Implementation and Networking of large-scale long-term Marine Biodiversity research in Europe

REGIONAL MEETINGS BIOMARE

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April 19-23, 2001

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May 10-11, 2001

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GENERAL INTRODUCTION

The international setting of BIOMARE – Prof. Dr. C.H.R. Heip

Since the Convention on Biological Diversity in Rio de Janeiro in *1992* many initiatives for research on biodiversity issues have been launched, most of them local and short term. Long-term biodiversity research, i.e. for more than 10 years, is very difficult to implement, even at the national level. Some of the major obstacles are the national and European funding systems and also the lack of an internationally agreed methodology for the measurement of marine biodiversity and the choice of indicators for (the degree of) biodiversity.
The implementation and further development of marine biodiversity research in Europe have been discussed in several meetings organised by the EC and the ESF over the last few years. The discussion at this level started at the MAST days in Sorrento (1996) and was followed by workshops in Plymouth (1997) where an inventory of marine biodiversity research was prepared, Yerseke (1997), where the first EMaPS Position Paper was prepared, and in Lisbon (1998) where these documents were discussed and approved and further action was proposed. From these meetings a consensus had grown among the scientific community in Europe that, in order to achieve the long-term and large-scale research that is needed to answer some of the most important questions in marine biodiversity, an important collaboration and co-ordination at the European scale was required. These measures should include comparative inventories of Europe's genetic resources, its species, habitats and landscapes, including marine microbiota, flora and fauna, and the understanding of the mechanisms and consequences of changes in marine biodiversity on large latitudinal and longitudinal gradients and on long time scales. Consequently, the concerted action 'Implementation and Networking of large-scale long-term Marine Biodiversity research in Europe (BIOMARE)' in which 21 institutes participate is organised.
There are a number of reasons why this co-ordination at the European level is relevant. Several national and EU projects within the Fifth Framework Programme are running or starting soon. These projects are short term (3-4 years) and local. The usefulness of the results from this research will be greatly improved by creating an international forum where they can be discussed. Furthermore, the European contributions to DIVERSITAS and to the International Biodiversity observation Year (IBOY, 2001) need to be prepared. The European Network of Marine Stations (MARS) may serve as the backbone of this effort since its 40-odd member institutes cover most of Europe's coasts. However the initiative will be open to all interested parties (not only to MARS member institutes) and can only work if it attracts commitment from an important number of researchers and institutes in Europe. The commitment sought is based on a series of flagship sites covering Europe from Spitsbergen in the north to the Canary Islands and Madeira in the south and to Greece and Turkey in the east. The research performed through the network of flagship sites should be a major European contribution to the DIVERSITAS programme.

Introduction of BIOMARE – Dr. H. Hummel

General aims

BIOMARE is a concerted action at European scale with 21 participating institutes (Fig. 1) organised to establish the infrastructure and conditions for marine biodiversity research over a period of two years. BIOMARE has three main objectives that will be complemented through three Workpackages (WP):
1) the achievement of a European consensus on the selection and implementation of a network of reference sites as the basis for long-term and large-scale marine biodiversity research in Europe, 2) internationally agreed standardised and normalised measures and indicators for (the degree of) biodiversity, and 3) facilities for capacity building, dissemination and networking of marine biodiversity research. The latter will be achieved by means of organising workshops, the improvement of training and mobility of students and researchers within a network of marine biodiversity research institutes, the publishing of an overview of ongoing research programs and existing infrastructure for marine biodiversity research in Europe through an internet website, and the construction of a database on available data,

aiming at employing data for socio-economic questions such as the impact of fisheries or tourism.
The methodology in each of the WPs is similar, following a sequence of inventories, reviews and evaluations made by WP-leaders consulting all members followed by regional meetings and workshops to discuss reports recommendations and implementation. The meetings are divided in three regions: Atlantic + Arctic, Mediterranean + Black Sea and North Sea + Baltic. The concerted action will maximise the integration of effort of marine biodiversity research at a Pan-European scale, enhance significantly marine biodiversity research in Europe and elsewhere by laying the foundations for long term and large scale effort to solve significant but hardly studied questions in marine biodiversity research, supporting biodiversity research and stressing the benefits of long term marine biodiversity monitoring to end-users and society.

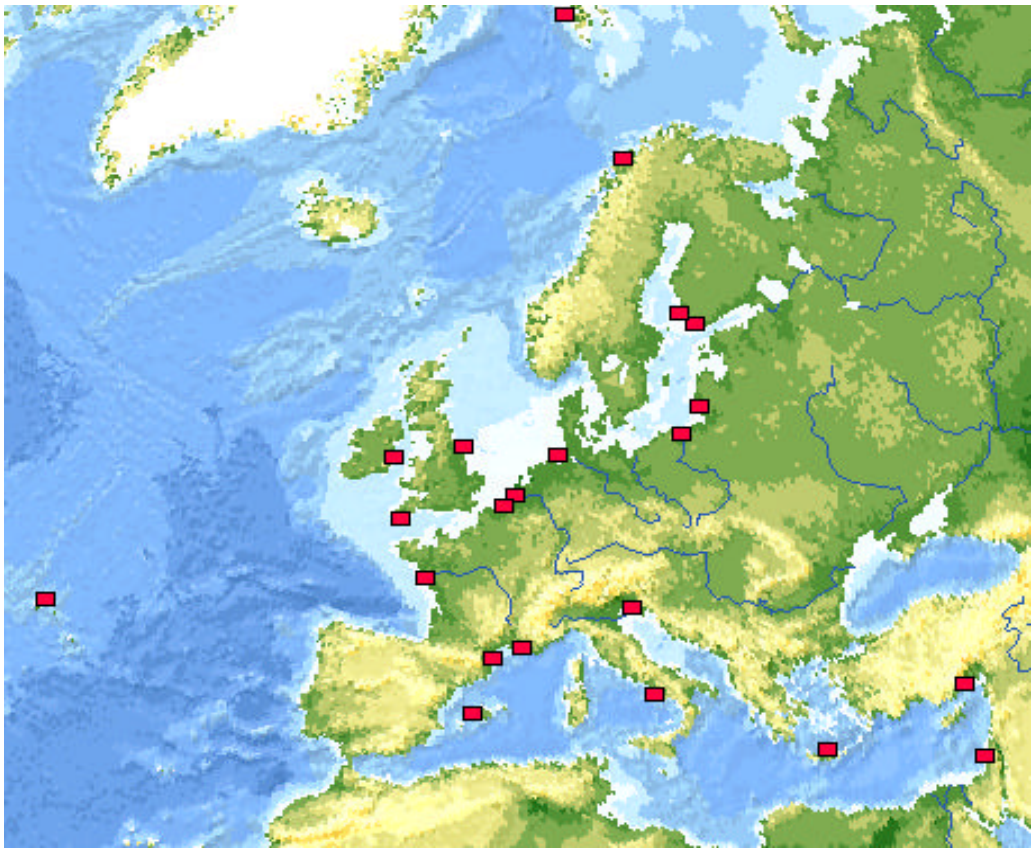


Figure 1. Locations of the member institutes of the BIOMARE Concerted Action

Workplan and progress.

The methodology in each of the Workpackages to reach the objectives is similar, following a sequence of

1) inventories by (E-)mail along all members,
2) regional meetings and a general workshop, and
3) reports.

The leading members carried out the first inventories and reviewed available data for sites with background data on biodiversity (WP1) and indicators (WP2), and reviewed existing networks and categorised available databases (WP3). The members of the Concerted Action have been contacted and consulted by the leaders for information and advice. Momentarily, we have had the first set of regional meetings with the aim to finalise the first comparisons on most suitable and best studied sites (WP1) and indicators (WP2), and on the most suitable way for installing a network and databases (WP3). The regional meetings of the Atlantic - Arctic and the North Sea - Baltic were combined in one meeting and organised by the Institute of Oceanology (IOPAS) Sopot (Poland), 19- 23 April, 2001. The regional meeting of the

Mediterranean and Black Sea was organized by IMBC (Kalamaki Hotel Corinth-Greece 10-11 May, 2001)

The results of the first inventories and discussions in the regional meetings were introduced by the WP leaders and regional co-ordinators, and are presented in this report. The report will be discussed in the steering committee, readjusted, and subsequently presented at the first general workshop. This workshop will be organized by IMEDEA, Palma de Mallorca, Spain in November 2001.
On the basis of the outcome of the workshop a further outline for criteria and protocols will be given, gaps in existing data and in knowledge will be identified, and recommendations will be formulated for the selection of sites, indicators, networking and integration of data with socio-economic questions.
Drafts of the final outlines, protocols and recommendations will be discussed in a second series of regional meetings and the steering committee, adapted accordingly, and reported by the leaders and regional co-ordinators.
At a second, final, workshop the results will be presented and evaluated with all members. The final outlines and recommendations will be reported in international journals and reports for specialists (students, researchers) and non-specialists, including regional and local managers.
The general co-ordinators guide the total process of inventories, meetings and workshop, and guard the milestones and deadlines. The steering committee will control the progress of the Concerted Action, gives information and advise to the leaders of the Workpackages, and helps to prepare workshops. The steering committee consists of the general co-ordinators (2), leaders of the Workpackages (3), and two representatives of each above recognised European region (2*3).

Progress

The progress of BIOMARE can be summarized in the following actions:

- November 2000: kickoff meeting of BIOMARE
- December 2000: Installation of the website
- December 2000 until May 2001: Inventories of primary and reference sites (WP1) and (bio)indicators (WP2), and the dissemination of the results via the website (WP3).
- April 2001: Regional meeting of the Atlantic-Arctic and the North Sea- Baltic regions
- May 2001: Regional meeting of the Mediterranean-Black Sea region
- May 2001: first management report

Practicalities

Websites
During the first few months of the CA, the dissemination of the results of the inventories was presented via mirror websites. Although this may seem convenient, the dissemination of the results via 'mirror sites' cannot take place within BIOMARE. It is necessary that the results are presented via the central website. The participants are kindly requested to disseminate their results via the means that are provided by WP3.
Travel costs
The estimated average travel costs for attending meetings are 600 Euros. This amount is not sufficient for participants traveling from far. The participants living in the more central parts of Europe are requested to minimize travel costs. This will enable the participation of the members in the more remote areas of Europe in future.
Student exchange
There is a possibility for student exchange between European and Canadian students. The project is similar to the former 'Erasmus student exchange' program. The duration of the exchange can vary between three weeks and one year. No bench fees are considered. Travel expenses will be paid. Deadline for suggestions is 23 May 2001. A letter of endorsement of the participating institutes is needed for submissions. A draft letter of endorsement is available. Prof. Dr. Eleftheriou is the coordinator for the European institutes. Dr. Costello coordinates the Canadian part. Persons that want o have more information and / or a copy of the draft letter of endorsement can contact prof. dr. Eleftheriou or dr. Costello.

WORKPACKAGE 1. REFERENCE SITES – Dr. R. Warwick

Introduction

Within BIOMARE a nested approach is used, making intensive studies at a small number of primary reference (flagship) sites and more limited extensive studies at a large number of sites.
The primary sites should be areas with a mosaic of habitats that are relatively pristine (unimpacted) when compared with similar areas elsewhere and which are therefore expected to have the comparatively highest diversity. These primary reference sites will serve to act as the baseline against which the status of degraded or impacted sites can be assessed, and subsequent changes monitored.
The exact criteria used to define these flagship sites will be discussed in more detail during the initial phase of the BIOMARE project.

Criteria are:

- The primary sites should be pristine, (relatively) free from anthropogenic disturbance, and also free from natural stressors if these are atypical of the region, which the site represents.
- They should comprise a mosaic of representative habitats within a well-defined area.
- Some background information should already be available
- They should be in areas that are afforded protection by their conservation status, which will ensure the perpetuation of their pristine status.
- There should be an appropriate infrastructure for biodiversity research.

The series of primary sites should aim at covering the major habitats in Europe.
Offshore islands may be amongst the favourite locations for primary because they are remote from anthropogenic impacts, not subject to freshwater or fine sediment inflows from rivers, have well-defined limits and a long coastline relative to their area. However, locations at the coast of the mainland are not restricted from the list a priori.

Possible research objectives at the primary sites are:

- inventory of the biodiversity present (including as complete a range of taxa as possible, the genetic diversity of target species and habitat diversity).
- study of the underlying phylogenetic pattern of biodiversity
- development of rapid assessment techniques for (dynamics in) biodiversity
- development and calibration of biodiversity measures based on relatively coarse data appropriate to the large scales of observation and the production of indices that are not strongly dependent on standardised sampling effort
- initialisation of long-term observational information in order to establish patterns of temporal change.

More extensive but less comprehensive studies of reference sites will be made at a much larger number of sites (approximately 30 sites per region), covering a range of impacted and non-impacted areas, and using the rapid assessment techniques developed at the reference sites and a restricted number of key species. The criteria for the selection of these sites are not so strict, but comparable habitats should cover a wide geographic range.

The objectives of studies at the less intensive reference sites are:

- to map the distribution patterns of biodiversity on a relatively fine scale;
- to assess Man's impact on biodiversity;
- to undertake long-term monitoring using rapid assessment techniques or biodiversity indicators.

The distribution of sites would initially be along three transects, corresponding to the BIOMARE regions:

- A North—South transect from Svalbard to the Canary Islands, with 5 to 6 primary sites and a number of reference sites along the Atlantic coasts of Iceland, Norway, Scotland, France, Spain and Portugal.

- An East—West transect through the Mediterranean, with 4 to 5 primary sites and an appropriate range of reference sites.
- An East—West transect in Middle Europe from the Baltic to the North Sea, with 3 reference sites and an appropriate range of reference sites.

