4 provides that other parties to UNCLOS must be notified, not only of the relevant derogation agreement but also of their intention to conclude it. This provision thus to some extent enables the negotiation of *lex specialis* treaties *intra se* parties to UNCLOS.

Fifthly, in paragraph 5 of Article 311, the parties "agree that there shall be no amendments to the basic principle relating to the common heritage of mankind set forth in article 136 and that they shall not be party to any agreement in derogation thereof." This provision thus represents a so-called suppression clause, as discussed above, by establishing priority over both existing and future agreements. The parties to UNCLOS thus curtail their sovereign treaty-making capacity in future negotiations insofar as the common heritage to mankind is concerned.

Article 311 is thus a complex provision, which combines many of the elements of conflict clauses discussed in the previous section. While the first two paragraphs establish priority in relation to previous treaties, paragraphs 3 to 5 relate to *lex specialis* and *inter se* agreements. Paragraph 6 is a suppression clause. The instructions for application in relation to other treaties are articulated in two instructions. Firstly, that in cases of contention in relation to a prior treaty, *lex anterior* only applies if it effectively does not conflict with UNCLOS. Secondly, that *lex specilis* has precedence in the cases where UNCLOS provides for the elaboration of more detailed rules in specific treaties. These two rules may be helpful in relation to prior treaties and specialized instruments within the law of the sea, but provide little guidance in conflict with subsequent treaties, as is the case with the conflict in relation to CBD and TRIPS. Since no instruction is provided for application in such cases, the guidance provided by UNCLOS for solving norm conflicts in relation to other treaties in line with paragraph 2 of Article 30 of the Vienna Convention is limited.[1170] Rather, the lack thereof is a signal of the position the drafters of UNCLOS wanted to endow the convention with: The status as the overriding framework for regulating all uses of the sea, as is also expressed in its preamble.

[1170] Alan E. Boyle, The making of international law (Christine Chinkin ed., Oxford : Oxford University Press. 2007), at 256-260.

The lack of references to the relationship between UNCLOS and treaties of other regimes of international law should thus not be regarded as coincidental. Rather, it makes clear that to the extent that other treaties overlap with UNCLOS, those other obligations will have to stand aside when conflicts arise.

However, paragraph 5 provides an important exception, which is of particular interest in the case of deep-sea bioprospecting. The suppression clause contained therein provides detailed instructions for one particular type of conflict. Preventing its parties from entering into any amendment to the principle of common heritage of mankind, it relates directly to the heart of the conflict relating to deep-sea bioprospecting. If this obligation is to be respected, parties to UNCLOS are prevented from entering into other treaties, to the extent that they contain obligations which affect the principle of common heritage of mankind as regulated in UNCLOS. Under Part C.1, it was concluded that it would be difficult to interpret the principle as not encompassing deep-sea bioprospecting, at least to the extent that such activities are conducted in relation to organisms on the seabed. Moreover, as established in section E.1, the contentions to which this gives rise in relation to CBD and TRIPS ought to be regarded as a treaty conflict. Accordingly, under this interpretation, the parties to UNCLOS violated the obligation in Article 311(5) in this regard by entering into CBD and TRIPS, and the common heritage of mankind principle in its original form should remain applicable, without being circumscribed by possibilities for appropriation by means of patenting.

E.5.4. Conclusion

It has now been discussed how the rules on treaty application relate to treaty conflicts generally, as well as in the particular context of deep-sea bioprospecting. It has first been established that there are arguments for rejecting a restrictive interpretation of the scope of Article 30 of the Vienna Convention. As a result, it would be possible to use the rules on treaty application also in conflicts between treaties in different regimes. This would, however, require that there is not merely a material conflict of treaties, but that relevant states are party to treaties involved. Since state parties may vary considerably across treaties, this subjective element can be decisive in issues of application. The conflicting treaties must also apply to the relevant parties at the same time. The temporal element is particularly relevant in establishing chronology in the setting up of hierarchies under application rules since the

Vienna Convention suggests *lex posterior* as the general rule for application in treaty conflicts. Yet, in practical cases, such as deep-sea bioprospecting, this approach would yield rigid consequences.

If the subjective element is considered in applying *lex posterior*, as would be advisable considering that priority otherwise would be based merely on theoretical conflict, it would be most appropriate to base the chronology on when states became party to the relevant treaties. The resulting order would however differ significantly across states. This could create considerable problems in treaty conflicts involving states that have ratified relevant treaties in different orders, as in the case of deep-sea bioprospecting. Moreover, there is no indication that states in this case foresaw or intended that obligations in the other relevant treaties would become undermined when deciding in what order to ratify or accede to treaties involved.

Establishing applicable treaty based on *lex posterior* would not result in less rigid consequences if the subjective element were set aside and priority were based merely on entry into force or date of adoption. This would result in complete suppression of relevant obligations in both CBD and UNCLOS in favor of TRIPS, even though all three treaties entered into force during a short period of three years 1993–1995.

Accordingly, it is suggested that in cases of conflict between treaties in different regimes, *lex posterior* ought to be applied less categorically. A more pragmatic approach to application in such treaty conflicts would be to seek for instructions by parties on how the treaty should be applied in cases of conflict. Under the exception to *lex posterior* in Article 30(2), such conflict clauses may under treaty law take precedence over *lex posterior.* Conflict clauses may come in different forms and may have different functions. There are strong arguments in favor of interpreting such clauses pragmatically, based on the assumption that state parties strive for a functioning relationship with other instruments. An outer limit of what can be regarded as conflict clauses is, however, set by the requirement in the Vienna Convention that only formal treaty provisions can be regarded as conflict clauses. Conflict clauses must thus be formal instructions in treaties on the relation to other instruments. Neither subjective interpretations of perceived or implicit intentions, nor judicial procedures for deciding issues of application thus qualify as conflict clauses under Article 30 of the Vienna Convention in a formal sense.

All three treaties in the present investigation contain explicit conflict clauses. However, as is often the case with conflict clauses, the instruction provided is of limited value in many practical cases. As regards the inconsistencies between UNCLOS, CBD and TRIPS in the case of deep-sea bioprospecting, relevant conflict clauses of the three treaties yield contradictory results. In UNCLOS, priority was claimed not only in relation to prior treaties, but also as regards future treaties, to the extent such undertakings affected the common heritage of mankind principle. This would effectively thwart the regulation of patentable subject matter of TRIPS to the extent that it conflicts with deep-sea genetic resources, which is most evident regarding deep-seabed micro-organisms. In the CBD, the conflict clause in relation to UNCLOS was generally considered submissive as regards rights and obligations of UNCLOS. This would include many though not necessarily all of the elements of regulation relating to deep-sea bioprospecting. In relation to prior treaties generally, the CBD similarly let those take precedence, save for cases where the core interest of CBD would be impeded or where it would cause a serious damage or threat to biological diversity. It is difficult to ascertain whether deep-sea bioprospecting would qualify for this criterion. As discussed in Parts B and C, it is not unlikely that in some cases, limited sampling operations aiming to serve as the basis for patenting under TRIPS could also represent such risks. At first sight, it thus appears that there is a legal basis in CBD for claiming that it could take precedence over TRIPS. However, the conflict clause in CBD is limited to relations to pre-existing treaties. Since TRIPS was both adopted and entered into force subsequent to the CBD, the provision is arguably inapplicable in that relationship.

In TRIPS as well as the other WTO treaties, conflict clauses in the sense of Article 30 of the Vienna Convention are, for relevant purposes, lacking. Counterintuitively, this lack of conflict clauses, under the Vienna Convention application rules, would result in priority of TRIPS over the other two treaties investigated in this case, since Article 30 provides that resort should be made to *lex posterior* in cases where conflict clauses are lacking. If the Vienna Convention definition of conflict clauses, however, is set aside, and the matter is instead approached from the perspective of WTO jurisprudence, the result could be the contrary, in line with the tendency in WTO dispute settlement to avoid conflict in relation to treaties in other regimes.

In sum, the use of the treaty application principles expressed in Article 30 of the Vienna Convention would give preference to both UNCLOS (by virtue of its conflict clause) and TRIPS (by virtue of *lex posterior*, save for states that became party to CBD or UNCLOS subsequently, in line with the subjective element), but not to the CBD even in cases of serious damage or threat to biodiversity.

It can thus be concluded that treaty application rules generally represent potentially helpful tools in solving treaty conflicts, also in cases with conflicts across regime boundaries. Where clearly expressed, conflict clauses appear to have a particular potential to clarify the hierarchies of treaty obligations in cases of irreconcilable conflict. In the case of deep-sea bioprospecting, however, the solutions to conflict suggested by the rules of application in the Vienna Convention would yield contradictory results.

Whereas this settles the analysis of how the treaty law rules on application solve treaty conflicts by establishing priority between the treaties involved, it remains to be discussed how the rules on treaty interpretation apply to treaty conflicts. The general rule of interpretation in Article 31 addresses the matter differently, attempting to prevent the conflict from arising by addressing the interpretation as such generally, rather than the relationship between or hierarchies of the treaties specifically. In other words, whereas the above discussion concerned how to apply treaties in cases of conflict, the next section will focus on how approaches of interpretation can be used to read the same *prima facie* conflicting treaty provisions harmoniously, and thus prevent the conflict.

E.6. Resolving norm conflicts by means of treaty interpretation

Treaty application rules are not the only way to address issues of regime conflict. Whereas these principles would be the primary option for solving treaty conflict, treaty law also provides a second approach to such problems: To regard inconsistencies across treaties not as problems of application but as problems of interpretation.

Compared to approaching inconsistencies across treaties under the principles of treaty application, addressing such problems by the rules of interpretation implies a different perspective. Where treaty application principles start out from the relationship between different treaties, as expressed in conflict clauses where such exist, the interpretative approach focuses on specific commitments, and calls for an interpretation which can coexist and function alongside obligations in other treaties.[1171]

From a systemic standpoint, both the perspective of application and that of interpretation function as means to ensure the integrity of public international law as a functioning system. In fact, as discussed in section A.6, the systemic argument would claim that the objective to remain coherent is inherent to public international law. However, the approaches suggested by the two perspectives are different, as regards presumption as well as target for the analytical operation.

Regarding treaty conflict as an issue of application implies *a priori* accepting the material treaty conflict. But rather than capitulating before the problem, effort is focused on how the conflicting obligations can be applied in concert to the extent that this is possible, and otherwise how priority should be established between obligations. From a treaty interpretation perspective, the *prima facie* conflict is not *a priori* accepted. Instead, treaty interpretation rules are used to prevent conflict. As already discussed, the International Law Commission Report on Fragmentation contends that this possibility of interpreting obligations in a manner which prevents conflict is not just an option under the rules of interpretation, but an obligation.[1172] The ILC Study Group puts much emphasis on the possibility of using harmonizing treaty interpretation principles to prevent treaty conflict, and in particular considers the principle of systemic integration, which will be further discussed below, as a “master key” to the house of international law, which makes the system function coherently.[1173]

[1171] Borgen, The George Washington International Law Review (2005); Michaels & Pauwelyn, Duke Journal of Comparative & International Law (2012).

[1172] Koskenniemi, Fragmentation of International Law: Difficulties Arising from the Diversification and Expansion of International Law - Draft conclusions of the work of the Study Group Finalized by Martti Koskenniemi. 2006., para. 43, at 15.

[1173] Koskenniemi, Fragmentation of International Law - Report of the Study Group of the International Law Commission. 2006., para. 420, at 211.

What the ILC Study Group puts less weight on in its report is that even if harmonious interpretation is a rhetorically satisfactorily argument for defending the integrity of international law as a functioning system, it is in many (if not most) practical cases of norm overlap far from easy to maintain credible harmonious interpretations. To functionally interpret obligations harmoniously implies an attempt to focus on potential common ground in areas of contention while maintaining the material content of relevant obligations. The interpretive approach to treaty conflict thus attempts to navigate as far as possible within the linguistically maneuverable course provided by conflicting provisions. This endeavor may be complicated. Needless to say, the difficulty increases with the level of divergence between the relevant provisions. For the operation to be successful, at least some area of commonality is required. Logically, the difficulty of the exercise also correlates with the degree of specificity in the language of relevant provisions. Regularly, however, it is assumed, the commonly general language of international law treaties provides a considerable degree of discretion in interpretation. But the possibility to use treaty interpretation rules to prevent conflict is not limitless. The interpretation tools reflected in Part III Section III of the Vienna Convention can only be employed to address conflicts if the respective colliding provisions are unclear or vague in some respect. Moreover, as stated by Wolfrum, if the states parties to an agreement willfully establish provisions that collide with other agreements and express their intention in clear, unambiguous wording, interpretation cannot be used to conciliate the conflict, since this would go against the intention of the parties.[1174]

Striving to establish harmonizing solutions based on treaty interpretation rules thus does not require any specific form of analysis, but uses standard rules of treaty interpretation, as expressed in Part III Section III of the Vienna Convention, primarily in Article 31 but also Articles 32 and 33. What is significant with treaty interpretation under the harmonizing approach is that it indicates a direction of interpretation that seeks out common ground and thereby promotes harmonization. By striving to find an interpretation which facilitates coherence, it can fairly be accused of not being objective.

[1174] Wolfrum & Matz, MAX PLANCK YEARBOOK OF UNITED NATIONS LAW (2000), at 474.

A major difference from the use of conflict clauses, *lex posterior* and the other, more categorical rules on application of treaties in Article 30 is that the use of interpretation principles does not aim to establish strict hierarchies and the disapplication of rules of either treaty. Instead, the interpretive perspective of apparent treaty inconsistencies uses a relatively soft approach in order to coordinate agreements.[1175] In other words, approaches of application take conflicting obligations as a starting point, whereas treaty interpretation tools are used to prevent conflict.[1176]

Accordingly, it may not be necessary to choose between the two approaches or regard them as conflicting. If coherence can be achieved by employing the treaty interpretation rules under Articles 31–33, the treaty conflict does not arise and the stricter rules on priority in Article 30 do not have to be invoked. There are thereby also practical arguments for attempting to use the softer harmonizing approach before resorting to the rules for application as means to address the treaty conflict. In the following sections, it will be evaluated how treaty interpretation principles can be used to prevent treaty conflict generally, as well as in the specific case of deep-sea bioprospecting. By using this example, the predictions of the ILC Study Group and other observers on the possibility of using treaty interpretation principles generally and the capability of the principle of harmonization in particular to preserve the coherence of international law will be tested.

E.6.1. The general rule of treaty interpretation and treaty conflict

In addition to the principles of treaty application, the general rule of interpretation in Article 31 of the Vienna Convention also provides rules relevant for addressing cases of norm conflict. Foremost, it establishes that treaties are to be interpreted in good faith and in light of their context, object and purpose. In addition, subsequent agreement or practice in the interpretation should be taken into account, as well as any relevant rules of international law applicable in the relations between the parties.

[1175] WOLFRUM & MATZ, Conflicts in International Environmental Law. 2003, at 133.
[1176] Michaels & Pauwelyn, DUKE JOURNAL OF COMPARATIVE & INTERNATIONAL LAW (2012).

Vienna Convention on the Law of Treaties Article 31
General rule of interpretation
1. A treaty shall be interpreted in good faith in accordance with the ordinary meaning to be given to the terms of the treaty in their context and in the light of its object and purpose.
2. The context for the purpose of the interpretation of a treaty shall comprise, in addition to the text, including its preamble and annexes:
(a) any agreement relating to the treaty which was made between all the parties in connection with the conclusion of the treaty; (b) any instrument which was made by one or more parties in connection with the conclusion of the treaty and accepted by the other parties as an instrument related to the treaty.
3. There shall be taken into account, together with the context:
(a) any subsequent agreement between the parties regarding the interpretation of the treaty or the application of its provisions; (b) any subsequent practice in the application of the treaty which establishes the agreement of the parties regarding its interpretation; (c) any relevant rules of international law applicable in the relations between the parties.
4. A special meaning shall be given to a term if it is established that the parties so intended.

In particular, the last point, referred to as the principle of systemic integration, provides a resort in difficult cases of contention between treaties. As expressed by the ILC Study Group, in case there is a systemic problem – an inconsistency, a conflict, an overlap between two or more norms – and no other interpretative means provides a resolution, then recourse may always be made to interpreting the conflicting norm in light of any relevant rules of international law applicable in the relations between the parties as provided in Article 31(3)(c) in order to proceed in a reasoned way.[1177] As discussed in Part D, each institution tends to favor the objectives of its own regime. In much of the academic debate on fragmentation, supporters of the systemic position have argued that the principle of systemic integration still ensures coherence in the end. This is rarely supported by evidence. Rather, systemic integration is expected to prevent fragmentation because theory says it should do so. This was essentially the ultimate message in the ILC Study Group Report, which concluded its discussion on a relatively positive note: Despite fragmentation, systemic integration will save the day for public international law.

[1177] Id. at 211.

In the final paragraph of the draft conclusions of the ILC Study Group Report, this was also expressed as a general responsibility for actors in the international system:

> *Irrespective of the special status or the designation ("fundamental") enjoyed by some norms, conflicts between rules of international law should be resolved in accordance with the principle of harmonization, that is, by bearing in mind that in the event of a conflict, the norms should be interpreted as compatible to the extent possible.*[1178]

Even if regimes of international law will have different ethos, purposes and rationales, as also admitted by the ILC[1179], it is thus claimed that they will work in concert because there are treaty interpretation rules ensuring coherence and it is a responsibility to interpret norms as compatible. In the following, the function of treaty interpretation rules in addressing norm conflicts will be discussed, and the validity of the suggestions by the International Law Commission tested.

E.6.1.1. Interpretation in good faith and ordinary meaning

Based on Article 31, the primary obligation in treaty interpretation is to establish what an interpretation in good faith provides, as well as the ordinary meaning of the relevant terms. Context as well as object and purpose are also clearly important. Taken together, this adds up to four elements: firstly, the obligation to undertake the interpretation in good faith; secondly, the importance of the ordinary meaning rule; thirdly, the relevance of the treaty's context; and fourthly, the implications of the object and purpose of the treaty.[1180] Among these four elements, interpretation in good faith appears to be the central element, or indeed the purpose of treaty interpretation exercises. In relation to this requisite, the other three elements appear to be assisting, supportive or guiding criteria.

[1178] Koskenniemi, Fragmentation of International Law: Difficulties Arising from the Diversification and Expansion of International Law - Draft conclusions of the work of the Study Group Finalized by Martti Koskenniemi. 2006., para. 43, at 15.
[1179] See id. at para. 13, at 7 as further discussed in Part D.
[1180] Isabelle Van Damme, *Treaty Interpretation by the WTO Appellate Body*, 21 EUROPEAN JOURNAL OF INTERNATIONAL LAW (2010), at 631.

The obligation to interpret a treaty in good faith, as well as the general rule of treaty interpretation generally, has been explained as a logical consequence of *pacta sunt servanda*, as expressed in Article 26 of the Vienna Convention. Accordingly, the reference to object and purpose has been regarded by Wolfrum as an explicit call for teleological interpretation: Interpreting treaty provisions should be no more difficult than establishing what the parties jointly intended.[1181] This call for basing interpretation on the common will of parties, however, has considerable shortcomings. Foremost, it is often difficult to read treaty obligations as expressions of commonly shared intentions. Rather, the material content of treaties can be regarded as the result of trade-offs in negotiations between different positions. The text of provisions is also often intentionally left vague in order to facilitate different interpretations. Treaty interpretation is therefore regularly challenging and teleological interpretation may be problematic.

The obligation to interpret treaties in good faith is also closely connected to the *bona fides* principle. This principle is often regarded as the fundament for *pacta sunt servanda*. For states, *bona fides* implies that "*their will must produce the effects it has openly sought, and they must be considered effectively bound, in accordance with their declarations*."[1182] However, it "*means more than simply bona fides in the absence of mala fides, or rejection of an interpretation resulting in abuse of rights (…) It signifies an element of reasonableness qualifying the dogmatism that can result from purely verbal analysis.*"[1183] The obligation to interpret in good faith has also been defined as a baseline structure of international treaty law aimed to underpin and effectuate the universally recognized principle that parties should fulfill obligations, as expressed and declared in the treaty and that failure to do so represents a breach.[1184] Moreover, the approach to treaty interpretation suggested in paragraph 1 underlines that it is the ordinary meaning, hence the objective meaning, of the text that is to be clarified.

[1181] WOLFRUM & MATZ, Conflicts in International Environmental Law. 2003, at 134-135.
[1182] Michel Virally, *Review Essay: Good Faith in Public International Law*, 77 THE AMERICAN JOURNAL OF INTERNATIONAL LAW (1983); JOHN O'CONNOR, THE PRINCIPLE OF GOOD FAITH IN LEGAL THEORY (WITH PARTICULAR REFERENCE TO PUBLIC INTERNATIONAL LAW) (ProQuest Dissertations Publishing. 1987).
[1183] RICHARD K. GARDINER, TREATY INTERPRETATION (Oxford : Oxford University Press 2nd rev. edition. ed. 2015), at 171.
[1184] Markus Kotzur, Good Faith (Bona fide) (Rüdiger Wolfrum ed., Oxford University Press)

Paragraph 1 of Article 31 is thus based on the assumption that the text of the treaty is the authentic expression of the intentions of the parties.[1185]

It thus follows that in the interpretation of treaty provision terms which are contentious in relation to other instruments, an interpretation cannot be established that deviates from the intention of the parties, as expressed in the treaty. However, as will be discussed, interpretation can vary considerably without going against good faith and ordinary meaning.

E.6.1.2. Interpretation based on the object and purpose of treaties

Among the supportive elements of Article 31, the exercise of establishing the object and purpose is often determinative. Under conventional interpretation, "*object and purpose*" appears to be regarded as a singular concept, even if, strictly speaking, the "object" is about what the treaty covers and the "purpose" is about why the treaty covers an issue.[1186] It is also clear that the object and purpose is not considered independently of other means of interpretation.[1187] The object and purpose should be considered in relation to conventional language ("*the ordinary meaning*").[1188]

Different considerations are possible when undertaking an assessment of the object and purpose of a treaty in the treaty interpretation context.[1189]

[1185] WOLFRUM & MATZ, Conflicts in International Environmental Law. 2003, at 135.
[1186] Benn McGrady, *Fragmentation of International Law or "Systemic Integration" of Treaty Regimes: EC-Biotech Products and the Proper Interpretation of Article 31(3)(c) of the Vienna Convention on the Law of Treaties*, 42 JOURNAL OF WORLD TRADE (2008).
[1187] BJORGE. 2014, at 58.
[1188] ULF LINDERFALK, ON THE INTERPRETATION OF TREATIES: THE MODERN INTERNATIONAL LAW AS EXPRESSED IN THE 1969 VIENNA CONVENTION ON THE LAW OF TREATIES § 83 (Springer Netherlands, Dordrecht. 2007), at 203.
[1189] Among the great number of authors having dealt with the matter, see especially AUST. 2000; Isabelle Buffard & Karl Zemanek, *The "Object and Purpose" of a Treaty: An Enigma*, 3 AUSTRIAN REVIEW OF INTERNATIONAL & EUROPEAN LAW (1998); Jan Klabbers, *Some Problems Regarding the Object and Propose of Treaties*, *in* FINNISH YEARBOOK OF INTERNATIONAL LAW (Martti Koskenniemi & Kari Takamaa eds., 1998); Ulf Linderfalk, *On the Meaning of the 'Object and Purpose' Criterion, in the Context of the Vienna Convention on the Law of Treaties, Article 19*, 72 NORDIC JOURNAL OF INTERNATIONAL LAW (2003); Belinda Clark, *The Vienna Convention Reservations Regime and the Convention on Discrimination Against Women*, 85 THE AMERICAN JOURNAL OF INTERNATIONAL LAW, pp. 281-321 (1991).

The ICJ has stated that the purpose of treaty interpretation is not to revise treaties or to read into the text of treaties issues that they do not explicitly address or that cannot be drawn out of a reasonable understanding of the text.[1190]

However, this leaves many questions unanswered. A first question is what ought to be the legal material subject for the interpretation in this regard: Is it the object and purpose of the conflicting treaty provision that is relevant, or is it more appropriate to investigate the general object and purpose of the treaty containing the conflicting provision? [1191] As noted by Linderfalk, "*'the object and purpose' of a treaty means those reasons for which the treaty exists – sometimes termed as the ratio legis or the treaty's raison d'être*."[1192] It is thus clear that it is general purpose of the treaty which should be considered, and the analysis should not be confined to the individual provision. This distinction is important since the overriding object and purpose of a treaty may differ significantly from the object and purpose of individual provisions. Framework conventions in particular, but more specific treaties too, may contain a broad range of obligations, some more mainstream or closer to the core of the treaty than others. Rather than expressing the general object and purpose of the treaty, individual provisions can express partial objectives. Limiting the analysis to the conflicting provisions risks blinkering the interpretation, resulting in the exaggeration of discrepancies in relation to other agreements. It can be assumed that in many cases, consideration of the purpose of the treaty provides indication of what interpretations are possible, and what potential readings can be ruled out due to incompatibility with the purpose. The overriding object and purpose of treaties can thereby be a supplement to the ordinary language of the individual provision, providing clearer guideline for harmonizing interpretation of different agreements.[1193]

[1190] See Interpretation of Peace Treaties with Bulgaria, Hungary and Romania, ICJ Reports (1950). 229; Case Concerning Rights of Nationals of the United States of America in Morocco, ICJ Reports (1952), 196; Certain expenses of the United Nations Case, ICJ Reports (1962), 159; South West Africa Cases (Second Phase), ICJ Reports (1966), 48 as cited in WOLFRUM & MATZ, Conflicts in International Environmental Law. 2003, at 134-135.

[1191] Klabbers, Some Problems Regarding the Object and Propose of Treaties. 1998.

[1192] LINDERFALK, On The Interpretation of Treaties: The Modern International Law as Expressed in the 1969 Vienna Convention on the Law of Treaties. 2007, at 204.

[1193] WOLFRUM & MATZ, Conflicts in International Environmental Law. 2003, at 134-136.

A second question concerns what perspective to apply in assessing the object and purpose; observers as well as states may have different understandings of the reasons for a treaty. According to Linderfalk, the term denotes a subjective teleological perspective, reflecting the purpose conferred on the law by the original lawmaker; the object and purpose the parties to the treaty mutually intended.[1194]

The challenges with applying this rule of interpretation do however not end with establishing what is implied by object and purpose under Article 31. Similar to the meaning of individual provisions, the object and purpose of treaties generally can be ambiguous or not clearly articulated. In other cases, the purpose may be complex, including a broad range of objectives. In environmental treaties, objectives are regularly expressed in general terms, such as the promotion of sustainable development or protection of environment. Using such objectives, which are common to most modern environmental treaties, as the basis for treaty interpretation that seeks to harmonize conflicting norms runs the risk of bringing about the contrary problem, namely that the common denominator is too broad to be useful.

In certain treaties, the object and purpose are explicitly stated in preambles or opening provisions. In others, the object appears to be more ambiguous.[1195] Whereas the former is the case with TRIPS and CBD, as discussed in Part D, UNCLOS appears to be less precise in this regard. Moreover, under the subjective teleological perspective there is reason for considering that object and purpose should not be interpreted solely based on explicit textual provisions, but should take into account broader rationales and logics underpinning treaties, as similarly discussed in Part D. Indeed, finding the "object and purpose" has been described as a matter of "extracting the 'essence,' the overall 'mission' of the treaty."[1196]

[1194] The subjective teleological interpretation can be distinguished from objective teleological interpretation, reflecting the views of the legal community or people in general. LINDERFALK, On The Interpretation of Treaties: The Modern International Law as Expressed in the 1969 Vienna Convention on the Law of Treaties. 2007, 204-205.

[1195] Borgen, THE GEORGE WASHINGTON INTERNATIONAL LAW REVIEW (2005).

[1196] David S. Jonas & Thomas N. Saunders, *The object and purpose of a treaty: three interpretive methods*, 43 VANDERBILT JOURNAL OF TRANSNATIONAL LAW (2010)

In sum, in cases of potential treaty conflicts, there is thus reason to conduct interpretation of contentious provisions in line with the overriding aim of the interpreted treaty, rather than individual provisions. It is also clear that the appropriate perspective to apply in this regard is that of the parties to the treaty, the relevant object and purpose is what they mutually intended.

This may be helpful in promoting a harmonizing reading, but it can also prevent such attempts. Even if a contentious provision viewed in isolation can be interpreted so as to prevent conflict with other treaties, such a reading would not be in line with paragraph 1 if it goes against the object and purpose of the treaty.

E.6.1.3 Contextual interpretation and the principle of systemic integration

How, then, should the *context* of the relevant obligations be approached in potential treaty conflicts? This element appears to be determinative in many cases. Paragraph 2 of Article 31 addresses what ought to be regarded as the context for the purpose of the interpretation, as regulated in paragraph 1, in addition to the text, including its preamble and annexes.[1197] It is important to note that similar to *object and purpose*, context should not be considered independently of other interpretative approaches.[1198] Rather, context should be considered as a second step in the interpretative process, subsequent and in relation to conventional language.[1199]

Firstly, context should include text of other parts of the same treaty, including preamble and annexes (paragraph 1). It goes without saying that ambiguous provisions should be interpreted in light of other parts of the same treaty. Secondly, agreements and instruments *related to* or *made in connection with the conclusion of* the treaty (which is being interpreted), should according to paragraph 2(a–b) be considered as part of the "*context for the purpose of the interpretation*" (insofar as it has at least been accepted by the parties as an instrument related to the treaty).[1200]

[1197] GARDINER. 2015.
[1198] BJORGE. 2014, at 58.
[1199] LINDERFALK, On The Interpretation of Treaties: The Modern International Law as Expressed in the 1969 Vienna Convention on the Law of Treaties. 2007, at 102.
[1200] VILLIGER, Commentary on the 1969 Vienna Convention on the Law of Treaties. 2009;VILLIGER. 2011.

In at least one of the regimes examined, this is relevant: As previously mentioned, TRIPS was not negotiated in isolation, but as a part of the broader Uruguay round of WTO agreements[1201], which among other agreements comprises the Marrakech Agreement establishing the World Trade Organization.[1202] Formally, the other treaties of the Uruguay round are annexes to the Marrakech Agreement. This connection has important implications, which will be further explored below.

Paragraph 3 of Article 31 of the Vienna Convention seems to open the door to an even broader perspective of context – and hence a more transformative interpretation of relevant obligations. In essence, the paragraph supports the contention that obligations should be interpreted in light of other relevant rules of international law.[1203]

Firstly, paragraph 3(a) establishes that together with the context, any subsequent agreement between the parties regarding the interpretation of the treaty or the application of its provisions should be taken into account. At first glance, this may appear relevant in the context of several treaties within the same regime of international law regulating the same issue. In all three regimes examined in this investigation, there are such connecting agreements which could be considered as developing the interpretation of the treaties. As discussed in Part A, the UNFSA and the Nagoya Protocol are explicitly referred to as implementing agreements and appear to have almost identical connections in this regard. Both are closely connected to their framework conventions, UNCLOS and the CBD respectively. Although TRIPS can hardly be regarded as having the same relationship to other treaties, it is, as already stated, clearly part of the broader family of WTO law. Perhaps counterintuitively, in spite of the close institutional relationships, such cases of treaties part of the same family of agreements or regimes of international law fall outside of the scope of the Paragraph 3(a).

[1201] For a comprehensive collection of the outcome of the round, see THE WTO AGREEMENTS - THE MARRAKESH AGREEMENT ESTABLISHING THE WORLD TRADE ORGANIZATION AND ITS ANNEXES (2017). A comprehensive commentary has been compiled by TERENCE P. STEWART, THE GATT URUGUAY ROUND : A NEGOTIATING HISTORY (1986-1992). 1, COMMENTARY (Deventer : Kluwer. 1993).
[1202] WTO Agreement: Marrakesh Agreement Establishing the World Trade Organization, Apr. 15, 1994, 1867 U.N.T.S. 154, 33 I.L.M. 1144 (1994).
[1203] Jonas & Saunders, VANDERBILT JOURNAL OF TRANSNATIONAL LAW (2010);GARDINER. 2015.

This is because for an agreement to qualify for paragraph 3(a), all parties to the interpreted treaty must be parties to the agreement indicating its meaning. This strict application of the subjective criterion disqualifies most relations between treaties from the scope of paragraph 3(a). No matter how close the material kinship is between a treaty and a subsequent agreement, the latter cannot be considered as guiding the interpretation of the former unless the same states are parties. If the requirement of subjective overlap is to be interpreted strictly, the formal requirement for the agreement guiding the interpretation is loser. There appears to be no requirement with regard to form of the agreement. States must however have had the intention to create law.[1204] Consequently, it appears that paragraph 3(a) primarily is aimed to regulate situations where the same group of states first have concluded a treaty, then realized that a provision is ambiguous and clarified it. The provision thus appears to lack relevance for the relationships between the treaties investigated in this study.

