Abstract

While biodiversity is declining at an unprecedented speed, we know little with regards to what is controlling biodiversity. Top-down and bottom-up effects are acknowledged to be two of the main factors impacting biodiversity. However, the majority of the research on top-down and bottom-up control focused on the abundance of organisms rather than diversity. As the biodiversity of primary producers and herbivorous are central drivers of ecosystem functioning, the interactions between these two trophic levels is of particular importance. Nutrient enrichment may increase the productivity of producer communities, but this bottom-up supply can at the same time decrease primary producer biodiversity. A decrease in primary producer diversity may in turn impact the fitness of herbivores. Moreover, nutrient enrichment correlates with cyanobacterial blooms which may not only impact ecosystem functioning but also human health. By increasing the consumer species biomass, attempts have been made to control cyanobacterial abundances. However, cyanobacteria are considered to be a low quality diet for consumer species. Additionally, theory suggests that nutrient enrichment and consumer species richness simultaneously impact primary producer diversity. Studying biodiversity of primary producers based upon morphological characteristics requires high expertise. Metabarcoding has been suggested as an alternative approach, but we do not yet know how reliable this method is with regards to biodiversity estimates. In this thesis I therefore aim to investigate: i) the impact of primary producer diversity on consumer species fitness; ii) the impact of cyanobacteria on consumer species fitness; iii) interactions between nutrient availability and consumer species richness, in shaping primary producer diversity; iv) benefits of using metabarcoding when studying biodiversity of primary producers. To investigate the interplay between bottom-up and top-down control of biodiversity I used a model system consisting of various benthic algae communities and up to five macroinvertebrate consumers. My results demonstrate that primary producer diversity impacts consumer species fitness. Moreover, I found that

cyanobacteria, provided an excellent growth increment for a consumer species. With regards to top-down control my findings demonstrate that increasing consumer species richness may increase primary producer diversity. Possibly due to complementarity feeding strategies of the consumer species. However, increasing nutrient levels diminished the effect of consumer species richness upon the primary producer diversity. Finally, I investigated measures to monitor biodiversity. I found that metabarcoding may be an excellent method in studying species richness and changes in overall community structures. These results have great repercussion to conservation planning, our understanding of trophic interactions and ecosystem functioning in general.