



Det här verket har digitaliserats vid Göteborgs universitetsbibliotek och är fritt att använda. Alla tryckta texter är OCR-tolkade till maskinläsbar text. Det betyder att du kan söka och kopiera texten från dokumentet. Vissa äldre dokument med dåligt tryck kan vara svåra att OCR-tolka korrekt vilket medför att den OCR-tolkade texten kan innehålla fel och därför bör man visuellt jämföra med verkets bilder för att avgöra vad som är riktigt.

This work has been digitized at Gothenburg University Library and is free to use. All printed texts have been OCR-processed and converted to machine readable text. This means that you can search and copy text from the document. Some early printed books are hard to OCR-process correctly and the text may contain errors, so one should always visually compare it with the images to determine what is correct.





FISKERIVERKET

NATIONAL BOARD OF FISHERIES, SWEDEN

14-05-1996

Salmon in perspective

Salmon in the Baltic - proposals for short-term and long-term measures

Postadress

Besöksadress

Telefon

Telex

Telefax

Postgiro

Box 423
401 26 GÖTEBORG

Lilla Bommen 6

031-63 03 00

27 108 NATFISH S

031-15 65 77

1 56 92-7

Table of contents

Summary	3
1. Introduction	6
2. Terms of reference and implementation of the work	6
3. Global analysis and international trends	
3.1 National and international goals for salmon fishery conservation	7
3.2 Fishing with drift-nets	13
3.3 Certification of fishing methods	14
3.4 Fishing tourism	14
4. The goals of the National Board of Fisheries for salmon conservation	16
5. The stock situation and need for measures	19
6. Enhancement releases and genetics	23
7. Measures in 1996	25
8. Measures in 1997	25
8.1 Total allowable catch	25
8.2 Closed summer season in the Baltic Sea	26
8.3 Fishing along the Bothnian Bay	27
8.4 Adipose fin clipping	36
8.5 Experiments with delayed release	36
8.6 Compensation matters	37
8.7 Total effects of the proposed measures	37
9. Measures from 1998 and onwards	43
9.1 "The salmon package" with a central closed area and delayed release ..	43
9.2 Increased mesh size	44
10. Socio-economic issues	45
11. Research and investigation methods	45
12. References	46

"The fact that he who changes acquires as opponents all those who have succeeded well under the old order and only half-hearted supporters in those who may conceivably succeed under the new." (Machiavelli)

Summary

Goals

The opinion of the National Board of Fisheries is that the following goals should apply for salmon conservation in the Baltic Sea:

- a) The **short-term** goal is to eradicate the acute threat to genetic impoverishment or in certain cases actual elimination, which the majority of wild salmon stocks face today.
- b) The **long-term** goal is to utilize the entire natural reproduction potential in every salmon carrying river or part of river. An interim goal set by the Baltic Sea Fisheries Commission is that a level of 50 % of the reproduction capacity in each salmon carrying river should be achieved before the year 2010.
- c) The growth potential in the sea should be made better use of than at present.

The state of stocks

Most of the wild salmon stocks in the Gulf of Bothnia are in a precarious situation. The outbreak of the so-called M74 syndrome in the early nineties has aggravated the position. The syndrome has now caused extensive mortality over a period of five years and shows no signs of abating. The presumption here must therefore be that the level of mortality will continue to be much the same as hitherto. Strict protection measures are therefore required. The EU's so-called Lassen Report recommends on its part a ban on salmon fishery in the Baltic Sea for the year 1997. The advice of ICES (the ACFM report) concerning recommendations for salmon fishery in 1997 is not available until later this year. In the current report the National Board of Fisheries has among other things acted on biological source material similar to what the ICES Baltic salmon working group has had access to.

Measures during 1997

a) Total allowable catch (TAC)

On account of the critical situation for the majority of stocks of naturally reproducing salmon in the Baltic Sea, where the M74 syndrome will as far as can be judged remain for a number of years to come, a substantial reduction in catches of such salmon is of vital importance. In view of this and bearing in mind the predetermined interim goal that a level of 50 % of the natural reproduction capacity in each salmon carrying river should be achieved before the year 2010, and also observing established Finnish regulations and proposed Swedish measures in the Bothnian Bay, the National Board of Fisheries has worked out alternative TAC levels; 206 000, 262 000 and 314 000 salmon respectively, depending on the efficacy of the coastal fishery regulations decided on by Finland and those now proposed by the National Board of Fisheries. With regard to the uncertainty in these calculations, it would seem appropriate to make to choose a TAC for 1997 at the lower end of the stated interval. This assessment assumes that the coastal fishery regulations mentioned are implemented to the full.

The National Board of Fisheries also shows what effects an increased share of catches in the Gulf of Bothnia - within an unchanged total Swedish quota - would have on the exploitation of wild

salmon stocks. Any such change would entail reduced exploitation of wild salmon, at all events with the implementation of the new coastal fishery regulations, i.e. the Finnish ones decided on and the Swedish ones here proposed. Changes in the distribution of quotas between the northern and southern Baltic would also have political allocation consequences, for which reason the Board refrains from submitting a proposal on this matter.

b) Terminal fishing areas and closed areas

In certain areas along the coast of the Bothnian Bay, outside rivers with reared stocks, it is intended to set up so-called *terminal fishing areas*. In these areas, where the proportion of reared salmon is considerably greater, and of wild salmon considerably smaller than average, extensive fishing can be conducted on reared salmon over along season. In the terminal fishing areas substantial catches can be made of reared salmon which, with the reduced TAC level now proposed, will in future return to spawn to a greater extent than at present.

The proposal entails maintaining, or alternatively extending, existing *closed areas* outside rivers with wild stocks with a continued ban on salmon fishery for 1997. The intention is to ease the restrictions as soon as the stock situation allows.

The precise extent and limits of the closed areas and terminal fishing areas will be more closely defined in the autumn of 1996.

c) Closed seasons etc.

The National Board of Fisheries proposes differentiated closed seasons during the early summer for the coastal areas of the Gulf of Bothnia, which in this respect would be divided into three areas. The proposal has taken into consideration the recently approved Finnish regulations. Coastal fishery with a fixed open season, as in the Finnish regulations, has very varying effects in years with early and late spawning migration. For the closed seasons to have the greatest possible effect it is therefore intended to lay down an opening date every year which varies within ± 10 days. This will be based on the close relationship between the winter-spring water temperature in the southern Baltic and the point in time when the salmon spawning migration starts along the coast of northern Sweden. A forecast of the spawning migration period can be made 1-2 months before the fishery starts in the Gulf of Bothnia.

d) The National Board of Fisheries intends to reintroduce a ban on fishing with salmon nets and salmon lines north of 59°30'N in the Baltic Sea, starting from the salmon fishing season in 1996. Such a ban prevailed up to the admission of Sweden to the EU.

e) Adipose fin clipping

The National Board of Fisheries proposes that all reared salmon released in the Baltic Sea area should be fin clipped for a period of preferably 4 years, or alternatively permanently, if the operation turns out well, as an aid to the management of wild and reared salmon. Adipose fin clipping should be formulated as an international project so as best to be able to synchronise the time-limited project and maximise the outcome for future management.

f) Delayed release

The National Board of Fisheries proposes that the trials with delayed release should now be intensified throughout the actual Baltic Sea. Danish trials off Bornholm have shown very favourable results. Sweden should be able to contribute know-how in the implementation of the trials. The Board is of the opinion that funds should be available from the EU for this matter.

Measures from 1998 and onwards

a) Implementation of the "salmon package"

The National Board of Fisheries proposes that the so-called salmon package, with a central closed area in the actual Baltic Sea and fishing for reared salmon in accordance with the delayed release method, be implemented under joint international action. By this means it is possible **both** to preserve naturally reproducing salmon stocks **and** to maintain and in the long run to increase profitable professional fishing for salmon in the Baltic Sea. Moreover, the increased return migration of salmon to the natural salmon rivers will have a considerable effect on employment by facilitating the development of extensive fishing by tourists.

b) Greater mesh size

If the so-called salmon package is not implemented, a considerable increase in the mesh size of salmon nets is proposed (to a magnitude of 225 mm, similar to what has been proposed in Finland).

Research and investigation needs

It is proposed that the following projects be implemented:

- To be able to minimise catches of wild salmon in the proposed terminal fishing areas, it is important that they are demarcated in the best possible manner. For this to be possible all available information should be utilized to the full. This means that tagging data, information on wild salmon migration etc must be compiled before the final formulation of these areas can take place in the autumn of 1996.
- Plans should be drawn up for the implementation of enhancement releases to a greater extent than today if the proposed fishery regulations do not come into force or the measures do not have the desired effect on the size of stocks. The plans should be drawn up in 1996 -1997 and they should be implemented before the year 2000 if the size of stocks does not increase in the way intended. One fundamental objective is that the releases should be temporary.
- It should be investigated whether the establishment of goals for the quantity of spawning fish (escapement) for individual wild salmon stocks is a suitable management instrument. It is partly a question of the theoretical background, but also the practical formulation, e.g. measuring how the goal is achieved and consequences for management dependent on whether the goal is achieved or not.
- One or two Swedish salmon rivers in the Baltic Sea area should be established as so-called index rivers, where the salmon stocks are followed particularly closely over a long period. This means among other things that return migration, parr production and smolt migration are monitored annually over a long succession of years. In these rivers survival during various phases of life can be studied closely.

1. Introduction

The situation for the majority of naturally reproducing salmon stocks in the Baltic Sea is very serious. The M74 syndrome has added to the earlier problems of great fishing intensity and environmental disturbances. Administrative measures in the form of fishery regulations that have been taken to save the salmon up to and including 1991 gave some favourable development. In 1992, however, mortality among salmon fry caused by M74 was alarmingly high and the favourable trend was broken. The syndrome is expected to remain probably for several years to come. Forceful measures are therefore needed, both in the environmental field and as regards fishery regulations. Such measures are described in this report.

2. Terms of reference and implementation of the work

Terms of reference

In the light of the comments of 05-03-1996 and 07-03-1996 respectively (reg.no. 249-451-96) by the National Board of Fisheries on the Proposal by the Ministry of Agriculture and Forestry in Finland, Salmon Working Group 1995 (JSM 1995:18), the Ministry of Agriculture stated in a memorandum of 15-04-1996 that the National Board of Fisheries should carry out the supplementary studies proposed by the Board in its reply to the measures submitted to it for consideration, and report on them no later than 13 May 1996. The section concerning socio-economic effects should be presented as soon as possible in the spring of 1996.

In the memorandum the Ministry has indicated that the National Board of Fisheries has the task of giving special priority to efforts to protect naturally reproducing salmon in the Baltic Sea, within the framework of the operational objective of fishing conservation stated in the 1995/96 appropriations instrument. In the supplementary study the Board is to pay heed to the points of view in salmon matters expressed among other things in the Bill withdrawn by the Government, 1994/95:231 General Fishing Conservation Fee, and in the Agricultural Committee's official report Salmon Fishery etc., 1995/96: JoU, 1995/96:150.

The Ministry of Agriculture further states that contacts with Finland at expert level are accommodated in the work. The National Board of Fisheries will also be in touch with the Salmon Research Institute and affected industries/interest groups before a proposal for Swedish regulation of salmon fishery etc. is formulated and submitted to the Ministry of Agriculture. According to the Ministerial memorandum, the Ministry of Agriculture intends to implement discussions with representatives for different interests in salmon fishery in May 1996, after the National Board of Fisheries has presented its proposal for salmon fishery. Formal talks with Finland are then planned to be implemented by the Ministry at civil servant level. The memorandum also states that it should be possible to effect a ministerial meeting between Sweden and Finland during the summer.

Implementation of the work

The work by the National Board of Fisheries with the supplementary study has been carried out in a working group with Head of Department Curt Johansson as Chairman and Principal Administrative Officer Ingemar Olsson as Secretary. Also included in the group are Principal Administrative Officer Lars Ask, National Board of Fisheries in Göteborg, Principal Administrative Officers Östen

Karlström and Adam Gönczi at the Research Offices in Luleå and Härnösand respectively, Regional Fisheries Officer Sören Johansson at the Västerbotten County Administrative Board and Fisheries Biologist Lars Karlsson, Salmon Research Institute, Älvkarleby.

During the course of the work, discussions have been held on relevant matters with the Salmon Research Institute, the Swedish Federation of Fisheries' Unions, the Swedish Association of Angling and Fishery Conservation, the Swedish Association of Fishing Water Owners and representatives of the tourist fishing industry.

On 9 April 1996 the National Board of Fisheries held informal talks on the salmon question with representatives for the Ministry of Agriculture and Forestry in Finland (Director-General P. Wramner and Head of Department C. Johansson; Deputy Director-General S. Havu and Fisheries Commissioner M. Aro).

It will probably not be possible to present the section of the inquiry that concerns socio-economic effects during the current year.

The conclusions presented in this report are those of the National Board of Fisheries.

3. Global analysis and international trends

3.1 National and international goals for salmon conservation and fisheries management

Goals stipulated by the Swedish Government and Parliament

The General Fishing Conservation etc. Bill 1994/95:231

In the 1994/95:231 Bill the Government has made a comprehensive assessment of the salmon question in the Baltic Sea. The Government notes that the situation for naturally reproducing salmon is extremely serious. The disease M74 has been added to earlier problems with too great intensity of fishing and environmental disturbances. The measures taken up to 1991 to save the naturally spawning salmon had led to some positive development, partly as a result of fishing restrictions and a general improvement in the Baltic Sea environment. The syndrome M74 was of course present even earlier in the Baltic Sea area, but it was first in 1992 that excess mortality became alarmingly high all round.

At the UN conference on environment and development in 1992, Sweden signed the Convention on Biodiversity. Sweden thereby undertook to preserve biodiversity. Prerequisites for the survival of the salmon as a species, including its genetic variation, must therefore be guaranteed. This means among other things that the natural migration up the unexploited rivers must be allowed to continue and that the genetic variation of individual stocks is given conditions in which it can be preserved. Rearing and releasing must be effected in such a way that the natural stocks are not threatened. Contacts with the Finnish government have revealed that it makes somewhat different assessments than Sweden of the concept of biodiversity. The Finnish opinion is that variation within a species can be maintained by genetically correct rearing. These differing approaches have both theoretical and

practical consequences. The Swedish view is that the salmon stocks should manage without further intervention from man than improved opportunities for natural reproduction. In Swedish compensatory rearing, the salmon follow as far as possible the same life cycle as naturally reproduced salmon. The Finnish rearing technique, on the other hand, entails keeping even brood salmon in basins, where they are not subjected to natural selection to the same extent.

From the Swedish angle it is of particular concern that Finnish compensatory rearing that most influences Swedish salmon fishery does not risk harming naturally reproducing salmon. The river Torne älv, which is administered by the Finnish-Swedish border river commission, is of mutual interest to Sweden and Finland. The Torne älv is one of the most important rivers in the Baltic with naturally reproducing salmon. Swedish sources have repeatedly called attention to the danger to the river's salmon stocks which the large Finnish releases entail for the naturally reproducing salmon.

In the prevailing crisis for naturally reproducing salmon, the National Board of Fisheries has begun to build up a gene bank with material from salmon stocks from the unexploited rivers. The breeding material may be used to strengthen the naturally reproducing stocks in an emergency situation.

The control of salmon fishery differs radically, from the fisheries policy point of view, from more or less all other control, since the stocks that are caught comprise more than 90% reared fish. The goal of preserving the naturally reproducing salmon stocks thus relates to only a small part of the entire salmon stock of the Baltic Sea, while the salmon that forms the basis of salmon fishery originates almost entirely from reared stocks.

The control of salmon fishery in the Baltic Sea also touches on a number of aspects of fisheries policy other than the preservation of biodiversity. There is the question of the distribution of fishing between northern and southern Sweden, between professional fishing, mainly conducted with drifting nets and hook lines in the southern Baltic, professional and semi-professional fishing with traps along the coast and angling, not least in the form of tourist fishing.

In the opinion of the Government, a reduction in catches of mixed stocks, primarily in the southern Baltic, is required to save the naturally reproducing salmon, together with a ban on fishing of the pure wild salmon stocks and intensive fishing of reared salmon, partly to prevent it spreading to rivers that have naturally reproducing salmon stocks.

To reduce fishing of mixed stocks, international agreements are, according to the Government, required which involve substantially reduced fishing of these stocks by the fishermen of all the Baltic Sea states. That is why Sweden has pursued the matter for several years, first with the aim of establishing a total salmon quota for the Baltic Sea and later to reduce it substantially. Finland shares the Swedish viewpoint, but considers that the reduction must occur gradually.

One alternative to substantial reductions in offshore fishery is to cut down releases of salmon considerably. To be effective this measure must entail reductions in both Swedish and Finnish releases. However, Finland does not consider that she can change the direction of rearing operations in such a way as to enable a rapid reduction.

Apart from the acute measures stated, more long-term efforts are required according to the Government, for example in salmon research.

The official report of the Standing Committee on Agriculture 1995/96: JoU4 Salmon fishery etc.

In the report a number of motions from the 1995 submission of motions were dealt with, concerning a general fishing conservation fee and measures to protect naturally reproducing salmon in the Baltic Sea.

The Committee shares the view put forward in several motions that forceful measures are required to save the remaining salmon stocks. A reduction in catches of mixed stocks, primarily in the Baltic Sea, is required to save the naturally reproducing salmon, together with a ban on fishing of pure wild salmon stocks and intensive fishing of reared salmon, partly to prevent them spreading to rivers that have naturally reproducing salmon stocks. An alternative to substantial cutbacks in offshore fishery is to reduce releases of salmon considerably. It is further stated that the Committee concurs with the opinion presented by the Government in the 1994/95:231 Bill.

Goals set by Finland

At the end of 1995 a report was presented, *Proposals by the Ministry of Agriculture and Forestry in Finland, Salmon working group 1995 (JSM 1995:18)*. In the report are shown proposals for solutions to how the naturally spawning salmon stocks in Finland, i.e. in the rivers Torne and Simo älv, can be made secure and strengthened. The goal of the proposed measures is primarily to save the two remaining salmon stocks in Finland.

Releases of salmon

The goal of the working group is to get the naturally reproducing salmon to increase its production of fry in the rivers Torne and Simo älv from the present level to about half of the production potential of the rivers. The goal entails raising within a couple of years the total smolt production (natural smolt plus released smolt) of the rivers to the stipulated level, with the aid of both enhancement releases, carried out with the help of these rivers' own reared salmon stocks, and fishing restrictions. In the light of the state of the natural salmon stocks, which continues to deteriorate, there is in this respect, according to the salmon working group, no time to lose and enhancement releases should therefore be made.

Restrictions on fishing

Reducing fishing capacity and allocating a fishery so that it does not disturb spawning migration presupposes the introduction of fishing restrictions. A sufficient restriction of fishing in the areas where the natural salmon's feeding migration occurs must however also be brought about. **The working group considers that Finland should not promote salmon fishery opportunities in the areas where the salmon undertakes its feeding migration. On the contrary, Finland should within the framework of the Baltic Sea Fishery Commission (IBSFC) be decidedly more forceful than hitherto in bringing about a reduction of the form of fishing mentioned, also on the part of the other Baltic Sea countries.** In addition the working group considers that, in the light of the change in age structure, towards younger and male dominated individuals, of returning salmon in spawning migration, the mesh size of fixed and drifting nets should be increased so much that the salmon is not normally caught before reaching an age of two years.

Protection of the salmon's spawn migration in sea areas

The salmon fishery that takes place in Finland's own sea areas is mainly fishing in June-July for spawning migrating salmon. It is the large female natural salmon that first start spawning migration. Therefore the restrictions on fishing during this migration should be concentrated to the beginning

of the migration period and then further extended in time. Spawning migration should be made secure the whole way from the northern Baltic Sea to the rivers with natural salmon reproduction. This means that the restrictions on fishing should follow spawning migration with differentiated effect area for area. The working group considers that the protection of spawning migration with closed seasons in the spring should be timed in the same way for both coastal fishery and offshore fishery.

In conclusion, the working group proposes that the present closed seasons for salmon fishery be extended so much that a sufficient number of natural salmon succeed in reaching their original rivers. As regards the rivers Torne and Simo älv the working group proposes even longer closed seasons for the next two years (1996 and 1997) in order to secure the return of the natural salmon. The working group considers that the date for the actual closed seasons should in practice be set so that they are the same from year to year. The timing of salmon migration can vary greatly on a yearly basis, but setting a particular time each year for the beginning of spawning migration and then on that basis effecting the technical drafting and presentation of changes in regulations would lead to an unwieldy system without improving the final result.

To create protection during the salmon's spawning migration, the working group proposed four differentiated spring closed seasons for the northern Baltic and the Gulf of Bothnia. On 8 March 1996 a regulation was issued on the basis of the proposal for restrictions on salmon fishery in Finland's territorial waters and fishing zone in the Main Basin and the Gulf of Bothnia, and also in Simojoki. It covers provisions for offshore fishery, fishing in river mouths and in rivers. A more detailed presentation of the contents of the regulation is given in section 8 below.

The working group also considers that the current summer closed period (for 1996 from 1 June to 15 September), which is based on IBSFC's recommendations, is for offshore fishery (net) in sub-areas 29N, 30 and 31 not the correct one for the protection of spawning migration, for reasons stated earlier. From the point of view of protection a summer closed period is not considered necessary from the beginning of July. The working group considers that Finland should aim for an earlier final date for the summer closed period, at the negotiations on international restrictions on salmon fishery in the Baltic Sea in 1997.

Finally the working group emphasizes that the purpose of the proposed restrictions on fishing is to save the natural salmon stocks. Because of the weak state of the natural salmon stocks the restrictions are from the point of view of fishing very severe. When it has been concluded that the recovery measures have produced results and the natural salmon stocks have been strengthened in accordance with the objectives, the restrictions on fishing can however be slackened and the salmon stocks exploited in a manner that complies with the principles of responsible and sustainable use.

