MARBENA

Creating a long term infrastructure for marine biodiversity research in the European Economic Area and the Newly Associated States.

FINAL REPORT

CONTRACT N°: EVR1-CT-2002-40029

PROJECT CO-ORDINATOR: **Prof. Dr. Carlo Heip**
Netherlands-Institute of Ecology-
Centre for Estuarine and Marine Ecology

PARTNERS :

1. Netherlands Institute of Ecology Centre for Estuarine and Coastal Ecology (NIOO-CEME) - The Netherlands
2. Flanders Marine Institute (VLIZ) - Belgium
3. Centro de Investigação Interdisciplinar Marinha e Ambiental (CIIMAR)- Portugal
4. Natural Environment Research Council (NERC) Centre for Ecology and Hydrology - United Kingdom
5. Ecological consultancy Services Limited (EcoServe) - Ireland
6. Fundació Universitat-Empresa De Les Illes Balears (FUEIB) - Illes Balears, Spain
7. University of Oslo (UO) - Norway
8. Forschungsinstitut Senckenberg (SNG) - Germany
9. Instituto do Mar (IMAR), Center of IMAR of the University of the Azores - Portugal
10. National Environmental Research Institute (NERI), Department of Marine Ecology - Denmark
11. Institute of Marine Biology of Crete (IMBC) - Greece
12. Marine Biological Association of the United Kingdom (MBA) - United Kingdom
13. Polish Academy of Sciences, Institute of Oceanology (IOPAS) - Poland
14. Institute of Oceanology, Bulgarion Academy of sciences (IO BAS) - Bulgaria
15. National Institute of Biology (NIB) - Slovenia
16. Centro Marino Internazionale (IMC) - Italy
17. Estonian Marine Institute (MEI) - Estonia
18. Akvaplan-Niva AS and University Studies on Svalbard (AN/UNIS) - Norway
19. Alfred-Wegener-Institute for Polar and Marine Research (AWI) - Germany

REPORTING PERIOD: 1 December 2002 - 1 April 2006

PROJECT START DATE : 1 December 2002 **DURATION :40 months**

Sections included: 1-6

TABLE OF CONTENTS

SECTION 1: MANAGEMENT REPORT

1.1. Objectives of the reporting period

During the last period the main objectives of the project were:

- Maintaining the link with BioPlatform and the European Platform for Biodiversity Research Strategy (EPBRS), by
  - the preparation of the presentation of relevant marine biodiversity (research) issues at the EPBRS meetings.
- Networking, with emphasis on the New Member States and S. Mediterranean countries
- Finalising the study of the 'market of supply and demand' of marine biodiversity information, and the completion of position paper on this matter.

1.2. Scientific/Technical progress made in different work packages according to the planned time schedule

EPBRS meetings (WP 2,4)

The EPBRS meetings have proven to be successful for increasing the visibility of marine biodiversity issues and research at European level. In consultation with, and approved by, the EC officer it was decided to continue supporting the EPBRS meetings as much as possible. In contrast to former electronic conferences, during which two separate e-conferences (MARBENA and BioPlatform) ran parallel in order to discuss biodiversity issues from the marine and the terrestrial perspective, now MARBENA directly fed into the BioPlatform / EPBRS e-conference.

MARBENA contributed to the e-conference for the EPBRS meetings 'Landscape scale biodiversity assessment: the problem of scaling" in Hungary (31 March to 4 April 2005) and successfully cooperated with BIOCLIME (Conservation of biodiversity in a changing climate: Review of evidence and identification of knowledge gaps, http://www.ceh.ac.uk/sections/ed/BIOCLIME.html) in an e-conference for the EPBRS meeting "Conservation of biodiversity in a changing climate: knowledge needed to support development of integrated adaptation strategies in Europe", Aviemore, Scotland on 2nd-5th October 2005.

The EPBRS meeting 'Europe's Mountain Biodiversity: Research, Monitoring, Management, (Vienna, Austria, 10-11 March 2006), was not preceded by an e-conference, but delegates of MARBENA successfully presented marine biodiversity issues on seamounts at the meeting.

Workshops / position papers (WP 2,3,5)

In 2006 two workshops have been organised to increase integration and to extend the network towards the new member states (former NAS), and to produce position papers on 'The status of European marine biodiversity research and potential extensions of the related network of institutes' (the 'market of supply and demand' of marine biodiversity information) and on 'Marine biodiversity information: an emerging market and opportunities for SMEs':

1. Preparatory Workshop "Topics and priorities in European Marine Biodiversity Research, with emphasis on the New Member States and on Emerging Business Opportunities for SMEs, preparatory workshop", Tallin, Estonia, 9-20 February 2006.
2. Workshop "Topics and priorities in European Marine Biodiversity Research, with emphasis on the New Member States and on Emerging Business Opportunities for SMEs", Yerseke, the Netherlands, 20-22 March 2006.

For more information see also section 6.3.

Networking (WP 2,5)
As networking is one of the main objectives of MARBENA, during the last phase of the project, special attention has been given to possibilities to extend the network towards the S. Mediterranean region. Furthermore links have been established with relevant FP6 projects, such as the Networks of Excellence MarBEF (Marine Biodiversity and Ecosystem functioning), Marine Genomics Europe (Implementation of high-throughput genomic approaches to investigate the functioning of marine ecosystems and the biology of marine organisms), and Euroceans (EURopean network of excellence for OCean Ecosystems ANalysis), through the participation of MARBENA partners.
Furthermore a cooperation was established with MAPO (Marine Pollutions), a project which gathers a wide range of actors who are committed to sensibilizing and supporting innovative SMEs to take part in European projects/networks in the field of marine pollution. MARBENA launched a request for participation of SME's with an interest in marine biodiversity research.

1.3 Deliverables obtained

Since the EPBRS meetings have in succession been supported, resulting in additional e-conferences and presentations of the results at EPBRS and EPBRS-linked meetings, the following Milestones and deliverables have been reached:

Deliverable No	Deliverable title	Delivery date	Nature[1]	Dissemination. Level[2]
3.3, 2.9	Yearly Report of the state of Network and related infrastructure	**36**	**Re**	**PU**
3.4, 3.5, 3.6, 2.15, 2.16, 2.17, 2.18	Position papers Topics and priorities in European Marine Biodiversity Research, with emphasis on the New Member States and on Emerging Business Opportunities for SMEs,	**32**	**Re**	**Pu**
3.5	Database: Actors in the European Marine biodiversity research	**35**	**O**	**PU**
3.6	The European Marine Biodiversity Research RTD catalogue	**35**	**O**	**Pu**
4.7	e-conference for the EPBRS meeting 'Landscape scale biodiversity assessment: the problem of scaling" in Hungary (31 March to 4 April 2005)	**40**	**Re**	**PU**
4.8, additional	e-conference for the EPBRS meeting "Conservation of biodiversity in a changing climate: knowledge needed to support development of integrated adaptation strategies in Europe", Aviemore, Scotland on 2nd-5th October 2005.	**40**	**Re**	**PU**
4. additional	Preparatory Workshop "Topics and priorities in European Marine Biodiversity Research, with emphasis on the New Member States and on Emerging Business Opportunities for SMEs, preparatory workshop", Tallin, Estonia, 9-20 February 2006.	**40**	**Re**	**PU**
4. additional	Workshop "Topics and priorities in European Marine Biodiversity Research, with emphasis on the New Member States and on Emerging Business Opportunities for SMEs", Yerseke, the Netherlands, 20-22 March 2006.	**40**	**Re**	**PU**
4. additional	The status of marine biodiversity research and potential extensions of the related network of institutes & The market of 'supply and demand' of marine biodiversity information, and the possible role of SME's and large industries – contributions	**40**	**Re**	**PU**

Deliverable No	Deliverable title	Delivery date	Nature[1]	Dissemination. Level[2]
	from the Southeastern Mediterranean Region			
4. additional	Representation at the EPBRS meeting in Hungary	**40**	**O**	**PU**
4. additional	Representation at the EPBRS meeting in Austria	**40**	**R**	**PU**
6.6	Management Progress Report	**36**	**Re**	**Re**
6.9	Scientific and Technical Report	**36**	**Re**	**Re**
6.12	Cost Statements	**36**	**Re**	**Re**
6.15	Technological Implementation Plan	**36**	**Re**	**Re**

1.4. Deviations from the work plan or/and time schedule and their impact to the project / 1.6. Difficulties encountered at management and co-ordination level and proposed/applied solutions

After consultation with, and approval by, the EC officer it has been decided to extend the project with another 4 months in order to facilitate the support to the EPBRS meeting 'Europe's Mountain Biodiversity: Research, Monitoring, Management, (Vienna, Austria, March 2006). Also it was decided that is was better to promote marine biodiversity issues at external events in stead of organising a final conference to present the results of MARBENA.

Table 2. Adjusted time table to cover recent developments

	2005												2006			
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4
Work Packages																
EPBRS / BioPlatform meetings[1]				HU						UK						AU
WP1. Preparation																
WP2.Coordination																
Steering Committee																
Conferences and workshops[2]													a			b
WP3. Infrastructure																
WP4. e-conferences[3]				HU					UK							
WP5. NAS																

[1] Presentation of marine biodiversity research and issues at the EPBRS or BioPlatform meetings of:
HU: Hungary; UK: Scotland; AU: Austria

[2] Conferences and workshops:
a: Tallinn, Estonia, January 2006
b: Yerseke, The Netherlands, March 2006

[3] e-conferences in preparation of EPBRS / Bioplatform meetings and workshops:
HU: Hungary; UK: Scotland

1.5. Co-ordination of the information between partners and communication activities

No remarks

SECTION 2: EXECUTIVE PUBLISHABLE SUMMARY RELATED TO REPORTING PERIOD

Contract n°	**EVR1-CT-2002-40029**	Reporting period:	24-40 months
Title	Creating a long term infrastructure for marine biodiversity research in the European Economic Area and the Newly Associated States		

Objectives:
In order to answer the most important questions in marine biodiversity at European scale, long-term and large-scale research is needed, and thus concertation and co-ordination. This is very difficult to implement. Major obstacles are the funding systems, lack of a Pan European Network of actors in marine biodiversity research and a sound research infrastructure at the European level.
Therefore MARBENA has created a network of marine scientists with strong links to the different stakeholders in marine biodiversity issues, from the EU-EEA and the New Member States, that adequately has prepared and exploited the possibilities of the next framework programme and the European Research Area, improved the infrastructure for marine (biodiversity) research and its accessibility and utilization by European scientists, and has increased the visibility of marine biodiversity issues for science managers, politicians and other end users, including the public at large.

Scientific achievements:
MARBENA had no specific scientific objectives, but was more aimed at networking and integration of knowledge and information.
During the last year MARBENA remained focussed on increasing the visibility of marine biodiversity issues and research in Europe.
MARBENA organised, and participated in E-conferences that addressed relevant marine biodiversity issues and the results were presented at the European Platform for Biodiversity Research Strategy (EPBRS) meetings, organised by the countries occupying the presidency of the EU at that time (Scotland, Hungary, and Austria).
MARBENA, BIOPLATFORM and BIOCLINE cooperated successfully in improving the visibility of (marine) biodiversity issues at a high policy level.
Two workshops were organised to define the status of the network of stakeholders in marine biodiversity issues in the EEA, New Member States and South-eastern Mediterranean Countries; and on business opportunities for SMEs.

Socio-economic relevance and policy implications:
Europe's natural but also its cultural history and patrimonium are strongly linked to the coastal environment.
The economic value of marine biodiversity is enormous.
However, the sustainable exploitation of many marine resources is an elusive goal with the present harvesting techniques, management systems and market mechanisms.
Rational management must be based on knowledge. This is true for fisheries, for coastal zone management (tourism for instance is often biodiversity based), for regulation of industrial and agricultural waste production etc.
The basic knowledge on marine biodiversity is insufficient to evaluate effects of human action, especially on the scales of space and time that matter.
The main aim of this project is to facilitate the improvement of this knowledge at the appropriate temporal and spatial scales, and thus contribute to the quality of the environment and the availability of natural resources and to the quality of life.
MARBENA has initiated a Pan European Network of actors in marine biodiversity research with a sound research infrastructure. The network of marine scientists has strong links to the different stakeholders in marine biodiversity issues.

Conclusions:
There is a need for Pan European Network of actors in marine biodiversity research. MARBENA has provided the infrastructure to support this network. It’s activities encompassed several successful e-conferences from all over Europe, and from different disciplines.

Keywords:
Marine Biodiversity; Network; EPBRS;

Publications

Non refereed literature:

Authors / Editors	Date	Title	Event	Reference	Type
Duarte, C, Jaume, D., Vanden Berghe, E.; van Avesaath, P.H.; Heip, CHR, Mees, J.	6 to 17 October, 2003	Electronic conference on 'Genetic Biodiversity in Marine Ecosystems – Measurement, Understanding and Management'	E-conference		Report
Josefson, A.B.; Vanden Berghe, E.; van Avesaath, P.H.; Heip, C.H.R.; Mees, J.	5 to 22 September 2002	Electronic conference on 'Marine Biodiversity in the Baltic and the European context'	E-conference		Report
Arvanitidis, C.; Eleftheriou, A.; Vanden Berghe, E.; Appeltans, W.; van Avesaath,P.H.; Heip, C.H.R., Mees, J.	7 to20 April, 2003	Electronic conference on 'MarineBiodiversity in the Mediterranean and the Black Sea' - Summary of discussions	E-conference		Report
Weslawski, J.M.; Ojaveer, H.; Vanden Berghe, E.; Appeltans, W.; van Avesaath, P.H.; Hummel, H.; Heip, C.H.R.; Mees, J.	2 to 12 June, 2003.	Electronic conference on 'Newly Associated States and Marine Biodiversity Research'	E-conference		Report
Hiscock, K.; Vanden Berghe, E.; Appeltans, W.; van Avesaath, P.H.; Hummel, H.; Heip, C.H.R.; Mees, J.	6 to 17 October, 2003	Electronic conference on 'Genetic Biodiversity in Marine Ecosystems – Measurement, Understanding and Management'	E-conference		Report
Weslawski, J.M.	1- 3 April 2004	Broad scale comparisons of European marine biodiversity 1- 3rd April 2004, Sopot, Poland	Workshop		Report
Emblow, C.S.; Vanden Berghe, E.; Appeltans, W.; Cuvelier, D.; van Avesaath, P.H.; Hummel, H.; Heip, C.H.R.; Mees, J.	21-24 May 2004	Sustaining livelihoods and biodiversity attaining the 2010 target in the European biodiversity strategy	E-conference		Report
Magni, P.; Malej, A.; Moncheva, S.; Vanden Berghe, E.; Appeltans,	6 to 24 September	Electronic Conference on 'The Southern and Eastern	E-conference		Report

W.; Cuvelier, D.; van Avesaath, P.H.; Hummel, H.; Heip, C.H.R.; Mees, J.,	2004	Mediterranean Sea and the Black Sea: New challenges for marine biodiversity research and monitoring'			
Heip, C.H.R.; Vanden Berghe, E.; Appeltans, W.; Cuvelier, D.; van Avesaath, P.H.; Hummel, H.; Mees, J.,	15-26 November 2004	Electronic Conference on 'Biodiversity Science that matters!	E-conference		Report
Young, J., Báldi, A., Benedetti-Cecchi, L., Bergamini, A., Hiscock, K., van den Hove, S., Koetz, T., van Ierland, E., Lányi, A., Pataki, G., Scheidegger, C., Török, K. and Watt, A.D. (Eds)	March 2005	Landscape scale biodiversity assessment: the problem of scaling. Report of an electronic conference.	E-conference		Report
Brooker, R., Young, J (eds), with contribution by Heip, C.	September 2005	Climate Change and biodiversity in Europer: a review of impacts, policy, gaps in knowledge and barriers to exchange information between scientists and policy makers	E-conference and review		Report
Morato, T, Santos, R.S.	March 2006	Europe's Mountain Biodiversity: Research, Monitoring, Management, (Vienna, Austria, 10-11 March 2006),	Presentation, EPBRS meeting		Report
Van Avesaath, P.H., Hummel, H. Heip. C.	Januari 2006	"Topics and priorities in European Marine Biodiversity Research, with emphasis on the New Member States and on Emerging Business Opportunities for SMEs, preparatory workshop, short Report	Workshop		Report
MARBENA et al.	March 2006	The status of European marine biodiversity research and potential extensions of the related network of institutes'	Workshop		Report

MARBENA et al.	March 2006	Marine biodiversity information: an emerging market and opportunities for SMEs:	Workshop		Report
Hendriks I. and Duarte C.	March 2006	Biodiversity research; allocation of effort and areas for improvement, IMEDEA (CSIC-UIB), Esporles (Islas Baleares), Spain. 15 pp.	Confidential Report		Confidential Report
Magni P. (ed.) with contributions by: Dr. Samir GRIMES – Algeria; Dr. Karim Ben Mustapha – Tunisia; Dr. Manal NADER– Lebanon; Dr. Izdihar AMMAR – Syria	March 2006	The status of marine biodiversity research and potential extensions of the related network of institutes & Marine biodiversity information: an emerging market and opportunities for SMEs – contributions from the Southeastern Mediterranean Region	Workshop; networking		Report

Refereed literature:

Authors / Editors	Date	Title	Event	Journal	Type
Kaiser, M.J., Austen, M.C.V, Ojaveer, H.	2004	European biodiversity action plan for fisheries: issues for non-target species	Outcome MARBENA e-conference and EPBRS meeting Ireland	Fisheries Research, 69 (2004) 1-6	Publication
Various	2004	MARBENA. Creating a Long term Infrastructure for Marine Biodiversity Research in the European Economic Area and Newly Associated states.	Workshop	Annales, Series Historia Naturalis 14 (2004), supplement	Publication

SECTION 3: SCIENTIFIC REPORT
DETAILED REPORT ORGANIZED BY WORK PACKAGES MONTH 25 to 40

3.1 WP1: PREPARATION

The activities within this workpackage have been concluded.

