



INSTITUTIONEN FÖR MARINA VETENSKAPER

# Phenotypic and Genotypic Responses in the Planktonic Diatom *Skeletonema marinoi*

Effects of Natural Processes and Anthropogenic Stressors

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## Abstract

Diatoms are one of the most diverse and abundant phytoplankton taxa and are highly important as primary producers, accounting for nearly half of the marine primary production and constituting the base in the marine food web. Despite their high dispersal potential they are genetically diverse and display genetically structured populations.

The high genetic diversity enables quick adaptation to changes in the environment. The ocean is a dynamic habitat, changing rapidly in e.g. temperature, nutrients and salinity and phytoplankton have to adapt in order to persist. Natural processes such as blooming events, predation and resting cell formation are all part of phytoplankton ecology and may all have an effect on the genetic or phenotypic diversity. Eutrophication and other climate changes are stressors in the marine ecosystem; species or populations that fail to adapt will be outcompeted by those who succeed in evolving to the new conditions and thus get better fitness. This process decreases species diversity and can in the same way alter genetic diversity within species and populations, making them sensitive to further changes of the environment. Therefore it is important to understand how natural processes affect the genetic and phenotypic composition of phytoplankton and furthermore, to understand if and how they can adapt to anthropogenic stressors such as climate change, eutrophication etc.

In this thesis I have used the common diatom *Skeletonema marinoi* to study how natural processes and anthropogenic stressors affect the genotypic and phenotypic structures. By geminating natural populations from a sediment core, we have been able to do phenotypic characterization and genetic analysis that demonstrate an adaptation to eutrophic conditions over nearly a century. The phenotyping was done by an optimized method that is more time efficient than other methods and thus can manage large sample sizes.

Moreover, we successfully induced resting cells that remain viable for 12 months. This treatment did not have any negative effects on the growth rate of germinated cells, but induced sexual reproduction, which can facilitate further genetic studies.

The presence of grazers can influence the genetic composition within a phytoplankton population. By creating a population of eight genetically and phenotypically different *S. marinoi* strains and exposing them to three levels of grazing pressure we found that a medium grazing level significantly altered the genetic composition of the population.

Phytoplankton spring bloom dynamics in the Baltic Sea was studied by measuring environmental parameters and isolating *S. marinoi* strains during eight weeks, along a transect across Baltic proper. Genetic analysis showed that the spring bloom was a dynamic event and that it consisted of two genetically differentiated populations. This differentiation was coinciding with a spatial and salinity gradient. Moreover, a shift in the populations was seen as silica concentration decreased, indicating a subpopulation specialized to lower silica concentrations.

The genetic diversity in a population increases the adaptation potential, thus it is of great importance to study and understand how small fluctuations, natural processes and human induced changes in the environment affect the genetic and phenotypic structures in phytoplankton. My thesis contributes to the understanding of how the common diatom *S. marinoi* can adapt to present and future stressors such as eutrophication, and is an important piece of the puzzle to understand on-going changes in the marine environment.

Keywords: Diatoms, Genotype, Phenotype, Resting cell, Eutrophication, Spring bloom, Diversity, Grazing, Adaptation, Phytoplankton.