Marine dimensions of European biodiversity and ecosystem observations

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- CBD: a stimulus for European networking

Networking in marine biodiversity & ecosystem observation

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  - results: trends in biodiversity
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Next steps

- Gaps and problems
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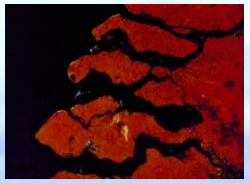


Why special emphasis on marine biodiversity?

Firstly because 70 % of the Earth surface is covered by seas.

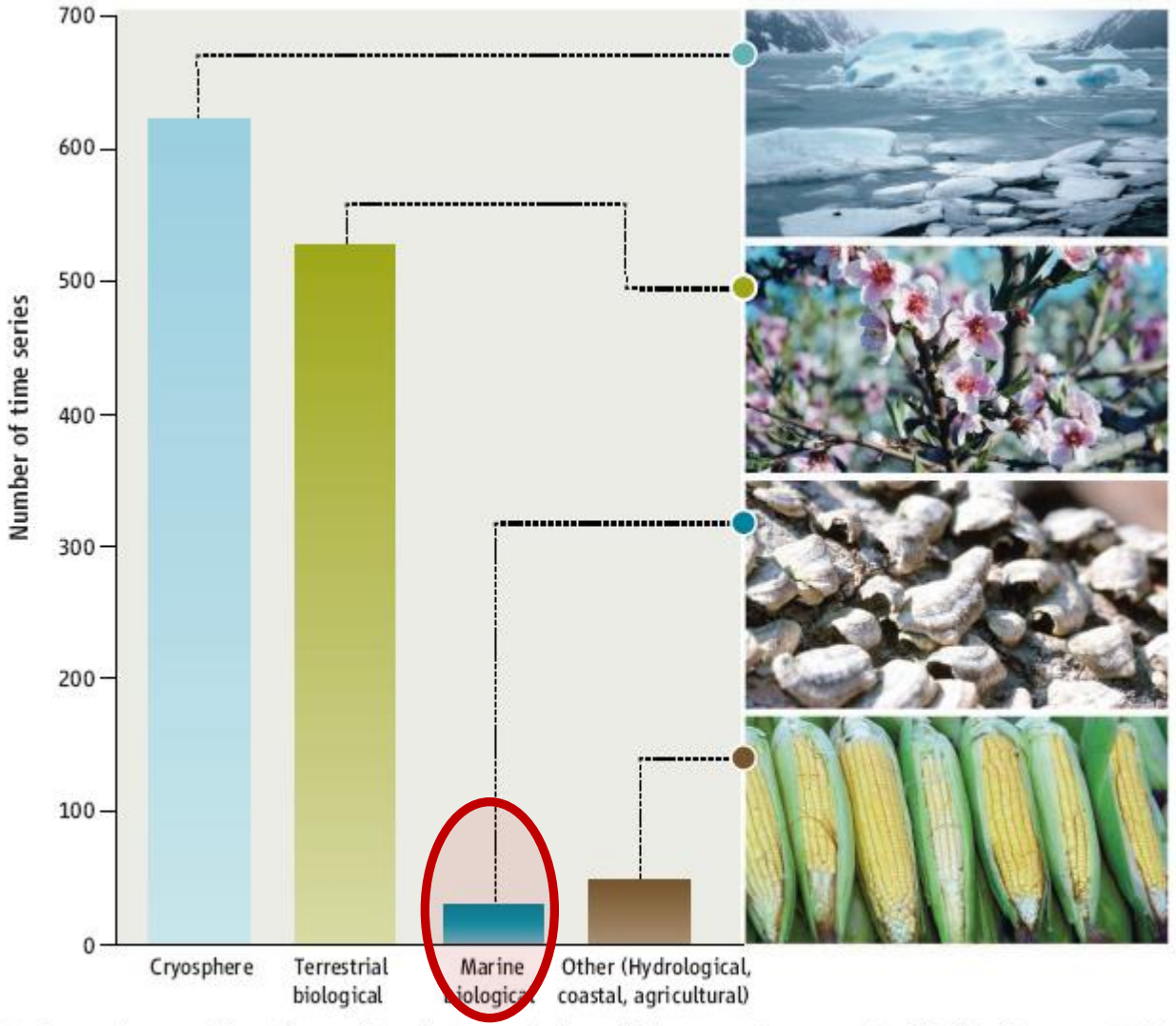
Secondly, because the marine realm has greater phylogenetic diversity (although less species) than land faunas and floras

	Number of phyla	
	Endemic	Total
Freshwater	0	14
Terrestrial	1	11
Marine	13	28
Total		33

This does provide, and may provide still unknown, goods and services of great value and importance to mankind, as food, chemicals, …..

Yet, biological studies, and resulting datasets, were mainly directed towards the terrestrial realm

The same trend for biodiversity studies.
Only 17 % dedicated to marine realm.



Marine undersampling. The number of time series from different environments included in the recent IPCC (Intergovernmental Panel on Climate Change) Fourth Assessment Report differ widely. Marine systems are vastly underrepresented compared with terrestrial systems (*1*).

A.J. Richardson & E.S. Poloczanska, 2008. Ocean science: Under-resourced, under threat. Science 320: 1294-1295

The attention for e.g. marine biodiversity in Europe developed only recently:

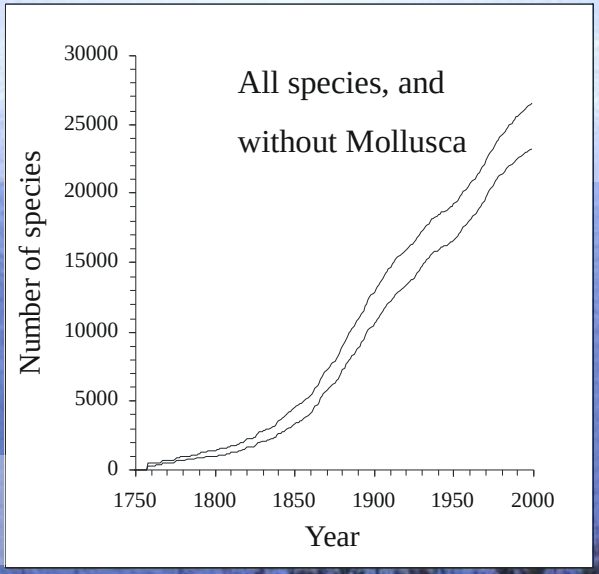
- After the Convention on Biological Diversity (Rio de Janeiro, 1992), the first steps in 1993-94 were made under the umbrella of ECOPS and the ESF. Actions failed