The transects correspond with the acknowledged regions.

The selection of the primary sites

Until now, in total 37 primary sites (see Fig. 2) and more than 100 reference sites have been proposed for the three regions. It is still possible to suggest primary and/or secondary sites. There are some mistakes in the positioning of the locations in the map with an overview of the primary and reference sites. The participants should check the position of their proposed primary and/or reference sites on the maps provided.

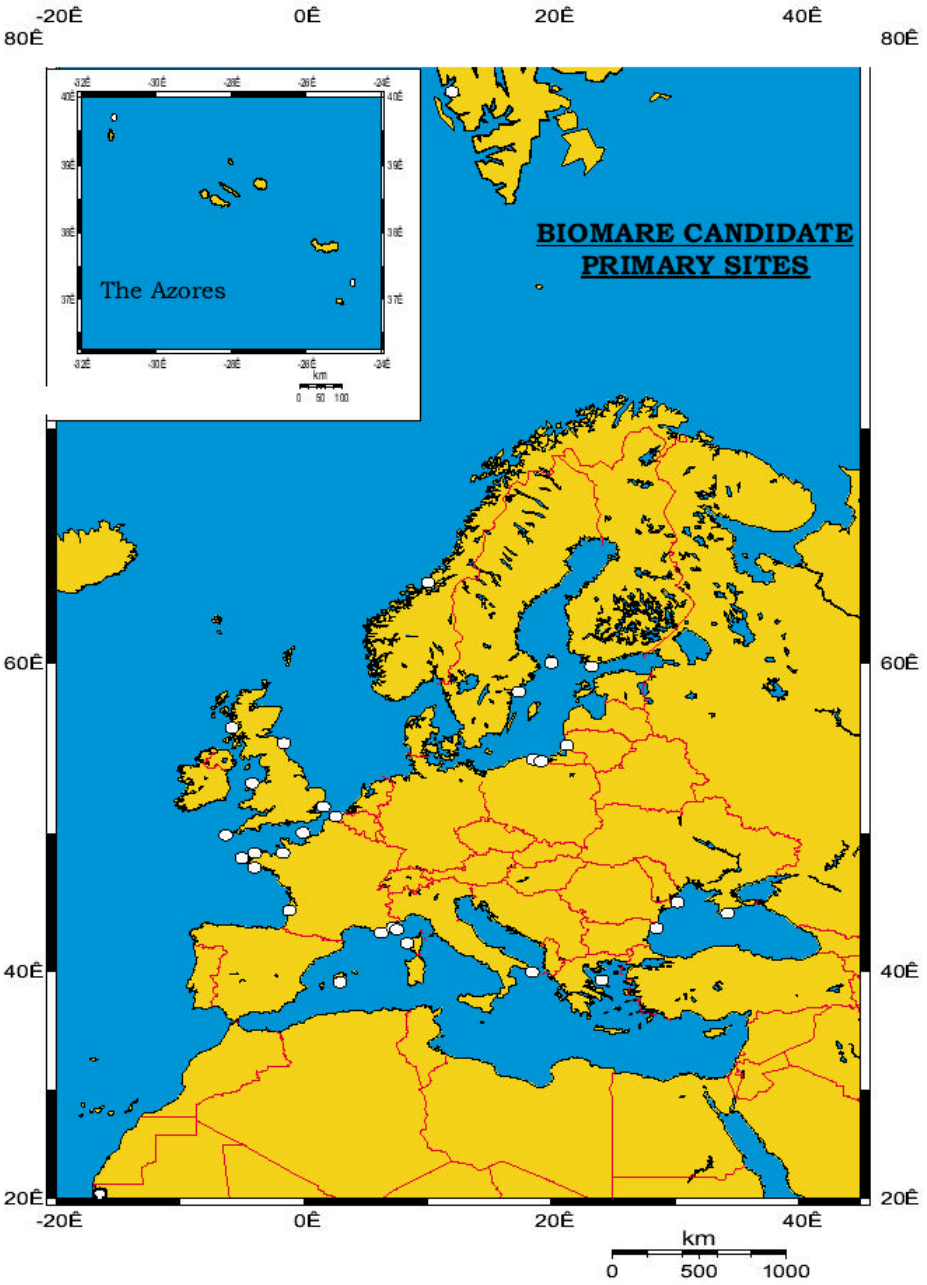


Figure 2. BIOMARE candidate primary sites.

Discussion on primary sites (Sopot)

There was some confusion about the strictness of the situation of the sites in the suggested transects of the original map. However, the map has been produced also for subjective reasons: the combination of the different transects represented a letter "E" in the map of Europe and could be used as a logo for the project. The position of the sites within these transects are, thus, not that important.
A final decision on the terminology to be used, being primary / reference / flagship sites, was not reached. Firstly the terms Primary site and Reference site will be used.
Monitoring at the primary sites should already have occurred. Information should be available.
A discussion took place about the responsibilities of the institutes that propose primary sites and the future of BIOMARE.
What are the obligations for the institutes that propose the primary sites at a later stage? Are they obliged to continue the monitoring and in the case that is true, for how long? Gathering and processing of (field) data takes time, manpower and, thus, money. The proposed long term monitoring requires (external) funds. A lot of German institutes are already not capable/willing to invest in the production of information to be incorporated with in the CA. So, even at this stage, additional funds are required to produce the data.
Nearly all the participants are in need of additional funding to comply with the demand to monitor the biodiversity of the primary site at long term. Is the objective of the CA to base a setup for future objectives? It should not be the case that participants suggest sites with the main aim to raise funds for monitoring in the future. It is possible that there will be a follow up. But that is outside the scope of BIOMARE. The idea of suggesting the sites as a tool to raise funds is not adopted within the framework of the CA.

There are some gaps in the geographical distribution of the primary sites. In some areas no sites have been proposed as primary/reference sites. Examples: North Spain / Portugal (south-European Atlantic coast). Furthermore there is a gap between Spitsbergen and the Norwegian coast.
The White Sea should be considered also. A lot of knowledge is present. However as the locations are actually not situated within the borders of EC countries, the incorporation of these sites in the CA depends on the strict criteria that are being considered. Herman Hummel will contact the institutes in the region with the request to propose sites as primary and/or reference sites.
In contrast, many primary sites have been proposed at the French Atlantic Coast.

Selection of the primary sites
The group was divided into two subgroups (according to the geographical region). The task was to reduce the number of suggested primary sites.

a. The North Sea-Baltic group
b. The Atlantic-Arctic group

Plenary meeting

A. North Sea – Baltic, results presented by Fred Buchholtz
Some (scientific-political) problems have been solved with the combination of several primary sites (see Table 1).

1. Aland Archipelago : Algo-Tvarminne, Asko .
2. Bay of Puck
3. Rostock-Warnemuende
4. Helgoland + Sylt (hard bottom + sand)
5. Sandy off shore bank near Belgium

Additional candidate sites.

6. Farne Islands + Flamborough head

Remarks:

- There was no Danish input.
- The pristiness and the research facilities of Flamborough Head were doubted. Furthermore Richard Warwick considered this site atypical for the region (chalk). The combination of the two sites (Farne and Flamborough) is not appropriate also: they differ too much. However, the site was not removed from the list.
- The east-west gradient needs a western extreme. This could be reached by combining the two provinces (Atlantic-Arctic and North Sea – Baltic) at the Scilly Islands.

- According to Herman Hummel the combination / joining of several sites is justified. This meets the requirement that there should be a mosaic of habitats present at the primary sites.
- What are the consequences for the pristiness if the sites will be combined? The size of the location will be larger and this could result in the deterioration of the pristiness (qualification). Again the question rises, what is pristine? 'Pristine' in Europe is not possible. The site should be as pristine as possible.

B. Atlantic-Arctic, results presented by Sabine Cochrane

A lot of sites had to be screened. In order to improve the objectiveness of the evaluation, the group developed a system to evaluate the suitability of the locations as primary sites.
In this system, each location received marks for the five different selection criteria. The marks ranged from 1 – 3. The lowest number indicated the highest suitability. The sum of the marks, in theory, could range from 5 to 15. However, the evaluated sites ranged in mark from 5 to the maximum of 10 and many sites differed only 1 point from other nearby locations.
This system of evaluation apparently still has to be improved. The scale of the marks could be increased, and the weight (importance) of a criterion could be increased / decreased relatively to the other criteria.
The group was not able to reduce the list of stations to the required total number. A number of sites were not discussed because no scientist was able to give additional information about the site. These sites were not included in the list, and should be evaluated at a later stage.

List of the selected candidate primary sites (Table 1)
From north to South:

- Arctic: at Spitsbergen remained two sites at the list: Kongsfjorden and Horndsen. It was not possible to choose between the two [political reasons]. The group has still to decide whether to join the locations or choose one of them.
- It was decided to scale up a location near Tromso. This site originally was suggested as a reference site, but fulfilled also the criteria for the primary sites. The location fills in a gap between Spitsbergen and South-Norway. Furthermore it represents non-glacial arctic fjords with water current influence. The Trondheim fjord also remained on the list.
- South Scandinavian Spot:
- Farne- island and Flamborough head: the same doubts as discussed in group A.
- Menai Bridge (Scotland) received a high score too, just as the Scilly Islands (U.K). The latter overlaps with Ouessant and Glenan (France).
- Two locations remained at the Azores. One site is a typical coastal site. The other is an offshore sea mount.

Locations that need further reduction of the number of primary sites:

a. France
b. Azores
c. Spitsbergen

Comments

- The sites of the White Sea still were not discussed. They have to be proposed as candidate (primary) sites first.
- There is a lack of sites in Spain/Portugal (Atlantic Coast).
- It is suggested to upgrade the reference sites at the Canary Islands (proposed as reference sites by Prof. Duarte). The location is considered an outer limit of the transect, thus valuable to include.
- On basis of the criteria selection the list of primary sites in this region is reduced to 12. Further reduction of the number of sites still is needed.
- One deep-sea primary site was proposed. The group decided that this location was out of range / scope.
- Iceland was not represented in the list. There were no contributions received from this region. They will be contacted again.
- Herman Hummel will contact the institutes that can contribute sites in the White Sea.
- Further information will be needed to fine-tune the selection. This could be reached by weighing the criteria.
- Doris Schiedek suggested proceeding with the development of the criteria selection system.

- Herman Hummel suggested defining no-go's: criteria that have to be complied with.

General Discussion

Habitat diversity is important if you use the primary sites to calibrate indicators. For this reason the weight of the habitat diversity criterion should be increased relatively to the other criteria.
The consequence for personal (personel?) interest for an institute was discussed when an institute proposes primary and / or reference sites. For the reference sites it is expected to have little or no consequences. The EC is expected to give more priority for funding for the monitoring of the primary sites than for the reference sites. Some scientist disagreed with this point of view. According to them, reference sites are more important than primary sites: the reference sites are located close to the station and form the basis for research / monitoring. However due to the large number of reference sites, it will be nearly impossible to raise funds for the monitoring of the biodiversity at these sites.
At the national level, participation in BIOMARE could be used to stress the importance of the monitoring of a certain site, and thus provides a tool to include the sites in national monitoring programs
Commercial (industrial) fishing activities have a serious disturbance effect. Pristiness should be defined also with regard to fisheries. It is important to provide a list with critical disturbances with respect to the validation of the pristiness of a site.
Some scientist urged to provide quantitative information about these factors in order to judge the pristiness of a site. 'Pristine' in Europe is not possible. The site should be as pristine as possible.

Chemical pollution was also regarded important with respect to the disturbance at a location (and thus pristiness).

After the discussion it was decided that all the institutes that proposed primary sites that already have been accepted by the group, as well as the candidate sites that are on the list of being accepted as primary sites, will be contacted again by the WP1 leader with the request to give additional information (about the several criteria of the primary sites). In this way a second large-scale questionnaire will be avoided.

Herman Hummel suggested developing of the criteria selection system in more detail. The group was divided into two subgroups again, according to the geographic region. The task was to differentiate the selection criteria of the primary sites. An additional task of the Atlantic-Arctic group was decreasing the number of primary sites.

The end product of the CA still was not clear. How far does the CA go? What kind of information do the institutes have to provide? What will be the output? Will it be a summation of species and indicators, or will it result in a research proposal. The endpoints and crossover points have to be specified. One of the results of the CA will be a list of all the information known.

Discussion on primary sites (Corinth)

Some proposals for sites had not been received and gaps in the geographical distribution of the primary sites were filled in, resulting in a list of 13 possible primary sites. As in Sopot, the lack of additional information about the individual sites made it impossible to reduce the number of primary sites.
In Sopot, offshore, deep-water sites, were considered out of scope for BIOMARE, and, thus, not included as primary sites. The majority of the proposed primary sites were situated near the coast and easily reached. The situation in the Mediterranean differs from that of the other regions. Here, deep water stations are located near the coast and are easily reached. Consequently, the criteria used to exclude the deep-sea stations in the other two regions are not valid. However, the majority of the sites proposed are coastal, shallow water sites. Therefore, it was decided that the deep-sea stations will be excluded from, but not ignored by, BIOMARE and will be discussed in a separate paragraph. It is possible to develop a parallel concerted action for deep-sea sites at a later stage.
It was suggested to extend the Atlantic ecosystem study from Norway towards the glacier bank.

The main objective of the present meeting was the reduction of the list of possible primary sites. In this region, in total 11 primary sites have been suggested, which has to be reduced to approximately 4-5 sites. The selection of the primary sites was carried out using the criteria list for primary sites

developed during the first regional meeting in Sopot (see also Table 2). In first instance, the criteria list was considered too detailed, and quantitative data for the judgment of the pristiness of a site were lacking. The primary sites were judged on the five basic criteria (pristiness, availability of a range of habitats, information available, protection status and facilities). The evaluation of the primary sites was based on the results of the database of the questionnaire of WP1 and the additional information the experts were able to give (Table 2).

