

Postdoctoral Project within the DFG DynaTrait Priority Programme (1704)

Title: Modelling the adaptive capacity of plankton communities in a changing ocean

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There is broad consensus in the scientific community that the world's climate is changing at an unprecedented rate and evidence is accumulating on the ecological consequences of the changing climate. In the aquatic realm, for example, such consequences have involved shifts in the phenology of phytoplankton and zooplankton and reorganizations of phytoplankton community compositions towards species with smaller cell sizes. In a changing environment, ecological communities need to adapt their distribution of phenotypes so that the average fitness increases and the community can thrive under the new environmental conditions. Adaptation can work through a change in the genetic composition (e.g. microevolution) or through different forms of phenotypic plasticity. Whether such mechanisms will play a role in the real ocean, for example by making phytoplankton communities more resilient to changing environmental conditions, is currently unknown. In this project we integrate a variety of laboratory data and field observations, including those acquired within the DynaTrait Priority Programme, into a trait-based modelling framework. This modelling framework is based on the adaptive dynamics of phytoplankton cell size and, critically, on a trade-off emerging from relationships between phytoplankton cell size and 1) phytoplankton nutrient uptake, 2) zooplankton grazing, and 3) phytoplankton sinking. With this tool we investigate how shifts in phytoplankton community composition and phenotypic diversity impact the foodweb dynamics of two contrasting regions of the Atlantic Ocean (temperate and tropical) under a number of environmental disturbances and future scenarios. Our project strives to translate the knowledge acquired within the DynaTrait Priority Programme into the context of a "real" ocean environment.

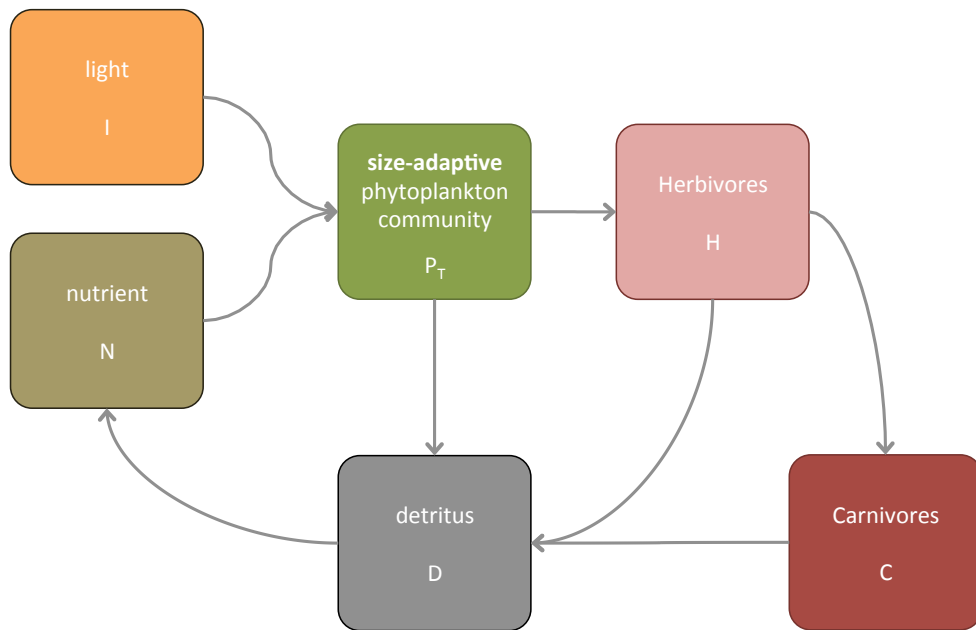
Relevant literature:

E. Acevedo-Trejos, G. Brandt, M. Steinacher & A. Merico (2014), [A glimpse into the future composition of marine phytoplankton communities](#), *Frontiers in Marine Science*, IN PRESS.

S.L. Smith, A. Merico, S. Höhn & G. Brandt (2014) [Sizing-up nutrient uptake kinetics: Combining a physiological trade-off with size-scaling of phytoplankton traits](#), *Marine Ecology Progress Series*, IN PRESS.

E. Acevedo-Trejos, G. Brandt, A. Merico & S.L. Smith (2013) [Biogeographic patterns of phytoplankton community size structure in the oceans](#), *Global Ecology and Biogeography*, 22, 1060-1070.

A. Merico, J. Bruggeman & K.W. Wirtz (2009) [A trait-based approach for downscaling complexity in plankton ecosystem models](#), *Ecological Modelling*, 220, 3001-3010.



Schematic of the simplified foodweb configuration considered in this project. The ecosystem consists of a size-adaptive phytoplankton community, which resources comprise light and nutrient, herbivorous zooplankton grazing on phytoplankton, and a compartment representing carnivores preying on herbivores.