3.2 WP2: general coordination – platform building - integration

3.2.1 Objectives

- General coordination of the project
- Communication with other EU activities and biodiversity initiatives (e.g. CoML DIVERSITAS, NATURA 2000 and others that will arise)
- Communication with the stakeholders, including the press
- Organization of workshops and conferences
- Monitoring and streamlining of the scientific in- and output of the workshops, e-conferences and general conference
- Presentation of relevant issues at the European Platform for Biodiversity Research and Strategy meetings

3.2.2 Methodology and scientific achievements related to work packages

The general co-ordinator was, responsible for overall project management, the organization and follow-up of a number of discussion forums (workshops, e-conferences, conferences) and the scientific contents of the project. As in the former years the project coordinator aimed at the integration of the information and (discussed) issues in the European Platform For Biodiversity Research and Strategy (EPBRS) meetings, and the tuning of the activities with those of the EPBRS groups: the discussion themes of the Electronic conferences are relevant for the EPBRS meetings and integrated with the discussion items of BioPlatform.

3.2.3 Socio-economic relevance and policy implication

The E-conferences dealt specifically with a number of specific socio-economic and policy implications of marine biodiversity research under the general headings of these conferences, which were decided by the local organizers under the EU Presidency and were all quite different. These are reported in detail under the summaries of the conferences. In general, the EPBRS is meant to be the instrument through which research is linked to policy at the national and European level. MARBENA makes sure that marine biodiversity is taken into consideration in these discussions. This is necessary because much of policies and knowledge for conservation and restoration of biodiversity is based on the terrestrial environment and tends to neglect the particular characteristics of marine systems. Some drivers of biodiversity change, such as global climate change and especially fisheries have a very different impact in marine systems than on land and the governance of marine ecosystems inside and especially outside national and EU jurisdiction is a complex and burning issue.

The results of the MARBENA e-conferences were presented at: EPBRS Meetings in Hungary, Scotland and Austria (see section 1.2)

MARBENA Workshops

The project organised the following workshops for the production of position papers on topics and priorities in European Marine Biodiversity Research, with emphasis on the New Member States and on Emerging Business Opportunities for SMEs:

1. Preparatory Workshop “Topics and priorities in European Marine Biodiversity Research, with emphasis on the New Member States and on Emerging Business Opportunities for SMEs, preparatory workshop”, Tallin, Estonia, 9-20 February 2006.

2. Workshop “Topics and priorities in European Marine Biodiversity Research, with emphasis on the New Member States and on Emerging Business Opportunities for SMEs”, Yerseke, the Netherlands, 20-22 March 2006.

3.2.4 Discussion and conclusion

The EPBRS meetings proved to be very useful to improve the visibility of marine biodiversity and related research at political and policy level.
MARBENA succeeded in establishing a sound network of stakeholders with an interest in marine biodiversity issues at a pan-European level.

3.3 WP3: research infrastructure and dissemination

3.3.1 Objectives

Setting up a long term infrastructure for marine biodiversity research in Europe in a stepwise approach:

- collect the information on people, institutes, infrastructure, research projects
- generate discussion on research priorities for the coming decade, including the need for new European infrastructure, and the mechanisms for implementation, within the scientific community
- identify on a regional basis the stakeholders outside the scientific community: policy makers, politicians, SME's, to discuss and improve the relevance of scientific research priorities for society in the region and to identify the technological requirements
- facilitate, catalyse and coordinate regional research projects that must be both knowledge and application oriented and provide a forum for discussion of their results.
- assess and where needed use or even create mechanisms of cooperation, regional and pan-European, and exchange, access to infrastructure, especially with non EU partners such as present in the NAS and Southern Mediterranean countries.
- discuss the progress in the science and its application at the end of the project to provide the basis for future activities.

3.3.2 Methodology and scientific achievements related to work packages

Statements on ‘The status of European marine biodiversity research and potential extensions of the related network of institutes’ and on ‘The market of 'supply and demand' of marine biodiversity information, and the possible role of SME's and large industries in European Marine Biodiversity research’ were produced by a panel of experts.

3.3.3 Socio-economic relevance and policy implication

The general progress has been reported in 3.2.3. In particular, the creation but especially the maintenance of good data bases on a number of items is a fundamental requirement for trans-national research and an important service to the scientific and science-administrative communities alike. It is also fundamental for marine policy development. This is evident in facilities such as GBIF (Global Biodiversity Information Facility) and OBIS (Oceanographic Biogeographic Information System, developed by the Census of Marine Life).

3.3.4 Discussion and conclusions

See section 6.3 and the statements mentioned in section 3.3.2.

3.4 WP4: internet services: electronic conferences and web site maintenance

3.4.1 Objectives

1. Build and maintain a website that will be the centre of the communication between the partners, and a vital part of the co-ordination of the Network.
2. To hold an Electronic Conference before each EPBRS meeting:
   - to raise a dialogue on the selected themes for the Platform meeting, involving a wider range of participants than is possible in the meetings themselves, and
   - to discuss issues that are relevant for the settlement and maintenance of the Marine Biodiversity Network.
3. To prepare for the Platform meetings through the e-conferences, involving both the scientific community and policy makers, specifically:
   - To identify current understanding on the selected themes.
   - To identify areas of uncertainty ('biodiversity information needs') on the selected themes.
   - To make provisional recommendations on research ('biodiversity research needs') on the selected themes (for subsequent discussion at the Platform meetings).
   - To provide background papers for the Platform meetings summarising current understanding, areas of uncertainty and recommendations on research on the selected themes

3.4.2 Methodology and scientific achievements related to work packages

The work package leader (VLIZ) built and maintained the website and developed the internet facilities for the e-conferences of WP1 and WP4. Also background papers for the EPBRS meetings and the MARBENA workshops were produced (the books of abstracts of the electronic conferences).

3.4.3 Socio-economic relevance and policy implication

The results of the e-conferences were presented at several EPBRS meetings which have a high impact at the European Policy level.

3.4.4 Discussion and conclusions

Electronic conference on Landscape scale biodiversity assessment: the problem of scaling (March 2005).

Session I- Scaling problems in biodiversity assessment

Scaling-up: This is a topic of particular interest and several keynotes and contributions addressed it. Because we can never accomplish a complete assessment of biodiversity of a large area such as a landscape or a region, we will always have to scale –up from samples to the entire area. Approaches include linking remotely sensed data with field investigations, models using the detection probabilities of species in small plots to extrapolate to a larger region, and the development of scaling functions. However, there are some specific problems. For example, there is a lack of rigorous testing of the accuracy of the first approach. For the second approach a major problem seems to be that we can estimate species richness in different habitat types, but we have problems combining these estimates for a landscape estimate because of undetected (unidentified)

species. Furthermore, contributors identified the potential of viewing ecosystems as self-organizing, i.e. as emergent systems,which change when crossing an emergence boundary. However, a lot of ecologists are not very familiar with this topic and, thus, for them the potential is not yet very obvious. Indicators: Indicators are still discussed controversially and it seems clear that all indicators have some shortcomings such as scale -dependency of their strength as indicators. Regarding taxonomic scales or hierarchies, the morphospecies concept in particular seems to be controversial as was indicated by several critical contributions. The use of species lists was also questioned, but again, opinions were not uniform. One of the main problems identified with species lists is that all species are regarded as equal, which, of course, they are not.Moreover, they may not be very useful for short time scales; abundance measures were suggested as more suitable for short time scales. Another problem identified is that species lists are very time-consuming and not very cost-effective to produce. The non-congruence of richness patterns of rare and common species, which was emphasized in one keynote, seems to be of particular importance in biodiversity assessment. For example, if we identify drivers of species richness based on all species, these drivers are mainly relevant for the common species. Furthermore, we don't know anything about how congruence of richness patterns of rare and common species changes with spatial scale. Regarding genetic diversity and indicators we hardly know anything. While there has been a lot of work on relationships between various indicators and species richness, there is hardly any work done on indicators on genetic diversity. Unfortunately the EASAC guide to biodiversity indicators (http://www.easac.com) was published towards the end of the e-conference. This could have been a very good basis for our discussions. There were other topics, which were not rigorously discussed, but are nevertheless important in this discussion:

1. The selection of conservation-relevant areas (in terms of biodiversity) is scale (or grain) dependent.
2. The trade-off between geographical precision and taxonomical precision.
3. Rarefaction was discussed as the method for quantification of biodiversity patterns at the landscape scale since most biodiversity indices are strongly sample -size dependent. Furthermore, a profound distinction was identified between species density and species richness. These two metrics may yield completely different answers to the same question.
4. Conclusions or biodiversity pattern detected critically depend on the design of the study, i.e. how sampling units are spaced (i.e. coverage and distance apart) and placed (i.e. simple random sampling v. stratified random sampling).
5. A lack of long-term monitoring data exist even in Europe. It is thus not easy to differentiate between population fluctuations and real trends.
6. The usefulness of methods or indicators depends on the time scales considered. While grid data may be useful to monitor species richness over centuries, abundance based measures should be promoted when considering shorter time-scales.
7. Monitoring schemes should not be set up unless we know how to relate observed changes to ecological processes and their drivers.
8. Additive partitioning of gamma diversity may help to identify sets of habitat areas that comprise the largest beta diversity. These areas deserve special attention in formulating land-use practices or in prioritizing areas for protection. Additive partitions of diversity may also inform us about sampling designs or monitoring strategies by identifying the sampling scales that contribute most to beta diversity. Temporal partition of diversity is also possible and may be important in monitoring biodiversity.

9. It was emphasized that we should start using the data we have already collected. This issue is not related to scaling problems in particular but still very important (as can also be seen in the EASAC guide to biodiversity indicators).
10. There is a lack of basic taxonomic agreement in various groups. It is of utmost importance to find a consensus and to compile full synonymic checklists. Even for vascular plants, which belong to the best known groups in Europe there is no actual checklist and the Flora Europaea is somewhat out of date. If we want to combine lists of species from different regions, agreement on species names or least full synonymic checklists are essential.

Session II- Biological scales and conservation

From a marine perspective, many issues of identifying marine protected areas of different sizes and incorporating entities from species to landscapes are well addressed and have not changed much, in terms of criteria used, for many years (although repackaging occurs). What has changed is the ability to use structured marine biological information. We have a directory of marine species (the European Register of Marine Species) and we have a biotopes classification in the European Nature Information System produced by marine biologists. We have criteria (in the UK at least) from which to identify rare and scarce species. OSPAR have identified workable 'threat' criteria for marine species and habitats.

From a terrestrial perspective, there seems to be more information, and at least some of it is easily available (e.g. bird and plant atlases). However, the research questions on scale issues are far from being well understood. Contributions identified key topics and many important questions. Following through some of the discussion, it is clear that some issues of both marine and terrestrial conservation are scale independent. They include the importance of good stewardship wherever rare, scarce, fragile, aesthetically, culturally or recreationally important species, landscapes or habitats are present.

A few research questions that have emerged from discussions are:

1. By protecting a full range of marine habitats in strict MPAs, would we protect the full range (or what proportion would we protect) of marine species?
2. Do MPAs do the job or should we be working much harder on a ´good stewardship´ approach - perhaps exemplified in the Water Framework Directive?
3. What habitats and species are most at risk from human activities and will need strict protection? (We have new scientifically based ways of assessing sensitivity – see http://www.marlin.ac.uk).
4. Are the consequences for loss of biodiversity different for different biotopes in terms of functionality and long-term survival.
5. Can we use coarse levels of taxonomic discrimination in a meaningful way to identify biodiversity changes, biodiversity hotspots etc in the sea - and then manage human activities to maintain that biodiversity.

Additional research topics from the terrestrial perspective are:

1. Identify threshold values, address why local population catastrophes have drastic effects on larger spatial scales ("transfer of catastrophe across spatial scales"), and find the cutoff values in reserve designs (subdivision vs. single large).
2. What is the time scale of the time delayed extinction due to habitat loss (scale dependence of the extinction debt)?
3. How do spatial responses of metapopulations to disturbances change in relation to spatial scale?

4. Which are the appropriate scales for the conservation of networks of ecological interactions?

Session III- Political and economic scales in relation to biodiversity

The contributions and comments made throughout this session of the e-conference can be grouped in three different areas of concern in relation to scales and biodiversity: (i) economic and value issues; (ii) political and structural issues of multi-level governance; and (iii) more general theoretical issues related to epistemology and how to address integration of knowledge in the context of complex environmental matters.

The discussion during the e-conference focussed more on the economic rather than the political. This raises some interesting questions: Are economic matters so much more important than political issues? Is it because politics might be primarily driven by economic thinking, making it an issue of economics most of the time? Or do we already know enough about political issues and policy processes making them less interesting to discuss? Or in contrast is it maybe that we know so little about them that we just don't really know what to ask? Or is it a result of the group this forum is addressing, lacking participation of people from political sciences and from administrations? Is it a problem of framing the problem to be dealt with by this science-policy interface (EPBRS) – having politics and policy-makers on the one side, ecological and socio-economic sciences on the other, but leaving political sciences aside?

Research questions/needs or problems that were addressed focusing on economic and value issues were:

1. The need for studies clarifying whether 'monetary values of nature are convincing authorities or the public to preserve nature' or if 'using monetary values may lead to crowding out of moral arguments for nature preservation' (Marzetti, Rauschmayer).
2. Scientists can (and should) offer a lot more than one (the monetary) perspective on the value of biodiversity and the ways in which to approach its management. There is the need to identify characteristics of institutional and social systems that take a more multidimensional stance on values (Spash).
3. There is a strong gap in understanding socio-economic and socio-cultural aspects of biodiversity conservation for sustainable development in specific ecosystems, such as mountains (Chettri).
4. In order to avoid misunderstandings and problems when integrating knowledge from the economic and ecological disciplines, research approaches should not discuss the problem of space in an abstract manner but rather start from a particular conservation problem, whose structure will determine the spatial scale for both economic and ecological research (Wätzold).
5. Research is needed to analyse public -private partnerships for biodiversity conservation and management in order to bridge the gap between biodiversity interests and economic interests at the local scale (case studies and research on underlying juridical, political and social issues) (Jansen).
6. Arguing that biodiversity validation and not biodiversity valuation will halt the loss of biodiversity, Jurgen Tack calls for (1) urgent action to increase innovative research in the field of environmental problems, particularly biodiversity related research, to balance technological progress between ecology and economy; and (2) innovative research on a much larger scale.
7. Valuation of biodiversity in a broader sense requires a better understanding of the processes behind the loss of biodiversity and a whole new ecological and economic

language which is not mathematical (not in the way we know mathematics today) (Tack).

8. Research needs to address alternative methods for expressing the values people hold with respect to biodiversity and reasons for its preservation (Spash). Such methods and their results depend on context (Rauschmayer), in particular on which stakeholders are involved, and on space and time scales (Sharman).
9. The diversity and role of some organisms and ecological processes which provide important services (such as e.g. the role of decomposer organisms in selfpurification of water) must be studied to estimate their contribution to environmental goods and services (Rossi).
10. Methods are needed that allow for the valuation of whole ecosystems or landscapes, taking account of all socio-ecological elements (Dick).

Research questions or problems that were addressed focusing on political and structural issues of multi-level governance were:

1. Research in political science is needed to understand the dynamics of EU biodiversity policy – unifying the research insights gained from the study of the EU as an international institution and actor with the knowledge gleaned from the study of the EU's internal system of policy governance (Baker).
2. Stressing the mismatch in several important areas between the international obligations of a country as a Party to the CBD and the different levels of government, Horst Korn concludes that research is needed on possible mismatches between international obligations of a country and its internal structures for implementation, in order to suggest improvements of the system, taking into account the different political structures of a country.
3. Jouni Paavola highlights the need to pay more attention to issues of social justice that arise in multi-level governance, in particular as means to influence the effectiveness of environmental governance solutions which rests on voluntary compliance and legitimacy. He emphasises systematic studies from a social justice viewpoint to draw applicable lessons.
4. Further explore the effect of government interventions in order to reduce adverse impacts on biodiversity – including studies of the potential of decentralization and selforganization (van den Heide).
5. More research is needed into the equity aspects of biodiversity conservation, restoration and management as the heaviest burden of biodiversity conservation tends to be borne by people in rural areas, in the vicinity of protected areas (van den Heide).
6. Open questions have been raised such as what polity-level in the EU multi-level governance is responsible for the definition of a reliable method for monitoring of biodiversity, its realisation, and the policy analysis of conservation efforts (such as the Natura 2000 network) (Jansen).
7. Seeing the black boxing of the social and the political in modelling and mapping decisions as a self-made socio-political trap and a recipe for (mostly bad) surprises, Chimere Diaw argues in favour of the reposition of the people at the heart of a broad range of conservation strategies. Accordingly he stresses the construction of sociallyoriented multiple use landscapes at local and regional levels as the key challenge for research and action in development and biodiversity governance.

Research questions or problems that were addressed focusing on general theoretical issues related to epistemology and how to address integration of knowledge in complex environmental matters were:

1. Mario Giampietro calling for research on participatory integrated assessments (1) required for developing a new epistemology, which acknowledges that the observer/narrator is a part of the self-modifying system, (2) that focus on the quality of the process of evaluation (who decides whose perspectives count and how) avoiding collapsing the descriptive with the normative when dealing with sustainability issues – facilitating the necessary abandonment of reductionism.
2. Kate Farrell stresses the need to develop a fourth distinct interdisciplinary nomenclature, ontological and epistemological structure with regard to biodiversity that will articulate into non-mathematical integrative methodologies. In order to develop such methodologies she emphasises (1) the role of time as a complex and scale dependant factor, (2) the importance of knowledge on human cognition, philosophy of the mind, organisational management and group behaviour, and in particular (3) the role of political philosophy. Furthermore, she stresses the need for research into the prevalence of mathematical analytical approaches to overcome scale differences and the ontological and epistemological consequences of this practice.
3. Further research is needed to explore structural issues related to the application of economic and political theory on biodiversity issues on the one hand (what/how, explanations of structure and operation going on at lower levels), and functional issues of the embedding economic and political systems and of potential alternatives (why/how, explanations of finalized functions and purposes, going on at or in relation to the higher level) (Koetz).

