Understanding toxic algal blooms through stable isotope analyses

MSc. thesis at the Flanders Marine Institute (VLIZ) and the Royal Netherlands Institute for Sea Research (NIOZ)

Broader context

Toxic algal blooms are increasingly found in coastal waters all over the world, causing significant food web disruption and threatening both the food safety as well as the food security of coastal populations. These events are formed by microscopic algae that produce potent (neuro)toxins as an evolutionary adaptation against zooplanktonic grazers and/or other microalgae that compete for nutrients. These interactions are respectively called “grazer deterrence” and “allelopathy”. Yet, despite decades of research, scientists are still debating the ecological importance of each of these roles of the toxins. More specifically, it is unclear to which extent grazer deterrence and allelopathy play crucial roles during bloom formation. Recently, research has shown that nutrient competition alone can accurately predict the interactions between toxic and non-toxic species. In the absence of grazers, the outcome of a developing bloom is determined by the rate at which each species can accumulate nutrients and convert them into biomass. Allelopathy, it seems, plays no role during the early stages of bloom development. Instead, it could be used to sustain blooms.

MSc thesis

In this MSc thesis, we want to further unravel the processes that determine the early stages of toxic bloom development. To this end, we need to investigate the role of grazing and grazer deterrence during nutrient competition between toxic and non-toxic algae. Through the clever use of stable isotopes (13C and 15N), we will trace the amount of toxic and non-toxic biomass that is consumed by zooplanktonic grazers, in order to derive feeding rates, growth rates and reproduction rates of phytoplankton and zooplankton. Based on these results, the outcome of bloom development will be reproduced through food web models, allowing us to quantify the relative contribution of each process. The experiments, analyses and data processing will be performed as a joint project between VLIZ and NIOZ. Candidates should be proficient in R

Contact person for this research line: Maarten De Rijcke (maarten.derijcke@vliz.be)