

Claudia Seiler Dept. River Ecology, Helmholtz-Centre for Environmental Research-UFZ, Magdeburg (UFZ) and Institute of Hydrobiology, Technical University of Dresden, Dresden (TUD)

Markus Weitere, Dept. River Ecology, Helmholtz-Centre for Environmental Research-UFZ, Magdeburg (UFZ)

Thomas Berendonk, Institute of Hydrobiology, Technical University of Dresden, Dresden (TUD)

Ursula Gaedke, Ecology/Ecosystem modelling, University of Potsdam, Potsdam (UP)

Effect of trait variability on the dynamics of coupled, bi-trophic plankton – biofilm systems

Many ecological processes result from predator-prey interactions. Therefore, it is of considerable interest to investigate these interactions in order to gain a deeper understanding of ecosystem dynamics and functions. Several examples show that prey species can develop defended phenotypes to reduce predation and thus mortality. However, such defense mechanisms may come at considerable costs which pay off only in the presence of high predator densities, which may occur only temporally. Furthermore, costs of defense may dramatically increase if the prey is subject to predation by different predators and especially when defense traits are predator specific and incompatible. Then each prey phenotype is in danger to be attacked by at least one of the predators.

Here we test the consequences of such variable costs of defense in a prey with high plasticity against either one of the two predators or both. As model organisms we will use the bacterial prey strain (*Pseudomonas putida*), which can form contrasting phenotypes, i.e. planktonic cells and biofilms. As predators, we will use a specialized plankton predator species (*Paramecium tetraurelia*, a single lineage) and a specialized biofilm predator species (*Acanthamoeba castellanii*, a single lineage).

Combining experimental approaches with mathematical modeling we will employ the specialization of the two predator species to manipulate the trait variation within the predator guild. This affects a single prey species that can react with a fast phenotypic plasticity in order to defend itself against either one or the other type of predator but not both simultaneously. We postulate that this interaction of the trait variation of the predator guild together with the phenotypic plasticity of the prey will lead to ongoing cyclic changes in the respective predator and prey biomasses and trait values. The very short generation times of all members of this microbial food web will enable us to observe time series with many generations providing insights into long-term interactions and trait adjustments within two interrelated food chains. Further we will establish an advanced batch and a flow-through chemostat system in which we can manipulate both, the costs of defense and the trait variation of the predator guild. These chemostat systems will comprise of a planktonic habitat and a variable amount of surface on which biofilm can develop. They allow to manipulate the loss rates by diluting the plankton habitat (prey and predator) and the biofilm habitat (prey and predator) in separate ways.

In order to link the microbial population dynamics to ecosystem structure and functions, we will investigate how the trait variation in the predator guild (plankton and biofilm predators) will change the biomass allocation and the carbon flux efficiency of the microbial food web. To our knowledge such experiments with a corresponding mathematical modelling have not been conducted so far.