Socio-economic measures

The working group considers that the measures as above in the form of releases and restrictions on fishing have every chance of contributing in a favourable way to the work of saving and strengthening the naturally spawning salmon stocks. In a longer time perspective - at least 10 years - these stocks will have been strengthened to such a degree that support releases can cease and the rational and responsible exploitation of salmon stocks can be stabilized.

A reduction of salmon fishery capacity from its present level to a level where professional fishing is still profitable would, according to the working group, have considerable socio-economic effects among those fishermen that fish professionally for salmon. Adaptation would to a crucial degree be

obstructed by the fact that other fish species of importance to professional fishing are not profitable, either due to poor stocks (sea trout and whitefish) or for market reasons (Baltic herring).

The working group considers it important that these socio-economic effects are investigated as quickly as possible and that solutions should at the same time be presented as to how salmon fishery capacity may be reduced.

Goals set by the International Baltic Sea Fishery Commission (IBSFC)

Delayed release

At the meeting in September 1993 of the International Baltic Sea Fishery Commission a working group was appointed on Swedish initiative to study biological, economic and legal aspects of so-called delayed release with the aim of assessing the value of the administrative method. The working group decided at a meeting in February 1994 to make the following recommendations to the Fishery Commission to be discussed at their 20th session in 1994:

- I. The Commission Secretariat should urge all parties to submit all relevant information on economic aspects (tables and other information) and on fishing techniques for salmon fishery in the Baltic Sea.
- II. All parties should carry out experiments - from 1995 and onwards - in delayed release of salmon smolt in order to gather information on biological, geographical, technical, legal, socio-economic and practical implications of this technique in each economic zone.
- III. The Commission should consult the International Council for Exploration of the Sea (ICES) for advice on whether the concept of delayed release forms a basis for future decisions.
- IV. The Commission should request of HELCOM that in illustration of the wild Baltic Sea salmon's precarious situation and the difficulties of preventing its extinction by measures in the area of fishing alone, the environmental conditions for the emergence of M74 should be investigated. The Commission should be informed as soon as possible.

The recommendations of the working group were adopted at the meeting in September 1994 with the Baltic Sea Fishery Commission.

Strategies for the preservation and exploitation of the salmon

It was decided on Swedish initiative at the meeting in September 1994 with IBSFC that a working group meeting should be held in Sweden in June 1995 to discuss and formulate various strategies and goals for the management and exploitation of both naturally reproduced and reared salmon, with regard paid to biological, economic and social factors, and to the distribution of costs for the production of smolt. The meeting was intended to assemble both scientists and administrators. At a meeting in Älvkarleby in June 1995 the working group reached the following recommendations to be presented to the Baltic Sea Fishery Commission at its 21st session:

a) Management objectives:

- I. Further decrease of naturally produced smolts should not be allowed in order to prevent the extinction of the wild stocks.
- II. The production of wild salmon should gradually increase to attain at least 50% of the natural production capacity of every individual river before the year 2010, this in order to achieve a better balance between wild and reared salmon.
- III. The level of fishing should be maintained as high as possible. Only restrictions necessary to achieve the first two objectives should be carried out.

b) Management strategies

- I. to reduce the TAC for salmon for the Baltic.
- II. to introduce a ban on salmon offshore fishery from 1 May to 31 July north of latitude 59°30' N.
- III. to appeal to the governments of all contracting parties to apply time and area closure measures as decided by national authorities, in order to protect wild salmon stocks.
- IV. having the opinion that the level of wild salmon smolt production is too low today as compared to the level of reared smolt production, ICES is requested to give advice on the appropriateness of having a fixed ratio of wild versus reared salmon and monitor global production of reared salmon accordingly. The advice shall only cover the Main Basin and the Gulf of Bothnia.
- V. to request ICES to examine the possible effects of increased mesh sizes on the Baltic salmon stocks.

The proposed strategies were adopted at the meeting in September 1995 with the Fishery Commission.

Objectives recommended by the International Council for Exploration of the Sea (ICES) and the EU.

In 1995 ICES recommended that, as regards the Baltic Sea salmon catch for 1996, offshore and coastal fishery in the Baltic should be closed that year. If fishing were to be permitted anyway the catch should be as small as possible.

Reared salmon should be caught as near the places of release as possible, where this can occur without catching wild salmon.

ICES has not yet made any recommendation for 1997.

In a report from the EU of 28 March 1996, "Report of the Group of Independent Experts to Advise the European Commission on the Fourth Generation of Multi-annual Guidance Programmes", the situation of commercial stocks of fish in EU fishing waters is assessed. As regards naturally reproducing salmon in the Baltic Sea, it is observed that at present 12 of 44 wild salmon stocks remain in the rivers that flow into these waters. These stocks are considered to lie below a

biologically acceptable population level. The production of wild salmon has been below the optimal level for many years.

3.2 Fishing with drift-nets

At the beginning of the 1990's UN resolutions were adopted with demands for a ban on all large-scale drift-net fishing in the open sea and oceans from 1992. The main purpose was to come to rights with the problem of by-catches of dolphins and other marine mammals, especially in connection with drift-net fishing for tuna fish.

In October 1991 the EU decided to prohibit drift-nets longer than 2.5 km from 1992, in order to reduce mortality among primarily dolphins and other marine mammals in conjunction with fishing for white tuna fish and to preserve fish stocks in the Atlantic and elsewhere. Exceptions were made for the Baltic Sea and temporarily for the north-east Atlantic, provided that it was scientifically shown that the exceptions did not constitute any ecological threat.

During membership negotiations with the EU, Sweden pursued the demand that the Baltic Sea should be exempted from any ban on drift-nets, a position which was approved by all parties in the Swedish Parliament. Both Sweden and Finland received assurances that no prohibition in the Baltic Sea was contemplated. Shortly thereafter the EC Commission presented a proposal for a total ban on drift-nets in all EU waters, thus including the Baltic Sea. The Council will as concluded at the Council meeting in December 1994 take available statements into consideration in assessing whether a total ban on drift-nets is a necessary preservation measure. This occurred in view of the fact that drift-net fishing for salmon in the southern Baltic Sea is of great economic importance, while at the same time incidental catches of birds and marine mammals are here considered negligible.

In the spring of 1995 the EC Commission's scientific committee - Scientific, Technical and Economic Fisheries Committee (STEFEC) - presented reports on drift-net fishing in the exempted areas. The report supported the Swedish demand for exemption of the Baltic Sea and draws among other things the following conclusions:

- Effects on the salmon population are complicated by the M74 syndrome. The present TAC level, disregarding M74, would permit recovery of the stocks. Fishing itself is therefore not threatened.
- Incidental catches of other species of fish comprise mainly sea-trout and rainbow trout. These by-catches do not constitute a threat to these species.
- Mammals are caught only very occasionally in the Baltic Sea. Owing to the design of the net, the sea birds that are caught can most often be freed and released unharmed.
- The socio-economic effects of a reduction in net length to 2.5 km, or alternatively a ban, would be to make profitable the salmon offshore fishery impossible.

The proposal has been discussed within the EU at several meetings of the Council of Ministers without a decision being reached. So far there has not been a qualified majority for the proposal.

Prevailing fishery regulations in the Baltic Sea permit fishing for salmon with drift-nets up to 21 km in length (total length). The binding regulations cover the EU (Denmark, Finland, Sweden and Germany), Estonia, Latvia, Lithuania, Poland and Russia. Current EU regulations in other EU waters permit fishing with drift-nets no greater than 2.5 km in length per ship, with the exception

of the Baltic Sea. The Swedish objective is that a ban on drift-nets should not cover the Baltic Sea and that this sea should also be exempted from the EU's current regulations which prohibit drift-nets longer than 2.5 km.

In the past year new information has been obtained on the state of the porpoise in the Baltic Sea. It concerns both the state of the population, which seems worrying, and to what extent it gets caught in fishing gear (such as drift-nets) and dies. It is however too early yet to draw any certain conclusions from the somewhat contradictory information.

The National Board of Fisheries has recently been given a special assignment from the Government to study the question and shortly submit a report on it.

3.3 Certification of fishing methods

The World Wide Fund for Nature (WWF) and Unilever, which is one of the world's largest companies as regards the purchase and sale of frozen fish, have in February this year (app. 1) announced a "Statement of Intent", from which it appears that a new initiative has been taken to "stop the serious decline in global fish stocks". The initiative implies that market forces will be used to attain the goals that have been set up: "..... to ensure the long-term viability of global fish populations and the health of the marine ecosystem on which they depend". A corresponding project with regard to the exploitation of forests was started earlier (1993) and has been partly implemented, with particularly great impact, as is probably generally known today.

WWF and Unilever have agreed to create an organisation - Marine Stewardship Council (MSC) - to support initiatives in the market which are assumed to lead to sustainable fishing. Broad consultation is intended with all those engaged in fishing and marine environment.

MSC is designed to function as an entirely independent body, which draws up principles for sustainable fishing and establishes specific standards for various fishing methods. Products which come from fish caught in compliance with established standards will be marked with an MSC logo. This product marking is intended to give the consumer the opportunity to choose fish products which come, for example, from an area where fish have been caught with certified gear.

It cannot be ruled out that the intended effect may be of the greatest importance - as for forestry - for such fishing methods as may be considered not to meet the conditions for certification. In this context the reader is referred to the attached article in Dagens Nyheter, from which it appears likely that similar activities may well become reality in our waters (app. 2).

It is stated that the basis of assessment for various types of fishing etc. has been determined by the FAO's Code of Conduct for Responsible Fishing and the UN's Agreement on Straddling Fish Stocks and Highly Migratory Fish Stocks.

3.4 Fishing tourism

Fishing tourism in general

In the inquiry on Swedish Fishing (SOU 1993:103) recreational fishing and fishing tourism in

Sweden are discussed. According to the inquiry, Swedish tourism is characterized by small-scale activities and is based to a considerable degree on extensive small-sized business. This applies not least to the large part of the tourism and recreational fishing sector that is centred around angling. Sweden is a unique and versatile angling country, since angling is possible in fresh, brackish and salt water for several of the western world's most attractive species of fish.

It appears from the SCB study *Recreational Fishing 90* that of the adult population of Sweden 2.2 million people are interested in recreational fishing. 1.4 million of these are anglers, i.e. they only fish with hand gear. A further 0.8 million say they are interested, but have not been fishing in recent years. Interest has been stable at this level since the 1970's.

Angling is one of the cornerstones of the Swedish tourist industry. In 1991 almost 900,000 longer fishing trips were made by Swedes. By longer trips are meant trips that include staying overnight and day trips to resorts further than 100 km from home.

The number of foreign fishing tourists in Sweden is not clear. There is however considered to be a great potential. In Germany, Benelux, the Alps area and Great Britain there is a roughly estimated total of 20 million anglers.

Domestic angling is a billion Kronor industry. Recreational fishermen spend SEK 600-800 million annually on fishing gear, travelling amounts to a magnitude of SEK 400-600 million, food and accommodation to SEK 200-400 million, fishing permits to SEK 180-250 million. Expenses for boats amount to SEK 1.5-2 billion. In addition there is income from tourism received in conjunction with visits from abroad that are wholly or partly directed to fishing.

Angling tends to be more widely spread over the year than perhaps any other type of recreation. The season is thus comparatively long and contributes substantially to evening out the tourist industry season. Angling is therefore an important source of supplementary employment and income in rural areas.

Fishing tourism in Jämtland

The county of Jämtland is rich in lakes and rivers. The water assets represent a total production potential in the order of 3,000 tons per year. The County Administrative Board estimates that fishing tourism in the county represents a value of about SEK 300 million. The effect of angling on employment is assessed at 275-550 full-time jobs. This is not just the tourist industry in a narrow sense but also various forms of trade and service firms that gain advantage of tourism. In a rural area income from tourism can be of decisive importance for being able to run operations on a year-round basis. Fishing supplements winter tourism in Jämtland and broadens the base of the tourist facilities. It is at the same time an important condition for small-scale tourism in the county's rural areas.

Angling as a regional development resource

A study of angling as a regional development resource in Norbotten and Västerbotten has recently been carried out (Weissglas *et al*, 1996). One section of the study is about the effects of angling on employment and the economy. The following assumptions are made:

- The rivers are assumed to produce salmon to the extent allowed by the biological and hydrological potential.
- A catch of 300 tons of salmon constitutes the input value for the calculations.
- Catches are estimated at 1 kilo of salmon per fishing day.

The summarizing comment is quoted:

"The day the salmon returns to our rivers and is primarily exploited as an angling resource, there will be an opportunity to provide about 300,000 fishing days in the counties of Norbotten and Västerbotten. If these fishing days are utilized to the full, an increase in local turnover in the area of about SEK 150 million would be created annually, provided that each angler spends on average SEK 500 a day in the area on fishing permits, supplementary equipment, boat hire, purchases of petrol, food and accommodation, visits to restaurants and other small items. With the inclusion of those accompanying the fishermen and the salmon's power of attraction on other tourists, a further increase in turnover totalling SEK 8 million annually would be created in the area investigated. We also assume that those accompanying the anglers would spend on average SEK 150 a day and that a plentiful supply of salmon in the natural rivers of the area would attract other tourists who in their turn would spend an average of SEK 100 during their visit in the area.

All the money spent would circulate in the local economy, giving salaries and profits to various companies and their employees, income which in turn would be used for the purchase of goods and services. This spin-off effect would contribute to **the total turnover in the area as a result of angling for salmon being estimated at about SEK 198 million annually. It is here assumed that 20 per cent of this sum would go to salaries and thus form the basis of about 180 full-time jobs**".

In a final summarizing comment a point is raised as to whether it is meaningful to create employment problems in one part of the country merely in order to improve the situation in another, i.e. to reduce professional fishing for salmon in the Main Basin so as to increase the supply of salmon in the rivers of northern Sweden. As is shown below, the "salmon package" of the National Board of Fisheries would mean **both** preserving the naturally reproducing salmon population **and** maintaining and in the long run probably increasing profitable professional salmon fishery in the Baltic Sea. Furthermore, the increased return migration of salmon to the natural salmon rivers would have considerable employment effects by facilitating the development of extensive tourist fishing.

4. The goals of the National Board of Fisheries for salmon fishery conservation

The National Board of Fisheries has ever since the beginning of the 1980's persistently pursued the question of extended protection for salmon in the Baltic Sea. It may be mentioned here that as a result of the work, the Swedish delegation at the meeting of the Fishery Commission as early as September 1982 presented certain principles for the preservation and conservation of the salmon population in the Baltic Sea. One leading principle was that the status of the naturally reproducing salmon stocks would be normative for salmon fishery conservation and fishing for salmon. In addition total catches would be biologically correct. No party had objections to the description of the problems and their causes or to the principles presented.

In March 1994 the Government instructed the National Board of Fisheries to evaluate the measures taken to protect the naturally reproducing salmon in the Baltic Sea and to submit proposals for an action plan for continued work. In the opinion of the National Board of Fisheries the goal for salmon fishery conservation according to the plan should be in the short term to remove the acute threat of genetic impoverishment or direct elimination that the majority of wild salmon stocks live under. In the long term the goal should be to utilize the entire reproduction potential of the salmon carrying rivers while at the same time making better use of growth potential. If the reproduction potential of

the rivers were taken full advantage of, a further million smolt could be produced, which would increase salmon catches by about 1,000 tons. If the average weight of salmon caught rose by one kilo a further 1,000 tons could be caught every year. Providing the acute threat can be averted, it should in time be possible to combine the preservation of wild salmon with considerably extended salmon fishery. As regards long-term measures, the Board mentions that Sweden should lend support to the development and international implementation of the method of delayed release of salmon, combined with protection of the salmon's birthplace areas. This would provide the opportunity to save the naturally spawning salmon, while maintaining and probably even increasing professional fishing for salmon.

In a resolution of 30 March 1995 the Government instructed the National Board of Fisheries, in consultation with the National Environmental Protection Agency, to prepare documentation of the environmental and fishery problems relating to the situation of naturally reproducing salmon in the Baltic Sea. The assignment was presented on 4 October 1995. The goals set forth were later to form the basis of the goals presented in the National Board of Fisheries' action plan for biodiversity.

Action plan for biodiversity

On 8 September 1995 the National Board of Fisheries presented to the Government an action plan for biodiversity in respect of fishery. The goal of salmon fishery conservation measures in the short term is to remove the acute threat of genetic impoverishment or in certain cases even direct elimination that the majority of wild salmon stocks live under in the Baltic Sea. In the long term the goal should be to utilize the entire reproduction potential of the salmon carrying rivers while at the same time making better use of growth potential. An interim goal should be to utilize 50% of the reproduction potential by the year 2010 in accordance with the recommendation from the meeting with IBSFC's working group in Älvkarleby in June 1995.

The National Board of Fisheries stated that as an operational goal the action plan presented by the Board in May 1994 for continued work with the preservation of wild salmon in the Baltic Sea would be implemented.

The action plan contains the following measures:

a) Measures in the short term

I. Salmon fishing should be suspended in 1994 and 1995 in all rivers with wild salmon in the counties of Norbotten, Västerbotten and Västernorrland and in the existing protected areas outside these rivers. Such suspension has been effected.

Continued measure

As long as the threat to wild salmon remains, primarily through M74, the measure should be repeated by means of annual decisions.

Continued measure

As a consequence of EU membership, Sweden no longer negotiates on her own on fishery in the Baltic, but is represented by the EC Commission. Within the compass of membership, Sweden should lend support to an adjustment of the extent and form of salmon fishery to what is required for the preservation of natural stocks.

II. Reduction of TAC for salmon:

b) Measures in the long term

I. Delayed release of salmon.

International co-operation is required to apply the method of delayed release on a larger scale. Experience of the method's application in the Baltic states, Russia and Poland is limited and trials in these countries are needed before a position can be taken on an introduction on a larger scale.

Continued measure

Sweden should work for the development and international implementation of the method of delayed release of salmon. This would facilitate a substantial reduction of offshore fishery for salmon in the salmon's growing areas.

II. Research on M74.

A special research programme FiRe (Disturbances in reproduction of Baltic Sea fish) has been drawn up in consultations between the National Board of Fisheries, the National Environmental Protection Agency, WWF and Vattenfall.

Continued measure

The research programme drawn up should be implemented.

III. Gene bank

In order to secure a reserve of genetic variation, gene banks should be built up with material from the most important wild salmon stocks.

Continued measure

The work initiated under the auspices of the National Board of Fisheries of establishing gene banks for 14 salmon stocks should continue. The gene banks should be maintained until the threats to the wild salmon stocks are averted.

Statements of 05-03-1996 and 07-03-1996 (reg.no. 249-451-96) by the National Board of Fisheries on Proposals from the Ministry of Agriculture and Forestry in Finland, Salmon Working Group 1995 (JSM 1995:18)

The National Board of Fisheries noted with satisfaction that, according to the inquiry proposal, Finland has changed her attitude to restrictions on fishing where the salmon undertakes its feeding migration, i.e. fishing of mixed stocks. Finland declares that within the IBSFC she will support a reduction in such fishing. The National Board of Fisheries also considered that it would be very positive if Finland and Sweden could harmonize their fishery conservation measures for salmon in the Gulf of Bothnia.

Finland has now prescribed in law considerable restrictions in the Gulf of Bothnia (see section 8.3.2). As appears below, the National Board of Fisheries also proposes more stringent rules for the area. As regards other Finnish offshore fishery, however, only statements of a general character have been made to date. The National Board of Fisheries' interpretation of the situation is that Finland now supports Sweden in her efforts to reduce TAC for salmon in the Baltic Sea.

In the opinion of the National Board of Fisheries the following goals **in brief** should apply for salmon fishery conservation in the Baltic Sea:

- a) The goal in the **short term** is to remove the acute threat of genetic impoverishment or direct elimination that the majority of salmon stocks are faced with today.
- b) In the **long term** the goal is to utilize the entire natural reproduction potential of every salmon carrying river or part of a river. An interim goal set by the Baltic Sea Fishery Commission is that a level of 50% of the reproduction capacity of each salmon carrying river should be attained before the year 2010.
- c) The growth potential at sea should be made use of in a better manner than today.

The calculations made in this report are based on the following concrete goals:
Every Swedish river in the Baltic Sea area with a stock of wild salmon should by the year 2010 have smolt production of at least 50% of potential production.

5. The stock situation and need for measures

The stock situation

Of the Baltic Sea area's former 70 or so rivers with salmon stocks, there now remain only about 45-50. In about 12 of the rivers stocks are maintained entirely through rearing, but in the other 35-40 there is some natural reproduction. It has been estimated that at present of the stocks have a chance of becoming wholly independent of human measures. In addition there are about 15 watercourses where there has previously been salmon, but which once again could have chances of becoming salmon carrying waters without any greater restoration of the river nursery areas where the fish grow.