The detailed questionnaire will be made in June 2001. Dr. Hummel will send the questionnaire to the steering committee and relevant participants for further comment. After the comments have been processed, the questionnaires will be sent to the relevant participants. Submission of the questionnaire will be possible until the steering committee meeting in September.

Table 1. Preliminary selection of primary sites in the North Sea – Baltic and Atlantic-Arctic region, Subgroup discussions
ID: identification number of the site in the database of WP1. Scores 1-3: from excellent (1) to intermediate (2) to bad (3). Sites with the lowest scores thus comply with most of the criteria considered essential for pristine sites. Total: sum of the scores.

ID	1st Proposer	Country (Site)	Location	Marks: pristine	habitat	Info	protected	facilities	total	remarks
1. North Sea – Baltic										
64	Bonsdorff	Finland	Aland Archipelago (cluster 1)							
na			Algo (cluster 1)							
65	Sandberg-Kilpi	Finland	Tvarminne (cluster 1)							
61	Ganning	Sweden	Asko (cluster 1)							
56	Weslawski	Poland	Bay of Puck							
na			Rostok – Warnemunde (cluster 2)							
na			Helgoland-Sylt (cluster 3)							
7	Vincx	Belgium	Western Coastal Bank							
86	Foster-Smith	U.K.	Farne Islands (cluster 4)							
92	Docrotoy	U.K.	Flamborough Head (cluster 4)							
2. Atlantic- Arctic										
na	Cochrane	Norway	Hornsend (?), not yet proposed	1	1	1	1	2	6	not yet prop
na	Santos	Portugal	Berlenga National Reserve, not yet proposed	0					0	net yet prop
15	Duarte	Spain	Canary Islands, upgrade reference site	0					0	Upgrade
18	Le Gal	France	Glenan Archipelago and Concarneau Bay	1	1	1	1	2	6	
21	Bachelet	France	Bassin d'Arcachon, Bay of Biscay	3	3	1	2	1	10	
24	Toulmond	France	Roscoff	2	1	1	3	1	8	
39	Retiere	France	Baie du Mont Saint-Michel	3	3	1	1	1	9	Downgrade to ref site?
40	Christian	France	Molene Archipelago and Ouessant island	1	1	1	1	1	5	
66	Cochrane	Norway	Kongsfjorden	2	1	1	2	1	7	
69	Cochrane	Norway	Tromsø, Balsfjord area upgrade of reference site	1	1	1	3	1	7	Upgrade
74	Santos	Azores	Formigas Bank	1	1	2	1	1	6	
75	Santos	Azores	Corvo Island	1	1	2	1	1	6	
85	Warwick	U.K	Isles of Scilly	1	1	1	1	1	5	
86	Foster Smith	U.K	The Farne Islands, off the Northumberland Coast	2	1	2	1	2	8	
90	Yule	U.K	Menai Strait	2	2	2	2	1	9	
91	Wolff	Mauritania	Banc d'Arguin						0	out EU region
92	Ducrotoy	U.K	Flamborough Head	2	1	1	1	1	6	habitat type (chalk) not typical for region. In terms of bodiv considered > Farne island
98	Sneli	Norway	Trondheimsfjord	1	1	1	3	1	7	
105	Hiscock	U.K	Firth of Lorn and Loch Linnhe, incl. Mull	1	1	1	3	1	7	
108	Emblow	Ireland	Lough Hyne marine nature reserve, Co. Cork.	1	1	1	1	1	5	
117	Moy	Norway	Bømlo-Sotra	2	1	1	3	1	8	

Table 2: Preliminary selection of the primary sites in Mediterranean - Black Sea tregion.
The evaluation is based on the criteria list developed at the regional meeting in Sopot (Poland) ID: identification number of the site in the database of WP1. Scores 1-3: from excellent (1) to intermediate (2) to bad (3). Sites with the lowest scores thus comply with most of the criteria considered essential for pristine sites. Total: sum of the scores.

ID	Location	Country	pristine	Habitat	information	legislation	facilities	total	remarks
Mediterranean									
3	Lecce	Italy	1	1[1]	2[2]	3	1	8	
6	North Sporade Islands	Greece	1	1	2	1	1	6	
11	Cabrera Archipelago	Spain	1	1	1	1	1	5	
16	Dyfamed Station	France							deep sea station
17	Villefrance Bay-Point B	France							polluted, not considered
30	Port Cross Islands	France	1	1	1	1	1	5	
35	Parc National de Corse	France	1	1	1	1	1	5	
116	Tuscany Archipelago	Italy	2[2]	2	2[2]	1	2	9	
Black Sea									
42	Island Zmeiny	Ukrain							elegible for funding?
47	Crimean coast	Ukrain							elegible for funding?
50	Cape Kiakra	Bulgaria							more info needed
Additional Sites									
Black Sea:									
	Site North Turkey	Turkey							Dr. Kideys
Mediterranean									
	South Turkey	Turkey							Dr. Kideys
	Shiqmona	Israel							Dr. Galil
	South Crete	Greece							Prof. Eleftheriou

[1]: no sandy beaches
[2]: additional information requested

Additional information to table 2

Mediterranean

3. Lecce

No scientists were able to give more detailed information about the site. No sandy beaches are present. It is a region suffering from tourism. This is the case for the whole region.

6. North Sporade Islands, National Marine Park.

The location consists of three small islands, situated in a 10 km2 area. Information is available (five years), mostly focused on benthos. No meiofauna data and time series data present.

11. Cabrera islands

The local population consists of 15 people maximum. All habitats are present. The location is situated nine km from Mallorca.

30. Port Cros Islands

The location is situated 30 km form the coast. Lab facilities are present. Commercial fisheries are forbidden. Cartography of habitats is present.

35. Parc National de Corse

Commercial fishery activities are forbidden. Diving is restricted. The area is very well protected. The location is situated 10 min from the nearest town. Community awareness is high.

116. Tuscany Archipellago.

Additional information about the site is missing. The pristiness and protection status are not clear (one of the locations mentioned is Elba).

Black Sea

42, 47 Ukrainian sites

It is not clear whether these sites will be eligible for fund raising within the EU community. Furthermore, the intention to build laboratories in the region could depend on the funding within BIOMARE. More information is required

50. Cape Kiakra

Two different institutes proposed this site. The location is affected by the Danube River. This could be an argument to exclude the location. However, half of the Black Sea is considered to be affected by rivers.

The USSR carried out a lot of research in the Black sea. It is possible that a lot of data exist for the proposed sites. The proposers should be contacted again to gather more detailed information.

Identified gaps

Mediterranean

If the site of Lecce is excluded, a large gap exists in this area. Alternatives have to be sought. Some suggestions: Sicilian Institutes of Palermo, Natali. Dr. Zupo will send an address of a contact person to Dr. Warwick. Malta was also mentioned as an alternative.

For the evenness of the distribution of the sites in the east west transect it would be good to have additional sites in Crete and Israel (see additional proposals for primary sites).

Black Sea

It is not clear which of the proposed locations are appropriate as primary sites. The primary site should primarily consist of EU-stations. Additional gaps could be filled in with contributions form outside the EU-community. It is possible that a station in North Turkey can submit a primary site (see below).

Additional proposals for primary sites:

1. Tunis station (Prof. Dr. Eleftheriou)

A marine station (regional center) is located in Tunis. They are able to propose a site in order to fill in the gap in this area. At a later stage this site was not included in the list of candidate primary sites.

2. Station South Turkey (Dr. Kideys)

A location at the southern part of Turkey was proposed as a primary site. Of this site, historical data are lacking. The area is protected and facilities are nearby. However, illegal fishing still occurs.

3. Turkish station in the Black Sea (Dr. Kideys)
A Turkish marine station is located at the southern part of the Black sea, and could be a suitable alternative for the proposed candidate primary sites in this region (see table 1) The institute will be asked to submit a proposal for a primary/reference site by Dr. Kideys.
4. Location in Israel: Shiqmona (Dr. Galil)
At the coast of Israel, a primary site was proposed. The site was described in a separate presentation. The coast of Shiqmona consists of a vermative reef (reef consisting of shells of mollusks) extending to approximately 1 m depth). At greater depth, the substrate consist of rubble-sand-etc. The reef has many endemic species of the Mediterranean and is representative for the coast of Lebanon until Syria. The deeper parts have an Eritrean influence and are representative for the coast of Syria until Egypt.
5. Location in south Crete (Prof. Dr. Eleftheriou)
An additional site from the coast of South Crete (in the vicinity of Ierapetra Bay) fills in the gap in this region of the Mediterranean.

All the institutes that have submitted suggestions for primary sites (including the primary sites suggested during this meeting) will be contacted again by the WP1-leader with the request to give more detailed information about the sites. For the survey a questionnaire will be developed. The detailed criteria list will be the basis for the questionnaire (Table 2).

Discussion on the criteria for the primary sites (Sopot)

Group A. North Sea – Baltic, Jan Marcin Weslawski

1. Pristineness: quantitative approach

The criterion contains several elements with different weights. The weights of the elements are not yet discussed in full detail.

Elements:

- Lack of industrial pollution, mining, dredging, dumping and agricultural pollution (eutrophication, pollution (pesticides etc.) was added later)
- Level of traffic: industrial and tourism
- Background eutrophication. Present situation related to background in the past, or the mean eutrophication
- Most of available biodiversity / taxa / habitats (was added later) in a region. This is the most important element of pristiness.
- Fisheries: large scale (industrial), non sustainable

The habitat array should be specified i.e. most of the available habitat in the region.

2. Array of habitats

- Is now combined with pristiness. Is placed also in the context of the size of the site.

3. Information available: high importance

- Presence of historical data
- Ongoing monitoring
- Available inventories
- Available databases
- Environmental background
- Level of detail of the above.

Remarks

- Richard Warwick does not agree that the presence of historical data is an important criterion. It is more important to have an actual inventory and the basis for long-term memory. According to Tom Pearson the historical data have additional value.

4. Protection status

- No protection -> no-go!
- Levels: strict / considerate

5. Facilities for research: high importance

- No facilities -> no-go!

  Elements:
- Logistics; lab in the vicinity of the site, boats, direct access to the area
- Access: direct access during the whole year or only seasonal access.
- Expertise
- Experimental facilities
- Analyses of samples and data
- Lodging

6. Additional criteria

- Training and education offered about the site
- High tech facilities
- Public awareness

Group B. Atlantic-Arctic, Results presented by Sabine Cochrane.

The main task of this group was the reduction of the number of Primary sites. Little attention was given to the refinement of the selection criteria for the Primary sites.

Selection criteria Primary Sites.

1. A-typical factors for the area: chemical / physical / biological stress
2. Habitat range: hard – soft bottom; inter / sub tidal / non tidal; exclude deep water (> 300m)
3. Information available: biological scope of data; time series
4. Protection status: used as a criterion if other selection criteria fail to make a distinction between the sites.
5. Facilities: same as list of previous group. Add: team of specialist available (=expertise); own funding for monitoring
6. Additional question / criterion: How representative is the site for the area?

This question was mentioned as a discussion point.
We could make a distinction between typical and atypical for the region. The region could be regarded as extended to halfway to the next station.

The discussion about the criteria for the primary sites was summarized in a detailed criteria list (Table 3). The primary sites will be judged on basis of the factors that are considered relevant for the main criteria of a primary site. Several factors were considered critical. If the sites do not fulfill these criteria they will not be accepted as a primary site ('No go' in Table 3). The weights of the different factors or criteria can differ. These differentiations were not discussed during the meeting.

Discussion on the criteria for the primary sites (Corinth)

Pristiness
In the 'Sopot list' the criteria to estimate the pristiness of sites are used in a semi-quantitative context. This somewhat subjective approach will trouble the estimation of the pristiness. It is better to use quantitative data.
With respect to the pristiness, the site should be placed in a table / matrix with quantitative information about data that adversely affect the pristiness of a site. This will enable an objective assessment of the pristiness of a site.
As possible parameters within the table were mentioned:

Distance to cities / mainland.
Human population in the vicinity of the primary site
Distance to pollution sources (such as oil refinement plants or sewage outlets);
This information is also available on maps and in reports. The amount of sewage output is available. UNEP has records of person equivalents of sewage outfall. As an indirect measure, also the population density in the vicinity of the sites can be used (with historical data, estimates can be made for future development). It is important that the members that proposed a primary site provide evidence that the site is pristine. It is even possible to collect the data ourselves because only 10 – 14 sites will be involved.
Distance to shipping lanes (marine transport 'highways')
In the vicinity of shipping lanes, the garbage on the seafloor can be larger than the amount of rubble. This garbage is ship based. Also the concentration of chemical pollutants such as TBT is higher in the vicinity of shipping routes. When the activities in the lane are high, the distance to the primary site should be larger also. This information could be valuable if we have to choose between two comparable primary sites.
Touristic development

Background eutrophication
In Sopot, this parameter was included in the list in order to estimate the pristiness of a site relative to the (present) eutrophication of the site. However, this is related to the sewage outlet, and can be excluded form the list.
Fishery
The effects of different types of fishing activities were discussed. According to some scientists all kind of fishing activities should be forbidden. Others trivialized the effects of artisanal fisheries (like lobster fisheries). The questions in the questionnaire should be specified: Are commercial fishing activities in the area allowed? Yes /no. If yes, specify: what kind and what levels of activity.