- in 1996 foundation of European marine stations (MARS) network (http://www.marsnetwork.org)

- in 1996/1999 some workshops supported by EC, ESF, UNESCO, and MARS led to inventories of marine biodiversity and European action plans on marine biodiversity (Warwick et al 1997, Heip *et al.* 1998, Heip & Hummel 2000)

- 1999-2001 the ERMS project (5th EC FW) European Register of Marine Species (Mark Costello, Ecoserve)

- Book listing 30,000 species
- Register of 600 experts (in 37 countries) in European marine species identification
- Bibliography of 840 identification guides



Discovery rate of European marine species

After the first initiatives it was felt that :

- Knowledge on marine biodiversity in Europe is <u>fragmented</u>

- by habitat: pelagic vs. benthic, deep sea vs. shallow coastal, lagoon vs. coastal
- within and between disciplines: ecology vs. taxonomy, genomics
- by nationality

- The approach to understand function and structure of, and changes in, marine biodiversity has hitherto been <u>ad hoc and local</u>,

mainly by its regional or national focus in biodiversity research.

- No agreed <u>common methodology</u> for many aspects of biodiversity is available

- <u>Sufficient awareness</u> at the level of policy and politics should be created

To counteract the previous weaknesses, new projects aimed for:

- <u>concertation and co-ordination</u> at European scale:

- implementation of <u>long-term</u> and <u>large-scale</u> marine biodiversity research

- <u>standardization</u> of methods and protocols

- <u>create awareness</u> (outreach) on issues of marine biodiversity research in Europe to researchers, policy makers, politicians, managers, public at large

Marine biodiversity and/or observation related research became in EC FP5, FP6, FP7, more and more concerted and networked.

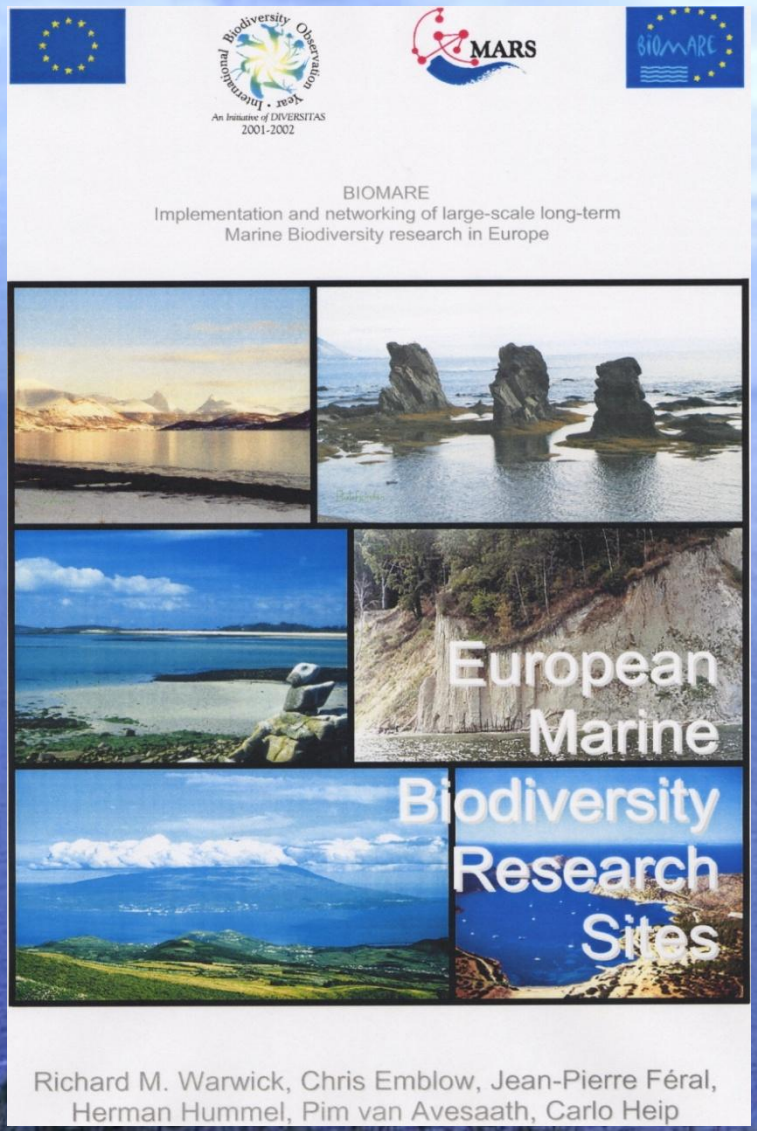
- EC 5th FW : Concerted Actions and e-conferences
  - 2000-2002: Concerted Action BIOMARE
  - 2002-2004: e-conferences by M@rble and Marbena

- EC 6th FW: Networks of Excellence
  - 2004-2009: MarBEF
  - 2005-2009: MGE - Marine Genomics Europe
  - 2007-2011: ESONet - European Seas Observatory Network

- EC 7th FW: Larger (Networks of) Networks
  - 2009-2020: EMODNet - European Marine Observation and Data Network
  - 2009-2013: ASSEMBLE
  - 2011-2013: EuroMarine = MarBEF, MGE, EurOceans
  - 2013-2017: FixO3

++ ESFRI - European Strategy Forum on Research Infrastructures
  - 2008-2010: LifeWatch
  - 2011-2014: EMBRC, JERICO

