Marine Biology Research in Europe: The institutional context

Herman Hummel
Netherlands Institute of Ecology

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CONTENT

- **Why marine biology as a theme**
  - concern about marine realm

- **The last two decades: Networks**
  - why larger networks
  - examples on results

- **LifeWatch**

Is marine realm so special that it needs more attention ?

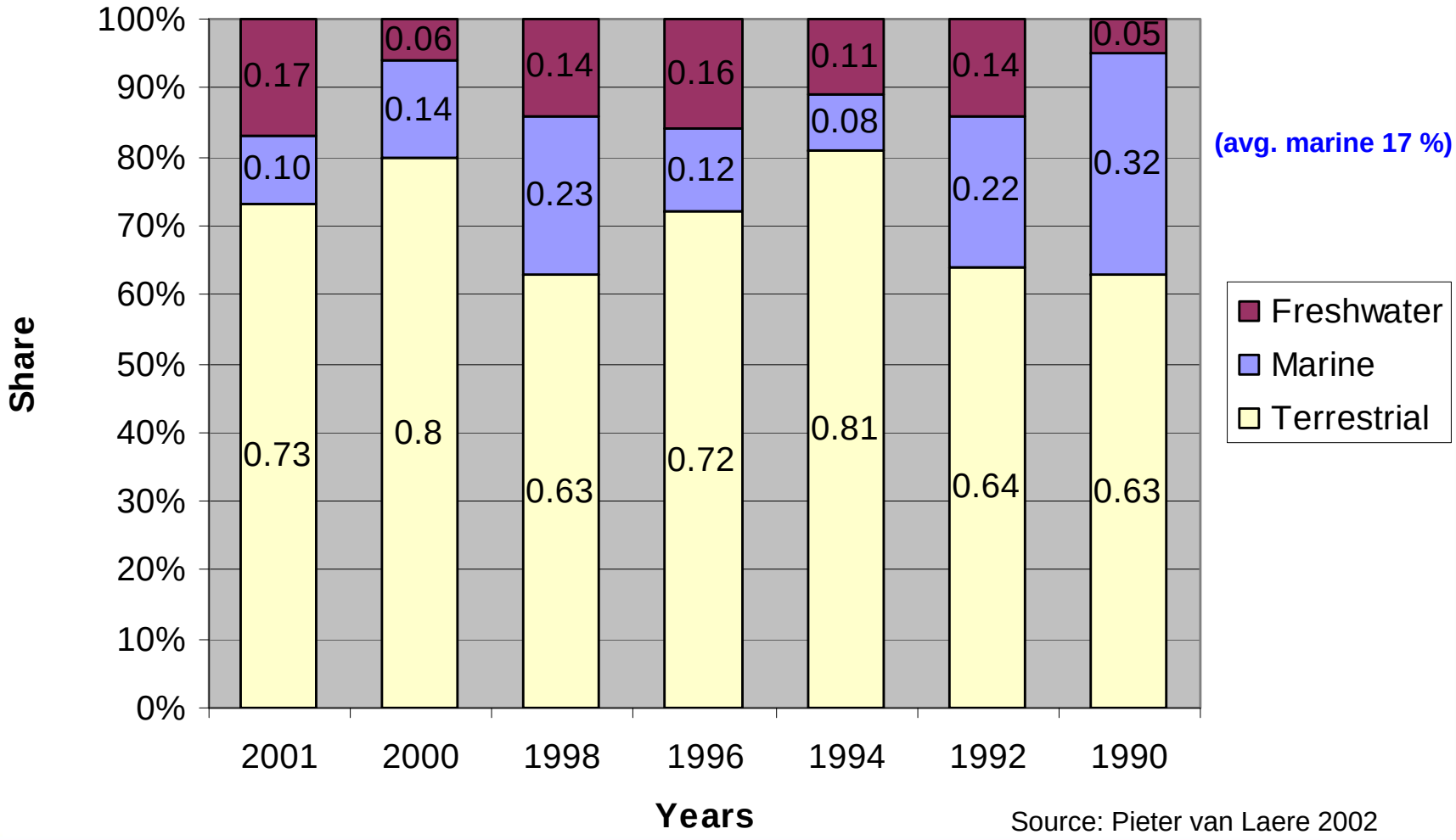
Yes, because marine territory covers 70 % of earth surface.

Yes, because marine realm has :
- **although less species**
- **greater phylogenetic diversity than land faunas and floras**

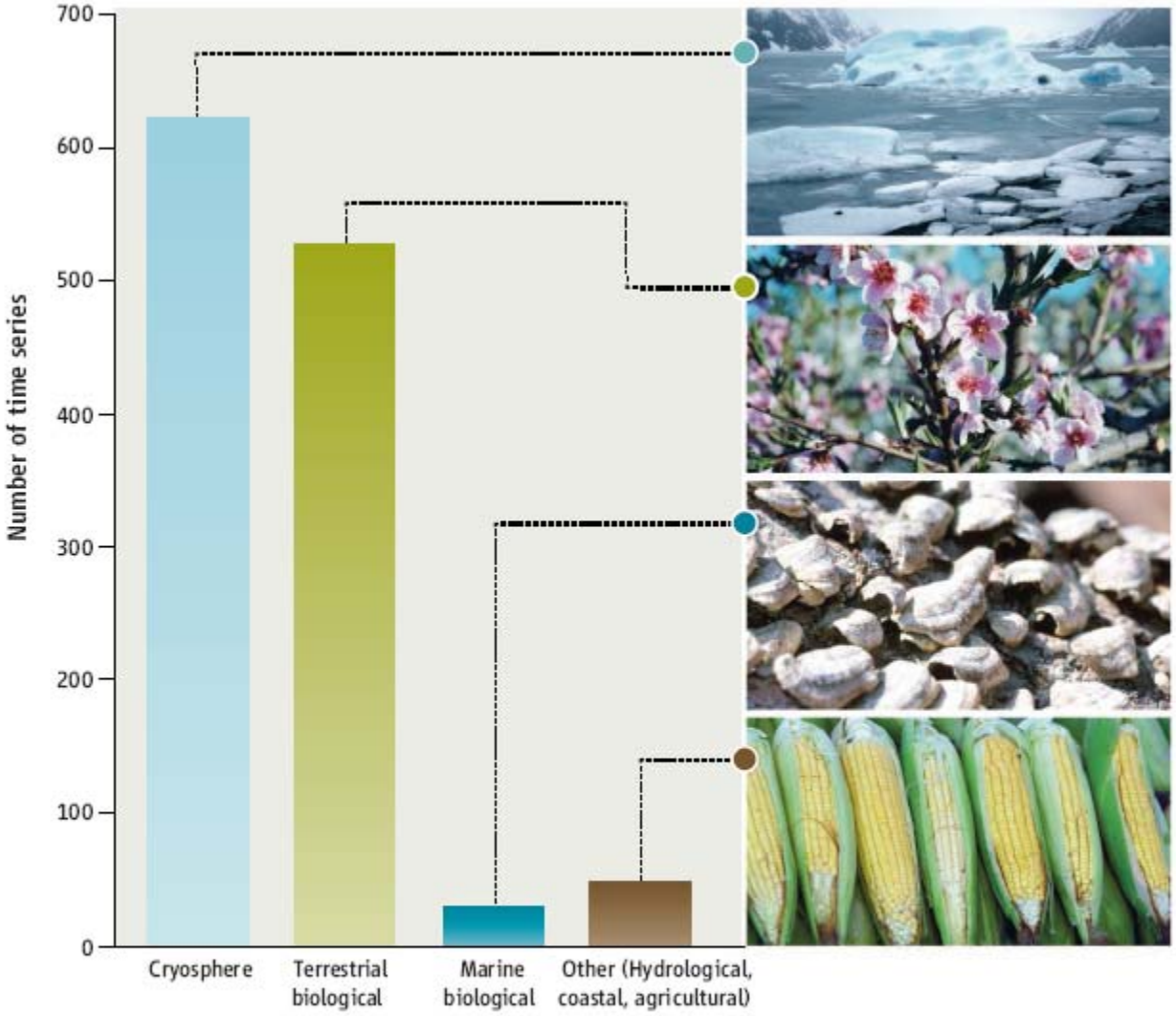
	Number of phyla	
	Endemic	Total
Freshwater	0	14
Terrestrial	1	11
Marine	13	28
Total		33

This does provide (and may provide still unknown) goods and services of great value and importance to mankind:
- **food**
- **chemicals**
- **play crucial roles in biogeochemical processes sustaining the biosphere**

Yes, because attention of research is mainly focussed on terrestrial realm.
E.g. studies on biodiversity : only 17 % of studies in marine realm.



Source: Pieter van Laere 2002



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

Other reasons why we need marine research :

- Ecological theories are mainly based on terrestrial paradigms. Yet, we cannot just borrow from terrestrial ecology. Processes in marine realm do not necessarily comply with terrestrial paradigms. Therefore, marine conservation and sustainable exploitation of marine resources may be based on inadequate and sometimes irrelevant or misleading knowledge

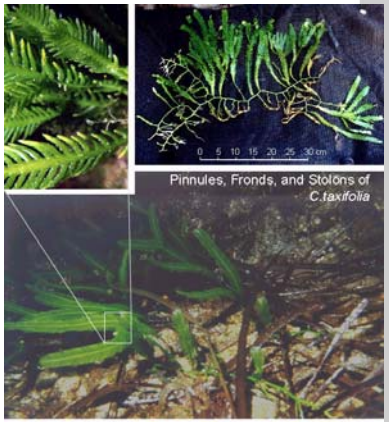
- The lack of scientific interest and effort until recently was a consequence of the general feeling that marine realm is far less threatened than terrestrial

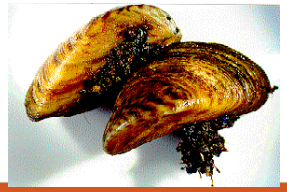
- The sustainable exploitation of the seas requires development of a sound theoretical framework for marine realm. Yet, as for e.g. the relation between functioning of marine ecosystems and biodiversity, the back-ground information is largely unavailable

Why more attention on marine realm during last decades ?