Paragraph 3(b) makes clear that subsequent *practice* in the application of the treaty which establishes the agreement of the parties regarding its interpretation similarly is relevant when interpreting treaties, together with the context. All states applying a treaty could be regarded as creators of practice in this context, and practice does not have to be positive actions.[1205] Practice may also be represented by omissions.[1206] As discussed in previous parts, deep-sea bioprospecting is a new activity, and practical application of treaty provisions relating to deep-sea bioprospecting is so far limited. It seems that in most cases, relevant conduct, such as granting patents connected to deep-sea genetic resources, has been carried out without considering the international legal implications. Linderfalk appears to consider that more direct reference to the relevant obligations or treaties is necessary for an act to represent practice in the meaning of paragraph 3(b). He mentions formal references to the relevant obligations, invoking a provision in a legal dispute, to support a position in a diplomatic conference or referring to it in official communication as examples

[1204] LINDERFALK, On The Interpretation of Treaties: The Modern International Law as Expressed in the 1969 Vienna Convention on the Law of Treaties (2007), at 162-163.
[1205] Oliver Dörr & Kirsten Schmalenbach, *Article 31. General rule of interpretation*, *in* VIENNA CONVENTION ON THE LAW OF TREATIES: A COMMENTARY (Oliver Dörr & Kirsten Schmalenbach eds., 2012), at 76-89.
[1206] VILLIGER, Commentary on the 1969 Vienna Convention on the Law of Treaties. 2009; LINDERFALK, *On The Interpretation of Treaties: The Modern International Law as Expressed in the 1969 Vienna Convention on the Law of Treaties* (2007), at 162-163.

of relevant actions.[1207] Under these requisites, many of the declarations by states in the lively debate on the relevant legal rules for marine genetic resources in the BBNJ-process would however qualify. Similarly, as also discussed in Part C, many states have expressed how they interpret the patentability criteria of TRIPS. Others have adopted national legislation referring to the relevant treaties. Even if all of these activities could be considered relevant for purposes of paragraph 3(b), they fall short of creating practice on interpretation of the relevant provisions. This is because they express different positions. For a practice on interpretation to develop under paragraph 3(b), it must establish agreement.[1208] Such a uniform interpretation of the provisions relating to deep-sea bioprospecting is highly unlikely to develop.

Last but certainly not least, paragraph 3(c) opens a multitude of new reference points by stating that in treaty interpretation, such rules *applicable in the relations between the parties* should be taken into account together with the context. In essence, Article 31 thus contains an element that is similar to the problematic heading of Article 30, as discussed under section E.5.1. What, then, are considered rules *applicable in the relations between the parties*? Should the criterion in paragraph 3(c) be interpreted liberally, akin to what was established in the discussion on the heading of Article 30?

As previously discussed in section E.5.1, *the applicable in between the parties* criterion has traditionally been interpreted as implying rules binding on all the parties to the treaty at issue.[1209] Although ITLOS in *Bluefin Tuna* as well as the Appellate Body in the *US-Shrimp* case had made more liberal use of references to other treaties (also to treaties where the lists of parties were not overlapping in the latter case), the view requiring full parallelism[1210] of parties has been considered to have gained support in the ruling of the WTO panel in *EC-Approval and Marketing of Biotech Products*.

[1207] LINDERFALK, On The Interpretation of Treaties: The Modern International Law as Expressed in the 1969 Vienna Convention on the Law of Treaties (2007), at 166-167.
[1208] Dörr & Schmalenbach. 2012, at 76-89.
[1209] VILLIGER, Commentary on the 1969 Vienna Convention on the Law of Treaties. 2009; LINDERFALK, On The Interpretation of Treaties: The Modern International Law as Expressed in the 1969 Vienna Convention on the Law of Treaties. 2007, at 178.
[1210] The notion that a treaty norm can only be taken into account as an interpretative guideline in a dispute when all parties to that dispute—or even all parties to the WTO Agreement which must be interpreted—have ratified that other treaty.

As observed by Peters, under the restrictive reading of the requirement for parallelism applied in *EC-Biotech*, Article 31(3) would however be rendered largely meaningless.[1211] Indeed, it could also be claimed that *the applicable in between the parties* criterion rather ought to be read as rules binding for the parties to the relevant dispute. This position was supported by the ILC Study Group in the Fragmentation report and has become recognized by an increasing group of observers.[1212] This represents a dispute-based perspective of interpretation, where the principle expressed in paragraph 31(c) is not regarded as an abstract way of solving issues of interpretation, but rather as a way of establishing the valid interpretation in cases where two or more states have conflicting views. The contentious provision, according to this understanding, should then be interpreted in light of other treaties applicable between the parties to the dispute.[1213] Although this view at first glance may appear difficult to reconcile with the ruling in *EC-Biotech*, it is fully compatible with the use of other treaties in the analysis of ITLOS in the *Bluefin Tuna* case as well as that of the Appellate Body in *US-Shrimp* (as similarly discussed in section E.5.2). Moreover, despite the restrictive approach to the "*applicable in relations between the parties*" element applied in *EC-Biotech*, the Panel also noted that even if there is no obligation to take other agreements into account, such considerations could nevertheless be made by using other treaties as references when interpreting "ordinary meaning" of terms, in light of their object and purpose, under paragraphs 1–2. The other agreement would thus not be referenced as a legally binding rule, but rather for being linguistically informative.[1214]

[1211] Essentially, if a complete parallelism of parties is required it would in most cases treaties would be non-usable for the interpretation of treaties with a broad membership, such as the WTO Agreement (which, moreover, has also non-state members which cannot accede to most other international treaties). The narrow reading would in addition have the paradoxical result that the more universal a treaty is, the smaller the chance that it could "meet" other treaties would be. Peters, INTERNATIONAL JOURNAL OF CONSTITUTIONAL LAW (2017).

[1212] Koskenniemi, Fragmentation of International Law - Report of the Study Group of the International Law Commission. 2006., at 237; McLachlan, INTERNATIONAL AND COMPARATIVE LAW QUARTERLY (2005); PAUWELYN, Conflict of Norms in Public International Law: How WTO Law Relates to Other Rules of International Law. 2003, at 261; Marceau, JOURNAL OF WORLD TRADE (2001), at 1087; Duncan French, *Treaty Interpretation And The Incorporation Of Extraneous Legal Rules*, 55 INTERNATIONAL AND COMPARATIVE LAW QUARTERLY (2006), at 305-307.

[1213] McGrady, JOURNAL OF WORLD TRADE (2008).

[1214] As declared by the Panel in paragraphs 7.92-93: "*We think that, in addition to dictionaries, other relevant rules of international law may in some cases aid a treaty interpreter in establishing, or confirming, the ordinary meaning of treaty terms in the specific context in which they are used. Such rules would not be considered because they are legal rules, but rather because they may provide evidence of the ordinary meaning of terms in the same way that dictionaries do. They would be considered for their informative character. It follows that when a treaty interpreter does not consider another rule of international law to be informative, he or she need not rely on it. In the light of the foregoing, we consider that a panel may consider other relevant rules of international law when interpreting the terms of WTO agreements if it deems such rules to be informative. But a panel need not necessarily rely on other rules of international law*.", Panel Reports, European Communities – Measures Affecting the Approval and Marketing of Biotech Products.

As explained in the ruling, interpretation in good faith requires choosing the interpretation that is "*more in accord with other applicable rules of international law*."[1215] Although it is difficult to dispute that the Panel took a generally restrictive approach to the *applicable in the relations between the parties* criterion, this part of the finding has been regarded as a somewhat paradoxical opening to harmonious interpretation, at least insofar as other treaties are used as reference points.[1216] Essentially, it appears that the Panel in *EC-Biotech* rejected the use of other treaties in systemic integration (save for cases of full treaty parallelism) while accepting reference to other treaties under the first two paragraphs of Article 31.

Accordingly, the *EC-Biotech* ruling can be read as leaving the door open to the possibility of using other treaties as points of references in interpretation and may thus not be as inconsistent with *US-Shrimp* as some observers have claimed.[1217] Moreover, it could be argued that it merely represents a panel decision, and as such it should not be considered to have the same weight as decisions by the Appellate Body. However, subsequent cases also seem to support the findings in *EC-Biotech*. In *Mexico-Soft Drinks*[1218], the Appellate Body itself took a more restrictive view on using norms originating outside the remits of WTO treaties in making decisions. Although it was not decisive in the case, the Appellate Body in its ruling implied that dispute settlement under the WTO should not make determinations based on compliance with international legal norms outside WTO treaties.[1219]

[1215] Id. at para 7.69.

[1216] Van Damme, Jurisdiction, Applicable Law, and Interpretation. 2009, at 335.

[1217] See in particular the position of Howse, as referred in section E.5.2.

[1218] Mexico – Tax Measures on Soft Drinks and Other Beverages, WT/DS308/AB/R, Appellate Body Report (The Appellate Body of the World Trade Organization 6 March), at 3.

[1219] "*We see no basis in the DSU for panels and the Appellate Body to adjudicate non-WTO disputes. Article 3.2 of the DSU states that the WTO dispute settlement system 'serves to preserve*

WTO jurisprudence thus appears to have applied a gradually more restrictive reading of the *applicable in the relations between the parties* criterion. Since the ruling in *US-Shrimp*, the institutions of WTO dispute settlement appear to have had at best lukewarm feelings about using treaties beyond the remits of the WTO regime in interpretation in the spirit of Article 31(3)(c) of the Vienna Convention.[1220]

Even if the practice on Article 31(3)(c) is limited from general international law, outside of WTO dispute settlement, it appears clear that irrespective of what requirement is set for the relation between treaties involved in interpretation, *applicability* in this context, according to conventional understanding, should be read as excluding non-binding norms.[1221] The relevant binding rules may, however, come in different forms: The relevant rules to be used as references may be general, regional or local customary rules, as well as bilateral or multilateral treaties, and even general principles of international law.[1222] Yet, the rules have to be rules of international law, not broader principles or considerations which may not be firmly established.[1223] Importantly, it is assumed that in entering treaty obligations, the parties did not intend to act inconsistently with other previous obligations.

Furthermore, Article 31(3)(c) sets as a criterion that the rules must be *relevant*. This has been interpreted by Villiger as concerning the subject matter of the treaty term at issue.[1224]

the rights and obligations of Members under the covered agreements, and to clarify the existing provisions of those agreements' (emphasis added). Accepting Mexico's interpretation would imply that the WTO dispute settlement system could be used to determine rights and obligations outside the covered agreements.", id, at para. 56.

[1220] Van Damme, EUROPEAN JOURNAL OF INTERNATIONAL LAW (2010).

[1221] Lagomarsino Jeffrey, *WTO Dispute Settlement and Sustainable Development: Legitimacy Through Holistic Treaty Interpretation*, 28 PACE ENVIRONMENTAL LAW REVIEW (2011)

[1222] Ulf Linderfalk, Who Are 'The Parties'? Article 31 3(c), Paragraph 3(c) of the 1969 Vienna Convention and the 'Principle of Systemic Integration' Revisited, 55 NETHERLANDS INTERNATIONAL LAW REVIEW (2008); Jonas & Saunders, VANDERBILT JOURNAL OF TRANSNATIONAL LAW (2010).

[1223] Koskenniemi, Fragmentation of International Law - Report of the Study Group of the International Law Commission. 2006., at 215.

[1224] VILLIGER, Commentary on the 1969 Vienna Convention on the Law of Treaties. 2009, at 433.

Pauwelyn has summarized the relevance criterion by stating that an extraneous treaty is relevant where it "*sheds light on the meaning*" of a term and will not be relevant where it "*has no bearing upon it*."[1225] In comparison with the *same subject matter* criterion, which is a central element of the preceding Article 30, the relevance criterion has been considered "*much looser*" by French.[1226] Other scholars, such as McGrady, have claimed that the *relevance* criterion appears to be at least similar if not identical to the same subject matter reference in Article 30, discussed under section A.4.1. Under the latter understanding, the same challenges in applying the criterion are valid for Article 31(3)(c), as for the heading of Article 30.[1227]

Provided that these conditions are also met, a relatively liberal interpretation of the applicable between the parties criterion is enabled, prescribing that the relevant rules should be read in light of one another, with the explicit aim of bridging differences and preventing conflicts.[1228] This approach to interpretation, which appears to be supported by most observers, is commonly referred to as the *principle of systemic integration*. The International Law Commission Study Group appears to perceive this principle as a natural consequence of the functioning of international law:

> *All treaty provisions receive their force and validity from general law and set up rights and obligations that exist alongside rights and obligations established by other treaty provisions and rules of customary international law. None of such rights or obligations has any intrinsic priority against the others. The question of their relationship can only be approached through a process of reasoning that makes them appear as parts of some coherent and meaningful whole.*[1229]

[1225] PAUWELYN, Conflict of Norms in Public International Law: How WTO Law Relates to Other Rules of International Law. 2003, at 264.

[1226] French, INTERNATIONAL AND COMPARATIVE LAW QUARTERLY (2006).

[1227] McGrady, JOURNAL OF WORLD TRADE (2008).

[1228] Jonas & Saunders, VANDERBILT JOURNAL OF TRANSNATIONAL LAW (2010).

[1229] Koskenniemi, Fragmentation of International Law - Report of the Study Group of the International Law Commission. 2006., para. 414, at 208.

This points to the need to carry out the interpretation so as to see the rules in view of some comprehensible and coherent objective, to prioritize concerns that are more important at the cost of less important objectives. Again, in the words of the ILC:

> *This is all that article 31 (3) (c) requires; the integration into the process of legal reasoning – including reasoning by courts and tribunals – of a sense of coherence and meaningfulness. Success or failure here is measured by how the legal world will view the outcome (...) The systemic nature of international law has received clearest formal expression in that article.*[1230]

This technique of interpretation, taking account of one treaty or legal norm in order to assist in the interpretation or application of another treaty or norm is thus one of the most important approaches to the integration of different bodies of law. Systemic integration can thus be regarded as a principle whereby the system of public international law confronts the challenges represented by fragmentation, as discussed in section A.6.

The reading of particular instruments in a "mutually supportive" light in line with the principle of systemic integration is sometimes referred to as the doctrine of "treaty parallelism."[1231] As pointed out by Boyle, this also connects to the theory on the organic growth of public international law.[1232]

[1230] Id. at 211, 313-315. However, it should be admitted that this standard interpretation of Article 31(3)(c) has been criticized by other observers, who contend that the principle of systemic integration is built on a misunderstanding. According to these observers, the term "*the parties*" in Article 31 should not be read as referring to all the parties to the interpreted treaty. Rather, the correct meaning of 'the parties' is *the two or more parties to a specific dispute (concerning the interpretation or application of the treaty)*. This strain of argumentation, has been extensively discussed by Pauwelyn, Conflict of Norms in Public International Law: How WTO Law Relates to Other Rules of International Law. 2003, at 254; Michaels & Pauwelyn, Duke Journal of Comparative & International Law (2012); Villiger, Commentary on the 1969 Vienna Convention on the Law of Treaties. 2009, at 432-434 and will not be developed further in this context.

[1231] McLachlan, International and Comparative Law Quarterly (2005).

[1232] Boyle, Relationship Between International Environmental Law and Other Branches of International Law. 2008.

Under the principle of harmonization, treaties can be subject to dynamic or living interpretation. What is central is their meaning at the time of interpretation, as established by the ICJ in the *Namibia* case.[1233]

The principle thus facilitates maintaining coherence in international law. Under the systemic perspective, this idea that the coherence across different treaties and regimes is maintained by dynamic or living interpretation is a central element of international law. As an interpretative technique, systemic integration thus helps to avoid conflicts between agreed norms, and can save negotiated agreements from premature obsolescence or from the need for constant amendment.[1234] Instead, systemic integration enables an evolutionary interpretation which permits changing values and social context to be reflected in the jurisprudence. As also observed by Boyle, evolutionary interpretation has generally been more common in some areas, such as international human rights law, and less relevant in other treaties, such as UNCLOS.[1235]

The International Law Commission Study Group highlights the importance of regarding the applicable rules as those in force *at the time of the interpretation* of the treaty.[1236] Not only does this underline the temporal element, as discussed in section E.3.3; it also accepts the notion of evolutionary interpretation of treaties. The notion of evolutionary development is closely connected to the organic element of international law, as discussed in section A.6.1. It also opens the door for regarding terms of treaties differently over time, as the meaning of relevant terms changes in response to external developments.

Whereas Boyle seems to regard evolutionary interpretation as closely connected to systemic integration as expressed in Article 31(3)(c) of the Vienna Convention, Bjorge considers evolutionary interpretation as a distinct approach, less connected to these specific elements of the rules of treaty interpretation.

[1233] ICJ, Legal Consequences for States of the Continued Presence of South Africa in Namibia, 1971, at 31; also Right of Passage over Indian Territory (Portugal v. India), ICJ Rep 125, ICGJ 173, 1957, at 142.

[1234] Boyle, Relationship Between International Environmental Law and Other Branches of International Law. 2008.

[1235] Ibid.

[1236] Koskenniemi, Fragmentation of International Law - Report of the Study Group of the International Law Commission. 2006., at 215.

Instead, as argued by Bjorge,

> *evolutionary interpretation can be explained by a proper understanding of the intention of the parties, the intention of the parties being the most important thread running through the law of treaties. As such, the evolutionary interpretation of treaties is not a separate method of interpretation; it is rather the result of a proper application of the usual means of interpretation, as means by which to establish the intention of the parties.*[1237]

Accordingly, where the parties have used generic terms in a treaty, the parties have necessarily been aware that the meaning of the terms was likely to evolve over time, and where the treaty has been entered into for a very long period, the parties must be presumed, as a general rule, to have intended those terms to have an evolving meaning.[1238]

From a practical standpoint, there are also reasons for considering evolutionary interpretation as distinct from systemic integration. Whereas the latter approach strives for focusing on areas of commonality across treaties (without focusing on which came first), the former would rather focus on how new rules relating to similar concepts (or any other external development) have transformed the understanding and hence meaning of treaties.[1239] Both approaches, however, in principle strive to fulfill the same purpose: to prevent fragmentation and maintain a functional and integrated system of public international law, in line with the systemic perspective, as discussed in sections A.6 and E.4.

Irrespective of whether the two approaches are regarded as distinct, a broad range of scholars agree that when two states have concluded two treaties on the same subject matter, but have said nothing of their mutual relationship, it is not only advisable to try to read them as compatible, but in most cases it is possible to succeed in such endeavors.[1240]

[1237] BJORGE. 2014, at 2.

[1238] ICJ, Navigational and Related Rights (Costa Rica v Nicaragua) 2009.

[1239] Gabrielle Marceau, *Evolutive Interpretation by the WTO Adjudicator*, 21 JOURNAL OF INTERNATIONAL ECONOMIC LAW (2018).

[1240] Czapliński & Danilenko, NETHERLANDS YEARBOOK OF INTERNATIONAL LAW (1990), at 474., PAUWELYN, Conflict of Norms in Public International Law: How WTO Law Relates to Other Rules of International Law. 2003, at 240-244.

In practical terms, Borgen has explained this as undertaking a simple examination of party intent, drawn from the various available readings of the treaty texts. Among possible readings of contentious provisions, the interpretation is selected which is most in line with other treaties.[1241]

The idea suggested by the principle of harmonization that a treaty should be read in harmony and consistency with the broader context of international customary and conventional law has also, as already indicated, received support in case law.[1242] In the words of the ICJ in the *Namibia* case, "*an international instrument has to be interpreted and applied within the framework of the entire legal system prevailing at the time of the interpretation.*"[1243] This opens the door to adjusting the reading of treaty provisions when relevant new norms have been added in other treaties, in line with evolutionary interpretation.

However, the possibility for thus adjusting interpretation according to changed circumstances and development in other treaties has also been circumscribed in jurisprudence. As similarly pointed out in the *Namibia* case, the ICJ maintains "*the primary necessity of interpreting an instrument in accordance with the intentions of the parties at the time of its conclusion.*" The ICJ has thus not accepted the application of evolutionary interpretation without discretion. Rather, a precondition has been that the concepts and terms in question "were by definition evolutionary," as in the *Namibia* case as well as the *Aegean Sea Continental Shelf* case.[1244] Thus, such evolutionary interpretation is not applicable to all treaties, but requires a certain element of transformability in relevant treaty provisions.[1245]

[1241] Borgen, THE GEORGE WASHINGTON INTERNATIONAL LAW REVIEW (2005), at 583.

[1242] Van Damme, Jurisdiction, Applicable Law, and Interpretation. 2009, at 330.

[1243] ICJ, Legal Consequences for States of the Continued Presence of South Africa in Namibia, 1971, at 31; also Right of Passage over Indian Territory (Portugal v. India), ICJ Rep 125, ICGJ 173, 1957, at 142.

[1244] Aegean Sea Continental Shelf Case (Greece v. Turkey) ICJ Rep 3, ICGJ 128 (International Court of Justice 19 December), at 32–3. The ICJ's approach, combining both an evolutionary and an inter-temporal element, reflects the ILC's commentary to what became Article 31(3)(c). See Arthur Watts, *The Law of Treaties*, *in* THE INTERNATIONAL LAW COMMISSION 1949-1998. THE TREATIES (Arthur Watts ed. 1999), at 690.

[1245] This point has been made by Boyle, see Boyle, Relationship Between International Environmental Law and Other Branches of International Law. 2008, at 129.

In addition, other international tribunals than the ICJ have applied evolutionary interpretation. In the previously discussed *US-Shrimp* case[1246], the WTO Appellate Body undertook such an analysis in order to determine the present meaning of "*exhaustible natural resources*" in the GATT Agreement. After first establishing that the objective of sustainable development informs the meaning of the generic term ("*natural resources*"), the Appellate Body focused on textual interpretation of the term *natural resources.*

As observed by Van Damme, it is not entirely clear whether it was the generic term applied in the textual interpretation of the term "*natural resource*" or interpretation in light of the objective of sustainable development in the preamble that was decisive in the ruling.[1247] It should also be noted that in the decision, the Appellate Body did not refer to Article 31(3)(c) of the Vienna Convention. Instead, it declared that the interpretation was justified on the basis of the principle of effectiveness. Still, the Appellate Body concluded that "*measures to conserve exhaustible natural resources, whether living or non-living, may fall within Article XX(g).*"[1248] The decision was thus not explicitly based on application of Article 31(3)(c) of the Vienna Convention, but availed itself of the possibility for decisions to be based on such motivations.[1249] The decision held not only that the term in question was not static, but that it was evolutionary.[1250]

The Appellate Body also opened up for a transformative interpretation and made clear that contentious elements of WTO law ought to be interpreted in light of other treaties of public international law, beyond WTO law. In the decision, it established that a number of environmental treaties drafted after the GATT should be regarded in interpreting the term. The references included not only UNCLOS and the CBD but also the 1992 Rio Declaration on Environment and Development, the 1973 Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), and the 1979 Convention on the

[1246] Appellate Body, United States - Import Prohibition Of Certain Shrimp And Shrimp Products, 1998.
[1247] Van Damme, Jurisdiction, Applicable Law, and Interpretation. 2009, at 334.
[1248] United States - Import Prohibition of Certain Shrimp and Shrimp Products, WT/DS58/AB/R (1998), at para. 131.
[1249] NORDQUIST, et al. 2002.
[1250] Appellate Body, United States - Import Prohibition Of Certain Shrimp And Shrimp Products, 1998.

Conservation of Migratory Species of Wild Animals.[1251] The case thus opened the door to interpreting contentious elements of WTO treaties in light of agreements beyond WTO law.

Does this imply that there are no constraints on harmonious readings aiming to prevent conflict in relation to other treaties? The ruling in *US-Shrimp* appears to impose little restraint in this regard. As noted by Pauwelyn, the environmental treaties cited by the Appellate Body as guiding in interpretation were not binding on all WTO members, not even in relation to all disputing parties in the case.[1252] Based on this finding, it appears that the subjective element of norm conflict has little importance for norm conflict under the interpretative approach generally and the principle of systemic integration in particular. The dissimilarities as regards the lists of parties between TRIPS, UNCLOS and CBD would thus not necessarily represent a problem for interpretation purposes under the approach taken in *US-Shrimp*.[1253]

It should, however, be noted that the ruling in the case did not amount to general revision or reinterpretation of a treaty. Rather, as pointed out by Boyle, it "*was concerned with the interpretation of particular provisions or phrases, such as 'natural resources' or 'jurisdiction', which necessarily import – or at least suggest – a reference to current general international law.*" This supports the notion that evolutionary interpretation can be regarded as a relatively limited task, which has to be consistent with the intention of the parties. As similarly concluded by Boyle,

> *it does not entitle a court or tribunal to engage in a process of constant revision or updating of treaties every time a newer one comes along (…) The result must remain faithful to the ordinary meaning and context of the treaty "in the light of its object and purpose."*[1254]

[1251] Id. at 48-49, paras. 130-131.
[1252] See, as similarly previously referred, for a thorough discussion of the case in the context of interpretation of contentious concepts in relation between treaties PAUWELYN, Conflict of Norms in Public International Law: How WTO Law Relates to Other Rules of International Law. 2003, chapter 5 as well as at 484-486.
[1253] Again, provided that the more restrictive approach in EC-Biotech is disregarded.
[1254] Boyle, Relationship Between International Environmental Law and Other Branches of International Law. 2008.

It generally appears difficult to establish what degree of flexibility is required in the interpreted provision. States involved in WTO disputes have increasingly referred to Article 31(3)(c) as justification for involving creative interpretations of terms relating to similar concepts across treaties.[1255] But so far, the Appellate Body has not fully declared its position in relation to such arguments. The previously discussed panel findings in *EC-Biotech* and *Mexico-Telecoms* support these conclusions: Provided that there is sufficient parallelism it may be accepted or even suggested by WTO jurisprudence to apply the principle of systemic integration where there is norm overlap between WTO obligations and other treaties. However, uncertainty persists as regards how different the terminologies between different treaties may be.

There are also cases where arguments suggesting cross-fertilization between treaties have failed to gain acceptance by tribunals. In the *Mox Plant Case*[1256], an evolutionary interpretation of UNCLOS in light of subsequent treaties suggested by Ireland fell on deaf ears. In the case, Ireland had claimed that the Aarhus Convention and EC law should be considered under Article 31(3)(c) in interpreting the definition of how "information" in the OSPAR Convention should be interpreted. Instead of accepting evolutionary interpretation, the tribunal ordered the parties to cooperate.

This case can, however, be contrasted with another example concerning evolutionary interpretation of UNCLOS. The precautionary approach, which was adopted as Principle 15 in the 1992 Rio Declaration is absent in the ten years older UNCLOS. Nevertheless, under the *Southern Bluefin Tuna* cases, the living resources conservation articles of UNCLOS have been given a precautionary interpretation.[1257] There appears to be support for the notion that other relatively recent concerns such as the protection of biological diversity or the sustainable use of resources similarly may be able to transform interpretation of concepts in UNCLOS.[1258]

[1255] BETHLEHEM, et al. 2009, at 334.

[1256] MOX Plant Case, Ireland v United Kingdom, Order, Request for Provisional Measures, ITLOS Case No 10, ICGJ 343 (International Tribunal for the Law of the Sea).

[1257] See ICJ, Southern Bluefin Tuna, 1999, paras. 77–9; and Judges Laing at paras. 16–19; and Treves at para. 9.

[1258] Boyle, Relationship Between International Environmental Law and Other Branches of International Law. 2008, at 131.

But more than discussing the specific element of precaution, the arbitral tribunal expressed general support for systemic integration in the case:[1259]

> *(…) it is a commonplace of international law and State practice for more than one treaty to bear upon a particular dispute … There is frequently a parallelism of treaties … The universal range of international legal obligations benefits from a process of accretion and accumulation.*[1260]

The concept is thus not merely a theoretical construction but has been affirmed in the practice of international law. However, the implications of the *Southern Bluefin Tuna Case* award should not be overstretched. After all, at issue in the case was the relationship between the 1982 UNCLOS and a fisheries treaty concluded for the implementation of the former. To claim that the same can be applied when interpreting treaties across different regimes based on the ruling could be considered as going too far. But at least the decision opens up for applying systemic integration in principle.

As already stated, the principle of systemic integration on the theoretical side thus appears as an appealing way of preserving the integrity of public international law that also has gained some support in case law. But does it function in real cases? The International Law Commission Report on Fragmentation appears to praise the principle for its intellectual beauty but shies away from investigating it empirically.

The principle of systemic integration has also been subject to criticism by many observers for the risk of exaggerating areas of commonality.[1261] Under this criticism, the principle is built on the presumption that by using a shoehorn, all feet can fit into the same shoe. By simply seeing norms in light of one another, it is presumed that an integrated set of norms can be provided. It is difficult to dispute that much of the support for the principle of systemic integration can be questioned. In particular, it is striking that most discussions on the principle revolve around theoretical arguments of interpretation.

[1259] NORDQUIST, et al. 2002.

[1260] ICJ, Southern Bluefin Tuna, 1999, para. 52.

[1261] JAN KLABBERS, et al., THE CONSTITUTIONALIZATION OF INTERNATIONAL LAW (United Kingdom: Oxford University Press - Special. 2009); Borgen, THE GEORGE WASHINGTON INTERNATIONAL LAW REVIEW (2005).

In the absence of more practical examples supporting the functioning of the principle in practical cases of overlap between treaties, it appears difficult to accept that it would have unlimited potential to prevent conflicts. Rather, as observed by Pauwelyn, there is reason to suspect that in many (if not most) cases of norm conflicts across regime boundaries in international law, the differences are so fundamental that employing the principle of systemic integration cannot bridge them.[1262] Simply based on semantic logic, conflict between completely contrary positions cannot be prevented by merely regarding how different obligations affect one another. Like the report of the ILC, the analysis of many observers appears to go no further than establishing that a harmonious interpretation provides a solution to the problem of fragmentation, seemingly mainly on rhetorical grounds. Indeed, basic practical implications of systemic integration have been granted surprisingly little attention in the discussion.

The *prima facie* conflict between treaties in different regimes in the case of deep-sea genetic resources has the potential to form the basis for a more practically oriented evaluation of the principle of systemic integration. Applying Article 31(3) of the Vienna Convention to the context of deep-sea bioprospecting would involve actively promoting the harmonization of different treaties regulating deep-sea bioprospecting, irrespective of their origin in different regimes of international law, so far as is possible under other requisites of Article 31 in order to find common ground. In comparison with the application approach, which primarily consisted of investigating explicit conflict clauses, the principle of systemic integration thus has a wider scope: It calls for (1) considering broadly what other obligations than the one interpreted the state in question is bound by, and (2) an evaluation of how those obligations affect the norm under interpretation.[1263]

E.6.2. Reference points for harmonizing interpretations

In section E.5.2, the relationship between the rules on treaty application and conflict clauses in the three treaties regulating deep-seabed mining was examined. A similar exercise will now be undertaken to investigate how the rules on treaty interpretation may be used in the three treaties, to promote harmonization and prevent treaty conflict. In the examination in section E.1 of the potential inconsistencies between treaties involved, it was obvious that there was a considerable degree of commonality in the rules of UNCLOS and the CBD relating to deep-sea bioprospecting. The rules of TRIPS, by contrast, implied a fundamentally different view, in particular relating to the bioprospecting of deep-seabed micro-organisms. It therefore appears rational to first examine those rules, to investigate the possibilities for harmonizing interpretations.

[1262] Michaels & Pauwelyn, DUKE JOURNAL OF COMPARATIVE & INTERNATIONAL LAW (2012).
[1263] Benvenisti & Downs, STANFORD LAW REVIEW (2007).

E.6.2.1. TRIPS

The interpretation of WTO law in relation to other treaties

Whereas the TRIPS agreement itself does not express how it relates to other treaties of international law, the treaty forms part of a broader family of WTO agreements, as discussed under section C.3.2. Issues of interpretation relating to these treaties are generally decided by the WTO dispute settlement body. In so doing, Article 3(2) of the Dispute Settlement Understanding of the WTO[1264] requires panels and the Appellate Body to "*clarify the existing provisions of those agreements in accordance with customary rules of interpretation of public international law*."

In part, Article 3(2) merely confirms the principle of *jura novit curia*. Panels and the Appellate Body can decide themselves how to interpret the WTO covered agreements.[1265] But it also entails that these judicial bodies cannot make such decisions independently, disregarding general international law. Interpretation of WTO agreements must follow customary principles of treaty interpretation.[1266] This is a powerful argument for not exaggerating the fear, which has been expressed by some observers, that WTO law could develop into an independent legal system, distinct from general public international law.[1267] Article 3(2) shows that even under its own merits, the interpretation of WTO law follows the same rules for interpretation as any other treaty.