BIOMARE (EC 5th FW): Implementation and networking of large-scale long-term MARine BIOdiversity research in Europe

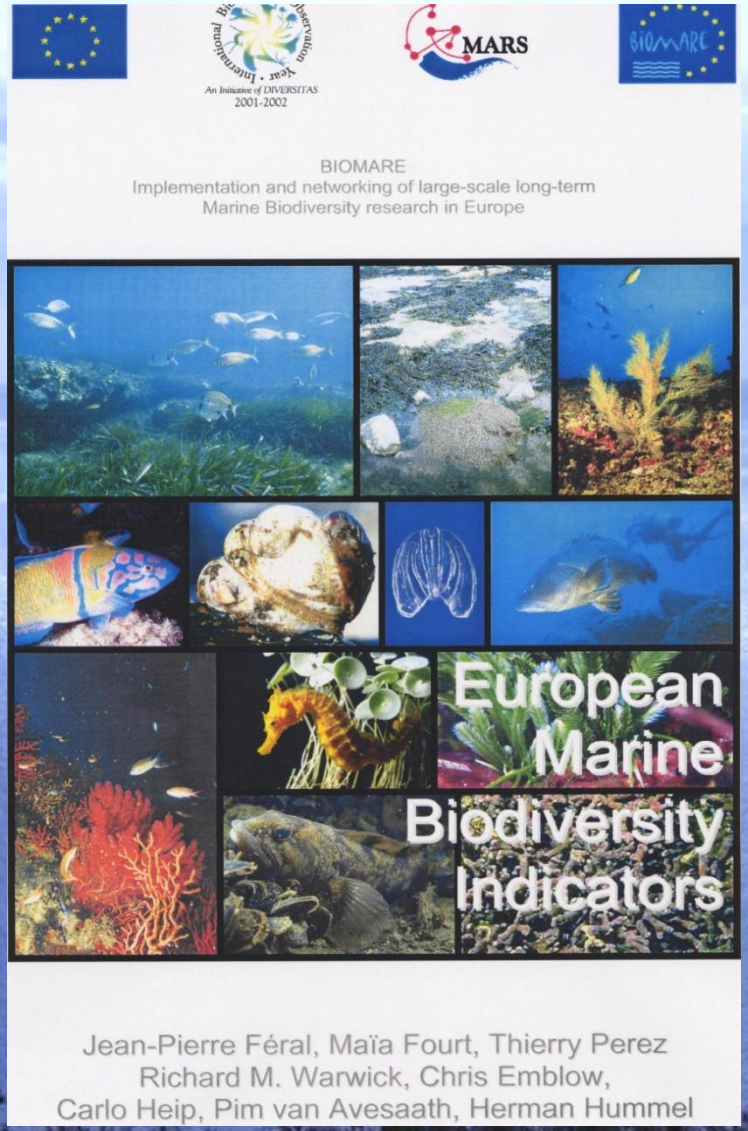


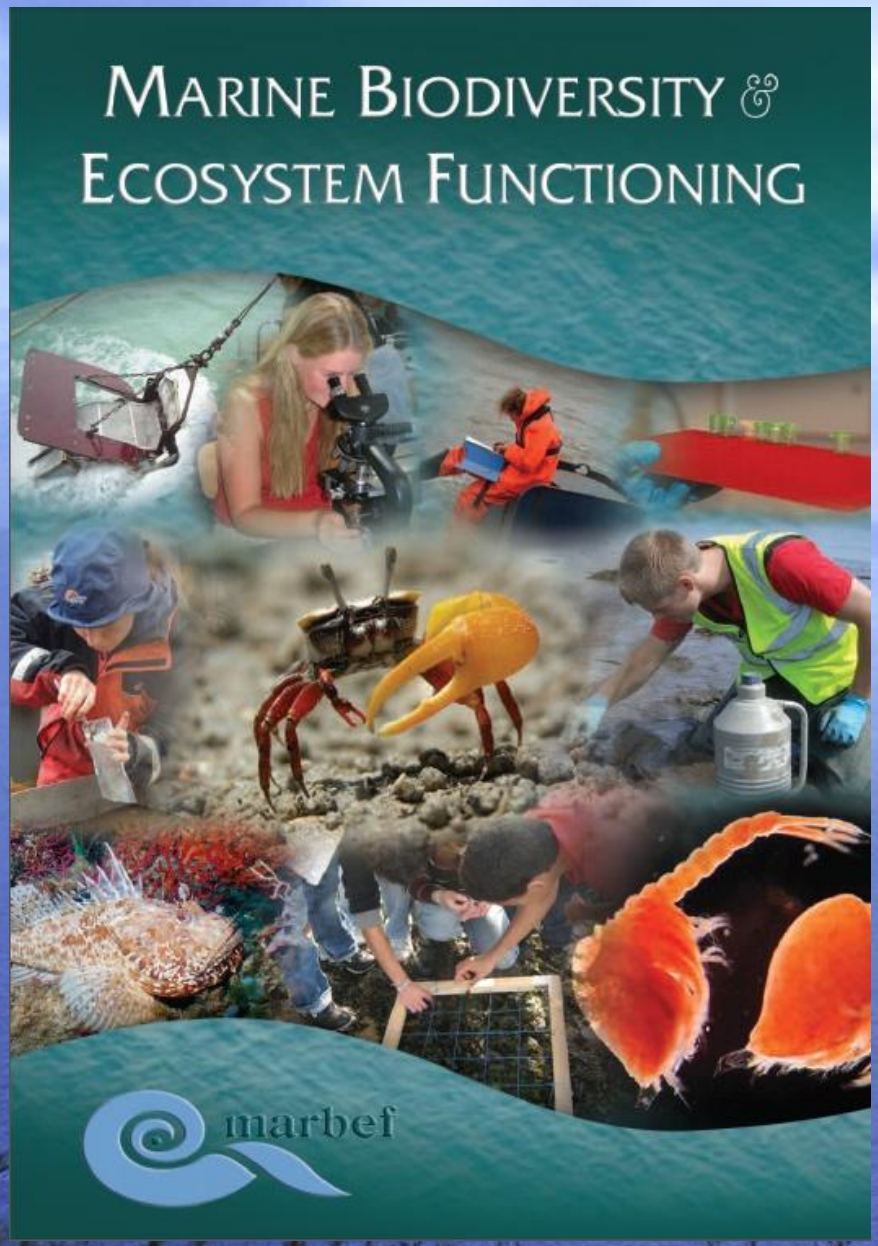
First overviews published in 2002:

Book on >100 marine biodiversity reference sites

and

Book on marine biodiversity indicators





The follow-up was the (EC 6th FW) MarBEF Network of Excellence on Marine Biodiversity and Ecosystem Functioning

Several overviews and analyses of databases at European scale were delivered
e..g. the MacroBen dataset

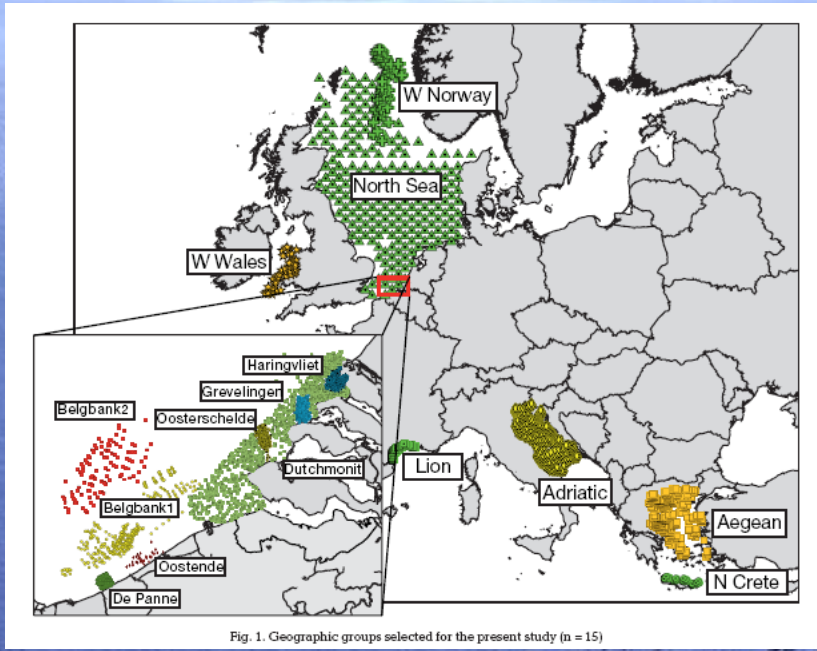
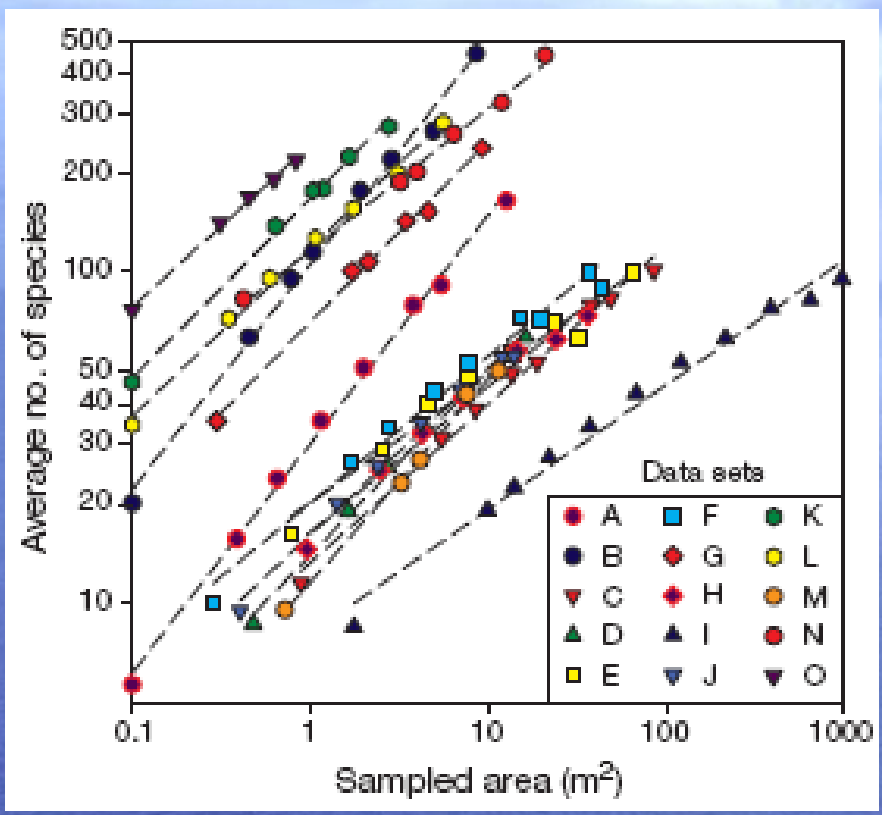
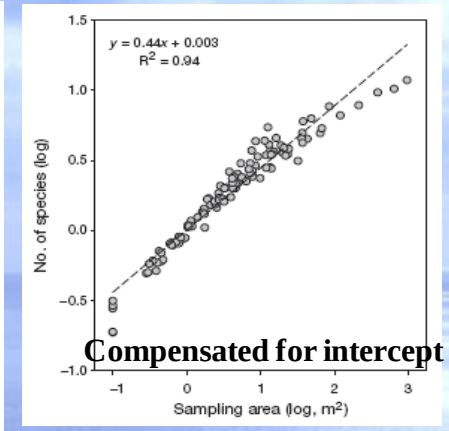


Fig. 1. Geographic groups selected for the present study (n = 15)

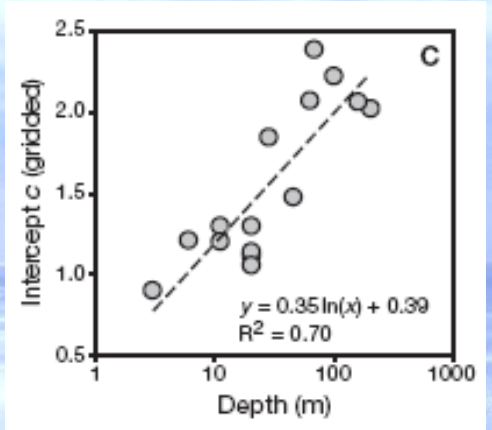
The MacroBen dataset on benthos covered the European distribution patterns of species diversity in relation to factors as productivity, depth, survey area, and latitude of areas like North Sea, Adriatic.