Because of (anthropogenic) threats to the environment:
- although local environment for millennia influenced
- this and last century increasingly strong impact on global environment

Increased pressures
- aquaculture
- over-fishing
- species introductions / invading (exotic) species
- pollution
- mining
- tourism





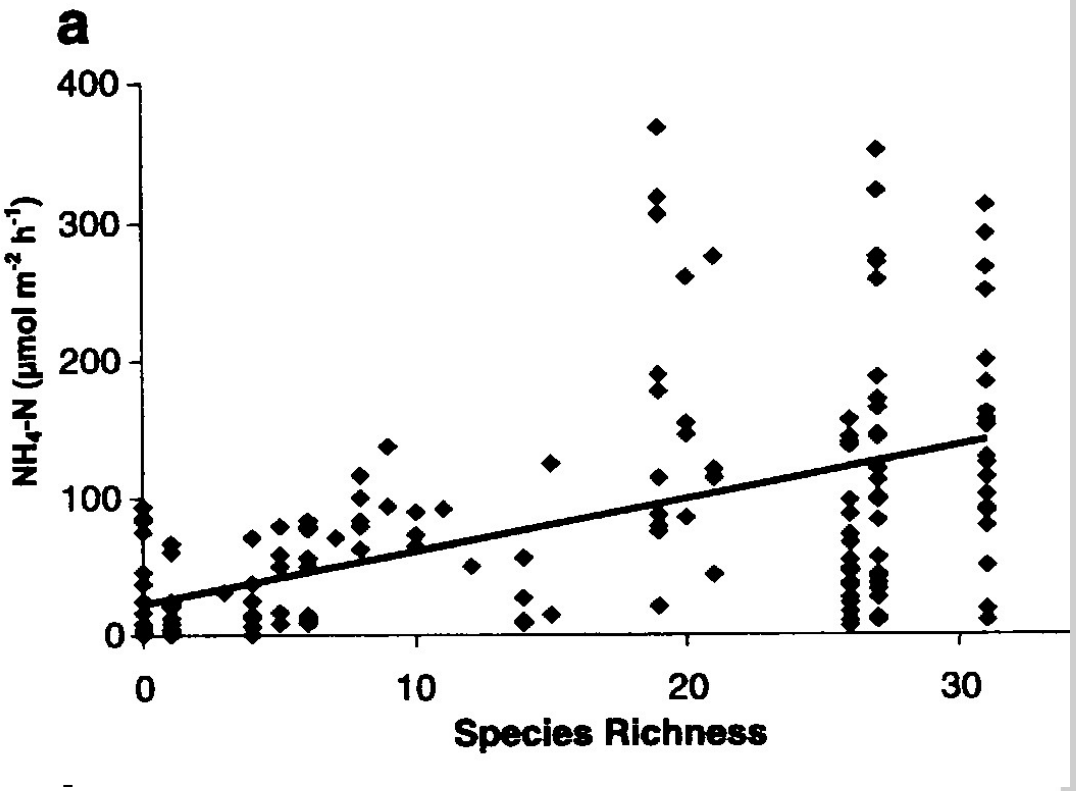
Threats do have an impact on the goods and services of biodiversity

Aquaculture, Fisheries
- refuge, nursery
- source of stock

Ecosystem function
- maintenance
- recycling nutrients

Amenity, tourism
- scenery, nature
- public health
- angling

Education
- public, schools
- researchers



Mechanisms through which marine biology (in Europe) was promoted

First organisations fisheries directed
- 1902 ICES - International Council for the Exploration of the Sea
- 1919 CIESM - International Commission for Scientific Exploration of the Mediterranean Sea

- **1966**: EMBS – European Marine Biology Symposium

- **1984-2002**: EC 1st - 5th FW : programmes with occasional groups of institutes
  - MAST programme – Marine Science and Technology
    1991 : (X)ODC : Oceanographic Data Centres
    1993-2000 : OMEX (Ocean Margin Exchange) programme

- **1992**: CBD (Convention on Biological Diversity; Rio de Janeiro) - Focus on joint action regarding marine biodiversity in Europe developed only recently

- **1993**: IGBP – LOICZ (Land Ocean Interactions in the Coastal Zone) programme

  - in 1993-1994 first steps for joint actions/programmes, under the umbrella of ECOPS and the ESF. Actions failed

From mid nineties in Europe increased level of networking

- **1994**: **EuroGOOS** – European Global Ocean Observing System
- **1995**: Foundation of **MARS** - European Marine Research Institutes and Stations Network)
- **1995**: **ESF Marine Board**

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

- **1999 EPBRS** – European Platform for a Biodiversity Research Strategy
  Policy and science (halting biodiversity loss by 2010)
  - 2001 Bioplatform
  - 2006 Biostrat

- Links with organisations in USA or global
  - **NAML** (National association of Marine Laboratories)(1988)
  - **POGO** (Partnership for the Observation of the Global Oceans)
  - **2000 CoML** (Census of Marine Life)
    - **2000 OBIS** (Ocean Biogeographic Information System)
      - 2004 EurOBIS
    - **2002** NaGisa (Natural Geography in Shore Areas)

After first initiatives there was still the need for large networks, since:

- Knowledge on marine biodiversity 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
  - by nationality
- Approach to understand (patterns, function of) biodiversity has hitherto been ad hoc and local, mainly by its regional or national focus in biodiversity research.
- No agreed common methodology for many aspects of biodiversity is available.

Consensus had grown that:

- concertation and co-ordination at European scale is urgently required to:
  - implement long-term and large-scale biodiversity research
  - plan adequate use of the European research infrastructure

- **EC 5th FW : Concerted Actions and e-conferences**
  - 1999-2001: ERMS - European Register of Marine Species
    - 2000: SMEBD - Society for the Management of Electronic Biodiversity Data
  - 2000-2002: Concerted Action BIOMARE
  - 2002-2004: e-conferences by M@rble and Marbena

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

- **EC 6th FW: Projects**
  - 2006: SeaDataNet

- **EC 6th FW: 2004-2008 ERA nets (European Research Area)**

  Networks of funding agencies
  - Balloon
  - MarinERA
  - BioDiversa
  - MariFish

- **Larger intergovernmental (top-down installed) networks**
  - 2000: GBIF (Global Biodiversity Information Facility)
  - 2005-2010: GEOSS (Global Earth Observation System of Systems)
    - GEOBON (GEO Biodiversity Observatory Network)

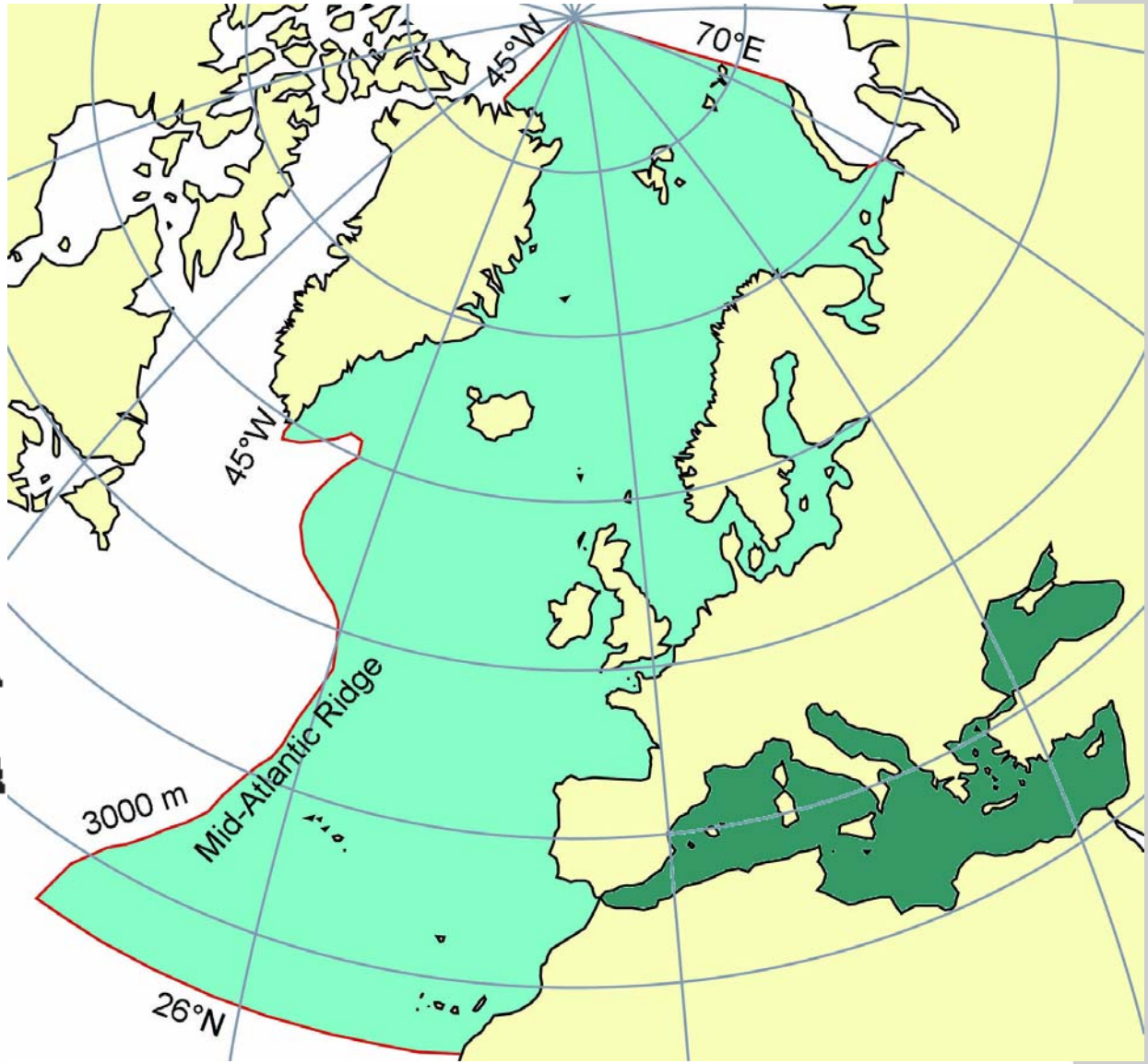
- **Initiatives bottom-up by institutes**
  - 2007: LTER Europe
  - 200x: EMECO - European Marine Ecosystem Observatory
  - 2008: MARS, MarBEF, MGE, EMBS

- **EC FP 7th : Larger (Networks of) Networks**
  - ESF-EuroGOOS-EC DG MARE:
    - 2008: EModNet - European Marine Observation and Data Network
  - EC FP 7th ASSEMBLE
  - EC FP 7th - ESFRI - European Strategy Forum on Research Infrastructures
    - 2008: LifeWatch
    - 2010: EMBRC (Genomics)
  - EC FP 7th - Follow-up of NoE's
    - 2010: EuroMarine = MarBEF, MGE, EurOceans

European Register of Marine Species (ERMS)

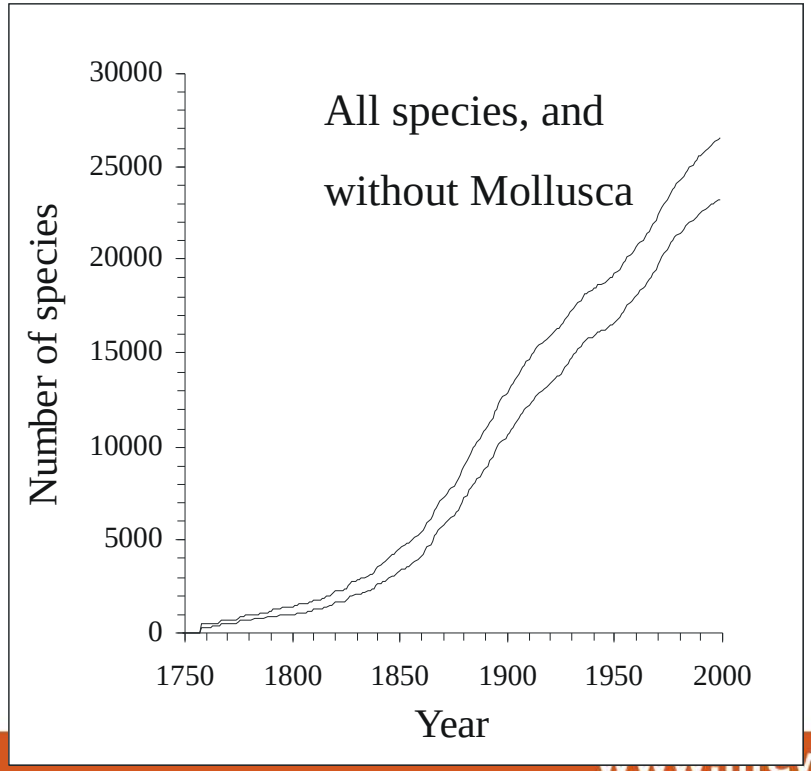
1999 - 2001

Co-ordinator:
Mark Costello – Ecoserve



Results of ERMS

- **Web site providing results (**now hosted via www.marbef.org**)**
- **Book listing 30,000 species**
- **Register of 600 experts (in 37 countries) in European marine species identification**
- **Bibliography of 840 identification guides**
- **Gaps in identification expertise and guides, knowledge of species groups, and marine species collections**



Many new species to be discovered

Followed by SMEBD

Discovery rate of
European marine species

BIOMARE

Implementation and networking of large-scale long-term MARine BIOdiversity research in Europe.

