CALL FOR APPLICATIONS

Announcement of a vacancy for an experimental Ph.D. position

on the robustness of plankton food webs of different levels of functional diversity against pulse perturbations

at Potsdam University

The current time, the Anthropocene, is characterized by multiple environmental changes with continuously accelerating rates. These changes include habitat fragmentation and destruction, the global distribution of invasive species and increasing temperatures due to global warming. All these changes intensively stress our ecosystems and push the biotic communities towards the edges of their fundamental niches. As a consequence, we are facing a strong and ongoing loss of biodiversity threatening the function and services of ecosystems. Such continuous and directed changes are called press perturbations. On top of these press perturbations, the climatic extreme events increase in amplitude and frequency leading to pulse perturbations such as heat waves, excessive nutrient inputs or the pulsed input of xenobiotics through surface run-offs.

For quantifying the response of a population or community to perturbations (sometimes called robustness), three measures are relevant: **Resistance** measures how far a system is pushed from its initial state. **Resilience** describes the ability of a system to return to its initial state. **Elasticity** refers to the speed with which a system bounces back to its initial state.

We first hypothesize that those communities that have already lost part of their diversity will have a lower resistance to pulse perturbations than systems with a higher diversity. We largely verified this hypothesis using a mathematical simulation model (Wojcik et al. accepted, Ecology & Evolution, or bioRxiv https://doi.org/10.1101/2021.03.22.436420) and now want to test it experimentally.

A second aspect of pulse perturbations, influencing the resilience, is the potential of food webs for switching between two alternative stable states: For example, at equilibrium conditions, the biomasses of a predator-prey system may be rather constant over time. At low turnover rates (in a chemostat, at low dilution rates), the producers may grow close to their carrying capacity, leading to a low growth rate and typically also a poor food quality for their consumers, e.g. because of a high carbon to nutrient ratio. The resulting low production of low quality food can maintain only a small consumer biomass, imposing only a low grazing pressure. A nutrient pulse will change this relationship temporarily and potentially shifts the whole system to another stable state. The mechanism behind this is that the nutrient pulse increases the food quality and production of the producers enabling higher production rates of the consumers. The nutrient pulse is continuously washed out, but the higher consumer biomass causes a higher nutrient turnover and a stronger top-down control of the producers resulting in a high growth rate and carbon to nutrient ratio. Thus, the pulse perturbation may lead to an alternative stable state with high consumer and low producer biomass.

In order to address these questions, we aim to study the effect of pulse perturbations on plankton communities with different diversity. To test the hypothesis that diverse community are more robust against disturbances we will run chemostats with diverse producer and consumer communities and measure the response parameters. These will then be compared to the results from mono-specific

consumer treatments. In an extended preliminary study, we have identified a diverse producer-consumer community that maintains its diversity over several weeks and showed an interesting response to a nutrient pulse. This is a prerequisite for addressing these questions. Based on the results of the mono-specific consumer treatments, we will identify experimental conditions that allow us to test the hypothesis that nutrient pulses can be switches from one to the other alternative state. This study includes complex experimental work with chemostats and plankton cultures. Interest in cooperating with modellers is welcomed, but not essential. Aside from these two subprojects there will be room for modifications and additional ideas.

Potential candidates hold a Master's degree in Ecology or in a related field. Experiences in plankton ecology are welcomed. We expect good skills in laboratory work, quantitative ecology, statistics, and scientific writing.

We offer a three year position for 65 % TV-L 13 starting preferentially in February 2022. We provide an excellent academic environment in the field of community ecology, both experimentally and theoretically (for details see https://www.uni-potsdam.de/de/ibb-ecology/index). The project will be supervised by Prof. Ursula Gaedke, Prof. Guntram Weithoff and Dr. Toni Klauschies.

If you are interested please send your letter of motivation and detailed CV to Gaedke@uni-potsdam.de. The position is open until it is filled.