Range of habitats
This should be a tick list in the questionnaire.
Representativeness of the site for the region.
This criterion could be removed from the list. It is up to the steering committee to judge this.
Available information
This is considered an important criterion. It should be indicated for the different taxa what kind of information is available and in what form (databases, etc.). Environmental factors should be included also. Salinity, turbidity temperature and hydrodynamic factors are all possible important variables.
Protection status
A list of the legislation in force should be given. Also it should be mentioned how long these rules have been implemented. If no enforcement is effective the site will not be accepted as a primary site.
Laboratory facilities
The present and future status of support for monitoring at this site should be described. Also the expertise available should be specified and how many people work at the station and/or institute near the site. A number of aspects mentioned in this category' were considered not relevant because of the present state of development in science: computing facilities, specialized lab facilities, library present etc.
Additional items
The available funds and facilities for long term monitoring at the primary sites should be mentioned. Long term monitoring should not primarily depend on external funds.
Furthermore, it should be justified why the site should have the status of a primary site. What is so special about the site? This additional information could be given in a text response in the questionnaire

Table 3. Detailed criteria list developed during the BIOMARE regional meeting in Sopot (Poland) April 19-23, 2001
Weight: the score that the site receives with respect to the factors that are considered: no go: the site will not be considered; 1-3: scores from excellent (1) to intermediate (2) to bad (3). Sites with the lowest scores thus comply with most of the criteria that are considered essential for pristine sites.

MAIN CRITERION	FACTORS TO BE CONSIDERED	WEIGHT
1. Pristiness	Industrial pollution, mining, dumping, dredging, agricultural pollution	No go
	Lack of traffic and tourism	3 to 1
	Related to background eutrophication	3 to 1
	Most of available biodiversity present	3 to 1
	Lack of deleterious fishery	3 to 1
	Presence of an a-typical stressor for the area	3 to 1
2. Array of habitats[1]	Most of the available habitats in the region	3 to 1
	How representative is the site for the region	3 to 1
3. Information available	Historical data	3 to 1
	Monitoring ongoing	3 to 1
	Inventories (taxonomic, genetic, biochemical)	3 to 1
	Available data base	3 to 1
	Data on environmental factors	3 to 1
4. Protection status	not protected	No go
	Protection level (strictly, moderately, partly)	3 to 1
5. Facilities	No facilities	No go
	Field station and boats	3 to 1
	Continuous access - limited, seasonal	3 to 1
	Expertise available	3 to 1
	Experimental facilities	3 to 1
	Library, data processing	3 to 1
	Housing	3 to 1
6. Additional criteria	Training, education	3 to 1
	Divers, high tech equipment	3 to 1
	Public awareness	3 to 1

[1](trade off between the minimal area for max species count and feasibility of processing the data)

WORKPACKAGE 2. INDICATORS – Dr. J-P. Féral.

Introduction

There is a need to rapidly detect significant changes in the environment and biodiversity and therefore to discuss and examine the existing indicators and to evaluate and validate those actually used at a local and/or at regional level. This has been first formulated on a mondial scale in the Convention on Biological Diversity (CBD) in Rio de Janeiro, 1992. The three main aims of this convention are:

- Conservation of marine biodiversity
- Sustainable use of its components
- Impartial and equitable sharing of the advantages brought by use of genetic resources

The Jakarta Mandate (Jakarta, 1995) recognized the global problem of erosion and loss of marine and coastal biodiversity. Its principal programme element (1) of the Implementation of integrated marine and coastal area management (IMCAM) is composed of:
- Operational objective 1.1: To review the existing instruments relevant to IMCAM and their implication for the implementation of the Convention;
- Operational objective 1.2: To promote the development and implementation of IMCAM at local, national and regional level;
- Operational objective 1.3: To develop guidelines for ecosystem evaluation and assessment, paying attention to the need to identify and select indicators, including social and abiotic indicators, that distinguish between natural and human-induced effects.

At present no operational indicator concerning marine and coastal biodiversity on a European scale is available. The activities within WP2 focus on the achievement of internationally agreed standardised and normalised measures and indicators for (the degree of) biodiversity. The beginning of the project is a suitable moment to discuss some general terms used in biodiversity studies and to describe the conceptual framework.

Biodiversity

Biodiversity is composed of several components: diversity of organisms, interspecific diversity and ecological diversity, situated in the framework of landscape diversity, interlinked at the population level, and all affected by human interaction and global changes. (Fig. 3.)

Causes of biodiversity changes

There are several direct causes for biodiversity changes acknowledged: over-fishing, loss of natural habitats, biological invaders, chemical pollutants and climate changes. Over-fishing and loss of natural habitat will lead to local extinctions. Bio-invaders will have consequences like the increase in competition in space. Chemical pollutants will lead to physiological disturbance, affecting the metabolic activities, leading to biochemical disruptions and affecting reproduction and growth. Climate changes lead to outbreaks of diseases, mass mortality effects and migrations of thermophylic species.
Recently, the frequency of epidemics and number of new diseases has increased. In 1999 the largest mass mortality event ever was recorded in the Mediterranean, with respect to: the size of the geographic area concerned, the high diversity of taxa affected (sponges, cnidarians, bryozoans, bivalves etc.) and the high mortality observed (up to 90 % at some sites). In the affected area exceptionally high and constant temperatures were registered for the whole water column during a period of one month, which probably caused the mass mortality.
Taking into account the global warning context monitoring programmes of vulnerable populations should be set up.

Indicators

An indicator consists of data selected from a larger statistical whole, and possesses particular significance and representativeness. Indicators condense information, and simplify the often-complex environmental phenomena, thus becoming precious communication tools. They refer to different scales: spatial scale (local, regional, European), time scale (including palaeontological time-scales) and biological organisation level.
The measurement of health responses in terms of response times and levels of biological organisation facilitates the establishment of causal relationships between (non-natural)

stressors and biological effects. If properly calibrated to higher level responses, lower level responses can be effectively used in ecological risk assessment.

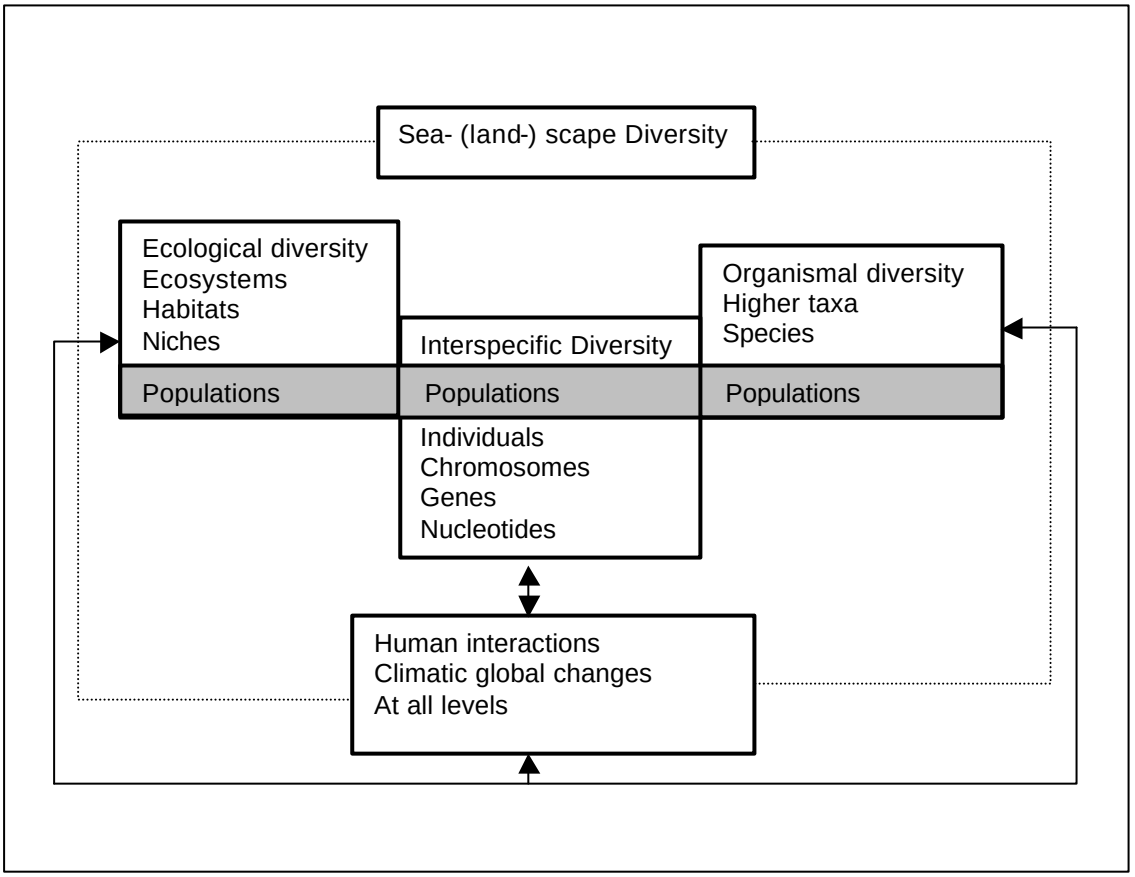


Figure 3. Composition and levels of biodiversity.

The bio-indicators will be considered following the model developed by OECD (examples are given without hierarchy):
State indicators give a description of the environmental situation (e.g. concentration of heavy metals, nitrates, quality of the ecosystems, relative number of threatened and extinct species, heterozygosity),
Constraint or pressure indicators indicate the pressure of human activities on the environment (e.g. habitat loss, fishing effort),
Use indicators are measurements of goods and services provided by ecosystems (e.g. fishery resources, mining, eco-tourism development etc.), and
Performance or response indicators indicate the actions undertaken to solve an environmental problem. (e.g. funding for monitoring, number of protected areas)

The are different types of bio-indicators, which eventually all facilitate the global assessment of the marine environmental health:
1. Bioindicators
An indicator is an organism or a group of organisms, which, by reference to biochemical, cytological, physiological, ethologic or ecological variables, allows in a practical and safe way, to characterise the state of an ecosystem or an ecocomplex and to highlight as early as possible their natural or caused modifications (*early warning*).
2. Biomarkers
Biomarkers are generally defined as measures of stressor exposure or effects of stressors at lower levels of biological organisation (sub-cellular to organism). To be considered as bioindicators however, biomarkers must be causally linked to ecologically relevant endpoints. Field studies should be designed such that measurements are representative of several levels of biological organisation including biomarkers of exposure and bioindicators of effects.
3. Biomonitors

Biomonitors are species that may concentrate chemical pollutants at higher levels than the physical medium.

Biomarkers are generally used to indicate exposure of organisms to contaminants at lower levels of biological organisation (sub-cellular to organism) while bioindicators are typically used to reflect effects of stressors on biological systems at higher levels of organisation (organism to community). Since financial resources for bio-assessment studies are usually limited, an optimum mixture of response-sensitive biomarkers and ecologically relevant endpoints should be measured with a focus on effects at the individual organism level.

A proper ecological risk assessment requires early markers of changes and affects. Effects on populations, communities and ecosystems have a high ecological relevance, but do not represent early signs of human pressures on biodiversity (Fig. 4), and biodiversity loss manifests itself long after the biochemical dysfunction, physiological abnormalities and /or impairment of reproduction or growth. Only a combination of different biological tools, from the ecosystem to the molecular level, with a range of species representing various trophic levels and dwelling in different habitats will give an overall view of human pressure on marine ecosystems.

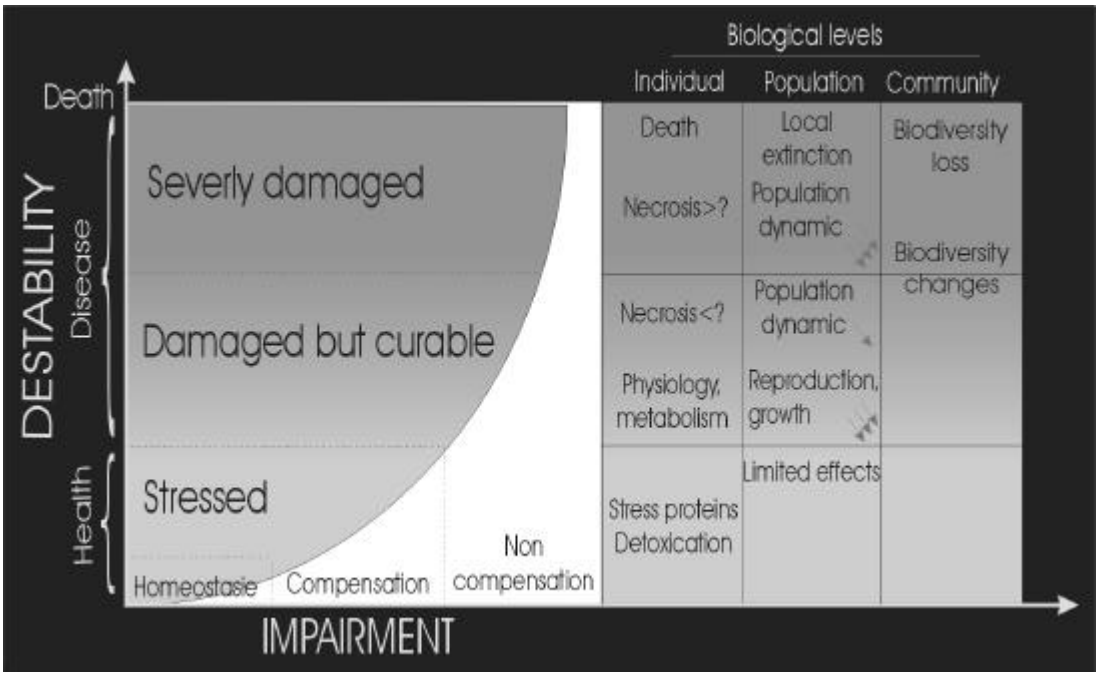


Figure 4. Early markers of effects for a better ecological risk assessment.