General co-ordinators:
Herman Hummel, Carlo Heip & Pim van Avesaath

Netherlands Institute of Ecology

Funded under the Energy, Environment and Sustainable development (EESD) Programme of the European Union. Contract number: EVR1-CT2000-20002

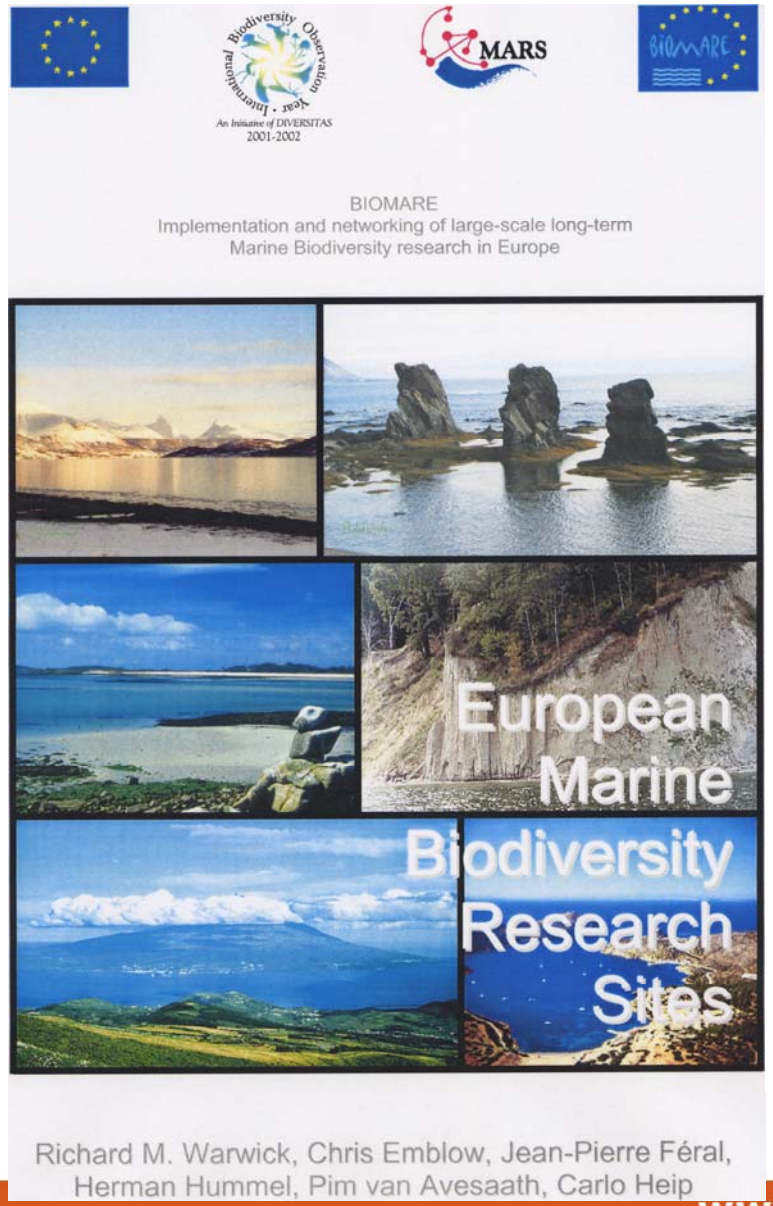
The objective of BIOMARE was to achieve European consensus on:

- 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

- 3) facilities for capacity building, dissemination and networking (through workshops, training and mobility, internet web-site, database)

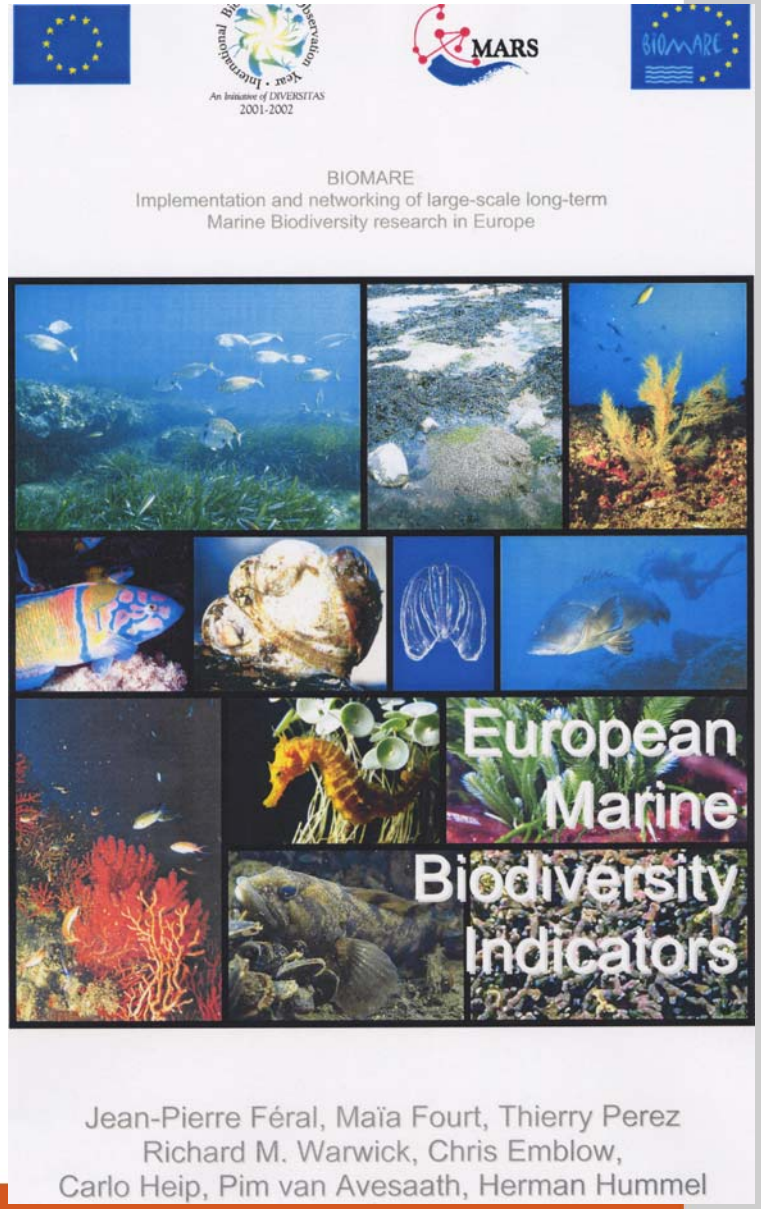
Results published in:



Book on marine biodiversity reference sites

and

Book on marine biodiversity indicators



Network of Excellence
FW6 - Thematic Priority 1.1.6.3 Global Change and Ecosystems

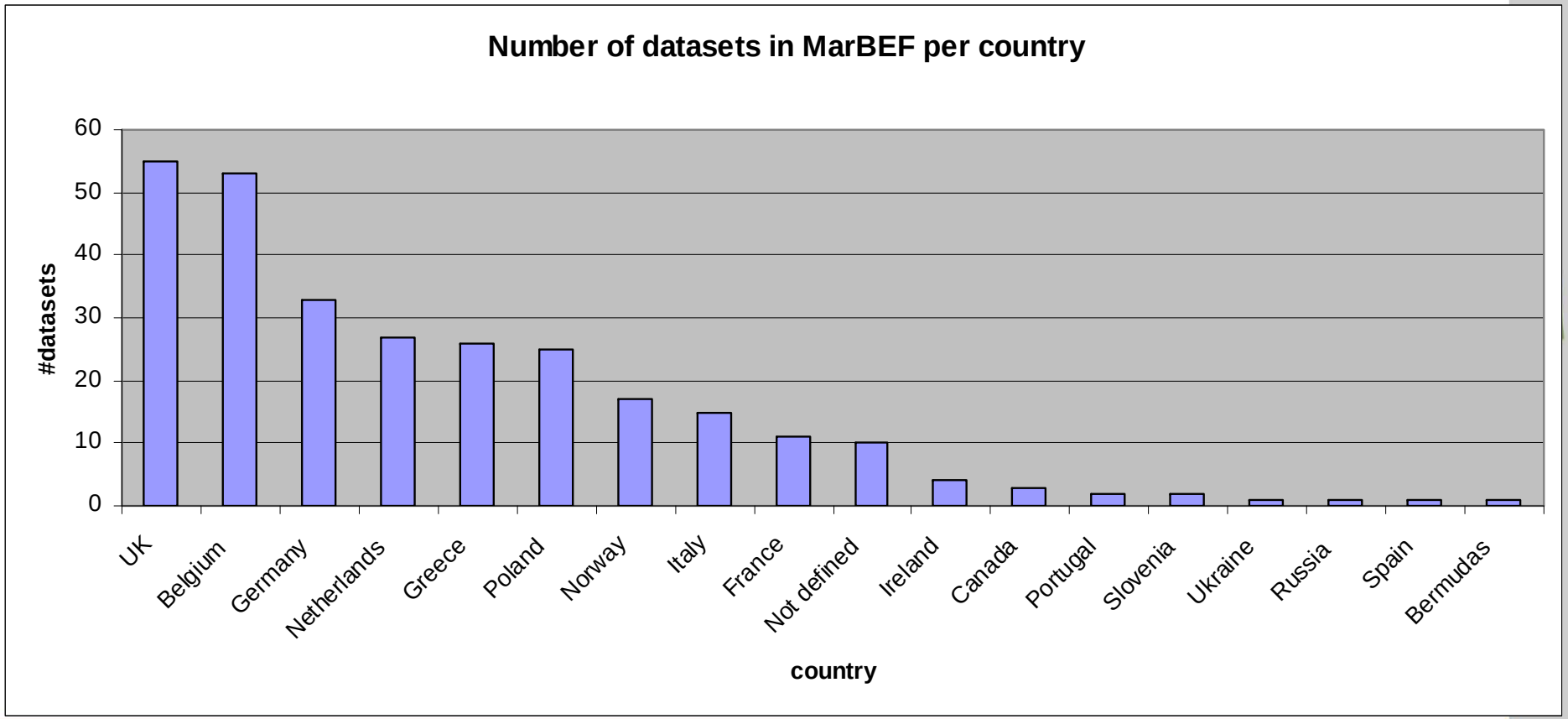
Marine Biodiversity and Ecosystem Functioning
MARBEF

