Consumer diversity effects in multispecies predator-prey systems: Relevance of inter- and intraspecific consumer trait variation

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Given the dramatic global loss of species, numerous ecological studies have addressed the consequences of biodiversity loss on ecosystem functioning, more recently also in a multitrophic context. Consumer diversity effects on food web dynamics were shown to be highly context-dependent and determined by the food web configuration, involving species-specific traits, such as consumer specialization and grazing rates. The functional traits of organisms and associated trade-offs are supposed to play a key role for ecosystem functioning. The proposed project aims at evaluating the role of trait variation on two interacting trophic levels for understanding the consequences of consumer diversity loss on trophic dynamics and ecosystem functioning in a joint approach combining laboratory experiments with a process-based model. We will use freshwater ciliate consumers and microalgal prey as a model system, which allows us to focus particularly on consumer-specific traits and trade-offs, such as consumer specialization (generalists versus specialists), grazing and growth rates (trade-off: specialization versus grazing efficiency) and the associated prey trait variation (edibility versus growth rate). Laboratory experiments on a ciliate – microalgae system will investigate the inter- and intraspecific consumer trait variation in dependence of prey composition and the presence of other ciliate competitors as well as long-term population dynamics (25-40 generations) and feedback loops among interacting trophic levels. Experimental data will be used to calibrate and validate a multispecies model, which will help to identify the mechanisms driving the observed patterns in experiments regarding population dynamics, community variability and the maintenance of trait variation (i.e. functional diversity). At the same time, model simulations will be used to optimize the experimental design of subsequent experiments. This joint approach will broaden the existing experimental and theoretical knowledge on trait dynamics in a multispecies food web and will substantially enhance our understanding of the consequences of biodiversity loss on trophic dynamics and ecosystem functioning.

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