

## MarBEF Theme 1: Global Patterns of Marine Biodiversity Across Ecosystems

# Past and future Theme 1 activities

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ONE OF THE GREATEST CONCERNS in marine biology today is the detection and management of changes in marine ecosystems as the result of global change. As different species have different physiological tolerances to parameters such as temperature and salinity, climate change could profoundly affect the taxonomic composition of marine benthic and pelagic communities. This would have a 'knock-on' effect on almost all aspects of our uses of the marine environment: from potential further damages to fisheries (through changes in foodwebs) to reduced amenity value of beaches due to blooms of harmful/ nuisance algae.

To detect changes and assess their impacts it is imperative to collect detailed long-term data, both on species assemblages and environmental parameters, and to do so over a long time. Only then will it be possible to assess changes in marine biodiversity, both natural and anthropogenic.

Many European long-term data sets exist, covering a range of geographic regions, types of organisms and environmental parameters, but these data series vary greatly in their degree of curation (see EurOBIS and data management papers), sampling frequencies, methodologies, etc. To be able to start using these data sets efficiently, it is vital to bring these data sets together, integrate them and check for consistency, and finally assemble the statistical/mathematical expertise to carry out appropriate analyses.

### Theme 1

MarBEF Theme 1, which aims to understand how biodiversity varies over space and time, and how this variation is influenced by environmental processes, has recognised these needs and is addressing them in a series of activities in collaboration with the Data Management team. One of the most important steps is to actually locate as-yet non-digitised data series; many of these are little known, but some have a duration of 40+ years. These data sets are at great risk of being lost, and it is therefore an urgent priority to archive these data sets properly and make them accessible for the purposes of analysis. These aims will be achieved by creating intensive dialogue with data custodians and by a series of dedicated workshops or courses, five of which have been earmarked for the remainder of the MarBEF project. In addition to achieving the primary Theme 1 goals, they will also be used to intensify interactions between MarBEF themes, with at least one workshop to be organised specifically for the purpose of integrating activities between Theme 1 and Theme 2.

### Theme 1 activities so far

The main activities carried out in the context of Theme 1 are the following:

A. The first of two workshops has been held in Oslo (March, 2005). This workshop was a practical exercise on the first version of the database, including data on the macrobenthos from EU waters. During the Oslo Workshop, the fundamental 10 hypotheses to test were formulated:-

- (1) Relationship between numbers of species and system functioning. How do functional characteristics vary in different areas? What are the numbers of species within different functional groups and how do they vary over European waters?
- (2) Are there differences between offshore and coastal benthic assemblages in structure and functional processes?
- (3) What are the relationships between functional traits and productivity?
- (4) How do large water masses influence benthic diversity (e.g. Arctic, Mediterranean, etc)?
- (5) Are there spatial and temporal correlations in assemblage structure?
- (6) How are local and regional species pools defined in a European marine context?
- (7) How do species abundance patterns vary across geographical areas? Species-area relationships in European soft-sediment assemblages in relation to scale/extent and in relation to traits (e.g. larval modes)?
- (8) What are the range size estimates for marine species across Europe (we do not have many estimates for European marine soft sediment species)?
- (9) Is biodiversity in the Arctic really lower than at lower latitudes?
- (10) Are there differences in structure between marine and terrestrial/freshwater systems? (This will need collaboration with terrestrial ecologists.)

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**Table 1: THEME 1 RMPs (RESPONSIVE MODE PROJECTS)**

<i>WP-RMP code and title</i>	<i>Principal Investigator(s)</i>
3-1 Causes and consequences of changing marine biodiversity – a fish and fisheries perspective (MarFish) ( <a href="http://www.marbef.org/projects/marfish/index.php">www.marbef.org/projects/marfish/index.php</a> )	MacKenzie, Brian
3-2 Biodiversity and ecosystem function under changing climatic conditions – the Arctic as a model system (ArctEco) ( <a href="http://www.marbef.org/projects/arcteco/index.php">www.marbef.org/projects/arcteco/index.php</a> )	Weslawski, Jan Marcin
3-3 Deep-sea & Extreme Environments, Patterns of Species and Ecosystem Time Series (DEEPSETS)	Billet, Dave
3-4 Meiobenthic and Nematode biodiversity: Unravelling Ecological and Latitudinal Aspects (Manuela) ( <a href="http://www.marbef.org/projects/manuela/index.php">www.marbef.org/projects/manuela/index.php</a> )	Vanaverbeke, Jan
3-5 Web Accessible Taxonomic Expertise in MarBEF: PROviding an e-Platform for the European Taxonomists (PROPE-taxon) ( <a href="http://www.medobis.org/prope/index.php">www.medobis.org/prope/index.php</a> )	Arvanitidis, Christos
3-6 Large-scale and long-term Networking on the observation of Global Change and its impact on Marine Biodiversity (LargeNet) ( <a href="http://www.marbef.org/projects/largenet/index.php">www.marbef.org/projects/largenet/index.php</a> )	Buchholz, Friedrich
3-7 Integration of different methods to study patterns and changes in pelagic biodiversity in the open ocean along the Mid-Atlantic Ridge (MARECO)	Pierrot-Bults, Annelies C. & Piatkowski, Uwe
3-8 European integration of marine microplankton research (MARPLAN) <a href="http://www.marbef.org/projects/marplan/index.php">http://www.marbef.org/projects/marplan/index.php</a>	Kooistra, Wiebe H.C.F.
3-9 Modelling key aspects of marine biodiversity	Lambshhead, John

