Integrating data and models to better understand the consequences of changes in marine ecosystems for the services they deliver to society

MB0130: NERC Marine Ecosystems Research Programme

What's the problem?

Human activities and environmental change can have wide consequences for marine ecosystems and the benefits they provide such as supplying food and supporting leisure and recreation ('ecosystem services'). The significance of such consequences is difficult to predict because of our limited understanding of marine food webs, and in particular how interactions and changes in feeding relationships between organisms affect the delivery of ecosystem services.

What are the aims of the project?

The Marine Ecosystems Research Programme (MERP, www.marine-ecosystems.org.uk) is advancing our understanding of the processes that drive the dynamics of marine ecosystems, and in particular marine food webs. This improved knowledge is integrated into existing ecosystem models, which are mathematical representations of an ecological system, to predict impacts of environmental change on the structure and function of marine food webs and the services they provide. The effectiveness of various indicators that are being developed to measure environmental status will also be explored. To meet these aims, the programme will:

1. Provide a more complete picture of how food web components (e.g. plankton or seabirds), pressures (e.g. fisheries impacts), environmental (e.g. temperature) and other variables are distributed in space and time to underpin advice on the state of food webs and the environmental conditions required to maintain them;
2. Improve understanding of the effects of natural and anthropogenic change on the state of marine food webs to inform effective planning of human activities and;
3. Develop scenarios reflecting future states of marine food webs and ecosystem service provision on different spatial and temporal scales that are relevant to management and policy. For example, scenarios that take account of impacts of climate change or different management

Figure 1: Filming on a MERP cruise for Al Jazeera. Source: MERP

Which policy areas will the research inform?

The research supports an ecosystem approach to assist in policy development, regulatory and management initiatives. Project outputs will inform the implementation of the Marine Strategy Framework Directive (MSFD), the Marine and Coastal Access Act, Marine (Scotland) Act, Common Fisheries Policy and the OSPAR Joint Assessment and Monitoring Programme as well as the work of UK Government departments. They will also aid the implementation of the EU Biodiversity Strategy, the Natural Environment White Paper and the further development of the Marine Protected Area network.

NERC SCIENCE OF THE ENVIRONMENT

Marine Ecosystems Research Programme

Department for Environment Food & Rural Affairs

What are the results from the project and how will they be used?

Whilst considerable progress has been made in the programme, work is still at the pre-results stage. Data relevant to marine ecosystems is continuously collected by various organisations around the UK for different purposes. MERP has established a trial data portal and tools for remotely accessing key biodiversity datasets (e.g. fish trawl surveys, habitat types). Such tools bring data together in new ways so we can develop a clearer vision of how ecosystems work. Initial versions of these tools are being tested, outputs will allow us to develop new maps and other data products to aid decision making.

MERP is also collecting new observations and synthesizing data from other studies to get a better understanding of how marine life responds to change, which will be built into computer models. Extensive fieldwork will gather vital information needed to improve the range and quality of information available for computer models, and thus our ability to understand how marine ecosystems will respond to change in the future. New data gathered from the MERP 2015 cruises will help improve estimates of kelp production and understanding of body-size spectra. Models are already showing that assumptions made in the past about how changes in marine plant life affect changes in marine animal populations (such as commercial fish/shellfish) may be incorrect.

Key elements of the modelling work include understanding the certainty of model predictions, improving the performance of existing models and developing new models linking marine life (and how it changes) to the products and benefits humans derive from the sea. This will allow us to make better informed decisions in future.

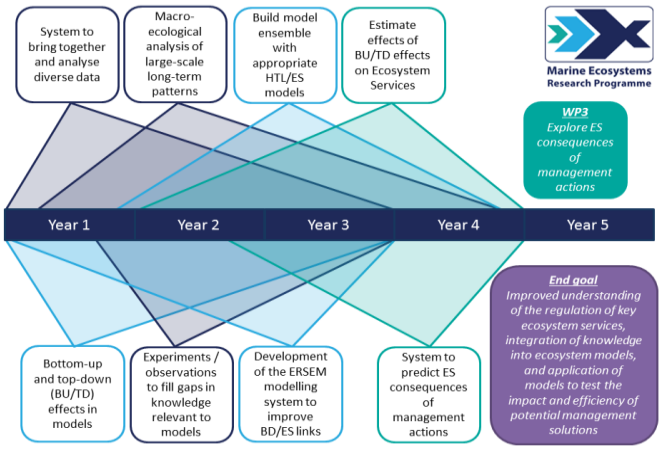

Figure 2: MERP Timeline and Progress

Figure 3: Different sizes of Monkfish captured aboard the Prince Madog

During the first year of the programme MERP has proactively engaged with the policy community at national and European levels through participation in workshops, sharing of scientific information and improving dialogue. Examples include:

- Joint MERP/Marine Management Organisation (MMO) workshop to develop a clear path between scientific research and management decisions, November 2015.
- A presentation to the Healthy and Biologically Diverse Seas Evidence Group (*HBDSEG*) in October 2015 by the MERP Coordinator.
- A presentation on 'Using ecosystem models for sustainable management of the Irish Sea' at the ICES Workshop on the impact of ecosystem and environmental drivers on Irish Sea fisheries management (WKIRISH) by the Scottish Marine Institute, September 2015.
- Participation in the Natural Capital Committee Workshop: Identifying metrics for natural capital (Defra, London) to discuss MERP ecosystem service research in June 2015.

Where can I find further information about this and related research?

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