Acquisition, validation, quality control and access to biodiversity data -

Training course for less experienced users of data products

History of marine (biodiversity) research networks

(with a focus on Europe as example)

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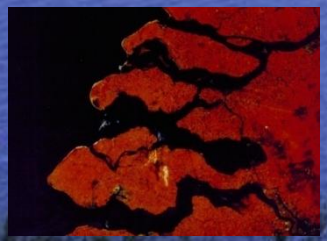
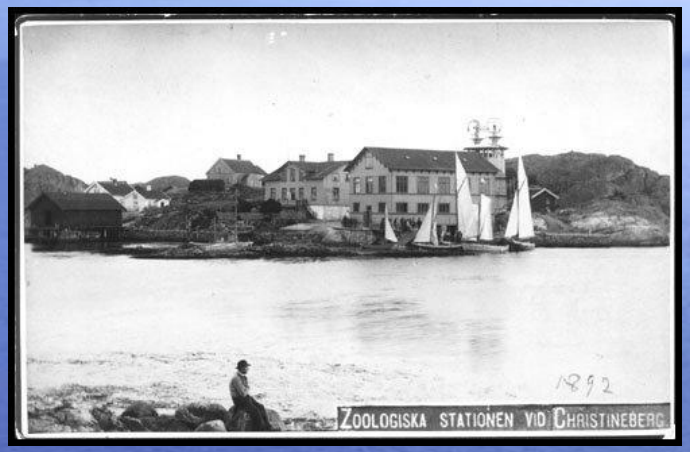
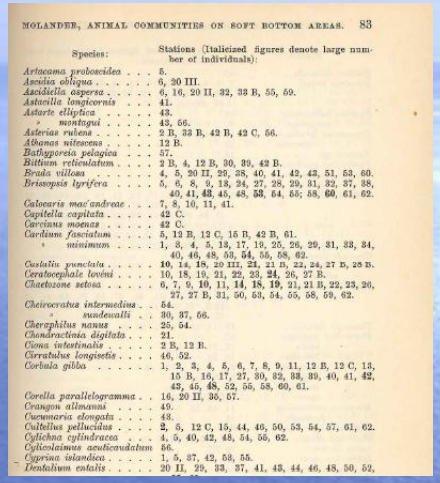



The history of marine research is strongly connected to marine stations. Since the 1850's several marine stations were founded:

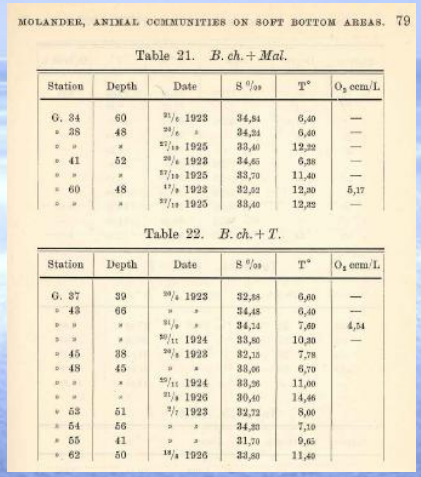
1859	Concarneau	1874	Wimereux
1871	Sevastopol	1876	NIOZ
1872	Naples	1877	Kristineberg
1872	Roscoff	1884	Villefranche





MOLANDER, ANIMAL COMMUNITIES ON SOFT BOTTOM AREAS. 83

Species:	Stations (Italicized figures denote large number of individuals):
Artacama proboscidea	5.
Ascidia obliqua	6, 20 III.
Ascidiella aspersa	6, 16, 20 II, 32, 33 B, 55, 59.
Astarte elliptica	41.
» *montagui*	43.
Asterias rubens	43, 56.
Athanas nitescens	2 B, 33 B, 42 B, 42 C, 56.
Bathyporeia pelagica	12 B.
Bittium reticulatum	57.
Brada villosa	2 B, 4, 12 B, 30, 39, 42 B.
Brissopsis lyrifera	4, 5, 20 II, 26, 28, 40, 41, 42, 43, 51, 53, 60.
	5, 6, 8, 9, 13, 24, 27, 28, 29, 31, 32, 37, 38, 40, **41, 43**, 45, 48, **53**, 54, 55, 58, **60**, 61, 62.
Calocaris mac'andreae	7, 8, 10, 11, 41.
Capitella capitata	42 C.
Carcinus maenas	42 C.
Cardium fasciatum	5, 12 B, 12 C, 15 B, 42 B, 61.
» *minimum*	1, 3, 4, 5, 13, 17, 19, 25, 26, 29, 31, 33, 34, 40, 46, 48, 53, **54**, 55, 58, 62.
Caulleria quadrata	**10**, 14, **18**, 20 III, **21**, 21 B, 22, 24, 27 B, 28 B.
Ceratocephale loveni	10, 18, 19, 21, **22**, **23**, **24**, 26, 27 B.
Chaetozone setosa	6, 7, 9, **10**, 11, **14**, **18**, **19**, 21, 21 B, 22, 23, 26, 27, 27 B, 31, 50, 53, 54, 55, 58, 59, 62.
Cheirocratus intermedius	54.
sundevalli	30, 37, 56.
Chergphilus nanus	25, 54.
Chondractinia digitata	21.
Ciona intestinalis	2 B, 12 B.
Cirratulus longisetis	46, 52.
Corbula gibba	1, 2, 3, 4, 5, 6, 7, 8, 9, 11, 12 B, 12 C, 13, 15 B, 16, 17, 27, 30, 32, **33**, 39, 40, 41, **42**, **43**, 45, **48**, 52, 55, 58, 60, 61.
Corella parallelogramma	16, 20 II, 36, 57.
Crangon allmanni	40.
Cucumaria elongata	43.
Cultellus pellucidus	**2**, 5, 12 C, 15, 44, 46, 50, 53, 54, 57, 61, 62.
Cylichna cylindracea	4, 5, 40, 42, 48, 54, 58, 62.
Cylichnina acuticaudatum	56.
Cyprina islandica	1, 5, 37, 42, 53, 55.
Dentalium entalis	20 II, 29, 33, 37, 41, 43, 44, 46, 48, 50, 52,