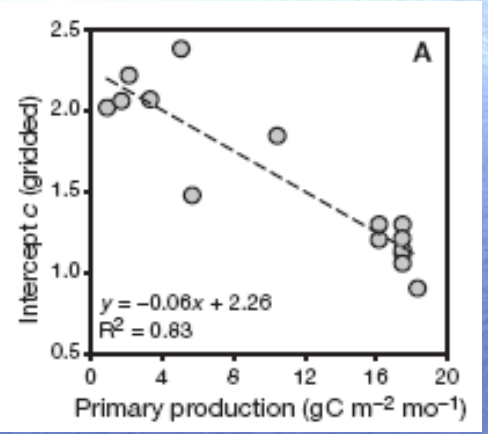
Escaravage et al 2009. MEPS 382: 253-264



Compensated for intercept

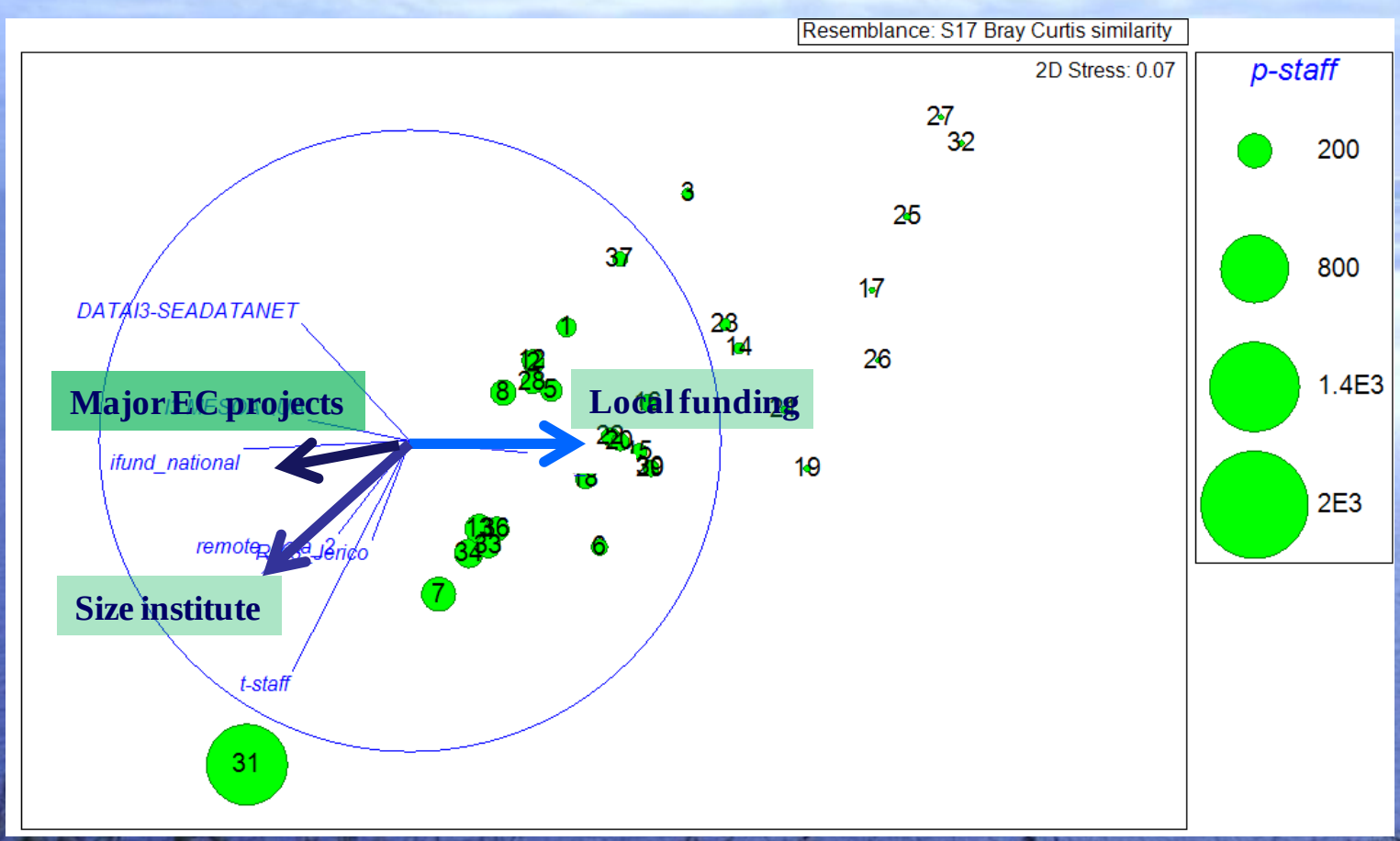


Benthic diversity in shallow European coastal seas suffers from eutrophication



In the 7th FW, actions were mainly connected to installing large networks of networks as EuroMarine, or ESFRI Infrastructures as LifeWatch.

