Royal Netherlands Institute for Sea Research

European Infrastructure for Marine Biodiversity Assessment

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European Institute for the Study of Marine Biodiversity and Ecosystem Functioning

MarBEF+

3d Meeting of the Expert Group on Marine Research Infrastructure

Brussels 7-8 September 2010

What is biodiversity?

- Genes, species, habitats (definition of the Convention on Biological Diversity)
- Marine biodiversity research investigates marine species, their genes and gene products, and the coastal and open sea habitats in which they live.
- Focus predominantly on species (species richness, species diversity), increasingly also on genes and gene products and habitats (ecosystems).
- Taxonomy, Ecology, Biogeochemistry, Fisheries, Ecosystem Management, Conservation etc.

Species

The number of marine species

- The number of known marine species is about 230,000 (Bouchet, 2006)
- This is much lower than on land, but life in the oceans is far more diverse at higher taxonomic levels for almost all animal groups except the arthropods.

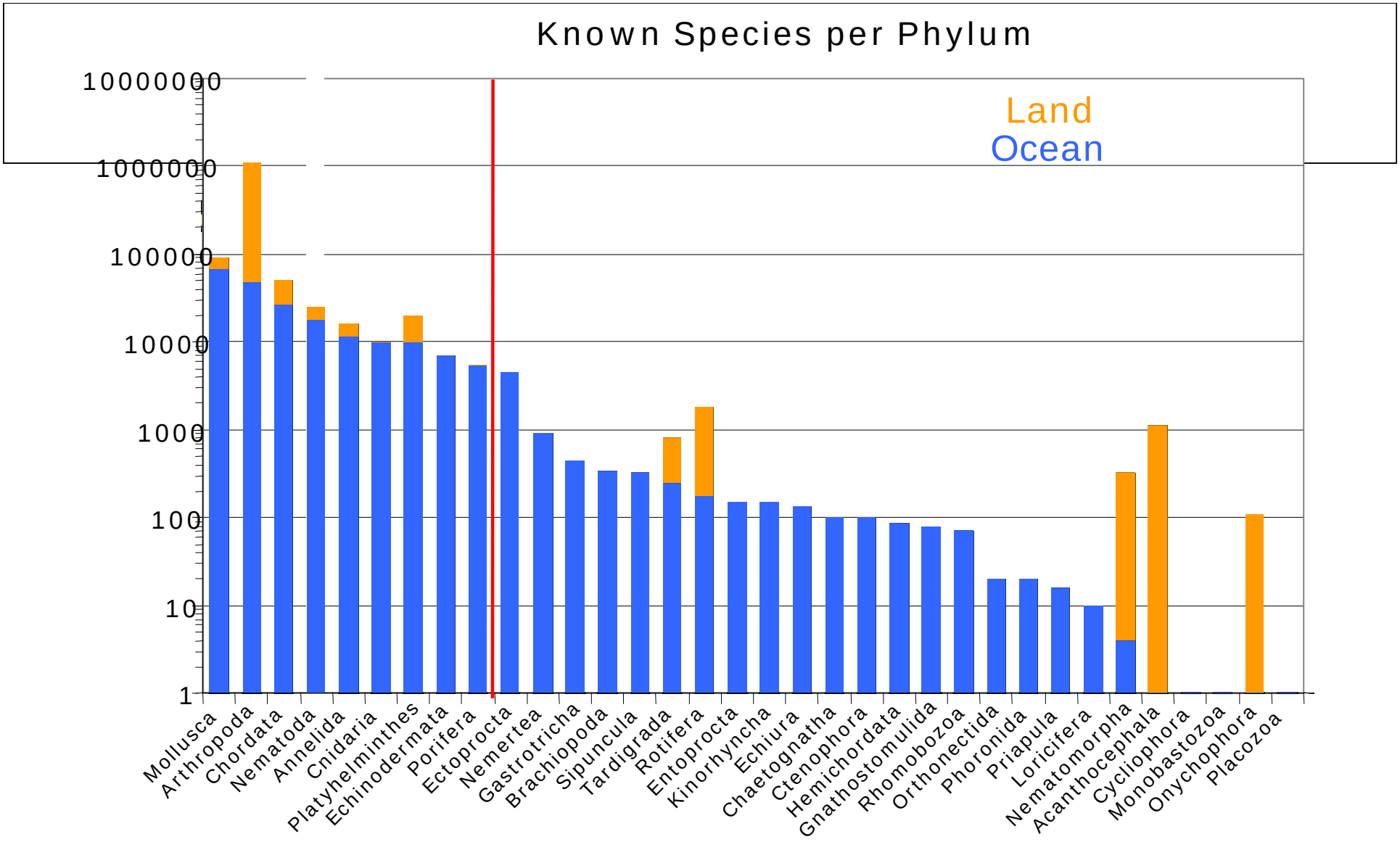
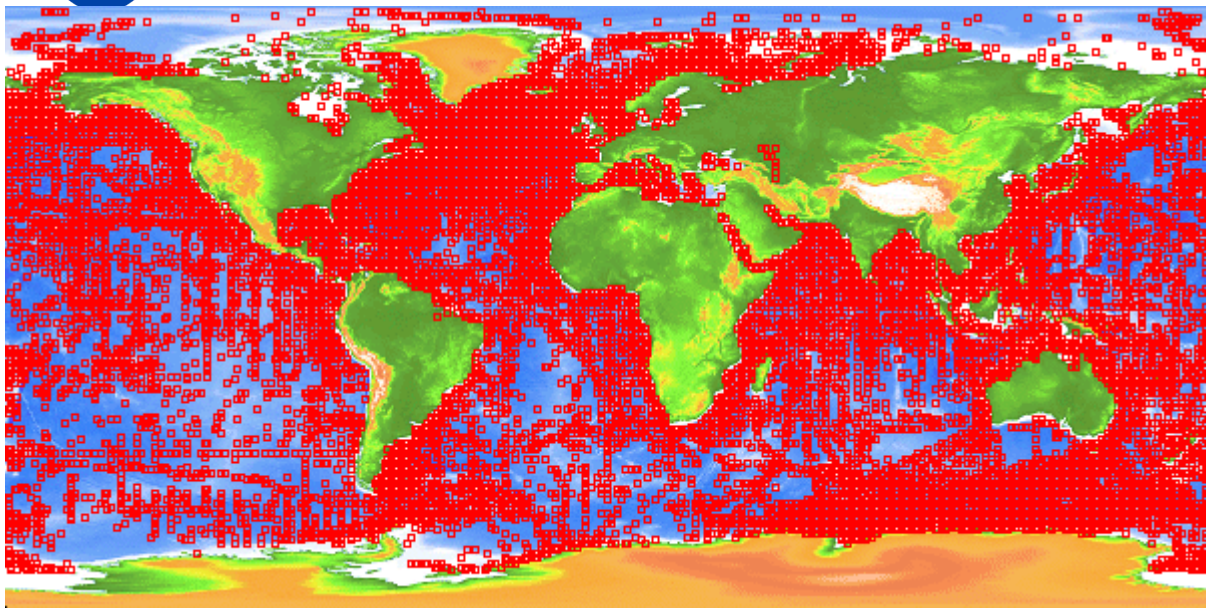


Figure 9A. Ranked animal phyla by identified marine species. Land diversity (orange) is high, but limited to a few groups. The exclusively marine phyla (13) contain 90% of the genetic diversity but less than 5 percent of marine species. Analysis focuses on nine phyla above red line. Blue stripes - estimated unknown nematode species. Major groups: Archaea, Bacteria and Eukarya. Uni-cellular protists, plants, and animals are Eukarya. Animalia contains 33 phyla. (Brusca and Brusca, 2003)

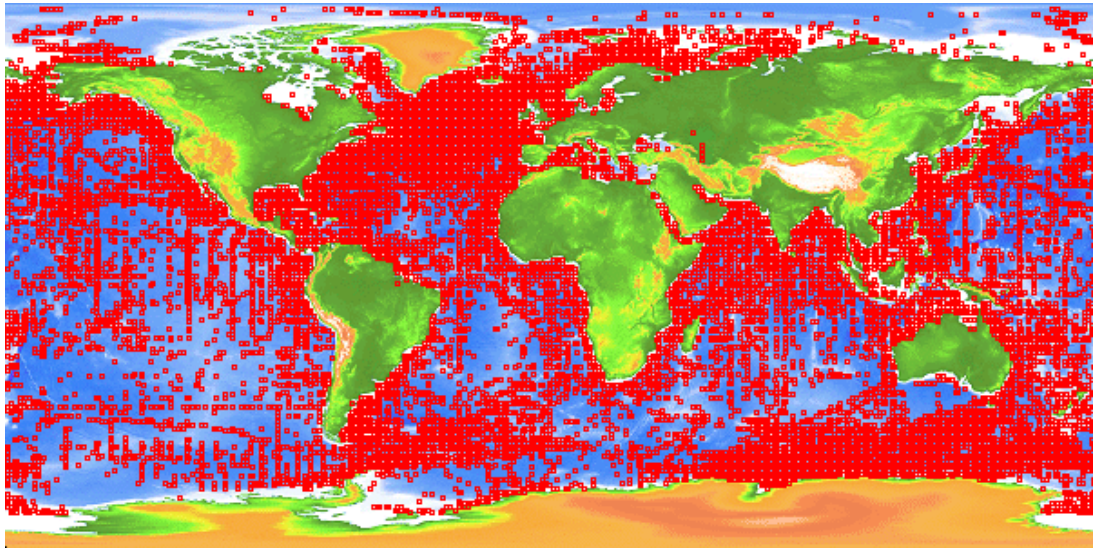
How many marine species to be found?

- OBIS: The Ocean Biogeographic Information System of the Census of Marine Life

OBIS: www.iobis.org



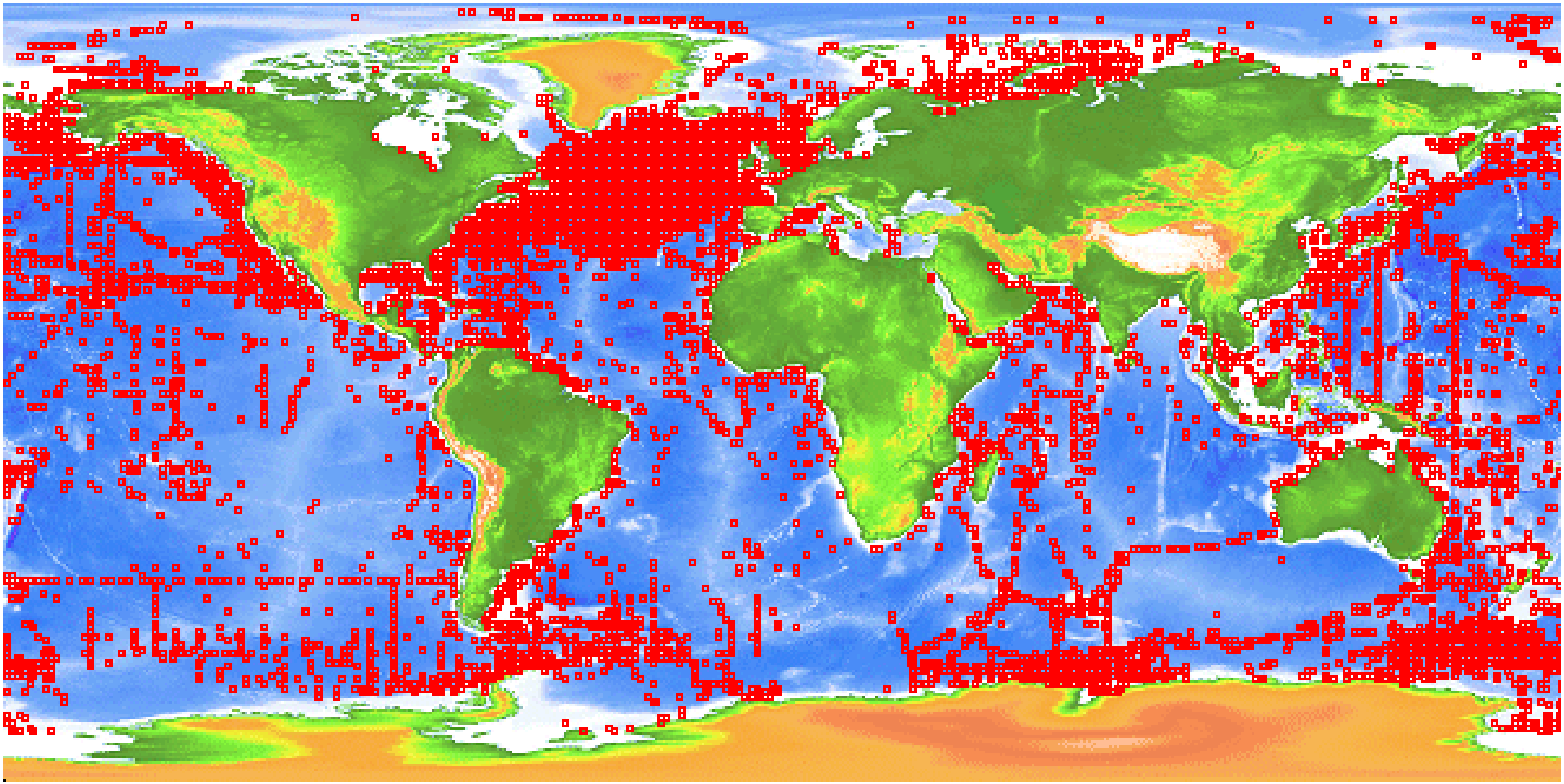
Currently in OBIS (Dec. 2009):
21.9 million records of 108,000 species from 707 databases