Session IV- Integrating ecological and social scales

This session has taught us new substantive as well as methodological aspects of the social science of biodiversity and has gained support for the relevance and significance of studying biodiversity as a social, political and economic problem. From a methodological point of view, we have learnt that sociological network analysis has much to offer to ecological analysis. Based on network analysis, the individuals-in-community perspective may be developed further in a quantitative way (Jordán, Balázs). Moreover, the mathematical tools of social choice theory, developed within economics, might also be applied to the ranking of conservation policy options, highlighting their different value judgements (Weikard). The productive exchange of ideas between natural and social sciences was clearly demonstrated by adopting the concept of metapopulation from population ecology to describing and understanding farmers seed exchange systems, a complex socio-economic phenomena (Van Dusen). Similarly, the term of cultural keystone species represent an invention in terms that has the great advantage to highlight the fundamental co-evolutionary interrelatedness of ecosystems and human cultures (Garibaldi and Turner). Such terms should help us to overcome our tendency for thinking and analysing in dichotomous terms that constrain the advance in interdisciplinary work. At the interface between natural and social sciences, the concept of ecosystem services has established a productive research field, mostly occupied by researchers identifying themselves with ecological economics. What are the biological or ecological processes and conditions that are related to ecosystem services? What is the relationship between biodiversity and ecosystem services? Gonczlik and Goslee highlight two important questions that need to be addressed from a natural science base: What kind of values do people attach to different ecosystem services? What level should institutional mechanisms for the management of ecosystem services be designed and operated at? Again, these are only a few of the most important and controversial issues that were raised (Hein and van Ierland). Lots of social conflicts are experienced around nature conservation and

biodiversity preservation. Models and insights from social psychology can helps us to understand the nature and intensity of these conflicts and design or re-design policies in order to avoid or at least mitigate the conflicts. On the one hand, there seems to be an untapped opportunity for involving citizens in nature conservation efforts – given the growing public knowledge on relevant issues and a sense of readiness to act (Székely). However, the process of decisionmaking needs to be designed in a strongly democratic way by involving all stakeholders and paying particular attention to those with the least power to influence and most to loose.
Participatory and deliberative decision support and conflict resolution techniques were advocated, along with designing more adaptive institutional mechanisms that by giving voice to local communities and tapping the wealth of their traditional ecological knowledge make biodiversity policies not only more effective but socially just (Stoll-Kleemann, Brown, Roth, Rauschmayer, Berge, Muessner and Chettri). There is an intimate relationship between the spatial organisation of different types of environmental knowledge and their associated organisations of power relations (as the keynote contribution by Roth pointed out with regard to the difference between traditional and scientific environmental knowledge). Spatial flexibility seems to be a desirable characteristic, therefore, for the science of biodiversity as well, with the goal of adaptive science for biodiversity (Rauschmayer).
The issue of social justice at the global level was evidently clear in the discussion of global commons, intellectual property rights (IPRs) and other mechanisms of biodiversity politics at the international political level (Boda, Oksanen and Weikard). The commodification of biodiversity is a strong political force prevailing in our market societies and dominating international politics. Biodiversity issues have become a new arena of political conflict – as some commentator previously put it. There is a need for overcoming ethnocentric myopism, primarily on the part of our culture, and honestly discussing and researching biodiversity issues as deeply political and ethical in nature. Taking the social, political, and ethical dimensions and complexities of biodiversity issues seriously, we believe, is a must for research and management efforts all over the world.
The philosophical and political significance of place, therefore, should not be underestimated (Lányi, Bela and Kohlheb). Without essentialising locality and placeness, the morality of place and the implication for a more democratic science and politics of biodiversity should be emphasised

Electronic conference on Climate Change and biodiversity in Europe: a review of impacts, policy, gaps in knowledge and barriers to exchange information between scientists and policy makers

There is a requirement for long-term and broad scale monitoring to track change and to be able to separate short-term variability from long-term trends and impacts of localised human activities from climate change. The design of monitoring and decadal research networks needs to be further developed. There should also be a meaningful assessment of status and health of existing systems focussing on local and regional perspectives, as well as the identification of pressures adversely affecting marine and coastal biodiversity so that action to reduce the pressure can be prioritised.
This needs to be carried out together with process-orientated research on the underlying mechanisms enabling better predictive ability of rates and scales of likely future changes. Experimental studies (laboratory and field) should be carried out to test the reaction of organisms to likely effects of climate-induced change and therefore better understand what aspects of climate change are most important in threatening ecosystem structure and

functioning. Specific experimental studies could include the assessment of the rate of atmospheric CO2 conversion into biomass, impacts of temperature and saturated CO2 levels on carbon fixation of individual species and the influence of temperature and salinity at organizational and functional levels of different species.
Predicting climate change impacts on biodiversity in marine and coastal ecosystems will necessitate the development of tools, and ways of constantly updating and integrating new methods and technologies as they develop.

Europe's Mountain Biodiversity: Research, Monitoring, Management, (Vienna, Austria, 10-11 March 2006),

Underwater Mountains, an unknown world.

Seamounts are prominent features of the world's underwater topography. In the European seas, there are over 350 seamounts that rise more than 1000 m above the ocean floor.
Seamounts are characterized by high species density over restricted areas, and by the concentration of nutrients caused by hydrological phenomena. Relatively few seamounts have been studied, with only about 10% having been sampled. On a global scale, their biodiversity is poorly known. Seamount biodiversity is threatened both by climate change, which could alter nutrient supply through modification of underwater currents, and by direct human activities, such as mining and trawling, which destroys populations of benthic species over a significant portion of the limited seamount surface. Long-term monitoring is a necessary part of research needed to understand slow ecological processes and dynamics especially in mountain and seamount ecosystems with long-lived species. Attention should be paid to the integration of knowledge gained from long-term ecological research sites.
During the discussions the following recommendations with respect to (sae) mountains were adopted in the recommendations of the meeting of the European Platform for Biodiversity Research Strategy, held under the Austrian Presidency of the EU , Vienna, 10-11th–March 2006, Concerning Europe's Mountain Biodiversity: Research, Monitoring, Management

- assess the status of European mountain biodiversity and to define favourable states for habitats and populations and preference states for ecosystems;
- increase understanding of the patterns and drivers of seamount biodiversity and its dynamics at various scales of space and time, the key processes maintaining the high biodiversity on seamounts, and the impacts of human activities on long-term sustainability of seamount biodiversity;
- clarify the role of diversity of organisms for ecosystem dynamics, functions, and services in mountain systems;
- explore the significance of relict populations, refugia and genetic basis for adaptations;
- upscale results from site-specific long-term ecosystem studies in the context of mountain regions
- build or improve regional models of global change scenarios for mountain ecosystems, taking advantage of the palaeological records;
- understand better the governance of mountain regions to improve its effectiveness for sustainability with respect to the different stakeholder goals;
- understand processes and dynamics in mountain and seamount ecosystems by coupling long-term monitoring and research;

- develop cost-efficient monitoring schemes, particularly in mountain or seamount areas with difficult access, extreme environmental conditions, or high anthropogenic impact;
- clarify the allocation of responsibility for monitoring and managing seamounts in extraterritorial waters;
- assess the impacts on biodiversity and ecosystem services in mountains of: climate change, infrastructure developments like roads, pylons, hydro-electric schemes and tourist facilities, land tenure regimes such as communal rights, tenant rights and access rights, changes in agricultural practices, including land abandonment and activities leading to eutrophication, changes in socio-economic conditions, perceptions and behaviour of local populations and mountain users, and the effect these impacts have on traditional habitats and culturally important species;
- define criteria, indicators and processes for effective conservation and sustainable management of biodiversity of mountains and seamounts;
- explore the potential of participative and adaptive management with the aim to improve sustainability of mountain and seamount ecosystems;
- evaluate ecosystem services incorporating local knowledge as appropriate;
- integrate socio-economic and ecological models into decision-making systems for policymakers to examine the impacts of policies on mountain land-use, conservation and biodiversity.

3.5: MARBENA Ambassadors in NAS

3.5.1 Objectives

To stimulate the integration of NAS and the southern Mediterranean states in the European Research Area by

- consulting WP3 in the construction of the databases and the analysis of the possibilities of the integration of research and information, the identification of bottlenecks and (logistic) constraints of marine biodiversity research and the definition of marine biodiversity research strategies (WP3) in these regions.
- The Ambassadors will moderate special issues during the E conferences
- Extending the Marine Biodiversity Network of research institutes; universities; museums involved in marine biodiversity research in the NAS and the Southern Mediterranean states

3.5.2 Methodology and scientific achievements related to work packages.

During the last phase of the project, MARBENA focussed on the possibilities to extend the network towards the S. Mediterranean region. A bottom up approach was chosen, based on the personal contacts of the MARBENA ambassadors. Thanks to the efforts of our Italian partner (IMC) we succeeded in contacting scientists from several northern African countries that were willing to contribute to the position paper 'The status of European marine biodiversity research and potential extensions of the related network of institutes'.
Statements on 'The status of European marine biodiversity research and potential extensions of the related network of institutes' (the 'market of supply and demand' of marine biodiversity information) and on 'Marine biodiversity information: an emerging market and opportunities for SMEs' were produced by a panel of experts.

3.5.3 Socio-economic relevance and policy implication

Networks of excellence tend to be based on and dominated by institutes in Western Europe. The creation of partnerships with institutes from Central and Eastern Europe and in the Mediterranean has become especially urgent with the extension of the European Union but should also focus on non-acceding countries, for instance in the Black Sea and the Southern Mediterranean.

3.5.4 Discussion and conclusion

The network successfully extended towards the new member states, and contacts were made with relevant research institutes from the South-eastern Mediterranean. The database with potential network members has been adopted by the NoE Marine Biodiversity and Ecosystem Functioning and will from the basis for the creation of the virtual centre for Marine Biodiversity and Ecosystem functioning that will be established in cooperation with the three networks of excellences MarBEF, Euroceans and Marine Genomics Europe,

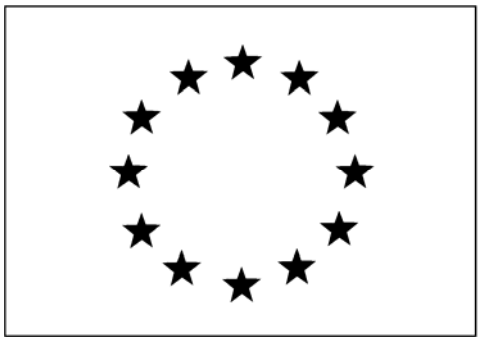
SECTION 4: TECHNOLOGICAL IMPLEMENTATION PLAN

TECHNOLOGICAL IMPLEMENTATION PLAN

A Framework for the further development, dissemination and use of
the results of EC RTD Projects (including also thematic networks and concerted actions)

DRAFT

DATA SHEETS



X Final version before final term (contractual obligation)

EC PROGRAMME :	**EESD-ESD**
PROJECT TITLE & ACRONYM:	Creating a long-term infrastructure for **mar**ine **b**iodiversity research in the **E**uropean Economic Area and the **N**ewly **A**ssociated States. **MARBENA**
CONTRACT NUMBER :	**EVR1-CT-2002-40029**
PROJECT WEB SITE (if any) :	**www.vliz.be/marbena**
PARTNERS NAMES :	Netherlands Institute of Ecology Centre for Estuarine and Coastal Ecology (NIOO-CEME) - The Netherlands Flanders Marine Institute (VLIZ) - Belgium Centro de Investigação Interdisciplinar Marinha e Ambiental (CIIMAR)- Portugal Natural Environment Research Council (NERC) Centre for Ecology and Hydrology - United Kingdom Ecological consultancy Services Limited (EcoServe) - Ireland Fundació Universitat-Empresa De Les Illes Balears (FUEIB) - Illes Balears, Spain University of Oslo (UO) - Norway Forschungsinstitut Senckenberg (SNG) - Germany Instituto do Mar (IMAR), Center of IMAR of the University of the Azores - Portugal National Environmental Research Institute (NERI), Department of Marine Ecology - Denmark Institute of Marine Biology of Crete (IMBC) - Greece Marine Biological Association of the United Kingdom (MBA) - United Kingdom Polish Academy of Sciences, Institute of Oceanology (IOPAS) - Poland Institute of Oceanology, Bulgarion Academy of sciences (IO BAS) - Bulgaria National Institute of Biology (NIB) - Slovenia Centro Marino Internazionale (IMC) - Italy Estonian Marine Institute (MEI) - Estonia Akvaplan-Niva AS and University Studies on Svalbard (AN/UNIS) - Norway Alfred-Wegener-Institute for Polar and Marine Research (AWI) - Germany

Executive summary

Please, synthesise (in 1 or 2 pages) your project original objectives and final outcome.

a) Original research objectives

A. **To facilitate a European Marine Biodiversity Research Area** by creating a pan-European network of marine scientists and its required research infrastructure, with strong links to the different stakeholders in Marine Biodiversity Issues, from the EU-EEA and the Newly Associated Nations, and that covers the European seas from the Arctic to the Atlantic, the Mediterranean and the Black Sea.

B. **To create awareness on the issues at stake and enlarge the visibility of marine biodiversity research in Europe**, the network must make the issues - the scientific questions and the relevance of the outcome of the scientific research - clear to a non-scientific audience, it must communicate with EU policy makers and politicians, with global organisations and programmes such as several IGBP programmes, DIVERSITAS and the Census of Marine Life initiative, national and other EU biodiversity platforms (e.g. the BioPlatform thematic network) and dissemination of information to the public at large.

Hereby, the project will contribute to the focussing, integration, strengthening and structuring of the European Research Area (ERA), and provide instruments for this (e.g. facilitate the building of a network of excellence, integrated (trans national/regional and multidisciplinary) consortia, thereby supporting the main programmes of the 6th framework programme for the marine biodiversity stakeholders. Special effort will be undertaken to involve the stakeholders from the Newly Associated States (NAS) in the network.

b) Expected deliverables

To develop a European Marine Biodiversity Network

MARBENA will start building a network of all the stakeholders in the marine biodiversity issue: scientists, managers, policymakers and other end users

MARBENA will open its activities and actively engage cooperation with any interested partner, including museums of natural history, universities government laboratories, and small and intermediate enterprises.

MARBENA will establish a structural link with the BioPlatform.

MARBENA aims at integration with scientists of the Newly Associated States and a sufficient coverage of the marine areas at the periphery: the Arctic Sea, the Black Sea and - when possible - the Southern Mediterranean Sea.

To build a long term research infrastructure for the network

MARBENA will provide the information and mechanisms for creating a solid basis on which the network can build. The activities will support the focussing and integration, the strengthening and the structuring the European Research Area of the Marine biodiversity issue at a pan-European scale.

Several activities will be developed:

Estimation of possibilities for the integration of marine biodiversity research and related data, research priorities at pan-European and regional scale for the middle and long term, their implementation and coordination together with the ways of financing European-level research (where needed).

Facilitating the possibilities for discussion between scientists, management and policy makers: e-conferences, workshops and symposia

Capacity building: based on indicated gaps in information and expertise workshops will be dedicated to overcome these problems. MARBENA will organize together with other partners a series of workshops on selected topics, discussion of case studies on selected priority issues for four regions in Europe involving scientists, policy makers, industry and the public (including the press) and a major conference to finalise the project and create the conditions for the future existence of the network.

To create visibility for marine biodiversity issues in Europe

To enlarge the visibility of the Marine Biodiversity issues and therefore strengthening the foundations of the European marine biodiversity Research Area in Europe, MARBENA will work on publicizing these issues with the stakeholders and the public. This will be done by maintaining an active web site, regular press releases, publication of newsletter, CD-ROM's and folders. MARBENA will link to other programmes of interest (DIVERSITAS, relevant IGBP-programmes, Census of Marine Life CoML etc.), to EU policy makers requiring information and support for implementation of e.g. the Water and Habitat Directives, the European Environment Agency and to the ESF Marine Board as a representative of the national funding agencies.

To develop and maintain a web site where information and issues produced by the Marine Biodiversity Network will be easily accessible to stakeholders involved in marine biodiversity as well as the public at large. The website will be the main communication structure for the network of marine biodiversity stakeholder. The website will have links to the MARS Web Site and to other web-sites (BioPlatform, ESF Marine Board, EU Directorate of Research)

To organise Electronic conferences on selected themes

To provide relevant information on the Marine Biodiversity issue for use in the meetings of the “European Platform for Biodiversity Research Strategy” (EPBRS) connected with the EU presidencies. For this, a close cooperation will be established with BioPlatform.

To organise workshops and a conference

MARBENA will organize together with other partners a series of workshops on selected topics involving scientists, policy makers, industry and the public (including the press) and a major conference to finalise the project and create the conditions for the future existence of the network.

Involving the Newly Associated States

In this project special effort will be undertaken to include the scientists and through them the other stakeholders of the marine biodiversity research from the Newly Associated States in the network. For this we propose the concept of MARBENA Ambassadors, well known and respected scientists who are residents of the NAS, who will actively extend the network in these countries. Furthermore the 'Ambassadors' will discuss relevant biodiversity issues at the Electronic conferences, workshops and symposia

c) Project's actual outcome ***(in terms of technical achievements or if appropriate task per task)***

d) Broad dissemination and use intentions for the expected outputs

Europe's natural but also its cultural history and patrimonium are strongly linked to the coastal environment. The coastal environment is the only marine environment that is accessible without special or expensive equipment and it is therefore part of the everyday life of many millions of Europeans. The economic value of marine biodiversity is enormous: hundreds of millions Europeans spend some time each year travelling to and fro the coastal environment and the sustainability of this huge tourist industry (one of the largest employers in Europe) depends to a large extent directly and indirectly on the biodiversity of the coastal zone. It is therefore clear that the most important contribution of this project is to the quality of the environment and the availability of natural resources and to the quality of life. The coastal zone is under heavy pressure and requires management in order to preserve this resource and the employment that goes with it in especially the tourism industry but also fisheries, health and education.

