Popular science summary of the PhD thesis

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Title of the PhD thesis	Trait-based models of plankton communities
PhD school/Department	DTU Aqua

Science summary

Marine plankton are small organisms that live in the ocean. Plankton refers to “organisms that drift with the currents”. Thus, these organisms range from bacteria, other microbes, tiny crustaceans and jellyfish. Plankton play an important role in marine systems. They are at the base of the food-web, fueling larger organisms such as fish. Plankton also play an important role in removing CO_2 from the atmosphere. Some plankton are photosynthetic – phytoplankton – and capture carbon from atmospheric CO_2. This carbon is eaten and respired by other organisms. Ultimately, a small fraction that is not respired sinks to the bottom of the ocean and is sequestered from the atmosphere for hundreds to thousands of years. Climate change is altering plankton communities and associated processes, such as energy transfer to fish and carbon sequestration. It is thus important to understand how the planktonic community will respond to climate change. To do so, we need a better understanding of how these food-webs work. The aim of this thesis is to investigate the mechanisms driving community composition and associated ecosystem processes.

We will use mathematical models to address this issue. However, current state-of-the-art plankton models do not incorporate the life cycle of organisms. For some large planktonic organisms, such as zooplankton, not implementing this life-cycle oversimplifies their representation. Thus, the second aim of this thesis is to implement the life cycle of zooplankton in plankton models.

In this thesis we have developed 3 manuscripts that address the mechanisms of plankton community composition through mathematical models. In the first manuscript we investigate how temperature affects microbial communities. We show that higher temperatures reduce carbon sequestration. In the second manuscript we implement the life cycle of zooplankton in plankton models. Here we present a modeling framework that accounts for the size distribution of the community. We use the model to investigate the drivers of community composition and associated carbon export. Finally, in the third manuscript we address how we couple the model developed in manuscript 2 to a 3D model of the oceans. With the models developed in this thesis, we improve the representation of zooplankton in plankton models and provide a novel framework to address global biogeochemical processes.