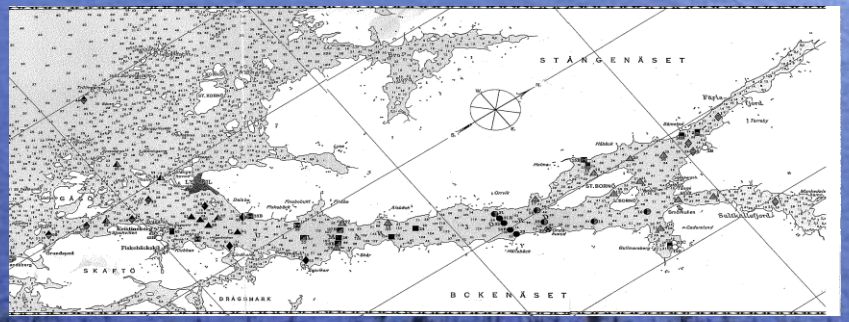
MOLANDER, ANIMAL COMMUNITIES ON SOFT BOTTOM AREAS. 79

Table 21. *B. ch.* + *Mal.*

Station	Depth	Date	S ‰	T°	O_2 ccm/L
G. 34	60	21/6 1923	34,84	6,40	—
» 38	48	20/6 »	34,24	6,40	—
» »	»	27/12 1925	33,40	12,22	—
» 41	52	28/6 1923	34,65	6,38	—
» »	»	27/12 1925	33,70	11,40	—
» 60	48	17/9 1923	32,22	12,20	5,17
» »	»	27/12 1925	33,40	12,22	—

Table 22. *B. ch.* + *T.*

Station	Depth	Date	S ‰	T°	O_2 ccm/L
G. 37	39	20/6 1923	32,88	6,60	—
» 43	66	» »	34,48	6,40	—
» »	»	21/9 »	34,24	7,60	4,54
» »	»	20/11 1924	33,60	10,20	—
» 45	38	20/6 1923	32,15	7,78	
» 48	45	» »	33,06	6,70	
» »	»	29/11 1924	33,26	11,00	
» »	»	21/9 1926	30,40	14,46	
» 53	51	7/7 1923	32,72	8,60	
» 54	56	» »	34,20	7,10	
» 55	41	» »	31,70	9,65	
» 62	50	18/9 1926	33,80	11,40	



A few decades later, at the beginning of the 20th century, marine sciences became more and more organised.
First overarching organisations, through which marine sciences (in Europe) were promoted, were fisheries directed:
- 1902 ICES - International Council for the Exploration of the Sea
- 1919 CIESM - International Commission for Scientific Exploration of the Mediterranean Sea

Focus on joint action, and increased level of networking in other marine sciences, was stimulated by the EC and UNESCO mainly in the last decades of the 20th century.

- 1984-2002 : EC 1st - 5th FW : programmes with occasional groups of institutes
- 1991 : ODC : Oceanographic Data Centres
- 1992 : CBD (Convention on Biological Diversity; Rio de Janeiro)
- 1993 : IGBP – LOICZ (Land Ocean Interactions in the Coastal Zone) programme
- 1994 : EuroGOOS – European Global Ocean Observing System
- 1995 : Foundation of MARS – European Marine Research Stations Network
  - in USA: 1988 : NAML - National Association of Marine Laboratories)

For marine stations it became also essential to join in larger networks and, in order to survive, not to act solitary.

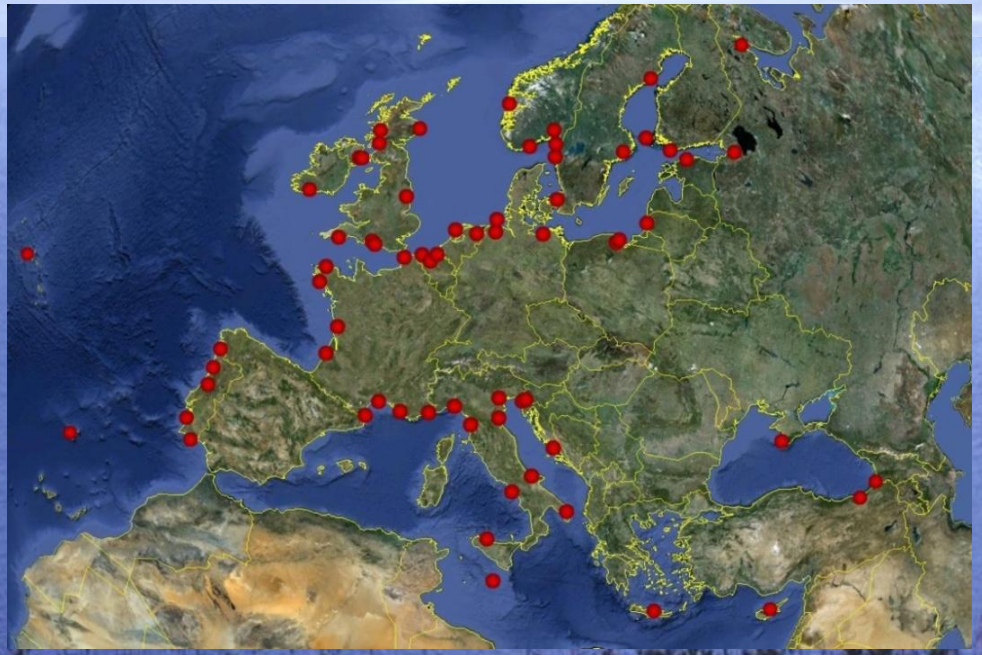
To promote the role of marine stations the MARS network was founded

MARS grew to one of the biggest networks of marine research stations (>60 members)

MARS aims / scope:

- to promote co-operation, scientific research and training at marine research stations
- to make larger and smaller infrastructures, with (experimental) laboratories alongside the sea, available.

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



After the first initiatives there was (and is) still the need for large networks, as:

- Knowledge on the marine realm (in Europe) is fragmented within and between disciplines. The research community has been unable to overcome its fragmentation :

- by habitat: pelagic vs. benthic, deep sea vs. shallow coastal
- by discipline: ecology vs. taxonomy, genomics, vs. physics, vs. chemistry
- by nationality

- Studies on (patterns, function of) the marine system were ad hoc and local

- mainly by a regional or national focus in research.

- No agreed common methodology for many aspects is available.

To counteract these weaknesses, new projects aimed for:

- concertation and co-ordination at European scale:

- implementation of long-term and large-scale marine biodiversity research

- standardization of methods and protocols

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

To this end, the members of the MARS network, developed some major joint actions.

