

MarBEF Theme 2: Marine Biodiversity and Ecosystem Functioning

Recent activities and looking to the future

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As we start to reach the completion of current projects within the MarBEF framework, Theme 2 is looking forward to an interesting and productive future. The objective of Theme 2 is to generate theory, models and tests of the relationship between marine biodiversity and ecosystem function through the integration of theory, modelling, meta-analysis and experimental tests. The theme consists of seven RMPs (Table 1), the overall aims of which are to determine rates of ecosystem functionality in both benthic and pelagic systems, by generating theories, models and experimental tests of the relationship between marine biodiversity and ecosystem function. Details of the meetings and any downloads regarding the RMPs can be obtained from the individual RMP websites.

Many Theme 2 workshops, meetings and sabbaticals have taken place during MarBEF and all have been highly successful. Large emphasis has been placed on integration within and between the themes (Figure 1). These efforts have been productive and many of the activities have led to the development of new ideas and collaborations.

A policy document, *Scientific Challenges*, produced through integrated effort between the three marine Networks of Excellence (Eur-Oceans, Marine Genomics Europe and MarBEF), has been produced to outline the challenges facing the marine community. The aim of this joint venture was to promote and develop the concept of a long-lasting, multi-

site institute. This document was written by Mark Cock, David Paterson, Paul Tréguer and Paul Wassmann.

A Theme 2-led synthesis paper, *Ecosystem Approach*, is currently underway which will provide an outline of current knowledge on the topic and will highlight areas that need to be considered for future research.

There are numerous research papers already published, and many more being prepared, and Theme 2 can look forward to achieving an extensive and successful publishing record. A few recent examples of some of the research papers arising from Theme 2 are as follows:

Hendriks, IE, Sintes, T, Bouma, TJ and Duarte, CM (2008). Experimental assessment and modelling evaluation of the effects of seagrass (*Posidonia oceanica*) on flow and particle trapping. *Marine Ecol. Prog. Ser.* (in press).

Table 1: THEME 2 RMPs (RESPONSIVE MODE PROJECTS)

WP-RMP code and title	Principal Investigator(s)
4-1 RMP on Genetic Biodiversity (GBIRM) (www.marbef.org/projects/gbirm/index.php)	J.-P. Ferral
4-2 The role of native and/or invasive ecosystem engineers in explaining biodiversity	T. Bouma, P. Herman, T. Ysebaert
4-3 Pan-European Gradients in Propagation and Settlement Events (www.marbef.org/projects/settlement/index.php)	K. Philippart
4-4 Effects of biodiversity on the functioning and stability of marine ecosystems – European scale comparisons (BIOFUSE) (www.marbef.org/projects/biofuse/index.php)	T. Crowe, L. Benedetti-Cecchi
4-5 Functioning of FOOD Webs across ecosystems of different BIODiversity level (FOODWEBIO) (www.marbef.org/projects/foodwebio/index.php)	A. Sokolowski
4-6 Microbial diversity and ecosystem functions: concepts, open questions and recommendations for integration of microbes into general ecological frameworks	K. Jürgens, J.M. Gasol
4-7 Role of Secondary Metabolites in Ecosystem Biodiversity (ROSEMEB) (www.marbef.org/projects/rosemeb/index.php)	A. Ianora



Arnaud-Haond, S, Diaz Almela, E, Teixeira, S, et al. (2007). Vicariance patterns in the Mediterranean Sea: East-west cleavage and low dispersal in the endemic seagrass *Posidonia oceanica*. *Journal of Biogeography* (in press).

Bu_as, M, Daunys, D and Olenin, S (2007). Overgrowth patterns of the red algae *Furcellaria lumbricalis* at an exposed Baltic Sea coast: The results of a remote underwater video data analysis. *Estuarine, Coastal and Shelf Science* **75**, 308-316.

Alonso-Sáez, L, Gasol, JM, Arístegui, J, Vilas, JC, Vaqué, D, Duarte, CM and Agustí, S (2007). Large-scale variability in surface bacterial carbon demand and growth efficiency in the subtropical North East Atlantic Ocean. *Limnol. Oceanogr.* **52**, 533-546.

