

GW4+ Doctoral Training Partnership (Plymouth Marine laboratory and University of Exeter)



Plankton mortality in ecosystem models and impact on human activity

Supervisors: **Dr. Sévrine Sailley, Dr Jorn Bruggeman** (Plymouth Marine Laboratory, PML); **Dr. Steve Simpson** (University of Southampton)

Background: Marine ecosystems are a vital resource for human society. They provide many ecosystem services, with perhaps none as important as the production of fish: energy and carbon fixed by plankton ultimately end up in the fish that are an important food source. Under climate change, this is under threat – model projections suggest that plankton production will go down in the future, and fish biomass is likely to follow suit. However, the models used for climate change projections do not include fish; limiting themselves to lower trophic levels, ending at zooplankton. This has implications for the projections they deliver.



First, further modelling or processing is needed to understand the impact of changes in plankton on fish stocks. Second, plankton models cannot represent the consequences of changes in fish stocks on plankton mortality. This places doubt on both fish and plankton projections and what this means for fishing communities and food security.

Method: The project aims to deepen understanding of the two-way link between plankton and fish, and of its importance for future projections of both fish and plankton, more specifically of the mortality term used as the link between both groups and how it can change model projections at the food production level. For this, the project will make use of two models available in house at PML: the European Regional Seas Ecosystem Model (ERSEM) as the lower trophic level model, and MIZER a dynamic size spectrum ecosystem model, used to represent fish, as the higher trophic level model. A bio-economic model will also be used to estimate the economic impacts of changes in fisheries and implications for fishing communities.

The project will first explore different ways of formulating mortality within either/both the lower trophic level and the higher trophic level and linking it to economic evaluations. Once the new formulation is decided, the student will run a set of future projections (similar to those done for IPCC climate run) and compare ecological and economic outputs to those collated by the FAO fisheries report for present time in order to validate the model.

Candidate: The project would be suited for a candidate with experience in modelling in either the fisheries or ecology side of the project. The student will also need to have experience with models and experience with handling large amount of data. Interest in economics plus background in economic theory is desirable. Candidates are encouraged to contact the lead supervisor (sesa@pml.ac.uk) for further information.