In Sweden we have natural salmon stocks left in 14 rivers. Of these 11 are in the Bothnian Bay area, one in the Bothnian Sea area (Ljungan) and two in the Baltic Main Basin area (Emån and Mörrumsån), table 1. The river Torne älv in the Gulf of Bothnia is shared between Sweden and Finland. In the Gulf of Bothnia there is also a weak natural salmon stock in the Finnish river Simo. Potential smolt production is also shown in the table, together with the trend of reproduction since the 1980's until 1995 and forecasts for 1996-1997. There is a large unexploited production potential in the Gulf of Bothnia. For large parts of the Baltic Sea there are unfortunately no details what potential production is conceivable and so it is often difficult to determine whether the stocks are weak in relation to potential production. As shown in the table, smolt production in the Gulf of Bothnia increased at the beginning of the 1990's, but the temporary rise has now been turned to a considerable decline. A similar picture is given in figure 1, which shows the year class strength of salmon parr in various rivers in the Gulf of Bothnia. This figure is based on results from electrofishing surveys (Karlström 1995). Several of the stocks in the Gulf of Bothnia now have production under 1,000 smolts per year. This means that they are very close to elimination and a change must occur quickly if the stocks are to survive with maintained genetic variation. The wild stocks in the rivers Emån and Mörrumsån have also declined considerably in recent years, but the threats to these stocks are less widespread, at least as regards Mörrumsån, than for the northern stocks. It is estimated that a larger quantity of spawning fish migrate up both rivers and that the trend is therefore not so critical there. The following account is therefore concentrated to **the northern stocks and the measures conditioned by the situation there.**

Apart from the rivers that already have salmon, there are in addition a number of Swedish rivers that are potentially salmon carrying. These are all the watercourses that have previously been salmon carrying and that do not require large restoration programmes of the nursery areas to meet the goal.

A preliminary list covers the following rivers which according to the goal should be salmon carrying before 2010: the rivers Sangisälv, Kåge älv, Bure älv?, Hörnån, Testeboån and Helgeån.

The production of reared smolt in the Baltic Sea is proportionately large in relation to the quantity of wild fish. In the table below is shown the production of smolts of varying origin per year for the period 1988-1996 in the whole Baltic Sea (except the Gulf of Finland).

Origin	Year								
	1988	1989	1990	1991	1992	1993	1994	1995	1996
Reared Sweden	2159	2147	1954	1960	2300	2789	1778	1346	1787
Reared Total	5675	5230	4309	3981	4602	5181	3909	4411	4643
Wild Sweden	270	270	270	291	303	347	401	163	188
Wild Total	418	425	422	429	465	511	581	289	314
Total ¹	6093	5655	4811	4520	5172	5880	4525	4781	5113

1. Including enhancement releases.

The total recruitment of smolts to the Baltic Sea has fluctuated during the period in the interval of 4.5-6.1 million smolt. Wild smolts have in recent years comprised barely 10% of the total production, from having been almost 100% about 50 years ago. A maximum in the latest 10-year period occurred in 1994 when 12.8% of reproduction was of wild origin and a minimum in 1995 when the wild smolts were 6.0% of the total number. About 70% of the total quantity of smolt originates from the Gulf of Bothnia, where both Finland and Sweden have programmes for the release of reared salmon smolt as compensation for damage incurred in conjunction with the expansion of hydro-electric power.

The strong dominance of reared fish causes problems when models are sought for exploiting stocks in relation to carrying capacity. In Sweden brood fish are caught wild for rearing purposes, which means that a certain quantity of fish is required each year. Because of the high rate of survival in hatcheries, only a small number of individuals are needed. This means that rearing is to a large extent independent of how salmon stocks are exploited. **Reared fish has therefore for several decades formed the basis of fishery which above all has exploited the wild stocks from the Gulf of Bothnia all too severely.**

Fishing for salmon takes place in the sea, along the coasts and up in the rivers. Offshore fishery occurs mainly in the Baltic Main Basin and comprises fishing for growing salmon. In this area fishing takes place in principle on entirely mixed stocks, which means that both wild and reared stocks are exploited to a similar extent. Coastal fishery of stocks from the Gulf of Bothnia occurs partly when spawning migrators move from the Main Basin to their home river, partly in intensive coastal fishery near the home river. The salmon's

migration up through the Gulf of Bothnia occurs mostly along the Finnish coast (see figure 5 section 8.3). This means that Finnish catches of Swedish and Finnish salmon during an early stage of spawning migration are of great significance for the total catch. A more thorough description of fishery in the Gulf of Bothnia is given in section 8.3. In the table below is shown Swedish salmon catches and the total catch (in tons) for the years 1991-1995, allocated to sea, coast and rivers in the Baltic Sea area (except the Gulf of Finland):

The total catch has fallen over the years from 4144 tons to 2647 tons. This is a decline of 36%. Coastal fishery and offshore fishery have both fallen considerably (each by about 37%). River fishery, on the other hand, has been almost constant during the period. It must be noted here though, both that the entirely dominant part of river catches comprise reared stocks, and that a large part of the catch (close to 40% at present) comprises brood fish. Swedish catches have also declined during the period, though clearly less than the average, or by 27% from 1991 to 1995. Sea catches constitute a large proportion of the total Swedish catch, varying from 58-69% of the total catch, while river catches have formed about 10% of the catch. The highest value was achieved in 1995 when it comprised 14% of the salmon catch. This means that there has been some redistribution from sea and coast to rivers. This is an expression of reduced fishery exploitation during the period which should have entailed an increase in wild stocks, but as noted above this positive trend was only temporary.

The main reason for the decline is the increased fry mortality known as M74. It was first discovered in 1974 at the Bergforsen hatchery, on the river Indalsälven. The symptoms appear primarily during the salmon fry's yolk sac resorption, i.e. before it is time for the fish to start eating external food. Mortality from M74 rose markedly at the beginning of the 90's and the syndrome has in recent years given rise to high rates of mortality in reared stocks, table 2. This mortality appears to be continuing at a similar or somewhat higher level in 1996, according to hatching forecasts so far reported. Smolt production of reared salmon has been influenced to a certain extent by M74, but not at all to the same extent that the wild stocks have suffered. One contributory reason is that it has been found that treatment of the newly hatched fry with tiamin (vitamin B₁) leads to survival on an almost normal scale. Similar treatment of wild fry is not possible and thus the M74 syndrome and the treatment widen further the already large discrepancy between the quantities of reared and wild salmon in the Baltic Sea.

The situation in the river Vindelälven may be selected as an illustrative example of the trend. The wild salmon stock in the river Vindelälven, like other wild stocks, suffered considerably from 1992-1996, figure 2. Despite a for recent years large quantity of spawning fish in 1994, the quantity of newly hatched fry found when electrofishing in 1995 was at a very low level. This shows that forceful measures are necessary to reverse the negative trend.

One way of accurately monitoring the development of individual stocks may be to establish goals for the quantity of salmon that should spawn in a river each year. It is a simple and concrete method of measuring the size of a stock. Setting the goals is at present complicated by the presence of M74. A high frequency of M74 may give occasion to set a higher goal for the quantity of spawning fish than if the M74 frequency is low. It is shown in table 3 how the goal can be formulated as the number of female salmon that will spawn in the river at low and high M74 frequencies in order to achieve the goal of 50% smolt production. It may be mentioned as an example that the quantity of female salmon that spawned in the rivers Ume/Vindelälven in the period from 1991-1995 varied in the interval 160-719 females. This means that with the present high frequency of M74 only 6.4-12.8% of the goal has been achieved. As appears from section 11 it should be investigated whether the establishing of fixed goals for the quantity of spawning fish (escapement) in each river with natural stocks is theoretically and practically feasible.

The need for measures

Because of the precarious situation of the majority of wild stocks, further measures must be taken if it is to be at all possible in the long run to achieve the long-term goals. It is foremost a question of the long-term survival of the wild stocks in the Gulf of Bothnia, but also the measures required to achieve the concrete goals set out above for production in the year 2010 of 50% of the potential. In this connection it should be made clear that smolt production in the year 2010 is essentially based on the quantity of salmon migrating to spawn in the year 2006. If it is also reckoned that a large proportion of the female salmon migrating to spawn after spending two years in the Baltic Sea (three years however for not insignificant quantities) then one salmon generation (a river in northern Sweden, natural salmon) covers about 6 (7) years, from the time the parent fish lay eggs to when they lay eggs. **This means that from the 1997 spawning migration we have just two salmon generations to influence the prospect of achieving the interim goal of a 50% utilization of capacity in 2010.**

In the opinion of the National Board of Fisheries there is a clear ranking order among the types of measures that should be taken to achieve the goal. The first principle is to eliminate, if possible, the causes of stock decline. Since in this case there is one strongly conducive reason for stock decline, M74, which cannot be influenced - at least not at present - it is instead a matter of trying to turn the stock trend in a positive direction with the aid of fishing restrictions. It is in principle only if this type of measure is not practicable that other measures, such as releases of fish, may be resorted to. The factors behind the preference of the National Board of Fisheries for fishing restrictions are treated in section 6.

Enhancement releases are at present made in a number of different watercourses in the Gulf of Bothnia. Among these is the river Torne älv where Finland is conducting a large-scale release operation. The National Board of Fisheries considers that the guidelines which should apply for enhancement releases are not entirely met by these releases and they should therefore be substantially reduced or cease altogether and be replaced by effective fishing restrictions. The fishing restrictions implemented by Finland in 1996, by the Border River Commission in 1995-96 and by Sweden over a long period of years should, in combination with a further tightening of Swedish regulations which in the current proposal is due to take effect in 1997, provide a basis for discussion on a reduction of the Finnish releases.

The situation is different in the potentially salmon carrying rivers which at present have no salmon at all, or the salmon rivers with salmon stocks where new reproduction areas have been made available through for example the installation of salmon ladders. In such cases there is no prospect of achieving the goal of a 50% production level in the year 2010 if no releases are made. In several of the potentially salmon carrying rivers listed above projects are already under way to introduce a salmon stock and they should then also be carried out in accordance with the principles discussed below for enhancement releases. Protective measures, such as closed areas etc., will be needed in the build-up phase as the new stocks begin to be established in these waters; this will however be treated as and when it becomes appropriate and is not further discussed here.

If the fishing regulations proposed below are not implemented to the full in 1997-1998 there will be a need for massive enhancement releases in many of the rivers with natural salmon stocks. If this is not done the stocks will in some cases probably be eliminated. Concrete plans for how the releases should be effected should therefore be drawn up as early as 1996-1997. It is important to observe that such enhancement releases mean that the stocks will be reared instead of wild, at least during a transitional phase. It also means an imminent risk of the releases becoming permanent as long as the reasons for the weak stock are not corrected, i.e. the stocks will remain reared and we will inevitably - in violation of commitments under the Rio Convention - for ever lose unique genetic material.

6. Enhancement releases and genetics

The most important principle for enhancement releases is that the causes of stock decline should be eliminated before the measure is resorted to. Otherwise there is a great risk that the releases lead to a reduction in genetic variation if the stock declines once again.

Another principle is that the enhancement releases should be a once-only measure so that the stock does not become dependent on rearing for its continued existence. Protracted rearing operations can only be permitted for stocks that have no chance of natural reproduction on a sufficient scale.

The question of when enhancement releases should be resorted to and how they should be carried out should be decided in the light of knowledge of the status of the particular stock. One important aspect is the existence of local populations in a river. If such do exist, or are presumed to exist, they should be treated as unique populations. As regards the size of population, there are a number of recommendations on the least acceptable genetically effective size of population (N_e) to avoid adverse genetic effects. One figure mentioned for long-term preservation is $N_e = 500$ individuals per generation, which in many cases may serve as a rule of thumb. Heed must of course be paid to local conditions in assessing the least acceptable size of population.

It is very important that the release material has the greatest possible genetic variation and that it definitely originates from the local population that is to be strengthened. The unnatural selection that can take place in a hatchery should be minimized. Releasing early stages such as eggs and fry is preferable, since natural selection then has a chance of working. Later stages of life, such as one-summer (0+) or one-year old fish, may be preferable as they can be marked. This gives an opportunity to follow the development of the stock and the marked individuals can be avoided as brood fish in hatcheries in cases where the replenishment programme is still in progress. Release of earlier stages also gives a lower rate of survival of the released material and therefore it seems likely that, with the type of replenishment that may be considered with present weak stocks, some of the releases must occur in later stages of life in order to attain maximum effect in raising the level of the stocks.

In the present position with protracted reductions in stocks owing to over-exploitation, in combination with extra mortality as a consequence of the M74 outbreak, it is also of immediate importance to build up a gene bank to safeguard the threatened wild salmon populations. Such a gene bank has been created with fish in hatcheries and as deep-frozen milt. It should be maintained until the threats to the wild stocks are averted.

The position in the gene bank regarding the number of individuals collected is at present (25-03-1996) as follows:

River/branch	No. of salmon young per year			Fry 1995	Frozen milt from males
	1993	1994	1995		
Torne älv/Lainio		96	162		
Torne älv/Swedish	157	59			
Kalix älv/upper	203	217	83		
Kalix älv/lower	268	22	50		
Kalix älv/Ångesån	119	86	27		
Råne älv		147	119		
Pite älv		8			12
Åby älv		24	265		
Byske älv		433			44
Ume älv/Vindelälven		200		5000	100
Öre älv		6	58		9
Lögde älv		39	798		9
Ljungan	7	1000	32	5000	65
Emån			197		
Mörrumsån		14000			25

Material has been collected from all stocks, but in some cases the number of young from some of the stocks is all too low and the collection of young should continue. Unfortunately the operations are very costly and at present it is uncertain to what extent it will be possible to continue collection. Owing to the great value represented by the material collected, security aspects, such as for instance the risk of mortality from disease etc., must be observed to a greater degree than with normal rearing. To ensure the long-term survival of each individual stock in a hatchery environment, costly improvements are therefore needed to the security related systems in the hatcheries used for the gene banks.

7. Measures in 1996

At the latest session of the Baltic Sea Fishery Commission (IBSFC) the parties agreed on certain new elements pertaining to salmon fishery in the Baltic Sea, as follows:

- The total catch in the Baltic Sea is to be reduced from 500,000 salmon in 1995 to 450,000 salmon in 1996. Sweden's share, after bilateral exchanges of quotas, came to 122,152 salmon.
- Salmon drift nets and anchored floating nets are to be banned in the Main Basin from 15 June to 30 September, in the Bothnian Bay and Bothnian Sea from 1 June to 15 September. The ban covers the area outside 4 nautical miles from the base line. The closed period has been extended by two weeks compared with 1995.
- Planned release of salmon smolt in years to come shall be reported to the IBSFC by 1 July, as also details of the release technique and the state of the wild stocks.
- "The International Baltic Sea Fishery Commission recommends to the Fishery Authorities from all Contracting Parties to declare a moratorium on salmon fishing in rivers and river-mouths with wild salmon stocks."
- A special resolution with management goals and management strategies recommended by "the *Ad hoc* Working Group on Salmon Strategies for the Baltic", which met in Älvkarleby in June 1995 (see above the section on "Goals set by the IBSFC").

On 21 December 1995 the National Board of Fisheries issued (FIFS 1995:33) on salmon fishery in the Baltic Sea and certain bordering fresh water areas for 1996. The directions entailed among other things a division of quotas for the areas south and north of 59°30'N. Fishing in the latter area was permitted in three periods. The directions also contained detailed regulations for fishing in salmon carrying watercourses.

8. Measures in 1997

8.1 Total allowable catch (TAC)

Conventional TAC

In the following section the calculation of a suitable TAC for 1997 has been related to the long-term goals for the Baltic wild salmon stocks as formulated by the IBSFC at the 1995 session. This has been incorporated into the goal of the National Board of Fisheries for the management of Swedish wild salmon stocks in the Baltic Sea. The goal is formulated in the following way:

"The production of wild salmon should gradually increase to attain at least 50% of the natural production capacity of every individual river before the year 2010, this in order to achieve a better balance between wild and reared salmon."

The southern stocks of salmon in rivers that flow into the Main Basin have declined considerably in recent years, but their status is considerably better, above all in the river Mörrumsån, than for most of the stocks in the Gulf of Bothnia, see table 1. The salmon stocks in the Gulf of Bothnia will therefore govern the measures to be taken to achieve the long-term goal. The estimated smolt production for 1992-95 and forecasts for 1996-1997 show that smolt production must increase substantially up to 2010 to reach 50% of potential production. In the Gulf of Bothnia the time from when a salmon spawns until the resulting smolt

migrates out to sea is 3-4 years. Since the fresh water phase is not affected by human measures (apart from releases etc.) it is the fishery exploitation up until the years 2006-2007 that govern smolt production in the year 2010.

Figure 3 shows how smolt production in the northerly rivers could be developed if it were to reach exactly 50% of potential production in the year 2010. The graph assumes even exploitation of the stock at an average level each year during the period until the year 2007. The model used in ICES' Baltic salmon working group has been used to estimate the average levels of exploitation required to give the trend outlined in figure 3.

The level of a TAC 1997 is highly dependent on what roe-smolt rate of survival is used. An original or "normal" rate of survival of 2% is often used. If mortality from M74 is used to adjust the original roe-smolt survival, an M74 frequency of 50% will be equivalent to lowering the rate of survival from 2% to 1%. If the M74 frequency is instead 65%, the rate of survival will be 0.7% and at 75% mortality survival will only be 0.5%.

The relationship between a suitable level of exploitation in the form of TAC 1997 and roe-smolt survival is shown in figure 4. The levels of exploitation and survival that the diagram shows would, if they remain until 2007, lead to the smolt production stated. The TAC for 1997 would be as follows:

	Survival from roe to smolt			
	2%	1%	0.7%	0.5%
TAC (1000s)	578	407	263	65
Smolt production in 2010	50% of potential	50% of potential	50% of potential	50% of potential

On account of what has been said previously about the frequency of M74 in reared and wild stocks (see section 5) in the past five years, it seems probable that 0.5-0.7% roe-smolt survival is realistic. For one of the worst hit stocks, the one from the river Vindelälven, the figure of 0.5% roe-smolt survival is possibly all too high. **Henceforth 0.5% roe-smolt survival has been allowed for as a main alternative.** This corresponds to M74 mortality in the region of 75% (Cf. further section "Coastal fishery and TAC", p. 39).

8.2 Closed summer season in the Baltic Sea

The summer closed period that previously applied to offshore fishery until 15 September has been extended for 1996 to 1 October. This means that the autumn start of fishing will be postponed about 2 weeks. In recent years the available quota has been filled at least 1-2 months before the end of the year. Fishing will now continue a little longer before the quota is filled. This means that the average weight will rise somewhat and the total catch in kilos will be somewhat higher. The situation of the wild salmon will not, on the other hand, be at all affected by the prolongment of summer protection. Generally speaking, with a restrictive TAC, relatively few of the measures that can be applied to strengthen the regulatory effect on offshore fishery have any importance for fishery exploitation.

8.3 Fishing along the coast of Gulf of Bothnia

The salmon migrates northwards in the Baltic Sea and up into the Bothnian Sea-Bay of Bothnia during the spring and early summer (see figure 5). It follows to a large extent the Finnish coast and it is first in the Kvarken area that fish from many of the Swedish stocks swim over to the western side of the sea area and then disperse to various parts of the Bothnian Sea and Bay of Bothnia. Salmon from the rivers Kalix and Torne älv continue to follow the Finnish coast even up in the Bay of Bothnia and are exploited by Finnish coastal fishery in this area too. It is probably only in the most northern part of the Bay of Bothnia that fish from these stocks swim over towards the Swedish coast.

8.3.1 Comparison between Swedish and Finnish fishery in the Sea of Bothnia and the Bay of Bothnia (sub-area 30 and 31)

The scope of fishery

Swedish and Finnish fishery in the Sea of Bothnia-Bay of Bothnia (Gulf of Bothnia) is shown in table 4 for the series 1981-1995 (preliminary data for 1995). Over the last three-year period about 30% of the total catch in the Gulf of Bothnia has been taken by Swedish fishery and about 70% by Finnish fishery. Finnish fishery is thus more than twice as big as the Swedish. About a third of the total Swedish salmon fishery was taken in the area and the corresponding share of Finnish salmon fishery was about half.

Swedish fishery is conducted as pure coastal fishery with traps and hoop nets. Finnish fishery is partly coastal fishery and partly offshore sea fishery in the Bay of Bothnia. The coastal fishery is conducted with similar gear to Swedish coastal fishery. The offshore sea fishery is conducted with drift-nets and lines and is similar to fishery in the Main Basin.

Amount of gear

The amount of gear deployed in various sub-areas is shown by county in table 5a-c. In the whole Gulf of Bothnia (the Swedish side) there are about 1,000 traps, of which about 700 are in the Bothnian Bay and about 300 in the Bothnian Sea. Half of the gear, about 500, is in the county of Norrbotten and the rest is distributed relatively evenly among the three nearest counties to the south, to the county of Uppsala, which only has a few salmon traps.

The traps can be divided into combi-gear and plain salmon gear. The combi-gear has a smaller mesh size and catches both salmon and whitefish, while the plain salmon gear has a larger mesh size and is more exclusively intended for salmon fishing. The combi-gear comprises both traps and fyke nets, while the plain salmon gear consists of traps. The traps are bigger and more effective gear than the hoop nets and are also used as floating traps. Traps were first introduced in the 1970s. Hoop nets are used in shallower areas.

In the northern part of the Bothnian Bay, in the counties of Norrbotten and Västerbotten, only combi-traps and combi-hoop nets are used to catch salmon and whitefish. Further south there is more plain salmon gear; in the county of Gävleborg 70% combi-gear and 30% plain salmon gear. As regards the distribution between traps and hoop nets, about 70% of the combi-gear in the counties of Norrbotten and Västerbotten (Bay of Bothnia) consisted of traps. The traps dominate even more in the Bothnian Sea.

The type of gear, including the net used, is important for whether, for example, salmon can be released gently from the gear. In the plain salmon traps the salmon get more entwined. The most gentle gear is the combi-hoop net, where the salmon is least harmed on release.

The trend in the amount of gear over the years is given in table 6 for the counties of Norrbotten and Västerbotten. The table shows a reduction in the amount of gear from the end of the 1970s until the most recent audit years 1992-94. It is above all the number of hoop nets that has declined, while the number of traps has not changed as much. The trap is a considerably more effective implement than the hoop net; so fishing is probably not much less effective.