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
  - 1999-2001: ERMS
  - 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
  - 2006-2011: ESONet - European Seas Observatory Network

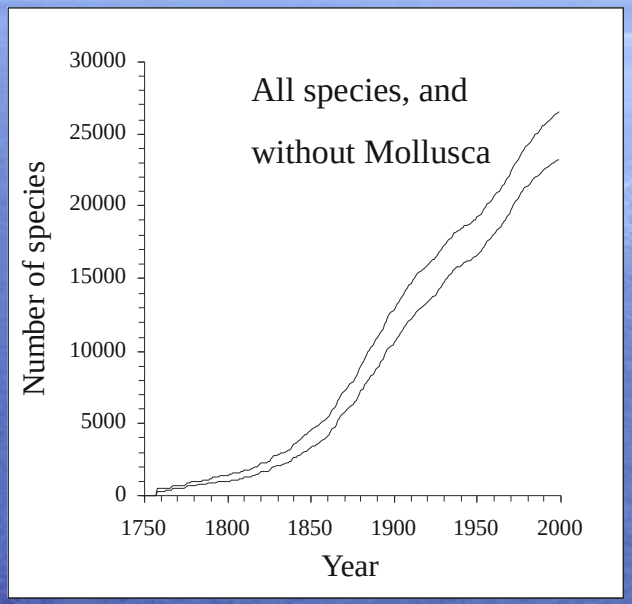
- EC 7th FW: Larger (Networks of) Networks
  - 2009-2020: EMODNet - European Marine Observation and Data Network
  - 2009-2013: ASSEMBLE
  - 2011-2013: EuroMarine = MarBEF, MGE, EurOceans
  - 2013-2017: FixO3

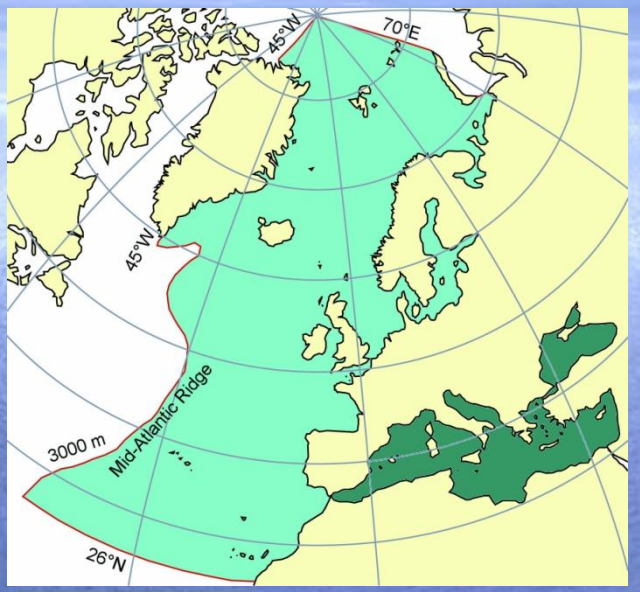
  ++ ESFRI - European Strategy Forum on Research Infrastructures
  - 2008-2010: LifeWatch
  - 2011-2014: EMBRC, JERICO

1999-2001 – ERMS : the European Register of Marine Species
Co-ordinator: Mark Costello – Ecoserve

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

Discovery rate of European marine species



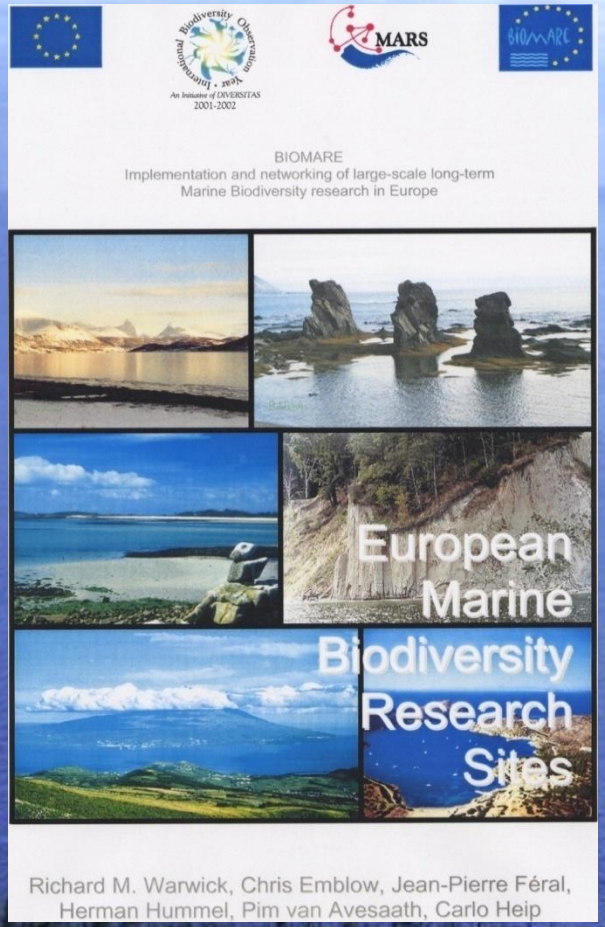


Conclusion: Many new species still to be discovered

The subsequent action was BIOMARE aiming to achieve European consensus on:

- 1) a network of Reference Sites for marine biodiversity research as the basis for long-term and large-scale research in Europe

- 2) a set of standardised indicators for biodiversity

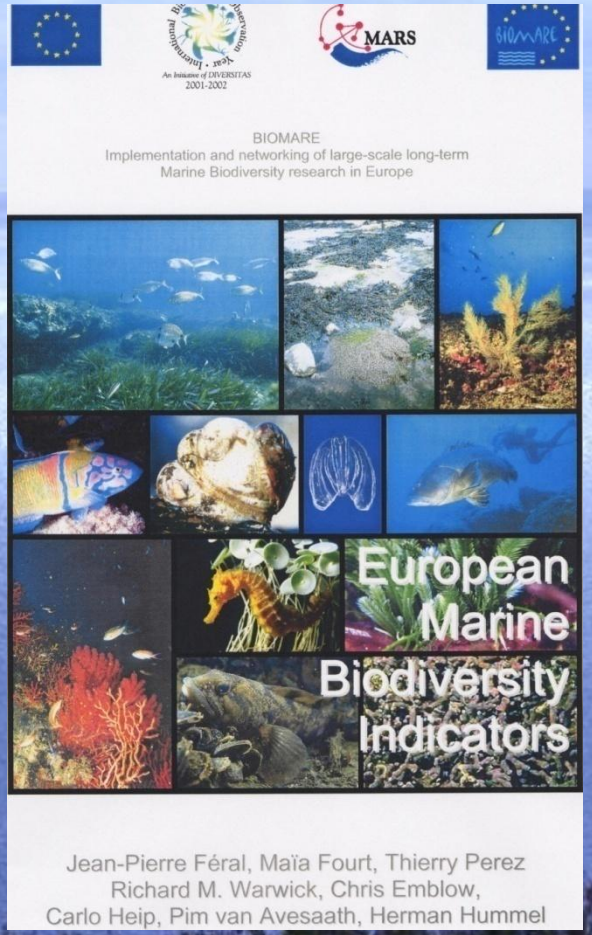


Results published in:

Book on marine biodiversity reference sites

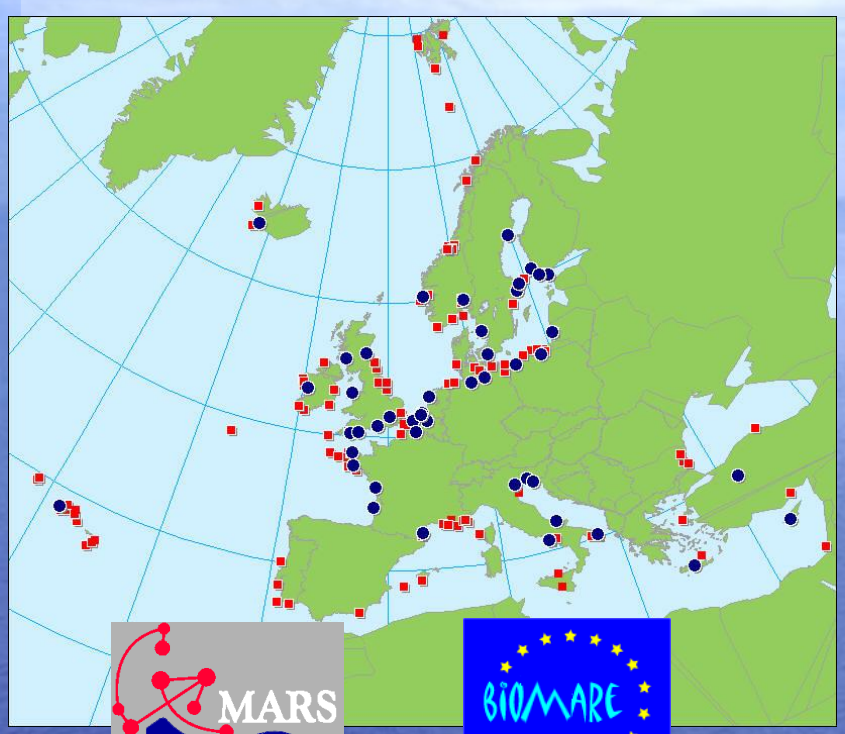
and

Book on marine biodiversity indicators



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

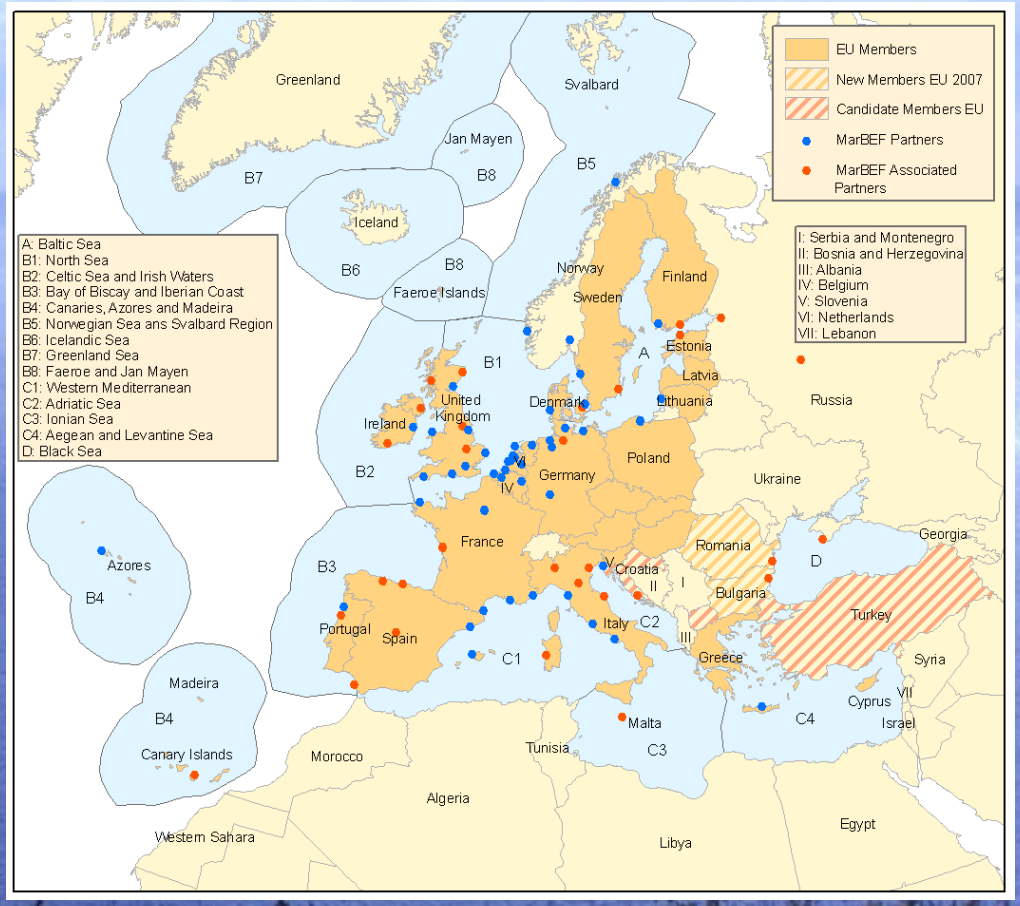
MarBEF extended the previous/existing actions by MARS and BIOMARE