[1264] WTO Dispute Settlement Understanding.
[1265] Jeffrey, PACE ENVIRONMENTAL LAW REVIEW (2011); Van Damme, *Treaty Interpretation by the WTO Appellate Body*, EUROPEAN JOURNAL OF INTERNATIONAL LAW (2010), at 322.
[1266] Ibid.
[1267] PAUWELYN, Conflict of Norms in Public International Law: How WTO Law Relates to Other Rules of International Law. 2003.

Like in other interpretation cases in international law, the fundamental rules for treaty interpretation are provided in the Vienna Convention on the Law of Treaties. However, rather than making explicit references, the Dispute Settlement Understanding refers to the customary rules on interpretation. This is most likely the result of not all WTO members being parties to the Vienna Convention.[1268] This is, however, of limited practical relevance. In its first reports, the Appellate Body confirmed what had already been established in other areas of public international law, namely that Articles 31 and 32 of the Vienna Convention have attained the status of "*customary rules of interpretation of public international law*."[1269]

All this may seem self-evident. But that judicial decision would become common in interpretation matters was far from predicted when the WTO Dispute Settlement Understanding as well as TRIPS and the Agreement Establishing the World Trade Organization[1270] were negotiated as part of the same generation of WTO agreements. Indeed, the interpretations of the WTO covered agreements by panels and the Appellate Body are formally authoritative only for the dispute being decided.[1271] When the Uruguay round was negotiated, the parties rather tried to prevent judicial resolution from becoming a standard-practice way of resolving matters of interpretation relating to these agreements. This can be explained by the reluctance among the negotiators to allow the WTO dispute settlement mechanism to decide universal interpretations of central concepts by means of practice.

[1268] Van Damme, EUROPEAN JOURNAL OF INTERNATIONAL LAW (2010), at 605-648.
[1269] Appellate Body, United States – Standards for Reformulated and Conventional Gasoline, at 16-17; Appellate Body, United States – Import Prohibition of Certain Shrimp and Shrimp Products, at para. 114; Japan – Taxes on Alcoholic Beverages (Japan – Alcoholic Beverages II), WT/DS8/AB/R, WT/DS10/AB/R, WT/DS11/AB/R, Appellate Body Report (The Appellate Body of the World Trade Organization 1 November), at 104; European Communities – Customs Classification of Certain Computer Equipment (EC – Computer Equipment), WT/DS62/AB/R, WT/DS67/AB/R, WT/DS68/AB/R, Appellate Body Report (The Appellate Body of the World Trade Organization 22 June), at para. 84; Korea – Definitive Safeguard Measure on Imports of Certain Dairy Products (Korea – Dairy), WT/DS98/AB/R, Appellate Body Report (The Appellate Body of the World Trade Organization 14 December), at para. 81.
[1270] WTO Agreement: Marrakesh Agreement Establishing the World Trade Organization, Apr. 15, 1994, 1867 U.N.T.S. 154, 33 I.L.M. 1144 (1994).
[1271] BETHLEHEM, et al. 2009, at 338.

Accusations against the Appellate Body of engaging in *ultra vires* actions and considering elements *obiter dicta* beyond its mandate have also been central in the refusal of the United States to allow the appointment of new Appellate Body members.[1272]

Instead, the WTO Agreement reserved the ultimate interpretative authority to WTO members. From the Agreement's Article IX:2, it follows that decision-making on interpretative matters should be decided by means of recommendations by a qualified majority among state parties. This was not only designed as the default mechanism for deciding on interpretation; indeed, it was foreseen by the parties to function as such in a pragmatic manner. By means of a series of recommendations, the parties would gradually clarify the ambiguities left in the agreements.[1273] Authoritative interpretations were designed to be "*binding on the parties and any organ which decides on their rights and duties on a basis of delegated authority*."[1274]

However, the practical functioning of the WTO system turned out very differently once the Uruguay round of agreements had been signed in Marrakesh in 1994. As a symptom of the general deadlock of the organization, WTO members with few exceptions[1275] have been incapable of adopting such authoritative interpretations. Thus, the systemically important tool of authoritative interpretations has remained almost completely unused.[1276]

[1272] Report on the Appellate Body of the World Trade Organization. (2020).
[1273] See, for an extensive discussion on this matter Claus-Dieter Ehlermann & Lothar Ehring, *The Authoritative Interpretation Under Article IX:2 of the Agreement Establishing the World Trade Organization: Current Law, Practice and Possible Improvements*, 8 JOURNAL OF INTERNATIONAL ECONOMIC LAW (2005).
[1274] Van Damme, EUROPEAN JOURNAL OF INTERNATIONAL LAW (2010), at 611.
[1275] On one occasion in 1999, the European Communities made requests for authoritative interpretations, see General Council, Request for an Authoritative Interpretation Pursuant to Article IX:2 of the Marrakesh Agreement Establishing the World Trade Organization, Communication from the European Communities, WT/GC/W/133, 25 Jan. 1999; General Council, Request for an Authoritative Interpretation Pursuant to Article IX:2 of the Marrakesh Agreement Establishing the World Trade Organization, Communication from the European Communities, WT/GC/W/143, 5 Feb. 1999.
[1276] Claus-Dieter Ehlermann & Lothar Ehring, *Decision-making in the World Trade Organization: is the consensus practice of the World Trade Organization adequate for making, revising and implementing rules on international trade?*, 8 JOURNAL OF INTERNATIONAL ECONOMIC LAW (2005), at 64.

It is also worth noting that members can give interpretive guidance tools to the Appellate Body in a "subsequent agreement." For example, WTO members agreed in the Doha Ministerial Declaration that the TRIPS Agreement "*can and should be interpreted and implemented in a manner supportive of WTO Members*' *right to protect public health and, in particular, to promote access to medicines for all*."[1277]

The general picture is thus that despite it being envisaged as a last resort in the limited number of cases where the parties would be unable to come up with authoritative interpretations, judicial decision has become the established way of deciding interpretation matters in WTO agreements.[1278] In exercising this role of deciding the valid rule in interpretation cases, both panels and the Appellate Body have exercised considerable autonomy.[1279]

Consequently, and perhaps surprisingly from the perspective of the negotiators of the Uruguay round, a practice has been developed under WTO dispute settlement practice on the interpretation of ambiguous terms in the different WTO treaties. Importantly, for the purposes of this investigation, panels and the Appellate Body have not only established interpretations of contentious issues in relation between WTO agreements, but also expressed how these agreements ought to be interpreted in relation to other treaties of public international law. On this issue, the Appellate Body has declared that WTO Agreements shall not be interpreted in "*clinical isolation.*" Quite the contrary, based on the findings of the Appellate Body in the *United States Gasoline* case, it seems clear that undertakings in such instruments ought to be read in light of subsequent practice and obligations in other WTO agreements.[1280]

[1277] Ministerial Conference, Doha Declaration on the TRIPS Agreement and Public Health, 14 November 2001, WT/ MIN(01)/Dec/2 at para. 4.

[1278] As one observer has put it, 'the (lack of) practice under Article IX:2 has meant that 'decisions [of the Appellate Body] are likely to have a kind of de facto finality as interpretations of law, even if they lack de jure finality', Robert Howse, The Most Dangerous Branch? WTO Appellate Body Jurisprudence on the Nature and Limits of the Judicial Power, in THE ROLE OF THE JUDGE IN INTERNATIONAL TRADE REGULATION: EXPERIENCE AND LESSONS FOR THE WTO (Thomas Cottier, et al. eds., 2003), at 11, 15.

[1279] Henning Grosse Ruse-Khan, *The (Non) Use of Treaty Object and Purpose in Intellectual Property Disputes in the WTO*, MAX PLANCK INSTITUTE FOR INTELLECTUAL PROPERTY & COMPETITION LAW RESEARCH PAPER NO. 11-15. (2011).

[1280] Appellate Body, United States – Standards for Reformulated and Conventional Gasoline, 1996, at 17.

If the *United States Gasoline* case thus opened up the door to interpreting contentious elements of WTO treaties in light of other WTO treaties, then the door to also including treaties beyond the WTO in interpretation matters was fully blown open in subsequent cases. As discussed in sections E.4.2 and E.5.1, the *US-Shrimp* case[1281] made clear that interpretations of contentious elements of WTO treaties should also consider treaties beyond WTO law. The case concerned interpretation of the term "*natural resources*" in the context of Article XX(g) of the GATT treaty from 1994. In its decision, the connection to the object of sustainable development, as called for by the "object and purpose" criteria in Article 31(1) of the Vienna Convention was first discussed by the Appellate Body. Initially, the Appellate Body established that the objective of sustainable development informs the meaning of the generic term ("*natural resources*"). But after having established this connection, the Appellate Body focused on textual interpretation of the term *natural resources.* The term was, in the consideration of the Appellate Body, "not '*static*' in its content or reference but (…) rather *by definition, evolutionary*."[1282] Moreover, "*it must be read by a treaty interpreter in the light of contemporary concerns of the community of nations about the protection and conservation of the environment*."[1283] This decision of the Appellate Body thus opened up the way for a transformative interpretation, supporting the perspective of international law as organically growing, as discussed in section A.6.1.[1284] But even more importantly, the Appellate Body made clear that contentious elements of WTO law ought to be interpreted in light of non-WTO rules of public international law. In its findings, the Appellate Body refereed to a number of multilateral environmental treaties.[1285]

[1281] Appellate Body, United States - Import Prohibition Of Certain Shrimp And Shrimp Products, 1998.

[1282] Ibid.

[1283] Appellate Body, United States - Import Prohibition Of Certain Shrimp And Shrimp Products, at para 130.

[1284] Similarly, the ICJ has considered the concept of terms in treaty obligations changing meaning in light of external factors. The court has declared that a generic term implies "*a known legal term, whose content the Parties expected would change through time*" or a term whose "*meaning was intended to follow the evolution of the law*", Declaration Judge Higgins, 1113, at paras 2–3 in Aegean Sea Continental Shelf Case (Greece v. Turkey) ICJ Rep 3, ICGJ 128. See also Bosselmann, COLORADO JOURNAL OF INTERNATIONAL ENVIRONMENTAL LAW AND POLICY (1996); KEVLES. 2002.

[1285] Appellate Body, United States - Import Prohibition Of Certain Shrimp And Shrimp Products, 1998, at paras 128-132.

As noted by Pauwelyn, it is worth observing that "*none of these were binding on all WTO members and some of them were not binding even on all the disputing parties in the particular case.*"[1286] In the ruling, the Appellate Body did not just open the possibility of changing the interpretation of terms over time, as law evolves;[1287] it also established that interpretation of a treaty obligation can be decided by referring to relevant provisions in other treaties. At least implicitly, the Appellate Body's decision can be interpreted as promoting the principle of harmonization in general. Similarly, it supports the notion that the principle that a treaty should be read in harmony and consistent with the broader context of international customary and treaty law applies also to WTO law.

The principle of harmonization, as previously discussed, was further scrutinized in the decision by the Panel in the *EC-Biotech Products* case[1288]. In the case, the EC claimed that the scope of a provision in another WTO agreement, the SPS Agreement[1289], should be interpreted in light of the CBD as well as the Cartagena Protocol on Biosafety to the CBD[1290]. In its decision, the Panel assumed that Article 31(3)(c) does not only grant the interpreter discretion over whether or not to apply other rules of international law. If the conditions are met, the Panel established, the interpreter has no other option than to take account of general international law.[1291] On the other hand, as previously discussed, the Panel also imposed a requirement for a complete parallelism as regards parties to treaties involved for applying Article 31(3)(c), a standard which the invoked references by the EC failed to meet. The Panel, however, did not rule out using other treaties as points of references, but more in order to establish the meaning of terms. The Panel in the *Mexico-Telecoms* case made a parallel finding, regarding provisions in other treaties as context

[1286] See, for a thorough discussion of the case in the context of interpretation of contentious concepts in relation between treaties chapter 5 as well as pp. 484-486 in PAUWELYN, Conflict of Norms in Public International Law: How WTO Law Relates to Other Rules of International Law. 2003.

[1287] BOYLE, The making of international law. 2007, at 244-247.

[1288] Panel Reports, European Communities – Measures Affecting the Approval and Marketing of Biotech Products, ; McGrady, JOURNAL OF WORLD TRADE (2008).

[1289] Agreement on the Application of Sanitary and Phytosanitary Measures, 15 April 1994, 1867 U.N.T.S. 493 (SPS Agreement).

[1290] Cartagena Protocol on Biosafety.

[1291] Panel Reports, European Communities – Measures Affecting the Approval and Marketing of Biotech Products, 2006, at para. 7.69.

for the interpretation of the meaning of a term central for the dispute.[1292] The WTO Panels in these decisions thus essentially confirmed what is called for by Article 3(2) of the Dispute Settlement Understanding – namely that the panels and the Appellate Body can clarify the existing provisions of those agreements *in accordance* with customary rules of interpretation of public international law. Finally, as previously noted, in the subsequent decision in *Mexico-Soft Drinks*[1293], the Appellate Body itself drew a line by declaring that it was not its role to determine rights and obligations originating outside the remits of WTO treaties.[1294]

The increasingly reluctant position within WTO dispute settlement on using treaties beyond its own regime in decisions may be explained by the notion that it is still not wholeheartedly accepted within the international trade law community that the WTO treaties could have equal standing with other treaties, outside the WTO regime, as observed by Simma and Pulkowski.[1295] WTO law, it is often argued by insiders, has its unique characteristics which are sufficient to distinguish it from other branches of international law, and the Appellate Body in the *US-Shrimp* case was erroneous in disregarding this fact.[1296]

This is in line with the discussion in Part D on the inclination of observers of international law regimes to regard "their" particular regime as unique, with preference in relation to other areas of international law. To be fair, it may indeed be questioned whether it would be reasonable for a tribunal primarily designed to handle international trade disputes to take on the task of making decisions on the relation between WTO agreements and other norms of general

[1292] Mexico – Measures affecting Telecommunications Services (WT/DS204/R), Panel Report (World Trade Organization Panel 2 April), at para 7.236.

[1293] Appellate Body, Mexico – Tax Measures on Soft Drinks and Other Beverages.

[1294] As previously noted in section E.6.1, although it was not decisive in the case, the Appellate Body in its ruling implied that dispute settlement under the WTO should not make determinations based on compliance with international legal norms outside WTO treaties. "*We see no basis in the DSU for panels and the Appellate Body to adjudicate non-WTO disputes. Article 3.2 of the DSU states that the WTO dispute settlement system 'serves to preserve the rights and obligations of Members under the covered agreements, and to clarify the existing provisions of those agreements' (emphasis added). Accepting Mexico's interpretation would imply that the WTO dispute settlement system could be used to determine rights and obligations outside the covered agreements.*", id. at para. 56.

[1295] Simma & Pulkowski, EUROPEAN JOURNAL OF INTERNATIONAL LAW (2006).

[1296] This reasoning can be illustrated by for instance Jiaxiang Hu, *The Role of International Law in the Development of WTO Law*, 7 JOURNAL OF INTERNATIONAL ECONOMIC LAW (2004).

international law. It could be suspected that the point of departure of the Appellate Body as well as the background of its judges may create a bias, which makes it more likely to favor the interests and the underlying rationale of the WTO agreements in relation to other treaties. The *US-Shrimp* ruling, where environmental treaties beyond WTO were considered indicative in the interpretation of a WTO treaty is, however, evidence against the suspicion that the Appellate Body would be guilty of such bias. Another way to approach the differences between the rulings in *US-Shrimp* and subsequent cases is to consider the difference in the disputed terms. In *US-Shrimp* the disputed term *natural resource* was a generic term, which was also used in other treaties. In *EC-Biotech*, on the other hand, the EC invoked a legal principle with disputed status.

In any event, it is clear that WTO dispute settlement practice has severely constrained the formal use of harmonious interpretation under the principle of systemic integration in Article 31(3)(c) since the Appellate Body's decision in *US-Shrimp* that WTO undertakings should be read in conjunction (and aim to build bridges) with treaties of other regimes. Yet, it could be argued that the practical implications of this rejection should not be exaggerated. This is because even if the findings in these latter two cases do not formally support interpretation based on Article 31(3)(c) save for the few cases which meet the requirement for complete overlap of parties, they nevertheless confirm that other treaties of international law can be considered as context for the purpose of interpretation.[1297] There appears to be general support in the practice of WTO dispute settlement (implicit in the Appellate Body ruling in *US-Shrimp* and more explicit in the panel cases) for building references to the object of a connecting agreement in order to facilitate interpretation.[1298] Indeed, none of these cases appear to preclude a liberal use of references to other treaties as context and object within the meaning of paragraphs 1–2 of the same Article. What, then, would be the difference between this referencing approach and systemic integration? The major difference seems to be whether the other treaties are regarded as legally binding or merely linguistically indicative in interpretation.

[1297] BETHLEHEM, et al. 2009, at 336; JOHN H. JACKSON, SOVEREIGNTY, THE WTO, AND CHANGING FUNDAMENTALS OF INTERNATIONAL LAW (Cambridge University Press. 2011), at 182-192.
[1298] McGrady, JOURNAL OF WORLD TRADE (2008).

In fact, it does not appear certain that the consequence in practical cases of interpretating conflicting terms by freely using terms, contexts, objects and purposes of other treaties as points of references would be much different compared to using Article 31(3)(c). Both methods could amount to letting the use of terms in other treaties decide the meaning of terms in the contentious (WTO) obligation.

Based on the rulings in the WTO dispute settlement decisions examined above, it actually appears that the Appellate Body is inclined to favor interpretations which give more weight to the aim behind agreements in other areas of international law, possibly even in cases where it would be on the verge of compromising the purpose of the WTO agreements.

Taken together, this shows how the view of how WTO obligations, including those of TRIPS, should be interpreted in relation to other treaties has evolved in WTO dispute settlement. An initial generous support of systemic interpretation has become more restrictive in subsequent cases, while still leaving the door open for using other treaties as points of reference as context, objects or purpose for deciding the meaning of ambiguous terms. Thereby, its own dispute settlement body has confirmed that even if the WTO may represent a family of closely related agreements (a "regime" in the sense laid out in section A.6) with obligations whose meaning should not necessarily be decided by treaties of other regimes, the ordinary meaning of terms in other treaties as well as the context, object and purpose of those other treaties could be used to establish the meaning of obligations.

Assessing the relationship of TRIPS to other treaties under the rules for treaty interpretation

Even if the formal use of systemic integration would be controversial under WTO practice in lack of full parallelism of parties to the relevant treaties, there is support for the notion that ambiguities in WTO agreements should be interpreted in light of other relevant rules of international law.[1299]

[1299] This is also since the "*same subject-matter*"-criterion appears to be fulfilled in the present case, as discussed under section E.5.1.

From the perspective of WTO jurisprudence, it thus appears uncontroversial to use overlapping norms in other treaties as points of references in interpreting contentious elements of TRIPS. Accordingly, it will now be explored if the conflict in relation to UNCLOS and the CBD could be prevented by using the relevant provisions in these treaties as reference points when defining the meaning of *prima facie* conflicting elements of TRIPS, thereby potentially establishing a harmonious interpretation (without formally applying systemic integration) and preventing conflict.

It seems natural to focus the examination on the provision of TRIPS deviating most from the other two regimes as regards appropriation of deep-sea resources: The controversial Article 27, which generally establishes that bioresources should be patentable, with no possibilities for states to make exceptions for the deep-seabed micro-organisms which are important in bioprospecting. As discussed in section E.6, the rules of treaty interpretation in the Vienna Convention call for interpreting difficult concepts in line with a number of elements. These elements, which can be regarded as the outer limits for interpretations, are equally relevant in relation to the reading of both the provision that is being interpreted and the treaty that is being used as a point of reference. Any interpretation of TRIPS Article 27 aiming to prevent conflict in relation to UNCLOS and the CBD must thus not go beyond what is permitted under Articles 31–33 of the Vienna Convention.

In order to assess if Article 27 of TRIPS can be interpreted in a manner which prevents conflict, it is thus necessary to first investigate how flexible a reading can be under these interpretation principles. In line with Article 31 of the Vienna Convention, it is necessary to establish what an interpretation in *good faith* provides, as well as the *ordinary meaning* of the relevant terms. It has furthermore been established that *context* as well as *object and purpose* are important. As previously noted, under conventional interpretation of this part of TRIPS, the "*object and purpose*" criterion appears to be regarded as a singular concept, even if, strictly speaking, the "object" is about what the treaty covers and the "purpose" is about why the treaty covers an issue.[1300]

Finding the "*object and purpose*" has been described as a matter of extracting the "essence," the overall "mission" of the treaty, as was noted in section

[1300] McGrady, JOURNAL OF WORLD TRADE (2008).

E.5.[1301] The notion that objectives ought to be guiding in the interpretation of contentious elements of treaties has been unequivocally supported by WTO jurisprudence. As discussed in the previous section, the Appellate Body in the *US-Shrimp* case established that the objective of sustainable development informs the meaning of the generic term ("*natural resources*"), and subsequent cases did not dispute making references to other treaties in establishing meaning of ambiguous terms. This raises the question if a declaration of an objective of a treaty represents "object and purpose" as called for by the criteria in Article 31(1) of the Vienna Convention. As identified in section E.6.1, "*'the object and purpose' of a treaty means those reasons for which the treaty exists – sometimes termed as the ratio legis or the treaty's raison d'être*."[1302] It cannot be taken for granted that declarations of objectives qualify for this requisite. Sometimes the object and purpose may be multifaceted or ambiguous, and only partly reflected in explicit provisions on objectives.

Indeed, in many cases, this exercise of assessing what object and purpose a certain treaty has may be burdensome and difficult. In the case of the TRIPS, however, it appears to be considerably easier. This is because the declaration of objectives of the TRIPS Agreement in Article 7 appear to represent an explicit textual expression reflecting the actual reason for negotiating the treaty, as identified in section D.3.[1303]

> **TRIPS Article 7**
>
> *Objectives*
>
> The protection and enforcement of intellectual property rights should contribute to the promotion of technological innovation and to the transfer and dissemination of technology, to the mutual advantage of producers and users of technological knowledge and in a manner conducive to social and economic welfare, and to a balance of rights and obligations.

[1301] Van Damme, EUROPEAN JOURNAL OF INTERNATIONAL LAW (2010), at 631; Jonas & Saunders, VANDERBILT JOURNAL OF TRANSNATIONAL LAW (2010).

[1302] LINDERFALK, On The Interpretation of Treaties: The Modern International Law as Expressed in the 1969 Vienna Convention on the Law of Treaties. 2007, at 204.

[1303] At the same time, TRIPS may be considered as containing plenty of rules with ambiguities where a treaty interpretation focused on the ordinary meaning may not lead to satisfactory results.

Given that all WTO members stressed the role of Article 7 for interpreting TRIPS in the Doha Declaration on TRIPS and public health[1304], one might expect this provision declaring the objective of the treaty to play a major role in establishing valid interpretation in ambiguous cases. However, some observers of intellectual property related disputes in the WTO have claimed that this is not the case. Rather, as shown in an investigation of WTO case law by Ruse-Khan, other references such as "ordinary meaning" and "context" appear to be more determinant than references to the objective of the treaty, as formulated in this article.[1305] This practice indicates that even if the objectives of the agreement are spelled out in other parts of TRIPS, it carries less weight than ordinary meaning and context, in the interpretation of the relationship between Article 27 and obligations in other regimes of international law.[1306] This is not surprising, as discussed in section E.6.1 ordinary meaning has a central role in treaty interpretation. If it is correct that ordinary meaning and context have been more influential than object and purpose in WTO practice, would an interpretation of TRIPS Article 27 focusing on the former elements differ from one based on the latter?

Considering how context is defined in the Vienna Convention, it seems that the consequences for interpreting TRIPS would yield the same result, irrespective of what element is prioritized. This is because the context for the purpose of the interpretation according to paragraph 2 of Article 31 of the Vienna Convention should include other parts of the same agreement, including preamble and annexes, as previously discussed.

[1304] Declaration on the TRIPS agreement and public health Adopted on 14 November 2001 DOHA WTO MINISTERIAL 2001: TRIPS WT/MIN(01)/DEC/2 20 November 2001.

[1305] While there is only a comparable limited number of TRIPS cases (7% of all WTO complaints), the 12 decisions issued contain in total 60 instances where individual TRIPS provisions or terms where subject to interpretation. In only 14 cases WTO adjudicators have relied on 'object and purpose' – compared to 42 times where 'ordinary meaning' and 37 times where 'context' where utilised. Those 14 cases break down in only two cases were Articles 7 and 8 have been applied; another three where they have been merely acknowledged; and nine where other objectives (of TRIPS or its provisions) have been applied. In addition, there are 13 cases where object and purpose of a treaty are merely mentioned as being relevant for the interpretation exercise. This paints, as one observer has put it "a picture of a quantitatively limited, and qualitatively rather arbitrary use of TRIPS object and purpose in the interpretation exercise," see Grosse Ruse-Khan, MAX PLANCK INSTITUTE FOR INTELLECTUAL PROPERTY & COMPETITION LAW RESEARCH PAPER NO. 11-15. (2011), at 2.

[1306] McGrady, JOURNAL OF WORLD TRADE (2008).

This means that where object and purpose are declared in treaties, as is often the case, those elements should be considered as part of the context. In TRIPS, this would highlight Article 7, similar to an interpretation focusing on object and purpose, albeit for identifying the context rather than the object and purpose.[1307] This demonstrates that it would matter little what element is highlighted.

That said, there are also differences. Whereas an interpretation focusing on object and purpose would focus on those elements as expressed in Article 7, a contextual interpretation would render other parts of TRIPS equally relevant. However, considering the central role of Article 7 in expressing the idea and function of TRIPS, even under a contextual interpretation this provision would provide most support in determining the meaning of other parts of the treaty. It thus appears that irrespective of whether object and purpose or ordinary meaning and context are considered the most central elements, the result would be the same. Under both approaches, the objectives articulated in Article 7 would guide the interpretation.

What values, then, are reflected in these objectives? Article 7 of TRIPS provides that the protection and enforcement of IPRs

> *should contribute to the promotion of technological innovation and to the transfer and dissemination of technology, to the mutual advantage of producers and users of technological knowledge and in a manner conducive to social and economic welfare.*

The provision thus clearly highlights economic and development interests of technological development as central purposes of the protection of intellectual property rights provided by TRIPS. These references appear to be of limited use in facilitating harmonizing interpretations of Article 27, in line with CBD and UNCLOS. The lack of references in Article 7 to environmental protection, for regarding certain resources as global commons or other values more similar to the purposes of conflicting treaties could be read as preventing interpretations of TRIPS that are not consistent with the agreement's rather simplistically expressed objective.

[1307] Or in other words: Even if the practice of the Appellate Body downplays the importance of *objective and purpose* in favor of *context*, the provisions on objectives in TRIPS Article 7-8 is relevant, as important parts of the context.

There are, however, other documents that could provide additional guidance in interpreting the purposes of central obligations, in addition to the objectives being prescribed for in TRIPS itself. Agreements and instruments *related* to the treaty (which is being interpreted) should under Article 31(2) of the Vienna Convention be considered as part of the "*context for the purpose of the interpretation*" (insofar as it has at least been accepted by the parties as an instrument related to the treaty). This is particularly relevant in the context of WTO law, where the relationship between different treaties may be closer than is normally the case in other regimes of international law. As previously discussed in section C.3, this is the result of WTO treaties having been adopted in concert, as components of the same Uruguay round of trade agreements. WTO treaties, including TRIPS, can be considered as not only belonging to the same regime but also part of the same "family" of trade agreements. The Marrakesh Agreement, functioning as a connecting framework convention for the other WTO agreements which are also formally annexes to the former, is particularly relevant. In the Marrakesh Agreement, general guidance is provided on the position, role and objective of WTO law. In its first preambular paragraph, the WTO Agreement declares that

> *their relations in the field of trade and economic endeavour should be conducted (...) while allowing for the optimal use of the world's resources in accordance with the objective of sustainable development, seeking both to protect and preserve the environment and to enhance the means for doing so in a manner consistent with their respective needs and concerns at different levels of economic development.*[1308]

Can the objectives expressed in this provision be regarded as indicative for the purpose of interpreting the contentious elements of Article 27 of TRIPS in relation to other treaties? Essentially, this depends on whether interpretation under Article 31 of the Vienna Convention should be based on object and purposes, not only as expressed in the relevant treaty but also as declared in other, connecting treaties. In light of the declaration in Article 31(2)(a) that the context for the purpose of interpreting treaties should include "*any agreement relating to the treaty which was made between all the parties in connection with the conclusion of the treaty*," this appears uncontroversial.

[1308] WTO Agreement: Marrakesh Agreement Establishing the World Trade Organization, Apr. 15, 1994, 1867 U.N.T.S. 154, 33 I.L.M. 1144 (1994).

After all, as previously stated, the relevant WTO treaties were concluded simultaneously. It can thus be established that in light of Article 31(3)(2)(a) of the Vienna Convention, objectives expressed in the WTO Agreement including elements such as "*sustainable development*" and "*preservation of the environment*" may be indicative in interpretations of not only that agreement, but also other WTO treaties, including TRIPS.[1309]

It is not certain that a generally expressed objective, as in the WTO Agreement, could determine the content of a specific material obligation, such as Article 27 of TRIPS. The Appellate Body has declared that more specific applicable agreements take precedence over more general ones.[1310] Moreover, broadly described objects and purposes of a treaty, including references to aims such as preservation of the environment and sustainable development, as in the preamble of the WTO Agreement, do not mean that environmental treaties, such as the CBD, automatically become decisive in the interpretation of WTO obligations, such as Article 27 of TRIPS.[1311] Still, at the very least, Article 31(2) of the Vienna Convention, in combination with the objectives expressed in the WTO Agreement, provides a basis for arguing that interpretation of TRIPS does not necessarily have to be confined to the purposes expressed in its Article 7. References to the wider elements expressed in the objectives of the WTO Agreement broaden the scope of possible interpretations.

Some indication for how TRIPS Article 27 could be interpreted in relation to conflicting obligations on deep-sea bioresources in CBD and UNCLOS can thus be established already on the basis of the first two paragraphs of Article 31 of the Vienna Convention. Central requisites calling for interpretation in line with *good faith*, *ordinary meaning* and *object and purpose*, as well as how the contextual criterion has evolved, impose constraints on how far readings of problematic provisions can be stretched.

[1309] BETHLEHEM, et al. 2009, at 333.

[1310] In EC-Bananas III, the Appellate Body criticized the Panel for not having applied a more specific agreement before the GATT, since the matter dealt specifically and in detail with the relevant procedures, European Communities—Regime for the Importation, Sale and Distribution of Bananas, WT/ DS27/R(US) (EC—Bananas III) (Appellate Body Report 25 September). See also LANGLET. 2009;Claude Chase, *Norm Conflict Between WTO Covered Agreements—real, Apparent or Avoided?*, 61 (2012), at 248.

[1311] McGrady, JOURNAL OF WORLD TRADE (2008).

Even if the objectives of TRIPS are formulated in narrow terms, the wider purposes of the connecting WTO Agreement can serve as the basis for arguing that Article 27 of TRIPS should be interpreted in line with objectives closer to those of conflicting treaties. In this manner, these implications of the first two paragraphs of Article 31 of the Vienna Convention can be regarded as the outer limits when approaching interpretation of Article 27 of TRIPS.

Would these flexibilities then enable an interpretation of TRIPS Article 27 which prevents conflict in relation to the other treaties?

> **TRIPS Article 27**
> 1. Subject to the provisions of paragraphs 2 and 3, patents shall be available for any inventions, whether products or processes, in all fields of technology, provided that they are new, involve an inventive step and are capable of industrial application. (5) Subject to paragraph 4 of Article 65, paragraph 8 of Article 70 and paragraph 3 of this Article, patents shall be available and patent rights enjoyable without discrimination as to the place of invention, the field of technology and whether products are imported or locally produced.
> 2. Members may exclude from patentability inventions, the prevention within their territory of the commercial exploitation of which is necessary to protect ordre public or morality, including to protect human, animal or plant life or health or to avoid serious prejudice to the environment, provided that such exclusion is not made merely because the exploitation is prohibited by their law.
> 3. Members may also exclude from patentability:
> (…)
> (b) plants and animals other than micro-organisms, and essentially biological processes for the production of plants or animals other than non-biological and microbiological processes. However, Members shall provide for the protection of plant varieties either by patents or by an effective sui generis system or by any combination thereof. The provisions of this subparagraph shall be reviewed four years after the date of entry into force of the WTO Agreement.

At first sight, it appears that the legitimate grounds for exclusion in paragraph 2 may provide a basis for preventing conflict in relation to both the calls in CBD for protecting biological diversity beyond national jurisdiction and UNCLOS with its principle of common heritage of mankind and the connected obligation not to raise legal claims in relation to deep-sea resources.

