

**M**arine biodiversity is threatened and changing through over-exploitation, habitat destruction, pollution, introduction of species and global climate change. The consequences of biodiversity loss for marine ecosystem functioning are unknown.

Understanding of biodiversity and ecosystem functioning needs to be addressed at all levels from genetic diversity of marine organisms, through the role of species, habitats and communities, up to seascapes and ecosystem diversity.

Halting biodiversity loss through informed marine environmental management, sustainable use and restoration of living marine resources requires interdisciplinary scientific understanding, spreading of knowledge and gaining support from society.

This is precisely the aim of MARBEF, a project created to bring together world-class marine scientists with outstanding skills and expertise into a virtual European Centre of Excellence in marine biodiversity and ecosystem functioning.

At present it consists of over 400 scientists from 56 institutes located in some 20 countries around Europe. All partner institutes are considered centres of excellence for marine biodiversity research in their countries.

## How MARBEF came about

The 1992 Earth Summit in Rio de Janeiro led to the Convention on Biological Diversity, which has now been signed by nearly all European countries. Since then many initiatives for research on biodiversity issues have been launched, the majority being local, short-term and focused on terrestrial environments.

Long-term (> three years) biodiversity research has been more difficult to implement, even at the national level, and marine biodiversity research in particular has long been considered less urgent because the main problems were thought to occur on land.

Some of the major obstacles have been national and European

In Europe there are world-class marine scientists with outstanding skills and expertise. The MARBEF project has brought this dispersed scientific excellence together to create a virtual European Centre of Excellence in marine biodiversity and ecosystem functioning to counteract the threat of biodiversity loss



**Carlo Heip,  
coordinator of  
MARBEF, at the  
opening General  
Assembly in  
Brugge**

funding systems and the lack of an internationally agreed methodology for the measurement of marine biodiversity and the choice of indicators.

But in 2000 a concerted action project was funded under the European Union Fifth Framework programme (FP5). BIOMARE (Implementation of large-scale long-term marine biodiversity research in Europe), co-ordinated by Carlo Heip and Herman Hummel of NIOO in The Netherlands, had three main objectives.

1. To achieve a European consensus on a network of marine sites to act as a basis for long-term and large-scale marine biodiversity research
2. To identify an internationally agreed set of indicators for biodiversity

# Biodivers countera

3. To identify existing facilities for biodiversity research in Europe with an aim to develop a clear unified approach to marine biodiversity research at a large scale in Europe.

The BIOMARE project was completed in 2002 and one of the main benefits was a close network of like-minded marine biodiversity experts from institutes spread across Europe.

To maintain the momentum generated under BIOMARE and to expand the network to include additional members, particularly from what were the Newly Associated States of Europe, a further proposal named MARBENA (Creating a long term infrastructure for marine biodiversity research in the European economic area and the Newly Associated states) was developed and successfully funded by the EU under FP5.

MARBENA expanded the network of marine scientists and, through a series of electronic conferences, created awareness of the biodiversity issues and increased the visibility of European marine biodiversity research.

However, during the final months of BIOMARE, the EU launched its Sixth Framework programme (FP6) calling for Expression of Interest for new Networks of Excellence research instruments.

Under the leadership of Carlo Heip the BIOMARE network reorganised itself, added to its numbers and after numerous meetings developed an outline for taking marine biodiversity research in Europe forward through the proposal MARBEF – Marine Biodiversity and Ecosystem Functioning.

In July 2003 word was

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received from Brussels that the proposal was to be funded under FP6. Following a further six months of negotiations, the MARBEF project kicked off in February 2004.

## Scientific objectives

MARBEF has three clear scientific objectives:

1. To understand how marine biodiversity varies across spatial and temporal scales and between levels of biological organisation methods to detect significant change can be developed
2. To examine the relationships between marine biodiversity (at all levels of organisation) and ecosystem function through the integration of theoretical and modelling exercises, comparative analyses and carefully-designed experimental tests
3. To understand the economic, social and cultural value and importance of marine biodiversity and therefore develop the research base required to support the sustainable management of marine biodiversity.

These aims will be achieved by

**Biodiversity  
threatened:  
Shallow algal  
dominated  
photolithic  
communities in the  
Mediterranean Sea**  
(Photo: Jo Harmelin)

the dedicated group of top marine scientists and institutes initiating innovative and excellent interdisciplinary research.

By creating a virtual European institute with a long-term research programme the 'sum of the parts' can be exceeded in terms of expertise and resources available in Europe. Expertise in one institute will be shared with others through focused and specialised training programmes and the network will provide resources for the exchange of scientists and researchers between institutes.