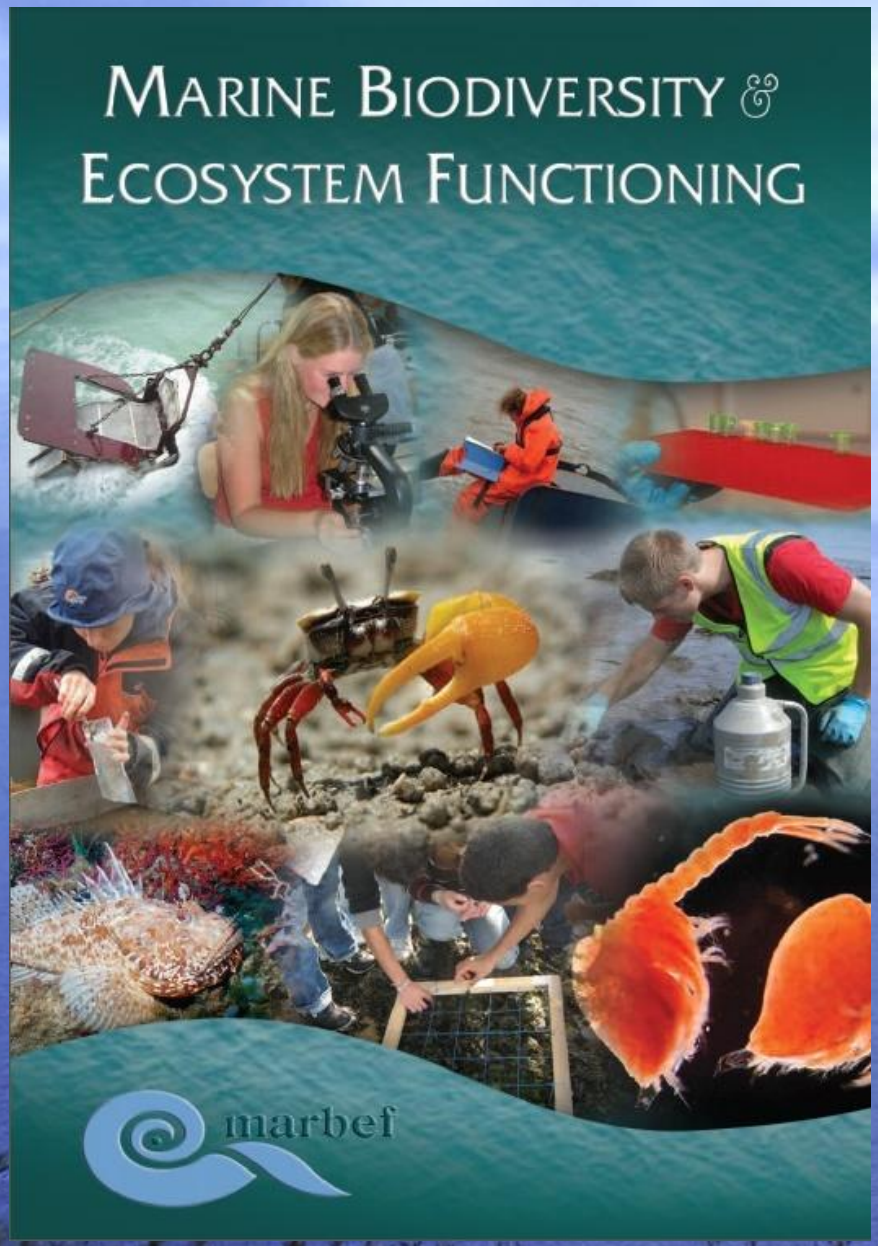


MARS members (blue dots)

BIOMARE Reference / Focal sites (red dots)

MarBEF participating institutes:
- 56 Full Members
- 39 Associated Members





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

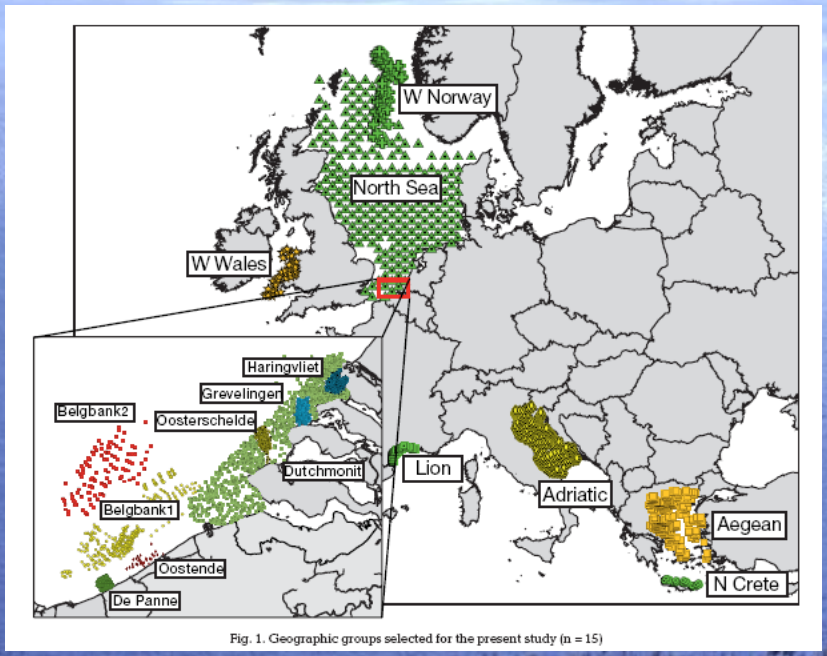


Fig. 1. Geographic groups selected for the present study (n = 15)

MarBEF datasets covering the European distribution patterns of species diversity showed the relation to factors as productivity, depth, survey area, and latitude of areas like North Sea, Adriatic.