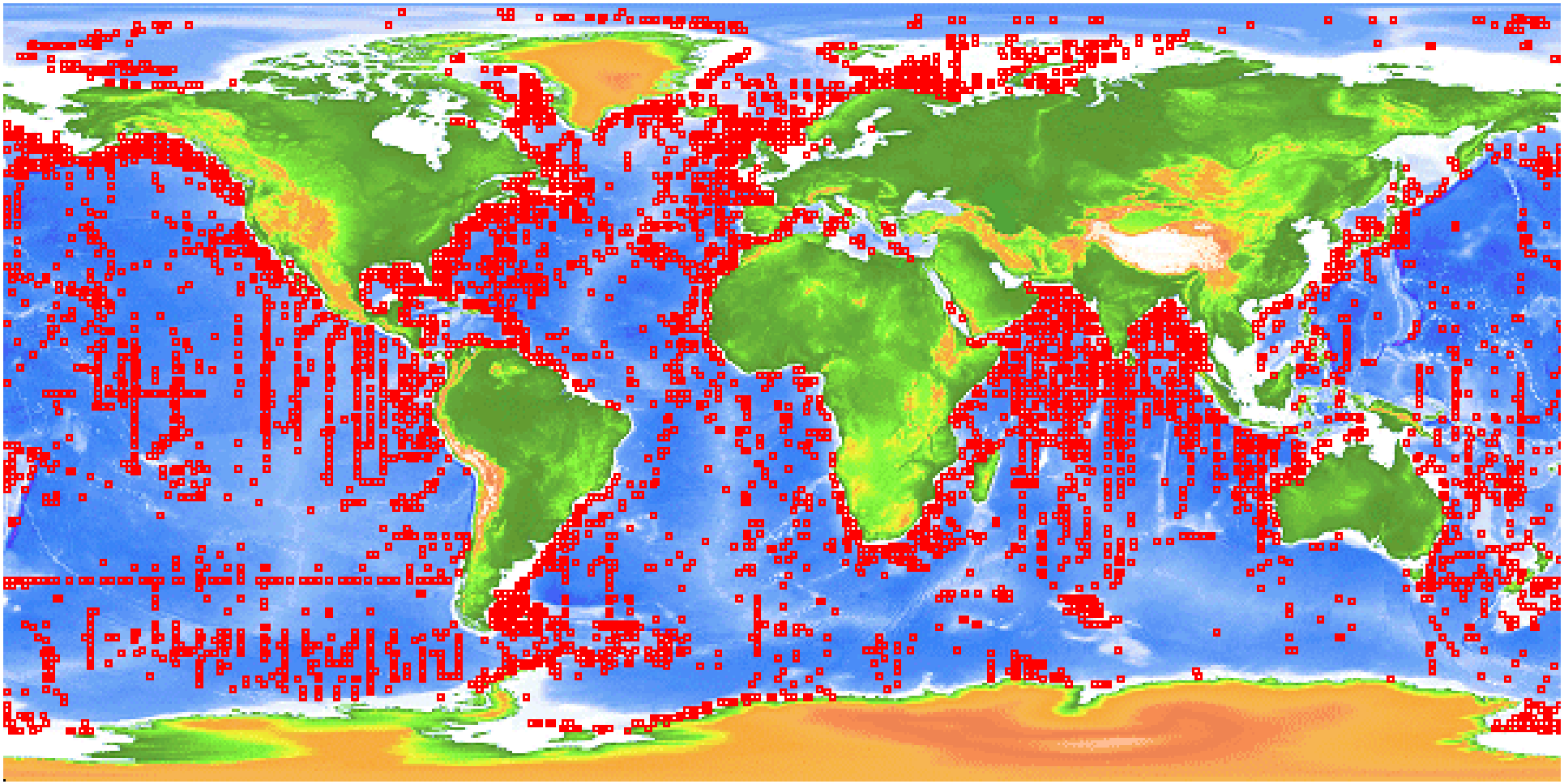
2008: 16.7 million records
2007: 13.6 million records
2006: 10 million records
2005: 5 million records

Filling in the data gaps – Southern Hemisphere, deeper waters, taxonomic groups

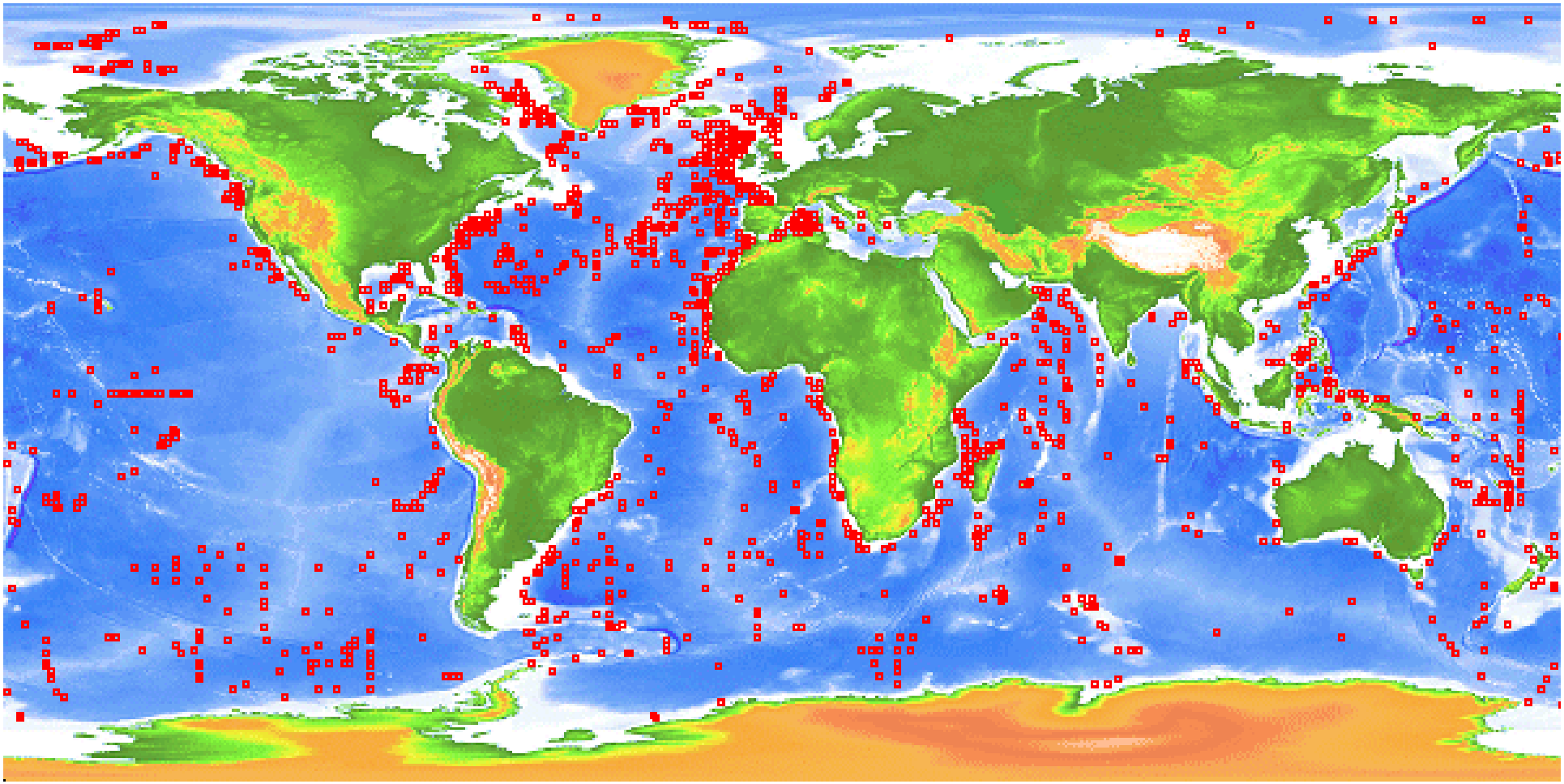
< 100 meters



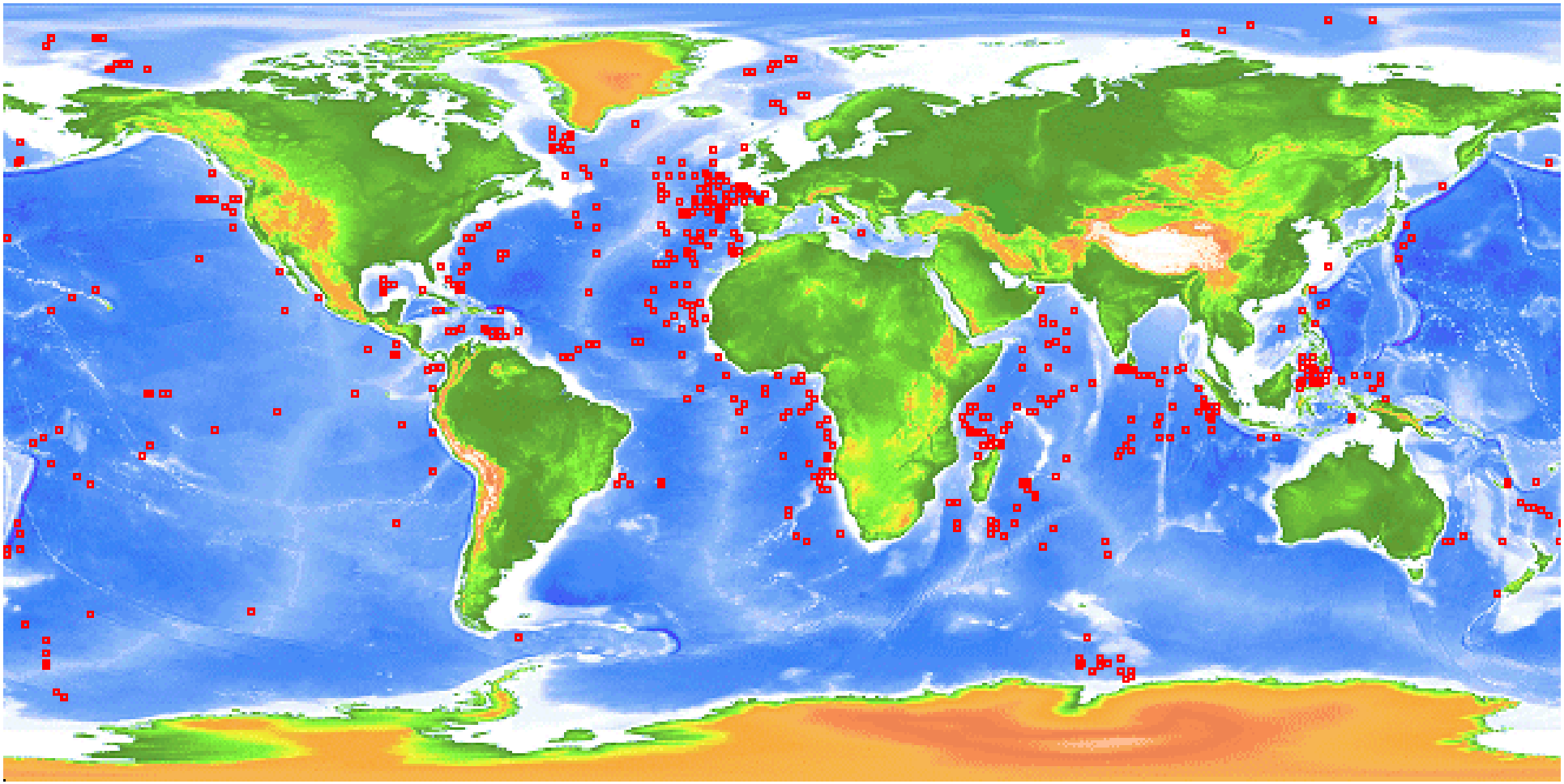
100-1000 meters

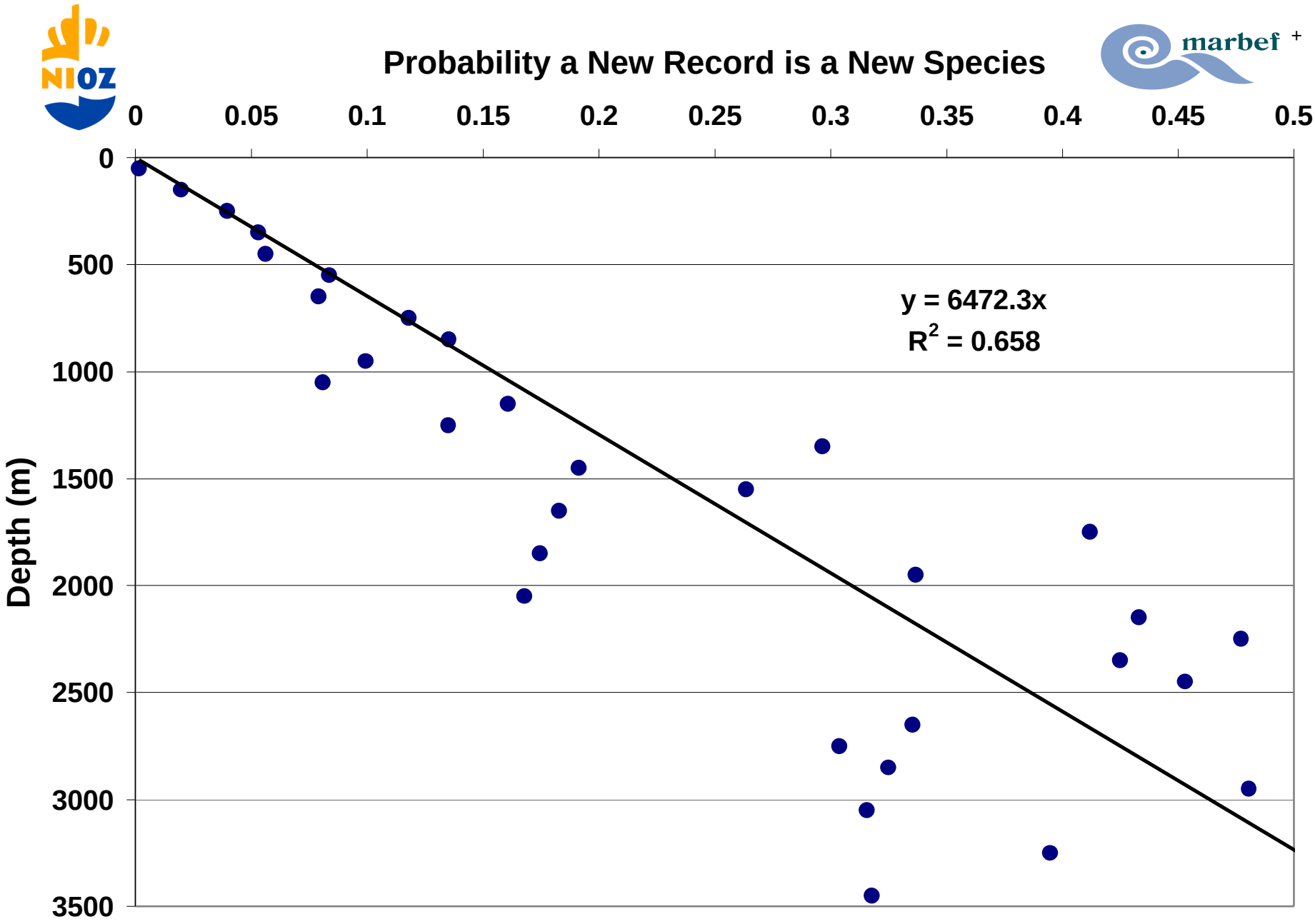


1000-3000 meters



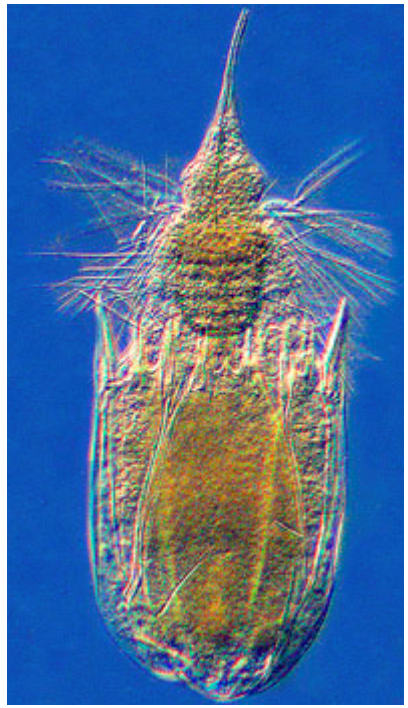
> 3000 meters




Probability a New Record is a New Species
0
0.05
0.1
0.15
0.2
0.25
0.3
0.35
0.4
0.45
0.5
Depth (m)
0
500
1000
1500
2000
2500
3000
3500
y = 6472.3x
R2 = 0.658

New animal phyla

- Loricifera
- Cicliophora
- Xenoturbella?



comments on this story

Stories by subject

- Cell and molecular biology
- Earth and Environment
- Evolution and palaeontology
- Microbiology

Stories by keywords

- Loricifera
- anoxic
- Metazoans
- Oxygen-free
- Multicellular evolution
- Deep sea
- Anaerobic
- Meiofauna

This article elsewhere

Blogs linking to

Published online 6 April 2010 | *Nature* **464**, 825 (2010) | doi:10.1038/464825b

News

Animals thrive without oxygen at sea bottom

Creatures found where only microbes and viruses were thought to survive.