1) Employment, education training and working conditions

We believe that marine research has a special place in education. Science in general, is not doing well in Europe. Europe is investing less and less of its richness in knowledge, and the image that the people at large have of science is less positive than it once was. We believe that the seas and the oceans and the life forms they contain - that are so different and so more diverse than what people know from daily experience on land - have great appeal especially to young people and that marine scientists should make it at least one of their objectives to communicate the excitement of their scientific endeavour to the next generation. The ocean is the last wilderness and the last unexplored area on earth. We know more about the moon than about the deep sea. The excitement of exploration and discovery, the thrive for knowledge that it generates, it is all there. Marine science can attract the young people that Europe needs for the challenges it faces in a rapidly changing world.

Marine sciences have another advantage: they are highly multidisciplinary. People graduating in marine science know (or should know) physics, chemistry, geology and biology, they have learned to use remote sensing and computer modelling and, perhaps most importantly, they have grasped the intellectual challenge of dealing with an extremely complex system

2) Environment and sustainable development

The data obtained within the MARBENA project will contribute to the development of policies to preserve the natural resources and to improve employment related to tourism, aquaculture (shellfish production) and fisheries as part of an sustainable development within Europe.

Furthermore, this knowledge can be transferred to various kinds of institutions and governmental bodies to support their activities in regard to ecosystem evaluation and assessment. By increasing the exchange of knowledge and expertise between scientists in different parts of Europe and different work areas MARBENA will contribute to the consolidation of the European Science and Technology Community and to the improvement of human resources.

The MARBENA project will provide the scientific information needed for the protection of critical habitats, and the scientific background for a diagnosis on the health of the marine environment and assist EU regulations in terms of risk assessment and strategic environmental assessment.

3) Quality of Life health and safety of the citizens

A healthy environment is essential to long term prosperity and quality of life and citizens in Europe demand a high level of environmental protection. The sustainability of the huge tourist and fishing industry in the coastal areas depends to a large extent on the quality of the coastal zone.

1.2 Overview of all your main project results

No.	Self-descriptive title of the result	Category A, B or C*	Partner(s) owning the result(s) (referring in particular to specific patents, copyrights, etc.) & involved in their further use
1	Duarte, C, Jaume, D., Vanden Berghe, E.; van Avesaath, P.H.; Heip, CHR, Mees, J., eds (2002). Electronic conference on 'European Heritage under Threat: Marine Biodiversity in Mediterranean Ecosystems' - Summary of discussions, April 22 to May 3, 2002. Flanders Marine Institute (VLIZ): Oostende, Belgium. iii, 48 pp	A	
2	Josefson, A.B.; Vanden Berghe, E.; van Avesaath, P.H.; Heip, C.H.R.; Mees, J., eds (2002). Electronic conference on 'Marine Biodiversity in the Baltic and the European context' - Summary of discussions, 5 to 22 September 2002. Flanders Marine Institute (VLIZ): Oostende, Belgium. iii, 37 pp	A	
3	Arvanitidis, C.; Eleftheriou, A.; Vanden Berghe, E.; Appeltans, W.; van Avesaath,P.H.; Heip, C.H.R., Mees, J., eds (2003). Electronic conference on 'MarineBiodiversity in the Mediterranean and the Black Sea' - Summary of discussions, 7 to20 April, 2003. Flanders Marine Institute (VLIZ): Oostende, Belgium. iv, 74 pp	A	
4	Weslawski, J.M.; Ojaveer, H.; Vanden Berghe, E.; Appeltans, W.; van Avesaath, P.H.; Hummel, H.; Heip, C.H.R.; Mees, J., eds (2003). Electronic conference on 'Newly Associated States and Marine Biodiversity Research' - Summary of discussions, 2 to 12 June, 2003. Flanders Marine Institute (VLIZ): Oostende, Belgium. v, 63 pp	A	
5	Hiscock, K.; Vanden Berghe, E.; Appeltans, W.; van Avesaath, P.H.; Hummel, H.; Heip, C.H.R.; Mees, J., eds (2003). Electronic conference on 'Genetic Biodiversity in Marine Ecosystems – Measurement, Understanding and Management' - Summary of discussions, 6 to 17 October, 2003.Flanders Marine Institute (VLIZ): Oostende, Belgium. vi, 55 pp	A	
6	Emblow, C.S.; Vanden Berghe, E.; Appeltans, W.; Cuvelier, D.; van Avesaath, P.H.; Hummel, H.; Heip, C.H.R.; Mees, J., eds (2004). Electronic conference on 'Sustaining Livelihoods and Biodiversity - attaining the 2010 target in the European Biodiversity Strategy' - Summary of discussions, 13 to 30 April, 2004. Flanders Marine Institute (VLIZ): Oostende, Belgium. iii, 30 pp.	A	

7	Magni, P.; Malej, A.; Moncheva, S.; Vanden Berghe, E.; Appeltans, W.; Cuvelier, D.; van Avesaath, P.H.; Hummel, H.; Heip, C.H.R.; Mees, J., eds (2004). Electronic conference on 'The Southern and Eastern Mediterranean Sea and the Black Sea: New challenges for marine biodiversity research and monitoring' - Summary of discussions, 6 to 24 September, 2004. Flanders Marine Institute (VLIZ): Oostende, Belgium. viii, 108 pp.	A	
8	Heip, C.H.R.; Vanden Berghe, E.; Appeltans, W.; Cuvelier, D.; van Avesaath, P.H.; Hummel, H.; Mees, J., eds (2004). Electronic conference on 'Biodiversity research that matters!' - Summary of discussions, 15 to 26 November 2004. Flanders Marine Institute (VLIZ): Oostende, Belgium. ix, 35 pp.	A	
9	Kaiser, M.J., Austen, M.C.V, Ojaveer, H., 2004. European biodiversity action plan for fisheries: issues for non-target species, Fisheries Research, 69 (2004) 1-6	A	
10	MARBENA. Creating a Long term Infrastructure for Marine Biodiversity Research in the European Economic Area and Newly Associated states. Annales, Series Historia Naturalis 14 (2004), supplement	A	
11	Climate change and biodiversity in Europe: a review of impacts, policy, gaps in knowledge and barriers to the exchange of information between scientists and policy makers, R. Brooker R. & Young J, eds (2005) NERC Centre For Ecology And Hydrology, Banchory Research Station, UK. Pp. 31.	A	
12	Carlo Heip, Herman Hummel, Pim van Avesaath, Iris Hendriks, Jan Marcin Węsławski , Ward Appeltans , Paolo Magni, Frederico Cardigos, Chris Emblow, Fred Buchholz, Vesna Flander-Putrle , Damia Jaume, Carlos Duarte, Ricardo Serrão Santos, The status of European marine biodiversity research and potential extensions of the related network of institutes	A	
13	Iris Hendriks and Carlos Duarte. Biodiversity research; allocation of effort and areas for improvement, IMEDEA (CSIC-UIB), Esporles (Islas Baleares), Spain. 15 pp.	B	
14	Paolo Magni (ed.). The status of marine biodiversity research and potential extensions of the related network of institutes & Marine biodiversity information: an emerging market and opportunities for SMEs – contributions from the Southeastern Mediterranean Region	B	

* A: results usable outside the consortium / B: results usable within the consortium / C: non usable results

1.3 Quantified Data on the dissemination and use of the project results

Items about the dissemination and use of the project results (consolidated numbers)	Currently achieved quantity	Estimated future* quantity
# of product innovations (commercial)		
# of process innovations (commercial)		
# of new services (commercial)		
# of new services (public)		
# of new methods (academic)		
# of scientific breakthrough		
# of technical standards to which this project has contributed		
# of EU regulations/directives to which this project has contributed		
# of international regulations to which this project has contributed		
# of PhDs generated by the project		
# of grantees/trainees including transnational exchange of personnel		

*# = number of ... / * "Future" means expectations within the next 3 years following the end of the project*

1.4 Comment on European Interest

All projects are expected to meet European interests. This section should provide an appraisal of your project in terms of European added value and support to the implementation of European Union policies.

1.4.1 Community added value and contribution to EU policies

a. European dimension of the problem
(The extent to which the project has contributed to solve problems at European level)

Europe's natural but also its cultural history and patrimonium are strongly linked to the coastal environment. The coastal environment is the only marine environment that is accessible without special or expensive equipment and it is therefore part of the everyday life of many millions of Europeans. The economic value of marine biodiversity is enormous: hundreds of millions Europeans spend some time each year travelling to and fro the coastal environment and the sustainability of this huge tourist industry (one of the largest employers in Europe) depends to a large extent directly and indirectly on the biodiversity of the coastal zone. It is therefore clear that the most important contribution of this project is to the quality of the environment and the availability of natural resources and to the quality of life. The coastal zone is under heavy pressure and requires management in order to preserve this resource and the employment that goes with it in especially the tourism industry but also fisheries, health and education.

b. Contribution to developing S&T co-operation at international level. European added value
(Development of critical mass in human and financial terms; combination of complementary expertise and resources available Europe-wide)

Marine biodiversity in Europe has been studied mostly through national efforts and therefore is not well known at a European scale, especially not at the genetic and system level. Although a comprehensive list of marine species in Europe now exists (ERMS project), distributions of many marine species are incompletely known and in many cases nearly completely unknown. When one wants to understand the existing biodiversity and how and why this biodiversity is changing, basic inventories, adequate indicators and knowledge of patterns and distributions are required. Such knowledge must be obtained at the characteristic scales, which for marine biodiversity are years to decades and hundreds to thousands of kilometres. Measurements at these large spatial and temporal scales are outside the scope of classical (local, national or regional) research projects and can only be achieved through new mechanisms depending on European co-operation. Measurements over such long time periods require concertation, commitment, agreement on methodology etc. by the partners. When a common methodology (indicators, monitoring, taxonomic keys, molecular tools etc.) is established, national programmes that often have their own objectives and methodologies will immediately achieve added value

In the case of inventories of marine biodiversity a European co-operation is required because for many taxonomic groups there are only a few experts and no single country has all the expertise required. Moreover there is hardly any quality assurance of taxonomic data when they are obtained outside the supervision of a museum of natural history.

European research will therefore benefit from this project in several ways.

1. Obvious benefits of networking in general (critical mass, shared use of infrastructure, exchange of researchers etc.) also apply to this project.
2. Multinational research programmes are hard to establish in Europe. The framework programmes of the EU are the big exception and have been tremendously important and successful in certain areas, including marine sciences. The ESF is now trying to initiate larger scale multinational research programmes. But many obstacles remain:

- Transnational networks of scientists do of course exist but they do not often function as research nodes on scales that are required for this type of work, and they require funding in order to survive. In order to develop large scale, multinational research programmes, a pan-European Network is essential. For individual institutes it will take a long time and much effort to develop such a network. Consequently these activities are being avoided, and if a network is being developed it will be local / regional and pragmatic with a very specific goal of the initiator of the network.

- There is limited insight in the possibilities for integrated research. Information about (logistic) facilities for cooperation is always shattered and incomplete, mostly because of the above-mentioned reason.
  It is very difficult to obtain funds for large scale, multinational research programmes. The development of research proposals to obtain funds for large projects is a complex and time-consuming effort. The success rate, however, is very low. Often the projects are rejected not on basis of the quality of the research, but on the relevance for society. From the researchers point of view it is very hard to get insight in what European society needs.

c. Contribution to policy design or implementation

(Contribution to one or more EU policies; RTD connected with standardisation and regulation at Community and/or national levels)

Eight of the forty priority habitats listed in the “Directive on the Conservation of Natural Habitats and of Wild Fauna and Flora” (92/43/EEC) are coastal. Approximately a third of the Union's wetlands are located on the coast, as well as more than thirty per cent of the Special Protection Areas designated under the “Directive on the Conservation of Wild Birds” (79/409/EEC). Coastal ecosystems tend to have very high biological productivity. The reproduction and nursery grounds of most fish and shellfish species of economic value are in the coastal strip, and a significant proportion of the catch of these species comes from this area, which accounts for almost half of the jobs in the fisheries sector.

The management of many marine resources (fish, shellfish) is a EU competence. International waters outside the 200 miles EEZ are, as far as we know, outside the EU jurisdiction. The biodiversity in these waters is increasingly being threatened by overfishing, which is all the more serious as the species involved (deep-sea fish, cold water corals) are very slowly growing species and there is at present insufficient or unexisting management of them.

European countries and the EU have agreed through a series of Conventions to study and protect their biodiversity. As pointed out by the European Environment Agency (1999) in their report “Environment in EU at the turn of the century (Chapter 3.11)” the overall threat and changes in biodiversity at all scales (genes, species, ecosystems and habitats) are expected to remain high in the EU to 2010 and beyond. The pressure comes from many interconnected sources, principally land use change, pollution and the introduction of alien species. Europe's natural but also its cultural history and present patrimonium are strongly linked to the coastal environment. The understanding and assessment of marine biodiversity are vital for safeguarding the European patrimonium of species. Understanding means a scientific discussion of sufficient width (involving the whole European scientific community) and depth (an outstanding discussion forum). Assessment means common methods and tools, agreement on future directions/questions/challenges to be addressed, identification of problems and hot spots and recognition of the most critical issues and potential hazards for the European marine environment

The Rio convention emphasises that research on biodiversity at all levels of organisation (from gene to ecosystem) and on all scales (local to global) should be undertaken. The identification of appropriate scientific tools required for European biodiversity research is a question which has to be addressed at a pan-European level. It combines the full range of the existing knowledge with the priorities and the principles of the Union, an idea shared by all members of the European Scientific Community.

MARBENA also aims at strengthening the scientific basis for using biodiversity as reflecting the overall environmental status and thus offer the highest standards for the assessment of ecosystem changes of the European Seas and for the determination of the limits of the impacted zones. Biodiversity assessment is a valuable tool for CZM policies - both these tools are in accord with the spirit and the principle of the sustainable development and management of coastal zones, a priority field of action within the Fifth Environmental Action Programme.

1.4.2 Contribution to Community social objectives

a. Improving the quality of life in the Community :

A healthy environment is essential to long term prosperity and quality of life and citizens in Europe demand a high level of environmental protection. The sustainability of the huge tourist and fishing industry in the coastal areas depends to a large extent on the quality of the coastal zone.

b. Provision of appropriate incentives for monitoring and creating jobs in the Community (including use and development of skills) :

MAREBNA believes that marine research has a special place in education. Science in general, is not doing well in Europe. Europe is investing less and less of its richness in knowledge, and the image that the people at large have of science is less positive than it once was. Marine science can attract the young people that Europe needs for the challenges it faces in a rapidly changing world.
Marine sciences have another advantage: they are highly multidisciplinary. People graduating in marine science know (or should know) physics, chemistry, geology and biology, they have learned to use remote sensing and computer modelling and, perhaps most importantly, they have grasped the intellectual challenge of dealing with an extremely complex system.

There is a strange failure in the marine market of Europe as far as links between academia and industry are concerned, outside the offshore industry and the fisheries. The many requirements for technological support from fundamental and applied marine research are met with difficulty by European industry and many laboratories rely to a large extent on US industry for their instrumentation. Perhaps the market is too small or too scattered and past experience of linking the two have not always been very positive. A network will at least have the advantage of formulating technology requirements on a much larger scale, thereby creating a much larger potential market, and can probably locate the proper SME's much easier than single laboratories in single countries.

c. Supporting sustainable development, preserving and/or enhancing the environment (including use/conservation of resources) :

The data obtained within the MARBENA project will contribute to the development of policies to preserve the natural resources and to improve employment related to tourism, aquaculture (shellfish production) and fisheries as part of an sustainable development within Europe.
Furthermore, this knowledge can be transferred to various kinds of institutions and governmental bodies to support their activities in regard to ecosystem evaluation and assessment. By increasing the exchange of knowledge and expertise between scientists in different parts of Europe and different work areas MARBENA will contribute to the consolidation of the European Science and Technology Community and to the improvement of human resources.
MARBENA will contribute to the scientific information needed for the protection of critical habitats, and the scientific background for a diagnosis on the health of the marine environment and assist EU regulations in terms of risk assessment and strategic environmental assessment.

1.5 Expected project impact (to be filled in by the project coordinator)

Remark: by replying to the following questions, the coordinator is asked to express his best estimation regarding the impact of the project.

Overall Policy Impact[1]

EU Policy Goals	I SCALE OF EXPECTED IMPACT OVER THE NEXT 10 YEARS[2] -1 0 1 2 3	II other Not applicable to project	II other Project Impact too difficult to estimate
1. Improved sustainable economic development and growth, competitiveness Θ	1		
2. Improved employment Θ	1		
3. Improved quality of life and health and safety Θ	2		
4. Improved education Θ	2		
5. Improved preservation and enhancement of the environment Θ	2		
6. Improved scientific and technological quality Θ	2		
7. Regulatory and legislative environment Θ	0		
8. Other _____ Θ			

[1] Coordinator should respond to section I or, if appropriate, to section II. If the project has had no impact, a "0" should be entered in section I. Scores other than zero in section I will prompt a more detailed subquestion on a separate screen. However, you may access in any case the subquestions by clicking on the symbol" Θ "following each main question.