General co-ordination and management

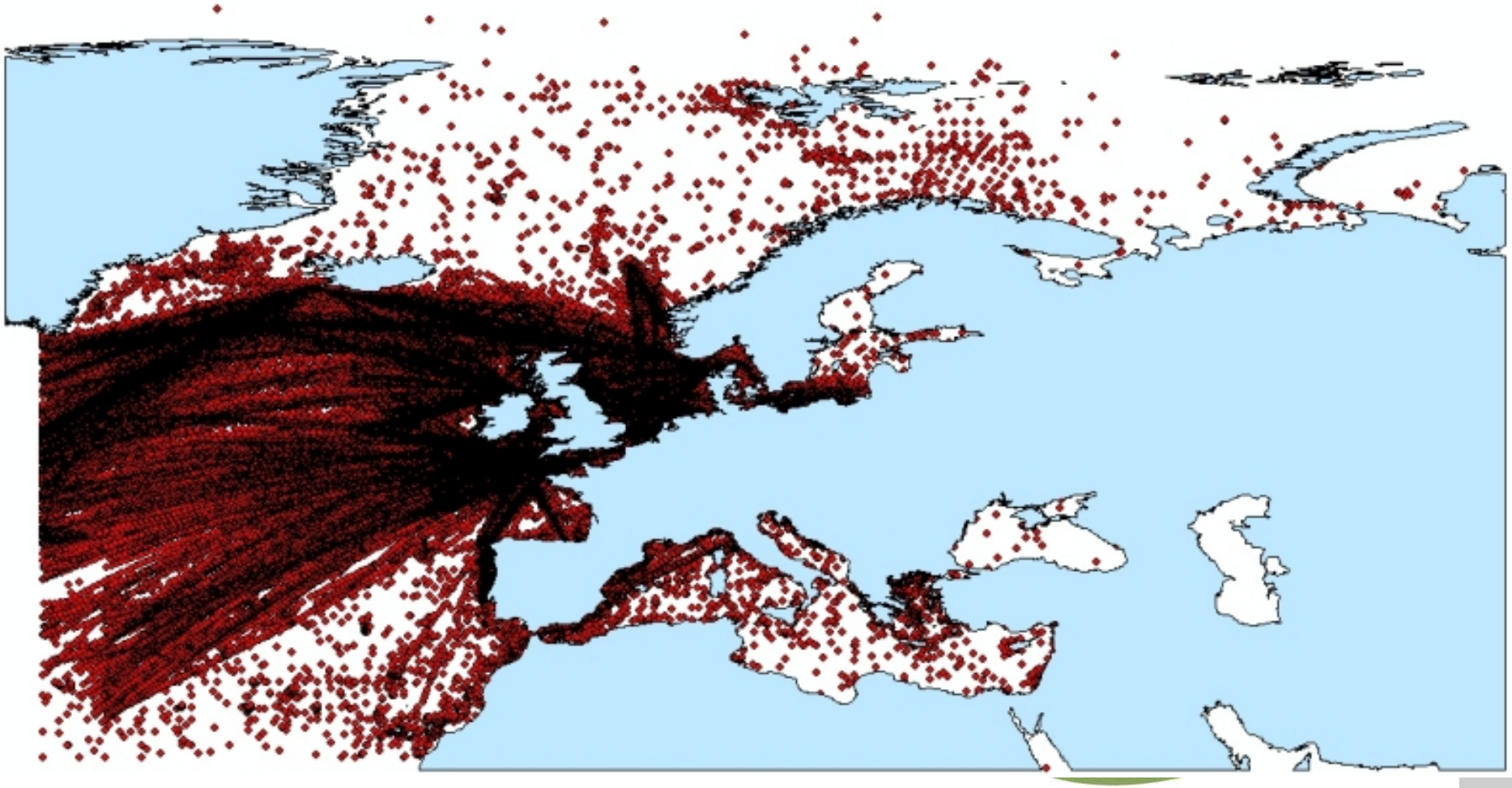
Carlo Heip, Herman Hummel, Pim van Avesaath

Netherlands Institute of Ecology
Centre for Estuarine and Marine Ecology
Korringaweg 7, 4401 NT Yerseke

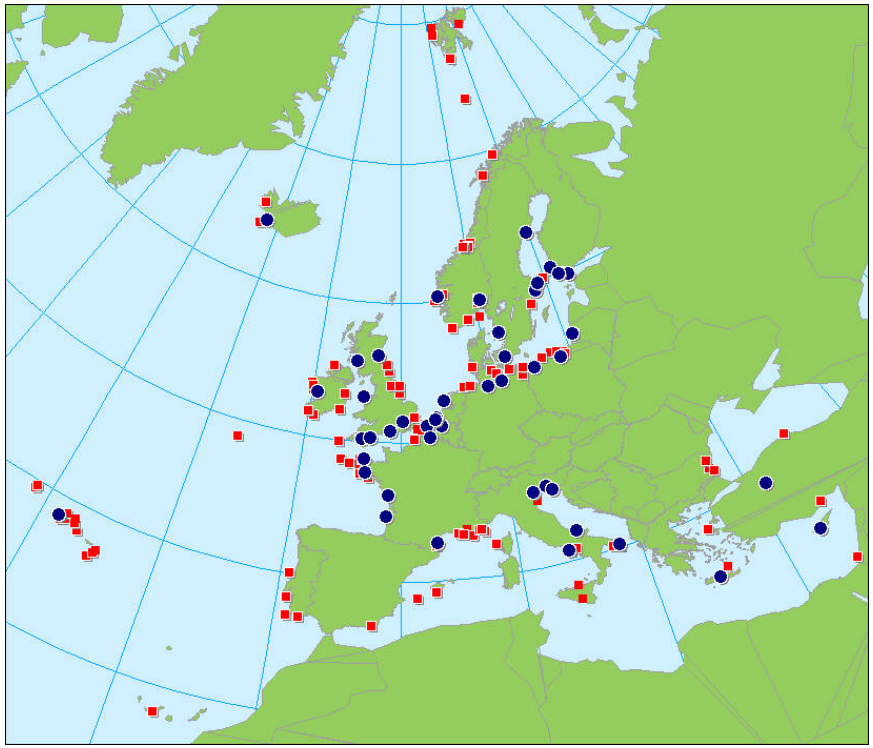
In total MarBEF has collected :
- + 4.4 million distribution records,
- on +17,000 number of species,
- from 221 datasets, of which 181 (82%) hold abundance and 20 (9%) have biomass data,
- from 94 institutions in 17 countries



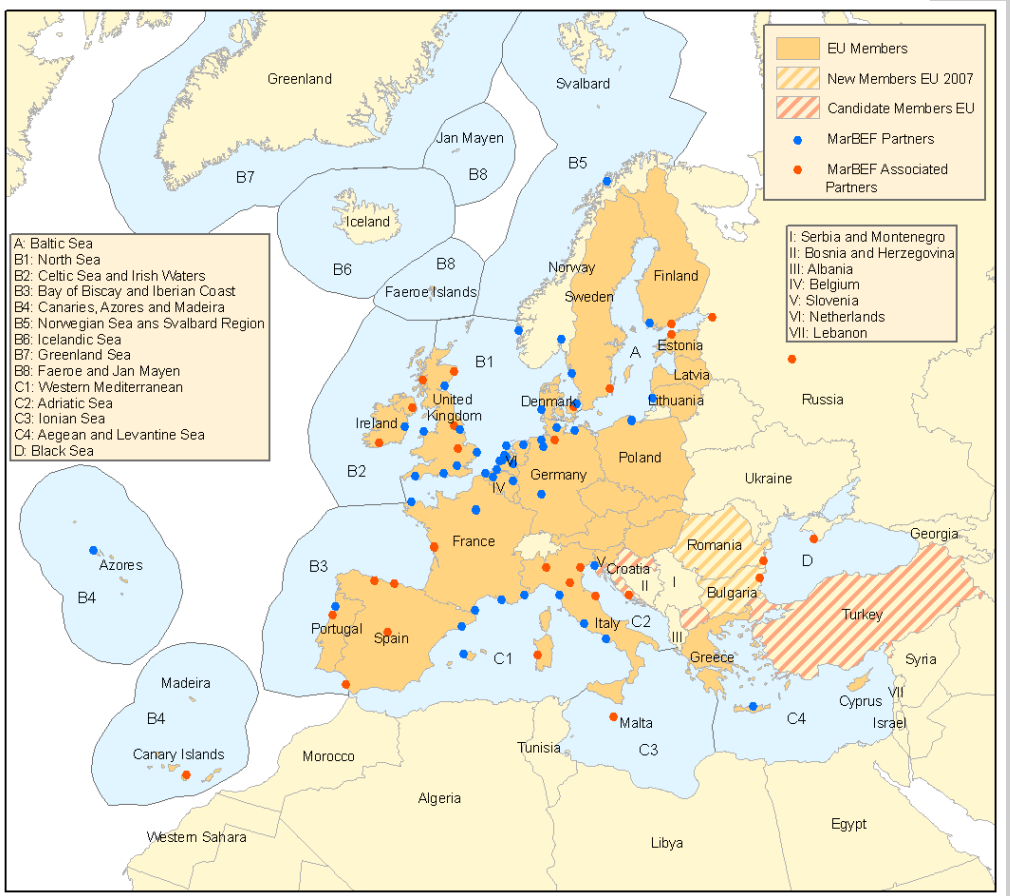
Overview of the localities holding distribution records in EurOBIS (freely accessible)



MarBEF extended the previous/existing actions by MARS, Marble, MarBENA and BIOMARE