Emphasis was more on coordination, and less on research.
The major EC networks became dominated by the larger institutions



Conclusion:

- Particularly larger institutes participate in major EC programmes

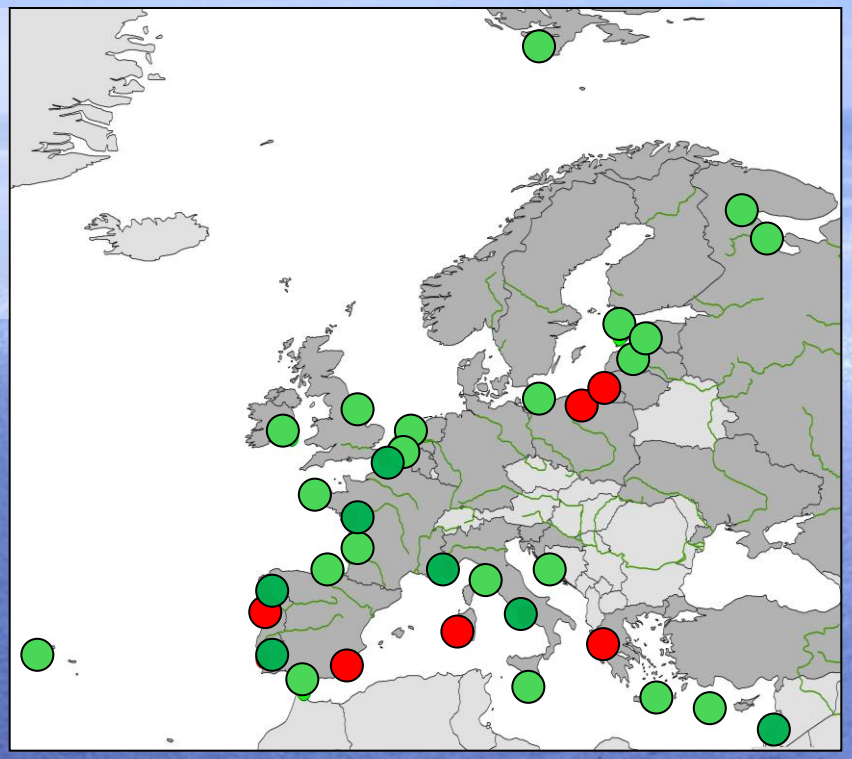
- Smaller institutes depend on local funding

Moreover, in EC 7th FW for marine observation networks, the emphasis was on the Deep Blue (oceanography, automated systems)(e.g. FixO3, JERICO).

Therefore, several initiatives tried to find funding outside the EC FW program, e.g. as ESF COST actions, as the EMBOS action:
a European Marine Biodiversity Observatory System.

Main mission of EMBOS: Can we observe patterns of (variation in) marine biodiversity in Europe by combining information from a large-scale range of marine stations using harmonised tools and methods

EMBOS Pilots (2014-2015), using harmonised methods, were carried out with observations at 34 stations.



Distribution of diversity with latitude, salinity, and SST, along European coast

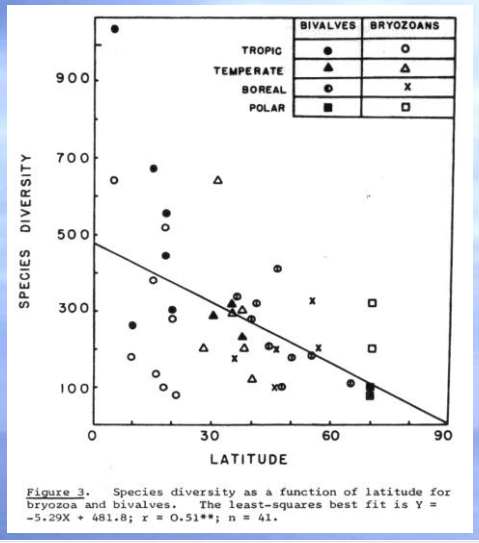
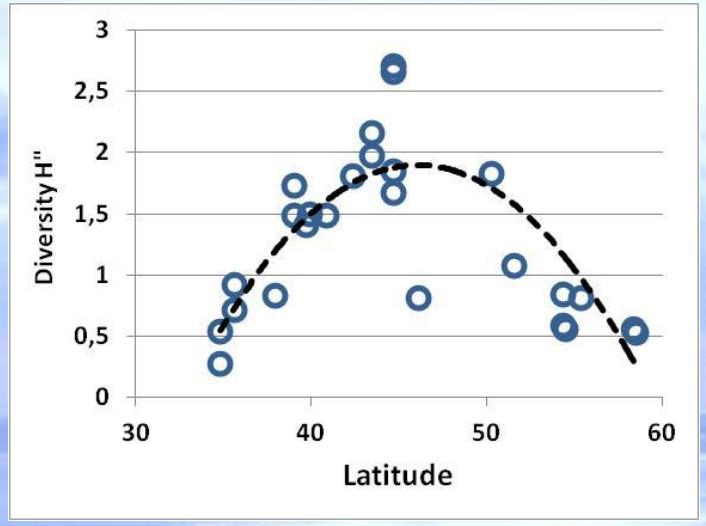
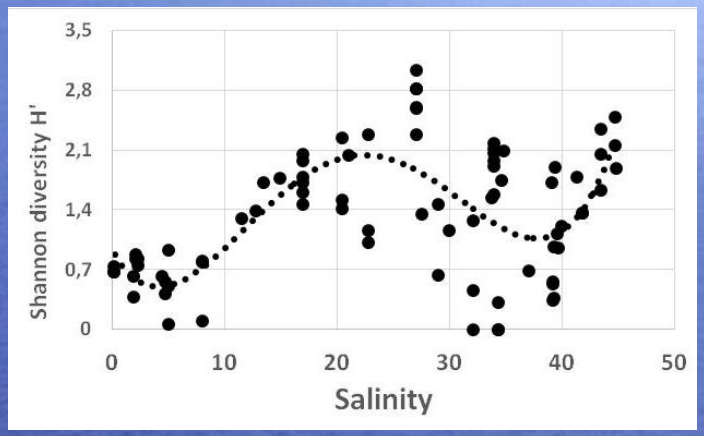
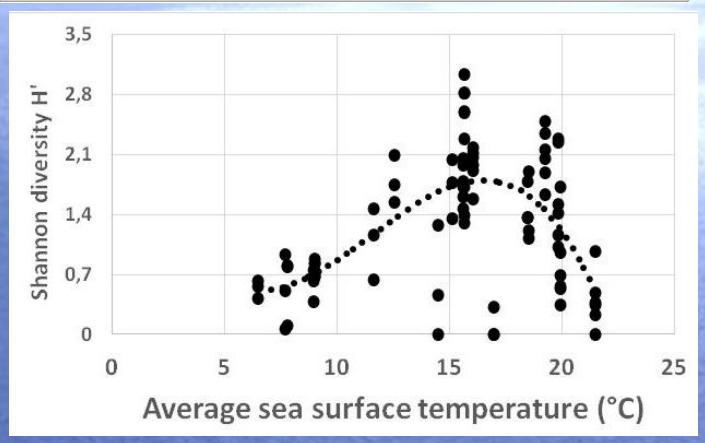


