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Marine Biodiversity and Ecosystems

Trophic Interactions and Their Ecological Consequences in Planktonic Food Webs

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Venue: Auditorium, 1st Floor,
Interdisciplinary Research Building
跨領域科技研究大樓1樓演講廳

Host: Dr. Benny K. K. Chan 陳國勤研究員

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Abstract

Understanding the complex interactions within marine planktonic ecosystems is crucial for comprehending their composition, distribution, and functional roles. My research focuses on investigating trophic interactions among marine plankton and their effects on diversity and biogeochemical cycling. By employing advanced statistical techniques on observational data from the southern East China Sea, I have revealed that trophic interaction is underlying the positive relationship between the diversity of bacterioplankton and nanoflagellates. Trophic interactions can amplify the impact of bacterioplankton diversity on community biomass, providing mechanistic insights into the biodiversity-ecosystem functioning relationship. More importantly, my studies extended the biodiversity-ecosystem functioning framework to the broader metacommunity level. In addition to statistical analyses, I have integrated theoretical models with in-lab manipulative experiments to elucidate how trophic interactions mediate the coexistence and functional roles of zooplankton species in consuming resource prey. Field incubation experiments have also been designed and conducted to further validat the findings from theoretical and lab-based studies; however, the complexity of natural planktonic food webs presents challenges in extrapolating results from controlled systems. Conducting field experiments has underscored the importance of capturing detailed trophic interactions and considering environmental variables comprehensively. Stemming from such experiences, my current research focuses on combining sophisticated manipulative experiments with high-throughput sequencing techniques and statistical analysis to quantify the growth and grazing mortality of bacterioplankton, nanoflagellates and microzooplankton. Conducting such experiments in various hydrographical regions including the East China Sea, Kuroshio and tropical northwestern Pacific has renders promising results, from which I am able to quantify energy flows in marine planktonic food webs. This experimental design and analytical framework will pave the way for understanding the impacts of trophic interactions among marine plankton on larger scale biogeochemical cycling. Looking ahead, integrating mixotrophy into my research framework is imperative due to its prevalence and significance, especially among nanoflagellates. To address this, I plan to combine field incubation experiments with innovative image-based devices, including pulse-shape recording flow cytometers and FlowCams. This integrated approach will complement sequence-based methods, allowing for a comprehensive assessment of mixoplankton biogeography and their impacts on biogeochemical cycling at larger scales.