## Research

MARBEF is adopting a phased approach to the objectives. Each theme has a core strategic programme – the major joint research activity for the theme – which will engage a large proportion of the MARBEF members in joint research. This top-down approach will guarantee that MARBEF focuses on and devotes major resources to meeting the priorities. This approach is combined with a responsive mode, in which smaller scale projects which

fill any emerging gaps in the overall programme, will be identified and selected.

The three major priorities are:

1. To adequately describe patterns in marine biodiversity at the appropriate scales of space and time. This strategic programme is designed to integrate research and data from the network members on large-scale, long-term patterns in marine biodiversity and build on results of previous EU projects, eg, BIOMARE
2. To assess changes due to natural disturbance and to human impact, including fisheries and climate change, based on sound knowledge of the relationship between biodiversity and ecosystem functioning. This project will determine the rates of selected ecosystem processes for different systems and across seasons to provide comparative assessments of the variability of functional measures across Europe. This generic study will provide an invaluable dataset with which to compare the activities of marine systems with terrestrial systems and examine the validity of transposing terrestrial paradigms in ecological theory to marine ecology
3. To provide correct and relevant information to national and EU policy-makers and society in general. To understand the economic, social and cultural value of marine biodiversity and hence develop the research base required to support the sustainable management of marine biodiversity including, for example, the monitoring of the health of marine ecosystems, the management of aquaculture, the conservation of marine biodiversity, the history of marine resource exploitation, and the leisure use of marine ecosystems.





**Biodiversity threatened: The Mediterranean seagrass beds (*Posidonia oceanica*) are important habitats for commercial fish species**  
(Photo: Jo Harmelin)

### Core activities

At the heart of the network are a series of core activities to support and facilitate the research and provide common tools and resources to the network.

### Data management

MARBEF will espouse the philosophy of data sharing, giving access to very large scale data sets able to reveal patterns not apparent in small scale. The core facility will be a distributed database containing information about all of the marine species known to occur in European waters, with details of sites from which they have been recorded. The biological data and associated physical data will form the basis for ongoing research into marine biodiversity research across Europe.

### Communication and outreach

More and more scientific work is being carried out to answer specific questions raised by policy makers and environmental managers, so communicating the results of research to who need it to make decisions and perhaps provide more funding, is vital.

So too is increasing the awareness of marine biodiversity issues to the general public.

The media tends to restrict coverage to major pollution incidents, but the public needs to be aware of the more general marine biodiversity topics, the effects of which may be just as significant. Two way communications

between the network and the public, end-users, students and school children, scientists, and industry will be facilitated through e-conferences and mailing lists, allowing feedback on the strategies and direction of the network at regular intervals.

In addition, the website ([www.marbef.org](http://www.marbef.org)) will provide a focal point for updates on project activities and a series of full colour newsletters will provide details of project progress and articles of interest from around Europe.



One of the most effective ways of communicating marine biodiversity science is through formal education. Yet how much marine biodiversity science is taught in schools and colleges? A thorough review of the European school curricular will be made and web-based material on specific marine biodiversity issues and topics of interest created. There is also the possibility of developing a European network of amateur recorders.

### Taxonomic clearing house

Inventories of species, communities and ecosystems are central to the success of the research programme in MARBEF and the

emphasis on field sampling and ecological analysis will naturally result in the discovery of new, rare, or newly introduced species.

Unfortunately taxonomists are spread widely across Europe and are not necessarily on hand to provide advice or expertise when needed. MARBEF is developing a system by which European marine ecologists can gain rapid access to this expertise. A fast-track 'taxonomy clearing system' will address the taxonomic/identification bottleneck and streamline the processes of identification of specimens and the description of new species.

The clearing system will expedite the necessary taxonomic work and act as a middle agent, receiving requests for taxonomic work and matching these requests to available taxonomic expertise. It will also provide access to the specialist feedback required for updating species inventory lists and also be an important focal point for the interactions between the taxonomic and ecological researchers within the network.

### Up the political agenda

MARBEF is now seven months down the road and still has a way to travel before achieving its objectives. This approach to science is new and there are challenges ahead; integrating of science at this scale; tying together the three main research themes, particularly between science and societal needs; communicating the achievements to the wider scientific community and more particularly to policy makers to ensure marine biodiversity does not move off but up the political agenda. ©

\*MARBEF is coordinated by Carlo Heip, Director Netherlands Institute of Ecology Centre for Estuarine and Marine Ecology and funded under the Thematic Area: Sustainable development, global change and ecosystems of the European Union's Sixth Framework programme.

Links: Implementation of large-scale long-term marine biodiversity research in Europe – [www.biomareweb.org](http://www.biomareweb.org)  
MARBEF: [www.marbef.org](http://www.marbef.org)