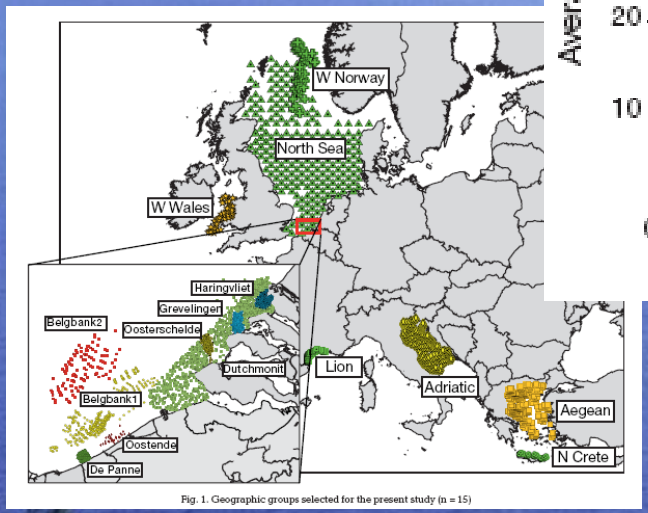
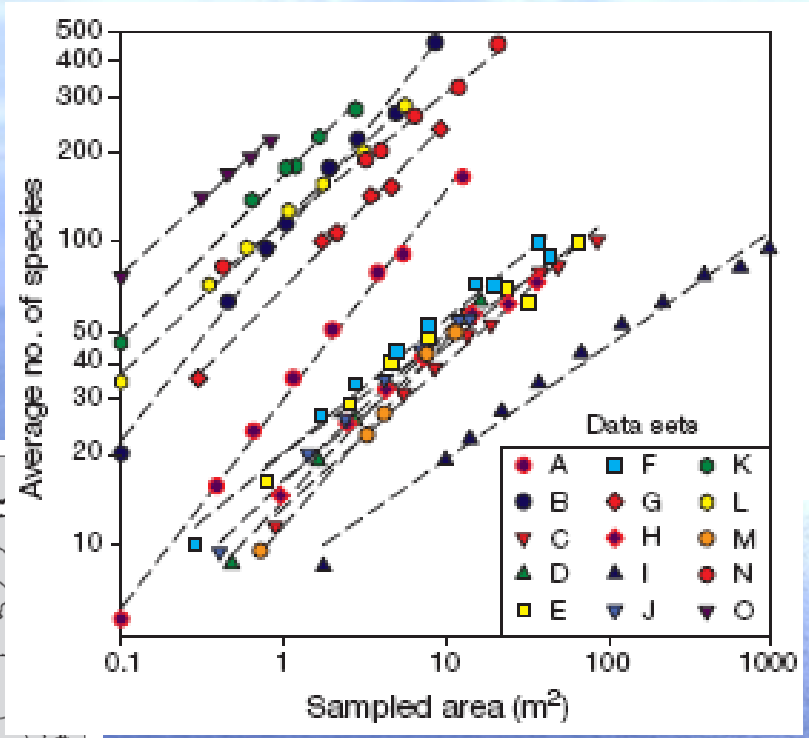
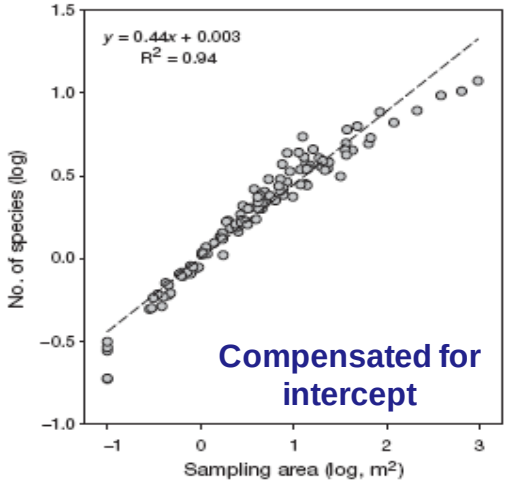
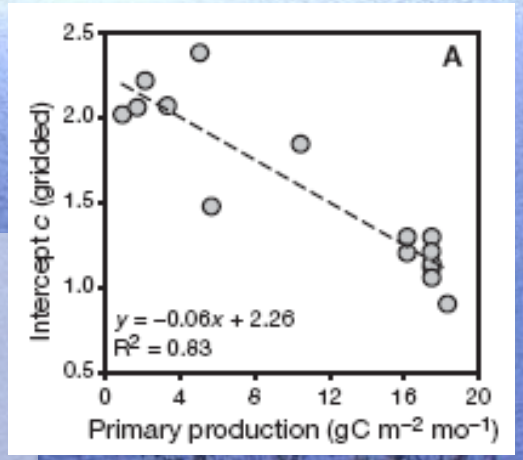


Fig. 1. Geographic groups selected for the present study (n = 15)