The distribution of gear between professional and other fishing

The distribution of gear between professional fishing and other fishing is shown in table 5a-c. The proportion of traps in professional fishing for the whole Gulf of Bothnia is about 55%, with a lower proportion in the county of Västernorrland and a higher one in the county of Gävleborg. There is, however, a relatively large difference between different areas. In the county of Norrbotten the proportion of gear in professional fishing was 55% for the whole county. In the Lule archipelago the proportion of professional fishing gear was as much as 75%, while in neighbouring Råne archipelago the proportion of professional fishing gear was only 13%. Professional fishing is concentrated to areas with a better supply of salmon and often whitefish as well, such as Lule archipelago. In the Råne archipelago fishing with traps is concentrated to whitefish and does not yield the same catch. Non-professional fishing is found in private waters and often in "intermediate areas" with no great supply of salmon. There are also similar differences in the county of Västerbotten, with particular "professional fishing areas" in Renholmen-Byske, Ursviken-Skellefteå, Täfteå-Holmsund and non-professional fishing areas in Gumboda-Holmön.

Number of fishermen with traps .

In the following table is shown the number of licensed fishermen that fish with traps. Altogether in the Gulf of Bothnia there are about 200 licensed fishermen who fish with traps. The largest number of fishermen, 68 in all, are to be found in the county of Norrbotten.

<u>County</u>	<u>Total number of fishermen</u>
Norbotten 1992	68
Västerbotten 1994	32
Västernorrland	50
Gävleborg	37
Uppsala	16
Total	203

Releases of reared salmon smolt and production of wild salmon smolt

Both the Swedish and the Finnish smolt releases cover more or less the whole Gulf of Bothnia. On the Swedish side the releases are made entirely as compensation for harnessed rivers and are determined by water-rights judgments. On the Finnish side there are corresponding compensation releases through water-rights judgments, but also direct releases of Neva salmon on the coast of the Sea of Bothnia. The releases and the production of wild salmon smolt are shown in table 7.

The Swedish smolt releases are made in nine different rivers and are spread along the whole Gulf of Bothnia from the river Lule älv in the north to the Dalälven in the south. The Finnish releases, on the other hand, are made in three rivers in the northern part of the Bay of Bothnia from Oulujoki, which is on a level with Piteå, and northwards.

Swedish fishery is based to a large extent on salmon returning to its home river in each more important catch

area, from the southern watercourses up to the northern ones. Finnish fishery is based in the Bothnian Sea and the Bothnian Bay up to Oulujoki, mainly of migrating mixed stocks of wild and reared, Swedish and Finnish fish, as there are no rivers there with releases or wild stocks. Only from Oulujoki and northwards are there separate stocks, which make for the coastal area of their own home river. This is shown in outline on the map in figure 5.

8.3.2 Comparison between Swedish and Finnish regulations for salmon fishery in sub-divisions 30 and 31, and in the river Torne älv

The following summary shows a comparison for the Gulf of Bothnia between current Swedish and Finnish salmon fishery regulations in accordance with the provisions FIFS 1993:31 of the National Board of Fisheries, with certain changes, and the Finnish regulations of 08-03-1996 adopted in a Directive on restrictions in salmon fishery in Finland's territorial waters and fishing zone in the Baltic Sea Main Basin, the Gulf of Bothnia and in Simojoki.

Finland	Sweden
<p><u>Area 4.</u> North of 65°30' Salmon fishery with net gear, anchored lines and drifting lines is prohibited in Finland's territorial waters and fishing zone, 1 March - 5 July 1996-1997 (1 April - 30 June from 1998)</p>	<p><u>Part of sub-division 31</u> Prohibition on fishing for salmon with drift-nets, drifting lines, anchored lines and anchored floating nets in the coastal water area. Salmon fishery is prohibited 1 October - 31 December. Prohibition on fishing for salmon with traps and nets 1 May - 10 June. Closed areas in the rivers Råne älv and Kalix älv.</p>
<p><u>Area 3.</u> Between 64°00' and 65°30' N. Salmon fishery with net gear, anchored lines and drifting lines is prohibited in Finland's territorial waters and fishing zone, 1 March - 25 June 1996-1997 (1 April - 25 June from 1998)</p>	<p><u>Part of sub-division 31</u> Prohibition on fishing for salmon with drift-nets, drifting lines, anchored lines and anchored floating nets in the coastal water area. Salmon fishery is prohibited 1 October - 31 December. Prohibition on fishing for salmon with traps and nets 1 May - 10 June. Closed areas in the rivers Rickleån, Bure älv, Skellefte älv, Kåge älv, Byske älv, Åby älv and Pite älv.</p>
<p><u>Area 2.</u> Between 62°30' and 64°00'. Salmon fishery with net gear, anchored lines and drifting lines is prohibited in Finland's territorial waters and fishing zone, 1 March - 25 June 1996-1997 (1 April - 20 June from 1998)</p>	<p><u>Part of sub-division 30 and 31</u> Prohibition on fishing for salmon with drift-nets, drifting lines, anchored lines and anchored floating nets in the coastal water area. Salmon fishery is prohibited 1 October - 31 December in sub-area 31 and part of area 30. Prohibition on fishing for salmon with traps and nets 1 May - 10 June in sub-area 31. Closed areas in the rivers Ångermanälven, Gide älv, Lögde älv, Öre älv, Hörnån, Ume/Vindelälven and Sävarån.</p>
<p><u>Area 1.</u> Between 59°00' and 62°30'. Salmon fishery with net gear, anchored lines and drifting lines is prohibited in Finland's territorial waters and fishing zone, 1 March - 20 June 1996-1997 (1 April - 15 June from 1998)</p>	<p><u>Part of sub-division 30</u> Prohibition on fishing for salmon with drift-nets, drifting lines, anchored lines and anchored floating nets in the coastal water area. Closed areas in the rivers Indalsälven, Ljungan, Ljusnan and Dalälven.</p>

The special regulations for the river Torne älv determined by the Border River Commission are in brief as follows:

Closed area in the whole Haparanda and Torneå archipelago. All fishing for salmon and salmon trout is prohibited for 1996 and 1997. All fishing with traps is prohibited from 1 May - 5 July. Exemption may be granted to professional fishermen for whitefish.

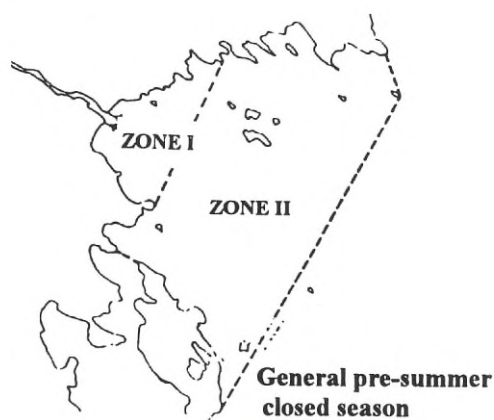
The Finnish regulations are favourable to the wild salmon stocks. Catch data from experimental fishing with a salmon trap in the Stockholm archipelago shows that wild salmon migrates earlier. Data from tagging of Swedish salmon shows that spawn migration through the Sea of Bothnia takes place to a large extent along the Finnish coast and thus the northerly Swedish stocks of wild salmon are also favoured by the Finnish regulations. It may at the same time be noted that fishing is levelled at catches of reared salmon, which

reduces the risk of these salmon migrating up the unharnessed rivers. Decisive for the real effect of the regulations is whether the fishing restrictions can be considered to limit fishing with combi-traps to a sufficient extent. If such fishing is allowed to continue on the same scale it is highly likely that incidental catches of salmon will be so great that the controls will hardly have the desired effects.

The provisions introduced by the National Board of Fisheries in 1996 (cf. section 6 above) may be said to constitute a step in the same direction as the Finnish regulations. The division of the Swedish quota in time and area that has been made is a clearly positive measure. One difference is that the Swedish provisions also include certain restraints on angling (rod fishing) in the rivers.

8.3.3 Closed areas and terminal fishing

By terminal fishery is meant fishing, mainly for reared salmon, concentrated in time and in one river mouth. The name terminal fishing is taken from Finland, where terminal fishing from this year on constitutes an important element in Finnish exploitation of salmon. In the view of the National Board of Fisheries the following skeleton sketch shows how such fishing may take place:



Furthest in towards the river mouth (zone I) fishing is free for the whole summer season until the end of August (when protection for migrating sea-trout spawners commences). Outside zone I (in the Bothnian Bay) there is in most cases a zone II with only shorter pre-summer protection, due to a certain amount of migrating natural salmon on the way to their home rivers, above all during part of the early summer. It can be foreseen that a similar zone II will only come into question in isolated cases for the harnessed rivers in the Bothnian Sea area. In the waters outside zone I (in the Bothnian Sea) and zone II (in the Bothnian Bay) the general pre-summer closed season applies (see below section 8.3.4).

A division into closed areas (coastal areas outside wild salmon rivers) and terminal fishery (coastal areas outside reared salmon rivers) is shown below:

Areas	Wild salmon rivers Closed areas	Reared rivers Terminal fishery areas
Bothnian Bay, Sweden	12	3
Bothnian Sea, Sweden	1	5
Bothnian Bay, Finland	2	3
Bothnian Sea, Finland	0	0

On the Finnish side, general protection as to time, step-by-step from south to north, is highly suitable as the stocks are not divided until up in the northern part of the Bay of Bothnia. It is only furthest north where the stocks are divided that a division by area becomes meaningful.

On the Swedish side a division by area is meaningful along the whole coast, as Swedish fishery is based to a large extent on fishing of separated stocks. A good division of the areas is therefore important, partly to protect the wild salmon but also to facilitate effective fishing outside the reared rivers' coastal areas. General step-by-step time protection is a useful supplement, but a large long-time corridor along the whole coast would entail a substantial limitation of fishing for reared salmon, while at the same time the effects on wild salmon would not necessarily be so great. It is therefore important that the closed areas are made sufficiently large but also that the terminal fishery areas are of such a size that they can really exploit the reared salmon and avoid eliminating large parts of the coastal fishery.

Proposals

Closed areas outside the wild salmon rivers

The river Torne älv closed area. The entire Haparanda archipelago on the Swedish side and the neighbouring Torne archipelago on the Finnish side are already included in a large closed area (and have always been so).

The river Kalix älv closed area. The entire Kalix archipelago is already included in the outer closed area of the river Kalix älv.

The river Råne älv closed area. To be extended southwards.

The river Pite älv closed area. To be extended southwards.

The river Åby älv closed area. To be extended.

The river Byske älv closed area. To be extended southwards. An amalgamation of the closed areas of the rivers Åby and Byske älv can be discussed.

The rivers Rickleån and Sävarån closed areas.

The river Ume/Vindelälv closed area.

Mixed reared and wild salmon, distinguished by means of adipose fin clipping.

Holmön. There are clearly mixed stocks here (salmon that cross over from Kvarken on the Finnish side). Extended protection can be discussed.

The river Öre älv/Lögde älv closed area. To be extended southwards to the Ångermanland coast. The problem of fishing wild stocks outside the river Ångermanälven is being investigated.

Fishery in coastal areas outside reared rivers (so-called terminal fishery)

The coastal area of the river Lule älv. Recoveries of marked Torne älv salmon have been very low in the Lule archipelago. No recovery of marked Kalix älv salmon, except along the Finnish coast and in the Torne archipelago.

The outer coastal area of the river Pite älv. Fishing here has always been based on Lule älv salmon.

The coastal area of the river Skellefte älv.

The coastal area of the river Ume älv (see above).

The coastal area of the river Ångermanälven.

The coastal area of the river Indalsälven.

The coastal area of the river Ljungan. Mixed reared and wild smolt. Reared smolt is separated by adipose fin clipping.

The coastal area of the river Ljusnan.

The coastal area of the river Dalälven.

8.3.4 Spring closed periods

Differentiated spring closed periods ("the corridor")

To reduce the exploitation of spawn migrators on their way north from the Main Basin to their home rivers, various measures may be considered. The following facts should be observed:

- large and older salmon spawn migrate before smaller and younger salmon.
- wild salmon spawn migrate before reared salmon.

Older and wild salmon should primarily be protected.

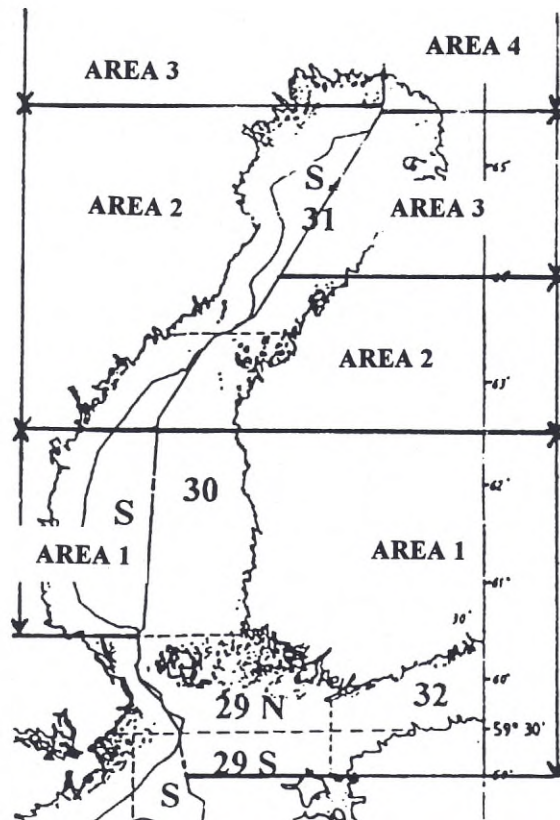
Spawning migration starts from the southern or middle part of the Main Basin and to reduce exploitation of spawn migrating salmon, offshore fishing with drift-nets can be prohibited from area 29N and northwards in the period April-June. In sub-division 30 drift-net fishing may possibly be prohibited all the year round. The prospect of creating an exploitation free "corridor" for the wild spawn migrators is dependent on the pattern of exploitation in the coastal area of the Gulf of Bothnia. A compilation has been made in table 8 and figure 6 which shows the distribution of coastal recoveries, from north to south in the Swedish part of the Gulf of Bothnia, of salmon from the rivers Lule älv, Skellefteälv, Ume älv, Ångermanälven, Indalsälven, Ljusnan and Dalälven. There is a strong concentration round each river-mouth area. In addition there is a common element in the form of a certain concentration of recoveries outside the Ångermanälven. Since wild stocks are concentrated to the area north of this river it seems probable that they too are exploited in the area around the Ångermanälven and the opening of coastal fishery in this area should therefore be put a little later compared with the areas to the south, to reduce the exploitation of wild salmon. Since it seems that the Swedish stocks cross the water in the Kvarken area and then disperse to the north and south, it is reasonable that the whole area from south of the river Ångermanälven and northwards should have the same closed periods for the coastal area, except of course for terminal fishing areas and closed areas.

Variable pre-summer closed seasons

The annual spawning migration for both reared and wild salmon stocks varies by up to 30-40 days. This means that coastal fishery with fixed open periods will have widely differing effects in years with early and late spawning migration (Karlsson et al. 1995). There is also a strong correlation between the time of

spawning migration and the number of spawners, such that when spawning migration is late there is only a small number of spawners and vice-versa when spawning migration is early. Fixed pre-summer closed seasons will therefore reduce exploitation when there is already a large number of spawning migrators and just the reverse, raise exploitation when the number of spawners is low. To avoid these problems a variable opening date for the coastal fishery should be introduced. This can be based on the strong correlation between the temperature of the sea water measured from a ferry on the Trelleborg-Sassnitz route in subdivision 24 and the time of spawning migration, figure 7a and b. For regression, with March as the explanatory variable, 65.6% of the variation is explained by the water temperature; the corresponding figure for March-April is 74.7%. The water temperature for March is available on 1 April and for April on 1 May. This means that a forecast for spawning migration time can be made 1-2 months before fishing starts in the Gulf of Bothnia. A simple way to implement it would be to vary the opening date by 14-20 days, depending on whether the water temperature is within certain temperature intervals, e.g. under 2.5°C, in March. The decision could be announced to fishermen early in May, more than a month before the earliest start of fishing in the Gulf of Bothnia. In this way there should be sufficient time for them to prepare for fishing. The low water temperature in March 1996, 1.18°C, would entail a late opening of coastal fishing this year.

The pre-summer closed periods proposed by the National Board of Fisheries are shown in the following figure and summary:



Sweden

Area 1

General closed period	1 April - 10 June ± 10 days
Terminal fishery area, Zone II (only by way of exception)	1 April - 31 May ± 10 days
Terminal fishery area, Zone I	Free fishing the whole summer season

Area 2

General closed period	1 April - 25 June ± 10 days
Terminal fishery area, Zone II (only by way of exception)	1 April - 10 June ± 10 days
Terminal fishery area, Zone I	Free fishing the whole summer season

Area 3

General closed period (No terminal fishery)	1 April - 30 June
--	-------------------

Comment on area 3:

The regulations take effect when fishing can later on be resumed in this area (at present a total ban on fishing for salmon under the regulations for closed areas outside the rivers Torne and Kalix älv. The southern border should be set at 65°35', a borderline just north of the Lule archipelago. This border also coincides with the Border River Commission's border. The Finnish border of 65°30' goes right through the Lule archipelago and is therefore not suitable.

Finland

The following general closed periods apply for Finland today:

Area 1

1996 and 1997	1 March - 20 June
From 1998 on	1 April - 15 June

Area 2

1996 and 1997	1 March - 25 June
From 1998 on	1 April - 20 June

Area 3

1996 and 1997	1 March - 30 June
From 1998 on	1 April - 25 June

Area 4

1996 and 1997	1 March - 5 July
From 1998 on	1 April - 30 June

Prohibition on fishing with salmon nets and salmon lines

A further step in the harmonization of salmon fishery in the Gulf of Bothnia is for Sweden to reintroduce the ban on fishing with drift-nets, drifting lines, anchored lines and anchored floating nets outside the coastal water area north of latitude 59°30'. The National Board of Fisheries is of the opinion that such a regulation should be introduced.

8.4 Adipose fin clipping

Before the negotiations by the Baltic Sea Fishery Commission in September 1995 there was discussed among other things the matter of adipose fin clipping, which had been suggested by ACFM (ICES) in combination with a prohibition on landing salmon that was not fin clipped. The National Board of Fisheries wrote in this part of its statement to the Ministry of Agriculture that the Board would have appreciated it if the ACFM's recommendations had been followed.

In a statement of 07-03-1996 on Proposals from the Ministry of Agriculture and Forestry in Finland, Salmon Working Group 1995 and the Report on the Assignment: An Expert Study of Certain Salmon Matters, the National Board of Fisheries gave its support to the proposal by the Swedish Federation of Fisheries' Unions that all reared and released salmon should be adipose fin clipped.

According to available information, survival is very low for salmon caught in drift-nets of the lengths used in the Baltic sea and taken aboard with so-called hauling machines. Survival is higher with hook fishing but unsatisfactory. By far the highest survival is reached in fishing that involves live catches, such as traps. This means that when fishing for salmon with drift-nets in the Baltic Sea there is little point in restoring the non-fin clipped, wild salmon to the sea. Returning the fish only becomes effective in fishing near the coast with gear for live catches.

8.5 Experiments with delayed release

In accordance with the decision by the Baltic Sea Fishery Commission in September 1994 all parties - from 1995 onwards - should carry out experiments with delayed release of salmon smolt in order to gather information on the biological, geographical, technical, legal, socio-economic and practical implications of this technique in each economic zone.

As regards the gathering of information, not particularly many details have yet been received, according to information of 13-05-1996 from the secretary of the Baltic Sea Fishery Commission.

In the report from ICES (ACFM) in the spring of 1995 on the situation of salmon stocks in the Baltic Sea, the evaluation of results from experiments with delayed release is treated in one item. It appears that Swedish experiments have been successful, but not Finnish. The Swedish release sites were located near the salmon's growing areas and the choice of release site seems to be of great importance. The choice is also important for the number of salmon that migrate to rivers. The results indicate that the delayed release model can be successful, but effective fishing of the remigrating, grown fish in the release area is necessary to prevent unacceptable up-river migration where the risk of genetic mixing with wild salmon can arise. With regard to the situation of the wild salmon well chosen sites are of the utmost importance.

In their comments of 29-03-1996 on the action plan of the National Board of Fisheries for biodiversity, the Swedish Federation of Fisheries' Unions shares the opinion of the National Board of Fisheries that delayed release is a method that should be further extended.

According to information received by the National Board of Fisheries, extensive experiments with delayed release have been made since 1990 off the coast of Bornholm (Tejn). The experiments have been initiated by "Laksefonden", later by "Laksefonden af 1991" (see app. 3). Smolt from the river Mörrumsån has been used there. Danish experience, as regards both rearing and recovery, has been so good that a further 5-year experimental programme is now being effected, apparently to a large extent with EU funds. 100,000 smolt is to be released annually during the period, of which 60,000 off Bornholm and 40,000 off the Danish coast in the south-west Baltic. It is hoped that new fishery can be developed here, preferably with large nets. In a letter recently to the Department of Fisheries in Copenhagen, the Danish Fisheries Association has pointed out the need for a change of management strategy for salmon in the Baltic Sea. A new approach may be a transition to the model with delayed release.

The Danish experiments have now been the subject of a scientific evaluation. A summary of this is attached (app. 4).

The National Board of Fisheries thus considers that extensive international experiments with delayed release must now be carried out. With regard to the matter's importance, Sweden should lend support with know-how if such is necessary for the implementation of the experiments, for example in the Baltic States. The Board estimates that it should at least in part be possible to obtain funds from the EU in this matter.