Janet Fang

Living exclusively oxygen-free was thought to be a lifestyle open only to viruses and single-celled microorganisms. A group of Italian and Danish researchers has now found three species of multicellular animal, or metazoan, that apparently spend their entire lives in oxygen-starved waters in a basin at the bottom of the Mediterranean Sea.

The discovery "opens a whole new realm to metazoans that we thought was off limits", says Lisa Levin, a biological oceanographer at Scripps Institution of Oceanography in La Jolla, California.

Some loriciferans live in anoxic sediments.

most recent | commented

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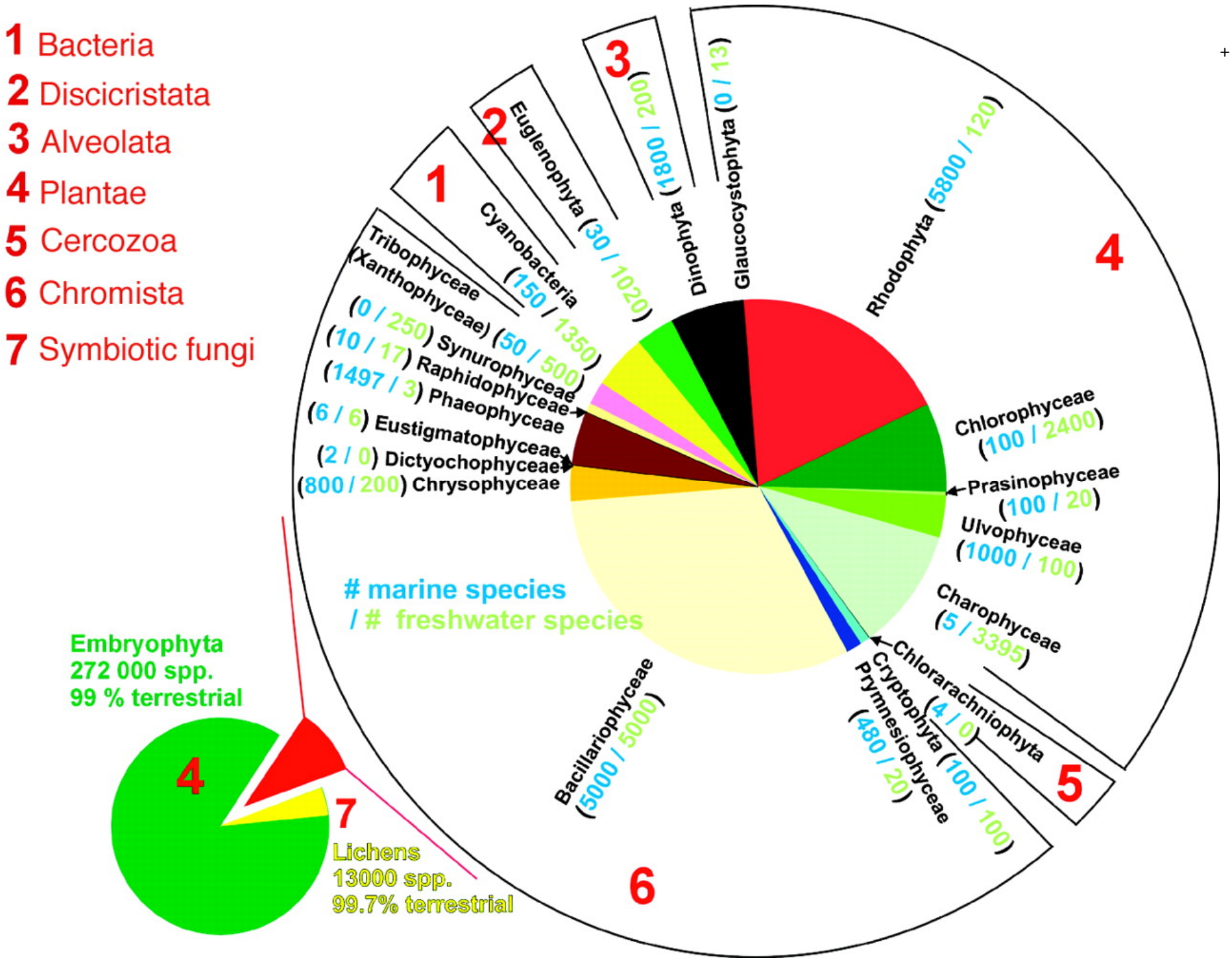
Plants?

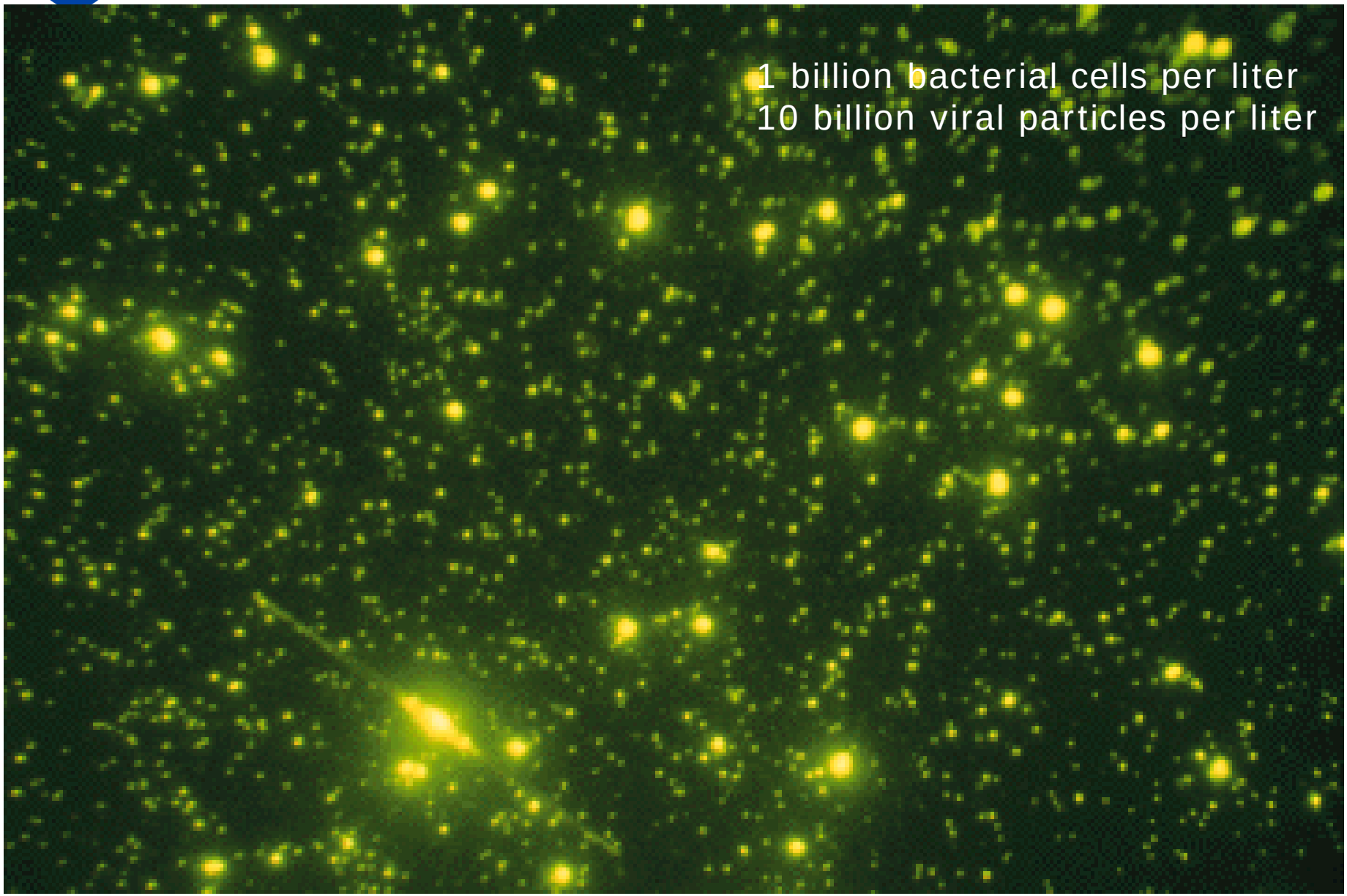

1 Bacteria
2 Discicristata
3 Alveolata
4 Plantae
5 Cercozoa
6 Chromista
7 Symbiotic fungi
1
2
3
4
5
6
7
Cyanobacteria (150 / 1350)
Euglenophyta (30 / 1020)
Dinophyta (1800 / 200)
Glaucocystophyta (0 / 13)
Rhodophyta (5800 / 120)
Chlorophyceae (100 / 2400)
Prasinophyceae (100 / 20)
Ulvophyceae (1000 / 100)
Charophyceae (5 / 3395)
Chlorarachniophyta (4 / 0)
Cryptophyta (100 / 100)
Prymnesiophyceae (480 / 20)
Bacillariophyceae (5000 / 5000)
Tribophyceae (Xanthophyceae) (50 / 500)
(0 / 250) Synurophyceae
(10 / 17) Raphidophyceae
(1497 / 3) Phaeophyceae
(6 / 6) Eustigmatophyceae
(2 / 0) Dictyochophyceae
(800 / 200) Chrysophyceae
marine species
/ # freshwater species
Embryophyta
272 000 spp.
99 % terrestrial
Lichens
13000 spp.
99.7% terrestrial

Europe?

Over 31000 marine species now known from European waters

- The European Register of Marine Species (including only plants and animals) as maintained by MarBEF grew with 1,371 species since 2006. The list now (2009) totals 31,455 marine species of plants and animals in Europe, which makes this the best known continent thanks to efforts of hundreds of taxonomists and ecologists.
- More than 136 plant and animal species found since 2006 are new to science, but in the microbial domain the number of new ‘species’ has grown exponentially.

How many marine microbes?


1 billion bacterial cells per liter
10 billion viral particles per liter

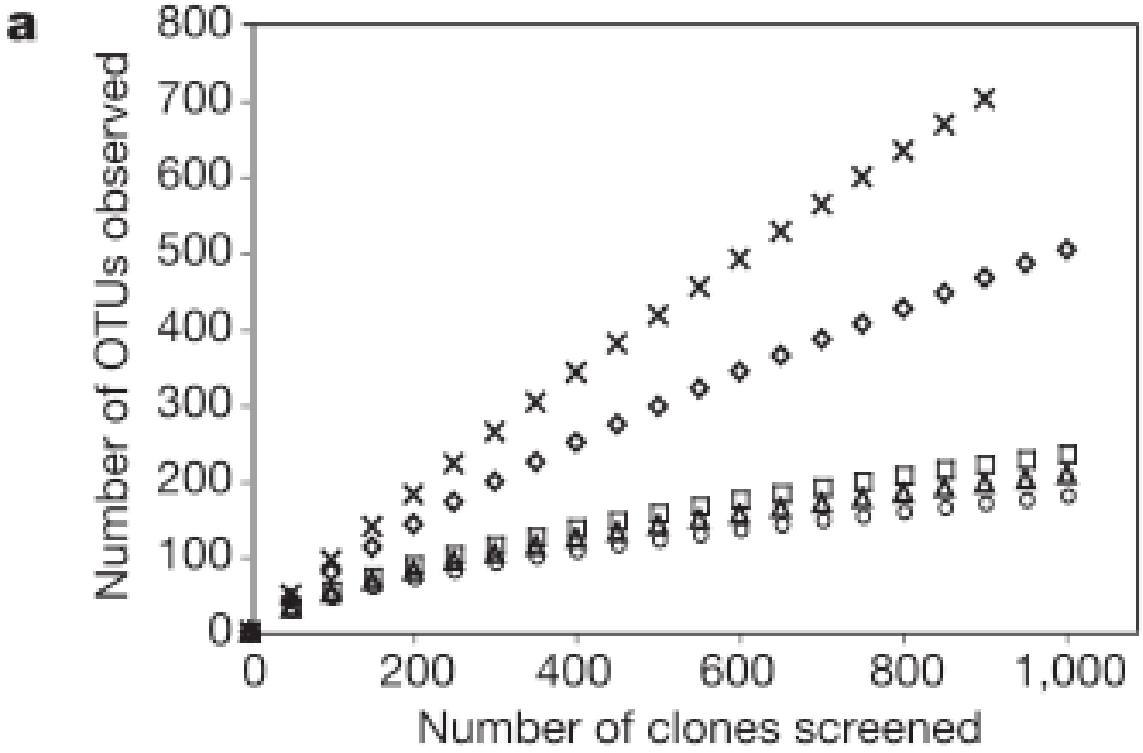
commentary

More than meets the eye

Earth's real biodiversity is invisible, whether we like it or not.

Ocean Microbe Census Discovers Diverse World of Rare Bacteria

New DNA Sequencing Tools Deployed by MBL Scientists Yield Startling Insights, Questions about Role of Vast Genomic Diversity and Ecological Change over Millions of Years; 20,000+ Kinds of Bacteria Found in 1 Liter of Seawater



Acinas et al. 2004, Nature
Pedrós-Alió 2006, TiM

Why an infrastructure for marine biodiversity assessment?

- Scientific knowledge
  - Marine Biodiversity is poorly known, especially microbial diversity and in deeper waters
  - Marine Biodiversity is changing and in many cases decreasing rapidly due to climate change, fisheries, acidification, eutrophication, …
- Legal obligations (CBD, OSPAR/Barcelona, Water Framework Directive, Common Fisheries Policy, Marine Strategy Framework Directive, …)
- Management and Sustainable Exploitation of Marine Resources (fisheries, offshore, tourism, maritime transport, …)
  - DPSIR (Drivers, Pressures, States, Impacts, Responses)

What to assess and how to do it?