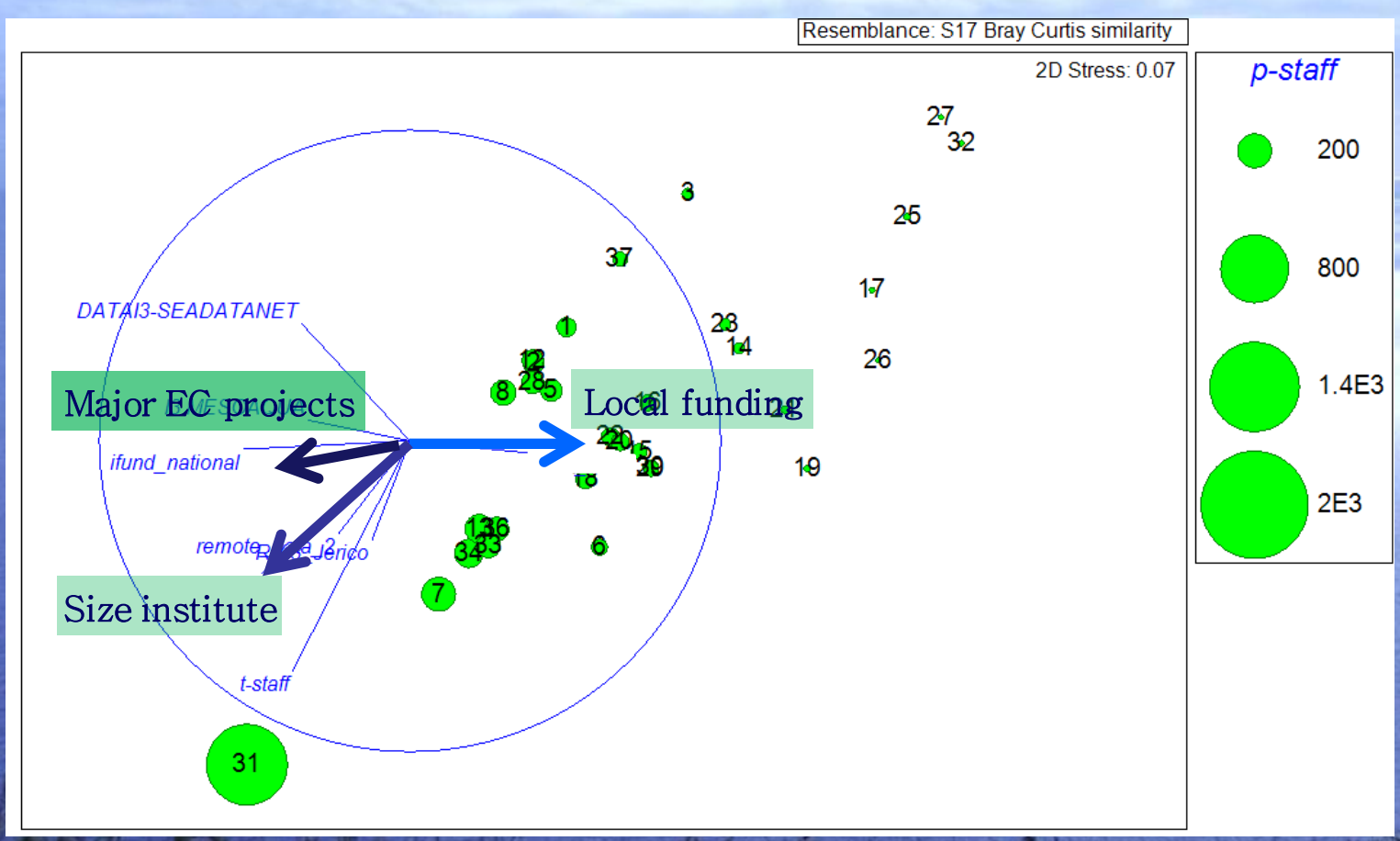


Species diversity was related negatively to primary production, indicating that coastal areas suffer still from eutrophication

Escaravage et al 2009. MEPS 382: 253-264

The following (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

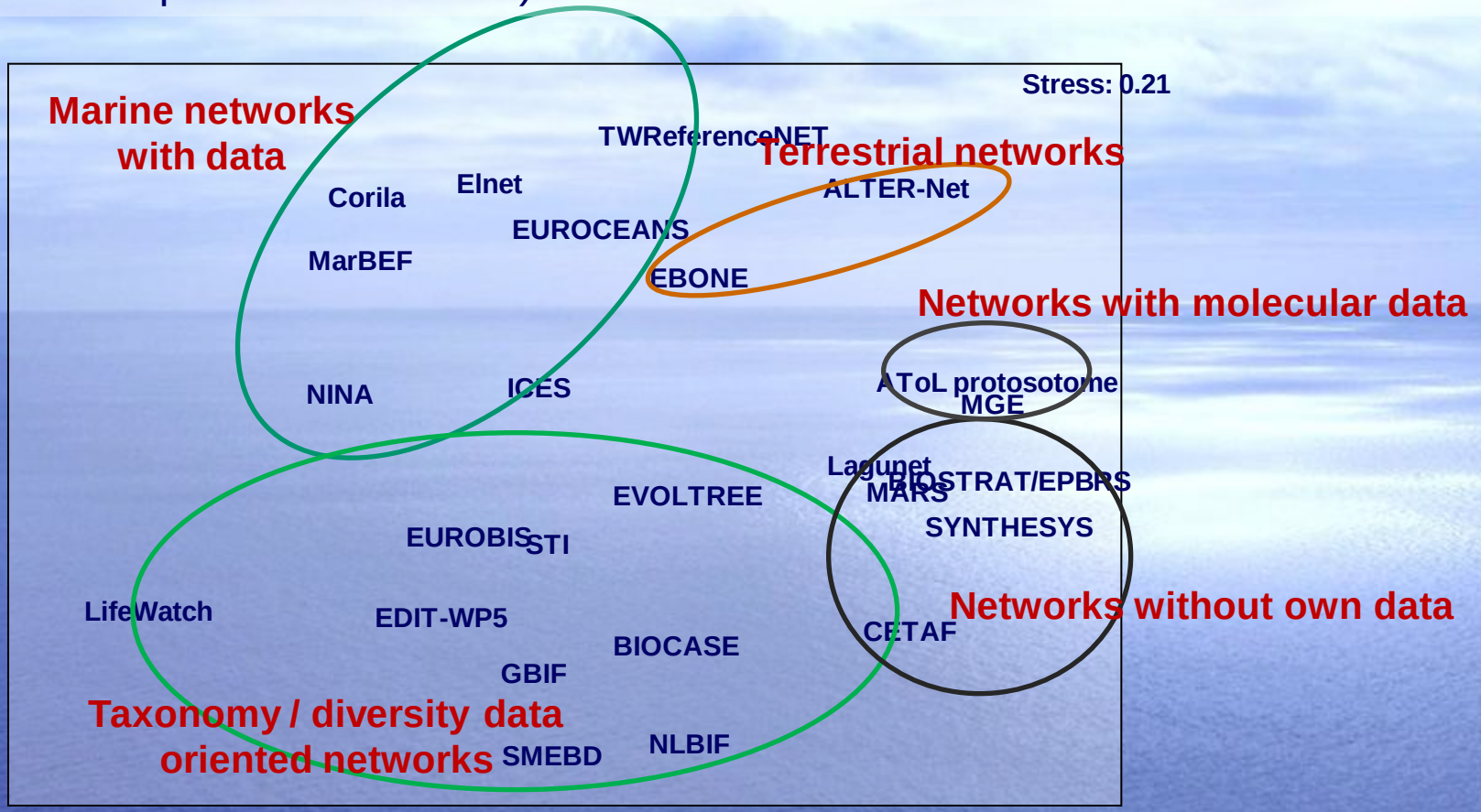


Conclusion:

- Particularly larger institutes participate in major EC programmes

- Smaller institutes depend on local funding

The high diversity of networks is however partly a façade, as indicated by a multidimensional scaling analysis of science networks in Europe (based on the aims/scope of the networks)