Important aspects in the experiments are:

- The use of suitable salmon stocks, i.e. as far as possible local ones, with good homing to the release sites
- Optimization of release time
- Optimization of catch occasion
- Choice of release site. It is of great importance that such areas are selected where the risk of catching sea-trout is small.

8.6 Compensation matters

Claims for compensation may be made in several cases. It can be a matter of stopping fishing in connection with closed areas outside natural salmon rivers, where it is of particular importance to guarantee free passage for the wild salmon for a considerable time. It can also be a matter of stopping coastal fishery from time to time or prohibiting fishing with drift-net and hooks.

In the opinion of the National Board of Fisheries, funds should be made available so that fishermen who have to cease fishing do not suffer unreasonable financial loss.

8.7 Total effects of the proposed measures

Introduction

The regulatory measures proposed earlier under section 8 can be divided in three different parts:

1. Regulations that affect the wild stocks selectively. Among these are closed areas outside and in rivers with wild stocks and pre-summer protection along the coast.

2. Regulatory measures that only affect the common level of exploitation in fishing of mixed stocks; among these are a conventional TAC and general limitations of fishing efforts.

3. A regulatory measure, type 2, which through redistribution of the catch between areas becomes selective and then belongs to category 1. This is primarily a TAC that to a greater or lesser extent is taken in fishing for mixed stocks or in terminal fishery of reared stocks alone.

It is difficult to estimate the combined effect of all measures, owing to their differing character, and the final result is therefore correspondingly uncertain. The probable effects are described below in the same order as described above.

Closed areas outside rivers with wild stocks

There are already closed areas outside rivers with wild stocks (section 8.3). From 1994-1996 fishing for salmon in these areas has been prohibited. The effect of this has been estimated for the salmon stocks in the rivers Byske älv and Ume älv. The estimate is based on recovery of tagged salmon:

	Ume älv	Byske älv
Recoveries from areas now included in closed areas	9	21
Recoveries from salmon ladders in rivers	24	10
Proportion of river stock caught in salmon ladder	90%	25%
Corrected size of river stock	27	40
% rise in salmon stock due to fishing ban in closed areas	33.3	52.5

The effect of the current ban on fishing in the closed areas can thus be estimated at an average of $(33.3+52.5)/2=42.9\%$. An extension of the present closed areas should increase spawn migration in the region of a further 10%, especially if the closed areas of rivers that lie near each other are connected over longer stretches of coast. This implies a reduction in F of about 0.1 (F = fishery exploitation).

Pre-summer protection in coastal fishery

The closing of coastal fishery now decided on by Finland, which it is here proposed should be implemented by Sweden for the first part of the coastal fishing season from 1997, affects wild stocks more than reared. This means that it has a positive selective effect on the wild stocks.

The Finnish regulations are expected to reduce catches along the Finnish coast by about 60-70% in comparison with the reference period (personal communication Erkki Ikonen, Game and Fishery Research Institute, Helsinki). According to the latest available data, coastal and offshore fishery in the Åland area will also comply with the Finnish regulations. Exploitation will decline differently for the stocks that migrate along the Finnish coast even in the Bothnian Bay and those that swim over to the Swedish coast in the

Kvarken area. A conservative average would be that selective catches (expressed as fishing exploitation, F) of wild Swedish stocks would decline by about $F=0.15$.

Further regulation of the opening period for Swedish coastal fishery from latitude $62^{\circ}30'$ and northwards can make the following contribution to the amount of spawning fish. The exploitation of various stocks along the Swedish coast is shown in figure 6. Apart from the expected high degree of exploitation in the river-mouth area of the home rivers, there is exploitation of 5-10% of the amount of recoveries in the rivers, in several areas at a further distance from the rivers. If coastal fishery down to and south of the river Ångermanälven is also regulated in the manner now intended, it seems probable that exploitation can be expected to decline by about $F=0.1$, providing the proposed dates are followed.

For the southernmost Swedish stocks in the Gulf of Bothnia, the effect of the Finnish regulations now decided on will be relatively small, but they will instead be somewhat more positively affected by the intended regulation of closed areas in the Swedish coastal fishery. Any extension of closed areas outside river-mouths will also have a preservative effect. Owing to local differences in conditions for possible increases in existing closed area, the additional wild salmon protection hereby provided will of course vary considerably. The total selective effect of the Swedish coastal controls here proposed and the corresponding Finnish controls decided on could therefore probably vary in the interval $\Delta F=0.2-0.4$ for various river stocks, i.e. an increase in the quantity of spawners of about 20-40% ($\Delta F=0.1+0.15+0.1=0.35$; cf. above).

Coastal fishery and TAC

The effects of coastal fishery controls have been combined with the effects of various TAC levels, figure 8. It has been assumed that the proposed regulations on coastal fishery would lead to a selective decline of $F=0.2-0.4$ more for wild stocks than it would for reared stocks. A reference line, $F=0$, has also been added to the diagram, which shows the trend if no restrictions in coastal fishery are introduced (the same line as is shown by the line for 0.5% roe-smolt survival in figure 4). A general reduction in all fishing areas is added to this reduction, due to a restrictive TAC. Below is shown at what TAC level the goal for 2010 can be achieved, depending on TAC and selective effects of the proposed coastal fishery controls. (In all the alternatives in the table below it is assumed that M74 mortality lies in the region of 75%, cf. end of section 8.1, p. 26).

Selective reduction in exploitation (F) of wild stocks due to coastal controls

	$\Delta F=0$	$\Delta F=0.2$	$\Delta F=0.3$	$\Delta F=0.4$
TAC (1,000s)	65	206	262	314
Smolt production in 2010	50% of pot.	50% of pot.	50% of pot.	50% of pot.

A TAC in the interval 206,000-314,000 individuals would take into consideration the effect of the proposed regulations of coastal fishery and provide the prospect of achieving the long-term goal **provided that mortality in M74 or for other reasons does not increase further and that the weakest stocks are not already so small that random variations can wipe them out**. Considering these risks, the biologically most responsible alternative of the above-mentioned TAC levels probably lies in the lower part of the interval, i.e. in the region of 200,000.

TAC with terminal fishery (within the quota) - a numerical example

In the compilation above effects were shown of reductions in fishery exploitation which occurred in a similar way throughout Baltic Sea fishery, at sea and in coastal fishery. This means that reductions occur both in areas where mixed stocks are exploited (in offshore fishery in the Main Basin), in partly mixed stocks (coastal fishery in parts of the Gulf of Bothnia) and in single salmon stocks (outside river mouths). An alternative exploitation model is that fishery instead is displaced towards fishing of single reared salmon stocks in river mouths, the so-called terminal fishery model (see section 8.3). This means - for one and the same catch quota - that exploitation at sea and along the coast would decline more than proportionally. To be able to make a more accurate assessment of the effect on the wild stocks, knowledge is required of two different factors which at present are not sufficiently well known:

1. The proportion of coastal fishery catches that occur in future terminal fishery areas.
2. The occurrence of wild fish in catches in terminal fishery areas.

The second of these two points is quite decisive for the success of the terminal fishery principle. It is assumed that fishing in these terminal fishery areas will be very intensive. This means that the exploitation of individual stocks will be high and in cases where there are wild stocks in neighbouring rivers, they can also be exploited in the terminal fishery area. The occurrence of wild salmon from the northern stocks in the Gulf of Bothnia must be kept at a lower level in terminal fishery than is the case in other sections of Baltic sea fishery. If this condition is not met it is to the advantage of the wild stocks if the catch (TAC) is taken in mixed fishing down in the Baltic Sea or in coastal fishery further away from the river mouths. If the entire TAC should fall to, say 200,000 individuals, the whole of the Swedish part of the TAC, 55,000 salmon with approximately the current quota distribution, could be fished up in terminal fishery areas.

We hope to be able to present a closer analysis in this respect later in the autumn (cf. section 11 item 1).

A possible model of how the regulation mechanisms affect each other is shown as an example in what follows.

For 1994-95 an average of 42,836 salmon were caught in coastal fishery and a total of 160,112 salmon at sea and on the coast. Coastal catches thus constituted 26.8% of the total Swedish catch within the catch quota. If 50% of the present coastal fishery catch is taken in future terminal fishery, it will be 13.4% of the present catch or 21,418 salmon. This effect already exists therefore in current fishing patterns and must be deducted if a larger proportion of the TAC is located in terminal fishery areas. The Swedish quota at present comprises 27.5% of the salmon TAC for the whole Baltic Sea (450,000 salmon in 1996). If we deduct 13.4% from the Swedish share, there remains 86.6%, which is 23.8% of the TAC. This figure represents that part of Swedish fishery that takes place in mixed stocks that are assumed to be quite homogeneous. If the occurrence of wild salmon from northerly stocks in terminal fishery is not zero, this must be taken into account and the effect on the TAC will be approximately as follows:

$$TAC_{diff} = {}^N TAC * {}^S TAC_{(\%)} * ({}^{Splan} TF_{Q\%} - {}^{Spres} TF_{Q\%}) * ((WN_{TAC\%} - WN_{TFO\%}) / WN_{TAC\%})$$

TAC_{diff}	=	Change in TAC
${}^N TAC$	=	Nominal TAC
${}^S TAC_{(\%)}$	=	Swedish proportion of total TAC
${}^{Splan} TF_{(Q\%)}$	=	Proportion of Swedish quota planned to be taken up in terminal fishery
${}^{Spres} TF_{(Q\%)}$	=	Proportion of Swedish quota taken up in terminal fishery at present
$WN_{(TAC\%)}$	=	Average proportion of wild northerly salmon in fishery within TAC
$WN_{(TFO\%)}$	=	Average proportion of wild northerly salmon in terminal fishery areas

One example: Total TAC is 200,000 salmon. The Swedish quota is 54,940 salmon. Sweden is assumed to take 50% of her quota in terminal fishery. The proportion of wild northerly salmon in the TAC is 6% and in the terminal fishery areas is at present estimated at 2%.

$$\text{Change in TAC} = 200000 * 0.2747 * (0.50 - 0.134) * (0.06 - 0.02) / 0.06 = 13,405 \text{ salmon.}$$

In this case the effect on the wild stocks has declined from a nominal TAC of 200,000 to an "effective TAC" of 186,595 individuals. What effect this has on the development of wild stocks can be seen in figures 4 and 8; i.e. the change in the fishing pattern in the example to 50% of the Swedish salmon quota being taken in terminal fishery means that a certain increased quantity of wild salmon is spared from being caught compared with the current fishing pattern. The saving will be the same if the TAC is reduced from 200,000 to 186,595. See the table below.

Catches in terminal fishery areas, % of Swedish salmon quota in the Baltic Sea	Effective TAC at different TAC levels, thousands			
	100	200	300	400
0	98	196	294	391
50	93	187	280	373
75	89	177	266	355
100	102	205	307	410
13.4 (pres.pos.)	100	200	300	400
25	84	168	252	336

In the table above is thus given the resulting "Effective TAC" if varying parts of the Swedish quota are taken in terminal fishery. The assumptions are as stated above: the proportion of wild salmon in terminal fishery is one third of what it is in mixed fishing (2% and 6% respectively) and at present 13.4% is fished in planned terminal fishery areas.

The Swedish salmon quota is at present divided in two parts; 75% of the catch is to be taken south of latitude 59°30'N and 25% north of this latitude. In the southern area there is almost exclusively offshore

fishery and in the northern area only coastal fishery (within the quota). Coastal fishery in the Gulf of Bothnia will in future consist of two components, partly the above-mentioned terminal fishery and partly the "common" coastal fishery outside the terminal fishery areas. For terminal fishery concentrated on reared salmon to increase in scope, it is presumed that the proportion of the quota caught north of 59°30'N can increase.

It is assumed that, with the pre-summer restrictions intended to be introduced in coastal fishery, "common" coastal fishery can be kept at a roughly constant level, even with a rise in the proportion of the quota allocated to the Gulf of Bothnia, and that the catch will therefore only rise in the terminal fishery areas. As has been pointed out above, the actual proportion of the coastal catch that can be caught in terminal fishery areas is uncertain. It is also quite possible that the quantity of wild salmon in terminal fishery areas will be lower than what has been assumed in the calculations shown here.

For these reasons it is hardly possible at present to say precisely how much wild salmon will be saved by the alternative of large quota displacements from south to north. That such a redistribution has several positive effects is however obvious. First of all the exploitation of wild salmon is reduced, secondly the exploitation of reared salmon is maintained at a high level and thirdly the interactions between different stocks will be decreased, for example strayers from rivers with reared stocks to rivers with wild stocks. Equally obvious is that these effects will be larger, the larger the proportion of the quota that is located to the Gulf of Bothnia.

TAC (thousands)	Effective TAC with different proportions of the Swedish quota north of 59°30' N				
	25 %	26,8 %*	50 %	75 %	100 %
100	100	100	96	91	86
200	201	200	192	182	173
300	301	300	287	273	250
400	401	400	383	365	346

* present situation

The table shows that, for example, an increase in fishing north of 59°30'N from 26.8% to 50% gives the same reduction in exploitation of wild salmon as a reduction in the TAC from 200,000 salmon to about 192,000 salmon, i.e. a saving of about 8,000 salmon, reared and wild together. This effect can thus be brought about by deciding on a 50/50 distribution of the Swedish salmon quota between the Gulf of Bothnia and the Baltic Sea Main Basin (south of 59°30'N).

The effect on wild salmon stocks of changing the TAC from the current conventional TAC to the "Effective TAC" can be evaluated from figures 4 and 8. It is clear that a cut in the total TAC level is the most important measure, but also that a redistribution of the TAC towards terminal fishery is of great importance in reducing the exploitation of wild stocks.

A change in the catch allocation north-south in accordance with what has been discussed above contains essential aspects of distribution that affect various categories of fishermen and their prospects of conducting operations. It is not within the discretion of the National Board of Fisheries to make decisions that have such consequences for redistribution policy.

9. Measures from 1998 and onwards

9.1 "The salmon package" with a central closed area and delayed release

The implications of the package solution

It appears from the report "Delayed release and closed areas - the saving of the salmon and salmon fishery in the Baltic Sea area" (1990) that results from large-scale taggings have shown that it is possible **both** to preserve naturally reproducing salmon stocks **and** maintain and in time probably even increase profitable salmon fishery in the Baltic Sea. The package solution contains the following main components:

- Protection of the salmon in its growing areas in the Baltic Sea, i.e. fishing of mixed stocks ceases entirely or at least in all essentials.
- Offshore fishery is compensated for the loss of traditional fishing opportunities through the establishment of fishing closer to the coast for spawning migrating salmon that is provided for fishing by delayed release on selected parts of the coast.

According to the report it is a **condition** of implementation that **both** these factors are fulfilled. If for example delayed release were applied on the southern coasts of the Baltic Sea without the cessation or at least reduction in all essentials of fishing of mixed stocks, conditions for the wild salmon would deteriorate further. The following measures are therefore required, according to the report:

- Continued release of reared smolt in harnessed rivers in accordance with water-court decisions.
- Closed areas at the river mouth outside all salmon and sea-trout carrying rivers and streams.
- If fishing in the Main Basin is restricted, offshore fishery north of latitude 60°N will increase and must be controlled.
- Coastal fishery north of latitude 60°N is controlled in relation to the capacity of individual salmon stocks.
- Fishing in the sea with professional gear is reserved for licensed professional fishermen. By professional gear is meant primarily salmon drift-nets, anchored floating nets, salmon drifting lines and anchored floating lines.
- The package is implemented as a joint international action.

As regards the general prospects of the "salmon-package" the following can be added:

- Fully implemented there will probably be no need for TAC and catch quotas for salmon.
- Possible catch quantities in professional fishing for returning, adult "delayed-release-salmon" are mainly determined by what quantities of smolt ("longer reared" and released with the delayed-release-technique) it has been decided to release in the area in question. ("As you sow may you reap"). Such fishing can thus be planned in quite another way than what has been possible with the fishing pattern applied hitherto in current fishery management in the Baltic.

The preservation of salmon in the North Atlantic in comparison with the Baltic Sea

In the north-east Atlantic fishing is controlled by the so-called North Atlantic Salmon Convention. The

convention has been ratified by all states/parties that produce salmon with the North Atlantic as growing area, thus including Sweden. All affected countries have thereby undertaken not fish salmon in the north-east Atlantic sea area outside the 12-sea-mile limit (with certain exceptions for the Faroe Islands). This restriction was introduced at the beginning of the 1980s.

The underlying reason for the general fishing ban in the north-east Atlantic was much the same as the long prevailing situation of salmon in the Baltic, namely marked over-fishing of the natural salmon stocks in their growing areas in the sea.

The main purpose of the convention is to eliminate exploitation during the period of life when the various populations of salmon form mixed stocks in the growing areas in the sea ("interceptational fishery"), where there is no possibility of dimensioning fishery in relation to the capacity of each stock. Catches are instead concentrated to areas nearer the coast (inside 12 sea-miles) where there are greater opportunities for stock adjusted exploitation. Sweden thus applies on the grounds mentioned a salmon fishing ban outside the 12-sea-mile-limit in Skagerrak-Kattegatt. It can accordingly be observed that Sweden applies different policies for salmon fishery in the Atlantic and the Baltic.

The restrictions on offshore fishery for salmon in the north-east Atlantic entailed by the salmon convention have been implemented **without** conditions for any general compensation for offshore fishery's loss of traditional catch domains. However, the package solution above offers a previously undeveloped opportunity on the part of the Baltic **both** to save the naturally spawning salmon stocks **and** to facilitate professional fishery in the sea for salmon, though closer to the coast than at present.

One objection that has previously been made to salmon fishery closer to the coast in accordance with the "salmon package model" is that crowding and obstruction will arise at the fishing sites with the drift-net's length of 21 km. Against this it may be said that the concentration of salmon is estimated to be sufficient to give profitable catches from fishing with considerably shorter lengths of drift-net than are now usually used. Another important aspect in this context is that areas with fishing for salmon under the "salmon package model" can be chosen where the risk of incidental catches of marine mammals is as little as possible.

9.2 Increased mesh size

Experiments were made in 1990 to study the effect of increased mesh size in salmon drift-net (Karlsson and Eriksson 1991). They showed that the quantity of spawners (escapement) could increase by up to about 80% if the mesh size of drift-nets was raised from the present 160 mm (stretched mesh) to 180 mm. This was for the period before a TAC was introduced. Provided an effective TAC is in force, a modest increase in mesh size (up to about 200 mm) will have little effect on the stocks of wild salmon. If the mesh size rises above about 200 mm, the exploitation of salmon with up to two sea years will decline so much that it will probably have consequences for the catch per unit of effort and escapement. Profitability in offshore fishery is strained at present and the great investment required to change to a new mesh size would be difficult to carry out. It is therefore likely that fishing with drift-nets would decline considerably if it were considered appropriate to increase mesh size.

In the opinion of the National Board of Fisheries, the possibility of bringing about an improvement in the status of wild salmon stocks by means of a substantial increase in the minimum permitted mesh size of salmon nets (of the order proposed by the Finnish inquiry, namely about 225 mm., from the current 157 mm.) should be a secondary alternative to the main proposal for carrying through the "salmon package" internationally as soon as possible, i.e. to change the pattern of exploitation in the Baltic Sea so that mixed

stock fishery ceases or at least declines radically, and that professional fishing is aimed at catching salmon nearer the coast, comprised predominantly of reared salmon released under the delayed release technique.

10. Socio-economic issues

The "salmon package" model means that no greater restrictions need be made in the overall profitability of professional fishery. Fishing will on the contrary probably increase in the long run. The national Board of Fisheries has commenced certain studies of fishery economy in respect of salmon fishery and the Board will return to the question in more detail in the section of the assignment concerning socio-economic questions.

As appears from the section above on the fishing tourism industry, there are very good prospects, if the measures proposed by the National Board of Fisheries are implemented, of developing fishing tourism operations which not least in areas with unemployment can provide good opportunities for the creation of new jobs.

11. Research and investigation needs

Short-term steps

1. To be able to minimize catches of wild salmon in the proposed terminal fishery areas it is important that they are demarcated in the best possible manner. For this to be possible, all available information should be utilized to the full. This means that tagging data, information on wild salmon migration etc. must be compiled before the *final formulation of these areas can take place in the autumn of 1996*.
2. It is proposed that all reared salmon in the Baltic Sea should be adipose fin clipped for a period of (2)-4 years as an aid in the management of wild and reared salmon. Adipose fin clipping should be formulated as an international project so as best to be able to synchronise the time-limited project and maximize the outcome for future management. During the period of the project it should be evaluated whether adipose fin clipping should remain as a normal element in all release of reared salmon in the Baltic Sea.
3. Plans should be drawn up for the implementation of enhancement releases on a large scale if the proposed fishery controls do not come into force or the measures do not have the desired effect on the size of stocks. The plans should be drawn up as early as 1996 -1997 and they should be implemented before the year 2000 if the size of stocks does not increase in the way intended.
4. It should be investigated whether the establishment of goals for the quantity of spawning fish (escapement) for individual wild salmon stocks is a suitable management instrument. It is partly a question of the theoretical background, but also the practical formulation, for example measuring how the goal is achieved and the consequences for management of whether the goal is achieved or not.
5. One or preferably two Swedish salmon rivers in the Baltic Sea area should be established as so-called index rivers, where the salmon stocks are followed particularly closely over a long period. This means among other things that escapement, parr production and smolt migration are monitored annually over a long succession of years. In these rivers survival during various phases of life can among others be studied closely. On account of the large, long-term investment that is required, the project should be formulated and implemented in co-operation between the National Board of Fisheries and other organisations. Suitable rivers can be selected from such as Åby älv, Byske älv, Ume/Vindelälven and Mörrumsån.

6. Experiments with delayed release technique should be carried out as soon as possible in other countries round the Baltic.