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

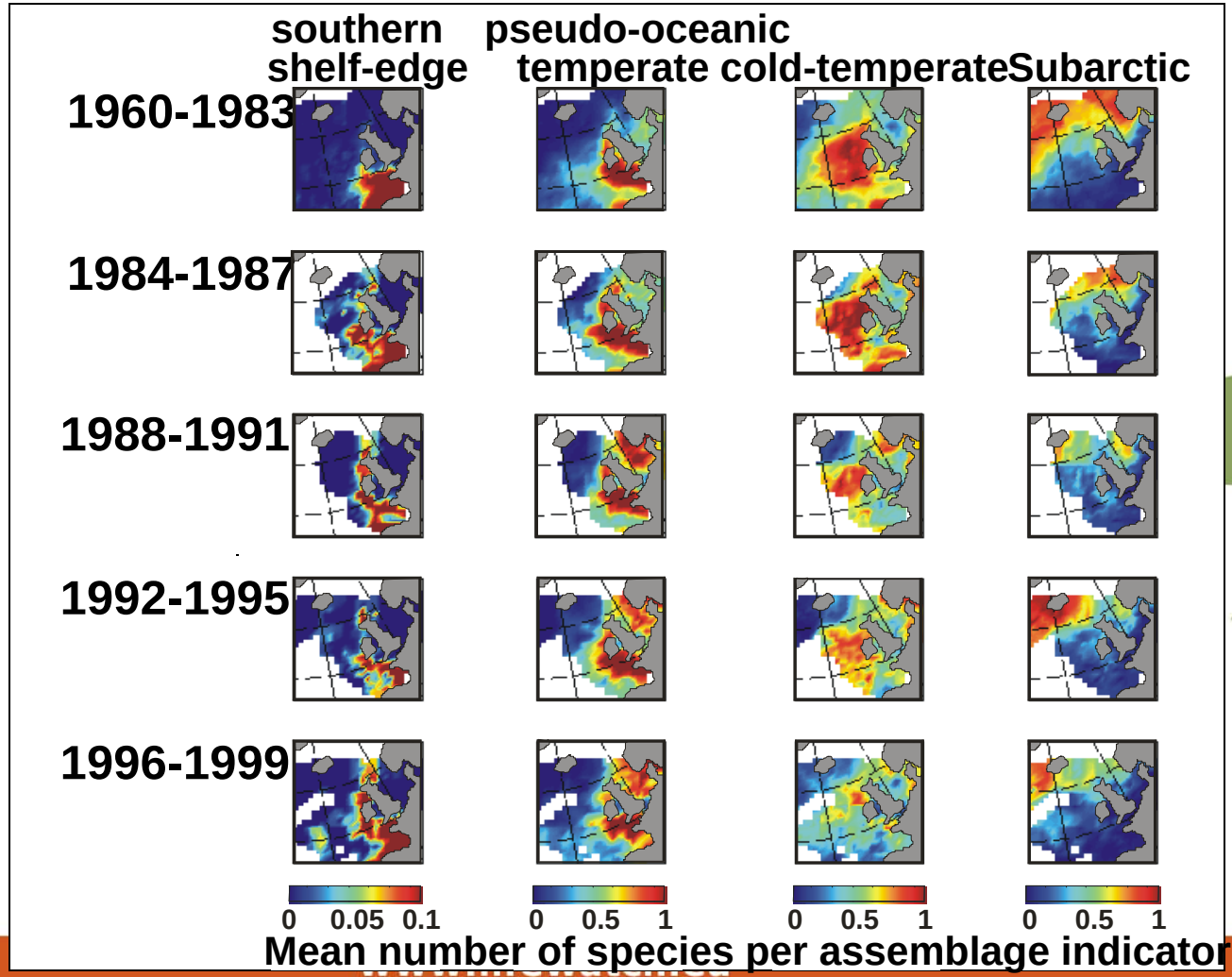


MARS members (blue dots)

BIOMARE Reference / Focal sites (red dots)

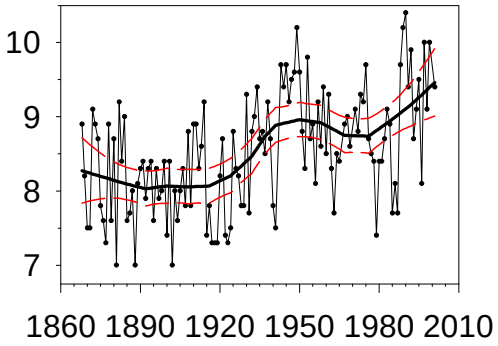
SAHFOS - Continuous Plankton Recorder Data

Long-term changes in four species assemblage indicators showing a poleward shift in the diversity of warm-water species associated with a decrease in the diversity of colder-water species



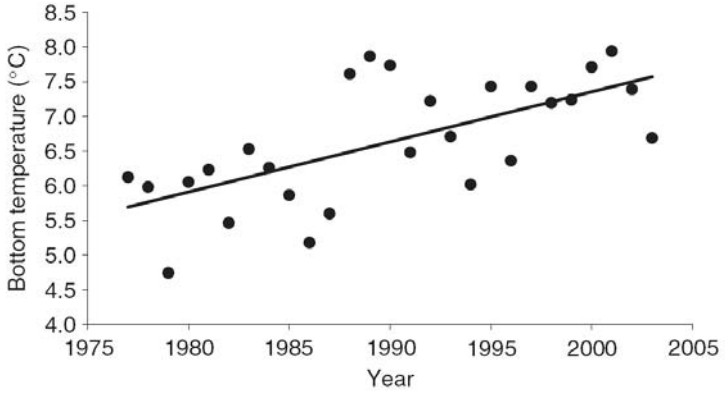
From Beaugrand et al. (2002). Science. 296: 1692-1694

Torungen, Skagerrak

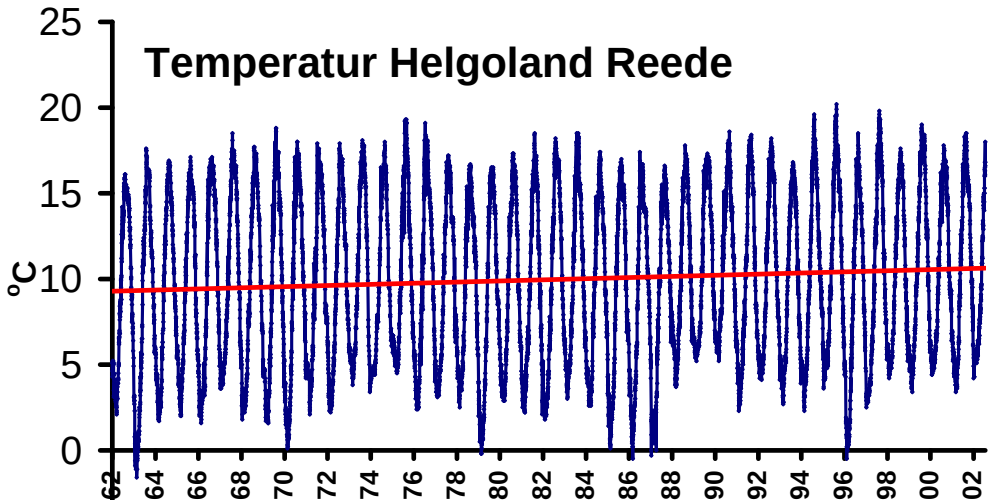


MacKenzie & Schiedek 2007
Global Change Biol.

Central North Sea



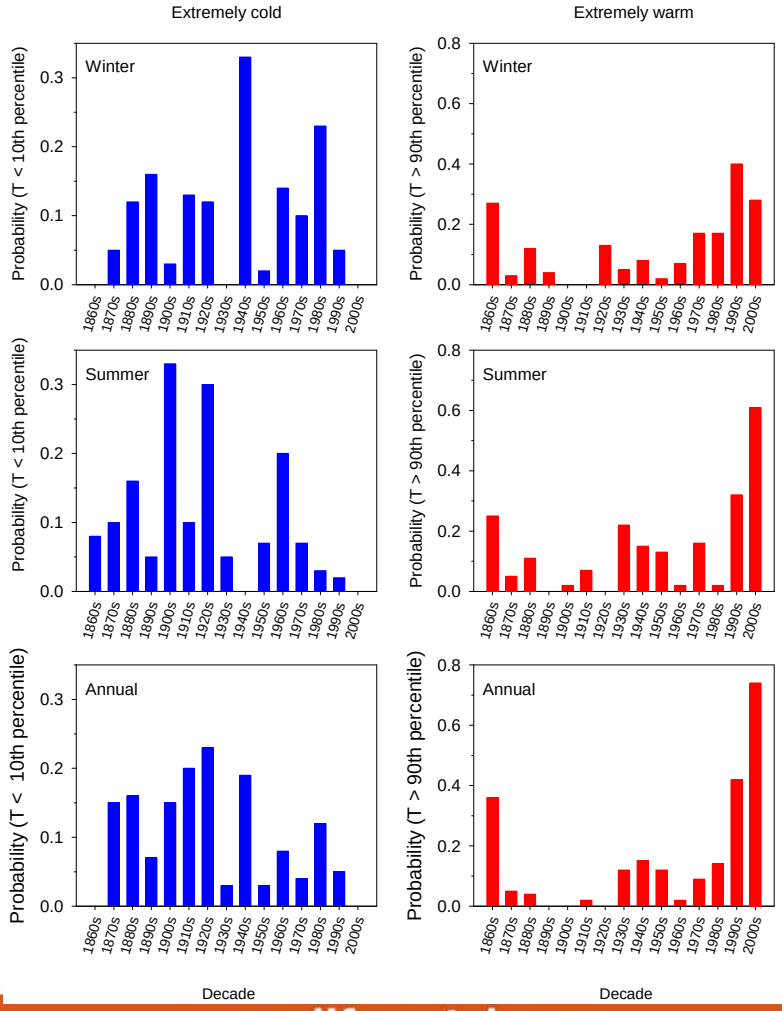
Hiddink & Ter Hofstede 2008
Global Change Biol. 14: 453-460



Karen Wiltshire, Helgoland

Mean Temperature rise of 1.13 ºC since 1960

Not only changes in average temperature but also changes in probability of Extremely Cold and Warm Years: 1860-2000