However, the explicit exclusion in paragraph 3(b) of micro-organisms from what states may exclude from patentability makes it considerably more difficult to reconcile TRIPS with the other treaties. As was discussed in Part B and C, a considerable number of bioresources relevant for deep-sea bioprospecting fall outside the scope of the categories for which the possibility to make exception from patentability applies. As similarly discussed, the explicit exceptions from the categories which may be excluded from patentability ought to be interpreted as conversely entailing an obligation to enable patents relating to the same resources. It is also difficult to dispute that the distinction between *micro-organisms* and organisms eligible for exception from patentability on the other, leaves little room for making arguments that it should be allowed to prevent patentability of the former types of bioresources too.

Interpreting Article 27 of TRIPS as not conflicting with UNCLOS and the CBD would require a reading whereby it would be possible to exclude "*micro-organisms*" from patentability. Alternatively, it would call for interpreting these terms as excluding genetic resources of the deep seabed. The problem with attempting to read the provision in this manner is that based on logical semantics, it would be directly contrary to what is provided according to a standard reading of the provision. Indeed, the interpretation necessary for preventing conflict would require going against the ordinary meaning of terms involved. As discussed in the previous section, this would be in direct violation of Article 31(1), which provides that a treaty shall be interpreted in good faith in accordance with the ordinary meaning to be given to the terms of the treaty. Since the attempt to prevent conflict would stumble on these basic elements of treaty interpretation law, it would not matter how much the terms used as references in other treaties can be stretched. Nor would the object, purpose and context of treaties involved be able to change the meaning of the terms. In essence, the limitations to interpretation provided by treaty law prevent readings that go against basic logical semantics, as would be required for preventing TRIPS from conflicting with UNCLOS and the CBD in the case of deep-sea bioprospecting.

Would it, then, be possible to prevent conflict if the matter were addressed under systemic integration, in line with paragraph 3(c) of Article 31 and its call for taking into account *any relevant rules of international law applicable in the relations between the parties*?

As discussed in the previous section, more recent WTO practice prevents the application of this approach in interpretation of WTO agreements unless there is full parallelism of parties to treaties involved.[1312] If these findings are set aside for a moment and the more permissive approach suggested by the *US-Shrimp* case[1313] is followed, would such an interpretation of Article 27 of TRIPS be able to harmonize the *prima facie* conflicting provisions? As previously discussed in section E.5.1, under the approach suggested in this decision, rules in UNCLOS and the CBD should represent context for the purposes of the interpretation of Article 27 of TRIPS and not merely serve as linguistic reference points in interpretation of TRIPS.

If CBD and UNCLOS accordingly were to be considered as contexts for the purposes of interpreting Article 27 of TRIPS, it could be argued that this context makes clear that the requirement for patentability includes an implicit exception for deep-sea genetic resources, at least for deep-seabed micro-organisms. Indeed, this is all that would be required to make TRIPS compatible with other treaties involved. But even under the liberal approach to interpretation taken in *US-Shrimp* case, interpreting Article 27 accordingly would be highly controversial. To start with, even if the decision in *US-Shrimp* did not clarify *how* generic interpreted terms would have to be to qualify in harmonious interpretations, the term for interpretation in that case, "natural resource," was relatively generic, and more or less directly linguistically overlapping with the provisions in the other treaties referred in the harmonizing approach taken by the Appellate Body. In the case of deep-seabed bioprospecting, the contentious terms in TRIPS consist of many elements and are considerably more precise, hence less elastic from an interpretative standpoint. To make matters more difficult, the terminology in CBD and UNCLOS that would be used to promote a harmonizing interpretation is different from that in TRIPS. Rather than integrating similar terms from different treaties, the interpretation of Article 27 necessary to prevent conflict in relation to CBD and UNCLOS would imply a fundamental transformation of the provision. As noted in section E.6.1, the ruling in *US-Shrimp* did not amount to general revision or reinterpretation of a treaty.[1314]

[1312] See in particular the discussion on EC-Biotech in section E.5.2.

[1313] Appellate Body, United States - Import Prohibition Of Certain Shrimp And Shrimp Products.

[1314] As noted in the previous section and as pointed out by Boyle "*each case was concerned with the interpretation of particular provisions or phrases, such as 'natural resources' or 'jurisdiction', which necessarily import— or at least suggest—a reference to current general international law*." This supports the notion that evolutionary interpretation can be regarded as a relatively limited task, which has to be consistent with the intention of the parties. As similarly concluded by Boyle, "*it does not entitle a court or tribunal to engage in a process of constant revision or updating of treaties every time a newer one comes along(…) The result must remain faithful to the ordinary meaning and context of the treaty 'in the light of its object and purpose*." Boyle, Relationship Between International Environmental Law and Other Branches of International Law. 2008.

Even more problematic from a systemic standpoint is that the outer limits to treaty interpretation, as discussed in the previous section, remain equally binding. This means that also interpretation under the principle of systemic integration must respect the obligation in Article 31(1) to interpret treaties in good faith in accordance with the ordinary meaning to be given to the terms of the treaty in their context and in light of its object and purpose. Respecting these obligations is equally difficult when adjusting the meaning of terms in Article 27 under the principle of systemic integration, as when the other treaties were used as reference points. Under an interpretation in good faith based on the ordinary meaning of terms, new treaty terms cannot be given a meaning that is incompatible with logical semantics, nor can exceptions be introduced to treaty provisions which go against existing language.

Accordingly, if the criticism against applying systemic integration in recent cases is set aside, arguments can be made for accepting far-reaching harmonizing interpretations in cases where the contentious provisions relate to the same concept. However, not even this would suffice to prevent the norm conflict relating to deep-seabed bioprospecting from the perspective of TRIPS. This is because it is not the legal means to build linkages between treaties and regimes that is lacking; it is the language of central provisions that sets boundaries. Harmonization in this case would not be possible without linguistically stretching the meaning of conflicting terms beyond what would be allowed under the requirements in the rules on treaty interpretation for interpretation to be conducted in *good faith*, and in line with *ordinary meaning* and *object and purpose* as well as the contextual criterion, as discussed in section E.6.1.

In conclusion, addressing norm conflicts from the perspective of WTO law by means of treaty interpretation tools, as provided in the Vienna Convention, may provide important means to prevent treaty conflict and maintain the coherence of public international law as a system. Such use of treaty interpretation principles has also become accepted in WTO jurisprudence.

Under the practice of WTO dispute settlement, it appears uncontroversial to use treaties of other regimes as references for establishing the meaning of ambiguous terms when interpreting WTO treaties appears uncontroversial. Systemic integration was accepted under the *US-Shrimp* decision, but it has come to be rejected in subsequent cases.

As has been illustrated by the inability to apply these approaches to promote harmonization and prevent conflict in the case of deep-seabed bioprospecting, these principles are much more difficult to apply in real cases than what is assumed in theoretical discussions. In real cases, irreconcilable language of treaty provisions can be expected to prevent harmonization in difficult cases, as has been demonstrated in the relationship between the TRIPS rules on patentable subject matter and the overlapping norms of the CBD and UNCLOS. This conclusion goes against the prediction of the International Law Commission Report, namely that treaty interpretation and systemic integration will prevent norm conflict and fragmentation, thereby ensuring coherence of the system of public international law. Even if this problem of deep-seabed bioresources may be regarded as anecdotal evidence and far from sufficient for disproving preconceived ideas, at the very least it calls for a renewed discussion on the principle of systemic integration from the perspective of practical cases of conflict.

E.6.2.2. UNCLOS

Approaching the norm conflict on deep-seabed bioprospecting by means of treaty interpretation from the perspective of UNCLOS involves challenges similar to the ones discussed under TRIPS. In order to prevent conflict, UNCLOS would have to be interpreted in a manner conducive to patenting of genetic resources, not only in the high seas but also in the deep seabed of the Area. As discussed in section E.1, the contentious provisions foremost relate to the common heritage of mankind principle. Since this principle according to Article 136 applies to the Area and its resources, it appears that there are two ways in which UNCLOS could be read if it is to be regarded as not conflicting with the other treaties. Preventing conflict would require an interpretation which excludes genetic resources in general and micro-organisms in particular either from the Area and its resources *or* from the principle itself.

Reinterpreting the scope of the Area

The rationale of the former option follows that of the restrictive position, as examined in Part C.1.4. As discussed in that context, the main argument in support of this position is based on the definition of resources in Article 133, which refers to resources as including "*all solid, liquid or gaseous mineral resources in situ in the Area at or beneath the seabed, including polymetallic nodules*," but it also states that "*(b) resources, when recovered from the Area, are referred to as 'minerals'*." Under the restrictive position, it was argued that if the Area had been meant to encompass also non-mineral resources, it appears counterintuitive to refer to resources as minerals. Emphasizing the wording of the resource definition, the restrictive position claims that if genetic resources as non-minerals do not fall within the resources of the Area, based on an *e contrario* reading of Article 136 they should not be considered as encompassed by the common heritage of mankind principle. The result would be, it has been argued, that genetic resources represent a *legal lacuna* under UNCLOS.[1315] Consequently, in lack of rules applicable to deep-sea genetic resources in UNCLOS, the rules of other regimes applying to these resources would not be incompatible. Alternatively, it has been claimed, whereas Part XI regulates mineral resources, the use of other resources in the Area falls under the regime of the freedom of the high seas and is excluded from the scope of application of Part XI.[1316]

Reinterpreting the principle of common heritage of mankind

The second option would suggest interpreting the scope of the principle of common heritage of mankind, rather than the Area, as excluding genetic resources and hence avoid conflict with TRIPS.

[1315] As discussed in Part C.1, the legal lacuna or legal gap-theory has also been referred to in Secretary-General reports on the Oceans and the Law of the Sea, such as that of 2003 and 2004, Oceans and the law of the sea. Report by the Secretary-General (A/58/65) (3 March 2003), at paras. 18, 147 and 195; Report of the UN Secretary-General on Oceans and Law of the Sea, advance unedited document of 4 Mar 2004, at para. 267. For some states, this has also been one of the premises for the so-called BBNJ-process for the negotiation of a new implementing agreement on the law of the sea. See also ARICO & SALPIN. 2005; Scovazzi, Bioprospecting on the Deep Seabed: a Legal Gap Requiring to be Filled. 2006.

[1316] Both the so-called Virginia Commentary and Churchill & Lowe's '*The law of The Sea*' appears to take this position (NORDQUIST, et al. 1995, 29; CHURCHILL & LOWE. 1999 p. 239 and fn. 49. This view was also supported by Glowka in the publication which initiated the debate on the legal status of genetic resources, Glowka, OCEAN YEARBOOK ONLINE (1996).

This would accept the notion of the Area as a maritime zone which like other zones encompasses all resources geographically located in it. It would, however, require reconsidering the interpretation of several others of the previously discussed rules of Part XI, apart from the already mentioned Article 136. This in particular includes the principle of non-appropriation in Article 137[1317] which prevents any legal claim to any part of the Area or its resources, as well as the general obligation that activities in the Area shall be carried out for the benefit of mankind as a whole, as provided in Article 140. It would most likely also require an exclusion of bioprospecting from the exclusive mandate of the International Seabed Authority, which in Article 157 is formulated as encompassing the organization and control of activities in the Area. Considering the exclusive rights involved in patenting, it would also additionally, or possibly alternatively, call for a new understanding of Article 150, which provides instrumental rules for how activities may be carried out in the Area, with a strong emphasis on promoting the economy in developing states.

Both ways of interpreting UNCLOS in order to promote harmonization with the other treaties may be further supported by arguments relating to systemic integration. Similar to the discussion under TRIPS above, systemic integration could be used as the basis for arguing that a relationship between UNCLOS, TRIPS and CBD which prevents conflict would require an interpretation that excludes genetic resources from the scope of the Area and/or the common heritage of mankind principle. Since it is considered an inherent value to maintain a functional system of international law, this interpretation should be favored.[1318]

[1317] Article 137 provides which provides the that "No state shall claim or exercise sovereignty or sovereign rights over any part of the Area or its resources, nor shall any State or natural or juridical person appropriate any part thereof. No such claim or exercise of sovereignty or sovereign rights nor such appropriation shall be recognized. 2. All rights in the resources of the Area are vested in mankind as a whole on whose behalf the Authority shall act. These resources are not subject to alienation. The minerals recovered from the Area, however, may only be alienated in accordance with this Part and the rules, regulations and procedures of the Authority. 3. No State or natural or juridical person shall claim, acquire or exercise rights with respect to the minerals recovered from the Area except in accordance with this Part. Otherwise, no such claim, acquisition or exercise of such rights shall be recognized."

[1318] In line with the systemic perspective of international law, as discussed in section A.6 and E.4.

Treaty law limitations to harmonizing interpretations of UNCLOS

Two ways of interpreting UNCLOS which could prevent conflict in relation to TRIPS have thus been identified. Would these readings be compatible with international law? Not unlike WTO law, UNCLOS explicitly positions itself in relation to general international law, by affirming in its preamble 8 "*that matters not regulated by this Convention continue to be governed by the rules and principles of general international law.*"

Like the WTO law provisions clarifying its relationship to public international law discussed in the previous section, this reference reaffirms that also from the perspective of UNCLOS, the Vienna Convention provides the relevant rules for treaty interpretation.[1319] Proelss considers that UNCLOS opens for harmonizing obligations in the convention with norms in other treaties by means of interpretation, so long as the treaty interpretation rules of the Vienna Convention are respected.[1320] This connects to the concept of evolutionary interpretation, as discussed in section E.6. Compared to the other treaties regulating deep-sea bioprospecting, it is particularly relevant to consider that contentious elements of UNCLOS may have developed by means of evolutionary interpretation. This is not only because the other treaties have been negotiated more recently, but also since the negotiation of relevant parts of UNCLOS predates the commercial interest of deep-sea genetic resources.

As previously discussed, different positions have been voiced on the specific legal basis for evolutionary interpretation in the Vienna Convention. Some consider the approach as more generally based on the intention of the parties and not specifically connected to any of the different elements of the Vienna Convention rules on treaty interpretation.[1321] Others appear to view it as closely connected to systemic integration.[1322] In any event, this approach must be compatible with the outer limits of interpretation, as defined by the rules on treaty interpretation.

[1319] This also follows from the customary nature of the Vienna Convention rules on treaty interpretation, as discussed in section E.4.

[1320] Proelss, United Nations Convention on the Law of the Sea: A Commentary. 2017, at 15.

[1321] Bjorge. 2014, at 2.

[1322] Boyle, Relationship Between International Environmental Law and Other Branches of International Law. 2008.

Evolutionary interpretation can thus only be accepted insofar as the parties have used generic terms in a treaty in awareness of the potential for development of their meaning.[1323] Accordingly, any attempt to harmonize the contentious elements of UNCLOS must foremost be in good faith in accordance with the ordinary meaning to be given to the terms of the treaty in their context and in light of its object and purpose, as well as respecting the other elements of Part III Section III of the Vienna Convention. Similar to what was conducted under the previous heading focusing on TRIPS, it is therefore necessary to examine if the two approaches to interpretation of the *prima facie* conflicting elements of UNCLOS would be compatible with the Vienna Convention rules on treaty interpretation.

As discussed in section E.6.1, different approaches may be used in establishing what obligations a treaty entails. One understanding may be favored over other possible readings. Terms may be interpreted in line with similar concepts of other treaties.[1324] Conflicting treaties may be interpreted so as to prevent conflict under systemic integration. Irrespective of how the reading is conducted, the rules on treaty interpretation in the Vienna Convention remain binding. Like the investigation of possible readings of TRIPS to avoid conflict under the previous heading, the requirement that a treaty shall be interpreted in line with the Vienna Convention thus sets the outer limits for possible understandings of contentious terms.

To start with the first approach of interpreting UNCLOS in order to prevent conflict, it seems feasible from a semantic standpoint to interpret Article 133 as excluding genetic resources from the definition of resources of the Area. The wording of the definition of resources of the Area is paradoxical. But if emphasis is put on paragraph (a), it appears unproblematic to interpret the definition as limited to mineral resources. Indeed, such a reading would be in line with the ordinary meaning of the terms, as called for by paragraph 1 of Article 31 of the Vienna Convention. However, as discussed in Part C.1.4, even if this restrictive perspective of the definition is accepted (and resources of the Area are understood as including only mineral resources), it would not follow logically that the common heritage of mankind principle is inapplicable.

[1323] ICJ, Navigational and Related Rights (Costa Rica v Nicaragua) 2009.

[1324] It is worth noting that the Bluefin Tuna Case where this approach was undertaken concerned the law of the sea, as discussed in section E.5.1 and E.5.2.

This is because Article 136 puts not merely the resources of the Area, but the Area *per se* within the scope of the common heritage of mankind principle. Thereby, it would not be sufficient to exclude genetic resources from the definition of resources of the Area to avoid applicability of the common heritage of mankind principle. In order to claim that there is a *legal lacuna* (or that genetic resources fall within the high seas regime), it would also be necessary to interpret the Area as altogether excluding genetic resources from its scope. There is reason for considering such a reading as going against the first paragraph of Article 31 of the Vienna Convention. This is because, as discussed in Part C.1.4, Article 1 of UNCLOS defines the Area not as a specific concept for mineral resources, but as a geographically defined space, similar to other maritime areas: "*'Area' means the seabed and ocean floor and subsoil thereof, beyond the limits of national jurisdiction.*" As pointed out by Oude Elferink, "*in principle, the ordinary meaning of the terms 'seabed', 'ocean floor' and 'subsoil', comprises the living and non-living resources that are found in those areas.*"[1325] As similarly discussed in Part C.1.4, this is further confirmed by the reference to "*the natural resources of the Area*" in Article 145(b) of the Convention as well as the inclusion of sedentary species in the continental shelf regime, which has been claimed to apply to the deep seabed by analogy.

Other provisions on the Area would also be difficult to reconcile with an interpretation of deep-sea bioprospecting as representing a *legal lacuna* or forming part of the high seas regime. In particular, Article 134 claims that "*Activities in the Area shall be governed by the provisions of this Part*," and Article 140, that "*Activities in the Area shall, as specifically provided for in this Part, be carried out for the benefit of mankind as a whole.*"[1326] Generally, the *legal lacuna* argument would also be problematic to reconcile with the explicit intention of the negotiators of UNCLOS to establish a comprehensive convention.[1327]

[1325] As further observed by Oude Elferink, "*These are general terms that have a specific spatial application that does not exclude certain natural components from that spatial scope of application because they differ from surrounding areas. The same applies to all other maritime zones. All resources located in a zone form part of that zone.*" Oude Elferink, THE INTERNATIONAL JOURNAL OF MARINE AND COASTAL LAW (2007), at 150. See also Scovazzi, THE INTERNATIONAL JOURNAL OF MARINE AND COASTAL LAW (2004), at 391.

[1326] Oude Elferink, THE INTERNATIONAL JOURNAL OF MARINE AND COASTAL LAW (2007), at 152.

[1327] As expressed in the preamble, UNCLOS "establishes a comprehensive framework for the regulation of all ocean space, conscious that its problems are closely interrelated and need to be

In contrast with this ambition, the interpretation excluding genetic resources from the Area would imply that there are rules applying to living resources in all maritime zones except for the Area. As discussed in Part C.1.4, based on negotiation documents there are strong indications that the concept of sedentary species as regulated in the continental shelf was intended to encompass all seabed organisms, and that the reason for not explicitly referring to living resources in the Area regime was that such species were considered insignificant at the time of negotiation. The references to both living and mineral resources in the drafting history of Part XI also support this notion.

The second option, in addition, suggesting that the common heritage of mankind principle rather than the Area should be interpreted as excluding the bioprospecting of genetic resources, would be difficult to reconcile with the notion of UNCLOS as a comprehensive convention, since the alternative would be that this activity is left unregulated, which would clearly go against the will of the negotiators.[1328] There are also functional arguments against excluding genetic resources connected to the mandate of the International Seabed Authority. The broad and general responsibility of the ISA to activities in the deep seabed, with no relevant exclusions, also appears to be a clear indication that the negotiators aimed to include all activities and resources in the regime of the Area.[1329]

Taken together, these indications from the negotiation documents make it difficult to reconcile any interpretation of the Area or the common heritage of mankind principle as excluding genetic resources with the first paragraph of Article 31 of the Vienna Convention.

considered as a whole." As observed by Armas-Pfirter (and previously discussed in Part C.1.4), "*pursuant to the convention, ocean space is divided into jurisdictional zones and different issues are governed on a geographical basis. This "zonal approach" means that a specific legal regime applies, geographically, only to a given marine area*." Armas-Pfirter, THE INTERNATIONAL JOURNAL OF MARINE AND COASTAL LAW (2009), at 281.

[1328] As argued by Francioni, the practical difference of bioprospecting to fisheries makes the freedom of fishing inapplicable to genetic resources of the Area. Similarly, the legal claims involved renders the regime on marine scientific resources inapplicable. Sovereignty is excluded in both the Area and the high seas. Thereby, the common heritage of mankind principle is the only principle which could be applicable to genetic resources. Since the convention aims to encompass all uses of the oceans, this principle must be regarded as applicable. See section C.1.4 and Francioni, International Law for Biotechnology: Basic Principles. 2006, at 12.

[1329] As similarly discussed in section C.1.4.

Generally, an interpretation of the conflicting elements of UNCLOS enabling patentability, as required by TRIPS, would face the same problems as those found in the converse relation, discussed under the previous heading. It would go against the ordinary meaning to be given to the terms of the treaty to interpret the common heritage of mankind principle as permitting the patenting of genetic resources of the Area. Both ways of interpreting the convention restrictively, and thereby avoiding this problem, seem to be incompatible with the requirement to reflect the intention of the negotiation parties, which is connected to the good faith criterion, as discussed in section E.6.1.

These restrictive readings can also be challenged based on the contextual criterion for not considering the implications of connecting parts of the convention. As has been made clear, individual provisions cannot be read in isolation, but must be interpreted in light of connecting provisions and the overriding purpose of the treaty. As regards the subsequent element in Article 31 of the Vienna Convention, calling for interpreting treaties in light of their object and purpose, there is no equivalent in the law of the sea to the connection in TRIPS to the provision in the Agreement establishing the WTO, upon which arguments can be built for making harmonious interpretation in relation to treaties of other regimes. Instead, UNCLOS declares the objective of the convention in the preamble, reflecting a limited ambition to consider values or objectives of other treaties in interpretation of its provisions. This is not surprising since UNCLOS was drafted as the supreme and central framework convention within the law of the sea.

Among the objectives formulated in the preamble, the express reference in recital 6 to the common heritage of mankind principle in particular raises challenges when attempting to prevent treaty conflict in the case of deep-sea bioresources by means of interpretation:

> *Desiring by this Convention to develop the principles embodied in resolution 2749 (XXV) of 17 December 1970 in which the General Assembly of the United Nations solemnly declared inter alia that the area of the seabed and ocean floor and the subsoil thereof, beyond the limits of national jurisdiction, as well as its resources, are the common heritage of mankind, the exploration and exploitation of which shall be carried out for the benefit of mankind as a whole.*

This direct reference as an objective of UNCLOS to promote the very concept that conflicts with other treaties in the context of deep-sea bioprospecting seemingly raises barriers to any harmonizing interpretation which would involve redefining the same concept. This is particularly relevant since Resolution 2749, which is referred to unequivocally, regards the common heritage of mankind principle as extending to all resources of the seabed beyond national jurisdiction.[1330]

Indeed, the reference to the resolution among the objectives of UNCLOS indicates that this resolution, rather than any other treaty, should be considered in interpretation of UNCLOS. This supports the notion of genetic resources as included in the regime of the Area and falling within the common heritage of mankind principle. The special status of the common heritage of mankind principle in UNCLOS also follows from how it is formulated in the operative provisions, in particular Articles 136 and 137, as discussed in Part C. Recital 6 of the preamble expresses only part of the objective of the convention, which as discussed in section E.6.1 not necessarily is the same thing as the full reason for which the treaty exists. Still, it appears difficult to reconcile an interpretation going against this clearly expressed objective, excluding important commercial relevant deep seabed resources from the scope of the principle, with the requirement to interpret the treaty in light of its object and purpose.

Indeed, the requirements for interpretations to respect the object and purpose of the treaty would render it difficult to read any provision in the treaty in a way that modifies the function of or excludes certain resources from the scope of the common heritage of mankind principle.

[1330] In paragraph 1, Resolution 2749 "*solemnly declares that: The sea-bed and ocean floor, and the subsoil thereof, beyond the limits of national jurisdiction hereinafter referred to as the area), as well as the resources of the area, are the common heritage of mankind.*", United Nations General Assembly resolution 2749 (XXV), Declaration of Principles Governing the Seabed and the Ocean Floor, and the Subsoil Thereof, beyond the Limits of National Jurisdiction, A/RES/25/2749 (12 December 1970). 1970.; Konrad Jan Marciniak, Marine Genetic Resources: Do They Form Part of the Common Heritage of Mankind Principle?, in NATURAL RESOURCES AND THE LAW OF THE SEA: EXPLORATION, ALLOCATION, EXPLOITATION OF NATURAL RESOURCES IN AREAS UNDER NATIONAL JURISDICTION AND BEYOND (Lawrence Martin, et al. eds., 2017).

Equally relevant in this context is Article 311(6) which declares that

> *States Parties agree that there shall be no amendments to the basic principle relating to the common heritage of mankind set forth in article 136 and that they shall not be party to any agreement in derogation thereof.*

This clearly implies that under the perspective of UNCLOS, the common heritage of mankind principle ought not to evolve organically in light of provisions in other treaties. The declaration in Article 311(6) thus severely circumscribes the possibilities for preventing treaty conflict by arguing that the principle or the regime of the Area has developed into allowing for the bioprospecting of deep-sea genetic resources. As discussed in section E.6.1, a necessary requirement for evolutionary interpretation is that the parties implicitly or explicitly allowed for terms in the treaty to develop. The declaration in Article 311(6) makes clear that the negotiators of UNCLOS explicitly wanted the contrary, to prevent a development which undermines the common heritage of mankind principle.[1331] There thus seems to be little room for arguments that the scope of the principle has come to exclude genetic resources. It appears more in line with Article 311(6) and the notion of the convention as comprehensive to claim that relevant terms have developed by means of evolutionary interpretation into reaffirming the scope as including genetic resources. Since the principle of common heritage of mankind was drafted to include the seabed resources which during the negotiation were considered most valuable, and the genetic resources which were unknown at the time have subsequently turned out to be more valuable than mineral resources, it would appear more reasonable to consider the definition as having developed evolutionarily to include genetic resources, as discussed in C.1.4.

[1331] Michael W. Lodge, The Common Heritage of Mankind, 27 THE INTERNATIONAL JOURNAL OF MARINE AND COASTAL LAW (2012); Pauwelyn disputes the notion that Article 311(6) effectively can prevent any subsequent modification of the principle, claiming that "*the contractual freedom of states parties to UNCLOS should allow them to amend Article 311(6) itself, e.g. by concluding a deviation from Article 136 and explicitly stating that this deviation is not subject to Article 311(6).*" Even if this observation would be correct, no such references which potentially could take precedence over this provision of UNCLOS have been declared in connection with conflicting treaties, or any other agreement. PAUWELYN, Conflict of Norms in Public International Law: How WTO Law Relates to Other Rules of International Law. 2003, at 303.

In conclusion, under the Vienna Convention rules on treaty interpretation, it does not appear that the formulation of the regime of the Area and the common heritage of mankind principle, including relevant negotiating documents, enable the degree of adjustment which would be necessary in order to interpret relevant parts of UNCLOS so as to prevent conflict with applicable rules on deep-sea bioprospecting in TRIPS, in particular relating to the bioprospecting of deep-seabed micro-organisms.

Even if these constraints imposed by treaty law were disregarded, and the problem were addressed only as a matter of systemic interpretation in line with other relevant rules of international law applicable in the relations between the parties, it is unlikely that the problem could be solved. It thus appears just as difficult as from the perspective of TRIPS to linguistically interpret the conflicting rules in UNCLOS in a manner that prevents conflict.

Yet, this does not imply that it is impossible to prevent treaty conflict by using the principle of systemic integration or evolutionary interpretation in all conflicts involving UNCLOS. As already established in section E.1, there does not appear to be any inconsistency between the rules of TRIPS and UNCLOS relating to bioprospecting in the high seas. In the case of deep-sea bioresources, the material overlap between UNCLOS and CBD appears considerably less difficult to bridge compared to that of TRIPS.[1332]

Rather than imposing contradictory obligations on states, the conservationist and benefit-sharing obligations of CBD applying to activities in areas beyond national jurisdiction conflict with the deep-sea rules of UNCLOS by adding an additional layer of restriction. It appears fully possible to conduct a harmonizing reading of the relevant provisions of UNCLOS which adjusts the interpretation to also include the conservationist and benefit-sharing elements of the CBD without violating the obligations to interpret treaties in good faith, and in line with ordinary meaning and object and purpose as well as the contextual criterion provided. Seen from the perspective of states bound by both treaties, implementing the relevant provisions of CBD does not render it impossible to also respect the relevant provisions of UNCLOS.

[1332] BOYLE, The making of international law. 2007, at 248-255.

This illustrates that the principle of systemic integration can help to facilitate coherence in norm conflicts, even in cases involving treaties such as UNCLOS, which contain little of express regard or concern for provisions in treaties of other regimes. Examining the conflicting elements of UNCLOS under the general rule of treaty interpretation thus yields different answers, depending on the magnitude of conflict. Contrary to the relation between UNCLOS and TRIPS, a harmonizing interpretation would be able to prevent conflict between UNCLOS and CBD. This illustrates that systemic integration may be capable of preventing conflict between treaties where the conflict consists of an overlap between norms where relevant terms are flexible enough to enable a reconciliatory reading. But in cases of incompatibility between fundamentally irreconcilable obligations, conflict cannot be prevented by means of harmonizing interpretation.

E.6.2.3. CBD

As already discussed in the context of application of conflicting treaties under section E.5, Article 22 of the CBD provides a comparatively straightforward instruction on how the convention is to be regarded in relationship to other treaties, which is equally relevant for treaty interpretation purposes as for application. In fact, paragraph 2 of Article 22 of CBD does not refer to application or interpretation, but rather to *implementation*, which can be considered as encompassing both aspects.

Accordingly, the CBD should be applied and interpreted in light of the law of the sea. For interpretation purposes, however, it is not necessary to regard paragraph 2 as an indication of priority for the law of the sea. Rather, it stresses that the CBD should be read in a manner that is compatible with UNCLOS. The provision can thus be regarded as an explicit call for harmonizing interpretations, much in line with the principle of systemic integration in Article 31(3)(c) of the Vienna Convention.

The qualification to implement the CBD with respect to the marine environment consistently with the "*rights and obligations of states under the law of the sea*," however, as previously discussed, raises questions about how to relate to provisions in UNCLOS which cannot be considered as representing rights and obligations. Arguably, the instruction in paragraph 2 lacks relevance in cases where CBD overlaps with more general approaches of UNCLOS.

In the case of deep-sea genetic resources, however, this is of limited relevance since the conflict involves central elements in UNCLOS of clearly binding character.

Since the scope of paragraph 2 of Article 22 is limited to the law of the sea, and corresponding specific instructions on the relation to other areas of international law are lacking in CBD, the convention provides less guidance for interpretation of cases of potential conflict in relation to other treaties, including TRIPS.[1333] As discussed under section E.5, the preceding paragraph 1 essentially represents a conflict clause and is of limited value beyond decisions of applicable treaties.

> **Article 22**
> *Relationship with Other International Conventions*
> 1. The provisions of this Convention shall not affect the rights and obligations of any Contracting Party deriving from any existing international agreement, except where the exercise of those rights and obligations would cause a serious damage or threat to biological diversity.
> 2. Contracting Parties shall implement this Convention with respect to the marine environment consistently with the rights and obligations of States under the law of the sea.

The lack of explicit calls for harmonizing interpretation in relation to other treaties than UNCLOS does not imply that such approaches cannot be pursued to prevent conflicts involving CBD. General rules for treaty interpretation apply, including the principle of systemic integration, as well as other treaty interpretation criteria provided by Section III of the Vienna Convention's Part III.

Similar to the investigation of TRIPS and UNCLOS, this calls for an examination of how the object and purpose of the treaty is formulated, in order to assess the outer limits of harmonizing interpretations. These are expressed in Article 1 of the CBD, which reflects a threefold ambition: Conservation of biological diversity; sustainable use of biodiversity; and fair and equitable sharing of benefits.[1334]

[1333] Id. at 248-255.
[1334] OLA DAJANI, GENETIC RESOURCES UNDER THE CBD AND TRIPS: ISSUES ON SOVEREIGNTY AND PROPERTY (E. R. Gold ed., ProQuest Dissertations Publishing. 2003).

In essence, this reflects the trade-off in the negotiation of the CBD of ensuring the conservation of biological diversity in return for a more equitable sharing of economic benefits as described in Part D.

> **Article 1**
> *Objectives*
> The objectives of this Convention, to be pursued in accordance with its relevant provisions, are the conservation of biological diversity, the sustainable use of its components and the fair and equitable sharing of the benefits arising out of the utilization of genetic resources, including by appropriate access to genetic resources and by appropriate transfer of relevant technologies, taking into account all rights over those resources and to technologies, and by appropriate funding.