Fontana, A, d'Ippolito, G, Cutignano, A, Miralto, A, Ianora, A, Romano, G and Cimino G (2007). Chemistry of oxylipin pathways in marine diatoms. *Pure and Applied Chemistry* **79**, 481-490.

A result of integration between the framework of the Networks of Excellence MARBEF and Marine Genomics-Europe is that of an integrative proposal in the major call of the FP7 program ENV.2007.2.2.1 .2. 3 "Ecology of important marine species." We hope that many more proposals of this nature will follow.

Cross-theme RMP integration occurred during the 2007 GA during a breakout session. During this integration session it was decided that an integrative workshop (cross-theme and CSP-RMP integrated) was required to address the various metrics and protocols for functionality measurement across differing marine systems. This workshop is being co-ordinated by Arturas Ragiuloas.

Theme 2 has also increased cross-theme integration activities by attending a joint

Theme 1,2 and 3 workshop hosted by Melanie Austin (Theme 3). The aim of this workshop was to examine the ecological data required to quantify marine ecosystem goods and services. The workshop provided an excellent opportunity for many fields and backgrounds to brainstorm, the result of which is to be a joint review paper.

A future workshop will take place during the World Conference on Marine Biodiversity and will be hosted by Martin Solan and David Paterson. The workshop will focus on "marine biodiversity futures and ecosystem functioning: frameworks, methodologies and integration." The outcome of this meeting will be a book which the Oxford University Press has already stated an interest in.

The RMPs are all busy finalising the experimental projects and preparing to report their findings to the marine biodiversity community at the World Conference in Valencia.

A new integrative approach for investigating the relationship between biodiversity and ecosystem functioning has been developed within the BIOFUSE RMP. This represents the first attempt to assess how alterations in biodiversity might affect functioning of the marine ecosystem, by combining pre-existing and ad hoc generated data, across a variety of marine habitats and European countries. Hypotheses about the role played by species diversity and human disturbances in determining the stability of a variety of marine habitats, ranging from rocky shore to soft bottoms to seagrass meadows, have not only been tested through meta-analysis of collated extant datasets, but the reliability of results thereby generated has been backed up by new

data obtained on purpose. A series of descriptive and experimental studies have been, in fact, repeated in different habitats at multiple sites across Europe, by members of BIOFUSE. Such a wide-breadth approach is unprecedented and has enabled the drawing of general conclusions about the generality, both across habitats and across large spatial scales, of the role of marine biodiversity in regulating ecosystem functioning. This knowledge is highly valuable for managers and policymakers since it points out some generalities in cause-effect relationships that regulate the capability of marine systems to deliver goods and services to humans.

Comprehensive studies by the FOODWEBIO RMP, on the structure and functioning of food webs in marine ecosystems of varying biodiversity levels and diverse physical or human constraints, have been performed at a pan-European scale to unravel possible interactions between the organisation of trophic connections and biodiversity. The comparisons focused on macrobenthic communities at several coastal and estuarine locations representing a range of environmental and ecological systems. Species diversity indicators and environmental variables have been related to data on the principle features of food webs (source of organic matter, a number of relative trophic levels, species distribution among trophic levels) that were assessed based on analysis of stable isotopes of carbon ($^{13}\text{C}/^{12}\text{C}$) and nitrogen ($^{15}\text{N}/^{14}\text{N}$) in living and non-living ecosystem components. The results found will be used to explain and model the complex relationships between diversity of habitats/species and the functioning food webs in European coastal waters.

The RMP ROSEMEB are hosting a workshop on "Chemical Ecology as a Driver for Blue Technology and Bioprospecting" in Ischia, Italy, 29th -31st October 2008. The aim of this workshop will be to bring together scientists interested in chemical ecology, blue technology and bioprospecting. This workshop is of great interest as it is a relatively new field which could benefit from a greater understanding of the natural function of secondary metabolites so as to find new applications for these potentially important natural drugs.

Theme 2 colleagues are looking forward to the chance to report their findings over the last five years at the World Conference on Marine Biodiversity in Valencia. We look forward to seeing you all there.

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