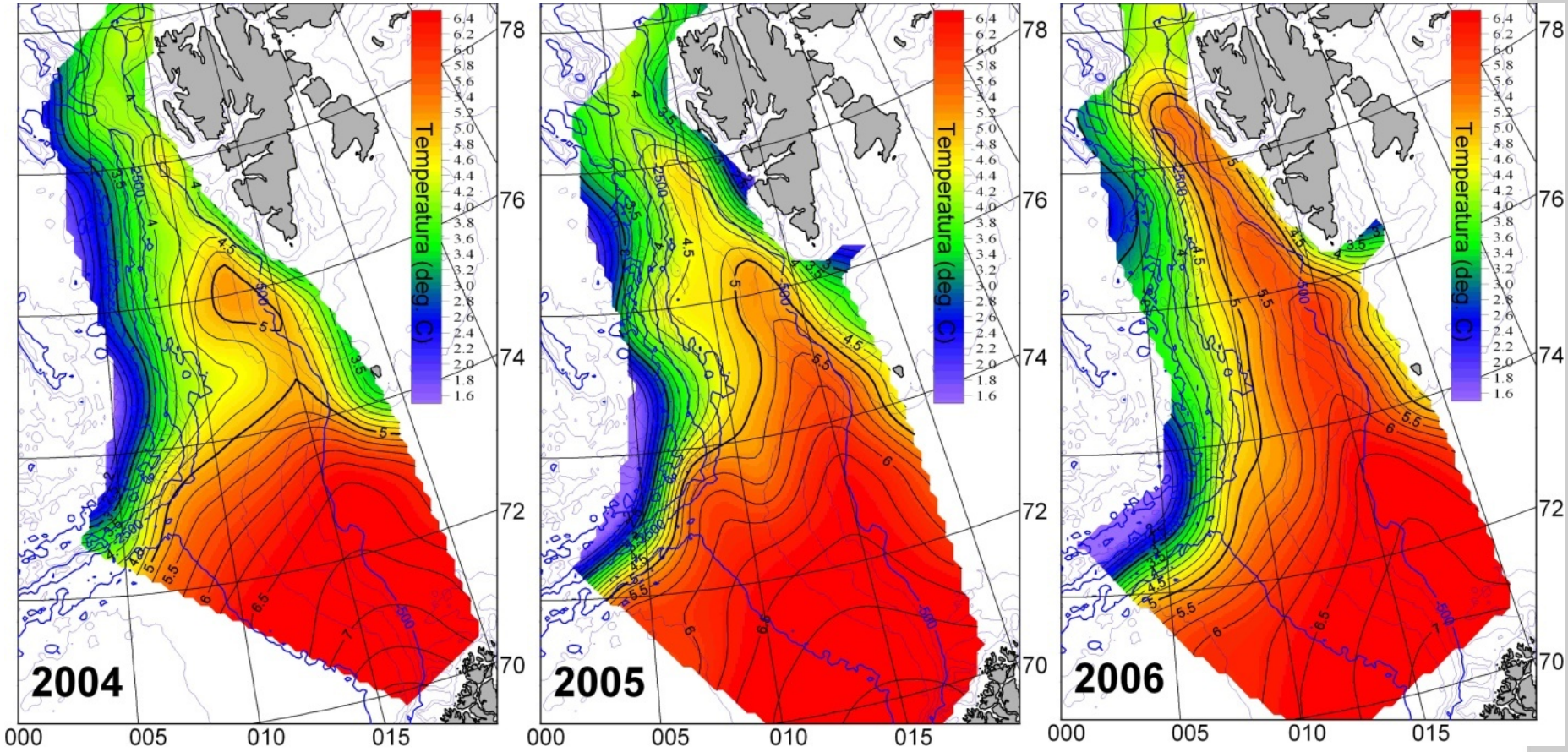


Extreme cold years becoming rarer

Extreme warm years becoming common

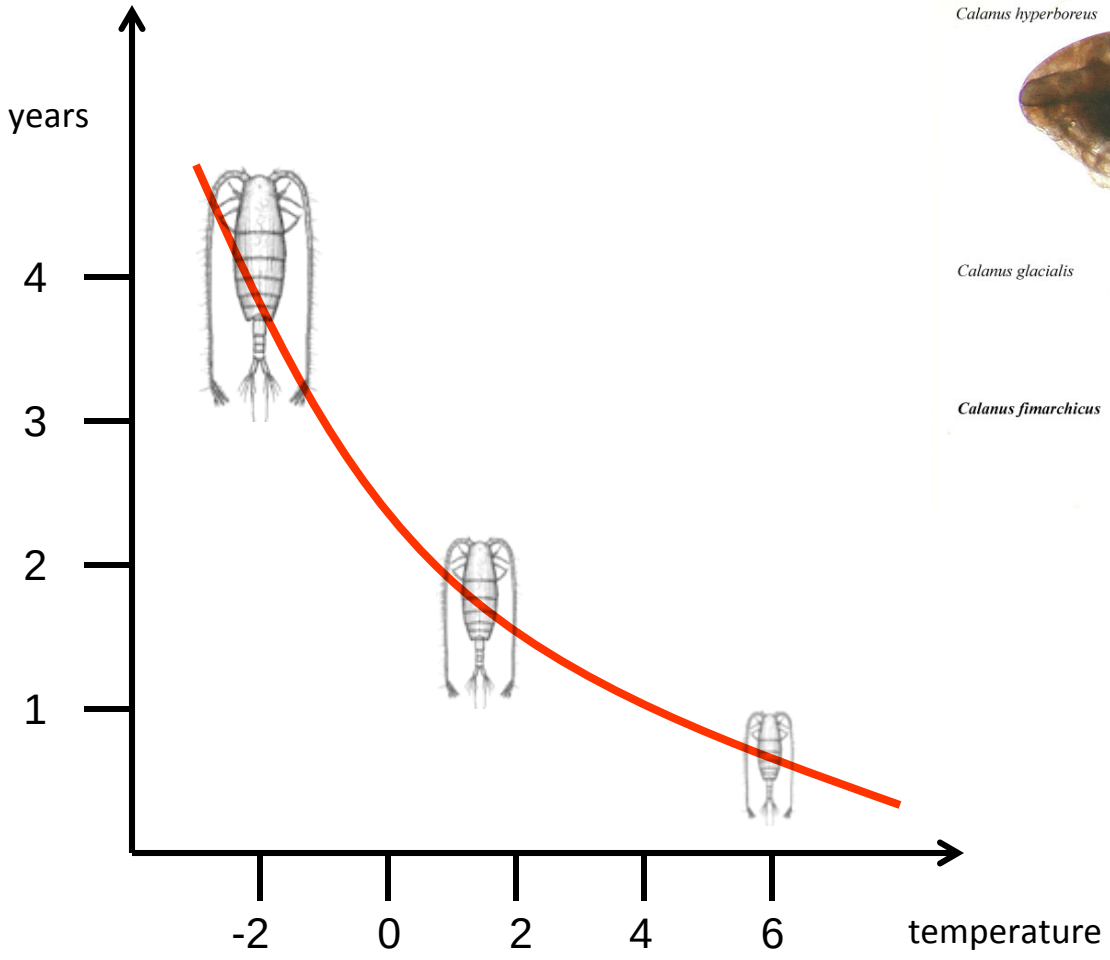
MacKenzie & Schiedek 2007
Global Change Biol.

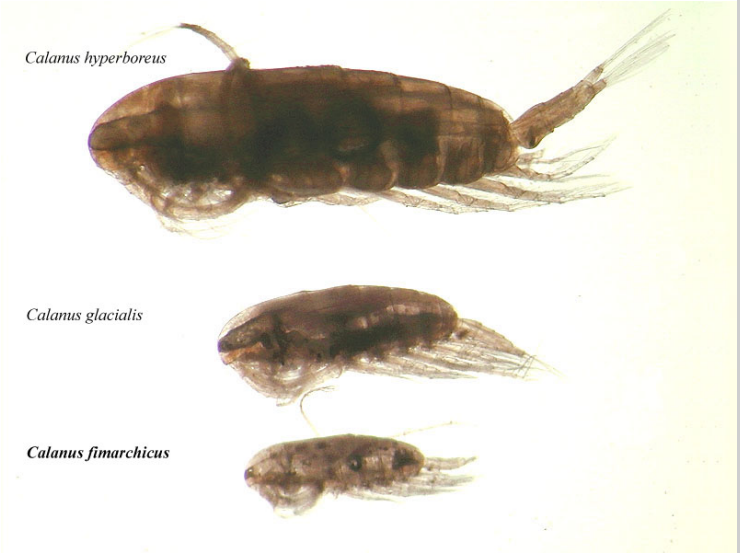
Examples of trends in (sub)Arctic

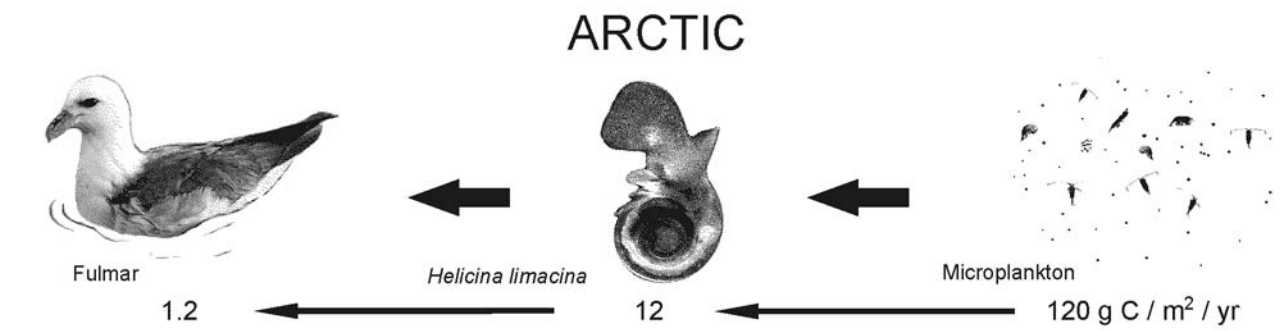


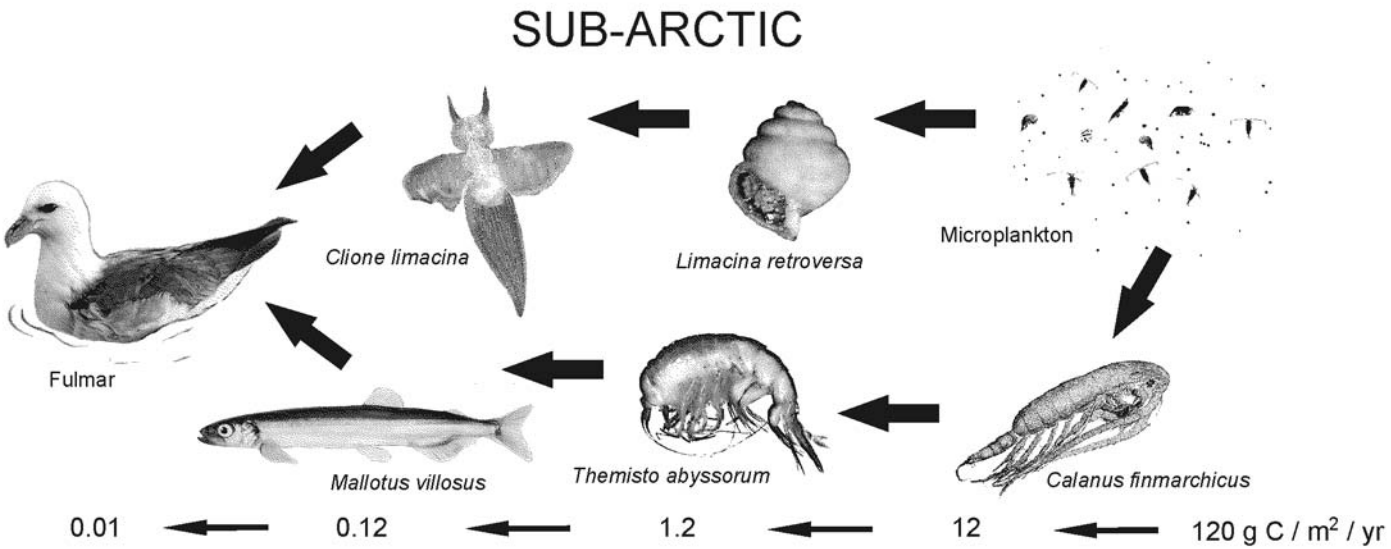
Water temperatures in the Arctic are increasing (Walczowski et al. 2007)

At higher temperatures more but smaller plankton species occur









Higher temperatures thus coincide with :