12. References

Karlsson, L. and Eriksson, C. 1991. Experimental fishery with salmon drift nets of different mesh sizes in the Baltic in the autumn of 1990. ICES C.M. 1991/M:13.

Karlsson, L., Karlström, Ö and Hasselborg, T. 1995. Laxens lekvandringstid i Bottniska Vikens kustområden och dess samband med havsvattentemperaturen. Salmon Research Institute. Comm. 1/1995.

Karlström, Ö. 1995. Salmon parr (Samo salar L.) production and spawning stocks in Baltic salmon rivers in northern Sweden 1976-94. ICES C.M. 1995/M:23.

Weissglas, G., M. Alatalo and H. Appelblad. 1996. Lax i strida strömmar. Sportfisket som regional utvecklingsresurs. Final report from the project Laxen tillbaka till våra älvar. Department of Social and Economic Geography, Umeå University. GERUM No. 31, 1996.

Table 1. Wild salmon smolt production (x1000) in Baltic rivers after 1980.

Region, Sub-div. och land	Vattendrag	Reprod. areal ha	Potentiell prod.	1980s					Prog.	
				1980s	1992	1993	1994	1995	1996	1997
Bottniska Viken, Sub-div. 31										
Finland	Kiiminkijoki	90	30	+	+	+	+	+		
	Pyhäjoki	100	40	+	+	+	+	+		
	Simojoki	255	75	10	17	10	12	1.4	0.6	2.3
Finland/Sverige	Torniojoki; Torneälv	5000	500	75	75	125	200	75	75	121
Sverige	Kalix älv	2500	250	50	75	88	130	44	44	60
	Råne älv +	390	20				3.2	1.2	1.3	1.3
	Pite älv +	435	33					3	3	5
	Åby älv +	80	16				3.6	1.2	1.4	1.8
	Byske älv	530	80	15	18	23	22	8.7	6.5	12
	Sävarån+	20	4							
	Rickleån+	15	5							
	Vindelälven	1000	200	25	20	23	39	15	14	14
	Öre älv+	100	20		+	+		0.9	0	0.9
	Lögde älv+	95	19		+	+	2.3	0.9	1	1
		Summa av sv. +			5	15	20			
Total Sub-div. 31		10610	1292	180	220	289	412	151	146.8	219.3
Bottniska Viken, Sub-div. 30										
Sverige	Ljungan	20	10	10	10	15	4	4	4	
Total Bottniska V., Sub-divs. 30-31		10630	1302	190	230	304	416	155	151	
Egentliga Östersj. Sub-divs. 24-29										
Sverige	Emån		20		5	5	4	4	3	
	Mörrumsån		120		110	90	60	30	60	
Total Sverige			140		115	95	64	34	63	
Estland	Pärnu									
Lettland	Irbe				10	10	10	8	7	
	Venta				15	15	15	15	15	
	Saka				10	10	10	10	10	
	Salaca				26	22	15	15	15	
	Vitrupe				5	5	5	5	5	
	Peterupe				5	5	5	5	5	
	Gauja				20	17	13	13	14	
	Daugava				5	5	5	5	5	
	Andra				4	3	3	4	4	
	Total Lettland				100	92	81	80	80	
Litauen	Neumunas, (Minija) och andra		150		20	20	20	20	20	
Total Estland, Lettland och Litauen					120	112	101	100	100	
Total Eg. Östersjön, Sub-divs. 24-29					235	207	165	134	163	
Bottn. Viken+Eg. Ö. Sub-divs. 24-31					465	511	581	289	314	
Finska Viken, Sub-div. 32										
Finland	Vantaanjoki	10	20							
	Kymijoki	50	100					3	3	
Ryssland (1)	Neva									
Estland	Luga									
	Kunde									
	Silja									
	Loobu									
	Pirita									
	Vasalemme									
	Keila									
Total Estland			15	15	15	15	15	7	7	
Total Finska V., Sub-div. 32		60	135	15	15	15	15	10	10	
Total Östersjön, Sub-divs. 24-32					480	526	596	299	324	

+= Low and uncertain production

1. No data available from the rivers Neva and Luga

Table 2. M74 related mortality (in %) of different populations of Baltic salmon 1985-1995 and a prognosis for 1996.

Älv	Sub-div.	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996
Simojoki	31								46	94	75	69	
Torne älv	31								70	74	85	66	
Lule älv	31								58	66	57	48	61
Skellefteälven	31								40	49	69	49	
Ume/Vindelälven	30	40	20	25	19	16	31	45	77	88	85	74	78
Ångermanälven	30								50	77	64	45	
Indalsälven	30	4	7	8	7	3	8	7	45	72	65	52	
Ljungan	30								60	97	50		
Ljusnan	30							17	33	59	86	52	
Dalälven	30	28	8	9	20	11	9	21	79	85	53	55	55
Mörrumsån	25	47	49	65	46	58	72	65	55	96	90	65	
Neva/Åland	29								-	70	50		
Neva/Kymi	32								45	60-70	-	30	
Mean		29.8	21.0	26.8	23.0	22.0	30.0	31.0	54.8	77.3	69.1	55.0	64.7

Table 3. Number of salmon females of salmon populations in rivers at the Bothnian Bay required to give a production level of 50 % of the potential smolt production.

Country	River	Potential smolt production (x1000)	Number of salmon females required to give 50 % smolt production	
			Low level of M74	High level of M74
Finland	Kiiminkijoki	30	187	374
	Simojoki	75	468	936
Finland/Sveri	Torne älv	500	3122	6244
Sverige	Kalix älv	250	1561	3122
	Råne älv	20	125	250
	Pite älv	33	206	412
	Åby älv	16	100	200
	Byske älv	80	500	1000
	Sävarån	4	25	50
	Rickleån	5	31	62
	Ume/Vindelälv	200	1249	2498
	Öre älv	20	125	250
	Lögde älv	19	119	238
	Ljungan	10	62	125
	Total		1262	7880	15761

Table 4. Salmon catches in the Gulf of Bothnia 1981-1995.

Year	Bothnian Bay																	
	Finland					Sweden					Total catch				Finland	Sweden		
	Sea	Coast	River	Total catch	Sea	Coast	River	Total catch	Sea	Coast	River	Total catch	Sea	Coast	River	Total catch	Total catch	Total catch
1981	125	157	6	288	26	242	35	303	151	399	41	591	663	705				
1982	131	111	3	245	0	135	30	165	131	246	33	410	543	542				
1983	176	118	4	298	0	140	32	172	176	258	36	470	645	544				
1984	401	178	5	584	0	140	52	192	401	318	57	776	1073	745				
1985	247	151	4	402	0	114	38	152	247	265	42	554	963	999				
1986	124	176	5	305	11	146	41	198	135	322	46	503	1000	966				
1987	66	173	6	245	8	106	35	149	74	279	41	394	1051	1040				
1988	74	146	6	226	1	141	45	187	75	287	51	413	797	903				
1989	225	207	6	438	10	281	63	354	235	488	69	792	1166	1411				
1990	597	680	14	1291	12	395	93	500	609	1075	107	1791	2295	1458				
1991	580	523	14	1117	1	350	84	435	581	873	98	1552	2172	1090				
1992	487	746	14	1247	7	386	87	480	494	1132	101	1727	2121	1181				
1993	279	426	16	721	10	267	83	360	289	693	99	1081	1626	1126				
1994	238	269	14	521	0	179	70	249	238	448	84	770	1208	842				
1995(1)	52	279	7	338	0	214	94	308	52	493	101	646	1195	792				

1) Prel. catch

Table 5a. Number of gears per county divided into commercial fishery and other fishery.

County	Commercial fishery	Other fishery	Sum	Percentage commercial fishery	Percentage gear
Norrbotten	286	238	524	55	50
Västerbotten	99	77	176	56	16
Västernorrland	80	107	187	43	17
Gävleborg	100	50	150	67	14
Uppsala	20	15	35	57	3
Sum	585	487	1072	55	100

Table 5 b. Number of gear in different parts of the County of Norrbotten, divided into commercial fishery, other fishery and main target salmon stock

Area	Commercial fishery	Other fishery	Total number	Percentage	Salmon stock
				Commercial fishery	
Haparanda	79	65	144	55	Torne, wild, (Kalix)
Kalix	54	53	107	50	Kalix, wild
Råneå	7	46	53	13	Råne, wild
Luleå	107	36	143	75	Lule, reared
Piteå	39	38	77	51	(Pite,wild), Lule, reared
Sum	286	238	524	55	

Table 5c. Number of gear in different parts of the County of Västerbotten, divided into commercial fishery, other fishery and main target salmon stock

Area	Commercial fishery	Other fishery	Total number	Percentage	Salmon stock
				Commercial fishery	
Renholmen - Byske	13	1	14		Åby-Byske, wild
Östanbäck - Fjällbäcken	4	4	8		"
Kågnäset	3		3		
Ursviken - Skellefteå	13	3	16		Skellefte, reared
Örviken - Burvik	27	26	53		"
Bjurön - Lövsele	11	8	19		
Gumboda - Ostrnäs	1	9	10		
Holmön	0	9	9		Mixed stock
Täfteå	3	4	7		
Täfteå - Holmsund	14	2	16		Ume, reared Vindel, wild.
Obbola - Sörmjöle	9	5	14		"
Hörnefors - Ava	1	6	7		Öre-Lögde, wild
Sum	99	77	176	56	

Table 6. Number of fixed gears in the counties of Norrbotten and Västerbotten, 1978-1994

Year	Fyke net	Trap	Salmon net	Sum
County of Norrbotten, number of gears				
1992	181	460	2	643
1988	169	517	7	693
1982	445	496	10	951
1978	739	255	0	994
1958	2241	0	0	2241

County of Västerbotten, number of gears

1994	46	124	6	176
1991	62	129	19	210
1987	69	146	28	243
1982	111	196	25	332
1979				318

Table 7. Releases of reared salmon smolts and production of wild salmon smolts in the Gulf of Bothnia.

River	Smolt number				
	reared	wild current	Sum wild current wild+reared	wild potential	Sum potential wild+reared
Sweden					
Lule älv	540 000				
Skellefte älv	118 500				
Ume älv/Vindelälven	94 000				
Sum Bothnian Bay	752 500	180 000	932 500	1 111 000	1 863 000
Gideälven	6 000				
Ångermanälven	210 000				
Indalsälven	320 000				
Ljungan	30 200				
Ljusnan	214 000				
Dalälven	190 000				
Sum Bothnian Sea	970 200	4 000	974 200	10 000	980 000
Sum Sweden	1 722 700	184 000	1 906 700	1 121 000	2 843 000
Finland					
Kemijoki	615 000				
Iijoki	310 000				
Oulujoki	200 000				
Sum Bothnian Sea	1 125 000				
Other production	250 000				
Total sum	1 375 000	43 000	1 418 000	310 000	1 685 000
Bothnian Sea, Neva salmon	100 000	0		0	100 000
Finland, total sum	1 475 000	42 000	1 517 000	310 000	1 785 000
Sweden and Finland total sum	3 197 700	227 000	3 424 700	1 431 000	4 628 000

Table 8. Recaptures of salmon from seven rivers from north to south along the Swedish coast of the Bothnian Bay. Recaptures in % of the number of river recaptures of the smolt year classes 1980-1994. m= river mouth.

Område	Lule älv	Skellefteälven	Ume älv	Ångermanälven	Indalsälven	Ljusnan	Dalälven	Summa
211	7.52	.	0.76	.	.	.	0.25	33
212	19.9	.	.	.	.	.	.	82
Lule m.	272.82	3.04	2.27	.	0.43	0.64	1.27	1143
214	54.85	13.04	0.76	.	.	.	1.27	262
221	4.13	10.43	1.52	0.09	.	0.32	.	45
222	0.24	14.78	.	.	.	.	.	35
Skellefte	9.95	254.35	1.52	0.09	.	.	.	629
224	0.24	19.57	3.03	.	.	.	.	50
225	1.94	16.52	1.52	.	0.21	.	0.51	51
226	0.97	11.3	0.76	.	.	.	.	31
227	0.49	2.17	6.06	0.09	.	.	0.25	17
228	9.22	10	6.82	0.27	.	0.32	.	74
Ume m.	2.91	4.78	137.12	1.28	0.64	1.59	0.51	228
232	0.24	0.87	3.79	0.09	.	0.32	.	10
233	0.24	0.43	5.3	0.18	.	.	.	11
241	2.91	1.74	5.3	3.74	1.28	5.41	1.02	91
242	4.13	3.04	21.97	3.47	1.06	4.46	2.29	119
243	0.97	.	4.55	0.73	0.85	0.64	0.76	27
Ångerma	6.8	2.17	35.61	49.73	24.26	17.83	5.09	815
245	3.64	0.87	10.61	11.41	36.81	9.55	1.53	365
Indal m.	1.94	2.17	5.3	5.29	177.66	9.87	1.78	951
247	.	.	1.52	0.73	7.87	1.27	1.27	56
251	0.73	0.87	0.76	1.09	2.77	11.15	0.51	68
252	0.24	.	.	.	.	0.32	.	2
Ljusnan	0.73	.	9.09	1.73	1.91	112.74	5.6	419
254	0.97	1.3	7.58	2.55	4.26	46.82	12.21	260
255	.	.	0.76	0.82	0.43	8.28	25.19	137
Dalälven	.	.	.	0.73	.	5.1	69.72	298
262	.	.	.	0.46	0.21	1.91	8.91	47
263	0.49	0.43	.	.	0.21	.	.	4
264	0.24	0.87	2.27	0.27	0.85	0.32	1.78	21
265	.	.	0.76	0.09	.	1.59	1.02	11
Älv	100	100	100	100	100	100	100	3047
Summa	509.47	474.78	377.27	184.95	361.7	340.45	242.75	9439

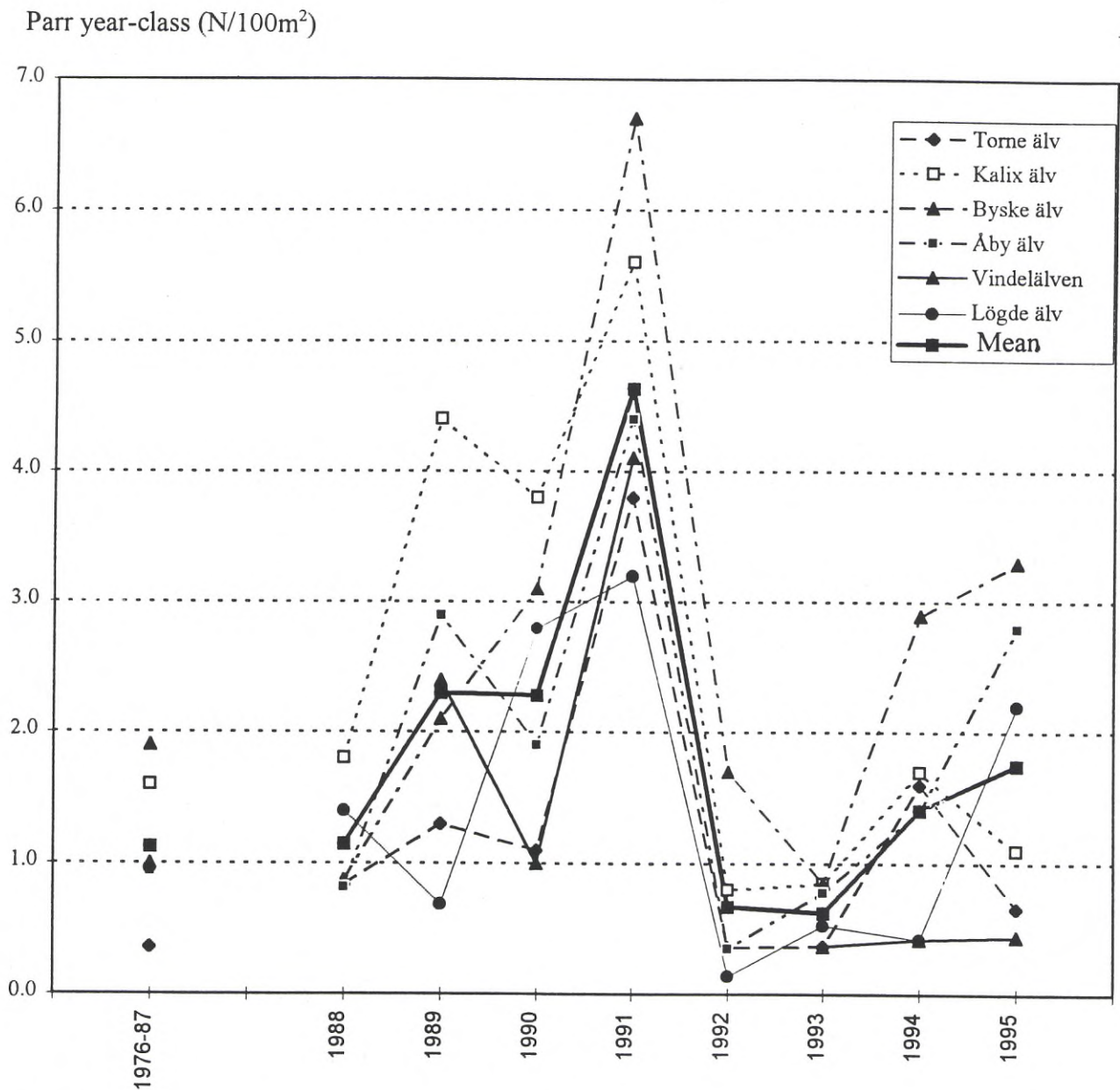


Fig.1 Generation strength in Torne älv, Kalix älv, Byske älv, Åby älv, Vindelälven, Lögde älv and mean for all rivers. Hatching generations 1976-1995.

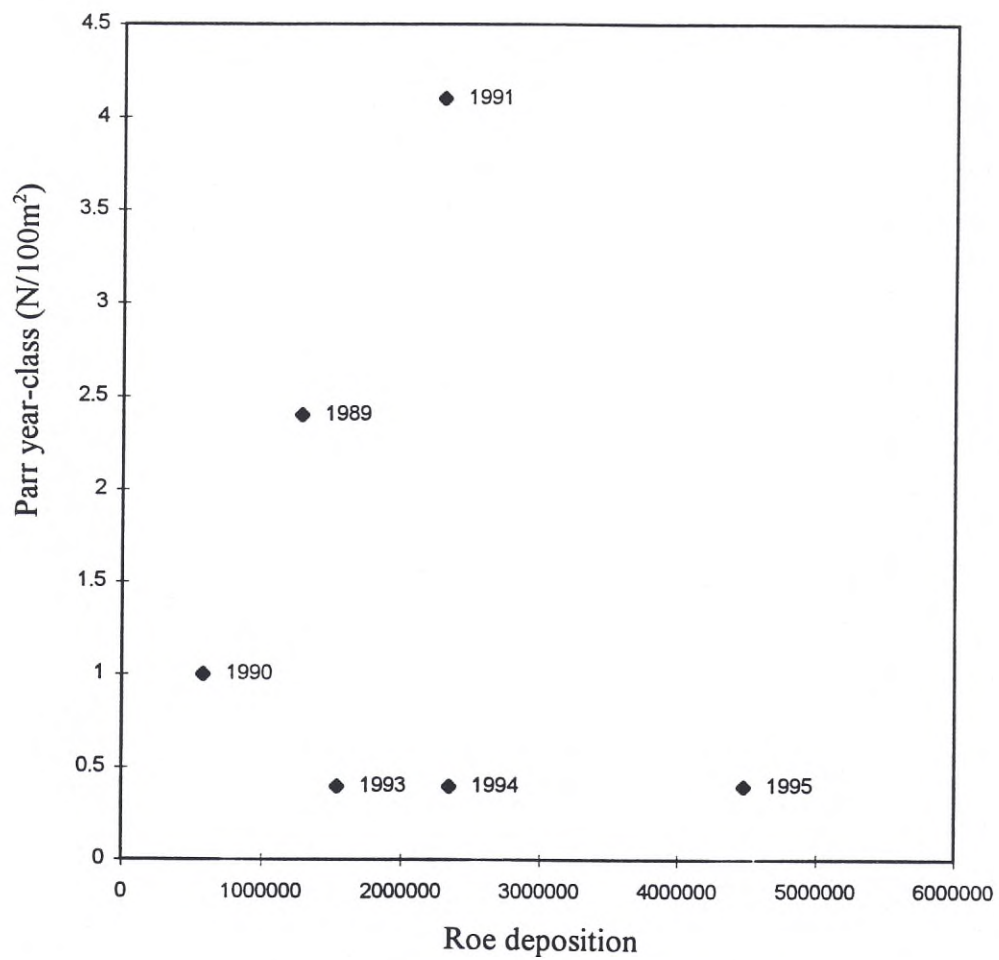


Fig. 2 Density of salmon 0+stirr in the river Vindelälven in relation to the quantity of roe 1989-1995.

