

On the behaviour of plankton communities : trade-offs and species diversity pull the strings

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Species diversity plays a key role in regulating ecosystem behaviour. But how should it be modelled? In this session I will look at approaches applied to plankton. Over the past three decades, bulk nutrient-phytoplankton-zooplankton-detritus models have grown into detailed Plankton Functional Type models. These explicitly describe many natural species, but they are complex, expensive to run, and difficult to constrain. Recent “trait-based”, “self-assembling” or “adaptive” approaches do this differently: they summarize species diversity in terms of a few key traits such as size, and allow these to control all aspects of physiology. This makes it possible to build diverse communities by effectively throwing together species with different trait values. In variable environments, these model communities can show realistic changes in species composition and diversity. But what regulates these changes? I will look at the role of *trade-offs* in selecting for particular species, and the role of *functional diversity* in regulating the rate of succession. Further, I will discuss how these two ingredients can be combined to build a compact, “adaptive dynamics” model that preserves the main features of species diversity, while considerably reducing model complexity. As proof of principle, I look at seasonal and interannual change in phytoplankton size in Lake Constance, for which a detailed 30-year record of species composition is available.