What constraints does this objective of the treaty impose when attempting to harmonize the obligations of CBD relevant for deep-sea bioresources with overlapping norms in UNCLOS and TRIPS? As discussed in Part E.1, it is essentially the obligations in the CBD relating to conservation and benefit-sharing which overlap with the other treaties in the context of deep-sea bioprospecting. These in particular include the obligations in Articles 6, 8 and 10 to protect biological diversity *in situ* and ensure sustainable use.[1335] According to the jurisdictional scope formulated in Article 4, these obligations apply in areas beyond national jurisdiction as regards processes and activities.

Would it, then, be logically possible and consistent with object and purpose of the CBD, as well as other elements of the treaty interpretation rules of the Vienna Convention, to read these obligations of the CBD in harmony with the requirement for patentability under TRIPS and the principle of common heritage of mankind and connected obligations of UNCLOS? Under the previous heading, it has already been established that there are no logical or linguistic arguments against reconciling the relevant provisions of UNCLOS with those of the CBD. Conversely, it appears fully possible for states to implement the CBD obligations to prevent processes and activities under their

[1335] Amongst other aspects, the convention requires its parties to, as far as possible and as appropriate, maintain viable populations in natural surroundings. As discussed in Part C.2, a "viable" population can be defined as one which maintains its genetic diversity, its potential for evolutionary adaptation and faces minimal risk of extinction from demographic fluctuations, environmental variation and potential catastrophe, including over-use. See Doc. UNEP/CBD/COP/2/12, para. 39.

jurisdiction from negatively affecting biological conservation in the deep seas under an interpretation which is compatible with the principle of common heritage of mankind, without violating treaty law obligations on interpretation.

It appears more difficult to reconcile these interests of the CBD with the obligation to enable patentability under TRIPS, at least in some cases. As noted in Part B, there are indications that many deep-sea ecosystems are so sensitive and endemic that even the limited sampling operations necessary for patenting may represent threats to conservation. If large-scale bioprospecting operations were conducted in these locations, the environmental impact would be considerable. The requirements of CBD to share information from findings appear less problematic in this context, since publication of patent data is a central requirement for patenting. As such, it seems that the obligation of conserving deep-sea organisms could only be interpreted as harmonious with patentability insofar as detrimental effects of sampling operations are prevented. This would require an implementation of TRIPS which prevents patentability of deep-sea bioresources in locations where such operations could represent a threat to conservation.

Indeed, based on the objective of the CBD as set out in Article 1, the obligation to ensure that activities are compatible with the obligation to ensure conservation of deep-sea species may be interpreted as allowing appropriation of elements of biological resources beyond national jurisdiction by means of patenting, provided that such activities are not detrimental to the environmental interests pursued by the CBD. Such a harmonious reading under the principle of systemic integration, which prevents conflict in relation to TRIPS, appears to be possible under the CBD, without going beyond the limitations for treaty interpretation set by the Vienna Convention. However, it should be noted that considering the rigid requirement to enable patenting under TRIPS, even such limited exceptions could be considered as representing an inconsistency in relation to the Vienna Convention rules on treaty interpretation. If, on the other hand, the relevant obligations of the CBD were interpreted as allowing patentability in line with TRIPS in all deep-sea locations, it would go against the objective of CBD and hence violate basic obligations of treaty interpretation. It thus appears that arguments could be made for interpreting the contentious areas of the CBD in a manner which avoids conflict with UNCLOS. However, it is not certain that the measures necessary for ensuring in situ conservation can be combined with the requirement in TRIPS to enable

patentability for some categories of biogenetic resources in all locations, irrespective of such considerations. If, however, exceptions for bioprospecting are imposed in certain sensitive locations, conflict could be prevented.

In conclusion, the treaty conflict that comprises the focus of this investigation provides a representation of the challenges in applying systemic integration in practical cases. Taken together, it can be concluded that states cannot implement obligations to ensure the conservation and enable patenting of deep-seabed bioresources, while at the same time fulfilling their obligations relating to the principle of common heritage of mankind. This inconsistency cannot reasonably be fully bridged by harmonizing interpretations under the principle of systemic integration, without going against other obligations under treaty law, thereby violating the object and purpose of the treaties. In the specific case of deep-sea bioresources, the notion that treaty interpretation principles and the principle of systemic integration ensure the coherence of public international law has been disproven.

In practical cases, the degree of material conflict between provisions involved, as well as the rigidity of objects, purposes and other elements of treaties involved, may hamper efforts to prevent conflict and maintain a coherent system of public international law.

In this case, systemic integration could prevent conflict in the relation between UNCLOS and CBD, as well as the relationship between CBD and TRIPS, save for some cases where the potential for conflict between conservation and patenting interests would persist. As regards bioprospecting of genetic resources of the high seas, there does not even appear to be an inconsistency between TRIPS and UNCLOS. If the same activity is carried out in the deep seabed of the Area, by contrast, the conflicting norms provide contrary obligations, which cannot be reconciled by means of treaty interpretation.

E.7. Concluding observations on the interaction of rules

The relationship between treaties that belong to different regimes has long been identified as a general problem in international law. As discussed in preceding parts of this investigation, the bioprospecting of marine genetic resources is not only regulated differently; it is also regarded as a fundamentally dissimilar concept across three regimes of international law.

The widely different perspectives of legal claims relating to deep-sea genetic resources have resulted in the development of rules in the law of the sea, international environmental law and international trade law which *prima facie* involve areas of conflict. The apparent inconsistencies have become more relevant as a result of the growing interest in deep-sea bioprospecting, involving technological aspects and novel uses of genetic resources, which poses some challenges to the application of international law rules.

In this part, an attempt has been made to bridge this problem by means of treaty law, first by rules on application aiming to resolve the conflict, and thereafter on the basis of treaty interpretation, including evolutionary interpretation and systemic integration, under the rules aiming to prevent the conflict.

Approaching the matter as a problem of application, it has been established that conflict clauses generally represent a pragmatic approach to treaty conflict, based on the recognition that it is inadvisable to produce a general rule on treaty priority. Indeed, an unconditional application of principles such as *lex posteriori* are likely to yield more rigid consequences and irrational results. This is particularly the case in conflicts across regime boundaries where norm conflicts have rarely been anticipated and the consequences of applying principles of priority would lead to results disconnected from widely shared intentions of parties. It was also established that there is support in the Vienna Convention for giving conflict clauses priority over other approaches to treaty inconsistencies.

Two of the treaties regulating deep-sea bioprospecting contain explicit conflict clauses. However, the implication of the clauses was found to be contradictory. In UNCLOS, priority was claimed not only in relation to prior treaties but also as regards future treaties, to the extent that such undertakings affected the common heritage of mankind principle. This could be considered as effectively blocking the obligation for patentability under TRIPS to the extent that it encompasses deep-seabed genetic resources. In the CBD, the conflict clause in relation to UNCLOS was generally considered submissive as regards rights and obligations of UNCLOS.

This would include many, but not necessarily all, elements of regulation relating to deep-sea bioprospecting. In relation to prior treaties generally, the CBD similarly let those take precedence, save for cases where the core interest of CBD would be impeded, i.e. where it would cause a serious damage or threat to biological diversity. It may thus seem that there is a legal basis in CBD for claiming that it could take precedence over TRIPS. Since TRIPS was both adopted and entered into force subsequent to the CBD, the limitation of the conflict clause in CBD to existing treaties was, however, found to be an argument against this notion.

In TRIPS as in WTO treaties generally, conventional conflict clauses were found to be lacking. However, and perhaps counterintuitively, it was established that this lack of conflict clauses would not necessarily result in a priority in application of the two other relevant treaties. Since treaty application rules provide that resort should be made to *lex posterior* in cases where conflict clauses are lacking, the result would be that under its own merits, TRIPS implicitly would claim unconditional priority in relation to previous treaties, including UNCLOS and the CBD.

In sum, approaching the problem by means of treaty application rules would give preference both to UNCLOS (by virtue of its conflict clause) and TRIPS (by virtue of *lex posterior* in lack of conflict clause) but not to CBD even in cases of serious damage or threat to biodiversity. This clearly does not provide a functional relationship between relevant norms.

In such cases, where rules of application fail to resolve conflict, the ILC Fragmentation Report emphasizes harmonizing interpretations under the treaty law principle of systemic integration as a means of preventing fragmentation and maintaining a coherent system of public international law. Indeed, this may represent an efficient way of preventing conflict between treaties that are part of the same regime, share a similar objective or carry a comparable kinship.

But there are also other treaty law obligations that must be considered. These include the obligations to interpret a treaty in respect of elements such as good faith and in accordance with the ordinary meaning to be given to the terms of the treaty in its context and in light of its object and purpose.

Many observers supporting a systemic view of public international law appear to overlook the fact that these other elements of treaty law set boundaries for how far harmonizing interpretations can stretch conflicting terms. Moreover, in cases with a high degree of material inconsistency between norms, logical semantics and insufficient flexibility of conflicting elements of treaties involved raise barriers to systemic integration.

From an interpretation perspective, it may be compatible with treaty law rules on interpretation to regard the obligations in the CBD for in situ conservation as circumscribing the requirement for patentability under TRIPS and the common heritage of mankind principle under UNCLOS, thereby enabling the obligations in CBD to function in concert with the other treaties. Systemic integration could thus prevent conflict in relation to the CBD. In the relation between UNCLOS and TRIPS, on the other hand, it generally appears difficult to prevent conflict between rules applying to deep-seabed bioprospecting by means of harmonizing interpretation, in particular for deep seabed micro-organisms. This is not only because the treaty law rules on interpretation set limits to possible understandings. The rules for the Area in UNCLOS, including the common heritage of mankind principle, provide contrary material obligations compared to the requirement for patentability in TRIPS. Since no area of commonality exists between these obligations, it is linguistically impossible to prevent the treaties from conflicting.

F. Concluding remarks

The case of deep-sea bioprospecting supports the contention that *intra se* (e.g. between several environmental or trade instruments) harmonization can be expected to be crafted out relatively painlessly. But it cannot be assumed *a priori* that a similar readiness exists as between parties to treaties across regimes. Perhaps unsurprisingly, it is difficult to find mutually satisfying solutions for the harmonization of treaties that seek to achieve physically incompatible purposes or that are inspired by very different (perhaps opposing) objectives.[1336]

The case of deep-sea bioprospecting thus provides a rather pessimistic outlook on the possibility for harmonization as a general cure to fragmentation. In some cases, where the treaties involved provide an area of commonality which would also be an acceptable interpretation under the rules on treaty interpretation, systemic integration may prevent conflict, as in the relation of the CBD to the other treaties. But in cases such as the relation between UNCLOS and TRIPS – where either the material obligations are too conflicting to enable a harmonizing interpretation, or such an understanding would require going beyond what is permitted under treaty interpretation rules – international law is unable to prevent conflict. In such cases, states that are parties to all treaties cannot simultaneously fully implement all relevant obligations but will have to exercise discretion as to what treaty to favor under domestic law. However, in doing so, they risk breaching obligations under the other treaties. In the case of deep-seabed bioprospecting, states are thus essentially facing a dilemma whereby they will violate international law, irrespective of how they act. Accordingly, in this case, public international law does not manage to function as a coherent system for its primary subjects.

The inability of treaty law rules to fully prevent or resolve the problem of contradictory obligations relating to deep-sea bioprospecting indicates that when the theoretical discussion on fragmentation is contextualized in concrete cases, it may be difficult to uphold systemic predictions of treaty law rules as ensuring that international law remains a coherent system.

[1336] Compare Koskenniemi, Fragmentation of International Law - Report of the Study Group of the International Law Commission. 2006., at 141-143.

On many issues where seemingly incoherent rules apply, the systemic elements of treaty law are able to resolve conflict. In the case of deep-sea genetic resources, however, the fragmentation of international law has resulted in conflicts between rules of three different regimes, which treaty law is unable to fully dissolve.

In this study, fragmentation and norm conflict have primarily been discussed from a systemic standpoint. The difference between the rules relating to deep-sea bioprospecting of regimes involved has been discussed, as well as how underlying divergences in ideology and purpose across regimes explain these differences, which become particularly relevant in light of the increasing interest in deep-sea bioprospecting. Focus has thus been put on the relationship between an activity and relevant rules, in particular on the causes of the conflict between the rules and consequences for application and interpretation of obligations involved.

In academic debate, fragmentation has first and foremost been discussed as a threat to the coherence of international law as a system. This was also the spirit of the speeches delivered to the General Assembly by the presidents of the ICJ during three consecutive years around the turn of the century, which ignited the fragmentation debate.

The then president of the ICJ Gilbert Guillaume declared that increasing fragmentation risked leading to forum- shopping and "*unwanted confusion*," threatening to "*distort the operation of justice*" which "*exacerbated the risk of conflicting judgments*."[1337] This reflects a focus on the impact of fragmentation on courts and international jurisprudence, which has remained the emphasis in the debate and also appears to have been the predominant perspective in the ILC Study Group Report, as discussed in previous parts. In international debate, with its emphasis on problems for courts and jurisprudence, many observers such as Spelliscy have feared that the incoherence resulting from fragmentation will erode "*the legitimacy of international judicial system*."[1338]

[1337] Address to the Plenary Session of the General Assembly of the United Nations by Judge Stephen M. Schwebel, President of the International Court of Justice, 26 October 1999 and Judge Guillaume's speech to the Assembly's Sixth Committee, as cited in Koskenniemi & Leino, LEIDEN JOURNAL OF INTERNATIONAL LAW (2002).

[1338] See for instance Shane Spelliscy, *The proliferation of international tribunals: a chink in the armor*, 40 COLUMBIA JOURNAL OF TRANSNATIONAL LAW (2001), at 170. Other notable

Charney first appears to agree, declaring that "*Not only may a cacophony of views on the norms of international law undermine the perception that an international legal system exists, but if like cases are not treated alike, the very essence of a normative system of law will be lost.*" After a closer examination of case law, Charney downplays the risks, observing that "*Although differences exist, these tribunals are clearly engaged in the same dialectic. The fundamentals of this general international law remain the same regardless of which tribunal decides the case.*"[1339]

Koskenniemi and Leino go much further, referring to the problem of fragmentation as theoretical, or even esoteric, reflecting a postmodern anxiety about a loss of overall control, born of a frustrated expectation that international law would eventually govern international society in the same way as domestic law governs domestic society. Instead, the authors imply, the institutional proliferation causing fragmentation is "*an unavoidable minor problem in a rapidly transforming international system, or even a rather positive demonstration of legal imagination to social change*."[1340]

In the ILC Study Group Report on fragmentation, chaired by Koskenniemi, the same arguments were repeated, describing coherence as only "*a formal and abstract virtue. For a legal system that is regarded in some respects as unjust or unworkable, no added value is brought by the fact of its being coherently so*."[1341] Even when setting aside the perspective on courts, and instead looking more closely at the impact of fragmentation and norm conflicts among treaties observers have given little weight to the negative impact.

observations on norm conflict in relation international courts include Rosalyn Higgins, *The ICJ, the ECJ, and the Integrity of International Law*, 52 INTERNATIONAL & COMPARATIVE LAW QUARTERLY (2003); Karin Oellers-Frahm, *Multiplication of International Courts and Tribunals and Conflicting Jurisdiction - Problems and Possible Solutions*, 5 MAX PLANCK YEARBOOK OF UNITED NATIONS LAW (2001); PHILIPPA WEBB, INTERNATIONAL JUDICIAL INTEGRATION AND FRAGMENTATION (Oxford University Press. 2016).

[1339] Jonathan I. Charney, *The impact on the international legal system of the growth of international courts and tribunals*, 31 NEW YORK UNIVERSITY JOURNAL OF INTERNATIONAL LAW AND POLITICS (1999), at 699; CHARNEY, Is international law threatened by multiple international tribunals? 1999.

[1340] Koskenniemi & Leino, LEIDEN JOURNAL OF INTERNATIONAL LAW (2002).

[1341] Koskenniemi, Fragmentation of International Law - Report of the Study Group of the International Law Commission. 2006.

In the words of Peters, when summarizing the positive effects of fragmentation, "*The resulting 'regime collisions' are praiseworthy because they manifest and further promote pluralism, contestation, and politicization – but it remains to be discussed what this means in normative terms.*" Moreover, "*competition between regimes, organizations, courts, and any other institutions may promote productive exploration and experimentation, enhances creativity, allows for correcting mistakes, reduces the risk of failure of one single institution, and thus overall leads to improved performance, notably to better lawmaking and law-application.*" Among the virtues of fragmentation, Peters further notes that fragmentation may prevent the concentration of power and claims that institutional dispersal constitutes a separation of power with the possibility of checks and balances.[1342]

A problem with these arguments is that they presuppose a dialogue between regimes, which this study has found little evidence of. To the contrary, in the case of deep-sea bioprospecting, there appears to have been surprisingly little consideration of other relevant regimes during the negotiation stages of the treaties involved. Even where treaties have been negotiated in parallel, as was the case with the CBD and TRIPS, no attempt has been made to coordinate discussions.

While courts indeed may face tough choices in dealing with overlapping obligations from different regimes of international law, there is reason to consider the preoccupation with the impact on courts and jurisprudence as being misguided. After all, with some exceptions, courts have shown a willingness to approach cases involving obligations from different areas of international law pragmatically.[1343]

[1342] Peters, INTERNATIONAL JOURNAL OF CONSTITUTIONAL LAW (2017), at 681. See also Bruno Simma, *Fragmentation in a Positive Light*, 25 MICHIGAN JOURNAL OF INTERNATIONAL LAW (2004).

[1343] In the said speech, Judge Guillaume referred to how the European Court of Human Rights decision in 1995 in the *Loizidou*-case had gone against the established jurisprudence of the ICJ concerning the effect of territorial reservation, as well as how the International Criminal Tribunal for the former Yugoslavia ('ICTY') decision in the *Tadic*-case had deviated from the application of the 'effective control' test in the 1986 *Nicaragua*-case of the ICJ, see Koskenniemi & Leino, LEIDEN JOURNAL OF INTERNATIONAL LAW (2002).

Moreover, twenty years after these fears were expressed by Judge Guillaume, few disputes involving norm conflicts have actually arisen and international courts seem to have been able to cross-fertilize jurisprudence and consider case-law developed by other tribunals.[1344] This led Judge Greenwood, Guillaume's colleague, to declare in 2016 that the fear of fragmentation at the start of the millennium, "*appears eerily reminiscent of the panic with which the dawn of the previous millennium was greeted by those who believed that the end of the world was nigh.*"[1345] Indeed, a lack of empirical findings of conflicts among cases facing international courts has led many observers to consider that the problem of fragmentation has been overstated.[1346] But perhaps this is because these observers have been looking in the wrong places?

Rather than manifesting itself in spectacular clashes between treaties in courtrooms in the Hague, Hamburg and Geneva, there is reason to suspect that fragmentation has its most important expressions in the arena of domestic-level implementation of international law. Where rules in different treaties provide conflicting obligations relating to practical activities, it is the primary subject of international law, the state, rather than international tribunals, which is most likely to end up in situations in which they face the difficult choices of fragmentation. When confronted with irreconcilable norm conflicts, as in the case of deep-seabed bioprospecting of micro-organisms, states end up in a dilemma where they effectively cannot avoid violating one of the obligations involved.

[1344] Paine. 2020; Andrew Lang, *Twenty years of the WTO Appellate Body's "fragmentation jurisprudence"*, 14 JOURNAL OF INTERNATIONAL TRADE LAW AND POLICY (2015); Andrew Lang, *The Role of the International Court of Justice in a Context of Fragmentation*, 62 INTERNATIONAL & COMPARATIVE LAW QUARTERLY (2013); WEBB. 2016; Antônio Augusto Cançado Trindade, A century of international justice and prospects for future, at 77-86; Magdalena Forowicz, Factors influencing the reception of international law in the ECtHR's case law: an overview; Lawrence Hill-Cawthorne, Just another case of treaty interpretation? Reconciling humanitarian law and human rights law in the ICJ; Dean Spielmann, Fragmentation or partnership? The reception of ICJ case-law by the European Court of Human Rights; Philippa Webb, Factors influencing fragmentation and convergence in international courts in BJORGE. 2014; WEBB. 2016.

[1345] Christopher Greenwood, *Unity and diversity in international law*, *in* A FAREWELL TO FRAGMENTATION: REASSERTION AND CONVERGENCE IN INTERNATIONAL LAW (Mads Andenas & Eirik Bjørge eds., 2015), at 37.

[1346] Peters, INTERNATIONAL JOURNAL OF CONSTITUTIONAL LAW (2017), at 698.; See also Mads Andenæs & Eirik Bjorge, *Introduction: from fragmenation to convergence in international law*, *in* A FAREWELL TO FRAGMENTATION: REASSERTION AND CONVERGENCE IN INTERNATIONAL LAW (Mads Andenas & Eirik Bjørge eds., 2015).

Under international law, states are obliged to implement all of its obligations in good faith, insofar their jurisdiction applies. However, in such situations, they are unable to do so.

Whereas only a small fraction of breaches of international law result in international disputes, norm conflicts concerning issues relevant to practical state behavior are not merely hypothetical problems for states. In the context of more abstract obligations, norm conflicts may never practically materialize, allowing states to ignore the area of contention. But in cases such as deep-sea bioprospecting, where an increasing commercial interest is coupled with rapid technological development, the norm conflict is likely to become highlighted, either in the drafting of domestic law applicable to deep-sea bioprospecting, or when subjects of the states are involved in such activities.

How, then, do states act when faced with norm conflicts? Even if states are able to avoid norm conflicts insofar as the conflicting obligations are provided in treaties by simply withdrawing or refraining from becoming party to one of the treaties involved, it appears that states are unlikely to do so. In the case of deep-sea bioprospecting, an overwhelming majority of states are party to all three central treaties. The inconsistencies between the norms involved have so far not made any state withdraw from either one of the treaties, although discontent with the seabed regime has influenced the United States' decision not to ratify UNCLOS. Still, the overwhelming number of states have become and remain parties to all three treaties investigated. So, how do states legally consider norm conflicts such as the one discussed in this study, whether in relation to individual projects or in the drafting of domestic law?

To fully answer this question requires detailed investigations of domestic approaches. Based on what has been established in this study, however, there are clear indications that when facing such dilemmas, states effectively prioritize the fulfillment of one obligation over another. This enables them to favor treaty obligations aligned with domestic interests over others. Accordingly, it is not surprising that it is mostly the developing countries that were reluctant to accept the approach to patentability under TRIPS, which has made exceptions under Article 27.

States more open to the patenting of biological resources have instead chosen to implement a much more liberal approach to patentability, as reflected in the European Union's approach in the Biotech Directive.[1347] Effectively, states may in this manner circumvent prohibitive rules with reference to permissive rules. Indeed, fragmentation appears more likely to result in states engaging in treaty shopping than forum shopping.

The case of deep-sea bioprospecting thereby shows that viewed from the perspective of the state, fragmentation appears as a much more real, and practically relevant problem than when viewed as a problem for courts or as friction between treaties. Although states may address norm conflicts differently, it is clear that in a time when the relevance of international law is increasingly questioned, this dilemma does not enhance the credibility of international law as a normative system. If states are put in situations where they have no other choice than to go against obligations in central framework conventions, it is not far-fetched to suspect that breaches of international law obligations in general would be considered less serious. The credibility of rules requires an element of logical function, and if this is lacking then the legitimacy of the system risks becoming questioned. Moreover, selective adherence to treaties where norm conflict arises undermines predictability and the very basis of the contractual element of treaties: namely that parties can expect other parties to implement their obligations in good faith. Indeed, the legitimacy of international law is connected to its logical function.

For any state perceiving international law as more than an abstract theoretical construction, there is a high likelihood that it would take obligations less serious in an incoherent system providing no other solution than breaching one of several obligations. As discussed above, the risk of fragmentation has often been portrayed as a loss of harmony and unity in the system of international law (and it has also been downplayed because such virtues have not been considered necessary).[1348]

[1347] As discussed in section C.3 has an open-ended approach to the patentability of bioresources, with no exceptions relating to the seabed rules of UNCLOS or the obligations relating to conservation established in the CBD.

[1348] Compare, on the one hand, Peters' identification of the negative elements of fragmentation, as "*a loss of coherence implies the loss of international law's quality as a legal order (or system)*" (…) "*what is at stake in fragmentation is unity, harmony, cohesion, order, and—concomitantly—the quality of international law as a truly normative order*", which as recalled by Peters

The findings in this study, however, indicate that the impact of fragmentation is not merely a loss of systemic coherence of esoteric concern. Whereas it is correct that an increasing diversity of treaties in international law does not *per se* undermine the latter's normative value, as observed by Andenas and Bjorge[1349], it can hardly be disputed that a lack of function for its primary subjects represents a problem.

Rather, fragmentation implies a real risk that international law in general loses credibility from the perspective of its primary subjects, namely the states. There is thus reason to take fragmentation seriously and turn the debate from the limited focus on dispute settlement and instead further investigate the impact on states. How then, should states facing norm conflicts, as in the case of deep-sea bioprospecting, act?

Lang and Leathley have proposed similar solutions to fragmentation. For Lang, a natural recourse in norm conflicts would be to ask the ICJ for advisory opinions.[1350] For Leathley, the ideal solution would be to create an institutional hierarchy among courts and tribunals. However, since that would be unrealistic he instead suggests an "*organically*" established hierarchy, whereby all courts defer to the ICJ and its jurisprudence.[1351] In line with the general emphasis in the debate, both these solutions focus on the role of courts in fragmentation. From the perspective of states facing norm conflicts, neither strategy provides a viable recourse. Bringing norm conflicts before international adjudication would require states to act as watchdogs in relation to other states which choose to disregard one of the obligations involved in norm conflicts.

relates to Herbert Hart's notion of international law as "*rules which constitute not a system but a simple set*" with Koskenniemi and Leino's understanding of fragmentation as a postmodern anxiety over an increasingly diverse system, as discussed above. HERBERT L. A. HART, THE CONCEPT OF LAW (Oxford University Press 3. ed. ed. 2012); Peters, INTERNATIONAL JOURNAL OF CONSTITUTIONAL LAW (2017);Koskenniemi & Leino, LEIDEN JOURNAL OF INTERNATIONAL LAW (2002); Peters, The refinement of international law: From fragmentation to regime interaction and politicization, INTERNATIONAL JOURNAL OF CONSTITUTIONAL LAW (2017).

[1349] Andenæs & Bjorge. 2015; Koskenniemi & Leino, LEIDEN JOURNAL OF INTERNATIONAL LAW (2002).

[1350] Lang, JOURNAL OF INTERNATIONAL TRADE LAW AND POLICY (2015).

[1351] Christian Leathley, *An institutional hierarchy to combat the fragmentation of international law: has the ILC missed an opportunity?*, 40 NEW YORK UNIVERSITY JOURNAL OF INTERNATIONAL LAW AND POLITICS (2007)

Generally, states are reluctant to initiate proceedings against one another, and it requires more fundamental interests than general concern for the systemic aspects of international law for states to invest in such a process. To use advisory opinions to resolve norm conflicts is formally not possible under current ICJ rules. Only five named UN organs, 15 specialized agencies and one related organization can initiate such procedures.[1352]

For political, practical, and formal reasons, then, it does not appear realistic for states to turn to international courts whenever they are faced with conflicting obligations. The findings in the case of deep-sea bioprospecting suggest that rather than advisory opinions and new hierarchical structures among courts or other measures at the international institutional level, the norm conflict must be addressed by the subject affected by these dilemmas: the states themselves.

Turning the debate from the limited focus on dispute settlement and instead further studying the impact on states calls both for investigating how states can apply existing treaties and for the development of new rules to prevent irresolvable treaty conflicts. Indeed, long-term, systematic use of more holistic approaches in conventional application and development of international law may contribute to maintain a functional relationship between different regimes of international law. As observed by Pauwelyn,

> *What must be avoided, however, is this fragmentation leading to self-contained islands of international law, de-linked from other branches of international law. Put differently, the specialized institutions should continue to make and enforce their specialized law, but in doing so they should also take account of general international law and the law made in other institutions.*[1353]

As already indicated, the most rational way to address the dilemma from the perspective of states may appear to be to withdraw from one of the conflicting obligations. From a purely systemic viewpoint, this would be desirable since it from a subjective perspective would resolve the norm conflict and maintain the coherence of international law. Yet there are considerable side-effects with such a solution.

[1352] See Chapter IV, Statute of the International Court of Justice.

[1353] Pauwelyn, MICHIGAN JOURNAL OF INTERNATIONAL LAW (2004)

Not only does the material element of the norm conflict between the relevant treaties persist, even if it does not apply in relation to the withdrawing state.[1354] Withdrawal from central treaties as a solution to norm conflict would also mark a step back for a rules-based international order. An alternative would be to follow the priority between treaties involved following from the rules on treaty application in the Vienna Convention on the Law of Treaties. If *lex posterior* is applied, this would yield different results across states, depending on in what order they became parties to the treaties involved, and thus only lead to confusion as discussed in section E.5.2. Moreover, the approach appears rigid and risks resulting in deciding priority between treaties based on elements not considered by state parties. Similar to addressing norm conflict by withdrawing from conflicting obligations, solving the problem by means of lex posterior also fails to address the problem of lack of communication across regime boundaries. Rather than addressing material inconsistencies, both solutions builds on favoring one treaty over another.

It would be preferable to address the problem under the more flexible approach provided by conflict clauses. As shown in this section E.5.3, such clauses are however in many relationships difficult to apply in practice since conflict clauses of different treaties may provide conflicting instructions and not all treaties contain such clauses. For conflict clauses to effectively resolve treaty conflicts, more effort has to be invested in drafting them in manner which enables their instructions to function coherently, also in relation to treaties of other regimes.

Generally, in the application of existing rules, the norms of individual regimes should not be implemented in isolation but in recognition that other areas of international law may provide relevant rules which also have to be taken into account, and which may limit the scope of possible interpretations. Such consideration of rules beyond regime boundaries could prevent conflict in ordinary cases of contention, as suggested in the relationship between the rules on conservation of biodiversity under the CBD, on the one hand and the rules relevant for deep-sea bioprospecting in the law of the sea and WTO law on the other, as discussed in section E.7.

[1354] The subjective and material elements of norm conflict are further discussed in section E.3.

In cases of irreconcilable norm conflicts, however, such as the relation between the rule on patentability of micro-organisms in TRIPS and the common heritage of mankind-principle, where two obligations provide contrary instructions in relation to states, not even holistic application provides a recourse.

Such cases may be resolved by the development of *lex specialis*, which addresses the area of material conflict. This, however, requires that the development of clarifying rules is not confined to one regime, but fully considers relevant pre-existing norms in all areas of international law and involves actors from regimes with overlapping mandate, which otherwise risk developing conflicting norms. Such holistic and integrative treaties have the potential to function as a mechanism which prevents that "*the special regime becomes a legal order unto itself – a kind of legal Frankenstein*" that "*no longer partakes in the same basis of legitimacy and formal standards of pertinence*" as feared by ICJ Judge Abi-Saab.[1355]

The development of such holistic *lex specialis*-treaties should be particularly prioritized in areas where there is a high degree of normative pluralism, where several regimes converge, or where there is an overlap of institutional mandates. Nowhere does this appear more relevant than in the management of the common resources of the oceans, where the lack of sovereign authority, the converging mandates of several regimes, and increased human involvement raise the risk of conflict.

Accordingly, the process of negotiating a new treaty on biological diversity beyond national jurisdiction (BBNJ) in general, at first glance appears to represent a good example of such a *lex specialis*-negotiation. As discussed in previous parts, the negotiation is directly relevant to deep sea bioprospecting as well as the management of the high seas and the Area and encompasses a range of issues which transcend different regimes.

[1355] Georges Abi-Saab, *Fragmentation or unification: some concluding remark (The Proliferation of International Tribunals: Piecing Together the Puzzle)*, 31 NEW YORK UNIVERSITY JOURNAL OF INTERNATIONAL LAW AND POLITICS (1999).

Throughout the process, considerations of international environmental law rules have been made. Such references have been most frequent in discussions on marine protected areas and environmental impact assessments.[1356]

In the draft text on definitions in the expected new BBNJ treaty, there is, however, congruency also in relation to the CBD and Nagoya in the use of central terms connected to marine genetic resources.[1357] The proposed rules on benefit sharing also builds on corresponding approaches in these treaties.[1358]

That said, surprisingly little regard has been paid to the perspective of genetic resources of WTO-law.[1359] Rather than attempting to address the divide in relation to TRIPS, the proposed text on intellectual property suggests new criteria on patentability which appear difficult to apply in relation to WTO law.[1360] Article 12 of the draft text of the BBNJ agreement would oblige states to "*ensure that intellectual property rights are supportive of and do not run counter*" to the BBNJ agreement.