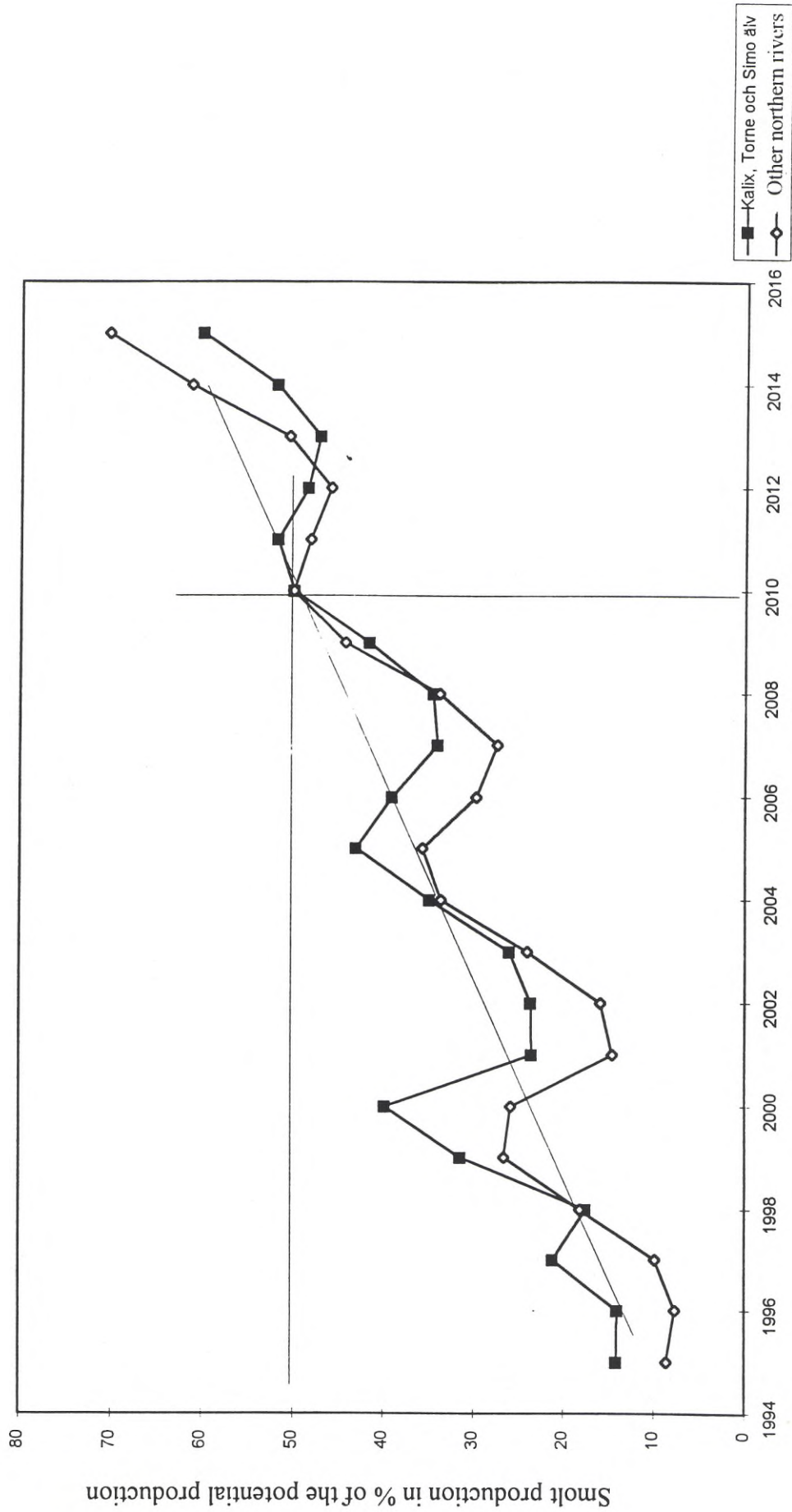


Fig. 3 Annual salmon smolt production in % of the potential production.

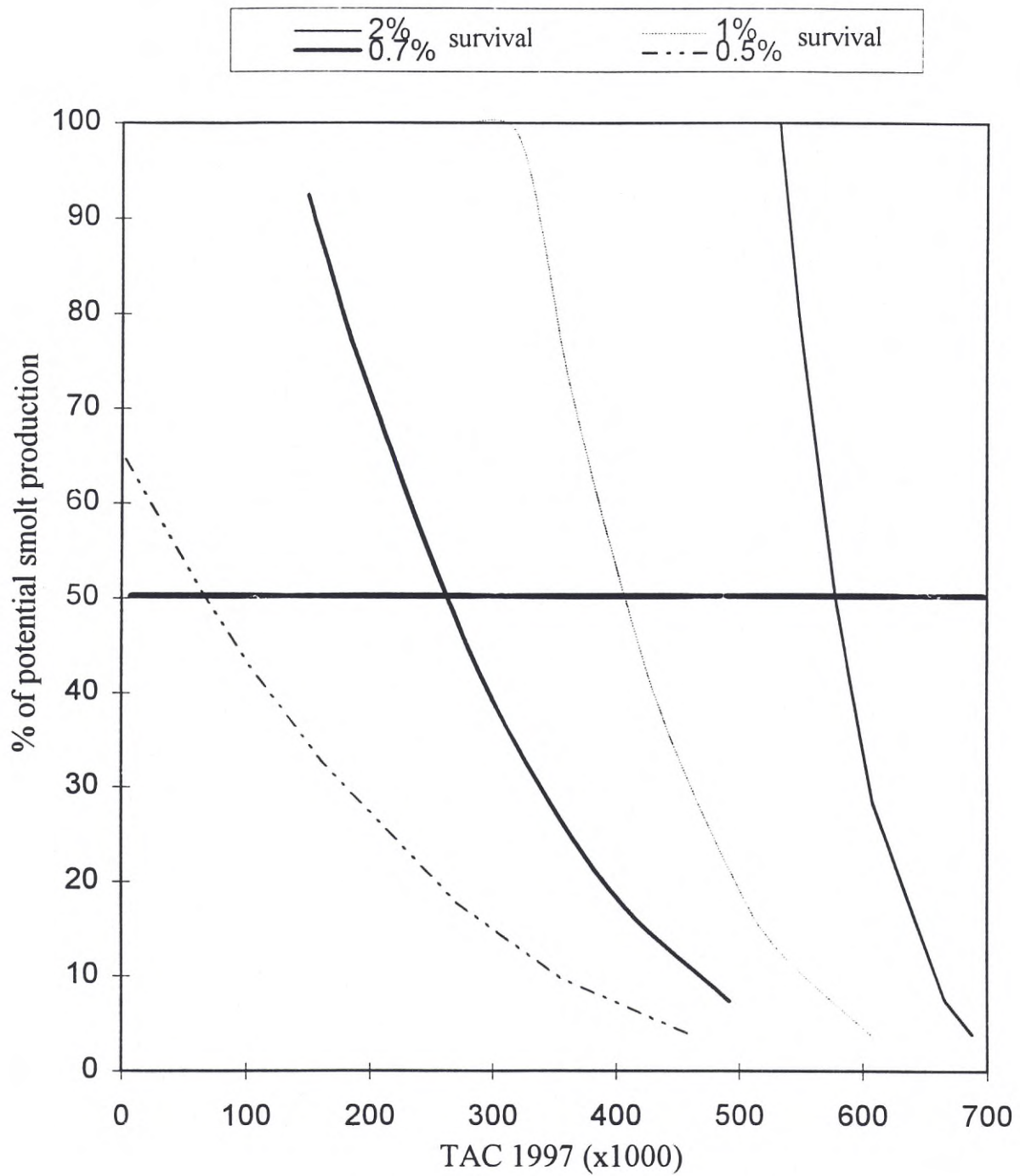
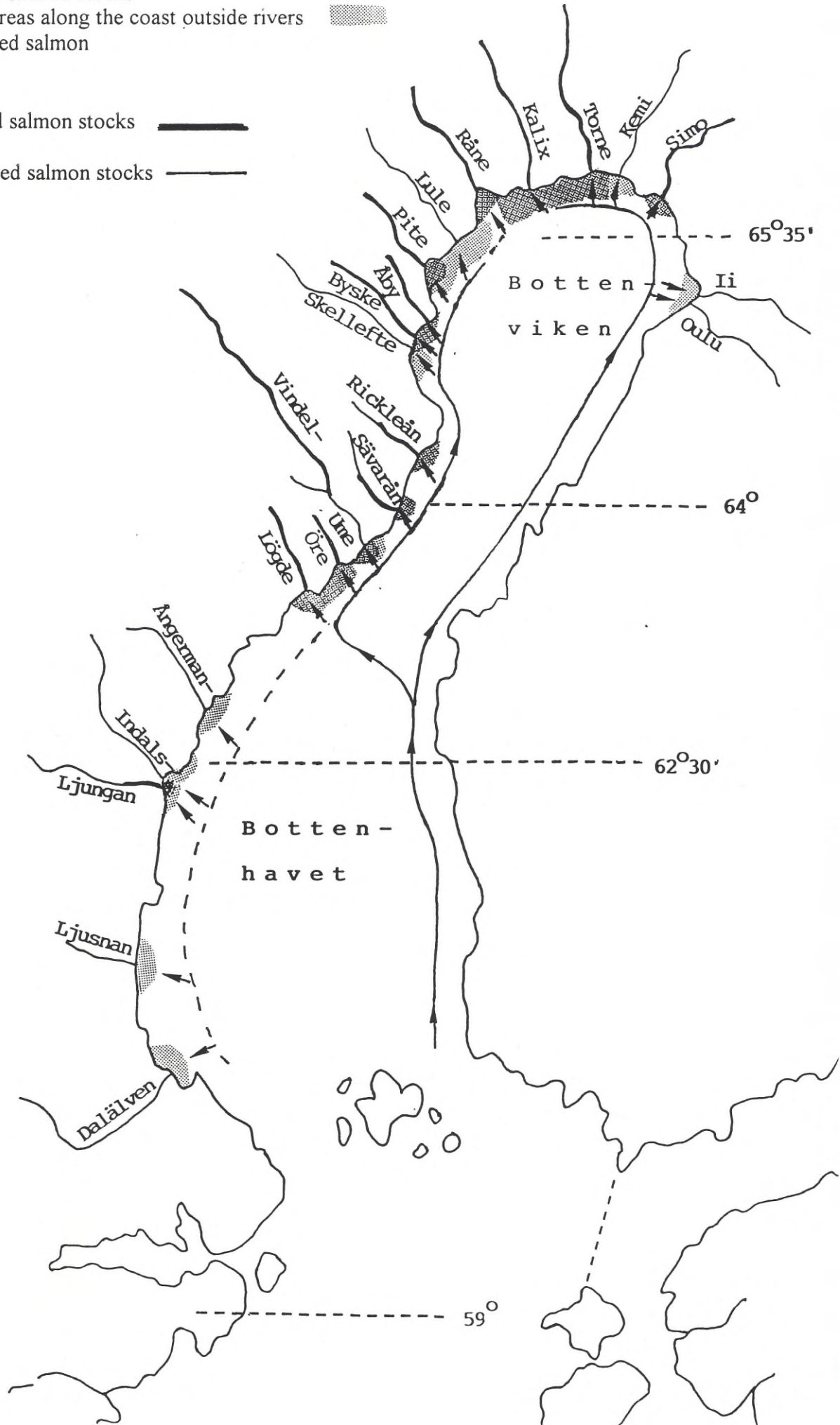


Fig. 4 Smolt production in the year 2010 in the rivers along the coast of the Bothnian Bay in relation to TAC 1997 and different roe-smolt survival.

Fig. 5 Closed areas along the coast outside rivers with wild salmon stocks
 Fishing areas along the coast outside rivers with reared salmon

Rivers with wild salmon stocks ———
 Rivers with reared salmon stocks ———



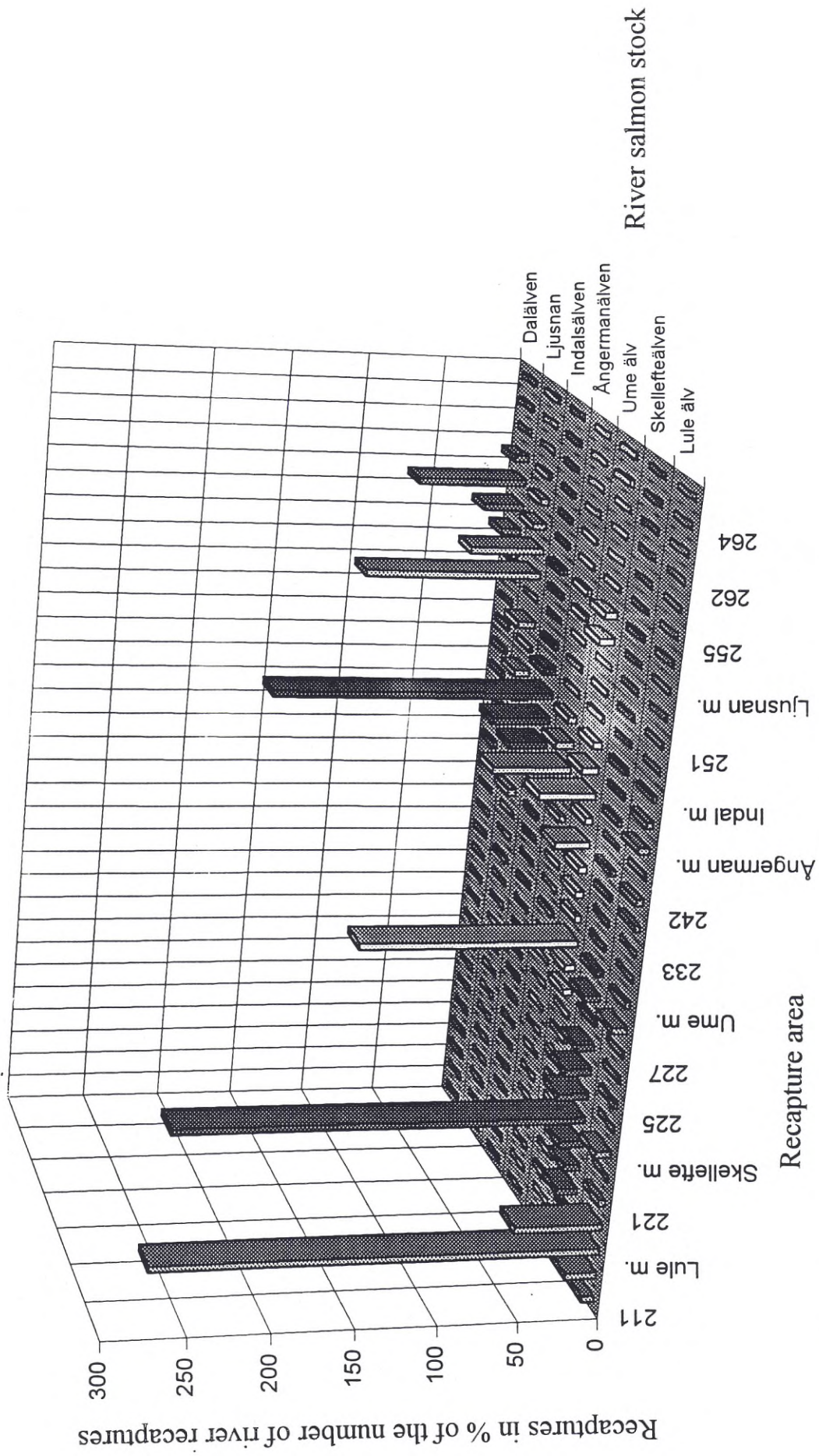


Fig. 6 The exploitation of salmon stocks along the coast of the Gulf of Bothnia

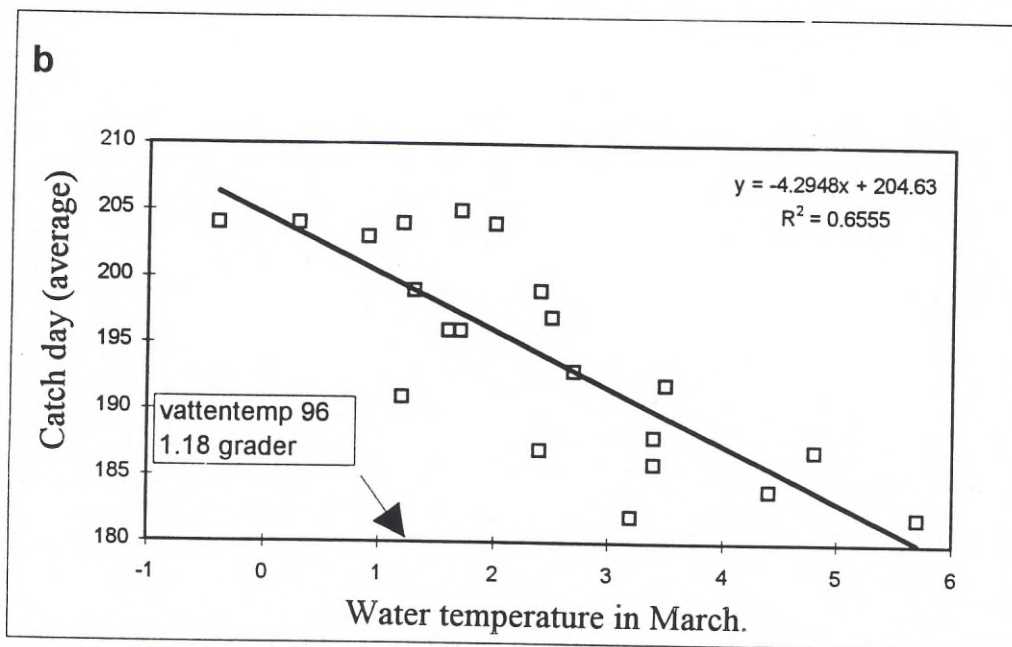
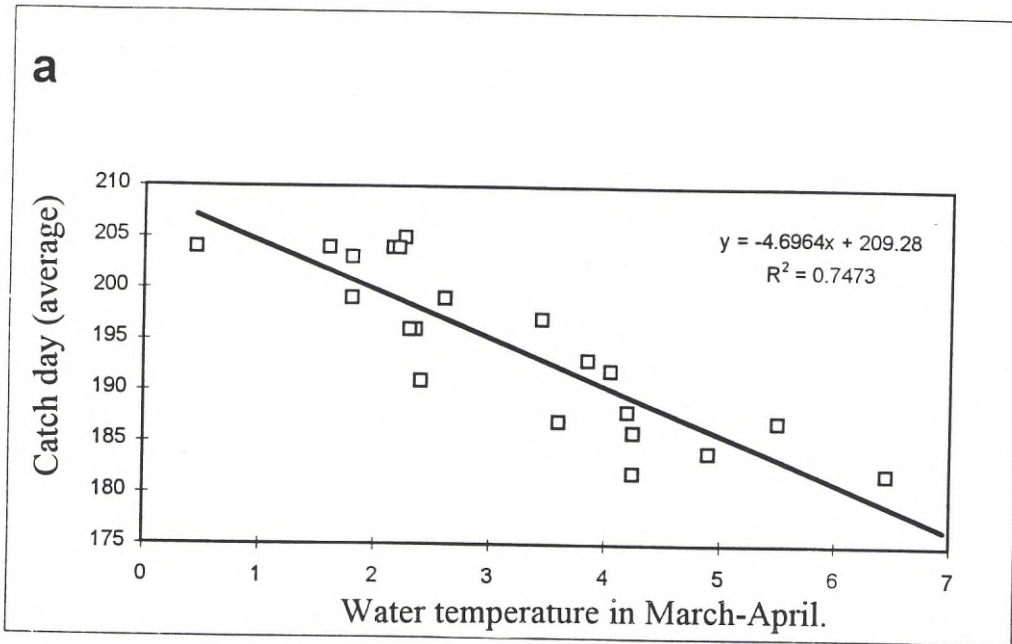


Fig. 7 Time for spawning migration 1974-1994 related to water temperature in the central Main Basin of the Baltic. a = Water temperature in March-April. b. Water temperature in March.

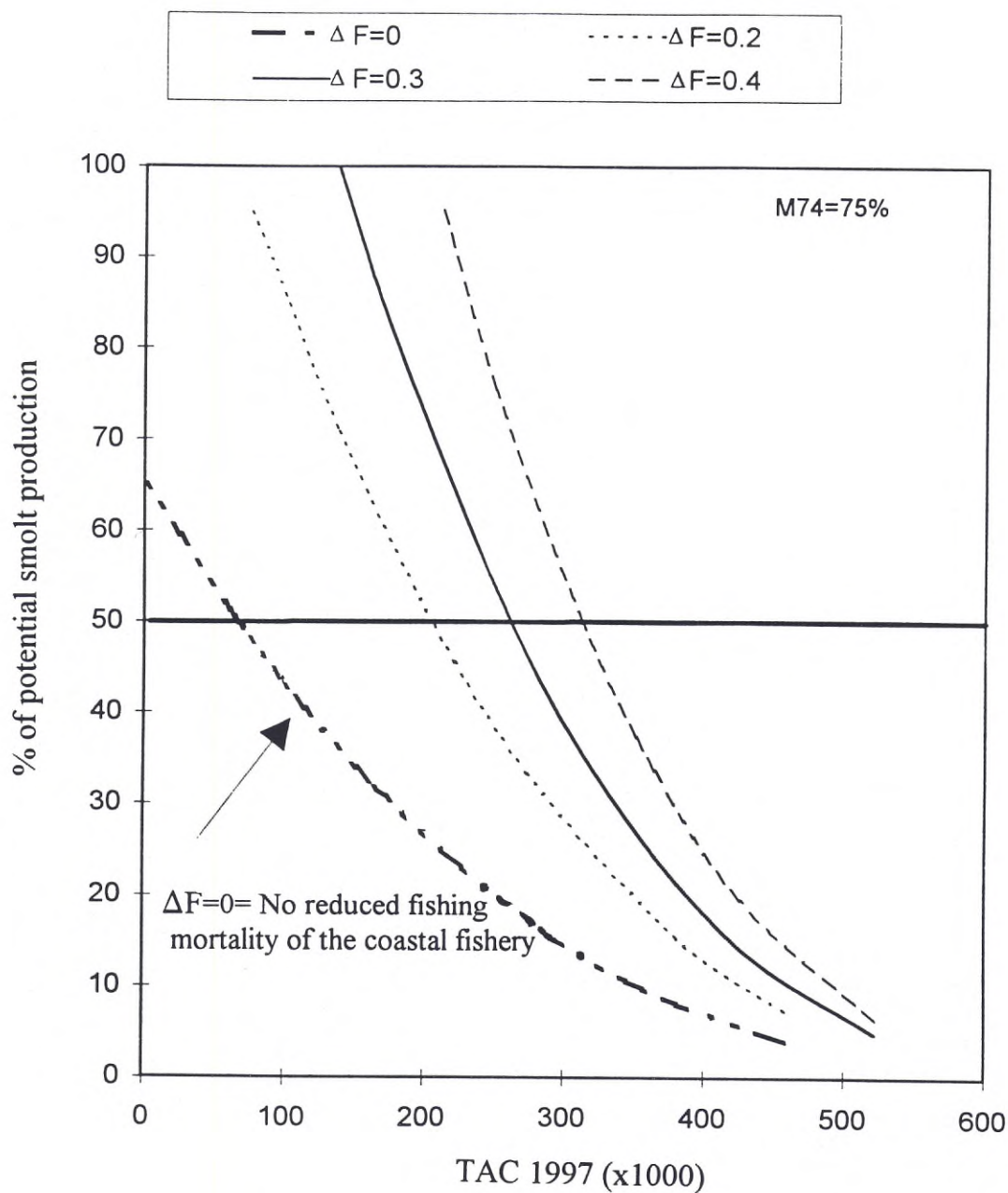


Fig. 8 Smolt production in the year 2010 in rivers along the Gulf of Bothnia in relation to TAC 1997 and reduction of the fishing mortality, ΔF , due to proposed fishing regulations along the coast. ΔF indicates a probable development if no regulations are introduced to the coastal fishery.



