

Title of project: An indicator approach to integrating historical and contemporary ecological datasets: a century of plankton change in the NE Atlantic

Location: Plymouth University, UK

Start date: Autumn 2015

Supervisors: Dr Abigail McQuatters-Gollop, Plymouth University; Prof Martin Attrill, Plymouth University; Mr David Johns, SAHFOS

Description of studentship: Climate change is significantly impacting North Atlantic marine plankton, presenting new challenges for marine management. New management mechanisms, such as the EU's Marine Strategy Framework Directive, require the development of policy indicators, informed by historical ecological data. These indicators will help to articulate Good Environmental Status scenarios, ultimately informing the setting of environmental targets.

A thorough understanding of long-term ecological change, and associated underlying environmental drivers, is therefore important for informing these policy requirements, an interdisciplinary aspect requiring both ecological and policy knowledge. Although the Continuous Plankton Recorder (CPR) survey, a spatially extensive multidecadal plankton dataset (1950s-present), exists, a lack of pre-1950s plankton data has presented challenges to identifying historical changes in regional plankton communities needed for baseline establishment. However, two historical plankton databases have recently become available. A newly digitised subset of CPR data (1931-1948) and a recently digitised database containing data from ICES plankton cruises (1902-1912), can help fill the pre-1950s gap in plankton data.

Sampling and analysis methodologies vary across the three datasets, resulting in a need to reconcile their information and devise innovative methods to best use their data. Taxonomic reconciliation of historical and contemporary species names, conversion of quantitative abundance values (contemporary CPR survey) to semi-quantitative values, and gridding of samples will facilitate integration of the disparate datasets into a common database. Taxonomic understanding of the plankton community is essential for this exercise; however, taxonomy is a specialist skill held by a diminishing number of scientists. Supported by taxonomic expertise, together, the historical and contemporary datasets can be used to examine changes in the North Atlantic plankton community during the past century, link observed changes to environmental drivers and inform policy needs.

The successful student will: **1)** Develop methodology to integrate differing data types; **2)** Integrate historical ICES and historical and contemporary CPR plankton datasets; **3)** Examine a century of Northeast Atlantic plankton community change, including change in spatial distribution, diversity, taxonomic distinctness and abundance, underpinned by training in plankton taxonomy; **4)** Retrospectively apply current UK and OSPAR policy plankton indicators (e.g. biodiversity indices, key species abundance, etc) to integrated dataset, developing century-long plankton indicator time-series, with changes linked to environmental drivers; **5)** Articulate visions for Good Environmental Status, based on indicator change, to inform policy target setting.

The interdisciplinary aspects of the PhDship connect ecology, taxonomy, and conservation through marine policy and will further stakeholder (policy makers and society) understanding of key science-policy challenges. The student will develop skills in spatial and temporal analysis, analysis of large datasets, statistical techniques, plankton sampling and analysis methods, and application of science to policy. Through partnership with SAHFOS, the student will undergo training in basic plankton taxonomy and will develop an in depth understanding of CPR sampling and analysis methodologies. The candidate will gain interdisciplinary expertise in plankton ecology and science-policy, which will allow him/her to contribute to

international research on ecology and conservation. The studentship will obtain innovative results from the creation of a novel, century-long plankton database. These results will be highly publishable in the peer-reviewed literature and will provide evidence (indicator time-series, GES scenarios) that will stimulate their uptake into the UK and international OSPAR policy processes.

Details of SoMSE research centre affiliation, working environment etc. The studentship will be based in Plymouth University's Centre for Marine and Coastal Policy Research (MarCoPol), which is part of the Marine Institute, and carried out in close collaboration with the Sir Alister Hardy Foundation for Ocean Science (SAHFOS). The Marine Institute is the UK's largest, including over 3000 staff, researchers, and students. In 2015 the Marine Institute's £4 million Marine Station was opened with state-of-the-art diving, teaching and research facilities. MarCoPol is truly interdisciplinary, bringing together academics from the fields of conservation, policy, sociology, economics, law, business, biology and ecology. The Centre's team of researchers works on delivering cutting edge scientific evidence into the UK, European and international policy, conservation and decision making processes by working closely with Defra, OSPAR, the International Council on Exploration of the Seas (ICES and others. SAHFOS is an international research and monitoring charity which hosts the Continuous Plankton Recorder (CPR) survey, the longest and most spatially extensive marine ecological dataset in the world. SAHFOS is an internationally-renowned centre for plankton taxonomy and research, and also plays a key role in supporting UK, European and international policy.

Essential requirements: A 1st class or 2:1 in Marine Biology, Oceanography, Conservation Ecology, Marine Policy or related disciplines; an interest in taxonomy and conservation. **Desirable requirements:** MSc or MRes in Marine Biology, Oceanography, Conservation Ecology, Marine Policy or related disciplines; experience in basic taxonomy and working with large datasets, R, and GIS.

Who to contact for further information (DoS): Please contact Dr Abigail McQuatters-Gollop abigua@plymouth.ac.uk for further information or an informal chat