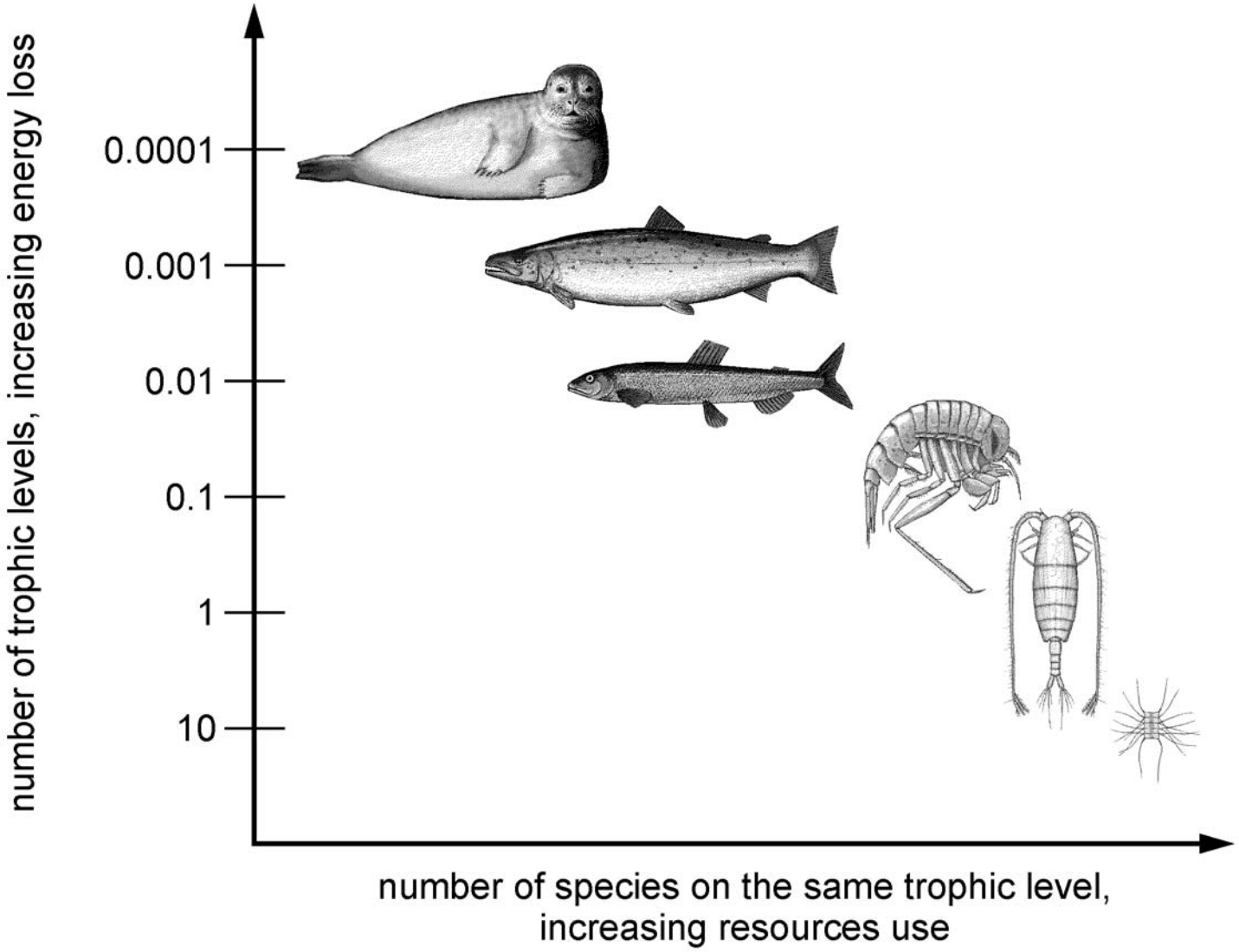
1) more species , but

2) smaller plankton species,

3) longer trophic chain length,

4) lower carrying capacity for larger predators

Surprising conclusion: Rising biodiversity in the Arctic may threat higher trophic levels

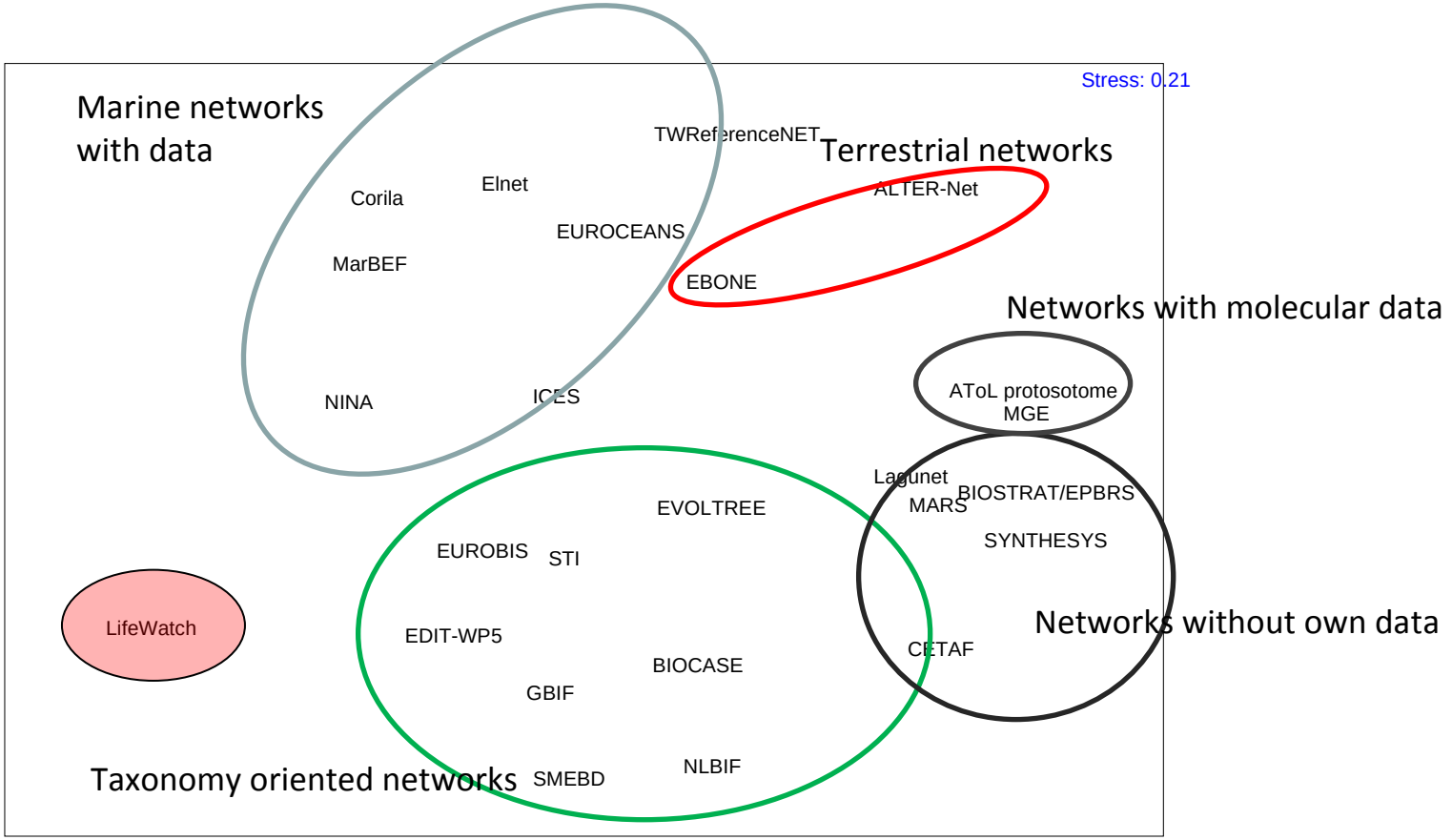


Thus, not the number, but the uniqueness of species counts

Little auks – change indicators

Fot. Cornelius Nelo

Multidimensional scaling analysis of the science network environment in Europe (based on the aims/scope of the networks)

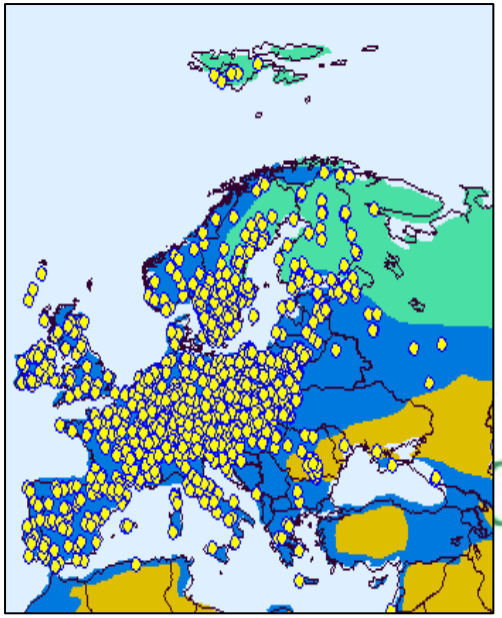


Strong separation into groups of networks along their major science discipline, i.e. terrestrial, marine, taxonomic and collection, molecular issues.

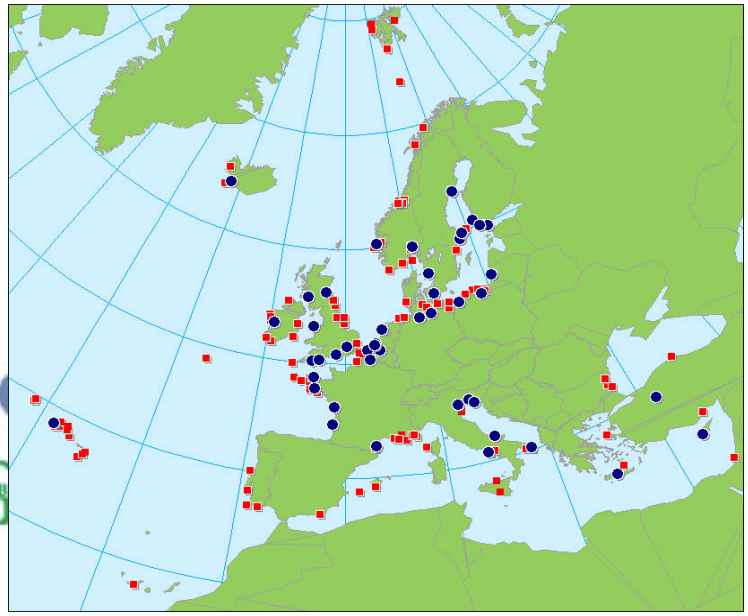
LifeWatch has a unique position.