[2] Indication for scale as follows: -1 represents negative impact, 0 no impact, 1 small positive impact, 2 medium positive impact , 3 is a strong positive impact

Indicate your replies below by putting in each box the number corresponding to the score you chose:

1. Economic development and growth, competitiveness	Scale of Expected Impacts over the next 10 years (2)	
	By Project End -1 0 1 2 3	After Project End -1 0 1 2 3
a) Increased Turnover for project participants - national markets	1	1
- international markets	1	1
b) Increased Productivity for project participants	1	2
c) Reduced costs for project participants	0	0
d) Improved output quality/high technology content		
d)		

2. Employment	Scale of Expected Impacts over the next 10 years (2)	
	By Project End -1 0 1 2 3	After Project End -1 0 1 2 3
a) Safeguarding of jobs	1	0
b) Net employment growth in projects participants staff	1	1
c) Net employment growth in customer and supply chains	0	2
d) Net employment growth in the European economy at large		

3. Quality of Life and health and safety	Scale of Expected Impacts over the next 10 years (2)	
	By Project End -1 0 1 2 3	After Project End -1 0 1 2 3
a) Improved health care		
b) Improved food, nutrition		
c) Improved safety (incl. consumers and workers safety)		
d) Improved quality of life for the elderly and disabled		
e) Improved life expectancy		
f) Improved working conditions		
g) Improved child care		
h) Improved mobility of persons	0	1

4. Improved education	Scale of Expected Impacts over the next 10 years (2)	
	By Project End -1 0 1 2 3	After Project End -1 0 1 2 3
a) Improved learning processes including lifelong learning	0	1
b) Development of new university curricula	0	1

5. Preservation and enhancement of the environment	Scale of Expected Impacts over the next 10 years (2)	
	By Project End -1 0 1 2 3	After Project End -1 0 1 2 3
a) Improved prevention of emissions	00	1
b) Improved treatment of emissions		0
c) Improved preservation of natural resources and cultural heritage	0	2
d) Reduced energy consumption		

6. S&T quality	Scale of Expected Impacts over the next 10 years (2)	
	By Project End -1 0 1 2 3	After Project End -1 0 1 2 3
a) Production of new knowledge	1	2
b) Safeguarding or development of expertise in a research area	0	2
c) Acceleration of RTD, transfer or uptake	0	1
d) Enhance skills of RTD staff	0	1
e) Transfer expertise/know-how/technology	1	3
f) Improved access to knowledge-based networks	2	3
g) Identifying appropriate partners and expertise	1	3
h) Develop international S&T co-operation	1	3
i) Increased gender equality	0	1

7. Regulatory and legislative environment	Scale of Expected Impacts over the next 10 years (2)	
	By Project End -1 0 1 2 3	After Project End -1 0 1 2 3
a) Contribution to EU policy formulation	1	0
b) Contribution to EU policy implementation	0	0

8. Other (please specify)	Scale of Expected Impacts over the next 10 years (2)	
	By Project End -1 0 1 2 3	After Project End -1 0 1 2 3

I, **project co-ordinator**, confirm the published information contained in this part 1 of the TIP.

Signature: **Name: Carlo Heip**

Date: 29 September 2006 **Organisation: NIOO-KNAW**

Annex 1. Man power matrix

Table Comparison between planned and used manpower for the last reporting period (months 25 to 40).

	Year 3	
	Planned	Used
Member No. / task	Hours	Hours
1. Coordination / NIOO: WP1; WP2; WP3	2838	3080
2. VLIZ: WP1; WP4	800	1482
3. CIIMAR: WP2	34	1078
4. NERC: WP4	68	0
5. EcoServe: WP3	196	115
6. FUEIB: WP1; WP3	24	242
7. UO; WP3	24	0
8. SNG: WP3	24	280
9. IMAR: WP3	30	30
10. NERI: WP4	0	0
11. IMBC: WP4	65	115.6
12. MBA: WP4	0	0
13. IOPAS: WP5	50	404.5
14. IO BAS: WP5	50	78
15. NIB: WP5	180	216
16. IMC: WP5	50	168
17. MEI: WP5	50	316
18. AN/UNIS: WP3	24	72.5
19. AWI: WP3	24	135

SECTION 5: EXECUTIVE PUBLISHABLE SUMMARY
RELATED TO THE OVERALL PROJECT DURATION

Contract n°	**EVR1-CT-2002-40029**	Project Duration:	40 months
Title	MARBENA: Creating a long term infrastructure for marine biodiversity research in the European Economic Area and the Newly Associated States		

Objectives:
In order to answer the most important questions in marine biodiversity at European scale, long-term and large-scale research is needed, and thus concertation and co-ordination. This is very difficult to implement. Major obstacles are the funding systems, lack of a Pan European Network of actors in marine biodiversity research and a sound research infrastructure.
Therefore MARBENA initiated a network of marine scientists with strong links to the different stakeholders in marine biodiversity issues, from the EU-EEA, the new member states and with links towards the SE Mediterranean Counties, that will be able to prepare and exploit the possibilities of the next framework programme and the European Research Area; improved the infrastructure for marine (biodiversity) research and its accessibility and utilization by European scientists, and has increased the visibility of marine biodiversity issues for science managers, politicians and other end users, including the public at large

Scientific achievements and main deliverables
MARBENA's achievements were not specifically scientifically based, but more aimed at networking and integration of knowledge and information. MARBENA focussed on increasing the visibility of marine biodiversity issues and research in Europe. For this, MARBENA organised, and participated in, E-conferences that addressed relevant marine biodiversity issues and the results were presented at the European Platform for Biodiversity Research Strategy (EPBRS) meetings, organised by the nations that were the presidency of the EU at that time (Scotland, Hungary, and Austria). MARBENA, BIOPLATFORM and BIOCLINE cooperated successfully in improving the visibility of (marine) biodiversity issues at a high policy level.
Workshops and surveys were organised to structure the initiated network and develop strategic plans for the future to enable a long lasting infrastructure.

Socio-economic relevance and policy implications:
Europe's natural but also its cultural history and patrimonium are strongly linked to the coastal environment.
The economic value of marine biodiversity is enormous.
However, the sustainable exploitation of many marine resources is an elusive goal with the present harvesting techniques, management systems and market mechanisms.
Rational management must be based on knowledge. This is true for fisheries, for coastal zone management (tourism for instance is often biodiversity based), for regulation of industrial and agricultural waste production etc.
The basic knowledge on marine biodiversity is insufficient to evaluate effects of human action, especially on the scales of space and time that matter.
The project facilitated the integration of this knowledge at the appropriate temporal and spatial scales, and thus contributes to the quality of the environment and the availability of natural resources and to the quality of life.
MARBENA has initiated a Pan European Network of actors in marine biodiversity research with a sound research infrastructure. The network of marine scientists has strong links to the different stakeholders in marine biodiversity issues.

Conclusions:
Integration of knowledge, expertise and research is needed to separate short-term variability in marine biodiversity from long-term trends and impacts of localised human activities from climate change, for science, sustainable management of marine resources and thus for policy, with the following priorities:

- Long-term broad scale monitoring
- Assessment of current status of marine biodiversity and pressures impacting biodiversity that could be reduced
- Process-oriented research in to key drivers of change and response of ecosystem structure and function
- Better understanding of the impacts of ocean acidification
- Integration of current research efforts
- Socio-economic aspects of biodiversity

To this end a Pan European Network of actors in marine biodiversity research with strong links to (research) policy, management and the public at large is required. MARBENA has provided the infrastructure to support

this network. It's activities encompassed several successful e-conferences from all over Europe, and from different disciplines.

Dissemination of results
The results of the project were presented at the EPBRS meetings. The database with actors in marine biodiversity research and other stakeholders in marine biodiversity issues has been adopted by the Network of Excellence 'Marine Biodiversity and Ecosystem Functioning' (MarBEF) and will from the basis for the establishment of a European Centre for the Study of Marine Biodiversity and Ecosystem Functioning (EMBEF) as a Europe-wide, virtual institution.

Keywords
Marine Biodiversity; Network; EPBRS;

SECTION 6: DETAILED REPORT RELATED TO OVERALL PROJECT DURATION

6.1 Background (description of the problems to be solved)

Europe's marine biodiversity – its biological species, the genes they contain and the habitats in which they live - constitutes a vast but fragile resource of great significance to its people. Europe has the longest coastline of all continents relative to its surface area. Its seas cover millions of square kilometres, encompassing climate zones from arctic to subtropical, and are home to tens of thousands of species of microbes, plants and animals. The seas provide a unique series of goods and services to society, including moderation of climate, processing of wastes and toxicants, protection of the coastline, and food and chemicals. Our coasts and shelf waters provide space to live and directly and indirectly create wealth, including millions of jobs in sectors such as fishing and tourism.

Many of these goods and services are currently used in a non-sustainable way. Numerous threats exist - including over-exploitation of living and non-living resources, pollution, effects of climate change, increasing tourism and introductions of alien species - and their effects have been well documented in many local studies. Large-scale studies are much less frequent. Marine ecosystems, despite their huge dimensions, appear to be particularly vulnerable to external forcing and may go through major changes (so-called regime shifts) where the whole system changes from one stable state to another. The collapse of major fish stocks is one of the most dramatic and well known examples of how human activities can directly change ecosystem structure even on very large scales. Less well understood are indirect impacts due to global change, with their potential consequences for oceanic circulation, temperature, pH and productivity.

Expertise on marine biodiversity in Europe is still fragmented but as a result of a series of smaller projects, integration has been much improved over the last few years. The marine biological community is in a unique position to move forward towards lasting change in the way marine biological science is delivered in Europe, because of the high degree of organization achieved through successfully completed projects under previous frameworks, such as BIOMARE. However, there is now a need to scale up this integration and take it to the next level. Remaining fragmentation can only be overcome by targeted networking to improve communication and discussion between research institutes from many disciplines of science, for instance by focusing on a small number of joint research projects.

Marine biodiversity research in Europe has been slowly developing from predominantly local activities in the middle 90's (Warwick et al. 1998: over 600 projects in Europe, mainly taxonomic, without any international coordination), to a number of national programmes and, finally, to the stage where the foundations for integration have been established but without actual implementation having taken place. This process started with a symposium organised by the EC during the MAST-days in Sorrento, Italy in 1995, where over one hundred scientists recommended to the Commission to look for ways to promote marine biodiversity research at a European level. This was taken up by the Commission and a series of workshops was organized, co-sponsored by the Network of European Marine Research Stations MARS, the Marine Board of the European Science Foundation and the DG XII of the European Commission from which first an inventory (Warwick et al., 1997[3]), then a Science Plan (Heip et al., 1999; http://www.esf.org/generic/626/EmapsPlan.pdf) and finally an Implementation Plan (Heip & Hummel, 2000;

[3] Warwick, R.M.; Goni, R.; Heip, C.H.R. (1997). An inventory of marine biodiversity projects in the EU/EEA member states. NIOO, Yerseke, The Netherlands (ISBN 90-74638-04-X)

http://www.esf.org/generic/626/marinebiodiversity.pdf were published). The implementation plan led to a successful proposal for a EU Concerted Action BIOMARE (http://www.biomareweb.org) which finished in October 2002 and which established a series of European Marine Biodiversity Research Sites and a list of indicators as a basis for long-term and large-scale research in Europe.
The EU programme MARBENA (2002-2006) was a pilot project to discuss policy-related issues via electronic conferences that contribute to the European Platform for Biodiversity Research and Strategy (EPBRS), to develop infrastructure and to network with NAS countries in Europe. MARBENA served as a vehicle to involve NAS countries also more closely with the European marine biodiversity research

6.2 Scientific/technological and socio-economic objectives

In order to answer the most important questions in marine biodiversity at European scale, long-term and large-scale research is needed, and thus concertation and co-ordination. This is very difficult to implement. Major obstacles are the funding systems, lack of a Pan European Network of actors in marine biodiversity research and a sound research infrastructure.

Therefore we initiated a network of marine scientists with strong links to the different stakeholders in marine biodiversity issues, from the EU-EEA and the Newly Associated Nations, that adequately prepares and exploits the possibilities of the next framework programme and the European Research Area, improves the infrastructure for marine (biodiversity) research and its accessibility and utilization by European scientists, and increases the visibility of marine biodiversity issues for science managers, politicians and other end users, including the public at large.

6.3 Applied methodology, scientific achievements and main deliverables

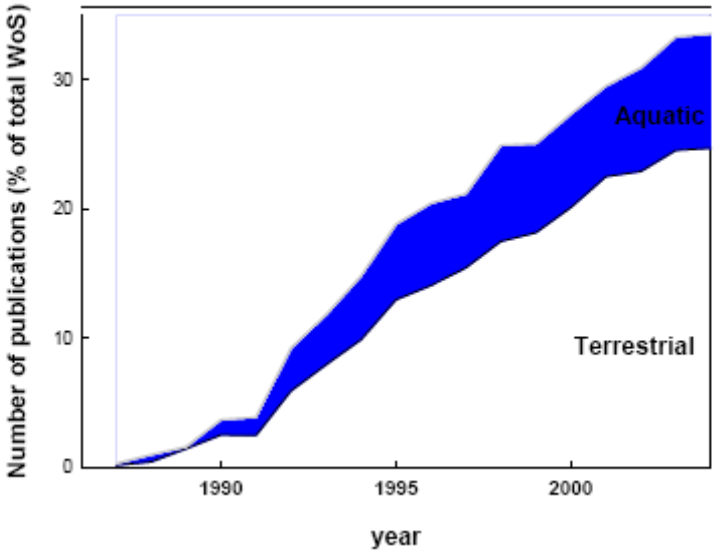
MARBENA initiated a Pan European Network of actors in marine biodiversity research with a sound research infrastructure, and with llinks to the different stakeholders in marine biodiversity issues, from the EU-EEA and the Newly Associated States, that improves the infrastructure for marine (biodiversity) research and its accessibility and utilization by European scientists, and increases the visibility of marine biodiversity issues for science managers, politicians and other end users, including the public at large.

The visibility for marine biodiversity issues was increased by communication with other initiatives (like DIVERSITAS, CoML etc.), a website, (electronic) conferences and workshops. The results of the majority of the E-conferences were presented at the meetings of the European Platform for Biodiversity Research Strategy for this a close link with BioPlatform and other relevan networks has been established.

6.3.1 Biodiversity research; allocation of effort and areas for improvement

Transformation of ecosystems and biosphere processes on a global scale, and the depletion of natural resources by human activity with the associated increase in species extinctions, have rendered biodiversity a fundamental research area. It is crucial to understand the consequences of these transformations on ecosystem services and design strategies to conserve biological diversity and use ecosystems in a sustainable manner. This situation has prompted the development of large-international concerted research programs (e.g. Diversitas), which have provided a new impulse to biodiversity research. The examination of patterns in the resulting research effort is essential to identify gaps, improve the balance across various scales of analyses and biomes, and improve the international coordination of research to address these problems at a global scale. We used a bibliometric analysis, of a database constructed with the aid of the Web of Science (WoS) and identified a yield of 13336 published articles between 1987 and 2005 concerning biodiversity research over a wide range of ecosystems (terrestrial to aquatic). The analysis of these papers showed that research efforts are increasing linearly, with the bulk (90%) of the research effort addressing terrestrial ecosystems and species, although research on aquatic (freshwater and marine ecosystems) is rising exponentially. Most of the research is observational or experimental in nature, with only a few models developed, and focuses on species. Despite constant technical improvements, research on genetic diversity and ecosystem function is still representing a minor component of the research effort. Research on different biomes is disseminated through different outlets, which fragments the community and the knowledge derived. Collaborative efforts remain limited, as the average number of authors per paper is not increasing with time, unlike the patterns in other disciplines. The international distribution of research efforts is highly skewed, with the USA and the EU contributing nearly 90% of the research and authors from countries most impacted by extinctions and ecosystem degradation showing a minor contribution to this research.

Marine vs. Terrestrial Biodiversity Research



Number of publications concerning biodiversity corrected for total number of publications in WoS retrieved with the keywords 'Ecology' and/or 'Biodiversity'

Yearly number of publications in biodiversity research increase, but exponential growth seems to have stopped. Marine and freshwater studies have a higher growth rate than studies with a terrestrial focus.
Publication efforts on biodiversity are differently allocated over journals, research on different biomes is disseminated through different outlets, which fragments the community and derived knowledge. Most excellent research (if we classify according to impact factors) on biodiversity is done on general, comprehensive and theoretical issues where Nature is the preferred outlet. Average impact factor (SE) for top 5 used journals for general, comprehensive subjects is 16.37 (6.682), for terrestrial 9.76 (0.464), marine 1.28 (0.254), and freshwater 1.37 (0.275).
The functioning of the global ecosystem is mediated in part by pelagic marine organisms through their influence on biomass production, elemental cycling and atmospheric composition but even so, most research effort is focused on land, which is explicable when we consider that there are more species known on land. Also terrestrial ecosystems might be more complex, although this might only appear so because they have been more extensively studied.
Furthermore the biggest crises involving extinction are reported to happen in this habitat. Marine species however are under threat of suffering high extinction rates due to over e.g. fishing. Coupled to terrestrial coastal areas, also the complexity of coastal systems, with their associated problems of over population and pollution should not be overlooked. The rate of discovery of new species in sea and the ongoing loss of marine habitats (e.g coastal areas, mangroves, coral reefs and seagrasses) also demand increasing efforts in marine biodiversity research and good coastal management. The Natura 2000 qualification of habitat lacks code numbers for marine habitats (8, in category 11. Open sea and tidal areas) while freshwater habitats are represented with 19 classification numbers and terrestrial (counting salt-marshes coastal areas as terrestrial) habitats account for the rest of the in total 217 classifications. This is in harsh contrast with the amount of habitats existing in these realms and calls for direct action due to the high disappearance rates of habitats in sea.

Contrary to popular belief, marine organisms are not always dispersed over large distances; insular speciation might occur more often than assumed in marine species with reduced dispersal capacities due to nonplanktonic lecithotrophic larvae. Therefore conservation efforts need to focus at the archipelagic level in the sea as on land.

6.3.2 Electronic conferences

MARBENA successfully increased the visibility of marine biodiversity research through the website, the organisation of electronic conferences and the presentation of the results at the EPBRS meetings.
MARBENA organized eight electronic conferences focussing on marine biodiversity and coordinated the input from the marine biodiversity research sector to another two e-conferences of BioPLATFORM/BIOCLIME, which is much more than originally was planned.
Although the popularity of the e-conferences by the general public increased throughout the course of the projects (as can be seen from the number of times the MARBENA web pages have been visited) we noticed that the panel of active scientists actually contributing to the discussion were showing some sign of e-conference-fatigue towards the end of the project. Although participation does not involve travel (which saves money and time), it takes quit some time to follow, and participate to, the discussions during the e-conference, which usually lasted much longer than physical conferences. Furthermore the frequency of e-conferences has increased significantly during the last years.
We are very grateful to the moderators and the participants to the e-conferences for their contributions and making the e-conferences a success. The most challenging E-conference was definitively the multilingual E-conference on The Southern and Eastern Mediterranean Sea and the Black Sea: New challenges for marine biodiversity research and monitoring', during which the moderators succeeded in reaching scientists from the s.e. Mediterranean countries.