[1356] Fran Humphries & Harriet Harden-Davies, *Practical policy solutions for the final stage of BBNJ treaty negotiations*, 122 MARINE POLICY (2020).

[1357] See foremost Article 1 of the Revised draft text of an agreement under the United Nations Convention on the Law of the Sea on the conservation and sustainable use of marine biological diversity of areas beyond national jurisdiction. where terms such as access, genetic resources, as well as the distinction between ex situ, in situ and in silico has been re-used from international environmental law.

[1358] See part 2 of the Revised draft text.

[1359] The relationship between a new potential BBNJ treaty and TRIPS was considered during the working group phase of the BBNJ process, but has since been less discussed. See in particular Ad Hoc Open-ended Informal Working Group to study issues relating to the conservation and sustainable use of marine biological diversity beyond areas of national jurisdiction, Intersessional workshops aimed at improving understanding of the issues and clarifying key questions as an input to the work of the Working Group in accordance with the terms of reference annexed to General Assembly resolution 67/78 - Summary of proceedings prepared by the Co-Chairs of the Working Group (United Nations General Assembly ed. 2013).

[1360] Article 12 of the Revised draft text provides that "[1. States Parties shall cooperate to ensure that intellectual property rights are supportive of and do not run counter to the objectives of this Agreement [, and that no action is taken in the context of intellectual property rights that would undermine benefit-sharing and the traceability of marine genetic resources of areas beyond national jurisdiction].] [2. [Marine genetic resources [collected] [accessed] [utilized] in accordance with this Agreement shall not be subject to patents except where such resources are modified by human intervention resulting in a product capable of industrial application.] [Unless otherwise stated in a patent application or other official filing or recognized public registry, the origin of marine genetic resources utilized in patented applications shall be presumed to be of areas beyond national jurisdiction.]]"

Furthermore, according to the draft text, marine genetic resources "*shall not be subject to patents except where such resources are modified by human intervention resulting in a product capable of industrial application.*"

This would represent a considerable deviation from the corresponding requirement in TRIPS, which does not include a formal requirement for human involvement and covers not only products but also processes.[1361] Under the same provision, states would be bound to ensure that intellectual property rights "*are not provided to genetic resources of areas beyond national jurisdiction that do not comply*" (with the BBNJ agreement).

Compared with the rules on patentability in TRIPS, it is clear that the more restrictive rule proposed in the BBNJ agreement would repeat the conflict in relation to WTO law.[1362] Judging from these negotiation texts, there thus appears to be limited prospects for the new BBNJ agreement to resolve the norm conflict between the rules applying to deep-sea bioprospecting. It should however, be borne in mind that these texts are not yet agreed. It remains to be seen if and how the proposal will materialize.

The lack of congruency of this part of the proposed BBNJ agreement in relation to pre-existing rules in TRIPS can be understood as the result of a confined perspective, reflecting an exclusive basis of the negotiation in the law of the sea. Indeed, the process is based on an ambition to negotiate an implementing agreement to fill a perceived legal *lacuna* or need to develop existing rules (depending on interpretation[1363]) in UNCLOS rather than to develop the relationship between this convention and other treaties.[1364]

[1361] The first paragraph of TRIPS, as further discussed in section C.3.3 provides that *Patents shall be available for any inventions, whether products or processes, in all fields of technology, provided that they are new, involve an inventive step and are capable of industrial application.*

[1362] As discussed in section C.3, Article 27 of TRIPS not only enables states to apply a more generous policy on patentability, but actually puts states under an obligation to enable patentability for genetic resources in all areas, qualified for the possibility of states to make exceptions from patentability under paragraph 2-3 of TRIPS Article 27. The possibility to make exception from patentability does however not extend to micro-organisms.

[1363] Also these positions are further discussed in Part C.

[1364] As discussed in Part C.1 the legal lacuna or legal gap-theory was referred to in Secretary-General reports on the Oceans and the Law of the Sea, such as that of 2003 and 2004, Oceans and the law of the sea. Report by the Secretary-General (A/58/65) (3 March 2003)., at paras. 18, 147 and 195; Report of the UN Secretary-General on Oceans and Law of the Sea, advance unedited document of 4 Mar 2004, at para. 267. For some states, this has also been one of the

Thereby, the negotiation risks becoming a missed opportunity to bridge differences between regimes, as discussed in Part D. In spite of encompassing issues which transcend such boundaries, regime differences could become solidified in lack of a holistic basis.

From the perspective of states facing conflicting obligations, it would be preferable to negotiate *lex specialis* treaties without regime bias, in consideration of the full spectra of international law rules applicable to the issues involved. In the case of deep-sea bioprospecting, this would call for drafting a holistic treaty on the use of genetic resources in oceans commons based on a coordinative endeavor, setting out to bridge the gap between all different regimes providing relevant rules. The lack of such ambitions reflects not only a lack of consideration of the conflict between treaties regarding the issues involved; it can also be seen as a symptom of the fragmentation of international law, where the law of the sea has developed into a distinct domain, based on its own logics. Where international law is developed by means of narrow, regime-specific *lex specialis*, conflicts across treaty boundaries risk being aggravated.

premises for the so-called BBNJ-process for the negotiation of a new implementing agreement on the law of the sea. See also ARICO & SALPIN. 2005; Scovazzi, Bioprospecting on the Deep Seabed: a Legal Gap Requiring to be Filled. 2006.

Bibliography

Treaties

Agreement for the Implementation of the Provisions of the United Nations Convention on the Law of the Sea of 10 December 1982 relating to the Conservation and Management of Straddling Fish Stocks and Highly Migratory Fish Stocks, 4 August 1995, 2167 U.N.T.S. 3 (UN Fish Stocks Agreement)

Agreement governing the Activities of States on the Moon and Other Celestial Bodies, 5 December 1979, 1363 U.N.T.S. 3

Agreement on the Application of Sanitary and Phytosanitary Measures, 15 April 1994, 1867 U.N.T.S. 493 (SPS Agreement)

Agreement on Trade-Related Aspects of Intellectual Property Rights (TRIPS), 15 April 1994, Marrakesh Agreement Establishing the World Trade Organization, Annex 1C, 1869 U.N.T.S. 299 (WTO TRIPS)

Agreement relating to the implementation of Part XI of the United Nations Convention on the Law of the Sea, 10 December 1982, 1836 U.N.T.S. 3

Budapest Treaty on the International Recognition of the Deposit of Microorganisms for the Purposes of Patent Procedure, Signed in Budapest on April 28, 1977, and amended on September 26, 1980, 1861 U.N.T.S.

Cartagena Protocol on Biosafety, 29 January 2000, 2226 U.N.T.S. 208

Convention for the Conservation of Southern Bluefin Tuna, 10 May 1993, 1819 U.N.T.S. 359

The Convention for the Preservation of Wild Animals Birds and Fish in Africa, 19 May 1900, 94 BFSP 75

Convention for the Protection of the Marine Environment of the North-East Atlantic, 22 September 1992, 2354 U.N.T.S. 67 (OSPAR Convention)

The Convention on Biological Diversity, regarding the conservation of biodiversity, the sustainable use of its components and the fair and equitable sharing of the benefits arising thereof, signed at the Earth Summit in Rio de Janeiro, Brazil, in 1992 and entered into force on 29 December 1993, 1760 U.N.T.S. 69 (CBD)

Convention on the Continental Shelf, 29 April 1958, 499 U.N.T.S. 311

Convention on the Grant of European Patents, 5 October 1973, 1065 U.N.T.S. 199 (European Patent Convention)

Convention on the High Seas, adopted in Geneva, 29 April 1958, 450 U.N.T.S. 11

Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter, 29 December 1972, 1046 U.N.T.S. 120 (London Convention)

The Council of Europe's Convention on the Conservation of European Wildlife and Natural Habitats, 19 September 1979, 1284 UNTS 209 (Berne Convention)

International Convention for the Prevention of Pollution from Ships, 2 November, 1973, 3407, 1340 U.N.T.S. 61 (MARPOL)

The International Convention for the Protection of Birds Useful to Agriculture, 19 March 1902

International Convention for the Safety of Life At Sea (SOLAS), 1 November 1974, 1184 U.N.T.S. 3

International Treaty on Plant Genetic Resources for Food and Agriculture, 3 November 2001, 2400 U.N.T.S. 303

The International Undertaking on Plant Genetic Resources for Food and Agriculture 31 I.L.M. 822 (1992)

Nagoya Protocol on Access to Genetic Resources and the Fair and Equitable Sharing of Benefits Arising from their Utilization to the Convention on Biological Diversity, 29 October 2010, 3009 U.N.T.S. (Nagoya Protocol)

Statute of the International Court of Justice, United Nations 18 April 1946, 33 U.N.T.S. 993

Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, Including the Moon and Other Celestial Bodies, 27 January 1967, 610 U.N.T.S. 205

UN Framework Convention on Climate Change, 9 May 1992, 1771 U.N.T.S. 107 (UNFCC)

Understanding on Rules and Procedures Governing the Settlement of Disputes, Marrakesh Agreement Establishing the World Trade Organization, Annex 2, 1 June 1995, 1869 U.N.T.S. 401 (WTO Dispute Settlement Understanding)

The United Nations Convention on the Law of the Sea, signed in Montego Bay, Jamaica 10 December 1982 and became effective 16 November 1994, 1833 U.N.T.S. 397 (UNCLOS)

United Nations, Charter of the United Nations, 24 October 1945, 1 UNTS XVI (UN Charter)

Vienna Convention on the Law of Treaties, adopted in Vienna, 23 May 1969, 1155 U.N.T.S. 331, 8 ILM 679 (1969)

WTO Agreement: Marrakesh Agreement Establishing the World Trade Organization, 15 April 1994, 1867 U.N.T.S. 154 (WTO Agreement)

UN resolutions and documents

Ad Hoc Open-ended Informal Working Group to study issues relating to the conservation and sustainable use of marine biological diversity beyond areas of national jurisdiction, Intersessional workshops aimed at improving understanding of the issues and clarifying key questions as an input to the work of the Working Group in accordance with the terms of reference annexed to General Assembly resolution 67/78 - Summary of proceedings prepared by the Co-Chairs of the Working Group

International Seabed Authority, Report of the Secretary-General of the International Seabed Authority under Article 166. Pargraph 4 of the United Nations Convention of the Law of the Sea, 7 June, 2002, UN Doc. ISBA/8/A/5, 12

"International Union for Conservation of Nature and Natural Resources (IUCN), World Conservation Strategy: living resource conservation for sustainable development (UNEP(02)/C6)." In, edited by., 1980.

Letter dated 15 May 2008 from the Co-Chairpersons of the Ad Hoc Open-ended Informal Working Group to study issues relating to the conservation and sustainable use of marine biological diversity beyond areas of national jurisdiction addressed to the President of the General Assembly, UN Doc. A/65/68 (2010)

Oceans and the law of the sea. Report by the Secretary-General (A/58/65) (3 March 2003)

Report of the World Commission on Environment and Development: Our Common Future. United Nations General Assembly document A/42/427 (1987)

Revised draft text of an agreement under the United Nations Convention on the Law of the Sea on the conservation and sustainable use of marine biological diversity of areas beyond national jurisdiction, available at: https://www.un.org/bbnj/news/revised-draft-text-agreement-under-united-nations-convention-law-sea-conservation-and (site accessed November 13 2020).

UN Report of the World Summit on Sustainable Development, Johannesburg, South Africa, 26 August–4 September 2002, A/CONF.199/20

UNEP/CBD/WGRI/1/2 Implementation of the Convention and the Strategic Plan and progress towards the 2010 Target

UNEP/CBD/WGRI/1/9 Framework for monitoring implementation of the Convention and achievement of the 2010 target

United Nations General Assembly resolution 61/105, Sustainable fisheries, including through the 1995 Agreement for the Implementation of the Provisions of the United Nations Convention on the Law of the Sea of 10 December 1982 relating to the Conservation and Management of Straddling Fish Stocks and Highly Migratory Fish Stocks, and related instruments, A/RES/61/105 (8 December 2006), available from undocs.org/A/RES/61/105

United Nations General Assembly resolution 64/72, Sustainable fisheries, including through the 1995 Agreement for the Implementation of the Provisions of the United Nations Convention on the Law of the Sea of 10 December 1982 relating to the Conservation and Management of Straddling Fish Stocks and Highly Migratory Fish Stocks, and related instruments, A/RES/64/72 (4 December 2009), available from undocs.org/A/RES/64/72

United Nations General Assembly resolution 69/292, Development of an international legally binding instrument under UNCLOS on the conservation and sustainable use of marine biological diversity of areas beyond national jurisdiction, A/RES/69/292 (9 June 2015)

United Nations General Assembly resolution 74/19, Oceans and the law of the sea, A/RES/74/19 (10 December 2019), available from undocs.org/en/A/RES/74/19

United Nations General Assembly resolution 2749 (XXV), Declaration of Principles Governing the Seabed and the Ocean Floor, and the Subsoil Thereof, beyond the Limits of National Jurisdiction, A/RES/25/2749 (12 December 1970)

United Nations General Assembly resolution 3201 (S-VI), Declaration on the Establishment of a New International Economic Order, UN Doc A/RES/S-6/3201 (1 May 1974)

United Nations General Assembly resolution 3281 (XXIX), Charter of Economic Rights and Duties of States, A/RES/3281 (6 November 1974)

United Nations General Assembly, Draft World Charter for Nature, A/RES/35/7 (30 October 1980)

United Nations General Assembly, Report of the Ad Hoc Open-ended Informal Working Group to study issues relating to the conservation and sustainable use of marine biological diversity beyond areas of national jurisdiction, UN Doc. A/61/65 (2006)

The Division for Ocean Affairs and the Law of the Sea, United Nations. "Marine biological diversity beyond areas of national jurisdiction - Environmental, scientific and technological aspects." New York, 2017.

EU and WTO documents

Decision on Trade and Environment. Adopted by ministers at the meeting of the Uruguay Round Trade Negotiations Committee in Marrakesh on 14 April 1994.

Declaration on the TRIPS agreement and public health Adopted on 14 November 2001 DOHA WTO MINISTERIAL 2001: TRIPS WT/MIN(01)/DEC/2 20 November 2001

Directive 98/44/EC of The European Parliament and of the Council of 6 July 1998 on the Legal Protection of Biotechnological Inventions (Biotech Directive)

World Trade Organization, Draft modalities for TRIPS related issues, WTO Doc. TN/C/W/52, 19 July 2008.

"General Council, Request for an Authoritative Interpretation Pursuant to Article IX:2 of the Marrakesh Agreement Establishing the World Trade Organization, Communication from the European Communities, WT/GC/W/133, 25 Jan. 1999; General Council, Request for an Authoritative Interpretation Pursuant to Article IX:2 of the Marrakesh Agreement Establishing the World Trade Organization, Communication from the European Communities, WT/GC/W/143, 5 Feb. 1999." In, edited by.

"Green Paper on Maritime Policy [COM(2006) 275]: European Commission Background paper No. 10 on Marine Biotechnology " In, edited by., 2006.

Ministerial Conference, Doha Declaration on the TRIPS Agreement and Public Health, 14 November 2001, WT/ MIN(01)/Dec/2

World Trade Organization, Ministerial Declaration of 14 November 2001, WTO Doc. WT/MIN(01)/DEC/1, 41 ILM 746 (2002) (Doha Declaration)

Cases

Aegean Sea Continental Shelf Case (Greece v. Turkey) ICJ Rep 3, ICGJ 128 (1978).

Association for Molecular Pathology v. Myriad Genetics Inc., 569 U.S. 576 (2013).

Award between the United States and the United Kingdom relating to the rights of jurisdiction of United States in the Bering's sea and the preservation of fur seals (Bering Sea Arbitration) (1893).

Barcelona Traction, Light and Power Company, Limited (BeIgium v. Spain), ICJ Rep, ICJ GL 50 (1970).

Canada-Patent Protection for Pharmaceutical Products, WT/DS114/13 Panel Report (2000).

Continental Shelf (Libya-Malta), ICJ Rep 13, ICGJ 118 (1985).

D'Arcy v. Myriad Genetics Inc., FCAFC 115 (2014).

Dispute regarding Navigational and Related Rights (Costa Rica v Nicaragua), Merits, ICJ Rep 2009, ICGJ 421 (2009).

European Communities – Customs Classification of Certain Computer Equipment (EC – Computer Equipment), WT/DS62/AB/R, WT/DS67/AB/R, WT/DS68/AB/R Appellate Body Report (1998).

European Communities – Measures Affecting the Approval and Marketing of Biotech Products, WT/DS291/R Panel Report (2006).

European Communities—Regime for the Importation, Sale and Distribution of Bananas, WT/ DS27/R(US) (EC—Bananas III) Panel Report (1997).

Fisheries (United Kingdom v Norway), Merits, ICJ Rep 116, ICGJ 196 (1951).

Fisheries Jurisdiction (United Kingdom v Iceland), Merits, Judgment ICJ Rep 3, ICGJ 142 (1974).

Guatemala—Anti-Dumping Investigation regarding Portland Cement from Mexico (WT/DS60/AB/R) Appellate Body Report (1998).

Indonesia—Certain Measures Affecting the Automobile Industry (WT/DS54, 55, 59 and 64/R) Appellate Body Report (1998).

Japan – Taxes on Alcoholic Beverages (Japan – Alcoholic Beverages II), WT/DS8/AB/R, WT/DS10/AB/R, WT/DS11/AB/R Appellate Body Report (1996).

Korea – Definitive Safeguard Measure on Imports of Certain Dairy Products (Korea – Dairy), WT/DS98/AB/R Appellate Body Report (1999).

Legal Consequences for States of the Continued Presence of South Africa in Namibia (South West Africa) notwithstanding Security Council Resolution 276, Advisory Opinion, ICJ GL No 53, ICJ Rep 16, ICGJ 220 (1971).

The M/V "Saiga" (Saint Vincent and the Grenadines v. Guinea) (ITLOS Case 2) (1999).

The M/V "Virginia G" Case (Panama/Guinea-Bissau) (ITLOS Case 19) (2014).

Mayo Collaborative Services v. Prometheus Laboratories, Inc., 566 U.S. 66 (2012).

Mexico – Measures affecting Telecommunications Services (WT/DS204/R) Panel Report (2004).

Mexico – Tax Measures on Soft Drinks and Other Beverages, WT/DS308/AB/R Appellate Body Report (2006).

MOX Plant Case, Ireland v United Kingdom, Order, Request for Provisional Measures, ITLOS Case No 10, ICGJ 343 (2001).

Reparation for injuries suffered in the service of the Nations, Advisory Opinion, ICJ Rep 174, ICGJ 232 (ICJ 1949) (1949).

Right of Passage over Indian Territory (Portugal v. India), ICJ Rep 125, ICGJ 173 (1957).

Sidney A. Diamond, Commissioner of Patents and Trademarks, v. Ananda M. Chakrabarty, et al., 447 U.S. 303 (1980).

Southern Bluefin Tuna, New Zealand v Japan, Provisional Measures, ITLOS Case No 3, (1999) 38 ILM 1624, ICGJ 337 (1999).

United States – Import Prohibition of Certain Shrimp and Shrimp Products, WT/DS58/AB/R Appellate Body Report (1998).

United States – Standards for Reformulated and Conventional Gasoline, WT/DS2/AB/R Appellate Body Report (1996).

Textbooks

Caring for the Earth - A Strategy for Sustainable Living - Second World Conservation Strategy Gland, Switzerland: IUCN, 1991.

The Ethics of Patenting DNA. London: Nuffield Council on Bioethics, 2002.

The First Global Integrated Marine Assessment: World Ocean Assessment I. Cambridge: Cambridge University Press, 2017.

Secretariat of the Convention on Biological Diversity (2004) Programme of Work on Protected Areas (CBD Programmes of Work). Montreal: Secretariat of the Convention on Biological Diversity, 2004.

United States Patent and Trademark Office Manual of Patent Examining Procedure (83 FR 4473). 9. United States Patent and Trademark Office 2018.

The WTO Agreements - The Marrakesh Agreement Establishing the World Trade Organization and its Annexes. 2017.

Yearbook of the International Law Commission 1966, Vol. II (A/CN.4/SER. A/1966/Add. 1). United Nations, 1966.

N. R. C. (US). From Monsoons to Microbes : Understanding the Ocean's Role in Human Health. Washington: Washington, D.C.: National Academies Press, 1999.

S. Aricò. Emerging and unresolved issues: the example of marine genetic resources of areas beyond national jurisdiction. Cambridge: Cambridge: Cambridge University Press, 2015.

S. Arico and C. Salpin. Bioprospecting of Genetic Resources in the Deep Seabed: Scientific, Legal and Policy Aspects. 20: United Nations University, Institute of Advance Studies, 2005.

D. J. Attard, M. Fitzmaurice and N. Martinez. The IMLI manual on international maritime law. Vol. 1, The law of the sea. International Maritime Law Institute manual on international maritime law. Oxford : Oxford University Press, 2014.

A. Aust. Modern Treaty Law and Practice. Cambridge, United Kingdom: Cambridge University Press, 2000.

J. H. Ausubel, D. T. Crist and P. E. Waggoner. First Census of Marine Life 2010: Highlights of a Decade of Discovery. 2010.

M. C. Baker, B. J. Bett, D. S. M. Billett and A. D. Rogers. The Status of Natural Resources on the High-Seas. 2001. Gland, Switzerland.

R. Barnes. The Convention on the Law of the Sea: An Effective Framework for Domestic Fisheries Conservation? : 2006.

K. Baslar. The Concept of the Common Heritage of Mankind in International Law. Developments in International Law, Volume: 30. Brill | Nijhoff, 1997.

F.-K. Beier and G. Schricker. From GATT to TRIPs : the Agreement on Trade-Related Aspects of Intellectual Property Rights. IIC studies. 18, New York: Max Planck Institute for Foreign and International Patent, Copyright and Competition Law, 1996.

L. Bently. Intellectual property law. 4. ed. Oxford: Oxford: Oxford University Press, 2014.

D. Bethlehem, I. Van Damme, D. McRae and R. Neufeld. The Oxford Handbook of International Trade Law. Oxford University Press, 2009.

P. W. Birnie, A. Boyle and C. Redgwell. International law and the environment. 3. Oxford: Oxford University Press, 2009.

E. Bjorge. The Evolutionary Interpretation of Treaties. Oxford: Oxford: Oxford University Press, Incorporated, 2014.

I. Borowy. Defining Sustainable Development for Our Common Future. Routledge, 2016.

M. Bowman. Biodiversity, Intrinsic Value, and the Definition and Valuation of Environmental Harm. Oxford University Press, 2002.

M. Bowman, P. Davies and E. Goodwin. Research Handbook on Biodiversity and Law. Edward Elgar, 2016.

M. Bowman, P. G. G. Davies and C. Redgwell. Lyster's international wildlife law. International wildlife law. 2. Cambridge
New York: Cambridge University Press, 2011.

A. Boyle and D. Freestone. International Law and Sustainable Development: Past Achievements and Future Challenges. Oxford University Press 2001.

A. E. Boyle. "The Rio Convention on Biological Diversity." Chap. 2 In International Law and the Conservation of Biological Diversity, edited by M. R. Bowman, Catherine. International Environmental Law and Policy Series, 33-50. Kluwer Law International, 1996. Reprint, 1.

A. E. Boyle. The making of international law. Oxford: Oxford : Oxford University Press, 2007.

A. E. Boyle and C. Chinkin. The making of international law. Oxford: Oxford University Press, 2007.

T. Broude and S. Yuval. Multi-Sourced Equivalent Norms in International Law. Hart Publishing, 2011.

I. Brownlie. Principles of Public International Law. 6. ed. Oxford: Oxford : Oxford University Press, 2003.

S. J. Buck. The Global Commons: An Introduction. London: Earthscan Publications Ltd., 1998.

R. Carson. Silent spring. Fortieth anniversary edition. Boston : Mariner Books, Houghton Mifflin Harcourt, 2002.

M. Chalfie and S. R. Kain. Green Fluorescent Protein: Properties, Applications, and Protocols. Methods of Biochemical Analysis. 2. 47: John Wiley & Sons, 2005.

L. Chang-fa. Treaty Interpretation Under the Vienna Convention on the Law of Treaties. 2018.

J. I. Charney. Is international law threatened by multiple international tribunals? Collected Courses of the Hague Academy of International Law (Book 271). 271: Springer, 1999.

R. R. Churchill and A. V. Lowe. The Law of the Sea. 3. ed. Manchester : Yonkers, NY: Manchester : Manchester University Press
Yonkers, NY : Juris Publ., 1999.

C. Correa. Trade related aspects of intellectual property rights: a commentary on the TRIPS agreement. 2007.

C. M. Correa and A. A. Yusuf. Intellectual property and international trade : The TRIPs Agreement. 3. 2016. London: Kluwer Law International.

O. Dajani. Genetic resources under the CBD and TRIPS: Issues on sovereignty and property. ProQuest Dissertations Publishing, 2003.

E. De Wet. Hierarchy in International Law. Oxford: Cary: Oxford University Press, 2012.

J. A. Du Pisani, Sustainable development – historical roots of the concept, 3 Environmental Sciences, pp. 83-96 (2006)

R. D. Eckert. The Enclosure of Ocean Resources: Economics and the Law of the Sea. Hoover Institution publication ; 210. Stanford, California, United States: 1979. Hoover Institution Press, United States.

A. E. Egelston. Sustainable Development: A History. Dordrecht: Springer Netherlands, 2013.

FAO. The State of World Fisheries and Aquaculture 2018 - Meeting the sustainable development goals. Rome: 2018.

E. Fattorusso, W. H. Gerwick and O. Taglialatela-Scafati. Handbook of Marine Natural Products. 2012. Dordrecht: Dordrecht: Springer Netherlands, 2012.

C. Fowler. "Unnatural selection : technology, politics, law and the rationalization of plant evolution." Diss. Uppsala : Univ., 1993.

R. K. Gardiner. Treaty interpretation. 2nd rev. edition. Oxford: Oxford : Oxford University Press, 2015.

D. J. Gervais. The TRIPS Agreement: Drafting History and Analysis. 4. London: Thomson Reuters, 2012.

A. Gillespie. The long road to sustainability: The past, present, and future of international environmental law and policy. 2018.

P. Glasner, P. Atkinson and H. Greenslade. New Genetics, New Social Formations. Routledge, 2014.

L. Glowka. A Guide to the Convention on Biological Diversity. IUCN Gland and Cambridge, 1994.

H. Grotius. The Freedom of the seas or The right which belongs to the Dutch to take part in the East Indian trade. New York: The Lawbook Exchange, 2001.

H. Grotius. The Freedom of the seas or, The right which belongs to the Dutch to take part in the East Indian trade. Right which belongs to the Dutch to take part in the East Indian trade. Kitchener, Ont.: Kitchener, Ont. : Batoche, 2000.

B. Guilloux. Marine genetic resources, R&D and the law 1 Complex objects of use. London
Hoboken, NJ : ISTE-Wiley, 2018.

H. L. A. Hart. The concept of law. 3. ed. Oxford: Oxford University Press, 2012.

D. Hunter, J. Salzman and D. Zaelke. International Environmental Law and Policy. 5. Foundation Press, 2015.

J. H. Jackson. The jurisprudence of GATT and the WTO : insights on treaty law and economic relations. Cambridge: Cambridge : Cambridge University Press, 2000.

J. H. Jackson. Sovereignty, the WTO and Changing Fundamentals of International Law. Cambridge: Cambridge University Press, 2006.

G. n. Jaenicke. Liber amicorum Günther Jaenicke. Berlin: Springer, 1999.

C. S. G. Jefferies and J. N. Moore. Marine Mammal Conservation and the Law of the Sea. Oxford: Oxford: Oxford University Press USA - OSO, 2016.

H. Jonsson. Friends in Conflict: Anglo-Icelandic Cod Wars and the Law of the Sea. United Kingdom: C Hurst & Co Publishers Ltd 1982.

M. Kachel. Particularly Sensitive Sea Areas: The IMO's Role in Protecting Vulnerable Marine Areas. The IMO's Role in Protecting Vulnerable Marine Areas. 13, Berlin, Heidelberg: Springer Berlin Heidelberg, Berlin, Heidelberg, 2008.

W. H. Kayser O. Pharmaceutical Biotechnology. Weinheim: Wiley-VCH, 2012.

H. Kelsen. General Theory of Norms. Oxford: Oxford University Press, 1991.

D. J. Kevles. A history of patenting life in the United States with comparative attention to Europe and Canada. Luxembourg: Luxembourg : Office for Official Publications of the European Communities, 2002.

S.-K. Kim. Springer Handbook of Marine Biotechnology. Berlin, Germany: Springer Berlin Heidelberg, 2015.

J. Klabbers. International Law. Cambridge University Press, 2017.

J. Klabbers. An introduction to international organizations law. 3. Cambridge, United Kingdom: Cambridge University Press, 2015.

J. Klabbers, A. Peters and G. Ulfstein. The Constitutionalization of International Law. United Kingdom: Oxford University Press - Special, 2009.

H. Korn, S. Friedrich and U. Feit. Deep Sea Genetic Resources in the Context of the Convention on Biological Diversity and the United Nations Convention on the Law of the Sea. Bonn: Bundesamt für Naturschutz (BfN), 2003.

M. Koskenniemi. The Politics of International Law. Oxford: Hart Publishing, 2011.

D. Langlet. Prior Informed Consent and Hazardous Trade: Regulating Trade in Hazardous Goods at the Intersection of Sovereignty, Free Trade and Environmental Protection. Alphen aan den Rijn: Kluwer Law International, 2009.

B. Latour. Science in action : how to follow scientists and engineers through society. Cambridge, Mass. Harvard Univ. Press, 1987.

D. Leary. International Law And The Genetic Resources Of The Deep Sea. Leiden - Boston: Martinus Nijhoff Publishers, 2010.

R. Lee. Law and Regulation of Commercial Mining of Minerals in Outer Space. Dordrecht: Springer Netherlands, 2012.

U. Linderfalk. On The Interpretation of Treaties: The Modern International Law as Expressed in the 1969 Vienna Convention on the Law of Treaties. The Modern International Law as Expressed in the 1969 Vienna Convention on the Law of Treaties. 83, Dordrecht: Springer Netherlands, Dordrecht, 2007.

S. Mahmoudi. The Law of Deep Sea-bed Mining: A Study of the Progressive Development of International Law Concerning the Management of the Polymetallic Nodules of the Deep Sea-bed. Stockholm: Dissertation Stockholm University, 1987.

D. S. Maier. What's So Good About Biodiversity?: A Call for Better Reasoning About Nature's Value. A Call for Better Reasoning About Nature's Value. 19, Dordrecht: Springer Netherlands, Dordrecht, 2012.

M. Markowski. The International Law of EEZ Fisheries. 2010.

L. Martin, C. Salonidis and C. Hioureas. Natural Resources and the Law of the Sea: Exploration, Allocation, Exploitation of Natural Resources in Areas under National Jurisdiction and Beyond. Juris, 2017.

F. McConnell. The Biodiversity Convention: A Negotiating History. London, The Hague, Boston: Kluwer Law International,, 1996.

T. L. McDorman. UNCLOS III and the LOS Convention. Oxford University Press, 2009.

J. A. e. McNeely. Conserving the world's biological diversity. Gland, Switzerland : IUCN ; Washington, DC : WRI, Conservation International, WWF-US, World Bank: 1990.

F. Millicay. A Legal Regime for the Biodiversity of the Area. Leiden, Boston: Martinus Nijhoff Publishers, 2007.

E. L. Miles. Global Ocean Politics: Decision Process at the Third United Nations Conference on the Law of the Sea, 1973-1982. The Hague, The Netherlands: Kluwer Law, 1997.

J. B. Morrell. The Law of the Sea: A History of the 1982 Treaty and Its Rejection by the United States. Jefferson, North Carolina and London: McFarland Publishing, 1992.

A. M. Nizamuddin. The Patenting of Life, Limiting Liberty, and the Corporate Pursuit of Seeds. Lanham, Maryland: Lexington Books, 2017.

M. H. Nordquist, N. R. Grandy, S. N. Nandan and S. Rosenne. United Nations Convention on the Law of the Sea, 1982: A Commentary Vol. III [Second Committee: Articles 86 to 132, and supplementary documents]. UNCLOS 1982: A Commentary. III, The Hague, The Netherlands: 1995.

M. H. Nordquist, N. R. Grandy, S. Rosenne and A. Yankov. United Nations Convention on the Law of the Sea, 1982: A Commentary Vol. IV [Third Committee: Protection and Preservation of the Marine Environment, Marine Scientific Research, and Development and Transfer of Marine Technology]. UNCLOS 1982: A Commentary. IV, Dordrecht: Dordrecht : Nijhoff, 1990.