Figure 3. Species diversity as a function of latitude for bryozoa and bivalves. The least-squares best fit is Y = -5.29X + 481.8; r = 0.51**; n = 41.







Conclusion: A harmonised system as EMBOS delivers accurate and comparable marine biodiversity data over a large-scale gradient along the European coast.

- Species diversity can be related to environmental factors (T, S, mud, grain size)

Latest challenges stem from: EC Horizon 2020 and MSFD

In the "Climate Action and Environment programme" emphasis is more on economic growth (jobs) and societal challenges than on natural environment:

In total 82 % of the topics are socio-economic driven, not curiosity/fundamental driven

Non-profit topics on observatories and service are: 1) Arctic observing system, 2) Citizens observations, 3) GEOSS, 4) cost effective in-situ observation technology.

- **nature:** **Innovation through nature-based solutions to improve society's resilience** (particularly in urban areas, Smart Cities)
- **ecology:** **Eco-innovation for a circular economy**
- **climate:** **Strengthening the global market for climate services**
- **water:** **Become global market leader by Water Innovation**
- **marine sector:** **Blue growth**

Regarding Observation:

- **mainly about big Earth Data (remote sensing)**
- **for in-situ observation primarily about free, full, open access to resources and data** (not about observing itself)

And, remarkably, hardly a link to MSFD, GES, Biodiversity Observation (except of the Arctic)

In the MSFD (and GES) many aspects of marine biodiversity are recognised as being important for management and in legislation

Background is that from 2008 all the European countries of the EC have the obligation to implement the MSFD, and to reach Good Environmental Status (GES) of the European marine water bodies by 2020.

No.	Descriptor
1	Biological diversity
2	Non-indigenous species
3	Commercial fish & shellfish
4	Food-webs
5	Eutrophication
6	Sea-floor integrity
7	Hydrography
8	Contaminants
9	Contaminants in seafood
10	Litter
11	Energy, incl. underwater noise

Descriptor 1: **Biological diversity is maintained.** The quality and occurrence of habitats and the distribution and abundance of species are in line with prevailing physiographic, geographic and climatic conditions.

Good Environmental Status for Descriptor 1 will be achieved given **no further loss of the diversity** of genes, species and habitats/communities at ecological relevant scales and when deteriorated components, where intrinsic environmental conditions allow, are restored to target levels.

0.0 – 0.8: Implementation of MSFD D1 is Poor
0.8 – 1.6: : Implementation of MSFD D1 is Inadequate
1.6 – 2.4: : Implementation of MSFD D1 is Moderate
2.4 – 3.2: : Implementation of MSFD D1 is Good
3.2 – 4.0: Implementation of MSFD D1 is Full