Global Biodiversity: Indicators of Recent Declines

Stuart H. M. Butchart,[1,2]* Matt Walpole,[1] Ben Collen,[3] Arco van Strien,[4] Jörn P. W. Scharlemann,[1] Rosamunde E. A. Almond,[1] Jonathan E. M. Baillie,[3] Bastian Bomhard,[1] Claire Brown,[1] John Bruno,[5] Kent E. Carpenter,[6] Geneviève M. Carr,[7]† Janice Chanson,[8] Anna M. Chenery,[1] Jorge Csirke,[9] Nick C. Davidson,[10] Frank Dentener,[11] Matt Foster,[12] Alessandro Galli,[13] James N. Galloway,[14] Piero Genovesi,[15] Richard D. Gregory,[16] Marc Hockings,[17] Valerie Kapos,[1,18] Jean-Francois Lamarque,[19] Fiona Leverington,[17] Jonathan Loh,[20] Melodie A. McGeoch,[21] Louise McRae,[3] Anahit Minasyan,[22] Monica Hernández Morcillo,[1] Thomasina E. E. Oldfield,[23] Daniel Pauly,[24] Suhel Quader,[25] Carmen Revenga,[26] John R. Sauer,[27] Benjamin Skolnik,[28] Dian Spear,[29] Damon Stanwell-Smith,[1] Simon N. Stuart,[1,12,30,31] Andy Symes,[2] Megan Tierney,[1] Tristan D. Tyrrell,[1] Jean-Christophe Vié,[32] Reg Watson[24]

SCIENCE VOL 328 28 MAY 2010

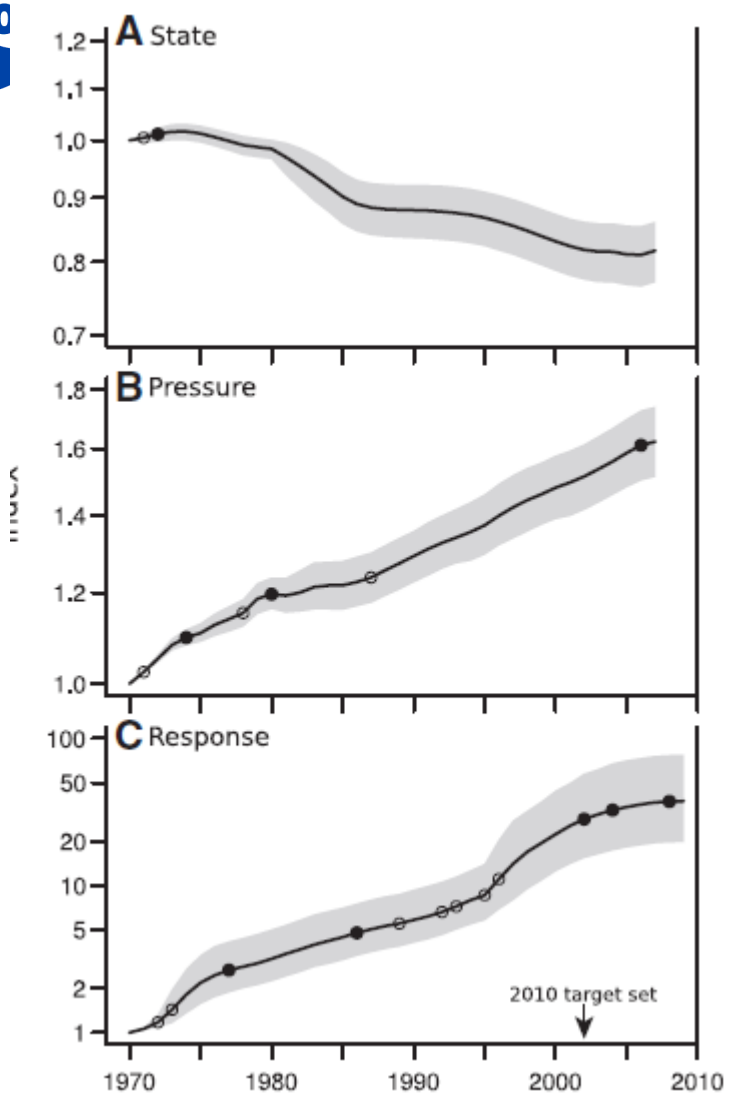
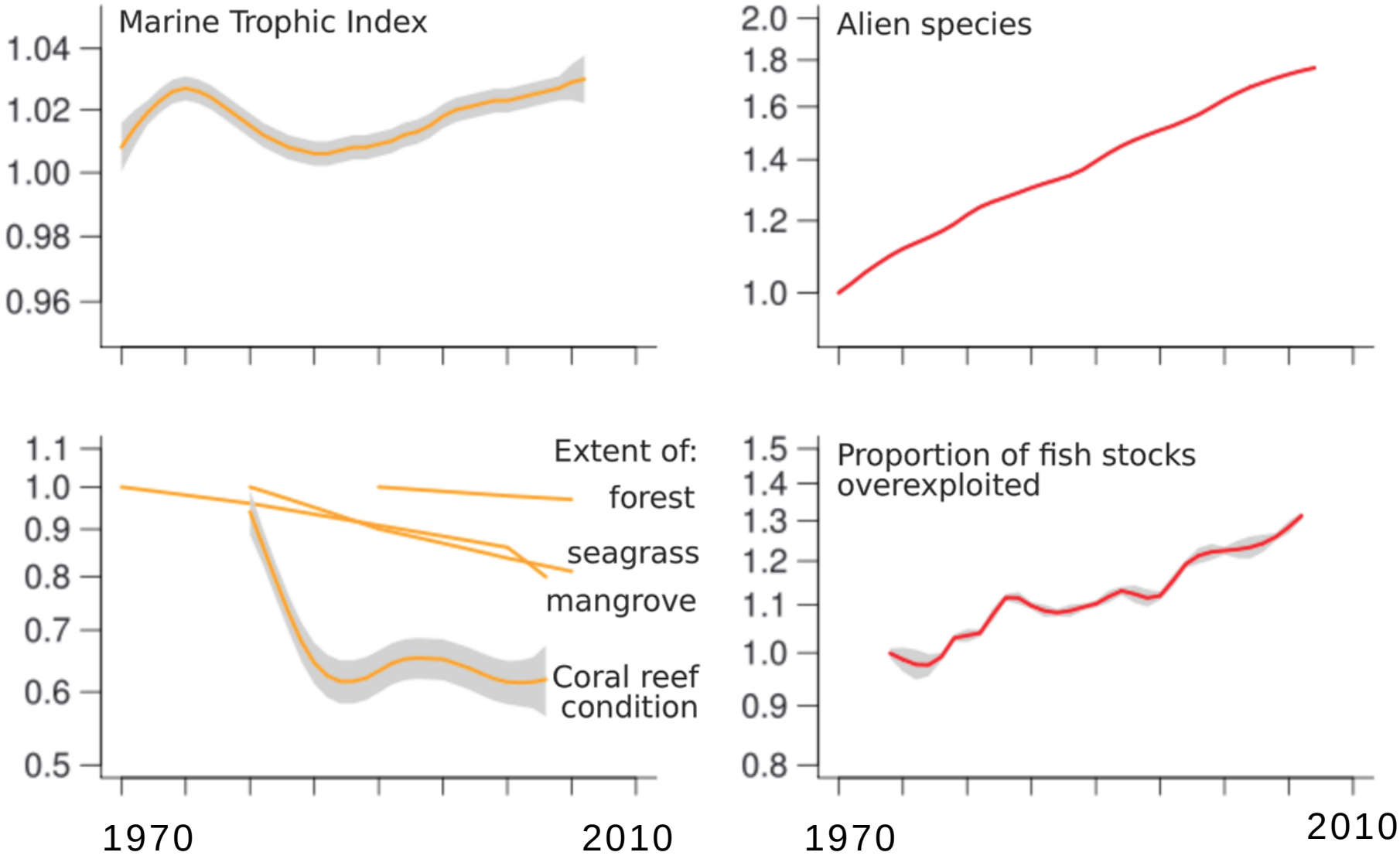
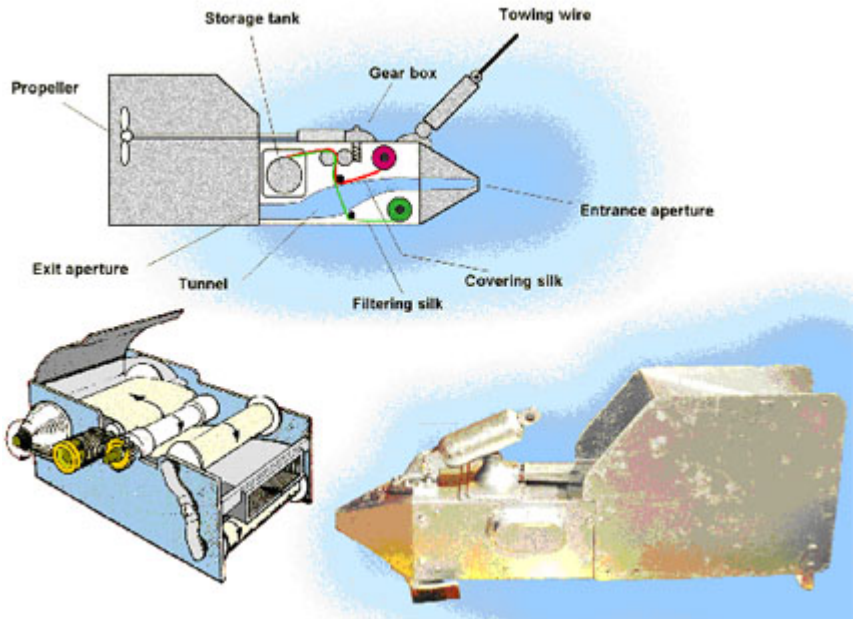


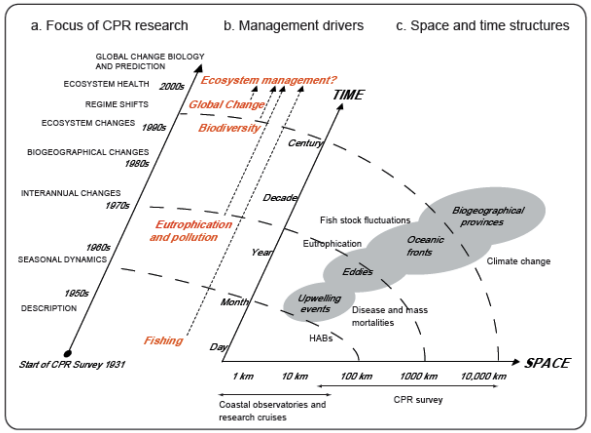
Fig. 2. Aggregated indices of (**A**) the state of biodiversity based on nine indicators of species' population trends, habitat extent and condition, and community composition; (**B**) pressures on biodiversity based on five indicators of ecological footprint, nitrogen deposition, numbers of alien species, overexploitation, and climatic impacts; and (**C**) responses for biodiversity based on six indicators of protected area extent and biodiversity coverage, policy responses to invasive alien species, sustainable forest management, and biodiversity-related aid. Values in 1970 set to 1. Shading shows 95% confidence intervals derived from 1000 bootstraps. Significant positive/upward (open circles) and negative/downward (filled circles) inflections are indicated.


Marine Trophic Index
1.04
1.02
1.00
0.98
0.96
Alien species
2.0
1.8
1.6
1.4
1.2
1.0
Extent of:
forest
seagrass
mangrove
Coral reef condition
1.1
1.0
0.9
0.8
0.7
0.6
0.5
Proportion of fish stocks overexploited
1.5
1.4
1.3
1.2
1.1
1.0
0.9
0.8
1970
2010
1970
2010