D. P. O'Connell. The international law of the sea. Vol. 2. Oxford: Oxford : Clarendon Pr., 1984.

J. O'Connor. The principle of good faith in legal theory (with particular reference to public international law). ProQuest Dissertations Publishing, 1987.

OECD. Marine Biotechnology Definitions, Infrastructures and Directions for Innovation OECD Science, Technology and Innovation Policy Papers. 2017.

OECD. Marine Biotechnology: Enabling Solutions for Ocean Productivity and Sustainability. No. 43: OECD Publishing, 2013.

G. Orellana Zabalza. The Principle of Systemic Integration: Towards a Coherent International Legal Order. Münster: LIT Verlag, 2012.

B. Parry. Trading the Genome: Investigating the Commodification of Bio-Information. Columbia University Press, 2004.

R. Paterson and N. Lima. Bioprospecting: Success, Potential and Constraints. 16, Cham: Cham: Springer International Publishing, 2017.

G. L. Patrick. An introduction to medicinal chemistry. Sixth edition. Oxford: Oxford : Oxford University Press, 2017.

J. Pauwelyn. Conflict of Norms in Public International Law: How WTO Law Relates to Other Rules of International Law. Cambridge: Cambridge University Press, 2003.

O. Perez. Ecological Sensitivity and Global Legal Pluralism—Rethinking the Trade and Environment Conflict. Oxford: Hart Publishing, 2004.

A. M. Post. Deepsea mining and the law of the sea. The Hague ; Boston: M. Nijhoff Publishers, 1983.

A. Proelss. United Nations Convention on the Law of the Sea: A Commentary. Oxford: Hart Publishing, 2017.

D. Pulkowski. The Law and Politics of International Regime Conflict. 1. Oxford: Oxford University Press, 2014.

P. H. Rampelotto and A. Trincone. Grand Challenges in Marine Biotechnology. Cham: Springer International Publishing, Cham, 2018.

M. Rimmer. Intellectual Property and Biotechnology: Biological Inventions. Cheltenham, UK: Edward Elgar, 2008.

C. Salpin. Chapter 5. The Law of the Sea: A before and an after Nagoya? 1: 2013.

P. Sands. Principles of international environmental law. 4. Cambridge Cambridge University Press, 2018.

P. Sands. Sustainable Development: Treaty, Custom, and the Cross-fertilization of International Law. Oxford University Press, 1999.

C. Sanger. Ordering the Oceans: The Making of the Law of the Sea. London: Zed, 1986.

R. D. Schmid. Pocket Guide to Biotechnology and Genetic Engineering: Wiley, 2003.

N. Schrijver. The evolution of sustainable development in international law: inception, meaning and status. Hague Academy of International Law. Leiden: Leiden : Martinus Nijhoff, 2008.

T. Scovazzi and F. Francioni. Biotechnology and International Law. London: Bloomsbury Publishing, 2006.

L. B. Sohn and J. Noyes. Cases and Materials on the Law of the Sea. 2. Nijhoff: Brill, 2014.

A. H. A. Soons. Marine Scientific Research and the Law of the Sea. Utrecht: Diss. Utrecht, 1982.

P. E. Steinberg. The Social Construction of the Ocean. Cambridge studies in international relations. Cambridge, United Kingdom: Cambridge University Press, 2001.

T. P. Stewart. The GATT Uruguay round: A Negotiating History (1986-1992). 2, Netherlands: Kluwer, 1993.

Y. Tanaka. A dual approach to ocean governance: The cases of zonal and integrated management in international law of the sea. 2009.

Y. Tanaka. The International Law of the Sea. Cambridge: Cambridge University Press, 2012.

P. Van Den Bossche. The Law and Policy of the World Trade Organization : Text, Cases and Materials. Cambridge: Cambridge : Cambridge University Press, 2005.

S. Van den Hove and V. Moreau. Deep-sea biodiversity and ecosystems: a scoping report on their socio-economy, management and governance. Cambridge (United Kingdom): 2007.

D. Vidas. Law, technology and science for oceans in globalisation: IUU fishing, oil pollution, bioprospecting, outer continental shelf. Leiden Boston, Massachusetts: Martinus Nijhoff, 2010.

M. E. Villiger. Commentary on the 1969 Vienna Convention on the Law of Treaties. Leiden: Martinus Nijhoff Publishers, 2009.

R. Volker and R. Wolfrum. Developments of International Law in Treaty Making. Springer-Verlag Berlin Heidelberg, 2005.

G. K. Walker. Definitions for the Law of the Sea: Terms Not Defined by the 1982 Convention. Leiden: Martinus Nijhoff Publishers, 2011.

R. Warner. Protecting the Oceans beyond National Jurisdiction: Strengthening the International Law Framework. Legal Aspects of Sustainable Development Series, No. 3, xxiv, Leiden/Boston: Martinus Nijhoff Publishers: 2009.

J. Watson. The WTO and the Environment - Development of competence beyond trade. Routledge Research in International Economic Law. Routledge, 2013.

P. Webb. International Judicial Integration and Fragmentation. Oxford, United Kingdom: Oxford University Press, 2016.

C. Wilson. The Impact of the Torrey Canyon disaster on technology and national and international efforts to deal with supertanker generated oil pollution: an impetus for change? : ProQuest Dissertations Publishing, 1973.

E. O. Wilson. The diversity of life. Massachusetts: Harvard University Press, 1992.

E. O. Wilson, F. M. Peter and B. National Forum on. Biodiversity. Washington, D.C.: Washington, D.C. : National Academy Press, 1988.

WIPO. WIPO Intellectual Property Handbook. Geneva, Switzerland: WIPO Publication, 2004.

R. Wolfrum and N. Matz. Conflicts in International Environmental Law. Berlin/London: Springer, 2003.

R. Wolfrum. Max Planck encyclopedia of public international law (MPEPIL). Oxford: Oxford : Oxford University Press, 2008.

R. Wynberg. Marine genetic resources and bioprospecting in the Western Indian Ocean: Western Indian Ocean. 2016.

M. A. Young. Trading Fish, Saving Fish: The Interaction Between Regimes in International Law. Cambridge University Press, 2011.

Book sections

A. O. Adede. "The Road to Rio: The Development of Negotiations." Chap. 1 In The Environment After Rio: International Law and Economics, edited by T. Treves, D. Siniscalco, L. Campiglio and L. Pineschi. 3-15. Graham & Trotman Martinus Nijhoff, 1994.

R. P. Anand. "Changing Concepts of Freedom of the Seas: A Historical Perspective." Chap. In Freedom for the Seas in the 21st Century: Ocean Governance and Environmental Harmony edited by., 72-86. Island Press, 1993.

M. Andenæs and E. Bjorge. "Introduction: from fragmenation to convergence in international law." Chap. 1 In A farewell to fragmentation: reassertion and convergence in international law, edited by M. Andenas and E. Bjørge. 1-36. Cambridge: Cambridge University Press, 2015.

S. Arico. "Marine Genetic Resources in Areas beyond National Jurisdiction and Intellectual Property Rights." Chap. 21 In Law, technology and science for oceans in globalisation : IUU fishing, oil pollution, bioprospecting, outer continental shelf edited by D. Vidas. 383-397. Leiden: Martinus Nijhoff, 2010.

D. Arora, C. Sharma, S. Jaglan and E. Lichtfouse. "Pharmaceuticals from Microbes - Impact on Drug Discovery." Chap. 1 In Pharmaceuticals from Microbes: Impact on Drug Discovery, edited by D. S. Arora, Chetan; Jaglan, Sundeep; Lichtfouse, Eric. 1-25. Cham: Springer International Publishing, Cham, 2019.

R. Barnes. "Entitlement to Marine Living Resources in Areas Beyond National Jurisdiction." Chap. 7 In The international legal regime of areas beyond national jurisdiction: current and future developments, edited by A. G. Oude Elferink and E. J. Molenaar. 83-142. Boston: Martinus Nijhoff Publishers, 2010.

D. Bodansky. "Precaution." Chap. In The Oxford Handbook of International Environmental Law, edited by J. Brunnée, E. Hey and J. B. Wiener. Oxford University Press, 2008. Reprint, 1.

R. P. Borris. "Bioprospecting: An Industrial Perspective." Chap. In Bioprospecting Success, Potential and Constraints, edited by R. L. Paterson, Nelson. Topics in Biodiversity and Conservation, 1-14. Springer International Publishing, 2017.

M. Bowman. "The Nature, Development and Philosophical Foundations of the Biodiversity Concept in International Law." Chap. 1 In International Law And The Conservation Of Biological Diversity, edited by M. Bowman and C. Redgwell. 5-32. London: Kluwer Law International, 1996.

M. Bowman and C. Redgwell. "Introduction." Chap. 0 In International Law and The Conservation of Biological Diversity, edited by M. Bowman and C. Redgwell. 1-5. London: Kluwer Law International, 1996. Reprint, 1.

A. Boyle. "The Convention on Biological Diversity." Chap. 8 In The Environment After Rio: International Law and Economics, edited by T. Treves, D. Siniscalco, L. Campiglio and L. Pineschi. 111-126. Graham & Trotman
Martinus Nijhoff, 1994.

A. Boyle. "International law and the protection of the global atmosphere: Concepts, categories and principles." Chap. In International law and global climate change, edited by., 7-19. Graham & Trotman
Martinus Nijhoff, 1994.

A. Boyle. "Relationship Between International Environmental Law and Other Branches of International Law." Chap. 7 In The Oxford Handbook of International Environmental Law, edited by D. Bodansky, J. Brunnée, E. Hey and K. W. Danish. Oxford: Oxford University Press, 2008. Reprint, 1.

A. Boyle. "The Rio Convention on Biological Diversity." Chap. 2 In International Law and The Conservation of Biological Diversity, edited by M. Bowman and C. Redgwell. 33-50. London: Kluwer Law International, 1996. Reprint, 1.

A. Braathen and H. Brekke. "Characterizing the Seabed: a Geoscience Perspective." Chap. 1 In The Law of the Seabed - Access, Uses, and Protection of Seabed Resources, edited by C. Banet. Publications on Ocean Development, 21-35. Nijhoff: Brill, 2020.

D. L. Burk. "Patents and Related Rights: A Global Kaleidoscope." Chap. 22 In The Oxford Handbook of Intellectual Property Law, edited by R. Dreyfuss and J. Pila. 462-486. Oxford: Oxford University Press, 2017. Reprint, 1.

G. Cataldi. "Biotechnology and Marine Biogenetic Resources: The Interplay between UNCLOS and the CBD." Chap. 5 In Biotechnology and International Law, edited by T. Scovazzi and F. Francioni. 99-110. London: Bloomsbury Publishing, 2006.

E. F. Costa. "Latin America and the Law of the Sea." Chap. 21 In Regions, Institutions, and Law of the Sea, edited by H. N. Scheiber and J.-H. Paik. 383-410. Martinus Nijhoff, 2013.

J. Crawford and P. Neville. "Relations between International Courts and Tribunals: The ‘Regime Problem’." Chap. In Regime Interaction in International Law - Facing Fragmentation, edited by M. A. Young. 235-260. Cambridge: Cambridge University Press, 2012.

O. Dörr and K. Schmalenbach. "Article 31. General rule of interpretation." Chap. 31 In Vienna convention on the law of treaties: A commentary, edited by O. Dörr and K. Schmalenbach. 521-570. Berlin Heidelberg: Springer-Verlag, 2012.

R. L. Farrell and S. M. Duncan. "Uniqueness of Antarctica and potential for commercial success." Chap. In Antarctic Bioprospecting, edited by A. D. R.-

F. Hemmings, Michelle and M. Rogan-Finnemore. 10-40. University of Canterbury, Christchurch: Gateway Antarctica, Centre for Antarctic Studies and Research, University of Canterbury, 2005.

D. Firsova. "Current Status and Perspectives in Marine Biodiscovery." Chap. In Bioprospecting Success, Potential and Constraints, edited by R. L. Paterson, Nelson. Topics in Biodiversity and Conservation, 29-50. Springer International Publishing, 2017.

F. Francioni. "Genetic Resources, Biotechnology and Human Rights: The International Legal Framework." Chap. 1 In Biotechnologies and International Human Rights, edited by F. Francioni. 3-33. Oxford: Hart Publishing, 2007.

F. Francioni. "International Law for Biotechnology: Basic Principles." Chap. 1 In Biotechnology and International Law, edited by T. Scovazzi and F. Francioni. 3-28. London: London : Bloomsbury Publishing, 2006.

S. Giubergia, C. Schleissner, F. de la Calle, A. Pretsch, D. Pretsch, L. Gram and M. Thogersen. "Screening Microorganisms for Bioactive Compounds." Chap. In The Marine Microbiome, edited by L. J. Stal and M. Silvia Cretoiu. 345-376. Switzerland: Springer, Cham, 2016.

G. R. Greco and M. Cinquegrani. "The Global Market for Marine Biotechnology: The Underwater World of Marine Biotech Firms." Chap. In Grand Challenges in Marine Biotechnology, edited by P. H. Rampelotto and A. Trincone. Cham: Springer International Publishing, Cham, 2018.

C. Greenwood. "Unity and diversity in international law." Chap. 2 In A farewell to fragmentation: reassertion and convergence in international law, edited by M. Andenas and E. Bjørge. 37-55. Cambridge: Cambridge University Press, 2015.

A. M. Halvorssen. "The origin and development of international environmental law." Chap. In Routledge Handbook of International Environmental Law, edited by S. Alam, J. H. Bhuiyan, T. M. R. Chowdhury and E. J. Techera. United States: Taylor and Francis, 2013.

R. Howse. "The Most Dangerous Branch? WTO Appellate Body Jurisprudence on the Nature and Limits of the Judicial Power." Chap. 1 In The Role of the Judge in International Trade Regulation: Experience and Lessons for the WTO,

edited by T. Cottier, P. C. Mavroidis and P. Blatter. 11-42. Ann Arbor: University of Michigan Press, 2003.

R. Howse. "The Use and Abuse of other “Relevant Rules of International Law” in Treaty Interpretation: Insights from WTO Trade/Environment Litigation." New York: Institute for International Law and Justice New York University School of Law, 2007.

J. Klabbers. "Some Problems Regarding the Object and Propose of Treaties." Chap. 3 In Finnish Yearbook of International Law, edited by M. Koskenniemi and K. Takamaa. 138-155. 1998.

T. Koh. "’A Constitution for the Oceans’." Chap. In The Law of the Sea - Official Text of the United Nations Convention on the Law of the Sea, edited by. United Nations, New York: UN Publications, 1983.

K. J. Marciniak. "Marine Genetic Resources: Do They Form Part of the Common Heritage of Mankind Principle?" Chap. 16 In Natural Resources and the Law of the Sea: Exploration, Allocation, Exploitation of Natural Resources in Areas under National Jurisdiction and Beyond, edited by L. Martin, C. Salonidis, C. Hioureas, I. A. Laird, B. Sabahi and A. M. Whitesell. Natural Resources and the Law of the Sea New York: JurisNet, LLC, 2017.

N. Matz-Lück. "Norm Interpretation across International Regimes: Competences and Legitimacy." Chap. 7 In Regime Interaction in International Law - Facing Fragmentation, edited by M. A. Young. 201-234. Cambridge University Press, 2012.

N. Matz-Lück and J. Fuchs. "Marine Living Resources." Chap. 22 In The Oxford Handbook of the Law of the Sea, edited by D. Rothwell, A. Oude Elferink, K. Scott and T. Stephens. 491-513. Oxford University Press, 2015.

R. J. McLaughlin. "Exploiting Marine Genetic Resources beyond National Jurisdiction and the International Protection of Intellectual Property Rights: Can They Coexist?" Chap. 20 In Law, technology and science for oceans in globalisation: IUU fishing, oil pollution, bioprospecting, outer continental shelf, edited by D. Vidas. 371-382. Leiden: Martinus Nijhoff, 2010.

J. Mossop. "Marine Bioprospecting." Chap. 36 In The Oxford Handbook of the Law of the Sea, edited by D. Rothwell, A. Oude Elferink, K. Scott, T. Stephens and J. Mossop. Oxford University Press, 2015. Reprint, 1.

D. G. Nagle and Y.-D. Zhou. "Mechanism-based Screening for Cancer Therapeutics with Examples from the Discovery of Marine Natural Product-based HIF-1 Inhibitors." Chap. 22 In Handbook of Marine Natural Products, edited by E. Fattorusso, W. H. Gerwick and O. Taglialatela-Scafati. 1111-1144. Dordrecht: Dordrecht: Springer Netherlands, 2012. Reprint, 2012.

K. E. Nelson. "Genomics." Chap. 25 In Microbial Diversity and Bioprospecting, edited by A. T. Bull. 250-259. ASM Press, 2004.

J. Paine. "The Judicial Dimension of Regime Interaction beyond Systemic Integration." Chap. 7 In Regime Interaction in Ocean Governance: Problems, Theories and Methods, edited by S. Trevisanut, N. Giannopoulos and R. Roland Holst. 184-221. Boston: Brill, 2020.

M. Pallemaerts. "International Environmental Law from Stockholm to Rio: Back to the Future?" Chap. In Greening International Law, edited by P. Sands. 1-19. The New Press, 1994.

A. Proelss. "ABS in Relation to Marine GRs." Chap. In Genetic Resources, Traditional Knowledge and the Law, edited by. Earthscan Publishers: 2009, 2009.

C. Redgwell. "Biotechnology, Biodiversity and Sustainable Development: Conflict or Congruence?" Chap. 1 In Biotechnology and International Law, edited by T. Scovazzi and F. Francioni. 61-98. London: Bloomsbury Publishing, 2006.

G. L. Rorrer. "Bioprocess Engineering of Phototrophic Marine Organisms " Chap. 9 In Springer Handbook of Marine Biotechnology, edited by S.-K. Kim. 257-293. Berlin, Germany: Springer Berlin Heidelberg, 2015.

G. Rose. "The International Undertaking on Plant Genetic Resources for Food And Agriculture: Will the Paper be Worth the Trees?" Chap. In Accessing Biological Resources: Complying with the Convention on Biological Diversity, edited by N. P. Stoianoff. 55-90. London: Kluwer Law International, 2004.

T. Scovazzi. "Bioprospecting on the Deep Seabed: a Legal Gap Requiring to be Filled." Chap. 4 In Biotechnology and International Law, edited by T. Scovazzi and F. Francioni. 81-97. London: Bloomsbury Publishing, 2006.

T. Scovazzi. "Is the UN Convention on the Law of the Sea the Legal Framework for All Activities in the Sea? The Case of Bioprospecting." Chap. 16 In Law, technology and science for oceans in globalisation : IUU fishing, oil pollution, bioprospecting, outer continental shelf, edited by D. Vidas. 309-317. Leiden ; Boston, Mass.: Leiden ; Boston, Mass. : Martinus Nijhoff, 2010.

I. Seidle-Hohenveldern. "Hierarchy of Treaties." Chap. In Essays on the Law of Treaties - A Collection of Essays in Honour of Bert Vierdag, edited by J. Klabbers and R. Lefeber. 7-19. Netherlands: Martinus Nijhoff Publishers, 1997.

G. Teubner and P. Korth. "The Productive Friction Between Regimes." Chap. 1 In Regime Interaction in International Law - Facing Fragmentation, edited by M. Young. 23-54. Cambridge University Press, 2012.

H. Ullrich. "Traditional Knowledge, Biodiversity, Benefit-Sharing and the Patent System: Romantics v. Economics?" Chap. 9 In Biotechnology and International Law, edited by F. Francioni. 201-229. London: London : Bloomsbury Publishing, 2006.

I. Van Damme. "Jurisdiction, Applicable Law, and Interpretation." Chap. In The Oxford Handbook of International Trade Law, edited by D. Bethlehem, I. Van Damme, D. McRae and R. Neufeld. Oxford University Press, 2009.

S. Vasciannie. "Resource entitlement in the Law of the Sea: some areas of continuity and change." Chap. 24 In The Reality of International Law: Essays in Honour of Ian Brownlie, edited by G. S. Goodwin-Gill and S. Talmon. 539-564. Oxford: Oxford Scholarship 1999.

M. E. Villiger. "The Rules on Interpretation: Misgivings, Misunderstandings, Miscarriage? The ‘Crucible’ Intended by the International Law Commission." Chap. 6 In The Law of Treaties Beyond the Vienna Convention, edited by E. Cannizzaro. Oxford: Oxford University Press, 2011.

I. Walden. "Intellectual Property Rights and Biodiversity." Chap. 9 In International Law and the Conservation of Biological Diversity, edited by M. R. Bowman, Catherine. International Environmental Law and Policy Series, 172-190. Kluwer Law International, 1996. Reprint, 1.

A. Watts. "The Law of Treaties." Chap. 8 In The International Law Commission 1949-1998. The treaties, edited by A. Watts. Oxford: Oxford University Press, 1999.

K. Wolfke. "Treaties and custom: aspects of interrelation." Chap. In Essays on the Law of Treaties - A Collection of Essays in Honour of Bert Vierdag, edited by J. Klabbers and R. Lefeber. 31-41. Netherlands: Martinus Nijhoff Publishers, 1997.

M. A. Young. "The Productive Friction Between Regimes." Chap. In Regime Interaction in International Law - Facing Fragmentation, edited by M. A. Young. 1-20. Cambridge University Press, 2012.

M. A. Young. "Regime interaction in creating, implementing and enforcing international Law." Chap. In Regime Interaction in International Law - Facing Fragmentation, edited by M. A. Young. 85-110. Cambridge University Press, 2012.

Z. O. Özçayir. "Illegal Oil Discharges from Shipss and Implementation Failures in the International Convention System." Chap. 13 In Law, technology and science for oceans in globalisation: IUU fishing, oil pollution, bioprospecting, outer continental shelf, edited by D. Vidas. 245-268. Leiden Boston, Massachusetts: Martinus Nijhoff, 2010.

Journal Articles

The First Global Integrated Marine Assessment: World Ocean Assessment I. Cambridge: Cambridge University Press, 2017.

F. M. Abbott, The Doha Declaration on the TRIPS Agreement and Public Health: Lighting a Dark Corner at the WTO, 5 Journal of International Economic Law, pp. 469-505 (2002)

G. Abi-Saab, Fragmentation or unification: some concluding remark (The Proliferation of International Tribunals: Piecing Together the Puzzle), 31 New York University Journal of International Law and Politics, pp. 919-933 (1999)

R. Acharya, Patenting of Biotechnology: GATT and the Erosion of the World's Biodiversity, 25 Journal of World Trade, pp. 71-87 (1991)

A. Aguilar, Exploring the last frontier of life: R & D initiatives of the European Union, 11 World journal of microbiology & biotechnology, pp. 7-8 (1995)

A. Aguilar, E. Magnien and D. Thomas, Thirty years of European biotechnology programmes: from biomolecular engineering to the bioeconomy, 30 New Biotechnology, pp. 410-425 (2013)

A. Aguilar, R. Wohlgemuth and T. Twardowski, Perspectives on Bioeconomy, 40 New Biotechnology, pp. 181-184 (2017)

L. M. Alexander, The ocean enclosure movement: inventory and prospect. (Law of the Sea XV), 20 San Diego Law Review, pp. 561-594 (1983)

P. Allott, Power Sharing in the Law of the Sea, 77 American Journal of International Law, pp. 1-918 (1983)

J. Apesteguia and F. P. Maier-Rigaud, The Role of Rivalry: Public Goods Versus Common-Pool Resources, 50 Journal of Conflict Resolution, pp. 646-663 (2006)

F. Armas-Pfirter, How Can Life in the Deep Sea Be Protected?, 24 The International Journal of Marine and Coastal Law, pp. 281-307 (2009)

S. Arnaud-Haond, J. M. Arrieta and C. M. Duarte, Marine Biodiversity and Gene Patents, 331 Science, pp. 1521-1522 (2011)

J. M. Arrieta, S. Arnaud-Haond and C. M. Duarte, What Lies Underneath: Conserving the Oceans' Genetic Resources, 107 Proceedings of the National Academy of Sciences, pp. 18318-18324 (2010)

D. Barben, The Political Economy of Genetic Engineering: The Neoliberal Formation of the Biotechnology Industry, 11 Organization & Environment, pp. 406-420 (1998)

L. Bartels, Applicable Law in WTO Dispute Settlement Proceedings, 35 Journal of World Trade, pp. 499-519 (2001)

E. Benvenisti and G. W. Downs, The Empire's New Clothes: Political Economy and the Fragmentation of International Law, 60 Stanford Law Review, pp. 595-631 (2007)

P. Bhatia and A. Chugh, Role of marine bioprospecting contracts in developing access and benefit sharing mechanism for marine traditional knowledge holders in the pharmaceutical industry, 3 Global Ecology and Conservation, pp. 176-187 (2015)

I. Bhatnagar and S.-K. Kim, Marine antitumor drugs: status, shortfalls and strategies, 8 Marine drugs, pp. 2702-2720 (2010)

R. Blasiak, J.-B. Jouffray, C. C. C. Wabnitz, E. Sundström and H. Österblom, Corporate control and global governance of marine genetic resources, 4 Science advances, pp. 1-7 (2018)

B. Boczek, Ideology and the Law of the Sea: The Challenge of the New International Economic Order, 7 Boston College International and Comparative Law Review, pp. 1-31 (1984)

A. Bonfanti, Environmental risks in biotech patent disputes: which role for ordre public before the European patent office, 3 European journal of risk regulation, pp. 47-56 (2012)

A. Bonfanti and S. Trevisanut, TRIPs on the high seas: intellectual property rights on marine genetic resources. (Agreement on Trade-Related Aspects of Intellectual Property Rights), 37 Brooklyn Journal of International Law, pp. 187-232 (2011)

C. Borgen, Resolving treaty conflicts, 37 The George Washington International Law Review, pp. 573-648 (2005)

K. Bosselmann, Plants and politics: the international legal regime concerning biotechnology and biodiversity, 7 Colorado Journal of International Environmental Law and Policy, pp. 111-148 (1996)

M. J. Bowman, The 1902 Convention for the Protection of Birds in Historical and Juridical Perspectiveal, 61 Ardeola, pp. 171-196, 26 (2014)

A. Boyle, Further Development Of The Law Of The Sea Convention: Mechanisms For Change, 54 International and Comparative Law Quarterly, pp. 563-584 (2005)

A. Broggiato, Marine Genetic Resources beyond National Jurisdiction - Coordination and Harmonisation of Governance Regimes, 41 Environmental Policy and Law, pp. 35-42 (2011)

A. Broggiato, S. Arnaud-Haond, C. Chiarolla and T. Greiber, Fair and equitable sharing of benefits from the utilization of marine genetic resources in areas beyond national jurisdiction: Bridging the gaps between science and policy, 49 Marine Policy, pp. 176-185 (2014)

A. Broggiato, T. Vanagt, L. E. Lallier, M. Jaspars, G. Burton and D. Muyldermans, Mare Geneticum: Balancing Governance of Marine Genetic Resources in International Waters, 33 The International Journal of Marine and Coastal Law, pp. 3-33 (2018)

M. Buck and C. Hamilton, The Nagoya Protocol on Access to Genetic Resources and the Fair and Equitable Sharing of Benefits Arising from their Utilization to the Convention on Biological Diversity.(Report), 20 Review of European Community & International Environmental Law, pp. 47 (2011)

I. Buffard and K. Zemanek, The "Object and Purpose" of a Treaty: An Enigma, 3 Austrian Review of International & European Law, pp. 311-343 (1998)

J. Busserolles, M. Payá, M. V. D'auria, L. Gomez-Paloma and M. J. Alcaraz, Protection against 2,4,6-trinitrobenzenesulphonic acid-induced colonic inflammation in mice by the marine products bolinaquinone and petrosaspongiolide M, 69 Biochemical Pharmacology, pp. 1433-1440 (2005)

C. Calcabrini, E. Catanzaro, A. Bishayee, E. Turrini and C. Fimognari, Marine Sponge Natural Products with Anticancer Potential: An Updated Review, 15 Marine drugs, pp. 1-34 (2017)

M. Chandler, The Biodiversity Convention: selected issues of interest to the international lawyer, 4 Colorado Journal of International Environmental Law and Policy, pp. 141-175 (1993)

M. A. Charette and W. H. F. Smith, The volume of earth's Ocean, 23 Oceanography, pp. 112-114 (2010)

J. I. Charney, The impact on the international legal system of the growth of international courts and tribunals, 31 New York University Journal of International Law and Politics, pp. 697-708 (1999)

C. Chase, Norm Conflict Between WTO Covered Agreements—real, Apparent or Avoided?, 61, pp. 791-821 (2012)

Z. Chi, F. Wang, Z. Chi, L. Yue, G. Liu and T. Zhang, Bioproducts from Aureobasidium pullulans, a biotechnologically important yeast, 82 Applied Microbiol Biotechnology, pp. 793-804 (2009)

J. M. Conley and R. Makowski, Back to the future: rethinking the product of nature doctrine as a barrier to biotechnology patents, 85 Journal of the Patent and Trademark Office Society, pp. 371-398 (2003)

R. Coombe, Intellectual property, human rights and sovereignty: new dilemmas in international law posed by the recognition of indigenous knowledge and the conservation of biodiversity, 6 Indiana journal of global legal studies, pp. 59-115 (1998)

G. M. Cragg and D. J. Newman, Natural Products: A Continuing Source of Novel Drug Leads, 1830 Biochimica et biophysica acta, pp. 3670-3695 (2013)

S. Cullis-Suzuki and D. Pauly, Failing the high seas: A global evaluation of regional fisheries management organizations, 34 Marine Policy, pp. 1036-1042 (2010)

W. Czapliński and G. M. Danilenko, Conflicts of Norms in International Law, 21 Netherlands Yearbook of International Law, pp. 3-42 (1990)

R. Danovaro, P. V. R. Snelgrove and P. Tyler, Challenging the paradigms of deep-sea ecology, 29 Trends in Ecology & Evolution, pp. 465-475 (2014)

L. A. de La Fayette, A New Regime for the Conservation and Sustainable Use of Marine Biodiversity and Genetic Resources Beyond the Limits of National Jurisdiction, 24 The International Journal of Marine and Coastal Law, pp. 221-280 (2009)

V. De Lucia, The Concept of Commons and Marine Genetic Resources in Areas beyond National Jurisdiction, Maritime Safety and Security Law Journal, pp. 114-133 (2018)

A. Deplazes-Zemp, 'Genetic resources', an analysis of a multifaceted concept, 222 Biological conservation, pp. 86-94 (2018)

P. Drahos, Global Property Rights in Information: The story of TRIPS at the GATT, 13 Prometheus, pp. 6-19 (1995)

P. Drankier, A. G. Oude Elferink, B. Visser and T. Takács, Marine Genetic Resources in Areas beyond National Jurisdiction: Access and Benefit-Sharing, 27 The International Journal of Marine and Coastal Law, pp. 375-433 (2012)

J. A. Du Pisani, Sustainable development – historical roots of the concept, 3 Environmental Sciences, pp. 83-96 (2006)

D. C. Dunn, J. Ardron, N. Bax, P. Bernal, J. Cleary, I. Cresswell, B. Donnelly, P. Dunstan, K. Gjerde, D. Johnson, K. Kaschner, B. Lascelles, J. Rice, H. Von Nordheim, L. Wood and P. N. Halpin, The Convention on Biological Diversity's Ecologically or Biologically Significant Areas: Origins, development, and current status, 49 Marine Policy, pp. 137-145 (2014)

C.-D. Ehlermann and L. Ehring, The Authoritative Interpretation Under Article IX:2 of the Agreement Establishing the World Trade Organization: Current Law, Practice and Possible Improvements, 8 Journal of International Economic Law, pp. 803-824 (2005)

C.-D. Ehlermann and L. Ehring, Decision-making in the World Trade Organization: is the consensus practice of the World Trade Organization adequate for making, revising and implementing rules on international trade?, 8 Journal of international economic law, pp. 51-75 (2005)

S. Elvidge, Bioprospecting at the poles, Chemistry & Industry, pp. 17-19 (2011)

D. Farrier and L. Tucker, Access to marine bioresources: hitching the conservation cart to the bioprospecting horse, 32 Ocean development and international law, pp. 213-239 (2001)

D. Faulkner, Marine Pharmacology, 77 Antonie van Leeuwenhoek, pp. 135-145 (2000)

O. Ferrajolo, The Common Heritage of Mankind in International Law: A Great Past but No Future?, Maritime Safety and Security Law Journal, pp. 114-133 (2018)

A. Fischer-Lescano, G. Teubner and M. Everson, Regime-collisions: the vain search for legal unity in the fragmentation of global law (Diversity or Cacophony? New Sources of Norms in International Law Symposium), 25 Michigan Journal of International Law, pp. 999-1046 (2004)

N. L. Fong, J. A. Lerman, I. Lam, B. O. Palsson and P. Charusanti, Reconciling a Salmonella enterica metabolic model with experimental data confirms that overexpression of the glyoxylate shunt can rescue a lethal ppc deletion mutant, 342 FEMS Microbiology Letters, pp. 62-69 (2013)