Key terms associated with biodiversity indicators:
Reference points give the means to measure progress and identify needs at political level. These are:

- Base lines (zero points) permitting changes to be measured against a certain date or a certain state
- Thresholds, which are used as early warning systems for problems
- Targets, which reflect tangible performance objectives

Assessment is the analysis of the gap between the present state and the reference state. Pressure-state-response assessment framework (Fig. 5):

- pressure is the complex of socio-economic factors or motive forces which affect biological diversity
- state is the present state of biological diversity
- responses are measures taken to change the actual or projected state.

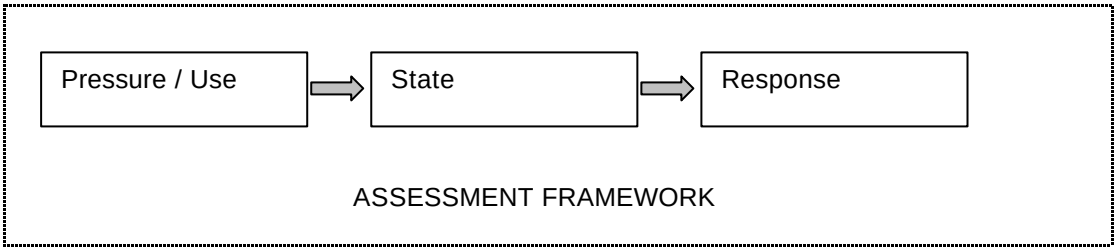


Figure 5. The different indicator types situated in the assessment framework.

The survey of marine biodiversity must involve complementary approaches.
1. A panel of biological tools able to give the first warning (e.g. the occurrence of nitrophylic species, potentially toxic (phytoplankton) species and exotic invasive species).
2. A panel of biological tools able to determinate the causes of biodiversity change: biomonitor species (a range of species representing various trophic levels or feeding strategies is essential to obtain an overall view of pollutant bio-availabilities), biomarkers of exposition reflecting the variation of the tolerance to a stressor (e.g. stress proteins) and biomarkers of effect with obvious ecological endpoints (e.g. markers of geo-toxicology, effect on growth).
3. Rapid assessment methods for biodiversity: cartography of the habitat using sounding systems, structure and dynamics of benthic communities with a geographical information system and a survey of key species for marine biodiversity (e.g. rare or endemic species, threatened species becoming extinct as a consequence of environmental changes and biogenic building species or key-stone constituents of trophic networks)
4. Long term survey including physical measurements and surveys of sensitive populations. The long term monitoring programmes must include social economical parameters such as pressure of human activities (water consumption, waste production etc.), professionals of the sea (fisheries, aquaculture etc.) and eco-tourism. Within this respect it is important to determine the tolerance thresholds of marine ecosystems.

The key features of a biomonitoring plan consist of features of biological, methodological and societal relevance (Fig 6.)

Common stages recommended in the indicator selection process may be the following:

- Determine the target public and its information requirements and clarify the criteria to be measured
- Determine the geographical unit, which must be studied. If the boundaries are unknown, preliminary studies are needed to verify that what is called a landscape does have the same biogeographical history and possess a certain ecological homogeneity.
- Choose the indicator group(s) for these criteria, according to one's knowledge of them, which must be good; but also checking the existence of standardised sampling techniques, (the same group of indicators is not necessary appropriate for all landscapes).
- Meticulously test indicators
- Set up targets, thresholds and/or marker data that are suitable for these indicators
- Try out these indicators in the field
- Express the results in terms of local (alpha) and landscape, or total (gamma) diversity, as well as in terms of beta diversity (e.g. measurement of substitution of species between differing communities).
- Produce comparable data, quickly made available in banks designed for their public use.

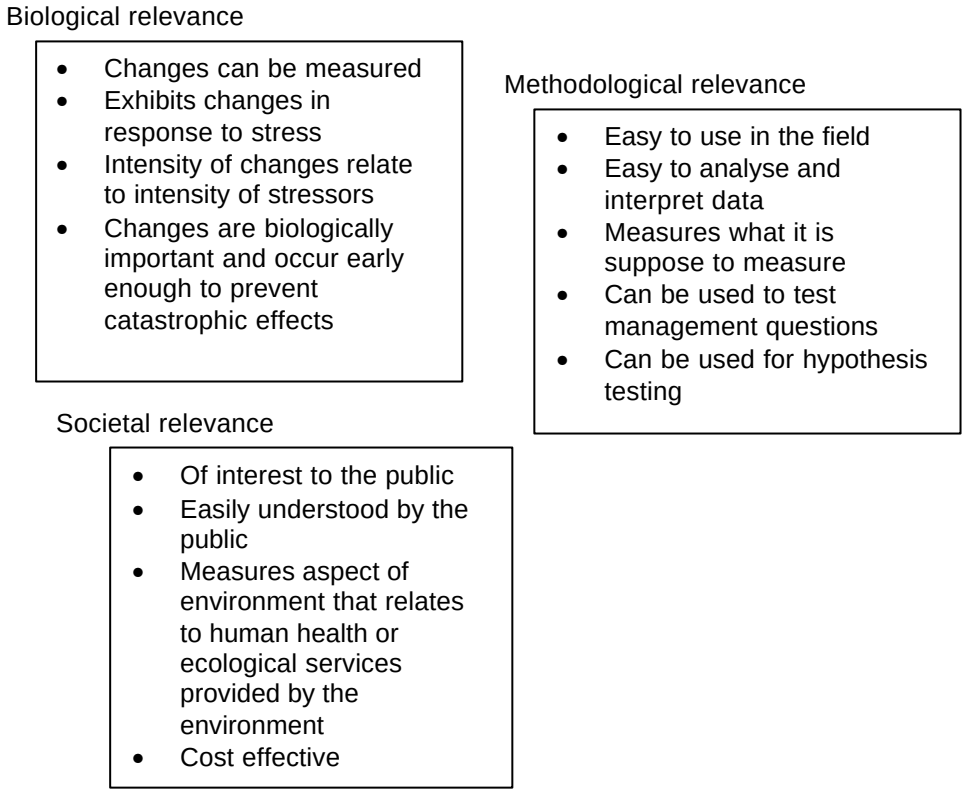


Figure 6. Key features of a biomonitoring plan.

Existing monitoring networks

A certain number of marine environment monitoring systems exist in France (taken here as example) and in other European countries. They should be completed and interconnected:

- Monitoring the bacteriological quality of bathing waters (total coliforms and streptococci whose abundance is correlated with the presence of pathogenic micro-organisms (salmonellae and viruses that are more difficult to show) since 1972 in France by the DDASS (Departmental Board for Health and Social Action) and the Ministry of the Environment. Similar networks exist in Spain and in Italy.

- The *Posidonia* Monitoring Network (RSP) is the only monitoring system in the Mediterranean which routinely uses a biological indicator. This network was set up in 1984 in the Provence-Alpes-Côte d'Azur region (France).

- The National Observation Network (RNO) has since 1974 measured the general parameters of sea water quality: temperature, salinity, nutrients and contaminants. From 1978 on, certain pollutants have also been measured in living organisms, such as mussels, oysters and fish. Since 1992, two pilot sites have been reserved for the routine measuring of the activity of a biological indicator, the detoxifying enzyme EROD. The RNO is managed by IFREMER.

- The Phytoplankton Network (REPHY) has in France since 1984 recorded phytoplankton disturbances, especially toxic unicellulars likely to make caught or cultivated Mollusks unfit for human consumption, and also microalgae responsible for red tides. It is managed by IFREMER.

- The Microbiological Network (REMI) has in France since 1989 monitored the bacteriological quality (fecal bacteria) of shellfish. These are sampled once a month, but when exceptional phenomena appear (increased contamination, accidental discharge) the sampling is done more frequently.

Links with other organisations

Potential end-users

- International Council for the Exploration of the Sea / Conseil International pour l'Exploration de la Mer. ICES-CIEM (http://www.ices.dk)
- European Environment Agency. EEA (http://org.eea.eu.int)
- Intergovernmental Oceanographic Commission. (http://ioc.unesco.org)
- United Nations Environment Programme. UNEP (http://www.unep.org) and related programmes.
- Commission internationale pour l'exploration scientifique de la Méditerranée / International commission for the scientific exploration of the Mediterranean Sea CIESM. (http://www.ciesm.org)

The questionnaire

The questionnaire was not accessible via the Internet for some time. These problems have been solved now.

It is important to read the introduction before filling in the questionnaire. The introduction gives relevant background information that is essential to understand the context of some questions in the questionnaire (see Box 1). The questionnaire has to be filled in from the viewpoint of an end-user (policy maker).

The geographical zones will be adapted in the next questionnaire. There will be four to five main geographic regions indicated. In addition, the coordinates of the appropriate region will be asked, e.g. one coordinate for a point, two coordinates to indicate the borders of a coastal region and two coordinates that indicate the diagonal of a (square) offshore location/region.

It is possible to submit several indicators. Just use one page for each indicator / species.

Box 1. Questionnaire of Workpackage 2 as put on the internet

CORRESPONDENT

Name :
e-mail address :
Institution/Laboratory :
Country :

BIOGEOGRAPHIC SECTOR

-Baltic Sea
-Arctic Ocean (including Norwegian Sea)
-Atlantic Ocean
-N-W Atlantic Ocean (North Sea, Channel, Iberic Basin)
-Atlantic Ocean (Canarian Basin, Cape Verde Basin)
-Black Sea
-Mediterranean Sea
    -Mediterranean (North Aegean)
    -Mediterranean (Gulf of Lyon, Ligurian Sea)
    -Mediterranean (Balearic Sea, Tyrrhenian Sea)
    -Mediterranean (Adriatic)
    -Mediterranean (Ionian Sea, South Aegean)
    -Mediterranean (Levant Sea)

1) MEASURING MARINE BIODIVERSITY

1.1) Sampling methods (trawling, diving, census along transects, etc..):
1.2) Recording (photo, video, use of a ROV) and image analysis :
1.3) Statistical techniques and biodiversity indices :
1.4) Rapid assessment methods :

2) SPECIES CONSIDERED AS "KEY-SPECIES"

2.1) Does an inventory of the marine "patrimony/heritage" exist (YES|NO)?
2.2) Organisation in charge?
2.3) Updating frequency?
2.4) Give a list of the species considered as key-species for biodiversity.
Species name : Phylum :
Habitat : Region :
Type (rare, endemic, threatened, builders, "key-stone" constituents, commercial species) :
Status (patrimonial species, protected or not ; surveyed or not) :

Known stressors or competitor:
Comments :

3) FACTORS THAT MAY HAVE AN IMPACT ON MARINE BIODIVERSITY

For each factor, explain how their biological effects are surveyed, within the framework of a monitoring network or not?
3.1) Chemical stressors :
3.2) Physical stressors :
3.3) Biological stressors :
3.4) Give examples or references of major effects on marine biodiversity of some of them:

4) INDICATORS

4.1) Among the indicator types (state, pressure, use and response indicator), describe those recommended or imposed by national rules.
Do data exist on :
4.2) the total amount of fisheries, per species and per year :
4.3) the number of medical or biotechnological substances discovered in marine organisms :
4.4) the development of ecotourism in coastal area
4.5) financial efforts made by governments for the biodiversity management or for improving the marine littoral quality

5) BIOINDICATORS

5.1) Indicator or sentinel species
Species name : Phylum :
Habitat : Region :
Stress reflected : Description of effects :
Comments :

5.2) Biologic indices
Give a description of the indices routinely used :
Name : Taxa involved :
Habitat : Thresold :

5.3) Biomarkers
Name and principle : Stress reflected :
Principle : Taxa used :
Links with ecologically relevant endpoints :

5.4) Biomonitor
Species : Habitat :
Bathymetric distribution : Feeding strategy :
Pollutants accumulated:

6) BIOMONITORING NETWORKS :

Name of the network :
Institution (person) in charge of the co-ordination
Main goals of the network :
Species and technical approach used :
Parameters measured :
Meshwork and frequency of the measures :
Annual budget :
Comments :

7) GENERAL COMMENTS

Each sections must be completed by relevant references
Reviews and synthetic papers are opportune

Discussion on indicators (Sopot)

It is important to choose the indicator for the change / process one wants to assess. A good indicator (monitor) could be species at the limit of its distribution.
Several scientists considered the presented approach too ambitious. The difference between indicators that reflect environmental health and indicators of biodiversity is too wide: BIOMARE should focus on the bio-indicators reflecting biodiversity: changes of biodiversity, what scale, and in what rate.
The Concerted Action aims to deliver a basis for long term monitoring (> 10 yrs). The priority should be the formulation of a list of biological indicators. Single species are not good indicators for biodiversity. Better is to choose indicators between the species and community levels: multigroup / multispecies indicators as surrogates for biodiversity. Each set of indicators has to be linked to the target. It is important to set the targets at this moment.
Apart from the search for indicators that can be used in the long term monitoring framework, we need indicators for the early warning systems. We have to provide useful tools for policy makers.

Biomarkers are good tools for early warning systems. They possess ecological information value. Research has shown that the distance between biomarkers and effects at the population level are not that great as previously considered. Factors that affect organisms at the (sub) cellular level also affect the organism at the population level.
Climatic changes and local disturbance can conflict (looking at regional scale…?). We have to address to this.