Summary of the MARBENA electronic conferences
Despite the low number of documented extinctions of marine organisms, it is a misconception that extinction in the ocean is unlikely because of its huge biogeographical ranges and high connectivity of habitat (Hendriks et al., 2006). Recent surveys and molecular analyses of ocean samples have revealed marine invertebrates with biogeographical ranges as small as 4 km. Marine diversity is much more extensive and vulnerable than previously thought. The reason why there are no more reported extinctions might be caused by the fact that knowledge on marine biodiversity in Europe is fragmented within and between disciplines and conservationists focus on large conspicuous species to involve the general public at large. There are some examples of small species losses (hydrozoans), but these have not reached the attention of the general public. It remains important to document exinction and changes because we need to detect threats in (conspicuous and inconspicuous) species, considering the (potential) importance of most species in a complex ecosystem. To this aim, morphological characteristics most probable will continue to be the most practical (field)tool, and 'classical' (phenotypic) taxonomic expertise will remain essential. This does not mean that other aspects of biodiversity, such as genetic and habitat diversity should be neglected. What can be learnt about underlying biodiversity from molecular genetics is of fundamental importance, and will determine how modern taxonomy (including phylogenetics) and marine biodiversity research (including in support of conservation) will develop in the future.

The discussions provided ample evidence for the present loss of marine biodiversity, through e.g. climate change, inappropriate development of the coastal zone, over exploitation, and widespread ecosystem degradation derived from pollution and nutrient inputs. However, the evidence for these changes is fragmented, mostly derived from observation on large conspicuous species, and the present knowledge is far more fragmented for more cryptic species. In many cases the observed changes cannot be separated from the effect of natural oscillations, so that the evidence for anthropogenic causes of the observed changes can be confounded with these natural oscillations.
To solve this problem we need to aggregate large scale and long-term information (datasets) on marine biodiversity of both 'pristine' (not affected by man) and affected regions, supplemented with historical, and archaeological research.

The evidence of changes in marine biodiversity is less controversial for the case of introduced species, where human intervention is clearly established. The bulk of the alien species introduced have not caused any observable negative effect on the indigenous biodiversity of the Mediterranean. The ecological and functional roles of most of these species are ignored. However, about 10% of the introduced species have been found to cause severe problems, either by inducing major changes in the food webs or by excluding indigenous species, besides their economic impact.
Because the prediction of which particular species are likely to have negative effects appears cumbersome, the precautionary principle should prevail, and introductions of alien species must be closely monitored.
Comprehensive, long-term observational programmes (preferable at large, pan-European, scale) are essential to be able to resolve the rates of change in Marine Biodiversity, as well as the causes of these changes (e.g. to distinguish between anthropogenic perturbations and natural oscillations). Unfortunately these programmes are expensive, and although the long-term datasets are highly appreciated, in general this kind of research is not 'sexy' (i.e. cutting edge research) enough to obtain external funding. Consequently at the moment only few long-term observational programs exist. This does not necessarily mean that policymakers are not willing to invest in marine research, but in case science is involved to solve a marine biodiversity issue, often the role of science gets minimized in the design of the new policy. It appears thus difficult to get in contact, and communicate, with other stakeholders in marine biodiversity. Focussing on the socio-economic aspects (such as the valuation) of marine biodiversity might help in covering the gap that still exists with policy makers, and the development of Indicators, based on adequate scientific evidence, validated through carefully-designed experiments, as well as the necessary expertise (taxonomic, genetic, etc.), may provide (cost) efficient ways to monitor and manage marine biodiversity.
Management and monitoring strategies may effectively combine species-oriented approaches with more integrative ecosystem-oriented protection. The adequate combination of these interacting strategies must be based on adequate scientific knowledge, where target species may be selected in relation to their value as keystone or umbrella species or critical risks.
Parallel to observational efforts, there must be an increase in our understanding of the functional role of marine biodiversity, and its bearing on the services and functions that support societal use of the Sea.

In summary, the conference participants called for improved international cooperation for research on marine biodiversity, based on synoptic monitoring programmes using standardized procedures, as well as the effective partnership for the transference of

know-how among countries and the design and execution of focussed, large-scale experiments to test the functional role of marine biodiversity.
Increased scientific networking and progress must provide the advice needed to optimize the conservation of marine biodiversity, and to engage through the demonstration of the multiple benefits from the maintenance of healthy marine ecosystems - all sectors involved in the use of the marine environment in the preservation of its biodiversity.

6.3.3 EPBRS meetings

The outcomes of the e-conferences have been presented at the different EPBRS meetings that were held under each presidency of the EU. The platform was a good tool to reach policymakers and other stakeholders in biodiversity, and MARBENA succeeded in establishing a link with terrestrial biodiversity.
The input of MARBENA was often relevant for the formulation of the EPBRS declarations. The EPBRS declarations can be found at the BIOPLATFORM (http://www.bioplatform.info/) and EPBRS (http://www.epbrs.org/) websites.

6.3.4 Networking

MARBENA started networking from its own membership. The level of cooperation of this network already was relatively high (Figure 1) with respect to the number integrating activities, such as joint papers, projects, PhDs and visits to and from institutes.

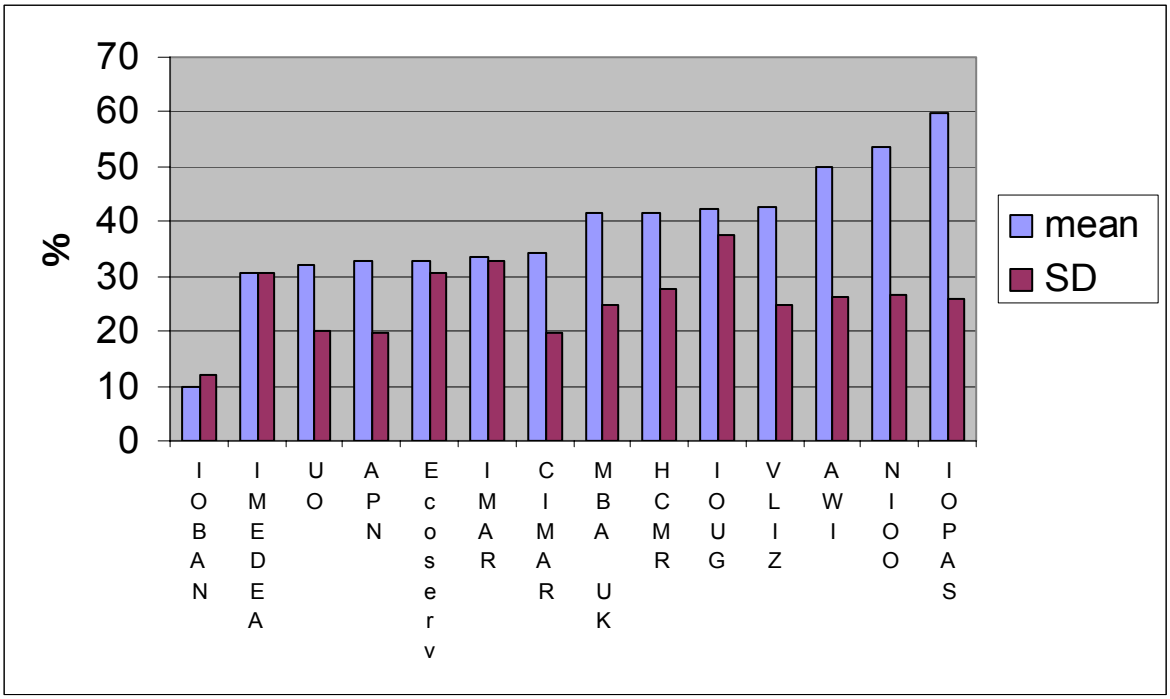


Figure 1. Level of integration amongst some of the MARBENA partners. The level of integration is based on the number integrating activities, such as joint papers, projects, PhDs and visits to and from institutes.

During the course of the project MARBENA initiated a database with scientists interested in Marine Biodiversity based on interest in electronic conferences organized by MARBENA and from the networking activities (Table 1). The table shows that marine biodiversity (research) is well anchored in most of the European countries (except for Latvia (0), and a few minor numbers in some new member or candidate EU member states, such as

Estonia, Malta and Slovenia). In EU countries there are on average 15 institutions active in marine biodiversity research in some way.
MARBENA succeeded in getting countries bordering the Black sea and south/south-east Mediterranean Sea involved (around 3 institutions per countries). In "Black sea institutions" there is even an equal amount of contacts (~3) compared to "European institutions", whereas in most "south/south-east Mediterranean" institutions there is only 1.5 contact persons on average).

Table 1. Number of institutions and people involved in marine biodiversity research as is recorded in the MarBENA/MarBEF register of resources.

	Country	*institutes*	*people*		
EU	Belgium	22	71		
	Denmark	16	32		
	Estonia	3	12		
	Finland	12	15		
	France	25	131		
	Germany	21	85		
	Greece	14	37		
	Ireland	19	26		
	Italy	18	89		
	Latvia	0	0		
	Lituania	10	13		
	Malta	1	3		
	Netherlands	14	72		
	Norway	20	47		
	Poland	10	28		
	Portugal	36	58		
	Slovenia	1	10		
	Spain	17	32		
	Sweden	10	16		
	UK	42	146		
Total		**291**	**876**		
Average		**15.3**	**46.1**	**3.0**	**pers/inst**
South and Southeast Mediterranean	Algeria	2	4		
	Egypt	3	3		
	Israel	5	8		
	Lebanon	2	2		
	Libya	1	1		
	Morocco	2	2		
	Palestinian authorities	1	1		
	Syria	3	4		
	Tunisia	3	5		
	Turkey (bordering Black sea)	5	11		
Total		**27**	**41**		
Average		**2.7**	**4.1**	**1.5**	**pers/inst**
Black Sea	Bulgaria	8	16		
	Georgia	2	3		
	Romania	2	7		
	Turkey (bordering Mediterranean sea)	1	8		
	Ukraine	3	22		
Total		**16**	**56**		
Average		**3.2**	**11.2**	**3.5**	**pers/inst**

With the establishment of the Network of Excellence 'Marine Biodiversity and Ecosystem Functioning (MarBEF, 2004-, www.marbef.org) within the 6th Framework programme the EC facilitated the initialization of a large and long lasting integrating and interdisciplinary research network that aims at the integration of marine biodiversity research at a pan European scale that also operates at the science-policy interface. The project will run until 2009. One of the aims of the NoE is to establish a European Centre for the Study of Marine Biodiversity and Ecosystem Functioning (EMBEF) as a Europe-wide, virtual institution.
EMBEF is conceived as a method of facilitating integrative and multidisciplinary marine biodiversity research in the long term. The creation of the multi site institute will assure the prominent and lasting place of marine biodiversity research in Europe and in the world so that the link to global initiatives such as the Census of Marine Life and DIVERSITAS can be established at the European level. EMBEF can also become an advisor and contributor to the European Platform for Biodiversity Research and Strategy. Recently the NoEs Euroceans and Marine Genomics Europe have joined the effort to develop and promote the concept of a long-lasting, multi-site Institute at the European level. For the visibility of marine biodiversity research, and the network itself, it is not good to have several networks focussing on the same issues. It is therefore that MARBENA decided not to extend the EMBION/MARBENA network as a separate initiative, but to join the creation of the virtual institute, and contributed the database of actors and resources. The (RTD) database has now been adopted by MarBEF and will be used for the multi-site (virtual) institute.

During the course of the project MARBENA focussed on efforts to extend the network towards the Baltic, and E. and SE Mediterranean:

Baltic region
Jan Marcin Weslawski and Henn Ojaveer - The four Baltic countries that joined the EU in 2004 are all active in marine biodiversity research, although their potential is diversified. Poland with 40mln inhabitants, and several marine research institutes, employs in total over 1000 persons in the marine science sector (over 200 phD+ scientists in marine research). The other, smaller, countries: Lithuania, Latvia and Estonia (joint population of less than 8 mln) employ in total less than 100 marine scientists, with one marine research institute per country.
The activities of the marine institutes of the Baltic are not restricted to the region (the Baltic) itself. For instance Poland has contributed significantly to the marine biodiversity knowledge in the Arctic and Antarctic (some 10% of marine biodiversity papers from global list) and in the field of fish taxonomy and biology to the Atlantic and northern Pacific areas.
The strong point of marine research~~ers~~ from Baltic countries is the orientation in both Western and Russian scientific literature, that permits to us the extensive resources of little known vast taxonomic publications of former Soviet Union. University curricula in Baltics, still contain the basic lectures on systematic zoology and botany, what makes the post graduate students well prepared for the biodiversity studies.

The Baltic, as an enclosed brackish sea, has a relatively long history of international scientific collaboration in monitoring and research. Here the ICES and HELCOM play crucial roles, with emerging new initiatives like the pan-Baltic European Research Area (ERA) project BONUS. Regular, annual meetings of Baltic scientists (Baltic Marine Biologists, Baltic Oceanographers, Baltic Geologists) provide a good working platform for a large population of marine scientists (some 500 from Scandinavia, 200 from Germany, 200 from Russia and 500 from Poland, Estonia, Latvia and Lithuania). The Baltic marine research is however strongly leveled towards environmental problems – eutrophication,

toxic blooms, overexploitation of fish resources, and true biodiversity studies are not very common. Still, the long term observations on macrozoobenthos, zooplankton and phytoplankton regularly carried out in all Baltic countries, give a good ground for Long Term Biodiversity Monitoring. Special issue of interest are the non- native (invading) species, not less than 50 of macrofauna species recently established stable populations in the Baltic, their spreading and ecological consequences are closely followed by number of Baltic marine biologists.

Mediterranean region

Christos Arvanitidis - Due to new research methods and techniques (in vivo study of biodiversity by SCUBA diving; genetic markers) the knowledge of marine biodiversity in the Mediterranean increased in the past few decades.
The researchers are very interested in biodiversity studies. This is obvious from contributions and papers published on this topic. On the other hand the GO's and NGO's as well as SME's are more interested in topics concerning destruction of habitats and pollution instead of biodiversity.

Policy choices have been hampered by inadequate science. Can our research reduce uncertainties and provide better basis for alternative choices? Sustainable use and conservation of biodiversity requires knowledge of:

- Definition of habitat types in the Mediterranean Sea; lists of habitats and species
- Impacts of most significant pressures (climate change, pollution incl. eutrophication, habitat fragmentation, connectivity, distuction, sea-use change, introduction of non-indigenous species, over-fishing etc.)
- Status and distribution of habitats and organisms (abundances, extent of habitats etc.)
- Trends of habitats and organisms

Some definitions and lists of Mediterranean habitats as well as lists of species already have been made. The information on species abundances and biomass (when available) are provided from stations sampled in the Mediterranean and Black Seas. Although in operational mode, it is still under development.

The ELME (European Lifestyles and Marine Ecosystems, at: www.elme-eu.org), funded by the EU under STREPs, is specifically targeted to the impacts of the most important pressures and tries to apply the DPSIR (Driver-Pressure-State-Indicator-Response) model to selected EU habitats, in order to make scientifically sound suggestions for the formulation of the EU policy on the sustainable development.

Among eight MARBENA electronic conferences, three focused also on the Mediterranean Sea: one organized in 2002 (22 April – 3 May), second in 2003 (7 – 20 April) and one in 2004 (6 to 24 September).

MARBENA e-conferences identified the Mediterranean and Black Sea as a unique model region for the marine biodiversity research and monitoring for several reasons:

- this region hosts several traditional marine research centres that possess long-term data sets on environment and biota;
- we may find the whole range of pristine to very impacted areas;
- region has a wide variety of habitats and organisms and high percentage of endemism;

- strong environmental and trophic gradients (south-north, east-west, vertical: oxyc-anoxic);
- a range of top predators, some of these are endangered species, while in contrast some increase in numbers (gelatinous predators);
- un-explored or ill-known environments and organisms (anoxic areas, microbiota).

Following major gaps in knowledge of Mediterranean & Black Sea biodiversity were identified:

- deep-sea biodiversity and biodiversity in specific environments;
- biodiversity at different spatial scales;
- long-term biodiversity trends;
- role of physical processes and anthropogenic impacts;
- coupling of biodiversity with ecosystem functioning;
- role of the smallest biological components.

Through presentations and discussion during the MARBENA workshop that took place in Piran from 27 to 30 November 2004 was revealed that in the region there were good observational series (inventories) and datasets at several Mediterranean and Black Sea institutions and, moreover, that UNEP/MAP may offer institutional framework for the future biodiversity monitoring activities.

Future research directions certainly include bioinvasions and the role of large top predators in relation to changes in the trophic status and environmental conditions.
Possibilities to implement recommendations for biodiversity research in the southern and eastern Mediterranean and Black Sea:

- inventory of species and habitats and their distribution, underpinned by significant new taxonomic effort
- develop, test and evaluate indicators, harmonise habitat and landscape classification (providing information on the status, trend of biodiversity and drivers of biodiversity change)

With different search tools on Internet we made inquiries about contributions that contain **“marine biodiversity”**. We got a huge number of hits. But among them we found different kinds of contributions. Like scientific contribution, tourist information, and popular, political contributions….
But we must know that some of the authors use words “species composition” instead of “biodiversity”. So the published material about this theme is even more comprehensive as it looks. We can find contributions about biodiversity of fishes, sharks, invertebrates, jellyfishes, polychaetes, sponges, plankton, macroalgae, sessile epifauna, as well as biodiversity of communities, different habitats and protected areas, genetic biodiversity, different impacts on biodiversity...
On the other hand most of the authors use the term biodiversity but, in the papers we can hardly see more than one ecosystem component (/level of biological organization) or more than one scale of observation, if we want to stick to the original definition of the “biological diversity”.