Trends in Marine Species

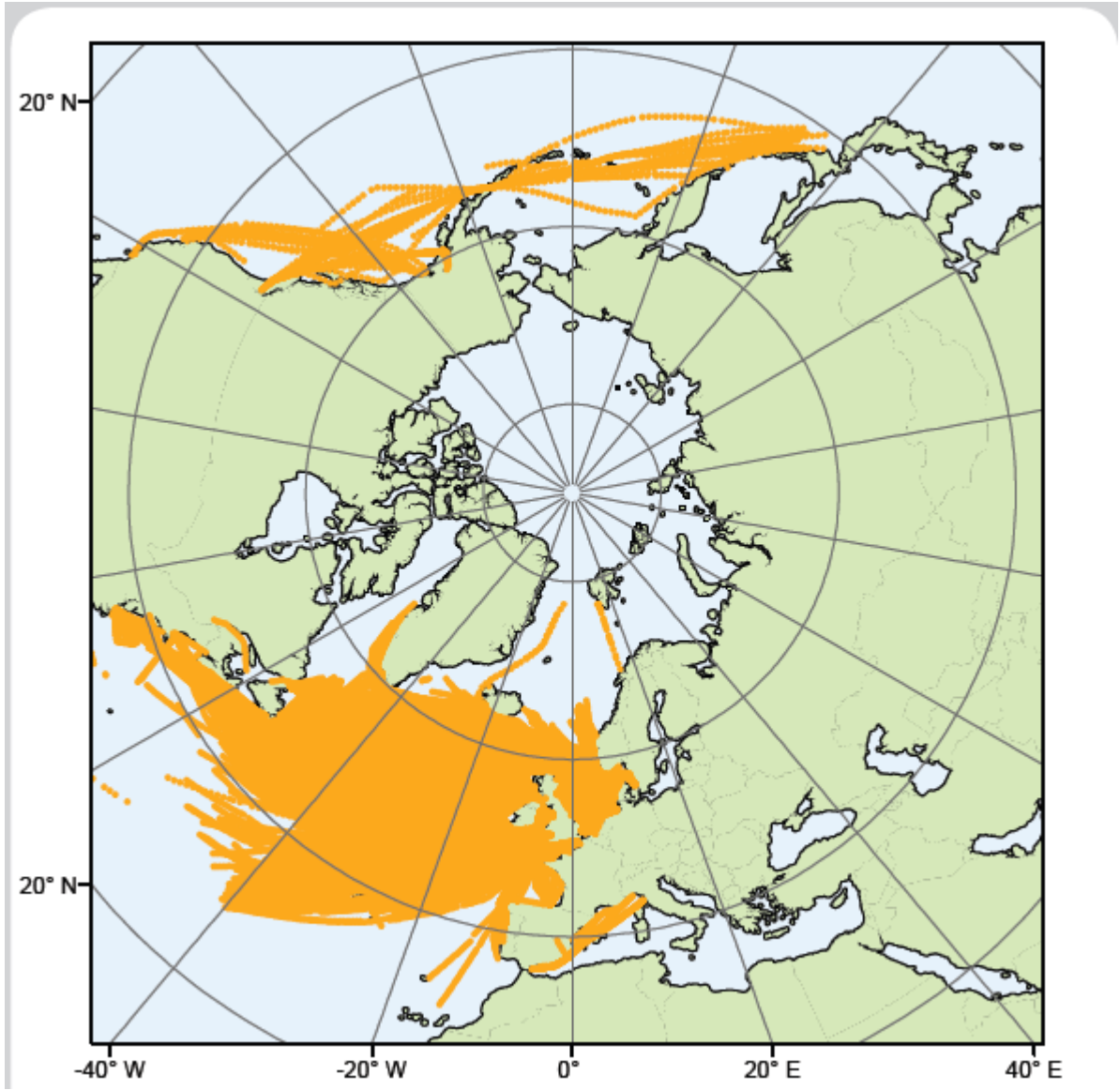
The Continuous Plankton Recorder CPR

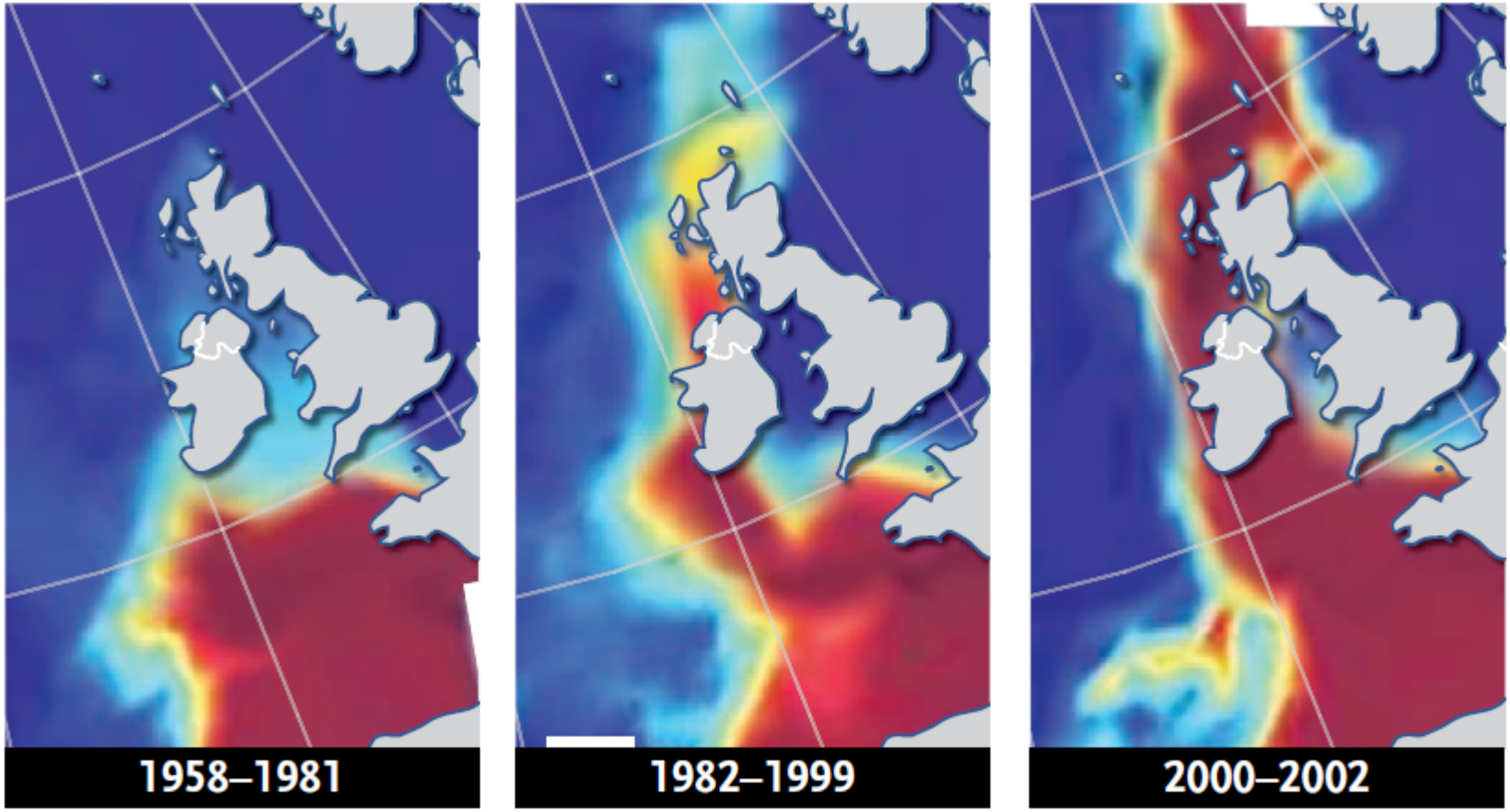




Passenger/cruise Ro-Ro ferry
PRIDE OF BILBAO
P&O Ferries, Portsmouth UK,
SA route: Bilbao, Spain to Portsmouth, UK
From: May 2004

Passenger /Ro-Ro ferry
BRETAGNE
Brittany Ferries, Roscoff, France
PR route: Plymouth to Roscoff, Western Channel
From December 2004


20° N
20° N
-40° W
-20° W
0°
20° E
40° E



Mean number of species per CPR sample

Taxonomy
Osteichthyes, Clupeiformes, Clupeidae

Maximum size
40 cm TL, though usually <35 cm.

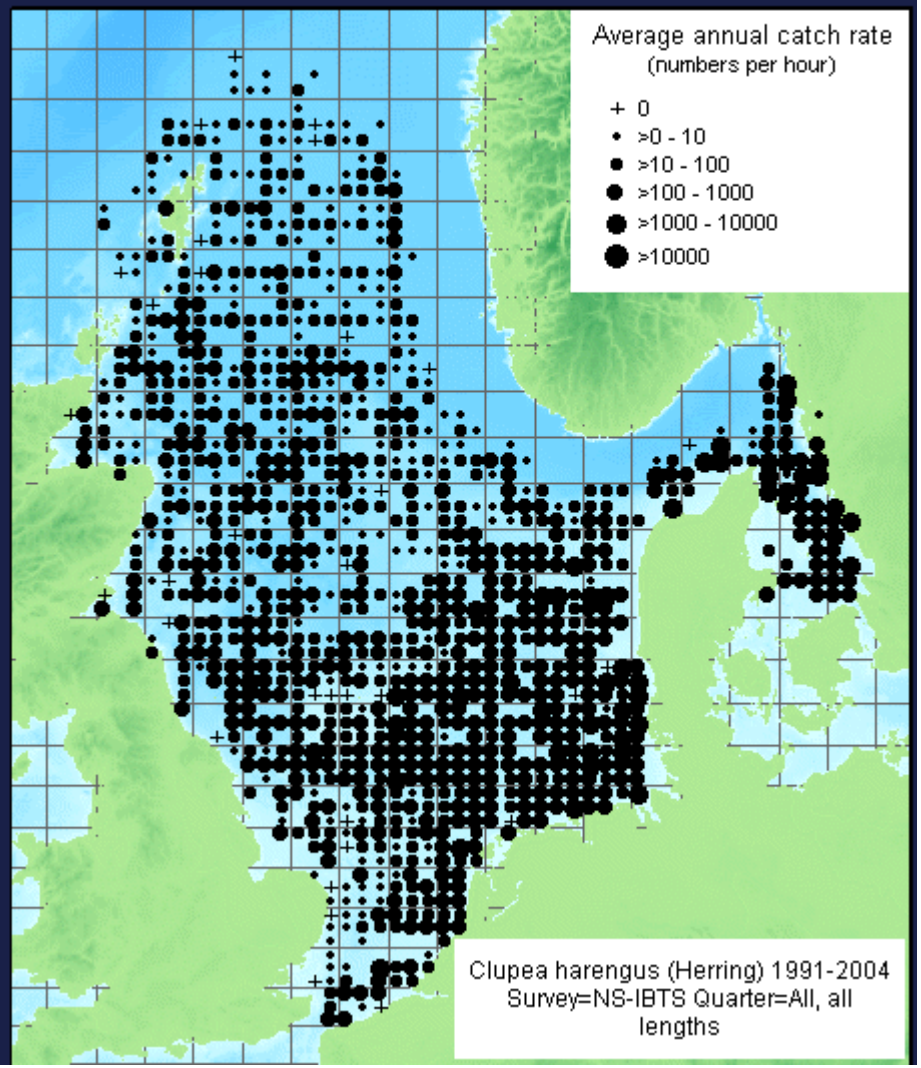
Description
A highly abundant pelagic species. They are filter feeders that feed on a variety of planktonic organisms. There are various spring and autumn spawning sub-populations, each with specific spawning sites. Eggs are laid in dense layers on gravel. Larvae are pelagic. Metamorphosis after 2-7 months depending on spawning time.

Description of stocks
Herring is widely distributed in the Northwest and Northeast Atlantic. Within the Northeast Atlantic, they are distributed from the northern Bay of Biscay to Greenland, and east into the Barents Sea.

Legal MLS
20 cm in the North Sea and 18 cm in the Skagerrak

Interest to fisheries
Herring is one of the most important commercial species taken in the North Sea, where it is targeted in purse seine and trawl fisheries. It is also a by-catch in industrial fisheries and small-mesh fisheries. Some inshore fisheries continue to fish for herring using drift nets.

Status of stocks- see graph
Landings increased after the Second World War to a peak of 2 million tonnes, though subsequent over-fishing and recruitment failure caused a collapse of the stock in the early 1970s. The fishery was closed from 1977-1981 to allow the stocks to recover. Management for herring has since improved and they are now harvested sustainably.



ICES International Council for the Exploration of the Sea
CIEM Conseil International pour l'Exploration de la Mer

ICES COOPERATIVE RESEARCH REPORT
NO. 292 OCTOBER 2008
ICES Zooplankton Status Report 2006/2007

ICES International Council for the Exploration of the Sea
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ICES COOPERATIVE RESEARCH REPORT
RAPPORT DES RECHERCHES COLLECTIVES

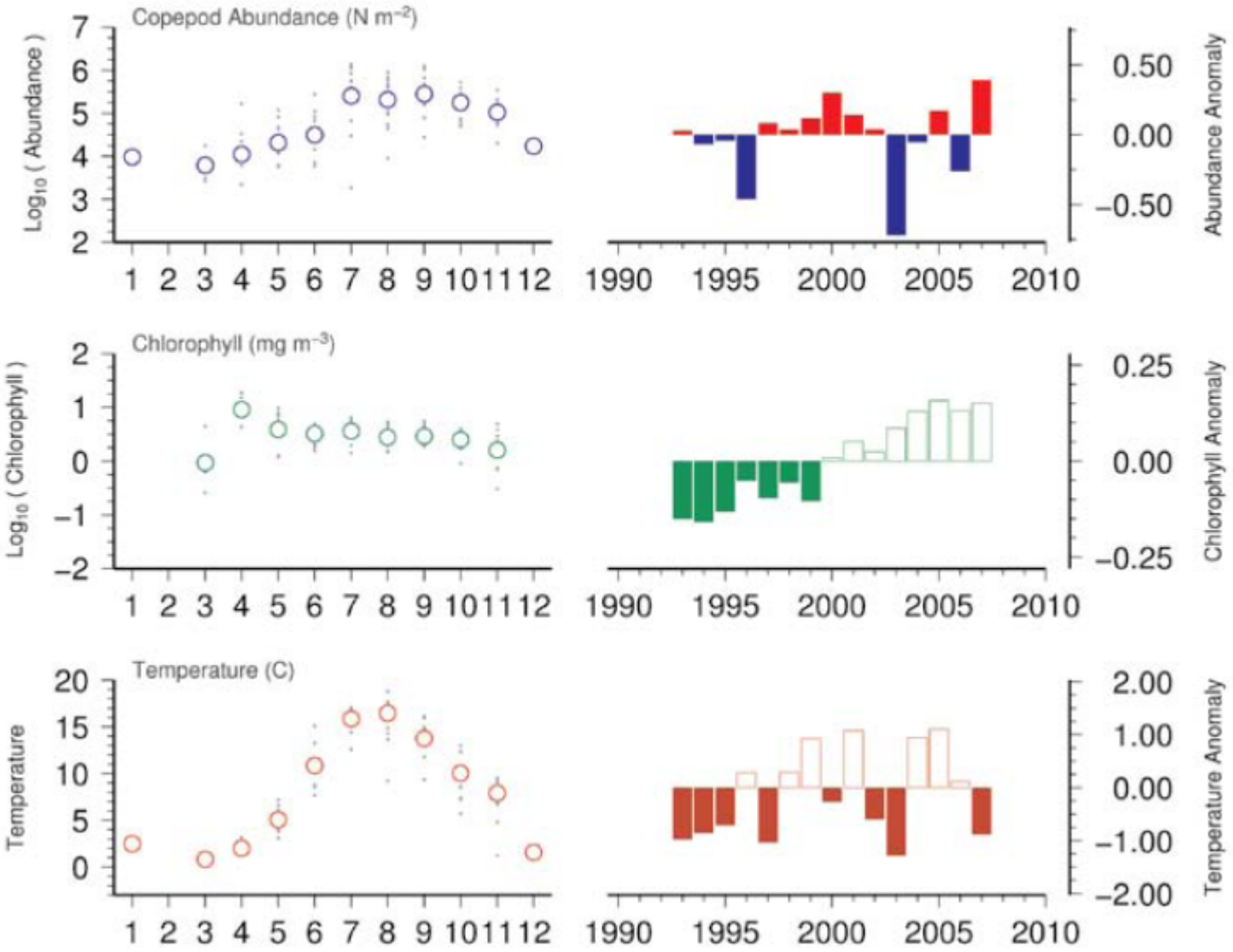
NO. 292 SPECIAL ISSUE
OCTOBER 2008

ICES Zooplankton Status Report 2006/2007

Editors:

Todd D. O'Brien
Angel López-Urrutia
Peter H. Wiebe
Steve Hay

Tallinn Bay (Gulf of Finland)