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B. The second Theme 1 workshop was held in Crete in October 2005. The most important achievements resulting from this workshop were:

- (i) Many working groups were formed in order to test specific hypotheses.
- (ii) Participants agreed on a draft with legal importance (The Declaration of Mutual Understanding for Sharing Data in Theme 1), which describes the rights and duties of data contributors inside and outside MarBEF.
- (iii) Hands-on sessions were held on the new version of the database (MacroBen). The database at the Oslo Workshop has been enlarged and many new data sets of soft-bottom macrofauna have been included. This is one of the most comprehensive marine benthic databases available globally. At the Oslo meeting, the database included 942 stations, 1,243 samples and more than 115,000 distribution records. The Flanders Marine Institute (VLIZ) now shoulders responsibility for the data management and has taken on the task of integrating and making the appropriate quality controls. Currently, the database includes 21,758 stations and more than 432,000 distribution records. The stations were geo-referenced and assigned to biogeographic divisions such as LMEs, Fredj, Longhurst, IHO, OSPAR and ICES. All taxonomic data are linked to ERMS and a set of tools to aggregate, explore and export the data has been established.
- (iv) An additional hypothesis has been formulated and is under testing: 'Testing the performance of the main biotic indices proposed for the EU WFD through the analysis of a pan-European Database.'
- (v) Presentation of the first results: based on the first version of the database, several hypotheses had already been tested and the results were presented in Crete. These hypotheses addressed, for example, questions about the relation of functional traits and structural composition in benthic assemblages, about exploring the structure and origin of large-scale ecological patterns found in the MarBEF dataset (macroecology), about changes in soft-bottom macrozoobenthos diversity at different spatial scales, and whether the various zoogeographic regions, as defined by various theories and systems (e.g. Longhurst, Fredj, OSPAR, IHO, ICES), can be considered as random samples of

the pan-European soft-bottom macrofaunal inventory. A copy of the Crete Workshop executive summary can be downloaded from: <http://www.medobis.org/prope/creports.php>.

C. A presentation of the main activities in Theme 1 was provided by J Gray during the MarBEF GA in Lecce (May, 2006). Also, a presentation of the results deriving from the testing of the 6th hypothesis (see above) were presented. A small committee was assembled and decided the next steps to be taken by the consortium. These steps are:

- (i) The Theme 1 co-leader (J Gray) and the data management leader (E Vanden Berghe) will contact the editor of MEPS to negotiate a special issue on the results of the hypotheses testing, as deriving from the Theme 1 activities on macrobenthos.
- (ii) Deadlines for the submissions were established, and a summary should be provided by the working groups by the end of July. The full manuscript for each paper should be delivered for submission in MEPS by the end of the year (2006).

D. A small meeting, led by Dr Paul Somerfield, was held in Crete (October 2006) in which the hypothesis of whether the inventories at specific scales (e.g. from the replicate unit to the regional) are random samples of those of the next, larger, ones (e.g. from station to the EU macrobenthos inventory) was tested by means of the Taxonomic Distinctness Indices. Mathematical experiments were conducted from the scale of the replicate unit to the regional one. Results will be presented during the forthcoming GA meeting.

### Outlook: Theme 1 is launching RMP LargeNet

Several Theme 1 Responsive Mode Projects are dealing with specific areas of changes in marine biodiversity (e.g. DEEPSETS, MARFISH). The latest project in this series is LargeNet, which will be concerned with the analysis of long-term

and large-scale changes in marine ecosystems both in soft- and hard-bottom and pelagic areas. Soft-bottom work has been started as one of the core activities of Theme 1 and has led to the MacroBen database and analysis workshops in Oslo and Crete. A coordination workshop for LargeNet will be held at the Alfred Wegener Institute in Bremerhaven, Germany, from 22-24 November where analysis and data management tasks for LargeNet will be planned. The most urgent task is, again, the location and archiving of data sets. This process will initially be based on the sets of sites outlined in the BIOMARE project, but will not be restricted to these. Contacts with data custodians have already been established and new data sets located. If you have not been contacted directly so far, any person or institute interested is welcome to join. This process will continue throughout the duration of LargeNet. Progress in the LargeNet project along with relevant documents will be posted on the recently established LargeNet project website, at <http://www.marbef.org/Projects/LargeNet/index.php>.

● Theme 1 (and LargeNet) lead is now in the hands of Fred Buchholz, Alexandra Kraberg and Doris Schiedek, and they will be delighted to communicate further.



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