STATEMENT OF INTENT



The Problem

Fish has never been more popular ... nor more threatened. Worldwide consumer demand for fish is steadily rising; but scientists warn that fish stocks are in serious decline.

In some areas, excessive fishing has driven staple species such as Atlantic cod commercially extinct. Nearly everywhere, fisheries that have sustained coastal communities for generations have suffered serious declines. Indiscriminate fishing practices kill and waste vast amounts of fish and other marine life annually.

A Global Solution

Two global organisations have committed to tackling this issue. WWF (the world's largest private, non-profit conservation organisation) wants a new approach to ensure more effective management of marine life. Unilever PLC/NV (a major buyer of frozen fish and manufacturer of many of the world's best known frozen fish products under such brands as Iglo, Gorton's and Birds Eye UK) is committed to long-term fish stock sustainability to ensure a future for its successful fish business.

Different motivations, but a shared objective: to ensure the long-term viability of global fish populations and the health of the marine ecosystem on which they depend.

How Will This Partnership Work?

The end objective of the partnership between WWF and Unilever is to establish, through consultation, an independent Marine Stewardship Council (MSC) which will create market-led economic incentives for sustainable fishing.

The MSC will be an independent, non-profit, non-governmental membership body. It will establish a broad set of principles for sustainable fishing and set standards for individual fisheries. Only fisheries meeting these standards will be eligible for certification by independent, accredited certifying firms. Products from certified fisheries will eventually be marked with an on-pack logo. This will allow consumers to select those fish products which come from a sustainable source.

Once established, the MSC will be independent of both industry and conservation organisations and be governed by a board of directors made up of experts from a variety of backgrounds.

The MSC will be modelled on the successful Forest Stewardship Council (FSC), launched by WWF, other conservation groups and timber traders in 1993 to promote a market-led solution towards more sustainable forestry practices around the world.

To create the MSC, WWF and Unilever will contribute matching funds into an extensive scoping exercise to explore how the FSC model can be adapted to meet the specific sustainability needs of global marine fisheries. This study will be undertaken by a number of consultants, coordinated by an independent project manager. It will result in a draft set of founding principles for the MSC.

These draft principles will be generated by and circulated to a broad spectrum of experts in fisheries - including fishing and industry groups, conservationists, regulators and academics. An open series of national and regional consultations and workshops around the world will then be held to refine and strengthen the principles and agree a process for international implementation.

WWF and Unilever are committed to supporting the process of agreeing the principles and establishing the MSC within two years. They will actively seek the widest possible involvement from other organisations in achieving these goals.

Dr. Robin Pellew,
on behalf of WWF International

Antony Burgmans,
Director, Unilever PLC/NV



Embargoed 00:01 22 February 1996

MAJOR NEW INITIATIVE TO HALT DECLINE IN FISH STOCKS

A major new initiative to halt the serious decline in global fish stocks was announced today (Thursday 22 February) by the World Wide Fund for Nature (WWF) and Unilever Plc/Nv, one of the world's largest buyers of frozen fish.

They have agreed to create a Marine Stewardship Council (MSC) to promote market-led incentives for sustainable fishing, and are embarking on a wide ranging process of consultation with all those concerned with fisheries and the marine environment.

Acting as a wholly-independent body, the MSC will set out broad principles of sustainable fishing, and lay down specific standards for individual fisheries. Products made from fish caught in accordance with those standards will receive an MSC 'on-pack' logo. This will allow consumers to select fish products which come from a source certified as sustainable.

The initiative represents a sea change in efforts to promote sustainable fishing. It is modelled on the Forest Stewardship Council (FSC), which has adopted a similar approach to sustainable forestry.

The decline in fish stocks poses a serious threat to the long-term viability of common commercial species such as cod, haddock and tuna. It also threatens the future of fishing communities in Europe and across the world. In developed countries, hundreds of thousands of jobs are at risk if the situation is not reversed. In the third world, entire communities dependent on fishing face economic and social collapse.

Repeated efforts to tackle the problem at the political level, mainly through setting catch quotas, have so far failed to halt the decline. WWF and Unilever believe that a market-based approach holds out the best hope of a solution, by uniting industry and consumer in a common endeavour.

The MSC will be set up only after wide-ranging consultation of all those involved with fisheries, from the industry itself to scientists, regulators and environmentalists.

"This initiative offers our best hope yet of reversing the worldwide crisis in marine fisheries," says Michael Sutton, director of WWF's Endangered Seas Campaign. "By working together with progressive seafood companies, we can enlist consumer power in favour of conservation goals."

Caroline Whitfield, International Manager for Unilever Fish Innovation Centre adds, "two of Unilever's core principles are that sustainable business is good business, and that we work in partnership to meet our goals. This initiative, on behalf of millions of consumers, is entirely consistent with these principles."

- Ends -

For further information, please contact: Media Natura, 44 -171-395-1315, 1318, 1319, 1320/1324

'Media Natura is an environmental communications agency engaged by Unilever and the World Wide Fund for Nature as part of the Marine Stewardship Council initiative.'

Fish soon to be environmentally labelled

By *GERT SVENSSON*

In a couple of years you will be able to buy environmentally labelled fish at Swedish frozen-food counters, caught within the scope of a fishery system that does not impoverish the seas and oceans.

- By the year 2005 all Findus brand fish products will be environmentally labelled, promises Christer Lundh, responsible for the fish division in Swedish Nestlé.

Of the world's 17 largest fishing grounds, 13 have been entirely depleted of fish or are in danger of depletion. Fishing fleets and companies that supply fish often appear in the international environmental debate as unscrupulous exploiters.

A couple of weeks ago the multinational food giant Unilever decided to try to wash away this mark. The company signed an agreement with the World Wild Fund for Nature (WWF) on a system for labelling fish environmentally, and solemnly promised environmental labelling on all its fish products by the year 2005.

Bulk buyer

Unilever is one of the world's largest bulk buyers of fish. The agreement means that in about two years you will be able to buy the first environmentally labelled fish products in shops in the USA and Central Europe.

Sweden is not affected by the agreement; apart from caviar and some freeze-dried soups, Unilever does not sell any fish products at all in Sweden. So no formal decisions have yet been made that can lead to environmental labelling of fish for the Swedish market.

But Lennart Nyman, Environmental Protection Manager in the Swedish branch of the World Wild Fund for Nature, tells DN that he will shortly be bringing up the matter for discussion with companies that operate in Sweden. The largest brands of frozen fish are Findus and Frionor, with about a third of the market each.

Findus is owned by Swedish Nestlé.

- We will not be outdone by Unilever, says Christer Lundh, responsible for the Fish Division. We have a responsibility for the marine environment, and we are of course interested in building up a system for environmental labelling of fish in co-operation with the environmentalists. By the year 2005 all Findus brand fish products will be environmentally labelled!

Frionor is a Norwegian company. Information Manager Per Terje Rogde says, to be sure, that environmental labelling of fish is a good idea, but he does not sound particularly convinced. He thinks the Norwegian fishing fleet is already considerate enough towards the fish stocks they exploit.

Means of competition

- If all fishermen behaved like the Norwegian ones fish would not need to be environmentally labelled, he says. But if this becomes a means of competition - then we will have to join in. I can promise that we will

always be at least as environment-friendly as Unilever!

Under the agreement between the World Wild Fund for Nature and Unilever, an independent body will decide what is overfishing and what is sustainable, environmentally acceptable fishing. The group will consist of representatives of the fishing and other industry, environmentalists and possibly the authorities concerned.

A similar model will probably be used in Sweden.

Plenty of suggestions

Lennart Nyman at the World Wide Fund for Nature has several suggestions for reducing the strain on the threatened fish stocks of the global seas:

- “ We people must be less choosy and learn to eat new species of fish; almost all fish is both edible and wholesome.
- “ Waste must be reduced. On average 27 per cent of the global catch is thrown away because it is the wrong sort or size of fish.
- “ We should also eat more reared fish, which requires well-developed methods of rearing.
- “ The fishing industry must acquire better knowledge and better gear so as to be able to fish for species and stocks that until now have been difficult or impossible to exploit.
- “ The intensity of exploitation must be better distributed through international co-operation. ?

Laksefonden af 1991

29 February 1996

v. Bornholm & ChristiansÝ's Fiskeriforening
Oernes Kaj 2, Postboks 74
3700 RÝnne

Danmarks Fiskeriforening
Studiestræde 3
1455 KÝbenhavn K
Attn.: Bent Rulle & Jens H. MÝller

Re: The future management of salmon fishing in the Baltic Sea, cf. the Foundation's letter of 31 October 1995.

As agreed, Laksefonden af 1991 hereby presents the following explanatory remarks concerning the above.

The Board of Laksefonden af 1991 has in recent years closely followed the work of the Baltic Sea Fishery Commission with regard to salmon and political developments in the area in the individual member states.

The Board interprets the current situation thus, that all the member states are clear as to the need to save the remaining so-called natural stocks, which to a greater or lesser degree are threatened with extinction, owing to the devastation of spawning areas, blocking of migration routes to such areas and the M74 phenomenon.

To save the salmon, matters have hitherto been focussed on a reduction of commercial fishing, which is reflected in the fact that proposals for closure have been made from several quarters. According to the Board's information, at the next session of the Baltic Sea Fishery Commission a proposal will be put forward by Finland for a closure of fishing or at best a substantial reduction in the TAC from 1997.

The Board of Laksefonden af 1991 is naturally much concerned by this development, as it is our firm conviction that delayed release should be implemented in future management strategy, so that both wild salmon and the trade are assured good prospects of survival.

As mentioned in our letter of 31 October 1995, we urge the Danish Fisheries Association to forward the views of the Foundation to the Department of Agriculture and Fisheries so that the current management strategy may be changed in such a way that a decision is made as soon as possible on a general introduction of delayed release in the Baltic Sea.

With the introduction of this method, providing that there is in the selected areas a sufficient quantity of fish and perhaps that free fishing was allowed, a change would automatically occur in the present pattern of fishing, from fishing of mixed stocks to fishing exclusively of released salmon - thus a clear preservation measure which is of benefit to both the threatened salmon and the trade.

It should be emphasized that it is not the intention of the Board to promote further controls on salmon fishing by for example proposing closed areas, since fishing in for instance the central part of the Baltic Sea is expected to decline naturally as a consequence of improved fishing opportunities and conditions in the release areas.

The Board of Laksefonden af 1991 has discussed the scope of releases necessary and points out that, to maintain reasonably profitable and stable Danish salmon fishery, a catch of about 160,000 per year will be needed.

Finally, the Board of Laksefonden af 1991 requests the Danish Fisheries Association to follow up the Association's letter of 10 August 1994 to the then Minister of Fisheries Bjørn West concerning the same matter.

Yours sincerely

Birger Rasmussen

Laksefonden af 1991

31 October 1995

**v. Bornholm & ChristiansÝ's Fiskeriforening
Øernes Kaj 2, Postboks 74
3700 RÝnne**

Danmarks Fiskerforening
Stuðiestræde 3
1455 KÝbenhavn K

Re: The future management of salmon fishing in the Baltic Sea.

It is with great concern that Laksefonden af 1991 learns that, for the fourth year in succession, a reduction has been made by the Baltic Sea Fishery Commission in the TAC stipulated for salmon in the Baltic Sea.

Laksefonden af 1991, which represents all Danish salmon fishermen, finds this development extremely disquieting, since the preservation measures neither satisfy the wild stocks nor an already depressed trade which is dependent on a reasonable quota. Finally, the present development contributes to further uncertainty as regards future trade prospects.

It is the opinion of the Foundation that a continuation of the current management strategy will in the long run eliminate fishing that otherwise has extremely good potential, if managed correctly. Similarly, the risk of extinction of natural stocks, and thereby impoverishment of biodiversity in the area, will continue to be imminent, circumstances that clearly no one ignore.

Laksefonden af 1991 therefore requests the Danish Fisheries Association to assist in changing the current management strategy towards the at present only known alternative - delayed release - by presenting the views of the Foundation to the Department of Agriculture and Fisheries.

When surveying salmon stocks, the salmon's migration patterns, fishing harbours and associated fishing grounds, it is in the view of the Foundation possible to indicate and establish a number of future fishing grounds where salmon fishing can be conducted for delayed release salmon.

In establishing these areas and implementing massive releases it will be possible in the long run to reduce fishing of mixed stocks in the central part of the Baltic Sea. The change-over would also mean an opportunity for free fishing, i.e. the elimination of the current quota system, since future fishing will occur exclusively for released fish, of which it is appropriate to catch as many as possible.

Laksefonden af 1991 is aware of the initiatives taken from Danish quarters concerning delayed release. However, the Foundation finds it essential that what has been said is incorporated in the controlling management policy, i.e. that the above-mentioned initiatives and objectives are discussed and approved by the Baltic Sea Fishery Commission promptly, since the current management is ruining the trade.

While we hope that the Danish Fisheries Association will assist in implementing the above-mentioned viewpoints, we would point out that the Foundation will of course be at your service in the continued work.

Yours sincerely

Birger Rasmussen
Chairman of the Board

c/c The Swedish Federation of Fisheries' Union
The National Board of Fisheries

2. SUMMARY

In the period from May 1983 to August 1993 the Danish Fisheries Investigations, Department for Freshwater Fish (FFI) released marked 1, 1+ and 2-year salmon off Bornholm and in the river Mörrum, and in the area around the Mörrum river-mouth. Various methods of release were tried: River release, coastal release and delayed release. The object of the releases was to improve the profitability of releases and to expand salmon fishing in general.

The release experiments showed a statistically very significant correlation between the length of release and survival/recovery ($p=0.0005$). It was shown that the transfer of 1-year fish to net cages laid out along the coast, and a subsequent 3-4 months' stay there before release (delayed release), increased the percentage of recovery from an average of 15.9% to 34.5%. A fact that was partly attributed to a greater length of release for the delayed release fish, but where other circumstances such as the release length, release site and release year have also been shown to influence the percentage of recovery. Also of importance is that the delayed release fish - in contrast to the direct release fish - become accustomed to the salty environment under protection and an optimal supply of food. Coastal released 2-year fish - which in the current experiments were significantly fewer than the delayed release fish and therefore (other things being equal) should in theory achieve lower recovery percentages than the latter - achieve higher recovery percentages in the current experiments than the delayed release fish. This is probably a result of differing intensities of fishing at the release sites.

It was generally the case for the experiment's releases that the time of recovery was proportional to the length of the fish at the moment of release. About 80% of the fish released was recovered in the first 1 1/2 years after the fish had reached the minimum size (60 cm.). About half the marked fish were recovered in their second winter in the sea in the period from September to March.

The majority of the salmon released was recovered in the southern part of the Baltic Sea. Catches were concentrated to the mouth of the river Mörrumsån, Hanö Bay and the area north of Bornholm. Only a few fish found their way out of the Baltic (1.9%). Of the delayed release fish from Tejn, 2.7% were caught in fresh water. 42.9% of these fresh water catches occurred in the river Mörrumsån. Even though the fresh water catches were small, it cannot be ruled out that any future releases of salmon off Bornholm may influence the swim-up of salmon in the river Mörrumsån. To avoid genetic contamination, only offspring of Mörrum salmon should be used as release material in future releases of 1+ salmon off Bornholm.

The marked fish were mainly caught in nets (about 80%) and on hook gear (about 11%). Hook gear dominated fishing in December and January, while nets dominated the rest of the year. The proportion of marked salmon caught in coastal and river fishing was greatest in July and August (40-50%). The reason for this is that salmon keep close to the coast during their spawn migration in the summer months, and salmon

cannot be caught with drifting gear in the open sea at this time of year, since it is in just these months that salmon swim down in deep, colder water. For the rest of the year, offshore fishery dominated (82-97% of the monthly catch).

7. PERSPECTIVES - SWEDISH EFFORTS TO PRESERVE THE BALTIC SEA SALMON

While the primary object of the current experiments have been to improve and verify the profitability of the Danish releases, Swedish experiments with delayed release (e.g. C. Eriksson, 1989; Anon., 1990; T. Eriksson, 1991) have formed part of a rescue plan to save the threatened stocks of wild salmon (Christensen, 1992).

The original natural production of salmon in the Baltic Sea rivers - estimated at 10 million smolt - has now been reduced to 0.4 million smolt (Christensen, 1992). Anon. (1990) states that the present capacity of the salmon rivers is only utilized 10 - 20%. To preserve commercial fishery for Baltic Sea salmon, the declining natural stocks are compensated by releasing reared salmon. Releases of reared salmon today comprise 4.3 million smolt annually (over 90% of the total smolt production) (Christensen, 1992).

From 1972 - 1990 the total catches in the Baltic Sea Main Basin grew from 1,670 tons per year to 3,283 tons per year (Anon., 1995). Since 1990 total catches have declined to a level of 2,097 tons in 1994. As mentioned in section 3.2, the majority of the Baltic Sea river salmon gather in the Main Basin to forage and it may therefore be assumed that fishery exploits the different stocks proportionally alike. A great deal of the Baltic salmon is caught as early as its second winter, which means that a smaller amount of fish survive to spawn. Since about 25 times more spawning couples of salmon are required in natural spawning than in artificially reared to give the same amount of smolt, the natural stocks suffer most from fishing (Anon., 1990).

Fishing salmon as early as their second winter in the sea may - as a result of reduced stocks - lead to genetic effects on the natural stocks, since the effective size of population is diminished (genetic diversity is reduced).

A third effect of the relatively early catch is that the salmon's large growth potential is poorly utilized. The growth of released fish has not been treated in the current report, but Larsson (1980) mentions that Baltic Sea salmon grows relatively poorly during its first year in the sea, but then grows more rapidly. Spawn mature Baltic Sea salmon after 2 summers in the sea (grilse) have a typical weight of about 1.5 kg, spawn mature fish after 2 winters in the sea usually 4-5 kg and spawn mature fish after 3 winters in the sea usually 8-10 kg.

Apart from what has been mentioned above, it has been feared that strays from releases of reared smolt will compete and mate with natural stocks and thereby influence their gene pool (T. Eriksson, L-O Eriksson, 1991).

The Swedes have drawn up a plan which both safeguards the remaining natural stocks of Baltic Sea salmon and facilitates commercial fishery (Anon., 1990). The plan consists of two parts:

- protection of salmon in the growing areas of the Main Basin

- compensation for reduced offshore fishery through the establishment of fishery closer to the coast for spawn migrating salmon. Such salmon is supplied for fishing with the aid of delayed release off selected coastal stretches.

It has been proposed that protection of the growing areas should be in force all the year round outside a 24-sea-mile line from the Baltic Sea coasts south of the Åland islands (Anon., 1990). Further controls should also be introduced to protect the salmon during its spawn migration in the Gulf of Bothnia and at the mouths of the rivers. Among other things, it is especially important that fishery north of the Åland islands does not exceed a capacity the stocks can bear, as this could neutralize the advantages attained in the Main Basin.

Theoretical calculations have shown that delayed release of about 400,000 1-year fish annually off selected stretches of coast could compensate for reduced offshore fishery and even increase commercial catches (Anon., 1990). This - in combination with the above-mentioned protection - would spare the natural stocks of Baltic salmon to such an extent that in the course of only 3 salmon generations complete utilization of the capacity of the natural salmon watercourses could be achieved.

The number of strays in conjunction with delayed release has proved to be low. Nevertheless it cannot be ruled out that greater releases along the Blekinge coast could influence the swim-up in the river Mörrumsån, so no other salmon stock than that of the Mörrumsån should be considered for releases there (Anon., 1990). In addition a relatively large closed area and a ban on all salmon fishing at the mouth of the river Mörrumsån during the spawn migration period should be introduced as a supplement to the existing closed area.

To prevent an adverse effect of salmon releases and an increase in coastal fishing of sea-trout stocks, the intensity of fishing for such can be relieved by a relatively large closed area and a ban on fishing outside the river-mouths of sea-trout watercourses.

As mentioned, the growth potential of the salmon is poorly utilized, as a large proportion are caught as early as in their second winter in the sea. The proposed measures aim at increasing the average size of landed salmon, and the mesh size of salmon drift-nets should therefore be raised - partly so that the increase in size should not fail to materialize and partly to render fishing for larger salmon more effective (Anon., 1990)