During the discussion it appeared that there was much confusion about the questionnaire of WP2. Some terms and questions were ambiguous. Also the impression rose that the list of possible indicators should be narrowed down. Due to technical problems a lot of participants did not succeed to fill in the questionnaire. Until now, only 13 contributions have been received. At the moment, these problems have been solved, and also the results are available on line. It was suggested to update the questionnaire in such a way that it can be send to the BIOMARE members by email.

It appeared necessary to differentiate the discussion on indicators on several

- spatial (Pan European, Regional, and Local scales),
- temporal scales (rapid assessment techniques and long term monitoring), and
- organizational levels (considered: species; communities; functional groups).

The selection of indicators and suggestions for the improvement of the WP2 questionnaire was further discussed in four subgroups with randomly chosen participant. The discussions in the subgroups were structured with the help of an item list that was handed out by Herman Hummel (see box 2).

Box 2. Handout of Dr. Hummel. The handout was originally made at the meeting in Sopot.

Tool for discussion in subgroups
Discussion on indicators of biodiversity
Think that you are an end-user (e.g. manager for coastal water biodiversity).
Then you will use a protocol and according to your question you will select some biodiversity indicators.
You have to think about different scales and levels:
Scale of time (rapid assessment or long-term monitoring)
Scale of space (station, regional, pan European)
Level of organization (one species, all species, surrogates (group of species or taxa, functional groups))

First question:
- What levels and scales do you recognize as being important to measure biodiversity (following the above, or make concrete additions)?

Then take the questionnaire of Jean Pierre Feral, and for each level and scale that you indicate, we ask you to give with **priorities**: (starting with section 1, ending with 5)
- Concrete answers, thus including criteria
- Additional questions
- Examples

Discussion in subgroups on basis of the handout (Box 2)

Group 1: Results presented by Jan Marcin Weslawski

Relevant scales:
- Time
Rapid assessment: describe catastrophic events
Long term monitoring: monitor biodiversity development.
Both were considered relevant and essential.
- Space
Consider places 10 – 20 miles around location, geographical orientated
- Organization
Take into account:
community level (focus on functional groups, linked with geographical region)
number of biotopes present; keystone species
genetic diversity of carefully selected species; the use of already acknowledged standard methods will enable to realize this analysis at short term. We have to consider that genetic loss is irreversible.

The questionnaire:
The questionnaire should relate to well defined biogeographic provinces (3 different provinces). This division should be based on literature and well established.
Methods: all methods are possible but should be standardized and inter-calibrated.
Key species: consider biotope building species; endemic species; level of endemism; charismatic species (species that are of growing concern of the public with respect to biodiversity and / or environmental health: large brown eyes and nice fur).
Factors that maximize disturbance may influence biodiversity: anthropogeneous and natural factors. But only select critical ones.
Bio-indicators: sentinel = early warning species; species that are already is use.

Comments
More attention should be paid to the geographical differentiation. In the questionnaire, The Azores can not be put in any of the categories. Furthermore the distinction in different geographical zones based on literature is not unequivocal. The Azores should be categorized in a different group: Macronesia; together with the Canaries and Madeira.
There are already five acknowledged core biomarkers on a European scale that are already operational and can be used.

Group 2: Results presented by Doris Schiedek
The group developed an indicator system from the viewpoint of an end-user, and focused on the description of the relevant time scales for biodiversity monitoring (Fig. 7).
The protocol for the rapid assessment technique was based on four different boxes with biomarkers/indicators (Fig. 8). The scheme forms the basis for the development of the protocol of selecting bio-indicators for the primary and reference sites. The boxes should be interlinked with the results/findings of WP1. The primary sites should be used to develop a protocol for reference sites, keeping in mind the indicator boxes; interconnecting them. An attempt should be made to narrow down the list of potential indicators.

Additional remark: the second item in the WP2 questionnaire should include soft bottom substrates and plankton.

Group 3: Results presented by Magda Vincx
The group formulated the following relevant questions:
What will be the end product of BIOMARE? Is the protocol a manual with methodologies? This should be discussed. In this case the survey of the methodologies could be linked with HELCOM.
The group looked for pragmatic solutions of the problems.

Relevant scales: space
- Pan-European: What is feasible? What information will we be able to provide. At Long Term: biomarkers, wide spread organisms. The research on higher taxa (benthos-nekton) is considered relatively easy (feasible?).
- Regional scale:
  functional groups could be related to human impact and fisheries

species diversity: number of taxa, soft bottom e.g. annelids, nematods; hardbottom macrofytes + associated fauna
(diatom) index

Furthermore more training is needed, especially the training of taxonomists is essential. With training at pan-European scale it will be possible to provide bio-indicators (standardization of method approaches?)
Rapid assessment techniques should be focused on higher taxa, remote sensing and chemical analysis (biomarkers?).

Questionnaire:
Items:
2.1. Should be connected with ERMS; this part could be improved
2.4. Key species and functional groups are considered important. Indicator species should be related to rapid assessment techniques. Rapid assessment techniques are likely related to larger animals. Rapid assessment techniques should include chemical and biochemical assessments. The rapid assessment requires training. (There was some confusion about the term key species.)
3.1. TBT
3.2. Use of littoral zone, dredging
3.3. Removal of predation and eutrophication

Group 4: Results presented by Sabine Cochrane
This group fell back on the main aims of BIOMARE:
What are the main aims of BIOMARE?

- Status overview: description of the current status.
- Change in biodiversity: scale and rate of biodiversity changes
- Large-scale inter-comparison of regional locations

This requires a multi-scale and multidisciplinary approach; a standardized approach, depending on level of organization.

Questionnaire:
Rapid assessment as part of long term monitoring. This requires standardisation. The aim is to provide the end-user with means to relate changed biodiversity to environmental changes.

Key descriptors of biodiversity are:

- Taxonomic inventarisations
- Functional groups
- Phylogenetic groups or – ratios
- Biomass / species / abundance concept
- Biogeographic groups
    - Spatial
    - Especially those at the limits of their geographical distribution [This is in agreement with the remark of Ducrotoy].
- Community indices
- Population indices

Relevant scales
Local tools:

- Taxon inventory
- Rare / endemic taxa
- Taxa that indicate environmental conditions
- Invasive taxa
- Top predators (also as a cause of disturbance)

Pan – European

- Community descriptors (functional groups etc.)
- Biogeography
- Population indices
- Broad community indices

Additional information:

- Stations distributed to the limits of the distribution (biogeographic provinces, water masses etc.)
- Seasonal effects
- Sample restrictions

Discussion

The biodiversity component concerned should not be uncoupled from the components related to environmental health. Decision makers need this type of information.
It could be relevant to take into account also the manipulation of biodiversity. Restoration could include e.g. the installation of artificial reefs even at places out of scope, thus increasing biodiversity beyond the 'original levels'.
A scientist brought to the attention the semantics of the used terms: What is environmental health? There are definitions of pollution, but no definition about health. What do we mean when using this term? Rapid assessment-technique? This term is ambiguous. It is being used differently in several contexts. It is even being used differently during the several presentations this day. Is it quick? Does it imply remote sensing? Does it imply the use of modeling? Within a socio-economic framework it indicates the use of computer modeling (GIS). We should specify what we mean with this term.
Furthermore: there is a difference between indicators and indices. The indices condense information of the indicators (see Fig. 9). The development of the indices could be the end product of BIOMARE.
Rapid assessment and slow assessment are both complimentary. Both should be included in the project.
The different approaches (databases) should be linked.
Furthermore existing data and historical data have to be analyzed (fitting of data) to compile extra data.
Primary sites should be selected on the criterion that there is a historical dataset present.
Training should be a main topic of the agenda: taxonomy and biomarkers.
Local and pan European scale were not considered contradictory but form a tool to discriminate between local and global changes. Within this context the species at the limits of their distribution range could be a helpful tool.
Herman Hummel noticed a link between the different approaches and presented a synthesis of the four approaches (see below: the BIOMARE Protocol on Bioindicators)

Discussion on indicators (Corinth)

General comments on the questionnaire of WP2: Corinth

Landing data are not suitable as indicators because of the continuously changing fishing techniques.
It will be difficult to define an indicator for the positive development of biodiversity. It is easier to find processes and indicators that adversely affect biodiversity. A grid of several indicators will be used for the monitoring of biodiversity. However, the end product will be a conceptual framework for indicators. It will not be possible to produce a well-defined grid of indicators at pan-European scale within the given time and available data.
For the development of the end-product, it is important to involve end-users already at this stage of the project.
The questionnaire was discussed in more detail in two subgroups on basis of a handout of dr. Hummel (see Box 2).

Discussion in subgroups on basis of the handout (Box 2)

The two groups interpreted the tasks differently. The first group focused on the content of the questionnaire. The second group mainly focused on the correction of the text and structure of the questionnaire.

Group 1: Results presented by Chris Emblow

In the Mediterranean it is necessary to work at a relatively small scale (< 1 km). All sampling techniques are considered appropriate for the short and long term scale. However diving appears to be the most appropriate sampling technique at small scale.
A list could be made with appropriate sampling techniques for the assessment of the applicability at different time and spatial scales.

In the Mediterranean, inventories already are available, but not yet linked. It should be attempted to link the databases. Key species will vary by area (e.g. Aegean, Adriatic), but probably it will be possible to detect some species with a wider distribution range covering the whole of the Mediterranean (e.g. *Posidonia oceanica*).
Keystressors: tourism, invasive species and pollution were considered the most relevant human induced stressors, temperature increase the most relevant physical stressor. Bacteria (Colliform bacteria, Streptococcus spp.) could function as indicators of environmental health, but were not considered suitable as indicators for biodiversity.
Comments on the presentation
It is difficult to place the human induced stressors in the framework of the questionnaire. 'Tourism' cannot be placed in the context of chemical, physical or biological stressors. It should be kept in mind that tourism itself cannot be considered a stressor itself, but the consequences of tourism can. Pollution can be chemical, physical and / or biological. The questions should be differentiated in the questionnaire. It is the task of Workpackage 2 leader to find a solution for this problem.
It was mentioned that fisheries was missing as a stressor.
It will be questionable whether bacteria will be a suitable indicator. The link with biodiversity can be reasoned but will always be indirect. It is expected that other environmental health indicators will be available with a direct link to biodiversity.

Group 2: Results presented by Jean-Pierre-Feral.
There should be a link between the necessary information mentioned in the introduction and the relevant questions in the questionnaires. Furthermore it should be mentioned to what region the questions reflect.

Additions to the relevant questions:
1.1) Sampling methods (trawling, diving, census along transects, etc.). Include subsection: used gear, mesh size, duration, region.
1.4) Rapid assessment methods. In literature four acknowledged rapid assessment techniques have been described. They could be mentioned in the questionnaire.
2.1) Does an inventory of the marine "patrimony/heritage" exist (YES|NO)? Specify the group of organisms and justify.
Move parts 3 (factors that may have an impact on marine biodiversity) and 4 (indicators) before part 2 (species considered as "key-species")
6) Biomonitoring networks: 'meshwork' should be called 'working grid'.

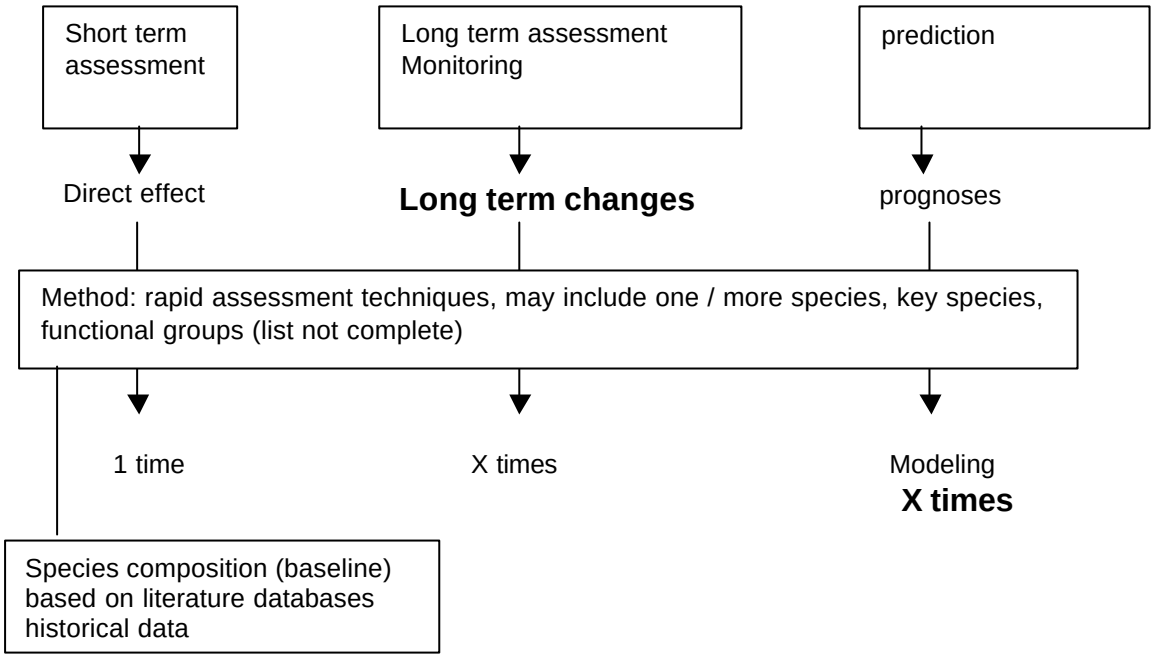


Figure 7. Schematic presentation of the time scales relevant for the monitoring of biodiversity.

