GÖTEBORGS UNIVERSITET

INSTITUTIONEN FÖR MARINA VETENSKAPER

Habitat-Forming Seaweeds in a Changing Climate

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ABSTRACT

Climate change is an umbrella term encompassing some of the largest and most potent selective pressures currently acting on ecosystems. It can have diverse effects on marine systems; the most powerful of which are changes to salinity through altered patterns of precipitation and evaporation, temperature through increased global temperature, and pH through the dissolution of CO_2 into seawater where it ultimately reacts with water to form carbonate (CO_3^{2-}) and hydrogen ions ($2H^+$). All these changes may impact marine organisms, in particular above the thermocline and in coastal waters. The studies included in this thesis were all performed in or close to the transition zone between the North Sea and the Baltic Sea. This area is a shallow coastal water mass influenced by the fully oceanic North Sea and the brackish Baltic Sea. Brown seaweeds are important habitat-forming seaweeds in this area, and bladderwrack (*Fucus vesiculosus*) is one of the most widespread and abundant.

The general objective of this thesis is to evaluate the effects of climate change on habitat forming seaweeds in a coastal area and to experimentally address the complexity caused by the multiple factors changing simultaneously as a consequence of climate change. For example, including both separate and interactive effects of changes in seawater temperature, pH, salinity, and grazing pressure on both adult and early life stages of primarily *Fucus vesiculosus* in the experiments. By conducting field and lab experiments and combining physiological, chemical, and genetic approaches, I detect different aspects of responses to climate induced stress.

My findings show that *F. vesiculosus* responds to climate change variables differently in different populations, and it responds to combinations of variables in ways that are not easily predicted based on experiments with single variables. I found that this seaweed will likely increase in growth by area but not weight under future climate change, and that its ability to induce chemical defence to grazing will be dramatically reduced. Furthermore, I found that *F. vesiculosus* and two other species of brown seaweeds may reduce their calcium content and tissue strength, which leads to increased risk of physical damage from storms and grazing and could result in population declines. This could in turn lead to significant effects on coastal ecosystems, and if these patterns are also true for other habitat-forming species they could have wide-reaching effects.

Keywords: Ocean acidification, warming, freshening, temperature, salinity, pH, pCO_2, *Fucus vesiculosus*, phlorotannins, grazing, tissue resilience, macroalgae.