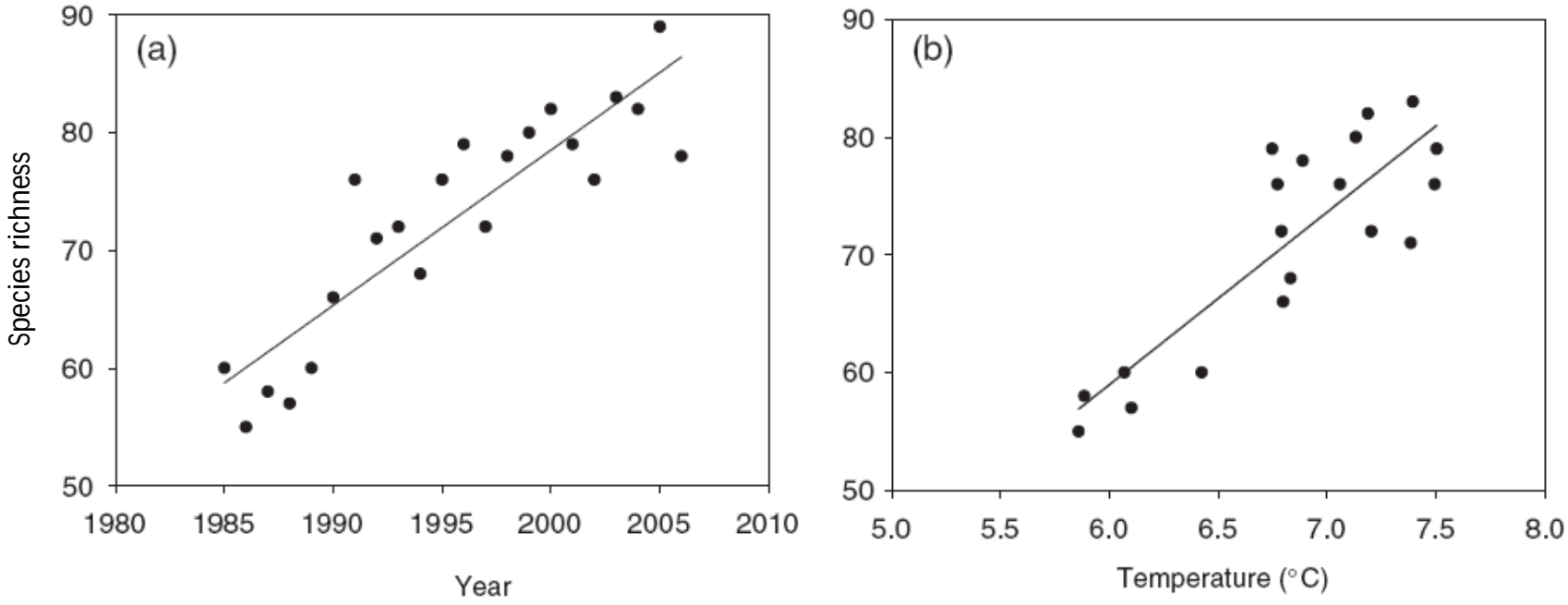
Global Change Biology (2008) **14,** 453–460, doi: 10.1111/j.1365-2486.2007.01518.x

Climate induced increases in species richness of marine fishes

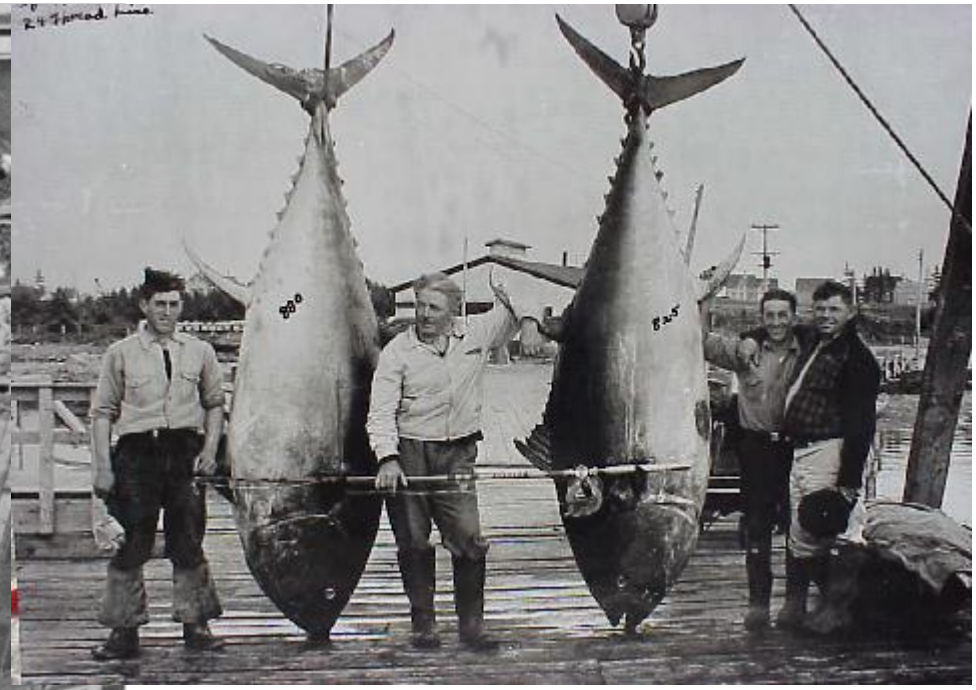
J. G. HIDDINK* and R. TER HOFSTEDE†
*School of Ocean Sciences, Bangor University, Menai Bridge, Anglesey LL59 5AB, UK, †Wageningen IMARES, Institute for Marine Resources & Ecosystem Studies, PO Box 68 1970 AB IJmuiden, The Netherlands

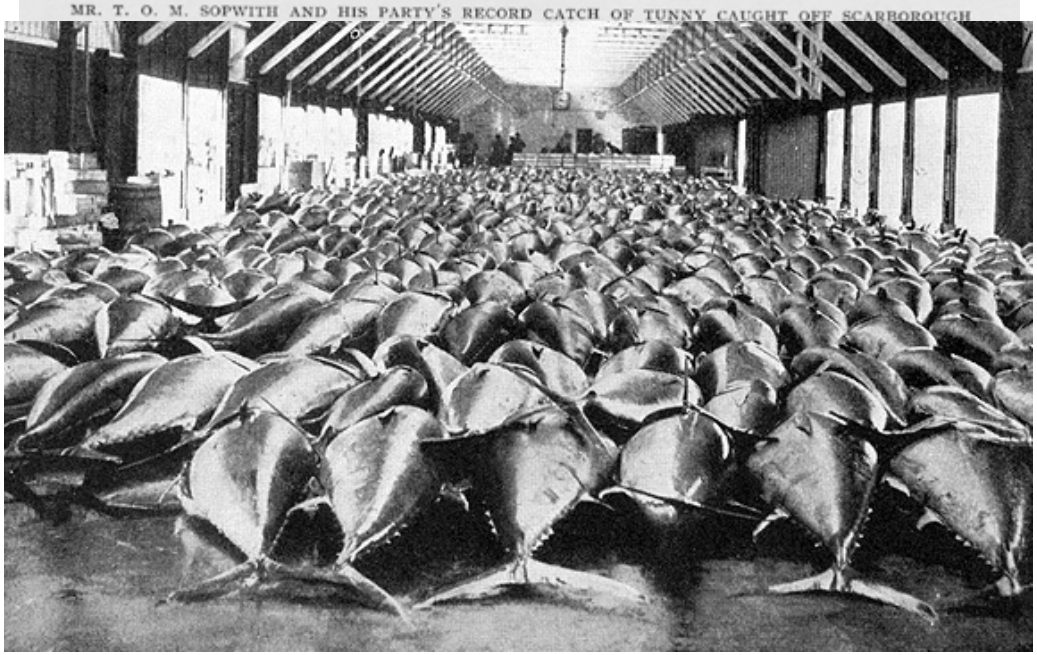
Fish Species Richness in the North Sea has strongly increased over time

- Small southern species increase
- Large northern species decrease their range



MR. T. O. M. SOPWITH AND HIS PARTY'S RECORD CATCH OF TUNNY CAUGHT OFF SCARBOROUGH





Climate Change and Overexploitation lead to decreasing numbers of top predators. Example: Bluefin Tuna caught in the North Sea UK 1933 (upper two) Denmark (lower) 1946. The species has now disappeared completely. (MacKenzie and Myers, 2007)

Marine Menace

Alien invasive species in the marine environment

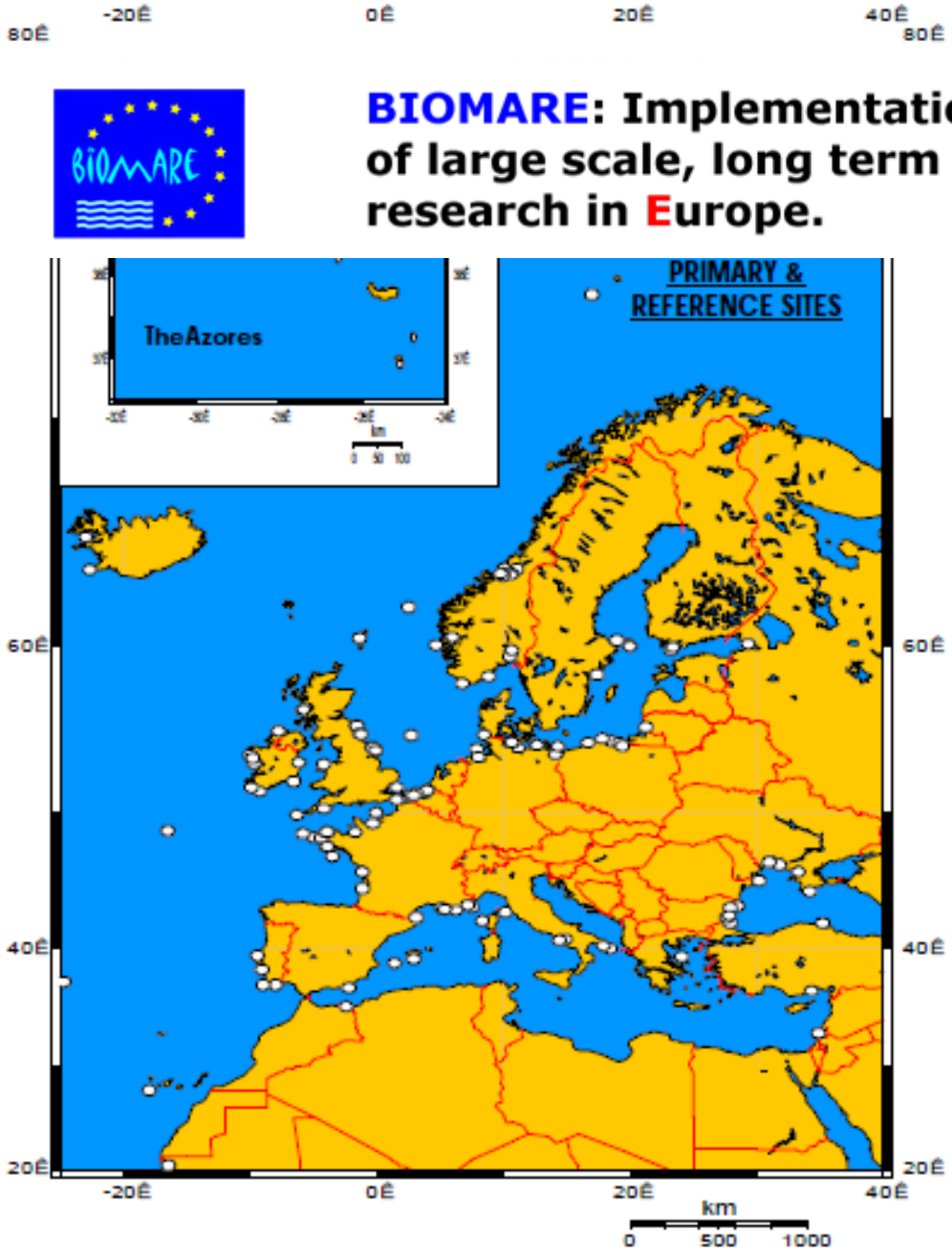
Black Sea disaster
the comb jelly

In the early 1980s, the comb jelly was accidentally introduced via ship ballast water to the Black Sea. It was also introduced into the Caspian Sea via the ballast water of oil tankers. In its new predator-free habitat, the jellyfish wreaked havoc on the entire ecosystem of the Black Sea. The situation was made worse by nutrient and other pollution. By 1992, the annual losses caused by drops in commercial catches of marketable fish were estimated at least US$ 240 million.

Rhopilema nomadica: jellyfish from the Red Sea, now a pest in Eastern Med

Sparisoma cretense: southern species moving northward in the Mediterranean

BIOMARE: Implementation and networking of large scale, long term **MAR**ine **BIO**diversity research in **E**urope.



Biodiversity assessment through remote sensing

marbef +

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Position Paper 12

Remote Sensing of Shelf Sea Ecosystems

State of the Art and Perspectives

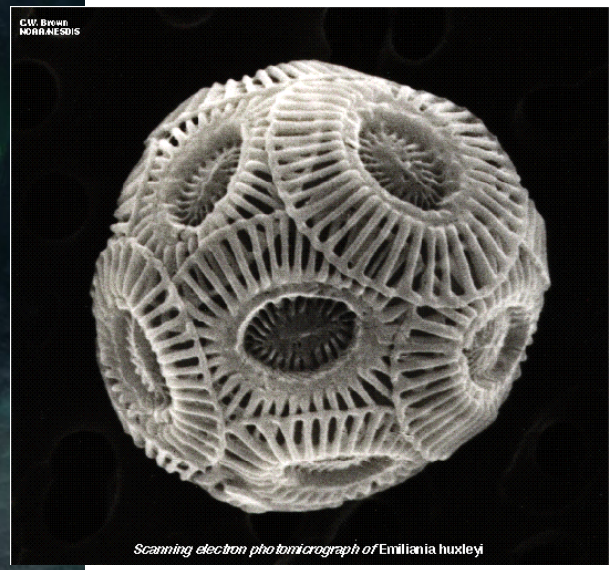
February 2008

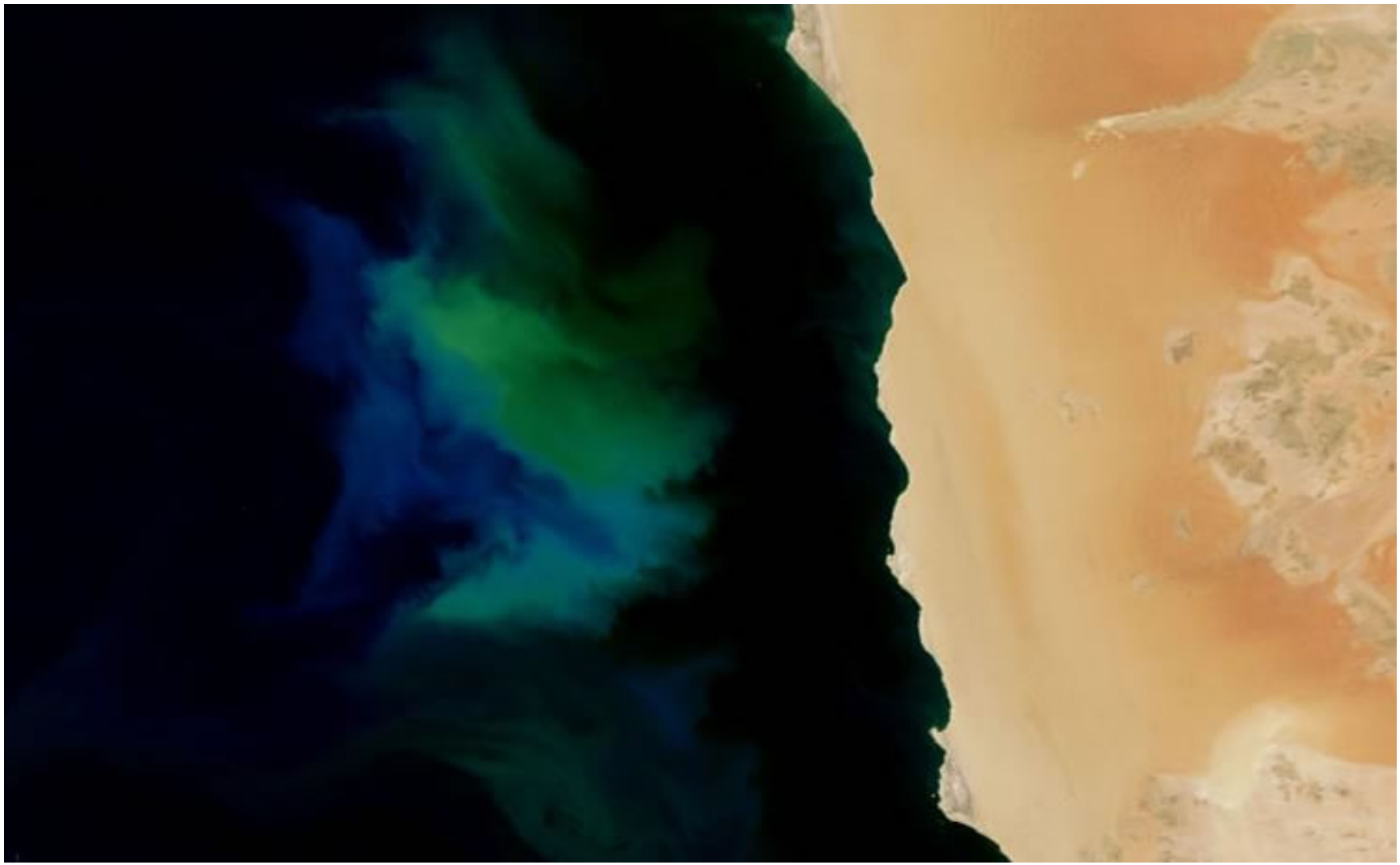
Biodiversity only mentioned in introduction