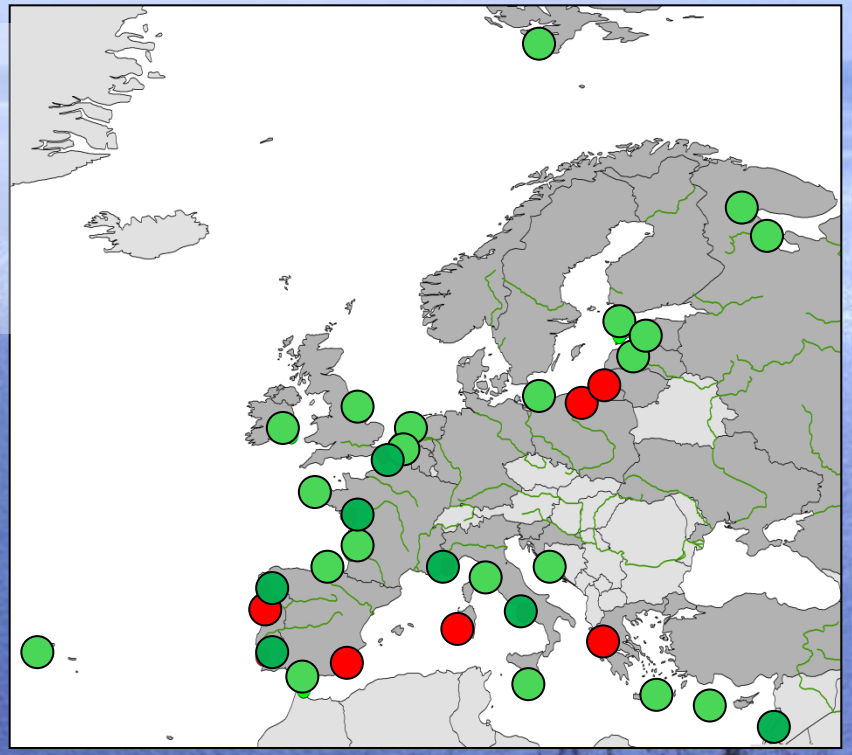
Most networks cluster together into groups of networks along their major science discipline, i.e. terrestrial, marine, taxonomy / diversity, molecular

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

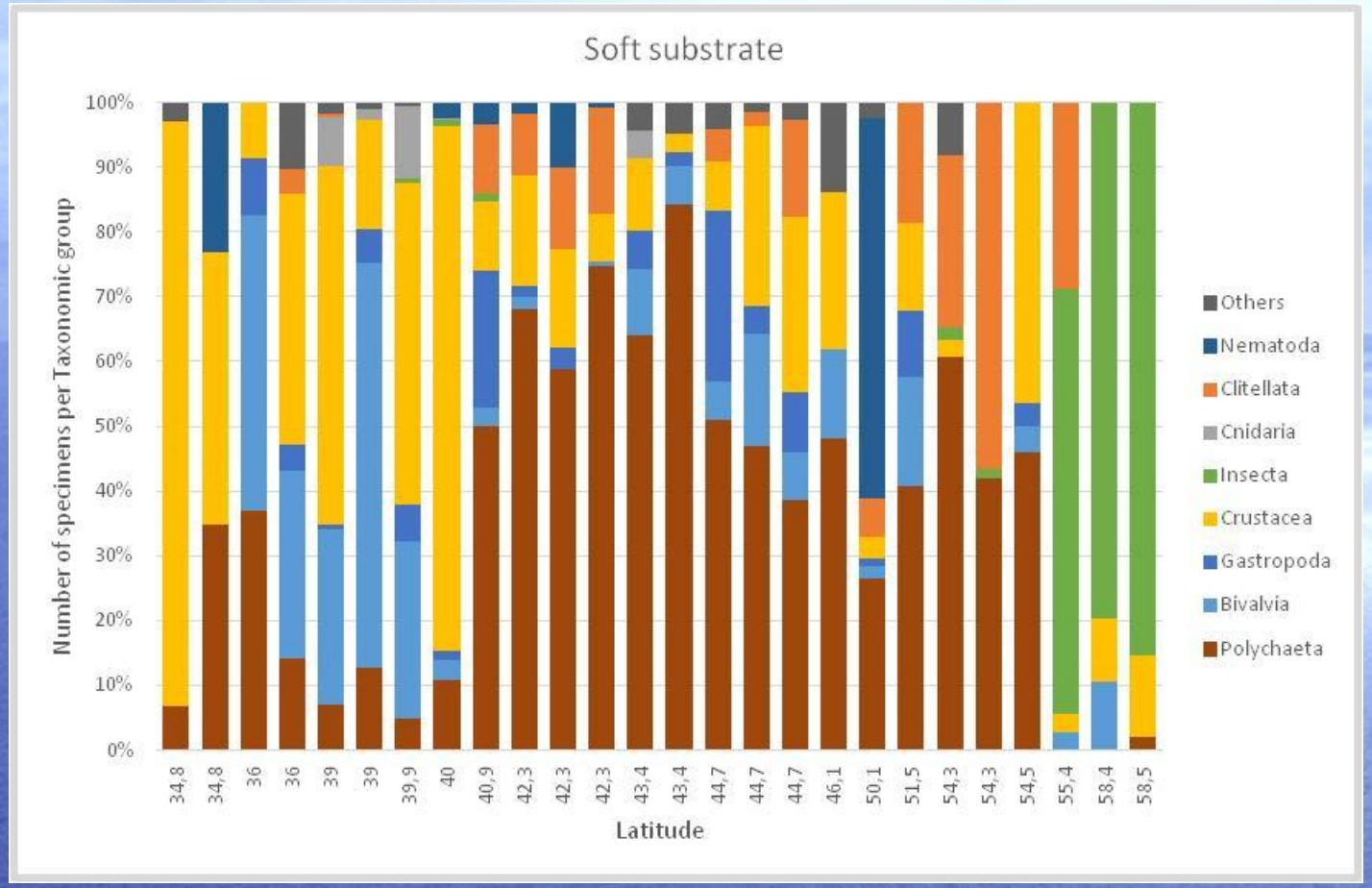
Therefore, several initiatives tried to find funding outside the EC FW program, e.g. as ESF COST actions, as the EMBOS action:
a European Marine Biodiversity Observatory System.

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



crustaceans

polychaetes

insects

mollusks

mollusks

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.

Gaps, Threats

5th & 6th FW (1998-2006)**: 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 (2007-2013)**: 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 (2014-….)**: 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

Escaravage, V., P. M. J. Herman, B. Merckx, M. W8odarska-Kowalczuk, J. M. Amouroux, S. Degraer, A. Grémare, C. H. R. Heip, H. Hummel, I. Karakassis, C. Labrune, W. Willems, 2009. Distribution patterns of macrofaunal species diversity in subtidal soft sediments: biodiversity–productivity relationships from the MacroBen database. Marine Ecology Progress Series 382: 253-264

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