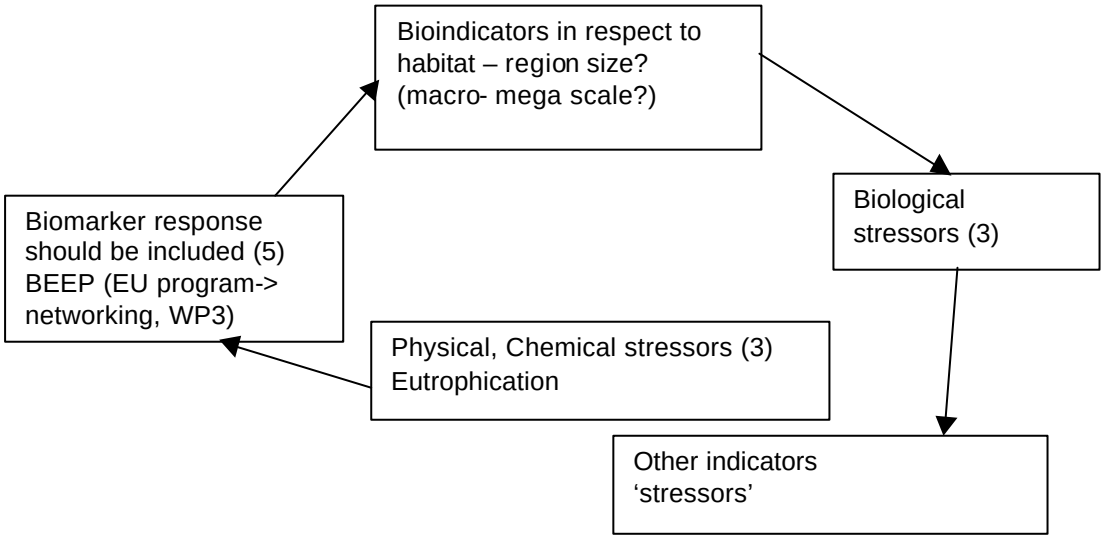


Figure 8. Schematic presentation of the protocol for the rapid assessment techniques. The numbers –in the boxes- refer to the parts in the questionnaire of WP2.

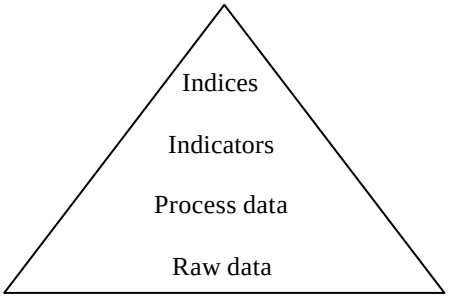
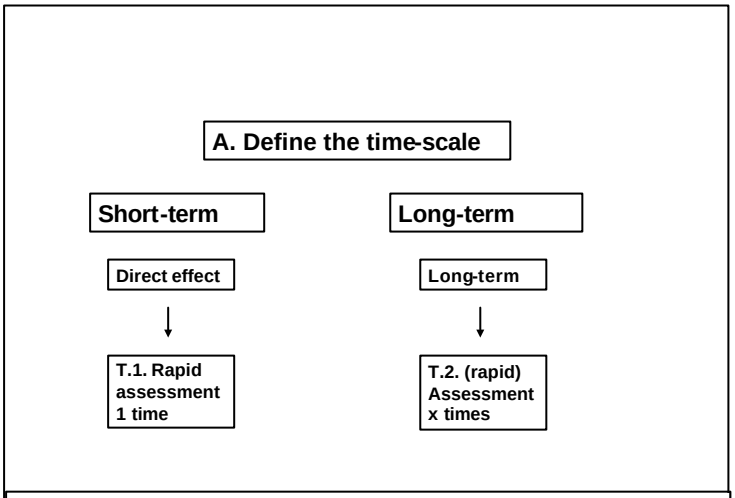


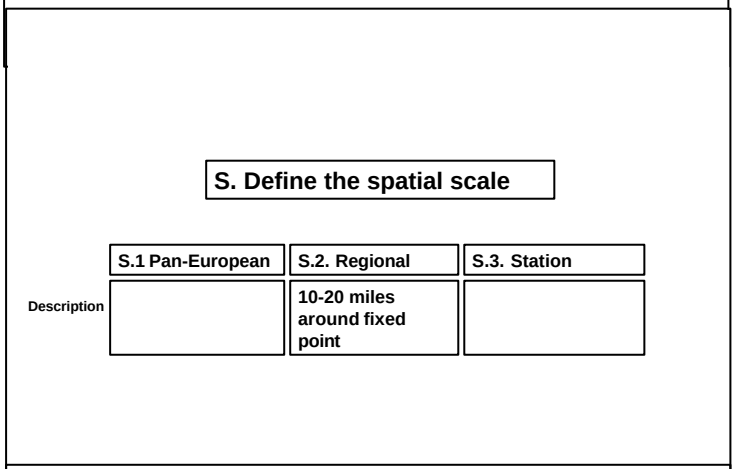
Figure 9. The information pyramid.

BIOMARE PROTOCOL ON BIOINDICATORS – Dr. H. Hummel

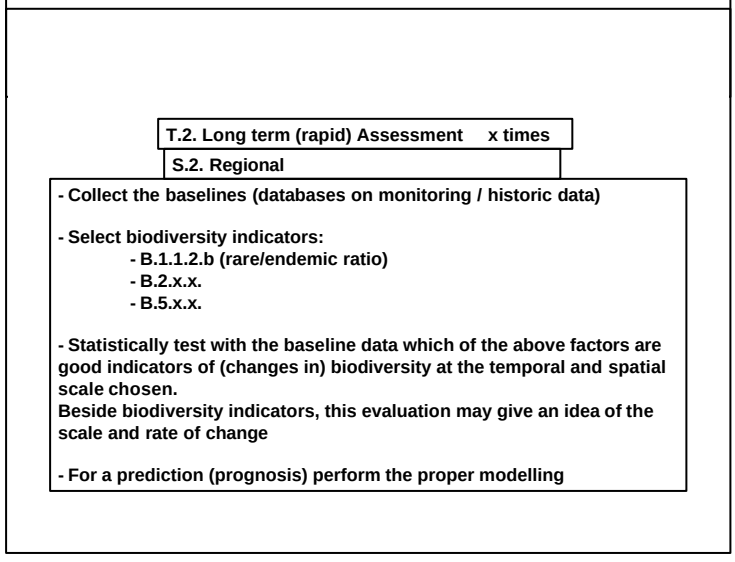
During the regional meeting in Sopot, Herman Hummel developed a protocol for the selection of bio-indicators for different aspects of biodiversity. The protocol was explained to the participants of the present regional meetings.
The system is developed to present the results of the BIOMARE concerted action to the end-users (policymakers, specialists involved in management and nature conservation etc.) in a usable format. In the decision system, a grid of indicators can be chosen relevant for the specified level(s) of organization and spatial and temporal scales. The concept is a 3D grid (multi-layer) of multiple choice decision steps, which eventually lead to a set of suitable bio-indicators for the set task(s) of the end-user. The proposed model is compatible with the modern ways of communication (Internet), and can be published via a website or CDROM.



In the first step (layer) of the model the relevant time scale has to be selected. The prognoses for the future, originally presented as a time-scale during the BIOMARE regional meeting in SOPOT (see presentation of the subgroups), is presented as an additional item in slide 4.

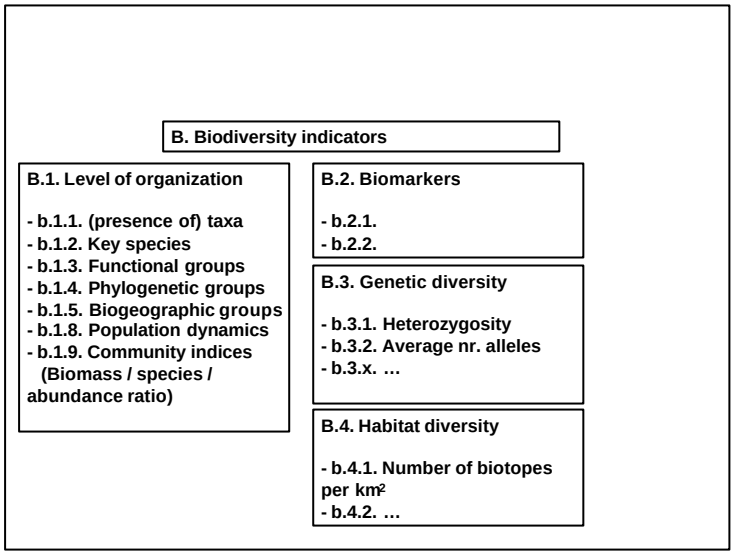


At the second level the relevant spatial scale can be selected: local, regional or pan-European.

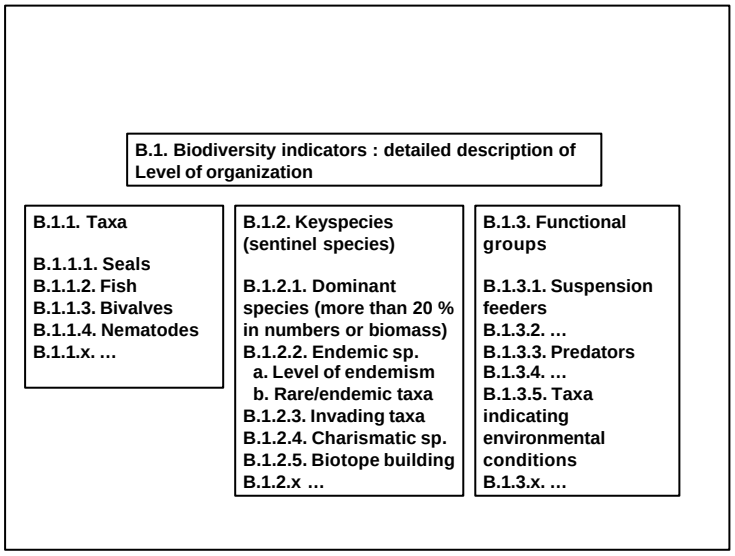


The third level lists the result of the first two decision steps. At the selected spatial and temporal scales it is possible to collect baseline data for different biodiversity indicators and specify the subset of possible indicators. Furthermore, tools will be

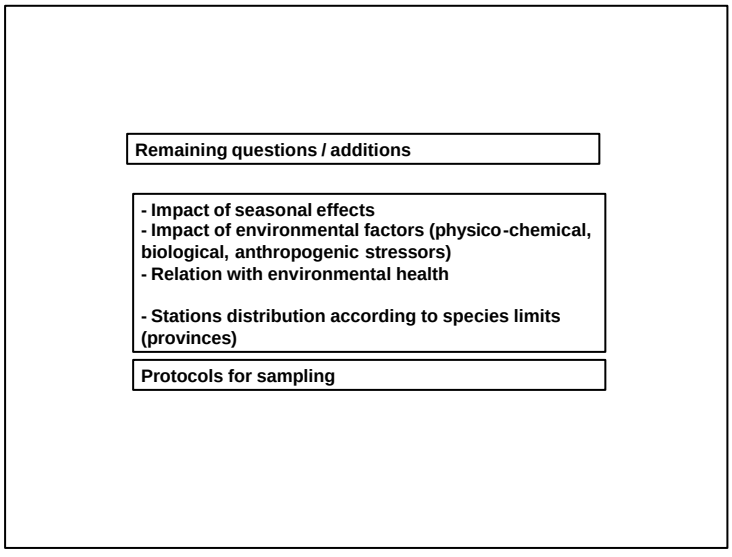
available to test whether the indicators are appropriate for the spatial and time scales selected.
This step is the preparation of the selection of a set of suitable indicators for biodiversity



The following step is the actual selection of the (set of) indicators. Different types of indicators can be chosen.



The information about the chosen indicators are presented in following steps (screens).



The decision model facilitates also the presentation of additional information.

WORKPACKAGE 3. DISSEMINATION – C. Emblow

Introduction
The WP3 developed three initial approaches:

1. **news server**: Marine B-list server
2. **website**. Established in December 2000. Until now more than 800 hits.
3. **newsletter**. The first newsletter will be made after the regional meetings. A call for contribution already was sent to the participants but until now no participants replied this message. The newsletter will be published via the website and via a hardcopy.

1. The news server

The activity 'on' the new server is fairly constant (in total 347 reactions over 10 months) and did not increase after the installation of the BIOMARE website. In total 200 members subscribed to the news server.

2. The website

As already has been mentioned in the introduction by Herman Hummel, the presentation of BIOMARE should be organized via the BIOMARE website.