Table 1. Examples of ecological variables and data sources useful for quantifying and modeling biodiversity[a]

Ecological variable	Sensor[b] Space (S)/ Airborne (A)	Spatial resolution	Revisit time	Spectral resolution	Description
Direct approaches					
Species composition	TM/ETM + (S), ALI (S), HYPERION (S), ASTER (S), IKONOS (S), Quickbird (S), AVIRIS (A), CASI (A)	<1–30 m	16 days (ETM, ALI, Hyperion); 4–16 days (ASTER); 2–5 days (IKONOS); 2–4 days (Quickbird); N/A for aircraft	V/NIR, SWIR, ASTER also has TIR	These sensors are being tested for their ability to measure directly canopy community, and perhaps species, type based upon unique spectral signatures
Land cover	MODIS (S), TM/ETM + (S), ASTER (S), ALI (S), IKONOS (S), Quickbird (S)	<1–1000 m	1–2 days (MODIS); 16 days (TM/ETM +); 4–16 days (ASTER); 2–5 days (IKONOS); 2–4 days (Quickbird)	V/NIR, SWIR, MODIS and ASTER also have TIR	Can discriminate different land surfaces at various resolutions; land cover classification is considered a first-order analysis for species occurrence
Indirect approaches					
Primary Productivity					
Chlorophyll	SeaWIFS (S), MODIS (S), ASTER (S), TM/ETM + (S), ALI (S), Hyperion, (S), IKONOS (S), Quickbird (S), AVIRIS (A), CASI (A)	<1–1000 m	1 day (SeaWiFS); 1–2 days (MODIS); 4–16 days (ASTER); 16 days (TM/ETM +, ALI, Hyperion); 2–5 days (IKONOS); 2–4 days (Quickbird); N/A (AVIRIS, CASI)	V/NIR, SWIR, MODIS and ASTER also have TIR	Measure reflectance to assess presence/absence of vegetation and relative greenness measures enabling detection of ocean and land surface chlorophyll useful for calculating productivity and plant health
Ocean color and circulation	TOPEX/Poseidon (S), AVHRR (S), MODIS (S), SeaWiFS (S)	1–10 km	10 days (TOPEX/Poseidon); 1 day (AVHRR); 1–2 days (MODIS); 1 day (SeaWIFS)	TOPEX/Poseidon; (microwave) AVHRR, MODIS, SeaWiFS (V/NIR, SWIR, MODIS and AVHRR also have TIR)	Circulation patterns can be inferred from changes in ocean color, sea surface height, and ocean temperature, important for understanding larval transport and movement of pathogens and sediment

Example: coccolithophorids





Namibia

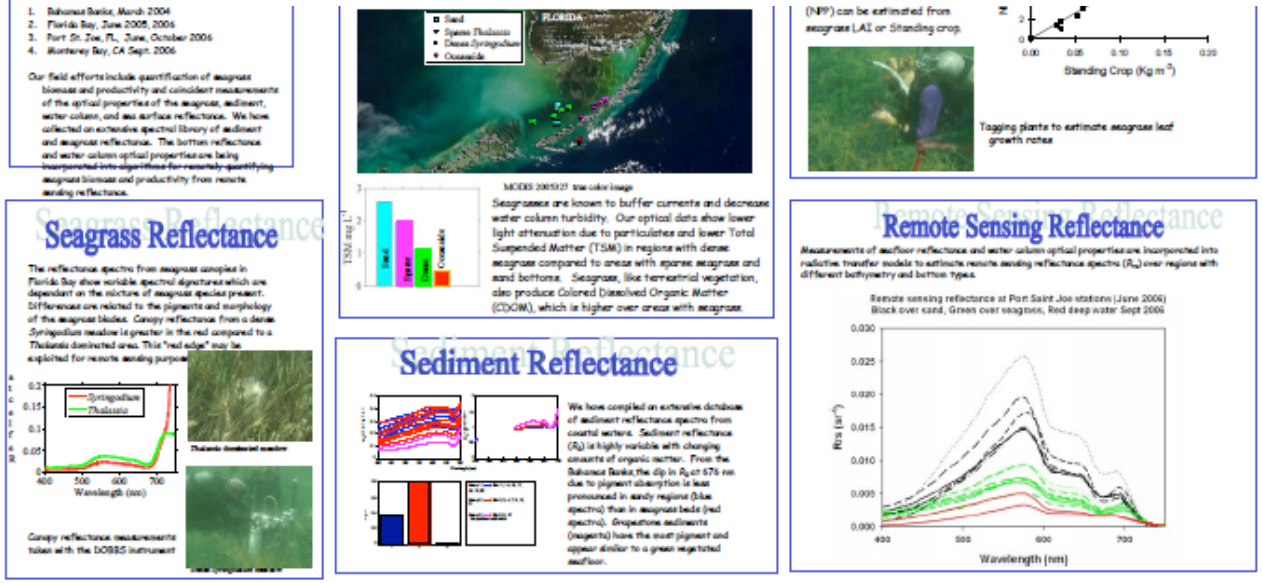
Remote sensing of seagrass ecosystems: use of spaceborne and airborne sensor

Meld een fout in dit record

Volledige referentie:

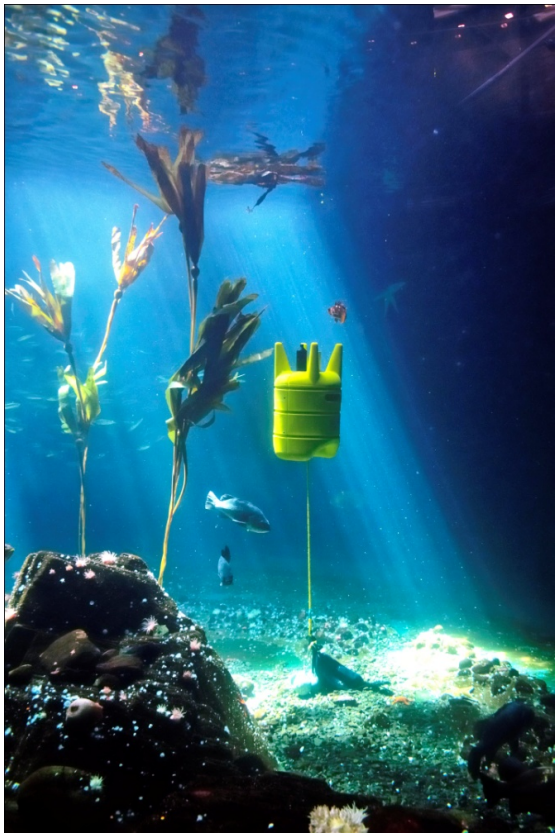
Auteurs

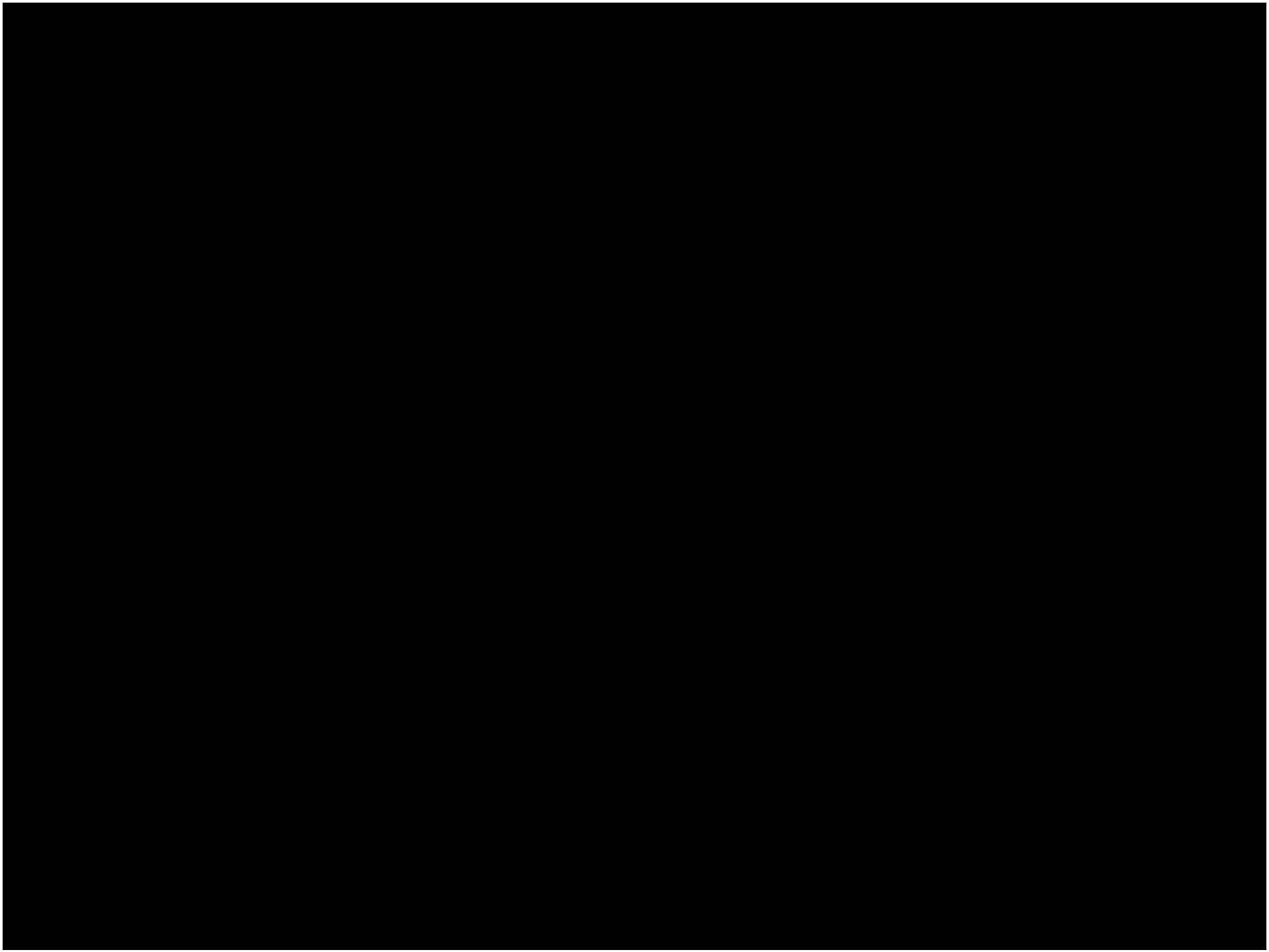
Dekker, A.G.; Brando, V.E.; Anstee, J.; Fyfe, S.; Malthus, T. (2006). Remote sensing of seagrass ecosystems: use of spaceborne and airborne sensor, ***in***: Larkum, A.W.D. *et al.* (Ed.) (2006). *Seagrasses: biology, ecology and conservation.* pp. 347-359



