

Title of project: **THE IMPACT OF CO₂ EMISSIONS ON PLANKTON IN THE NE ATLANTIC**

Supervisors: Professor Jason Hall-Spencer and Dr Abigail McQuatters-Gollop

Description of studentship: There is a major international policy focus on the impacts of carbon dioxide emissions on marine ecosystems in Europe, at present these are concerns (but a lack of empirical evidence) that this could cause ocean productivity to plummet and lead to increased jellyfish outbreaks. The aims of this studentship are to generate a significant volume of new information on the ecological responses of plankton to ocean acidification. This will be the first biological study of a natural high-CO₂ analogue in the Atlantic; the successful candidate will undertake novel experiments to show which plankton thrive or suffer as CO₂ levels rise.

The student will test the effects of OA on community structure, trophic interactions and physiology of key functional groups of Atlantic plankton at a natural high-CO₂ seep. By simultaneously examining phyto- and zooplankton assemblages, the student will be able to assess the effects of OA on the pelagic food web, information needed to underpin socioeconomic assessments of impacts in the region. This information will improve the accuracy of predictions, which are currently based on the nearest available natural analogues for ocean acidification (in the Mediterranean and the Baltic) which have a disparate carbonate levels and plankton communities. The student will address three integrated hypotheses generating data that are critical to model predictions and assessments of the effects of OA (Hilmi et al. 2013). **Hypothesis 1: Atlantic CO₂ seeps create gradients in carbonate chemistry that have similar ecological shifts in the plankton to those noted in the Mediterranean, despite lower alkalinity and a completely different set of species present.** The student will be trained in how to first characterise spatial and temporal variations in the physico-chemical environment of an Atlantic CO₂ seep area and then test for consistent trends in abundances, diversity and composition of plankton along gradients of carbonate chemistry across the seep site and in three reference areas. **H2 Ocean acidification will stimulate NE Atlantic phytoplankton productivity although the effects will be species-specific and modified by nutrient levels.** The student will determine algal responses to increased CO₂ levels through manipulative experiments on diatoms to assess effects of ocean acidification on primary productivity. **H3 There is a tipping point at which CO₂ levels severely disrupt settlement of the larval stages of calcified plankton.** Assess recruitment from the meroplankton across a range of taxa to characterise changes in recruitment success along Atlantic CO₂ gradients. Improved understanding of the likely effects of ocean acidification on mollusc recruitment will inform adaptive management processes for ensuring the sustainable use of living marine resources (which is of significant interest to the aquaculture industry).

Details of SoMSE research centre affiliation working environment etc.: the Marine Biology and Ecology Research Centre (MBERC), is one of the largest and most active in Europe with 33 staff, 8 postdocs, 7 research assistants and *ca* 45 PhD students providing access to a range of expertise that will directly input into the research and stimulate ideas. MBERC produces 90+ papers in peer-reviewed journals each year with staff called upon in 2015 to provide expertise to International Council on the Exploration of the Seas (ICES), the Intergovernmental Panel on Climate Change (IPCC), OSPAR, the United Nations (UN), and others. MBERC has a commitment to providing high quality training and mentoring to talented scientists. In 2015 a £4 million Marine Station was opened with

state-of-the-art diving, teaching and research facilities. MBERC outputs feature prominently in current syntheses on the impacts of ocean acidification e.g. www.whoi.edu/OCB-OA/FAQs.

Essential requirements: A 1st class or 2:1 in Marine Biology, Oceanography or related disciplines, diving and fieldwork experience. Desirable requirements: A MSc or MRes in Marine Biology, Oceanography or related disciplines, HSE diving

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