J. Frakes, The common heritage of mankind principle and the deep seabed, outer space, and Antarctica: will developed and developing nations reach a compromise?, 21 Wisconsin International Law Journal, pp. 409-434 (2003)

E. Franckx, The 200-mile limit: between creeping jurisdiction and creeping common heritage? Some law of the sea considerations from Professor Louis Sohn's former LL.M. student, 39 George Washington international law review, pp. 467-498 (2007)

D. Freestone and R. Rayfuse, Ocean iron fertilization and international law, 364 Marine Ecology Progress Series, pp. 227-233 (2008)

D. French, Treaty Interpretation And The Incorporation Of Extraneous Legal Rules, 55 International and Comparative Law Quarterly, pp. 281-314 (2006)

G. Frisvold and K. Day-Rubenstein, Bioprospecting and Biodiversity Conservation: What Happens When Discoveries are Made?, 50 Arizona law review, pp. 545-576 (2008)

J. Gamble and M. Frankowska, International law's response to the New International Economic Order: an overview, 9 Boston College International and Comparative Law Review, pp. 257-291 (1986)

J. Gaunce, On the Interpretation of the General Duty of “Due Regard”, 32, pp. 27-59 (2018)

D. Gershon, If biological diversity has a price, who sets it and who should benefit? (Merck & Co's agreement with Costa Rican scientists), 359 Nature, pp. 565 (1992)

K. B. Glaser and A. M. S. Mayer, A renaissance in marine pharmacology: From preclinical curiosity to clinical reality, 78 Biochemical Pharmacology, pp. 440-448 (2009)

L. Glowka, The Deepest of Ironies: Genetic Resources, Marine Scientific Research, and the Area, 12 Ocean Yearbook Online, pp. 154-178 (1996)

M. Gorina Ysern, International law of the sea, access and benefit sharing agreements, and the use of biotechnology in the development, patenting and commercialization of marine natural products as therapeutic agents, Ocean yearbook, pp. 221-281 (2006)

M. Gorina-Ysern, Marine Scientific Research Activities as the Legal Basis for Intellectual Property Claims?, 22 Marine Policy, pp. 337-357 (1998)

A. Gourgourinis, The Distinction between Interpretation and Application of Norms in International Adjudication, 2 Journal of International Dispute Settlement, pp. 31-57 (2011)

H. Grosse Ruse-Khan, The (Non) Use of Treaty Object and Purpose in Intellectual Property Disputes in the WTO, Max Planck Institute for

Intellectual Property & Competition Law Research Paper No. 11-15., pp. 1-35 (2011)

B. Gwertzman. "U.S. Will Not Sign Sea Law Treaty." In The New York Times, edited by, 5-5. 1982.

P. M. Haas, Introduction: epistemic communities and international policy coordination, 46 International Organization, pp. 1-35 (1992)

G. Handl, Environmental Security and Global Change: The Challenge to International Law, 1 Yearbook of International Environmental Law, pp. 3-33 (1991)

G. Hardin, The Tragedy of the Commons, 162 Science, pp. 1243-1248 (1968)

A. Hertogen, Letting Lotus Bloom, 26 European Journal Of International Law, pp. 901-926 (2015)

I. K. Heidbrink, The Oceans as the Common Property of Mankind from Early Modern Period to Today, 6 History Compass, pp. 659-672 (2008)

R. Higgins, The ICJ, the ECJ, and the Integrity of International Law, 52 International & Comparative Law Quarterly, pp. 1-20 (2003)

R. T. Hill and W. Fenical, Pharmaceuticals from marine natural products: surge or ebb?, 21 Current Opinion in Biotechnology, pp. 777-779 (2010)

D. S. Hodgins, Life forms protectable as subjects of US patents--microbes to animals (perhaps), 16 Applied biochemistry and biotechnology, pp. 79-93 (1987)

G.-P. Hu, J. Yuan, L. Sun, Z.-G. She, J.-H. Wu, X.-J. Lan, X. Zhu, Y.-C. Lin and S.-P. Chen, Statistical Research on Marine Natural Products Based on Data Obtained between 1985 and 2008, 9 Marine Drugs, pp. 514-525 (2011)

J. Hu, The Role of International Law in the Development of WTO Law, 7 Journal of International Economic Law, pp. 143-167 (2004)

E. M. Hudzik, A treaty on thin ice: debunking the arguments against U.S. ratification of the U.N. Convention on the Law of the Sea in a time of global climate crisis, 9 Washington University Global Studies Law Review, pp. 353-370 (2010)

J. P. Hughes, S. Rees, S. B. Kalindjian and K. l. Philpott, Principles of Early Drug Discovery, 162, pp. 1239-1249 (2011)

F. Humphries and H. Harden-Davies, Practical policy solutions for the final stage of BBNJ treaty negotiations, 122 Marine policy, pp. (2020)

J. Jabour-Green and D. Nicol, Bioprospecting in areas outside national jurisdiction: Antarctica and the Southern Ocean, 4 Melbourne Journal of International Law, pp. 76 (2003)

M. Jaspars, D. De Pascale, J. Andersen, F. Reyes, A. Crawford and A. Ianora, The marine biodiscovery pipeline and ocean medicines of tomorrow, 96 Marine Biological Association of the United Kingdom. Journal of the Marine Biological Association of the United Kingdom, pp. 151-158 (2016)

L. Jeffrey, WTO Dispute Settlement and Sustainable Development: Legitimacy Through Holistic Treaty Interpretation, 28 Pace Environmental Law Review, pp. 545-936 (2011)

C. W. Jenks, The Conflict of Law-Making Treaties, 30 British Yearbook of International Law, pp. 401 (1953)

A. Jerardino and C. W. Marean, Shellfish gathering, marine paleoecology and modern human behavior: perspectives from cave PP13B, Pinnacle Point, South Africa, 59 Journal of Human Evolution, pp. 412-424 (2010)

G. T. Jóhannesson, How ‘cod war’ came: the origins of the Anglo-Icelandic fisheries dispute, 1958–61, 77 Historical Research, pp. 543-574 (2004)

G. M. John, V. Fabien, A. L. Jonathan, E. Jörg and P. Marco, Opportunities and challenges in phenotypic drug discovery: an industry perspective, 16 Nature Reviews Drug Discovery, pp. 531-543 (2017)

D. S. Jonas and T. N. Saunders, The object and purpose of a treaty: three interpretive methods, 43 Vanderbilt Journal of Transnational Law, pp. 565-609 (2010)

A. L. Joshua, R. H. Daniel, L. Haythem, A. P. Vasiliy, E. L. Nathan, D. O. Jeffrey, C. S.-R. Alexandra, D. S. Richard, N. A. Joshua, Z. Karsten and O. P. Bernhard, In silico method for modelling metabolism and gene product expression at genome scale, 3 Nature Communications, pp. 1-10 (2012)

C. C. Joyner, Biodiversity in the marine environment: resource implications for the law of the sea, 28 Vanderbilt Journal of Transnational Law, pp. 635-687 (1995)

A. Jørem and M. W. Tvedt, Bioprospecting in the High Seas: Existing Rights and Obligations in View of a New Legal Regime for Marine Areas beyond National Jurisdiction, 29 The International Journal of Marine and Coastal Law, pp. 321-343 (2014)

B. Karumudi, Natural Product Drug Discovery, 2 Journal of Pharmacognosy & Natural Products, pp. 102-103 (2015)

S. Kaye, Implementing high seas biodiversity conservation: global geopolitical considerations, 28 Marine Policy, pp. 221-226 (2004)

G. Ken, Peptide leads new class of chronic pain drugs, 23 Nature Biotechnology, pp. 399 (2005)

D. Kennedy, The Mystery of Global Governance, 34 Ohio Northern University Law Review, pp. 827-1072 (2008)

J. G. Kers, E. Van Burg, T. Stoop and M. Cornel, C., Trends in genetic patent applications: the commercialization of academic intellectual property, 22 European Journal of Human Genetics, pp. 1155–1159 (2014)

G. Kesteven, MSY Revisited. A Realistic Approach to Fisheries Management and Administration, 21 Marine Policy, pp. 73-82 (1997)

P. Kiuru, M. V. D'Auria, C. D. Muller, P. Tammela, H. Vuorela and J. Yli-Kauhaluoma, Exploring marine resources for bioactive compounds., 80(14) Planta Med, pp. 1234-1246 (2014)

J. Klabbers, The transformation of international organizations law, 26 European Journal of International Law, pp. 9-82 (2015)

Y. Kodama, M. Shumway and R. Leinonen, The Sequence Read Archive: Explosive Growth of Sequencing Data, 40 Nucleic acids research, pp. 54-56 (2012)

V. Koester, The Nature of the Convention on Biological Diversity and its Application of Components of the Concept of Sustainable Development, 16 The Italian Yearbook of International Law Online, pp. 57-84 (2006)

T. Koh, The origins of the 1982 Convention on the Law of the Sea, 29 Malaya Law Review, pp. 1-17 (1987)

M. Koskenniemi, The Fate of Public International Law: Between Technique and Politics, 70 Modern Law Review, pp. 1-30 (2007)

M. Koskenniemi and P. Leino, Fragmentation of International Law? Postmodern Anxieties, 15 Leiden Journal of International Law, pp. 553-579 (2002)

J. Kotz, Phenotypic screening, take two, 5 Science-Business eXchange, pp. 380-380 (2012)

E. Kurlanda, Exploitation of sea resources and the territorial application of the law of the sea, 4 Journal of Politics and Law, pp. 51-62 (2011)

L. E. Lallier and F. Maes, Environmental impact assessment procedure for deep seabed mining in the area: Independent expert review and public participation, 70 Marine Policy, pp. 212-219 (2016)

A. Lang, The Role of the International Court of Justice in a Context of Fragmentation, 62 International & Comparative Law Quarterly, pp. 777-812 (2013)

A. Lang, Twenty years of the WTO Appellate Body's "fragmentation jurisprudence", 14 Journal of International Trade Law and Policy, pp. 116-125 (2015)

B. Larschan and B. Brennan, The Common Heritage of Mankind Principle in International Law, 21 The Columbia Journal of Transnational Law, pp. 305-337 (1983)

C. Lauritano, J. H. Andersen, E. Hansen, M. Albrigtsen, L. Escalera, F. Esposito, K. Helland, K. O. Hanssen, G. Romano and A. Ianora, Bioactivity Screening of Microalgae for Antioxidant, Anti-Inflammatory, Anticancer, Anti-Diabetes, and Antibacterial Activities.(Report)(Author abstract), 3 Frontiers in Marine Science, pp. 1-12 (2016)

M. Leal, C. Madeira, C. Brandão, J. Puga and R. Calado, Bioprospecting of Marine Invertebrates for New Natural Products - A Chemical and Zoogeographical Perspective, 17 Molecules, pp. 9842-9854 (2012)

M. C. Leal, C. Madeira, C. A. Brandão, J. Puga and R. Calado, Bioprospecting of marine invertebrates for new natural products - a chemical and zoogeographical perspective, 17 Molecules (Basel, Switzerland), pp. 9842 (2012)

D. Leary, M. Vierros, G. Hamon, S. Arico and C. Monagle, Marine genetic resources: A review of scientific and commercial interest, 33 Marine Policy, pp. 183-194 (2009)

C. Leathley, An institutional hierarchy to combat the fragmentation of international law: has the ILC missed an opportunity?, 40 New York University Journal of International Law and Politics, pp. 259-306 (2007)

U. Lindequist, Marine-Derived Pharmaceuticals - Challenges and Opportunities, 24 Biomolecules & Therapeutics, pp. 561-571 (2016)

U. Linderfalk, On the Meaning of the 'Object and Purpose' Criterion, in the Context of the Vienna Convention on the Law of Treaties, Article 19, 72 Nordic Journal of International Law, pp. 429-448 (2003)

U. Linderfalk, Who Are 'The Parties'? Article 31 3(c), Paragraph 3(c) of the 1969 Vienna Convention and the 'Principle of Systemic Integration' Revisited, 55 Netherlands International Law Review, pp. 343-364 (2008)

M. W. Lodge, The Common Heritage of Mankind, 27 The International Journal of Marine and Coastal Law, pp. 733-742 (2012)

A. V. Lowe, The international seabed: a legacy of mistrust, 5 Marine Policy, pp. 205-216 (1981)

V. Lowe, Was it Worth the Effort?, 27 The International Journal of Marine and Coastal Law, pp. 875-881 (2012)

D. S. Maier. What's So Good About Biodiversity?: A Call for Better Reasoning About Nature's Value. A Call for Better Reasoning About Nature's Value. 19, Dordrecht: Springer Netherlands, Dordrecht, 2012.

R. H. Manley, Developing nation imperatives for a new law of the sea: UNCLOS I and III as stages in the international policy process, 7 Ocean Development & International Law, pp. 9-18 (1979)

G. Marceau, Conflicts of Norms and Conflicts of Jurisdictions The Relationship between the WTO Agreement and MEAs and other Treaties, 35 Journal of World Trade, pp. 1081-1131 (2001)

G. Marceau, Evolutive Interpretation by the WTO Adjudicator, 21 Journal of International Economic Law, pp. 791-813 (2018)

K. J. Marciniak, New Implementing Agreement under UNCLOS: A Threat or an Opportunity for Fisheries Governance?, 84 Marine Policy, pp. 320-326 (2017)

S. Marr, The Southern Bluefin Tuna cases: the precautionary approach and conservation and management of fish resources, 11 European Journal of International Law, pp. 815-831 (2000)

E. Marris, Marine Natural Products: Drugs from the Deep, 443 Nature, pp. 904 (2006)

A. Martins, H. Vieira, H. Gaspar and S. Santos, Marketed Marine Natural Products in the Pharmaceutical and Cosmeceutical Industries: Tips for Success, 12 Marine Drugs, pp. 1066-1101 (2014)

B. McGrady, Fragmentation of International Law or "Systemic Integration" of Treaty Regimes: EC-Biotech Products and the Proper Interpretation of Article 31(3)(c) of the Vienna Convention on the Law of Treaties, 42 Journal of World Trade, pp. 589-618 (2008)

C. McLachlan, The Principle Of Systemic Integration And Article 31(3)(C) Of The Vienna Convention, 54 International and Comparative Law Quarterly, pp. 279-320 (2005)

G. Messenger, The Development of International Law and the Role of Causal Language, 36 Oxford Journal of Legal Studies, pp. 110-134 (2016)

R. Michaels and J. Pauwelyn, Conflict of norms or conflict of laws? Different techniques in the fragmentation of public international law, 22 Duke Journal of Comparative & International Law, pp. 349 (2012)

E. Molenaar, Managing Biodiversity in Areas Beyond National Jurisdiction, 22 The International Journal of Marine and Coastal Law, pp. 89-124 (2007)

T. F. Molinski, D. S. Dalisay, S. L. Lievens and J. P. Saludes, Drug development from marine natural products, 8 Nature Reviews Drug Discovery, pp. 69 (2008)

M. Monga and E. A. Sausville, Developmental Therapeutics Program at the NCI: molecular target and drug discovery process, 16 Leukemia, pp. 520 (2002)

N. Y. Morris-Sharma, Marine Genetic Resources in Areas beyond National Jurisdiction: Issues with, in and outside of UNCLOS, 20 Max Planck Yearbook of United Nations Law Online, pp. 71-97 (2017)

J. Mossop, Protecting Marine Biodiversity on the Continental Shelf Beyond 200 Nautical Miles, 38 Ocean Development & International Law, pp. 283-304 (2007)

J. Mus, Conflicts between Treaties in International Law, 45 Netherlands International Law Review, pp. 208-232 (1998)

A. T. Mushita and C. B. Thompson, Patenting Biodiversity? Rejecting WTO/TRIPS in Southern Africa, 2 Global Environmental Politics, pp. 65-82 (2002)

W. E. G. Müller, R. Batel, H. C. Schrder and I. M. Mller, Traditional and Modern Biomedical Prospecting, 1 Evidence-based Complementary and Alternative Medicine, pp. 71-82 (2004)

D. Nagle and Y.-D. Zhou, Marine Natural Products as Inhibitors of Hypoxic Signaling in Tumors, 8 Phytochemistry Reviews, pp. 415-429 (2009)

J. E. Noyes, The common heritage of mankind: past, present, and future, 40 Denver Journal of International Law and Policy, pp. 447 (2011)

S. Oda, Some reflections on recent developments in the Law of the Sea, 27 The Yale Journal of International Law, pp. 217-221 (2002)

K. Oellers-Frahm, Multiplication of International Courts and Tribunals and Conflicting Jurisdiction - Problems and Possible Solutions, 5 Max Planck Yearbook of United Nations Law, pp. 67-104 (2001)

J.-Y. Ortholand and A. Ganesan, Natural Products and Combinatorial Chemistry: Back to the Future, 8 Current Opinion in Chemical Biology, pp. 271-280 (2004)

A. Oude Elferink, The Regime of the Area: Delineating the Scope of Application of the Common Heritage Principle and Freedom of the High Seas, 22 The International Journal of Marine and Coastal Law, pp. 143-176 (2007)

B. Oxman, The third United Nations Conference on the Law of the Sea: the 1976 New York sessions, 71 American Journal of International Law, pp. 247-269 (1977)

A. Pardo, Before and after. (Symposium: The Law of the Sea - Where Now?), 46 Law and Contemporary Problems, pp. 95-105 (1983)

S. Park, Biodiversity prospecting: Pharmaceutical investment in Costa Rica, 17 Harvard International Review, pp. 52 (1995)

J. Pauwelyn, Bridging fragmentation and unity: international law as a universe of inter-connected islands, 25 Michigan Journal of International Law, pp. 903-916 (2004)

R. Pavoni, Mutual Supportiveness as a Principle of Interpretation and Law-Making: A Watershed for the 'WTO-and-Competing-Regimes' Debate?, 21 European Journal of International Law, pp. 649-679 (2010)

R. J. Payne, Mining the Deep Seabed: The Political, Economic and Legal Struggle, 40 The Journal of Politics, pp. 933-955 (1978)

B. Pejin, M. Mojovic and A. G. Savic, Novel and highly potent antitumour natural products from cnidarians of marine origin, 28 Natural Product Research, pp. 1-8 (2014)

A. Peters, The refinement of international law: From fragmentation to regime interaction and politicization, 15 International Journal of Constitutional Law, pp. 671-704 (2017)

H. Pringle, The Brine Revolution, Hakai Magazine of Coastal Science and Societies, pp. 1-10 (2015)

A. Proelss, The Law on the Exclusive Economic Zone in Perspective: Legal Status and Resolution of User Conflicts Revisited, 26 Ocean Yearbook Online, pp. 87-112 (2012)

P. Proksch, R. Ebel, E. RA., V. Wray and K. Steube, Bioactive Natural Products from Marine Invertebrates and Associated Fungi, 37 Progress in Molecular and Subcellular Biology, pp. 117-142. (2003)

P. Proksch, R. Edrada-Ebel and R. Ebel, Drugs from the Sea - Opportunities and Obstacles, 1 Marine Drugs, pp. 5-17 (2003)

D. Purdue, Hegemonic trips: World trade, intellectual property and biodiversity, 4 Environmental Politics, pp. 88-107 (1995)

M. Rabone, H. Harden-Davies, J. E. Collins, S. Zajderman, W. Appeltans, G. Droege, A. Brandt, L. Pardo-Lopez, T. G. Dahlgren, A. G. Glover and T. Horton, Access to Marine Genetic Resources (MGR): Raising Awareness of Best-Practice Through a New Agreement for Biodiversity Beyond National Jurisdiction (BBNJ), 6 Frontiers In Marine Science, 2019, Vol. 6, pp. 520-542 (2019)

E. Ramirez-Llodra, A. Brandt, R. Danovaro, B. De Mol, E. Escobar, C. German, L. Levin, P. Arbizu, L. Menot, P. Buhl-Mortensen, B. Narayanaswamy, C. Smith, D. Tittensor, P. Tyler, A. Vanreusel and M. Vecchione, Deep, diverse and definitely different: unique attributes of the world's largest ecosystem, 7 Biogeosciences, pp. 2851 (2010)

M. Reed, The contributions of UNESCO Man and Biosphere Programme and biosphere reserves to the practice of sustainability science, 14 Sustainability Science, pp. 809-821 (2019)

J. A. Roach, Today's Customary International Law of the Sea, 45 Ocean development and international law, pp. 239-259 (2014)

C. Romano, The Southern Bluefin Tuna Dispute: Hints of a World to Come . . . Like It or Not, 32 Ocean development and international law, pp. 313-348 (2001)

G. K. Rosendal, Impacts of Overlapping International Regimes: The Case of Biodiversity, 7 Global Governance, pp. 95-117 (2001)

K. Rosendal, A. I. Myhr and M. W. Tvedt, Access and Benefit Sharing Legislation for Marine Bioprospecting: Lessons From Australia for the Role of Marbank in Norway, 19 Journal of World Intellectual Property, pp. 86-98 (2016)

D. Russo, Addressing the relation between treaties by means of 'saving clauses.', 85 British Yearbook of International Law, pp. 133-170 (2015)

C. Salpin and V. Germani, Patenting of Research Results Related to Genetic Resources from Areas beyond National Jurisdiction: The Crossroads of the Law of the Sea and Intellectual Property Law, 16 Review of European Community and International Environmental Law, pp. 12-23 (2007)

L. Sarma, Biopiracy: Twentieth Century imperialism in the form of international agreements, 13 Temple International and Comparative Law Journal, pp. 107-136 (1999)

C. Schiraldi and M. De Rosa, The production of biocatalysts and biomolecules from extremophiles, 20 Trends in Biotechnology, pp. 515-521 (2002)

D. Schuster, C. Laggner and T. Langer, Why drugs fail--a study on side effects in new chemical entities, 11 Current Pharmaceutical Design, pp. 3545-3559 (2005)

K. N. Scott, Conservation on the High Seas: Developing the Concept of the High Seas Marine Protected Areas, 27 The International Journal of Marine and Coastal Law, pp. 849-857 (2012)

T. Scovazzi, Mining, Protection of the Environment, Scientific Research and Bioprospecting: Some Considerations on the Role of the International Sea-Bed Authority, 19 The International Journal of Marine and Coastal Law, pp. 383-410 (2004)

T. Scovazzi, The negotiations for a binding instrument on the conservation and sustainable use of marine biological diversity beyond national jurisdiction, 70 Marine Policy, pp. 188-191 (2016)

S. K. Sell and A. Prakash, Using Ideas Strategically: The Contest Between Business and NGO Networks in Intellectual Property Rights, 48 International Studies Quarterly, pp. 143-175 (2004)

S. J. Shackelford, The tragedy of the common heritage of mankind, 28 Stanford Environmental Law Journal, pp. 109-169 (2009)

J. S. Sherkow, The Natural Complexity of Patent Eligibility, 99 Iowa Law Review, pp. 1137-2299 (2014)

J. S. Sherkow and H. T. Greely, The History of Patenting Genetic Material, 49 Annual Review of Genetics, pp. 161-182 (2015)

B. Simma, Fragmentation in a Positive Light, 25 Michigan Journal of International Law, pp. 845-847 (2004)

B. Simma and D. Pulkowski, Of Planets and the Universe: Self-contained Regimes in International Law, 17 European Journal of International Law, pp. 483-529 (2006)

C. P. Smith, Patenting life: the potential and the pitfalls of using the WTO to globalize intellectual property rights, 26 North Carolina Journal of International Law and Commercial Regulation, pp. 143-181 (2000)

P. V. R. Snelgrove, An ocean of discovery: biodiversity beyond the Census of Marine Life, Planta Med., pp. 790-799 (2016)

S. Spelliscy, The proliferation of international tribunals: a chink in the armor, 40 Columbia journal of transnational law, pp. 143-176 (2001)

A. Subramanian, Genetic Resources, Biodiversity and Environmental Protection - An Analysis, and Proposals Towards a Solution, 26 Journal of World Trade, pp. 105-109 (1992)

H. Suleria, S. Osborne, P. Masci and G. Gobe, Marine-Based Nutraceuticals: An Innovative Trend in the Food and Supplement Industries, 13 Marine Drugs, pp. 6336-6351 (2015)

J. Sutherland, TRIPS, Cultural Politics and Law Reform, 16 Prometheus, pp. 291-303 (1998)

Y. Tanaka, Zonal and Integrated Management Approaches to Ocean Governance: Reflections on a Dual Approach in International Law of the Sea, 19 The International Journal of Marine and Coastal Law, pp. 483-514 (2004)

K. Tanner, C. Vilanova and M. Porcar, Bioprospecting challenges in unusual environments, 10 Microbial Biotechnology, pp. 671-673 (2017)

C. B. Thompson, International Law of the Sea/Seed: Public Domain versus Private Commodity, 44 Natural Resources Journal, pp. 841-1239 (2004)

C. C. Thornburg, J. R. Britt, J. R. Evans, R. K. Akee, J. A. Whitt, S. K. Trinh, M. J. Harris, J. R. Thompson, T. L. Ewing, S. M. Shipley, P. G. Grothaus, D. J. Newman, J. P. Schneider, T. Grkovic and B. R. O'Keefe, NCI Program for Natural Product Discovery: A Publicly-Accessible Library of Natural Product

Fractions for High-Throughput Screening, 13 ACS Chemical Biology, pp. 2484-2497 (2018)

H. Thornton, Hugo Grotius and the Freedom of the Seas, 16 International Journal of Maritime History, pp. 17-38 (2004)

J. Toye, Assessing the G77: 50 years after UNCTAD and 40 years after the NIEO, 35 Third World Quarterly, pp. 1759-1774 (2014)

J. P. Trachtman, The domain of WTO dispute resolution.(World Trade Organization), 40 Harvard International Law Journal, pp. 377 (1999)

J. P. Trachtman, Fragmentation, Coherence and Synergy in International Law, 2 Transnational legal theory, pp. 505-536 (2011)

A. Tsoupras, E. O'Keeffe, R. Lordan, S. Redfern and I. Zabetakis, Bioprospecting for Antithrombotic Polar Lipids from Salmon, Herring, and Boarfish By-Products, 8 Foods, pp. 1-15 (2019)

D. Tyfield, Enabling TRIPs: The pharma–biotech–university patent coalition, 15 Review of International Political Economy, pp. 535-566 (2008)

M. W. Tvedt, Patent law and bioprospecting in Antarctica, 47 Polar Record, pp. 46-55 (2011)

R. Uruena, Indicators as the working language for interaction among regimes, 106 Proceedings of the Annual Meeting-American Society of International Law, pp. 251-253 (2012)

I. Van Damme, Treaty Interpretation by the WTO Appellate Body, 21 European Journal of International Law, pp. 605-648 (2010)

G. K. Venbrux, When Two Worlds Collide: Ownership of Genetic Resources unde rthe Convention on Biological Diversity and the Agreement on Trade-Related Aspects of Intellectual Property Rights, 6 Pittsburgh Journal of Technology Law and Policy, pp. 1-34 (2006)

G. Verhoosel, Prospecting for Marine and Coastal Biodiversity: International Law in Deep Water?, 13 The International Journal of Marine and Coastal Law, pp. 91-104 (1998)

D. P. Verma. "Review of Article 27.3(B) Under TRIPs Agreement: A Critical Analysis." In, edited by., 2010. Reprint.

N. Vermeulen, From Darwin to the Census of Marine Life: Marine Biology as Big Science, 8 Plos One, pp. 1-8 (2013)

M. B. Vieira, Mare Liberum vs. Mare Clausum: Grotius, Freitas, and Selden's Debate on Dominion over the Seas, 64 Journal of the History of Ideas, pp. 361-377 (2003)

B. E. W. Vierdag, The time of the 'conclusion' of a multilateral treaty: Article 30 of the Vienna Convention on the Law of Treaties and related provisions, 59 British Yearbook of International Law, pp. 75-111 (1988)

M. Virally, Review Essay: Good Faith in Public International Law, 77 The American Journal of International Law, pp. 130-134 (1983)

A. von der Ropp and T. Taubman, Bioethics and Patent Law: The Case of Myriad, WIPO Magazine, pp. 8-9 (2006)

E. Voultsiadou, Therapeutic properties and uses of marine invertebrates in the ancient Greek world and early Byzantium, 130 Journal of Ethnopharmacology, pp. 237-247 (2010)

E. Vranes, The Definition of 'Norm Conflict' in International Law and Legal Theory, 17 European Journal of International Law, pp. 395-418 (2006)

J. A. Vucetich, J. T. Bruskotter and M. P. Nelson, Evaluating whether nature's intrinsic value is an axiom of or anathema to conservation, 29 Conservation Biology, pp. 321-332 (2015)

H.-J. Wagener, Free Seas, Free Trade, Free People: Early Dutch Institutionalism, 26 History of Political Economy, pp. 395-418 (2007)

A. Weindl, Grotius's Mare Liberum in the Political Practice of Early-Modern Europe, 30 Grotiana, pp. 131-151 (2009)

E. B. Weiss, International environmental law: contemporary issues and the emergence of a new world order. (Symposium: International Law for a New World Order), 81 Georgetown Law Journal, pp. 710 (1993)

E. O. Wilson, F. M. Peter and B. National Forum on. Biodiversity. Washington, D.C.: Washington, D.C. : National Academy Press, 1988.

R. Wolfrum and N. Matz, The Interplay of the United Nations Convention on the Law of the Sea and the Convention on Biological Diversity, 4 Max Planck Yearbook of United Nations Law, pp. 445-480 (2000)

C. H. Wong, K. W. Siah and A. W. Lo, Estimation of clinical trial success rates and related parameters, 20 Biostatistics, pp. 273 (2019)

K. S. Woong, How did they become law? A jurisprudential inquiry about the outcome principles of historic United Nations environmental conferences, 45 Georgia Journal of International and Comparative Law, pp. 53-97 (2016)

K. J. Wu. "Coronavirus Vaccine Makers Are Not Mass-Slaughtering Sharks." In New York Times, edited by., 2020.

M. Zebich-Knos, Preserving Biodiversity in Costa Rica: The Case of the Merck-INBio Agreement, 6 The Journal of Environment & Development, pp. 180-186 (1997)

K. E. Zewers, Bright Future for Marine Genetic Resources, Bleak Future for Settlement of Ownership Rights: Reflections on the United Nations Law of the Sea Consultative Process on Marine Genetic Resources, 5 Loyola University Chicago International Law Review, pp. 151-176 (2008)

K. S. Woong, How did they become law? A jurisprudential inquiry about the outcome principles of historic United Nations environmental conferences, 45 Georgia Journal of International and Comparative Law, pp. 53-97 (2016)

Reports

"International Union for Conservation of Nature and Natural Resources, United Nations Environment Programme, World Wildlife Fund, Food and Agriculture Organization of the United Nations and Unesco, World Conservation Strategy: Living resource conservation for sustainable development." In, edited by., 1980.

"Marine and Coastal Biodiversity: Review, further elaboration and refinement of the programme of work." In, edited by.: The Convention on Biological Diversity Subsidiary Body on Scientific, Technical and Technological Advice, 2003.

"United Nations Informal Consultative Process on Oceans and the Law of the Sea - An Update on Marine Genetic Resources: Scientific Research, Commercial Uses and a Database on Marine Bioprospecting." In, edited by., 2007.

"WIPO Intergovernmental Committee on Intellectual Property and Genetic Resources, Traditional Knowledge and Folklore - Genetic Resource Disclosure Requirements Table." In, edited by., 2017.

European Commission. "Communication from the Commission on Blue Growth – Opportunities for marine and maritime sustainable growth." In, edited by., 2012.

M. Koskenniemi. "Fragmentation of International Law: Difficulties Arising from the Diversification and Expansion of International Law - Draft conclusions of the work of the Study Group Finalized by Martti Koskenniemi." In, edited by. Geneva: International Law Commission, 2006.

M. Koskenniemi. "Fragmentation of International Law: Difficulties Arising from the Diversification and Expansion of International Law - Report of the Study Group of the International Law Commission." In, edited by. Geneva: International Law Commission, 2006.

R. E. Lighthizer. "Report on the Appellate Body of the World Trade Organization." Office of the United States Trade Representative, 2020.

D. Newmann. "Report of the workshop on bioprospecting in the high seas." Rome: FAO, 2005.

OECD. "Frascati Manual - Proposed Standard Practice for Surveys on Research and Experimental Development." 2002.

OECD. "Genetic Inventions, Intellectual Property Rights and Licensing Practices: Evidence and Policies." 2002.

P. Oldham. "Valuing the Deep: Marine Genetic Resources in Areas Beyond National Jurisdiction." 2014.

World Trade Organization. "The Relationship Between the Trips Agreement and the Convention On Biological Diversity." In, edited by., 2002.

World Trade Organization. "The relationship between the TRIPS Agreement and the Convention on Biological Diversity." In, edited by.: World Trade Organization, 2002.