The past and existing science Networks helped constructing LifeWatch

Terrestrial LTER sites



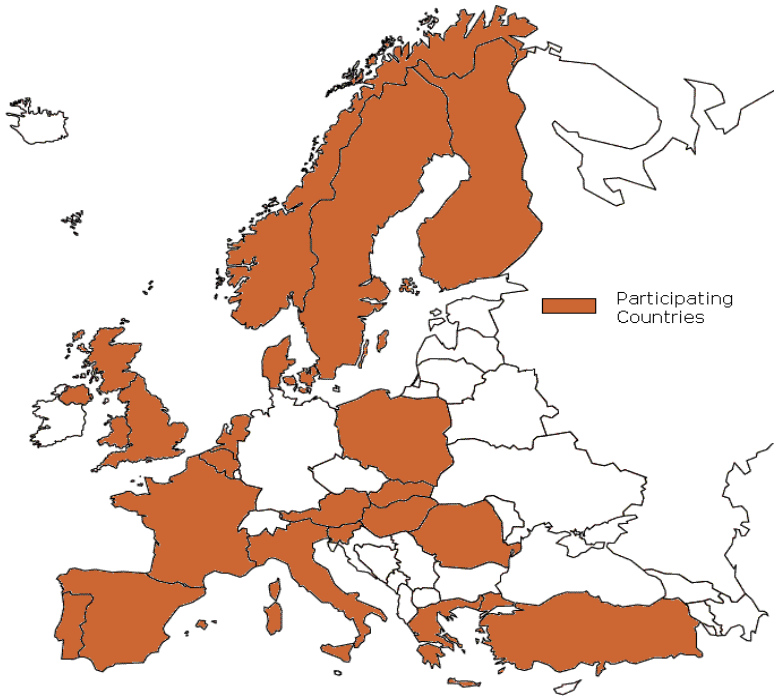
Marine sites



Natural science collections

LifeWatch

e-Science and Technology Infrastructure for biodiversity data and observatories

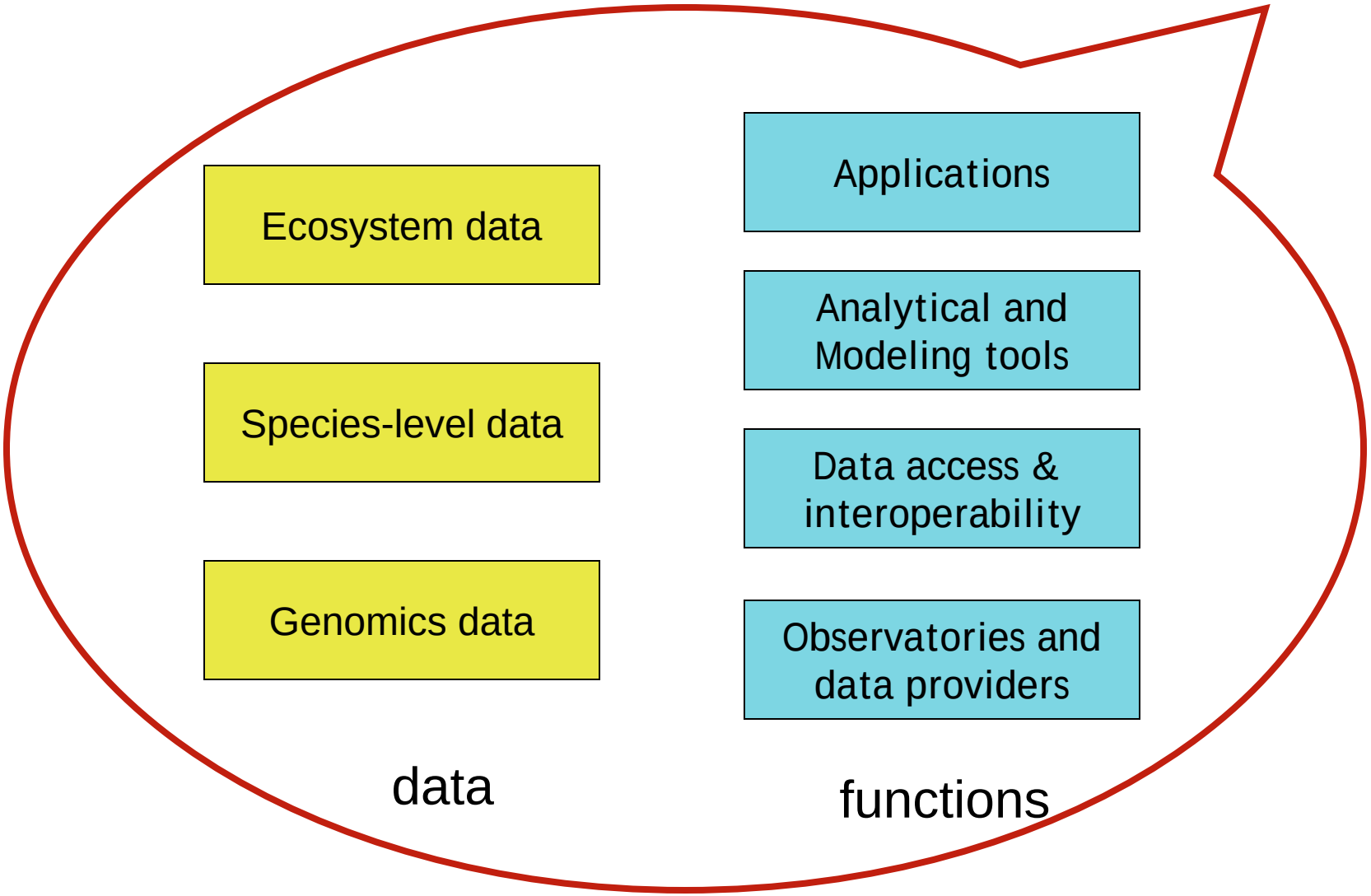


Vision and Ambition

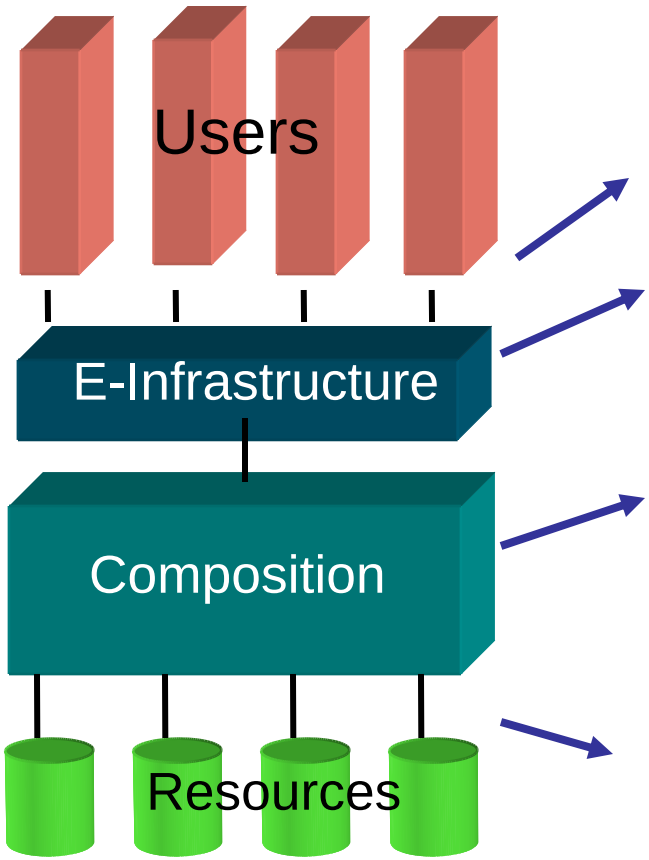
- Unravel biodiversity from the genetic level to the ecosystem
- Innovative design for a novel large-scale methodological approach

For researchers and policy makers, private and public sector

Infrastructure

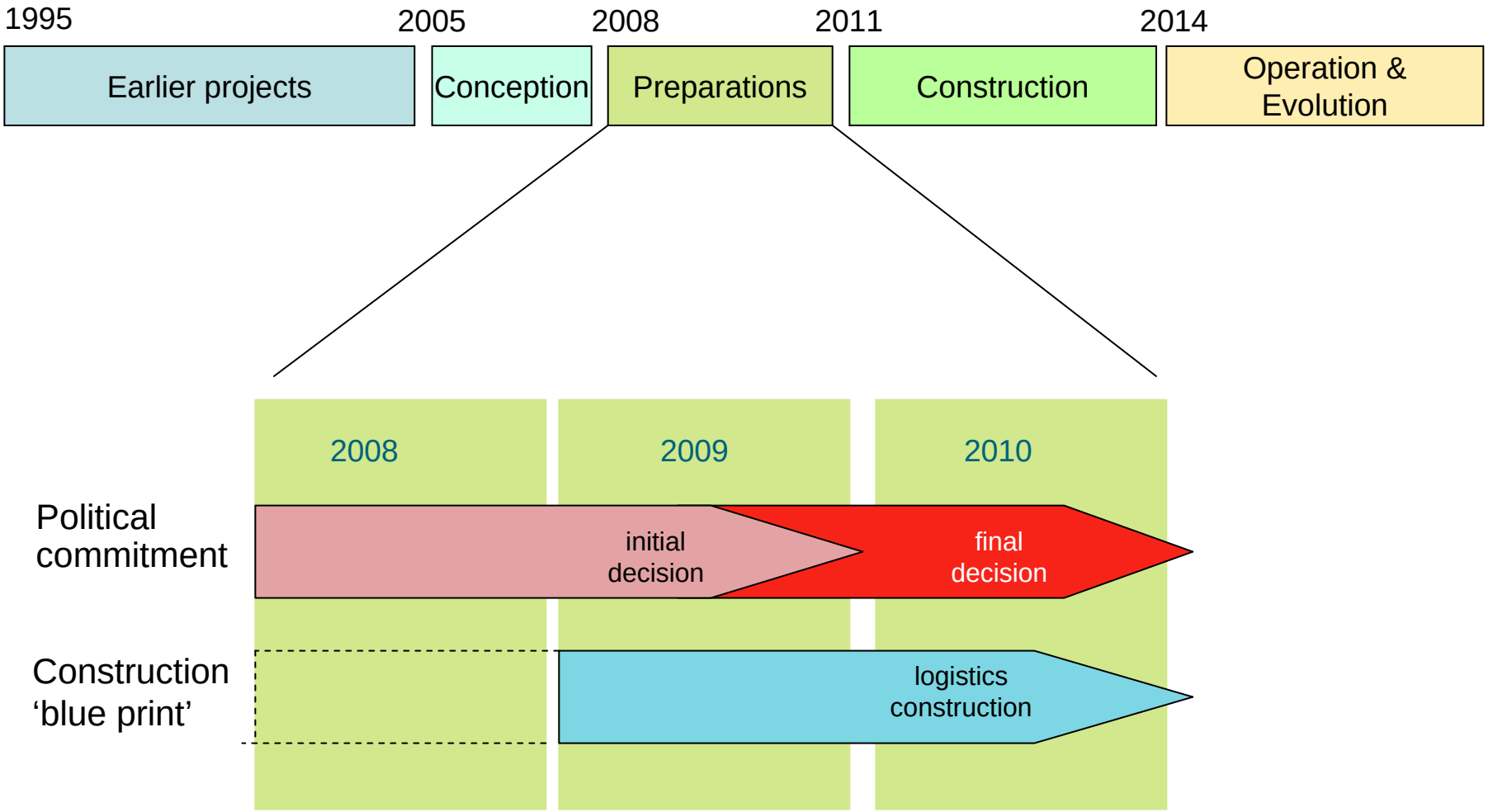


Architecture



- Collaboration
  - Common Exploratory Environment
  - Collaborative Virtual Organisations
- Semantic annotation
  - Supporting different scientific views of the data
- Analysis and processing
  - Integration of resources
  - Documented, shared workflows
  - Grid computation
- Data repository and digitization of specimen-based data
- Lightweight instrument networks and sensor networks
- Modelling software and computation

The Life Watch life cycle



Good luck and **Thank you for your attention**

www.marbef.org
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