Another, important gap is the availability of reliable long-term data in the region. Although there are a few labs with long tracking monitoring activities, these data, even the meta-data are hardly available.

Decline of taxonomic expertise is another serious threat for Mediterranean and Black Sea marine biodiversity. Well-trained taxonomists are many times forced to work under monitoring or other relevant projects because this is the only source of funds for their Institutions/Academic Establishments, as well as for their teams. Consequently, this may have serious consequences for the development and continuous maintaining of taxonomic monographs/keys for most of the taxa occurring in the region.

Papers at the molecular/genetic level on species other than the edible ones, referring to either fisheries or aquaculture, are also sparsely found in the relevant literature from the Mediterranean and Black Sea region. Links between taxonomists, ecologists, biogeographers and molecular scientists should be enhanced: this is a *major* gap, partly encountered in the context of the large EU Network of Excellence.

In the recent years, the term “ecosystem approach” has become very fashionable. The term particularly relates to marine biodiversity but so far has been almost *exclusively* used by disciplines like fisheries and modeling. The approaches used, so far, to tackle this new direction are: (i) fisheries and their correlation to the environmental variables (e.g. temperature, fronts); (ii) habitat diversity, deriving from mapping approaches (cartography), thus relating to the potential biological diversity; (iii) top-predator population dynamics under the assumption that if their populations are maintained, then, the quality of the ecosystems they make use of are also maintained. An *ecosystem approach* that encompasses all ecosystem components from the viruses and bacteria to top-predators in benthic, hyperbenthic and pelagic realms, and follows their interrelationships in space and time is *absolutely* absent in the Mediterranean and the Black Sea region. Mathematical approaches to study trends in ecosystem change in relation to climate change and to anthropogenic forcing, under the afore-mentioned context, are also a *major* gap, with the exception of dynamic modelling, which suffers from many “black boxes” describing many of the ecosystem components. Biodiversity modelling, based on niche-based models also exists but it has never been applied to the region.

Among the *major* gaps, one would cite the absence of “environmental probes”, that is the production of reliable and non-expensive tools that can rapidly assess the marine biodiversity/environmental health, especially in the coastal waters. The development of such tools probably involves multi-disciplinary approach and more focused research with molecular/genetic techniques, which can provide with such useful tools. “*Environmental probing*” is a *must* priority for the years to come.

Last, but probably not least in the list of “*demand and supply*”, comes the issue of ISO certified labs in the region, capable of both performing marine biodiversity/environmental health monitoring activities and also providing education to the NGOs and SMEs stuff on this particular subject, consistent with the EU policies, as described by the EU Directives such as the Common Fisheries Policy (CFP) and the Water Framework Directive (WFD).

The South-eastern Mediterranean region

Paolo Magni - Regional cooperation in the Mediterranean Sea represents a major challenge of the XXI century towards a better understanding of biodiversity-related issues at the basin scale. This requires a major effort in enhancing the collaboration among scientists in the entire Mediterranean region, especially between northern and southern countries, to share similar and coordinated efforts. The MARBENA project has contributed to such integration by sustaining an active interaction with several scientists from various south-eastern Mediterranean countries working on marine biodiversity.

As a follow-up of the large and active participation to the 7th MARBENA electronic conferences, which focused on the south-eastern Mediterranean region, various contributions south-eastern Mediterranean colleagues were received for the implementation of the MARBENA final report. Several aspects related to the current status of marine biodiversity in the south-eastern region, identification of strength and weakness, possibilities for regional integration were highlighted (see report 'The status of marine biodiversity research and potential extensions of the related network of institutes & Marine biodiversity information: an emerging market and opportunities for SMEs – contributions from the South-eastern Mediterranean Region').

There is a clear desire of regional cooperation, networking and integration with EU-Mediterranean countries from south-eastern Mediterranean colleagues. A balanced (i.e., not biased towards the north-western Mediterranean) network should be put in place to evaluate and integrate all the work done at the regional level, taking into account the experience of north-western Mediterranean countries. At the same time, there also is a need to enhance more debate (dialog) among scientists with different backgrounds in order to create appropriate roles that are applicable to the south-eastern region. Thus, a partnership process with normative to be established and agreed by all partners on an equal level of responsibility. In the south-eastern Mediterranean region, there also a need to reduce infrastructural and publishing gaps, whereas there is a weakness (gaps, lack) in having reliable long-term scientific data, as compared for instance to the North Sea and the Baltic Sea, which mainly come from scattered (i.e. individual, not coordinated) research programs. It also appears, however, that this effort should go in parallel to a better integration at the sub-regional (e.g., North Africa, Eastern countries) and even national level, as in several cases there are not concerted actions and programs even within an individual country.

Due to a weaker economic situation, funding for conducting research on marine biodiversity seems to be a major problem, while it would also help to reduce brain-drain in south-eastern Mediterranean countries. Along this line, while research is mainly a domain of public Universities, there is a need to involve other institutions and organizations including private Universities, local municipalities, NGOs and stakeholders at large.

6.3.5 International cooperation with other initiatives

MARBENA successfully maintained links with other marine biodiversity initiatives like DIVERSITAS, CoML, EUROCOML, EURONAGISA, MarBEF, EUROCEANS, Marine Genomics Europe, etc. through individual memberships of the MARBENA partners, and through participation to the EPBRS meetings. OSPAR, ICES, EEA, and EAS were contacted, in cooperation with MarBEF, in order to assist in the preparation and future establishment of the virtual centre for European Marine Biodiversity. They have agreed to take part in the event.

6.3.6 Small and Medium sized Enterprises

The economic force of SMEs within Europe is clear. SMEs form the backbone of the EU-25 enterprise culture where over 99 % of businesses employ fewer than 250 people[4] and thus play a significant role in the market. In 2003 it was estimated that there were over 1.9 million SMEs' in Europe employing nearly 140 million persons with an average turnover of over €1.5 million per enterprise[5]. In addition to being an important economic force SMEs are a huge competence resource which should be utilised for the development of the European economy, culture and research potential. Yet, the marine environmental market is underdeveloped and turns out to be a rather complex and challenging market.

The 6th Framework Programme places special emphasis on the needs of small and medium-sized enterprises, and special actions are developed and still foreseen such as SME specific calls for proposals in the context of the new instruments, reinforcement of National Contact Points, and specific training and take-up measures. In addition, the involvement of SMEs is taken into account in the evaluation criteria particularly for the new instruments.

Business Opportunities

MARBENA has studied the business opportunities for SMEs in marine biodiversity based on expert judgement.
Three main groups of SMEs have been identified in the marine biodiversity sector:

1. producers, exploiters and marketers of biodiversity (mariculture, fisheries, tourism, bioprospecting etc),
2. research and consultancy companies providing a service to industry and governments, and
3. manufacturers and developers of equipment and products[6] (commercial equipment and gear for the groups above, research equipment etc).

1. Producers, exploiters and marketers of biodiversity

The producers, exploiters and marketers of biodiversity exploit marine nature in two main ways:

(1) directly from the direct harvest of wild species for food, fuel, fibres, and pharmaceuticals; and
(2) indirectly, (aesthetically and culturally) via the provision of ecological services such as (eco)tourism, climate regulation, soil formation, and nutrient cycling.

The market of direct harvest of marine ecosystem services has been well developed, and in many cases even over-developed.
The market of the indirect exploitation of ecosystem services is rather new, and still new niches are being discovered every day, but the development is not as visible/evident as for the first group. A problem with this is that ecological benefits are mostly not captured by conventional, market-based economic activity and analysis, and therefore mostly ecosystem services are not recognized as potential business opportunities. However there are some good examples of exploitation of these indirect benefits:

[4] Europe in figures. Eurostat yearbook 2005
[5] Europe in figures. Eurostat yearbook 2003
[6] This market is highly specialized and

Recreation

This is a fairly straightforward ecosystem service. The marine environment provides business focused at individuals. The sea can be used for recreational uses like water sports, such as sailing, swimming, canoeing, surfing, kite-surfing and a lot of money is made in the diving tourism industry with yearly number of tourists increasing exponentially. PADI statistics show exponential growth with over 10 million certifications having been issue by 2000, with value of app. 400 euros per certification. This does not include individual paying for a dive after certification or the value business associated with equipment and other facilities.

However coral reefs are disappearing, 30% of the area could be lost in the next 20 years. Such a loss might significantly impact on dive tourism. Effort should be put in conservation, to not lose the business opportunity of the diving industry.

Gas regulation.

There is money in CO_2, it has market values: CO_2 sequestration has presently a market (even a stock exchange market) value of about 26.50 €/tCO_2. Carbon emissions trading involves the trading of permits to emit carbon dioxide and other greenhouse gases, calculated in tonnes of carbon dioxide equivalent (tCO_2e). It is one of the ways countries can meet their obligations under the Kyoto Protocol to reduce emissions and thereby mitigate global warming.

This market is growing: 107 million metric tonnes of carbon dioxide equivalent (tCO_2e) were exchanged through projects in 2004, a 38% increase relative to 2003 (78 mtCO_2e). It is not only the large companies buying the stock, there is a market from country to individual levels. There are even companies offering the opportunity to 'purchase' car emissions on the internet. the money you pay is used to finance sustainable energy projects.

Provided the ocean sequesters about 2 Gt C/year, the market value of this service is 53 billion euro/year.

The conservative message is that globally the marine environment buries 0.12 Gt/year of carbon in bare sediments across the ocean and 0.12 Gt C/year in coastal habitats (mangroves, sea grass beds, salt-marshes). Fifty percent of ocean burial is within 2% of the surface therefore the protection of key-areas will be highly beneficial.

Genetic resources

The Marine realm contains most species. New genetic resources are linked with the discovery (exploration of) marine biodiversity. The highest potential is in extreme habitats. An example of a recent discovery: The bacteria *Pyrococcus furiosus*, recently discovered by NASA grows at enormous speed (1 duplication every 37 minutes) at 100 º C in submarine volcanoes , and is the only known living organism able to use Tungsten.

<u>Application of discovered species:</u>

Proteins from bacteria isolated from submarine volcanoes are stable at high temperature and can be used for development of more efficient and sure methods for genome sequencing. e.g. polymerase Tfu used in PCR, isolated from bacteria *Thermococcus fumicolans* from hydrothermal vents by researchers from IFREMER

Besides containing high genetic diversity, marine organisms represent 20 times higher bioactive substances (of interest for new pharmaceutical products) than terrestrial organisms ([7]Munro et al. 1990). Some pharmaceutical companies have already several natural substances, isolated from tunicates, molluscs and sponges under clinical trials.

Marine institutes are increasingly aware of the possibilities and using opportunities as demonstrated by the webpage of the Australian Institute of Marine Science where they try

[7] Murray H.G. Munro, John W. Blunt, Eric J. Dumdei, Sarah J.H. Hickford, Rachel E. Lill, Shangxiao Li, Christopher N. Battershill, Alan R. Duckworth (1999) The discovery and development of marine compounds with pharmaceutical potential. Journal of Biotechnology: 70, 15-25.

to attract possible business partners to develop the natural products potential of Australia's marine biodiversity.

The potential markets for business opportunities indirectly utilising marine biodiversity information and research are there, but what seems more difficult is realising that potential and turning ideas into an economically viable enterprise. How this should be achieved is not yet clear since it is a recently developed market and the scientists that have elucidated the potential value under estimate the effort required for ideas to mature into a viable business.

2. Research and consultancy companies providing a service to industry and governments

At a European level there may be considerable national differences in the role of SMEs and applied research units connected to research institutes.
SMEs also play an important role with regard to the interpretation of scientific results and making this information usable and understandable for industry and environmental managers. Likewise the implementation of technological innovations is best developed and made commercial by involving SMEs.
Thus SMEs have a specific, if not unique role, in marine biodiversity research projects.

Regional roles of SMEs

The balance of the roles played, markets exploited and niches filled by marine biodiversity SMEs varies throughout Europe particularly between the established EU states and those from new members states and countries bordering Europe. Many of the markets are driven by legislation, where the implementation of legislation is still immature the markets are immature or absent.
Examples from several states are highlighted in below.

Norway

In Norway the main direct market for biodiversity is aquaculture and fisheries. The turnover for cultured seafood in 2005 was €4 billion; with approximately 650 000 tonnes of salmon and trout alone harvested. Around 5 million full time jobs are created directly within the aquaculture industry. In 2005, the Norwegian fisheries harvest was approximately 2.4 million tonnes of finfish and 56 000 tonnes shellfish, with a first-hand value of just under €1.5 billion ([8]Statistics Norway). Many of the fish landing and processing facilities are SME's. Norway exports farmed and wild fish to 145 countries and the export value of salmon and trout alone in 2005 was €1.7 billion ([9]Norwegian Seafood Federation). Within the EU, an estimated 18 000 full time jobs are created through the processing of farmed Norwegian salmon ([10]Sintef report). Harvesting of kelp also is carried out in south-western Norway. Marine bio-tourism based on sea-angling (mostly cod and haddock) is an increasing market. This is operated by independent small businesses along the coast and is a significant source of revenue for rural areas, many of which suffer from de-population. Also some whale-watching safari businesses exist in northern Norway.
The aquaculture and fisheries industries are therefore a major driving force creating SME market opportunities for manufacturers and developers of equipment and products. Norway is a leading producer of fish cage equipment, hatchery, farm management and processing technology, fish feed and trawling equipment, many of which are carried out by

[8] Statistics Norway (ssb.no)
[9] Norwegian Seafood Federation (www.lhl.no)
[10] SINTEF 2005: Employment in the EU based on Farmed Norwegian Salmon". SINTEF report SFH 80A05603 (ISBN 82-14-03543-0) 53pp.

SMEs. The annual turnover of fisheries-related equipment, including gear, yards and services, is estimated at €1.5 billion ([11]Norwegian Trade Portal). These markets in turn create applied niches for SMEs specialising in applied research and development both for technology as well as biological research into optimal culture conditions and target species.
Because aquaculture and fisheries are governed by strict environmental resource management policies, a large market is opened for research and consultancy companies providing services both directly to the industry and to the government. Examples here are environmental impact assessments, baseline and follow-up monitoring, concession applications and conflict analyses.
The petroleum industry is perhaps Norway's highest-profile export product, and a major user of biodiversity-related management tools, which rely heavily on sea floor biodiversity monitoring. The annual turnover of such routine monitoring services alone is estimated at around € 2 million. There also is an increasing market for biodiversity research related to petroleum activities in the Barents Sea (assessing baseline conditions and natural variation). Another expanding market in Norway is bioprospecting, including the use of by-products of fisheries, biotechnology and a national species databank.
In summary therefore, SME biodiversity-related market opportunities in Norway are largely driven by the aquaculture and fisheries industries and also indirectly by the petroleum industry. The well-developed state of environmental regulation and legislation for these industries has created a large 'secondary market' within consultancy and applied research. Biotechnology and bio-tourism are expanding markets.

Ireland
In Ireland the role of marine biodiversity related SMEs follows closely that in Norway although the scale at which they support the aquaculture industry, and to a lesser extent the oil and gas industry, is proportional to the value of the industry in Ireland.
The main driving force behind marine biodiversity based consultancies is national and European legislation requiring developers and industry to take account of environmental issues. In the last few years the Water Framework Directive has provided a significant momentum to the market and before that, and to a lesser extent, the implementation of the Habitats Directive and the Environmental Impact Assessment Directive. The Convention of Biodiversity also provided a small boost to the market highlighting the need for local and national biodiversity action plans.
The marine sector is still however relatively undeveloped compared to the terrestrial or freshwater where public pressure and visibility has driven the need for consultation and issues to be addressed prior to legislative requirements. The general awareness of marine issues is still maturing and is now becoming a contributory market force. As such there are no SME consultancy companies dealing exclusively with the marine environment in Ireland and all also provide services for freshwater and/or terrestrial consultation. There are however numerous consultancies and sole traders who are exclusively terrestrial orientated.
Over the last ten years there has been a noticeable increase in the number of consulting engineering companies, some of who are SMEs, who are developing in-house environmental and ecological expertise. The expertise is however primarily terrestrial orientated with few venturing into the marine field and still relying on external expertise. The need for a significant investment in expertise and equipment to carry out marine work effectively would most likely be a factor.

[11] Norwegian Trade Portal (www.nortrade.com)

Other emerging sectors are marine tourism and leisure and interestingly some are taking advantage of offshore developments such as wind farms to base their business. Sea safaris and whale and dolphin watching are also becoming established.

Germany

Outsourcing personnel to establish and support SMEs in marine research: a German example

German marine research institutions are usually government financed. The public employment system is rather inflexible in terms of contracting personnel on a short time basis. E.g. there are only standard contracts which require a certain set of prerequisites in qualifications, previous experience and a minimum time of employment. Furthermore, the maximum time of employment at any research institute is currently 12 years. This means that a person on short term contracts cannot accumulate employment time beyond this limit. This also adds to the inflexibility in the public personnel system.

In the last decade, small enterprises have formed, mainly founded by post doctoral students. They use their experience gained often during the time of working on their dissertation in further support of science projects. These are either single persons or small groups which often establish independent enterprises. They gain their salaries through science support. They also have the possibility to employ either helpers or additional experts for the work on a specific task or deliverable on short term (sub-) contracts. Here, the administrative effort is minimized in contrast to the public system. Marine research institutes tend to support such endeavours by contracting experts or SMEs for either permanent service or single tasks. Further support is given by letting the SMEs use installations, instrumentation and laboratory space of the institutes on a no or minimum rental basis. Furthermore, SMEs are supported by regional employment development programmes. The SMEs in turn maintain their high expertise by staying in permanent contact with the scientific community of the various institutes.