The website was established December 2000 (see Fig. 10) and contains:

- General information about the project
- General information about the three different work packages
- Links to the member institutes
- Link to the news server
- Links to other (marine) biodiversity channels
- Links to the information already present
  - Database and maps of WP1
  - Questionnaire of WP2
- Additional information:
  - Agenda (details of meetings and newsletter)
  - Report steering committee
  - On line form to register

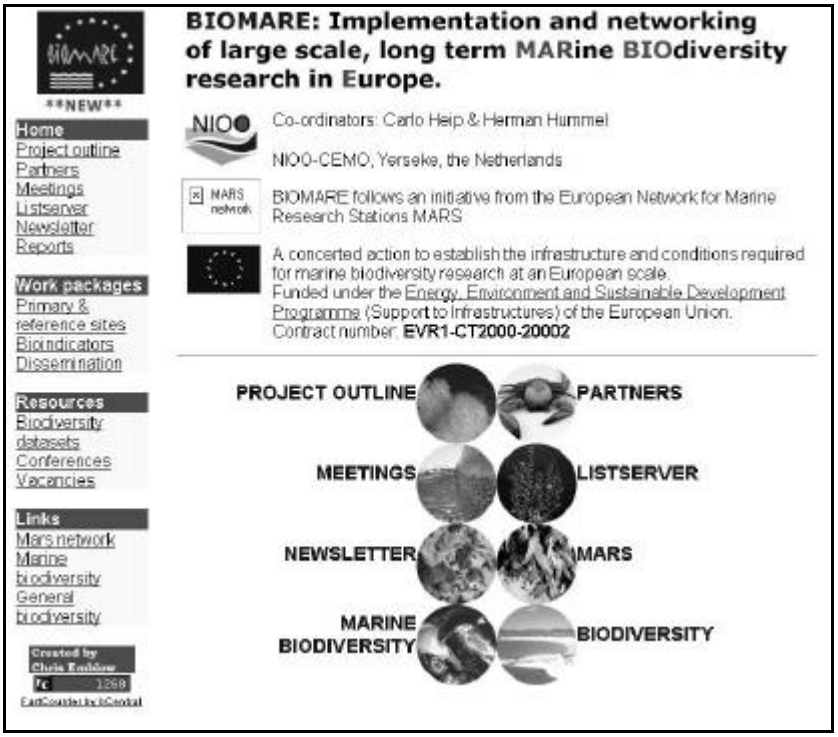


Figure 10. The website (www.biomareweb.org), developed and maintained by the WP3-leader.

3. The newsletter:
Will be made after the regional meetings and will consist of an email version and a hardcopy. The newsletter will be send to a broad audience. The contact list of MARS and ERMS will be used for this purpose.

Future plans for the dissemination of the BIOMARE concerted action.

Website
- Give detailed information about the contacts/members of the extended network (see below)
- Install Databases (see below)
- List facilities for training

Installation of databases: current status of marine biodiversity research in Europe
A. Institutes involved in Marine Biodiversity Research
The database will hold information about:
- Current state of marine biodiversity research in Europe. Facilities for training
- Facilities for research
- Available information

This database will initially be based on the MARS questionnaire (send to MARS members).
Additional information will be gathered via a questionnaire that will be send to the institutes with an interest in marine biodiversity research.

B. Information about long-term biodiversity datasets
Mentioning:
- Location
- Sampling protocol
- What is sampled?
- Length of program
- Availability (electronic access)
- Contact person / institute

The database will only contain meta-information.
C. Information about the Primary and reference sites (see discussion)
D. Species list

Extension of the network:
The network will be extended in the near future. A contact list will be collated from the contact lists of ERMS, MARS and other sources (like CIESM). The BIOMARE members are requested to nominate regional partners. Please send email addresses of institutes and/or contacts with a possible interest in the BIOMARE activities to Chris. Check your colleagues in the region. The member institutes that have an own web site should provide a link to BIOMARE. Equally, BIOMARE is able to provide a link to their website. Send the info to Chris Emblow.

News server
The use of the news service will be promoted to the people involved in marine biodiversity research. It can be used to advertise meetings, workshops, jobs etc.

Newsletter
The newsletter will be compiled after this meeting. One part of the newsletter will be an agenda with a list of meetings, courses, and workshops that can be attended by BIOMARE members. Please send contributions to the WP3 leader.

Discussion on dissemination (Sopot)

The results of WP1 will be presented via the website. A species list with publications can be provided. An international coding for habitats in Europe exists. This could be used in the questionnaires and databases.
A target list of journals for the dissemination of BIOMARE should be made. Herman Hummel already has a provisional list. Several journals are mentioned as possible targets. The journals should be international refereed journals.
Herman Hummel is going to present the aims and progress BIOMARE to the Dutch regional and national public via local newspapers on short term. The articles will be prepared in Dutch and later translated in English. This translation can be used as the basis for the dissemination of the results of BIOMARE by the member institutes. Within this concept, the member institutes are invited to function as representatives of BIOMARE and develop similar initiatives.
NGO's will be targeted via specific journals. ' The journal 'Coastline' will devote a special issue to BIOMARE. It is very probable that NGO's will read this journal. Within this respect, the partners are again invited to contact local newspapers among else to bring BIOAMRE under the intention of (local) managers and policy makers.
BIOMARE intends to lobby in the terrestrial ecology and biodiversity world. This can be reached via the publication of articles in general ecology journal, such as 'Trends in Ecology and Evolution'. The WP3 leader will provide a list with target journals.

Discussion on dissemination (Corinth)

In discussions, it should be clear what is meant by the term 'end-users'. This term often is used to indicate only the person of an institute that pays for the service and / or products. But to whom do we refer with this term within BIOMARE? What information do they need, and in what form? Within BIOMARE we refer to scientists, environmental managers, policy makers of the government, coastal management and environmental health involved in the biodiversity issue in Europe. It is necessary to have a list of potential end-users. The BIOMARE members should create a list of potential end-users in their region, and send the information to the WP1 leader. This list is valuable for the dissemination of the results.
The data that will be published via the website will be metadata. Institutes that provide this information do not have to fear that their knowledge and valuable primary data will be unprotected and 'sold-out' via the Internet. Dr. Zupo pleads for an international standard for the management of databases (primary- and metadata). A consensus is urgently needed to exchange and link data.
To the opinion of some scientists, the visits to the website could be improved by making the website more attractive. Other disagreed. A link will be established with the website of the IMBC (1.5 million hits) in order to increase the visibility of the website.
Until now, the list-sever of MARS is open for all institutes, but will be limited to MARS-members only as from September 2001. MARS invoices will be sent to the members and potential members soon.

Suggestions for the newsletter

The deadline for contributions will be the end of June 2001.
1. Description of biodiversity in the region: a summary of the present state of art of biodiversity research in the region. The regional members could provide these contributions.
2. Specific overview of the knowledge and gaps of biodiversity research. Dr. Arvanitidis will produce an overview of the overall knowledge of benthic fauna of the Aegean Sea and identify gaps. This work will be presented during the Workshop in November 2001. An abstract will be published in the second newsletter.
3. Specific article about Shiqmona (Israel).
Dr. Galil will contribute an article about the proposed primary site.
4. Ms. Orlando will write an article about the advantages of SCUBA in marine ecological research.

Within the MARS network, funds are available for the exchange of young promising PhD scientists between institutes (travel costs). A similar initiative could be developed within the BIOMARE network. It was suggested to make available 250. Students can apply for the grant by submitting a short resume of the research they want to carry out at the suggested institute, together with a short CV. The winner will be asked to send in an extended abstract for the newsletter. The steering committee

will judge the submissions.

Additional presentations during the Corinth meeting:

Prof. Dr. Heip: Rationale of BIOMARE, and the European sixth framework programme.
Dr. Galil: Shiqmona (Israel), suggestion to upgrade the location as a primary site.
Dr. Zupo: Biodiversity in the Bay of Naples.

Appendix 1. List of participants, Sopot (Poland), April 19-23, 2001

Nr	Country (partner nr)	Institute	Representative	Status	E-mail
1	Norway (6)	Akvaplan	Sabine Cochrane	reg. Coordinator Atl/.Arctic	sabine.cochrane@akvaplan.niva.no
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3	UK (2)	PML	Richard Warwick	WPI leader	rmw@pml.ac.uk
4	UK (18)	CERCI	Jean-Paul Ducrotoy	member Atl./Arctic	external@ucscarb.ac.uk
5	Eire (4)	EcoServe	Chris Emblow	WP3 leader	cemblow@ecoserve.ie
6	Eire (4)	EcoServe	Mona McCrea	member Atl./Arctic	mona@ecoserve.ie
7	France (16)	CNRS	Claude Amiard-Triquet	member Atl./Arctic	Claude.Amiard-Triquet@isomer.univ-nantes.fr
8	France (16)	CNRS	Philippe Garrigues	member Atl./Arctic	p.garrigues@lptc.u-bordeaux.fr
9	France (16)	CNRS	Jean-Pierre Feral	WP2 leader	feral@obs-banyuls.fr
10	Azores, Portugal (5)	UoA	Ricardo Serrao Santos	reg. Coordinator Atl/.Arctic	ricardo@dop.uac.pt
11	Azores, Portugal (5)	UoA	Pedro Afonso Santos	member Atl./Arctic	afonso@dop.uac.pt
12	Poland (9)	IOPAS	Jan Marcin Wesfawski	reg. Coordinator N.Sea/Balt.	weslaw@iopan.gda.pl
13	Poland (9)	UL	Krzysztof Jazdzewski	guest N.Sea/Baltic	kryjaz@biol.uni.lodz.p l
14	Poland (9)	IOPAS	Piotr Kuklinski	member N.Sea/Baltic	kuki@iopan.gda.pf
15	Finland (19)	AAS	Sonja Salovius	member N.Sea/Baltic	sonja.salovius@abo.fi
16	Finland (19)	AAS/UoT	Ulla Helminen	member N.Sea/Baltic	
17	Lithuania (21)	CORPI	Sergey Olenin	member N.Sea/Baltic	serg@samc.ku.lt
18	Netherlands (1)	NIOO	Pim van Avesaath	member	avesaath@cemo.nioo.knaw.nl
19	Netherlands (1)	NIOO	Carlo Heip	General coordinator	heip@cemo.nioo.knaw.nl
20	Netherlands (1)	NIOO	Herman Hummel	General coordinator	hummel@cemo.nioo.knaw.nl
21	Belgium (17)	UG	Magda Vincx	member N.Sea/Baltic	magda.vincx@rug.ac.be
22	Belgium (17)	UG	Steven Degraer	member N.Sea/Baltic	steven.degraer@rug.ac.be
23	Finland (20)	TZS	Eva Sandberg -Kilpi	member N.Sea/Baltic	eva.sandberg@helsinki.fi
24	Finland (20) '	TZS	Ari Ruskanen	member N.Sea/Baltic	
25	Germany (10)	AWI	Fred Buchholz	reg. Coordinator N.Sea/Balt.	fbuchholz@awi-bremerhaven.de
26	Germany (10)	IOW	Doris Schiedek	guest N.Sea/Baltic	doris.schiedek@io-warnemuende.de
27	France (16)	UM	Thierry Perez	member Mediterranean	perez@com.univ-mrs.fr
28	Poland (9)	UG	Maciej Wolowicz	guest N.Sea/Baltic	ocemw@univ.gda.pi
29	Poland (9)	MIR	Jan Warzocha	guest N.Sea/Baltic	warzocha@mir.gdynia.pl

Appendix 2. List of participants, Corinth (Greece), May 10-11, 2001

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1	Anastasios Eleftheriou	Institute of Marine Biology of Crete, P.O. Box 2214, 71003, Heraklion, Crete	Greece	telef@imbc.gr
2	Christos Arvanitidis	Institute of Marine Biology of Crete, P.O. Box 2214, 71003, Heraklion, Crete	Greece	arvanitidis@imbc.gr
3	Drosos Koutsoubas	Department of Marine Science, Aegean University, Sapfous 5, 81100, Mytilene	Greece	drosos@aegean.gr
4	Maria Skoula	Institute of Marine Biology of Crete, P.O. Box 2214, 71003, Heraklion, Crete	Greece	msimbc@imbc.gr
5	Carlo Heip	Netherlands Institute of Ecology Korringaweg 7, 4401 NT Yerseke	The Netherlands	heip@cemo.nioo.knaw.nl
6	Herman Hummel	Netherlands Institute of Ecology, Korringaweg 7, 4401 NT Yerseke	The Netherlands	hummel@cemo.nioo.knaw.nl
7	Pim van Avesaath	Netherlands Institute of Ecology, Korringaweg 7, 4401 NT Yerseke	The Netherlands	avesaath@cemo.nioo.knaw.nl
8	Richard Warwick	Centre for Coastal and Marine Sciences, Plymouth Matine Laboratory (PML), Prospect Place, West Hoe, Plymouth PL1 3DH	United Kingdom	r.warwick@pml.ac.uk
9	Jean-Pierre Ferral	Observatoire Oceanologique de Banyuls, BP 44, F-66651, Banyuls-sur-Mer	France	feral@obs-banyuls.fr
10	Gerard Bellan	Centre d'Oceanologie de Marseilles, Station Marine d'Endoume, Rue de la batterie des lions, 13007, Marseille	France	gbellan@com.univ-mrs.fr
11	Ôhierry Peres	Centre d'Oceanologie de Marseilles, Station Marine d'Endoume, Rue de la batterie des lions, 13007, Marseille	France	perez@com.univ-mrs.fr
12	Mark Costello	Ecological Consultancy Services Ltd (ECS), 17 Rathfarnham Road, Terenure, Dublin 6	Ireland	mcostello@ecoserve.ie
13	Chris Emblow	Ecological Consultancy Services Ltd (ECS), 17 Rathfarnham Road, Terenure, Dublin 6	Ireland	cemblow@ecoserve.ie
14	Damia Jaume	Instituto Mediterraneao de Estudios Avanzados (IMEDEA), CSIC-Univ. Illes Balears, Carretera de Valldemossa, km 7.5, 07071 Palma de Mallorca	Spain	vieadjl@clust.uib.es
15	Rafael Sarda	National Council of Research in Spain (CSIC), Cami Sta Barbara s/n, 17300, Blanes	Spain	sarda@ceab.csic.es
16	Valerio Zupo	Stazione Zoologica "A. Dohrn", Laboratorio Ecologia del Benthos , Punta San Pietro, 80077 Ischia	Italy	vzupo@alpha.szn.it
17	Alenka Malej	Marine Biological Station, National Institute of Biology (MBS), Fornace 41, 6330 Piran	Slovenia	malej@nib.si
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