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Spitfire Doctoral Training Partnership (Plymouth Marine laboratory and University of Southampton)

Zooplankton, Jellyfish and Climate

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Background: Zooplankton is an important component of the marine pelagic ecosystem playing a key role in carbon cycling as well as redistribution of primary production to higher trophic levels. It is a very diverse group spanning several trophic levels, comprising small unicellular heterotrophs (microzooplankton), mesozooplankton (copepods, krill), and gelatinous organisms (jellyfish, salps). Climate change and human activity has lead to widespread changes in the zooplankton community composition through change in the abundance, size and phenology of species or a complete change in the dominant group. Such changes are likely to have profound impact on the functioning of the ecosystem. There have already been worldwide records of increase in jellyfish occurrence, with consequences for fisheries and aquaculture, indicating an impact not only within the pelagic but the benthic portion of the marine ecosystem. We propose here to use the Western Channel Observatory time-series, L4, to build a detailed model of the pelagic food web to explore the consequences of long-term trends in zooplankton community on pelagic ecosystem function in UK coastal waters and use it as a case study regarding potential impact from changes in the zooplankton community composition.

Figure 1: A bloom of jellyfish

Method: In this project, the student will combine existing field sampling data, laboratory based experiments and modelling to describe the role of the different components of the zooplankton community on carbon cycling at different temporal and spatial scales. The project focuses on jellyfish and how their presence and abundance (e.g. bloom) can impact the pelagic ecosystem. For this purpose the project will have three different aspects to draw from:

Data: The student will have access to the Western Channel Observatory (WCO) time-series data describing the species composition and processes (e.g. primary production, grazing) of the plankton community. In addition the student will undertake laboratory experiments to provide data on processes not routinely measured.

Inverse model: An inverse model is a model that is based on known information such as biomass and metabolic process (e.g. respiration). These will come from the L4 data, as well as laboratory microzooplankton and gelatinous zooplankton feeding experiments. This approach describes the flows of carbon through the food web, in order to identify the dominant pathways for fate of primary production (e.g. loss through sinking, recycled) and identify the major players of the food web (jellyfish, copepod).

Cruise: Lastly the spatial variation of the food web will undertaken by the student participating in a NERC NC funded cruise (e.g. RAPID, Ellet Line) to collect samples for food web analysis.

Candidate: We are looking for a student with a background in marine ecology, enthusiastic about both practical and theoretical work to undertake both aspects of this project. Candidates are encouraged to contact the lead supervisor (sesa@pml.ac.uk) for further information.