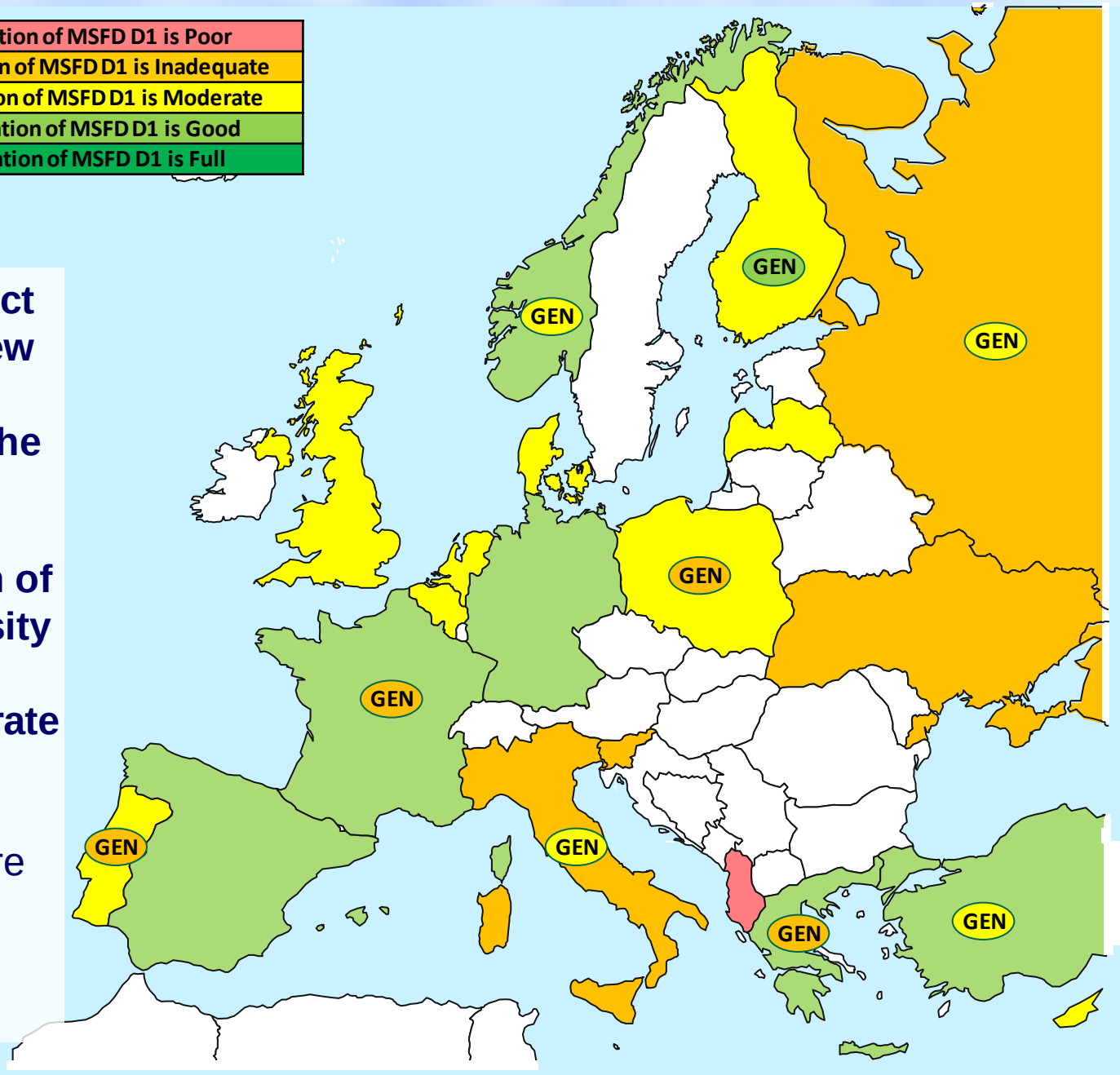
EMBOS

cost

In the EMBOS project we made an overview of the status of implementation of the MSFD Descriptor 1.

The implementation of the use of biodiversity indicators is on an average only moderate

(and for genetic biodiversity even more weakly developed)



Gaps, Threats

5th & 6th FW : concerted actions and networks tried to find a balance between concerted action, biodiversity research, creating awareness, and networking.

>> These actions delivered several general overviews and strong cooperation

>> Yet did not deliver observatory infrastructures.

7th FW : actions mainly connected to installing large networks of networks, and emphasis on Deep Blue ocean.

>> Emphasis was more on coordination, and less on research

>> The major EC networks became dominated by the larger institutions

>> Smaller institutes and stations are more dependent on local funding

>> More emphasis on ocean, less on coast

>> For observations emphasis on automation or RS, hardly on in-situ

Horizon 2020 : emphasis on economic growth (jobs) and societal challenges

>> Further loss of fundamental research

>> Biodiversity Observation in coastal seas is almost completely lost (except Arctic)

>> Much attention for Open Access to Big Data, instead to Observation of new data

>> No link with MSFD

Remedies, Recommendations: How to continue?

If we aim for a lasting role of marine biodiversity observation issues in European research networks, we should focus (more) **on:**

- strengthening cooperation at large-scale (pan-European level) by:
  - filling in gaps (Black Sea, Scandinavia, ...)
  - increase 'observatory-density'
  - include the smaller observatory stations

- stronger cooperation between transitional waters, coastal seas, open sea, …
  - since there are no principle differences in research approaches

- a network stimulating long-term objectives

- adopting socio-economic themes,
  - simultaneously keep the fundamental research intact

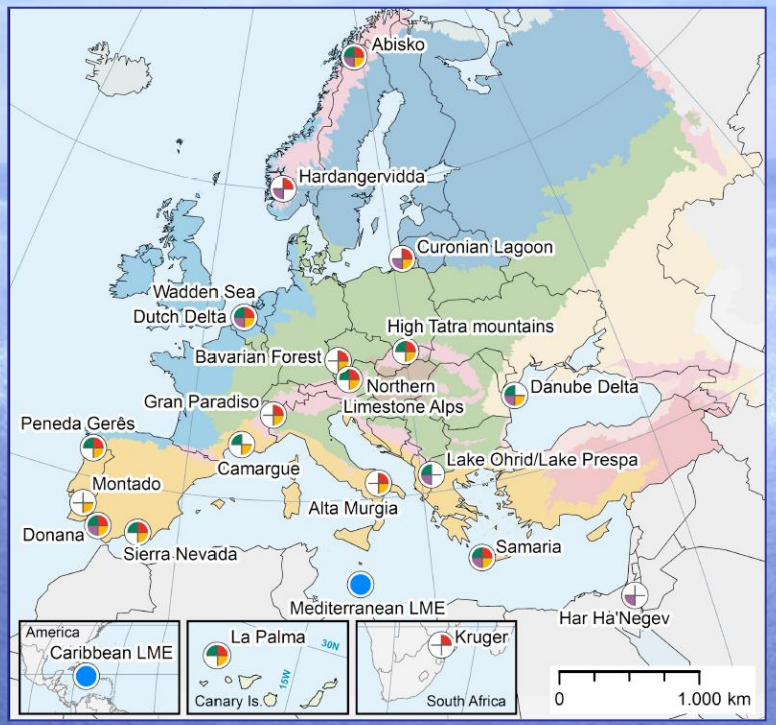
- a proper interface with policy and politics
  - make a link with the MSFD and GES

An example on how a balance may be reached is given by the Horizon2020 project EcoPotential dedicated to "Improving future ecosystem benefits through earth observations"

Focussing on (improving) the status of Protected Areas, by using remote sensing and in-situ observations for indicating its ecosystem services

EcoPotential:

- **Brings back biodiversity** (as an ecosystem service) **on the science agenda**
- **Further cooperation (integration) between domains and disciplines**
- **Even geographic spreading** (includes Black Sea, ..)
- **Strives for harmonised approaches regarding ecosystem services variables**
- **Proper plans to communicate and involve with stakeholders and policy**



We may aim for a similar balanced project on (marine) biodiversity observation


GEO GROUP ON EARTH OBSERVATIONS
EMBOS
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European Commission
MARS
The European Network of Marine Research Institutes and Stations
Federal Ministry of Transport and Digital Infrastructure
museum für naturkunde berlin
LIFEWATCH
NIOZ
EMBOS
cost
BIOCOMBE
Thank you all for your attention
marbef
BIOMARE
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10TH GEO EUROPEAN PROJECTS WORKSHOP | 31 MAY – 2 JUNE 2016, BERLIN