The range of services offered by such SMEs is broad. Many are consultants in research projects, e.g. in aqua- or mariculture. Furthermore, consulting in environmental impact study projects is frequent. Some specialize in managing research projects. Taxonomic expertise is used in evaluating expedition material; here small specialized sorting centres exist. Increasingly, long term ecological observation series are supported again by specialized SMEs; here, abiotic factors or specific taxonomic groups are being determined. Another field is the development, service and maintenance of sophisticated instruments which is being outsourced by the research institutes.

The major advantage is the flexible adjustment in personnel and effort to a given task – often on short notice. The persistence of the SMEs is facilitated by the institutes' permanent support.

With regard to European projects, the use of such a, or similar SME structure would be invaluable. Particularly in employing experts according to need without having to go through a cumbersome employment procedure will facilitate the success of many projects. In fact, during the development of a running project, needs and objectives for additional research emerge frequently. The use of SMEs to cover such unforeseen needs on short notice would certainly smooth the progress of large interdisciplinary projects. At the same time, employment and maintenance of expertise in many scientific fields would be supported. A prerequisite is to establish a mechanism in EU-project management that allows sub-contracting experts and specialized SMEs at a larger scale; or facilitates the participation of this group in another way (new mechanism).

Poland (New Member State)

There are no SMEs, registered in Poland, with direct declaration of a “marine biodiversity” profile. On the other hand, there are a number of small firms that are carrying out activities which are important for biodiversity studies, such as sorting centres that provide sorting and identification services for marine biological samples. These are usually associated with research institutes, which provide quality control and facilities support. The estimated turnover of this service in Poland is close to $2M annually (as of 2005) and employment (together full time and part- time) makes some 60 positions. The small companies and single scientists providing that service work for USA, Canada and number of EU research institutes and are processing estimated number of 2000 zooplankton and phytoplankton samples annually.

Other SME’s of interest are consultancies able to provide of biodiversity assessment (usually on habitat and macrofauna species level), although such services were not yet requested. Manufacturers specialised in marine biological equipment production and dealers are a small group (no more than 5 firms). There is a potential market for marine biodiversity services in Poland, since the implementation of EU directives, Natura 2000 and creation of Marine Protected Areas has created a need for massive information gathering and processing. Here the competition with governmental research institutes and universities is a main limiting factor.

Science and SMEs as competitors

In some European areas monitoring of biodiversity is also considered by research institutes, as an opportunity to indirectly feed in financial support to actual research science. Services for biomass monitoring of commercially important species is used, in a scale economy, to pay for the human resources and other expenses needed to fulfil that particular task and also to create scientific background or perform research activities.

From the scientific point of view commercial work can provide a distraction from the science but provide important financial resources. For the SME point of view the competition for monitoring work can result in SMEs being out competed by research institutes or the market being absent.

3. Manufacturers and developers of equipment and products

This market supplies tools for marine biodiversity research, and although the SMEs are not actively involved in research, cooperation in projects would benefit both science and industry by innovation of science (by the use of new technologies), and the innovation of the tools by the use in research. The innovation and development of tools and equipment involves dedicated research and actions that are likely to be beyond the scope of marine science.

What do EU research projects have to offer SMEs

Participation in EU funded research programmes can provide a number of opportunities for SMEs. These benefits however are different from typical research institutes and it is important to keep in mind the different priorities SMEs have.

For example, MarBEF as a unique network provides SMEs with several opportunities outside of the direct involvement as funded partners. MarBEF brings together a huge resource in marine biodiversity and can provide information and opportunities which SMEs might exploit. These need to be carefully examined and opportunities for making them available to SMEs identified. It should be noted that the basis of MarBEF is to develop a collaborative network of marine scientists and that SMEs might not wish to share their competence with competing institutes.

Of additional concern to SMEs wishing to participate in EU projects is the level of funding. We must assume that an SME exists to make money. Therefore as commercial companies SMEs charge out their time to cover three things, salaries, overheads and profit. In a normal business situation the aim is to minimise overheads and salaries to maximise profit.

Firstly and understandable there is no provision in the EU financial models to allow for profit to be included within the funding. If the company is participating with 100% cost this will cover actual salaries and justifiable overheads. If under many research programmes the funding is only 50% then only 50% of salaries and overheads are covered and effectively the company will make a loss on every hour spent on the project. For SMEs with a developed in house RTD programme which would otherwise be internally funded the participation in EU projects to obtain funding is highly beneficial. For SMEs in the marine biodiversity research sector this is generally not the case. Of course participation in the project will provide additional non-monetary benefits however if these cannot be converted into funding in the future then the funding is a significant barrier to participation.

What can SMEs offer research projects, and what do these require of SMEs

Within the marine biodiversity sector SMEs form a very heterogeneous group. In addition to acting as participants in biodiversity research programmes and applications they are significant users of various kinds of biodiversity and biodiversity information. Most importantly they form an important bridge between basic research and major end users such as the energy industry, fisheries, as well as policy makers on regional, national and EU, and international level.

How to exploit the competence within SMEs by research projects is much less clear. Such competence forms the basis of the marketable value of the SME and as such sharing this with others for no or little return, or even sharing with potential competitors, is not considered positively by many SMEs, and it is evident that this should be counter balanced by the advantages of participation to the research projects.

Recommendations for the improvement of future involvement of SMEs in EU funded projects: interface

For the improvement of in the involvement of SMEs in future EU research project we propose to establish an interface between science and industry. Te interface should be linked to a (science) network with adequate critical mass, that can draw the attention of stakeholders in marine biodiversity issues and with potential markets (possibilities for investment) for SMEs, and has strong links with DG research to discuss strategies for the improvement of the participation of the SMEs to EU funded projects. The interface should be governed by SMEs with expertise in participation to EU funded research projects
Main objectives:

1. Increase SME end users' awareness of biodiversity, and their use of biodiversity in broad terms in their activities
2. Increase involvement of SMEs in biodiversity research in general
3. Increase funding of SMEs working with biodiversity research and biodiversity applications
4. Explore how SMEs can act as a mechanism for the exploitation of new and existing technologies and observing systems, in the exchange between basic research institutes and the industry. This might involve the establishment of a controlled forum where mutually beneficial co-operation can be explored.

For this the following action are required:
1. Knowing the actors: database and survey
A better insight is needed in the present market of SMEs involved in marine biodiversity. There are many SMEs involved in marine science, but only a handful are active in EU funded marine biodiversity research. We first need to know who the others are. This information is scattered and hard to find, and a targeted action is required for this. Then we need to verify the reasons for not participating to the EU projects. The present information is based on the experience of SMEs active in EU projects, and new insights could emerge from the new potential partners.

2. Facilitating participation to EU projects
SMEs run for profit and one of the indicated bottlenecks for participation is the way of EU funding. This should be communicated with DG research in order to look for solutions. For example special reimbursement models for SMEs could be developed.

3. Outreach
SMEs should be show what the advantages are for participation to Eu funded research marine biodiversity research projects, such as

- access to new and existing markets for their products and services (linking to new or existing partners for funded projects, opportunities to test and develop products, etc)
- market their products and services (direct advertising, raising company profile)
- develop products and services
- raise profile of their company
- seek a competitive advantage
- identify future staff

This needs a professional approach.

A first step in this would be to install a think tank group attached to a network of excellence that will further develop strategies to improve the involvement of SMEs in marine biodiversity research that can be adopted by the virtual institute on marine biodiversity at a later stage.

The *think tank* group should also prepare proposals including costs to carry out the activities and fulfil the ideas. These activities should connect real SME projects to all the proposed activities. All the proposals should be defined as projects, and SMEs should be invited to take on and perform these according to contracts.

6.4 Conclusions including socio-economic relevance, strategic aspects and policy implications

Marine Biodiversity Research

Europe's natural but also its cultural history and patrimonium are strongly linked to the coastal environment. The economic value of marine biodiversity is enormous. However, the sustainable exploitation of many marine resources is an elusive goal with the present harvesting techniques, management systems and market mechanisms.

Rational management must be based on knowledge. This is true for fisheries, for coastal zone management (tourism for instance is often biodiversity based), for regulation of industrial and agricultural waste production etc.

The basic knowledge on marine biodiversity is insufficient to evaluate effects of human action, especially on the scales of space and time that matter.

There is a requirement for long-term and broad scale monitoring to track change and to be able to separate short-term variability from long-term trends and impacts of localised human activities from climate change. The design of monitoring and decadal research networks needs to be further developed.

There should also be a meaningful assessment of status and health of existing systems focussing on local and regional perspectives, as well as the identification of pressures adversely affecting marine and coastal biodiversity (e.g. fisheries activity) so that action to reduce the pressure can be prioritised.

This needs to be carried out together with process-orientated research on the underlying mechanisms enabling better predictive ability of rates and scales of likely future changes. Experimental studies (laboratory and field) should be carried out to test the reaction of organisms to likely effects of climateinduced change and therefore better understand what aspects of climate change are most important in threatening ecosystem structure and functioning. Specific experimental studies could include the assessment of the rate of atmospheric CO2 conversion into biomass, impacts of temperature and saturated CO2 levels on carbon fixation of individual species and the influence of temperature and salinity at organizational and functional levels of different species. Another very serious gap in knowledge at present is the rate of ocean acidification and the impacts it will have on biodiversity.

Predicting climate change impacts on biodiversity in marine and coastal ecosystems will necessitate the development of new tools, and ways to constantly update and integrate new methods and technologies as they develop. In addition the multi-trophic responses that need to be considered over a range of spatial and temporal scales will need the integration of current research efforts.

Summary of priority activities:

- Long-term broad scale monitoring
- Assessment of current status of marine biodiversity and pressures impacting biodiversity that could be reduced
- Process-oriented research in to key drivers of change and response of ecosystem structure and function
- Better understanding of the impacts of ocean acidification
- Integration of current research efforts
- Socio-economic aspects of biodiversity

Network

The integration of marine biodiversity knowledge and research needs a network of scientists including other stakeholders in marine biodiversity. MARBENA has initiated this network with members from all over Europe, including the new member states (former newly associated states) and even succeeded to include potential members of southern Mediterranean (non-EU) countries.

The network will be consolidated in a long lasting virtual European Centre for the Study of Marine Biodiversity and Ecosystem Functioning. For this cooperation has started with several NoEs. Strategies need to be developed for the extension of the membership towards policy makers and other end-users of marine biodiversity information.

SMEs

The economic force of SMEs within Europe is clear. SMEs form the backbone of the EU-25 enterprise culture where over 99 % of businesses employ fewer than 250 people[12] and thus play a significant role in the market. In 2003 it was estimated that there were over 1.9 million SMEs' in Europe employing nearly 140 million persons with an average turnover of over €1.5 million per enterprise[13]. In addition to being an important economic force SMEs are a huge competence resource which should be utilised for the development of the European economy, culture and research potential. Yet, the marine environmental market is underdeveloped and turned out to be a rather complex and challenging market.

Above some elements of the policy background are sketched against which SMEs active in the present market of marine environmental products and services have to develop and market their innovative products. The same holds for the 'promising' market of biodiversity related products. Although such a market in a longer (decade) perspective is available, it is paradoxical to note that SMEs that are generally identified by the European Commission as key players in the development of these niche markets don't have the financial capability to address this challenge. So, despite the growing international European awareness about the marine environment and despite the rapidly increasing need for marine information, the market for these products and certainly biodiversity related products remains complex and difficult. A successful example of such an initiative was the EUREKA/EUROMAR initiative of the early eighties of the last century. As a consequence the emerging market for marine biodiversity related products and services are, despite its promise, too complex and fested with uncertainties and risks. This situation is hampering the 'break through' of innovative SMEs in the biodiversity related products and services market.

The clear message appears to be that the aims and objectives of SMEs are primarily commercial and any activities that SMEs become involved in need to, in the long or short term, generate income. The participation of SMEs in any activity needs to provide direct income to cover salaries and expenses, and also profit, or to be seen as an investment which might lead to future activities which are profitable. Without these short term or long term benefits being apparent it is unlikely that SMEs will undertake any activity and is the most likely reason why more SMEs are not fully involved in existing EU research initiatives. Participation in the preparation of proposals (unpaid time and travel expenses) and the participation projects (unpaid time for administrative tasks) requires an investment from any partner. Such costs may also contribute to the low participation of SMEs in the present EU projects.

[12] Europe in figures. Eurostat yearbook 2005
[13] Europe in figures. Eurostat yearbook 2003

6.5 Dissemination and exploitation of the results

The results of MARBENA have been presented at the meetings of the European Platform for biodiversity Research strategy, hosted by successive EU presidencies, and at other relevant meetings. Strong links have been created with the European platform for biodiversity, (BioPlatform) and the network of excellence Marine Biodiversity and Ecosystem functioning (MarBEF). The latter has agreed to adopt the RTD database (Register of Resources) until the establishment of the virtual institute.

6.6 Main literature produced

Non refereed literature:

Authors / Editors	Date	Title	Event	Reference	Type
Duarte, C, Jaume, D., Vanden Berghe, E.; van Avesaath, P.H.; Heip, CHR, Mees, J.	6 to 17 October, 2003	Electronic conference on 'Genetic Biodiversity in Marine Ecosystems – Measurement, Understanding and Management'	E-conference		Report
Josefson, A.B.; Vanden Berghe, E.; van Avesaath, P.H.; Heip, C.H.R.; Mees, J.	5 to 22 September 2002	Electronic conference on 'Marine Biodiversity in the Baltic and the European context'	E-conference		Report
Arvanitidis, C.; Eleftheriou, A.; Vanden Berghe, E.; Appeltans, W.; van Avesaath,P.H.; Heip, C.H.R., Mees, J.	7 to20 April, 2003	Electronic conference on 'MarineBiodiversity in the Mediterranean and the Black Sea' - Summary of discussions	E-conference		Report
Weslawski, J.M.; Ojaveer, H.; Vanden Berghe, E.; Appeltans, W.; van Avesaath, P.H.; Hummel, H.; Heip, C.H.R.; Mees, J.	2 to 12 June, 2003.	Electronic conference on 'Newly Associated States and Marine Biodiversity Research'	E-conference		Report
Hiscock, K.; Vanden Berghe, E.; Appeltans, W.; van Avesaath, P.H.; Hummel, H.; Heip, C.H.R.; Mees, J.	6 to 17 October, 2003	Electronic conference on 'Genetic Biodiversity in Marine Ecosystems – Measurement, Understanding and Management'	E-conference		Report
Weslawski, J.M.	1- 3 April 2004	Broad scale comparisons of European marine biodiversity 1- 3rd April 2004, Sopot, Poland	Workshop		Report
Emblow, C.S.; Vanden Berghe, E.; Appeltans, W.; Cuvelier, D.; van Avesaath, P.H.; Hummel, H.; Heip, C.H.R.; Mees, J.	21-24 May 2004	Sustaining livelihoods and biodiversity attaining the 2010 target in the European biodiversity strategy	E-conference		Report

Magni, P.; Malej, A.; Moncheva, S.; Vanden Berghe, E.; Appeltans, W.; Cuvelier, D.; van Avesaath, P.H.; Hummel, H.; Heip, C.H.R.; Mees, J.,	6 to 24 September 2004	Electronic Conference on 'The Southern and Eastern Mediterranean Sea and the Black Sea: New challenges for marine biodiversity research and monitoring'	E-conference		Report
Heip, C.H.R.; Vanden Berghe, E.; Appeltans, W.; Cuvelier, D.; van Avesaath, P.H.; Hummel, H.; Mees, J.,	15-26 November 2004	Electronic Conference on 'Science that matters!	E-conference		Report
Young, J., Báldi, A., Benedetti-Cecchi, L., Bergamini, A., Hiscock, K., van den Hove, S., Koetz, T., van Ierland, E., Lányi, A., Pataki, G., Scheidegger, C., Török, K. and Watt, A.D. (Eds)	March 2005	Landscape scale biodiversity assessment: the problem of scaling. Report of an electronic conference.	E-conference		Report
Brooker, R., Young, J (eds), with contribution by Heip, C.	September 2005	Climate Change and biodiversity in Europer: a review of impacts, policy, gaps in knowledge and barriers to exchange information between scientists and policy makers	E-conference and review		Report
Morato, T, Santos, R.S.	March 2006	Europe's Mountain Biodiversity: Research, Monitoring, Management, (Vienna, Austria, 10-11 March 2006),	Presentation, EPBRS meeting		Report
Van Avesaath, P.H., Hummel, H. Heip. C.	Januari 2006	"Topics and priorities in European Marine Biodiversity Research, with emphasis on the New Member States and on Emerging Business Opportunities for SMEs, preparatory workshop, short Report	Workshop		Report
MARBENA et al.	March 2006	The status of European marine biodiversity research and potential extensions of the related network of	Workshop		report

		institutes'			
MARBENA et al.	March 2006	'Marine biodiversity information: an emerging market and opportunities for SMEs':	Workshop		Report
Hendriks I. and Duarte C.	March 2006	Biodiversity research; allocation of effort and areas for improvement, IMEDEA (CSIC-UIB), Esporles (Islas Baleares), Spain. 15 pp.	Confidential Report		Confidential Report
P. Magni (ed.) with contributions by: Dr. Samir GRIMES – Algeria; Dr. Karim Ben Mustapha – Tunisia; Dr. Manal NADER– Lebanon; Dr. Izdihar AMMAR – Syria; Dr. Rais CHEDLY – Tunisia	March 2006	The status of marine biodiversity research and potential extensions of the related network of institutes & Marine biodiversity information: an emerging market and opportunities for SMEs – contributions from the Southeastern Mediterranean Region	Workshop; networking; confidential report		

Refereed literature:

Authors / Editors	Date	Title	Event	Journal	Type
Kaiser, M.J., Austen, M.C.V, Ojaveer, H.	2004	European biodiversity action plan for fisheries: issues for non-target species	Outcome MARBENA e-conference and EPBRS meeting Ireland	Fisheries Research, 69 (2004) 1-6	Publication
Various	2004	MARBENA. Creating a Long term Infrastructure for Marine Biodiversity Research in the European Economic Area and Newly Associated states.	Workshop	Annales, Series Historia Naturalis 14 (2004), supplement	Publication