

# iDiv sabbatical project report

## Structured Population Dynamics Subject to Stoichiometric Constraints

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**Scientific hosts:** Dr. Ulrich Brose, Dr. Helmut Hillebrand, and Dr. Stanley Harpole.

### Feedback:

One main purpose of my sabbatical was to develop new theoretical modeling frameworks in predictive ecology that couple structured population dynamics with stoichiometric constraints. My collaborators and I aimed to develop novel mathematical models that investigate how varying nutrient and light levels shape ecological structures and promote biodiversity, using dynamical systems theory to construct and analyze systems of differential equations that represent food webs. Using the theory of Ecological Stoichiometry, we constructed multi-species food web models. The key aspect of these models was formulating multi-species functional responses that depend on both the quantity and quality of resources. We included adaptive compensatory and complementary forging behaviors that depend on variable nutrient ratios of primary producers. We've made good progress in analyzing the models we developed and have a manuscript in prep.

My time at iDiv made this entire project possible. I am an applied mathematician in the Department of Mathematics and Statistics at Texas Tech University with a background in dynamical systems theory that I apply to ecological modeling projects. For me, coming from a math department, the interdisciplinary atmosphere and community at iDiv was an incredible experience. iDiv was the ideal place for these projects and was key for pushing my research in this area forward. The iDiv network of researchers with knowledge of existing data sets, as well as the infrastructure for conducting empirical experiments are invaluable resources. I learned so much from discussions with Stanley Harpole and Ulrich Brose and expanded my understanding of building and analyzing *ecologically relevant* models on biodiversity. They offered refreshing perspectives that were not only key for developing stoichiometric multi-species functional responses for my current modelling projects but have shaped how I will approach model development throughout my career.

Leipzig is a wonderful city. It is the type of city that you not only want to visit, but you want to live in. My children, ages three and six, loved their time at the Leipzig International School and Kindergarten. My advice for future sabbatical fellows is to take your family and invest in bicycles.