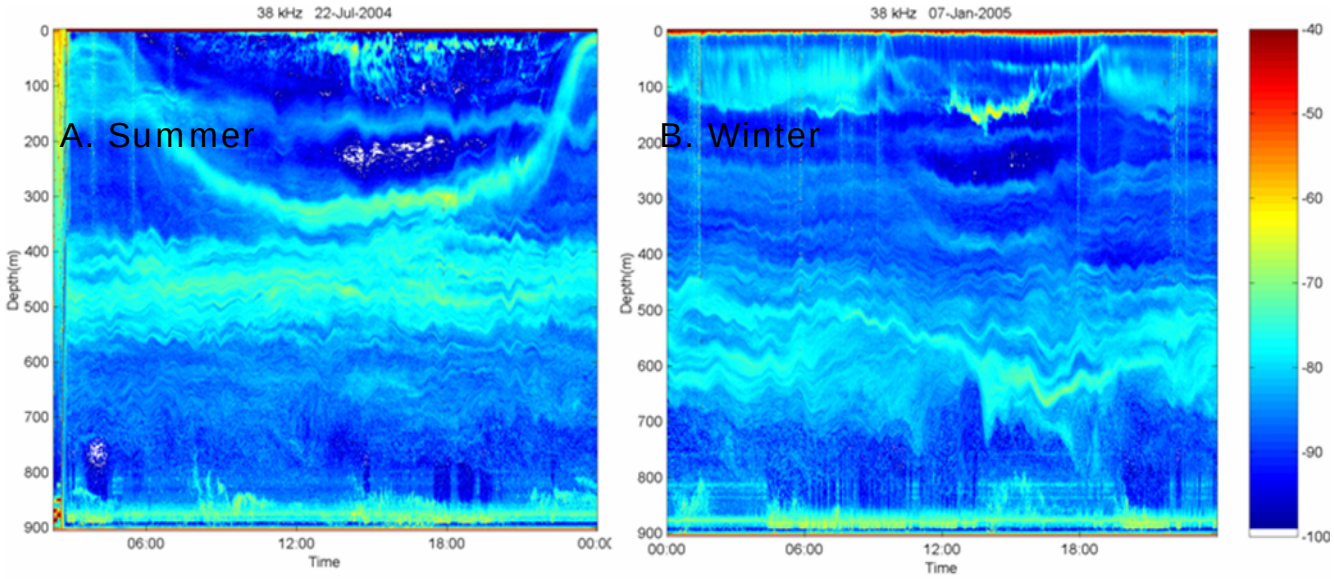
New observation methods

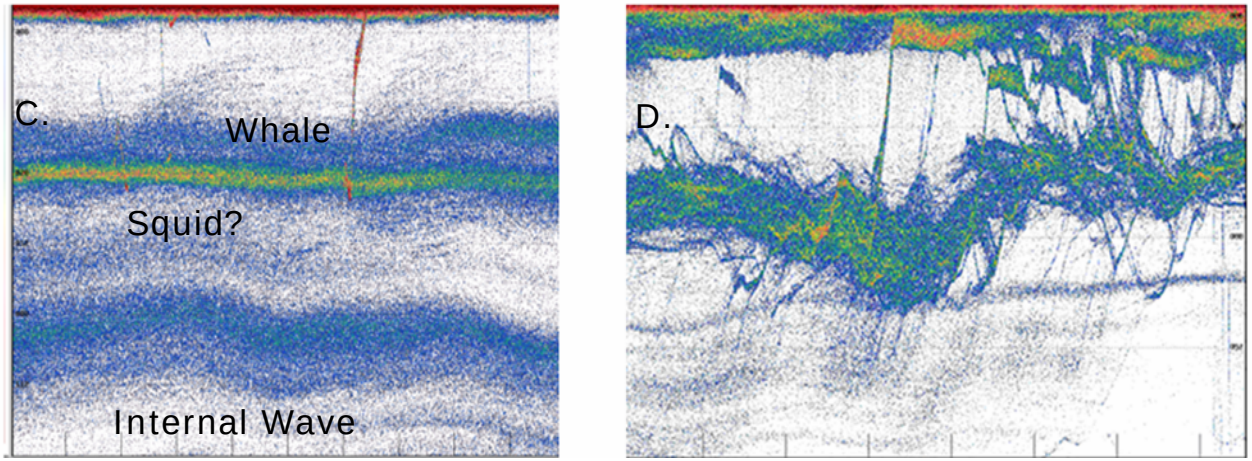
- A few examples from the Census of Marine Life





CoML & Ocean Observing





Fish Schools Relocating

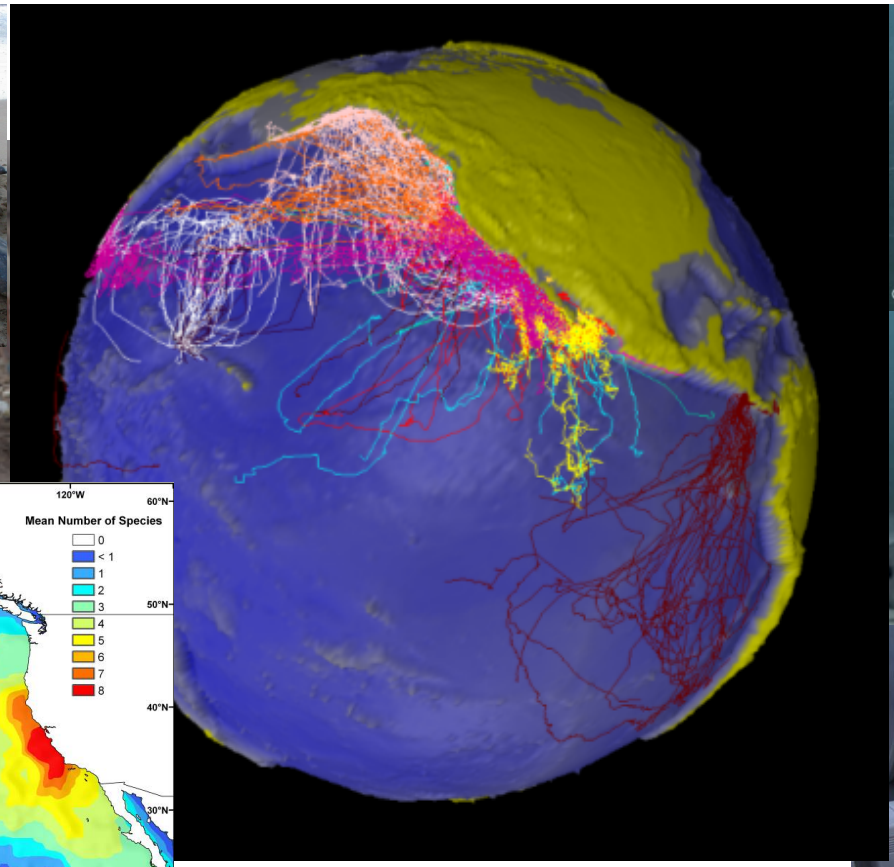
Upward-looking Simrad sonar in the Charlie-Gibbs Fracture Zone on the Mid-Atlantic Ridge. (A) and (B): Dramatic reduction in diurnal plankton migration in winter versus summer.

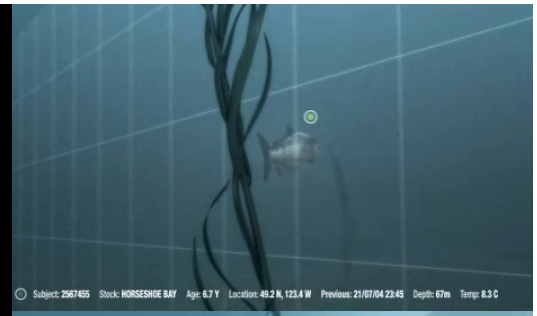
(C): 100m whale dives to feed, likely on squid, above an internal wave moving the whole plankton community. (D): Fish school breaking up at 50m and reforming near surface. Time bars 15 min.

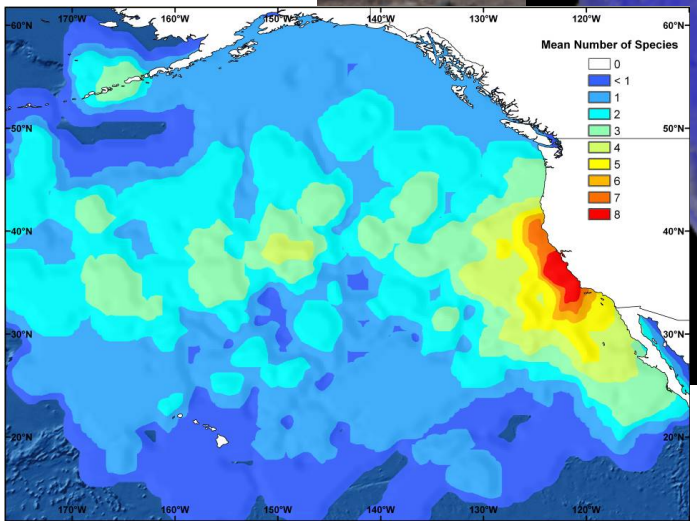
Data from CoML MAR-ECO project.

CoML & Ocean Observing

Monitoring far animal migrations by tagging & telemetry – providing technology & protocols





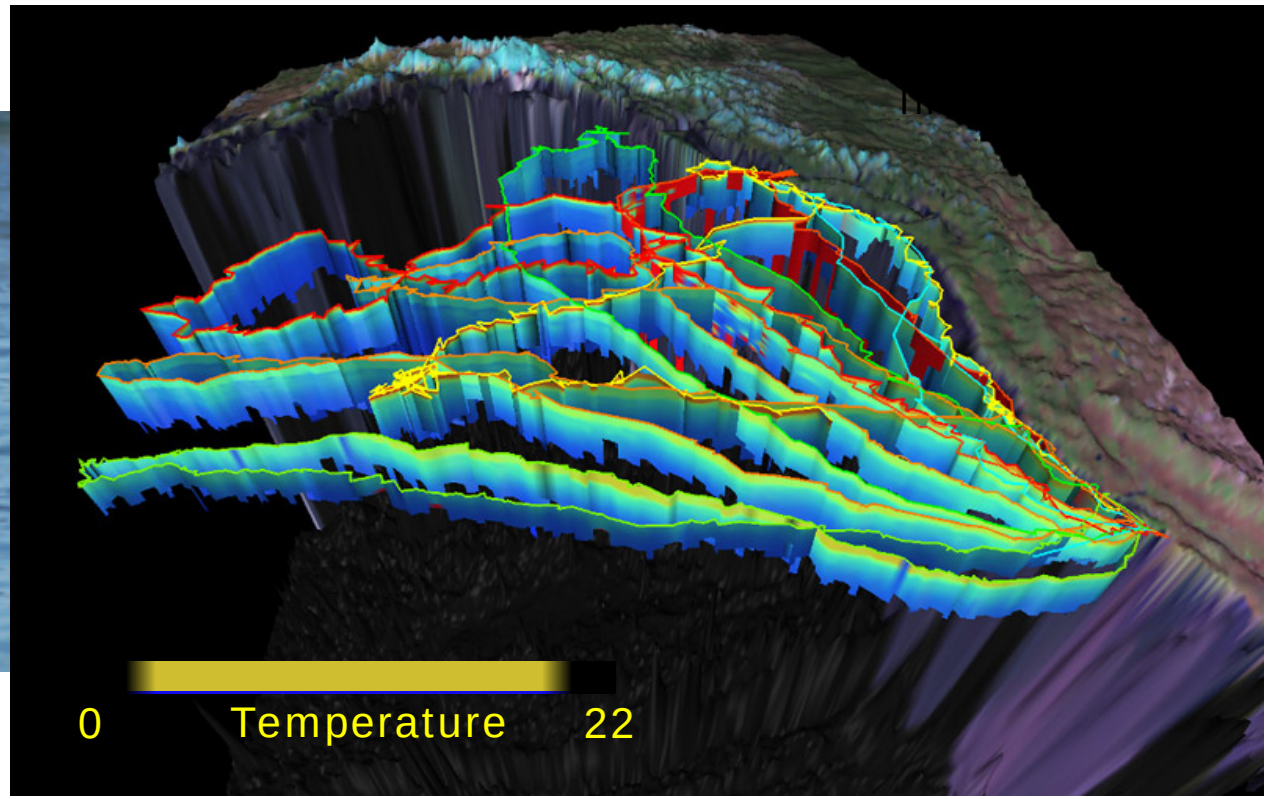


Images: TOPP & POST projects

CoML & Ocean Observing

Animal oceanographers – collecting vast amounts of oceanographic data

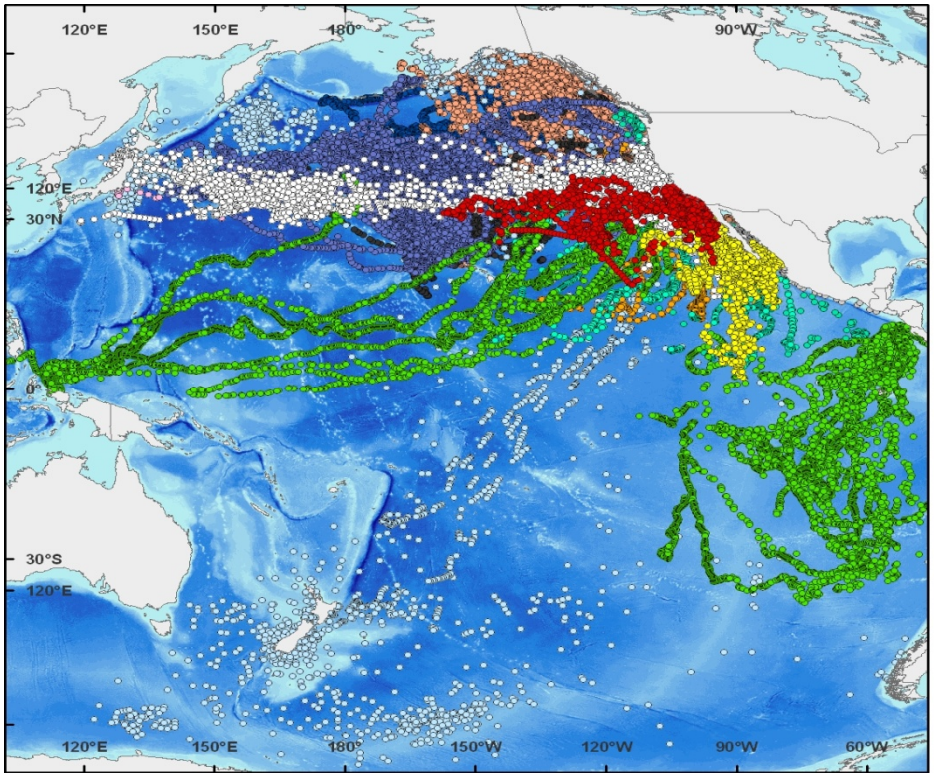
Some animals dive 1000m



7 seals tracked during 2-3 month summer feeding migrations

Top Predators

To obtain global biological & oceanographic information including migration patterns for large open-ocean animals by using electronic tagging technologies.



- Black-footed Albatross
- Blue Whale
- California Sea Lion
- Humpback Whale
- Laysan Albatross
- Northern Elephant Seal
- Sooty Shearwater
- Albacore
- Blue Shark
- Humboldt Squid
- Leatherback Turtle
- Loggerhead Turtle
- Mako Shark
- Mola
- Pacific Bluefin
- Salmon Shark
- Thresher Shark
- White Shark
- Yellowfin Tuna

TOPP

GTOPP Global Tagging of Pelagic Predators

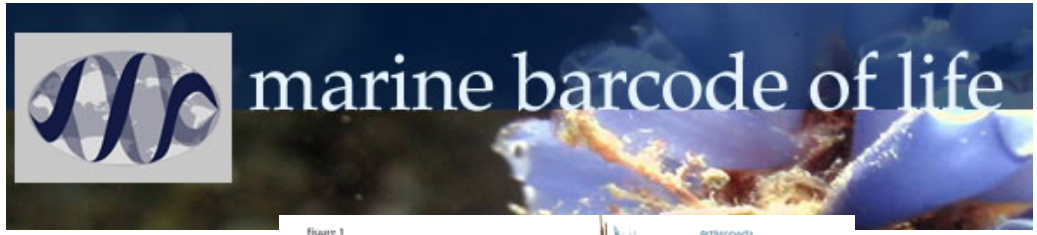
Tracks of 19 species of marine vertebrates tracked as part of the TOPP program. The tracks show areas of overlap and common habitat utilization. These data are being examined with respect to the underlying oceanographic features that may be responsible for these patterns. Image: Dan Costa, UC Santa Cruz, TOPP project.

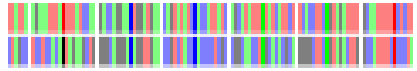
DALHOUSIE UNIVERSITY
Inspiring Minds

Ocean Tracking Network

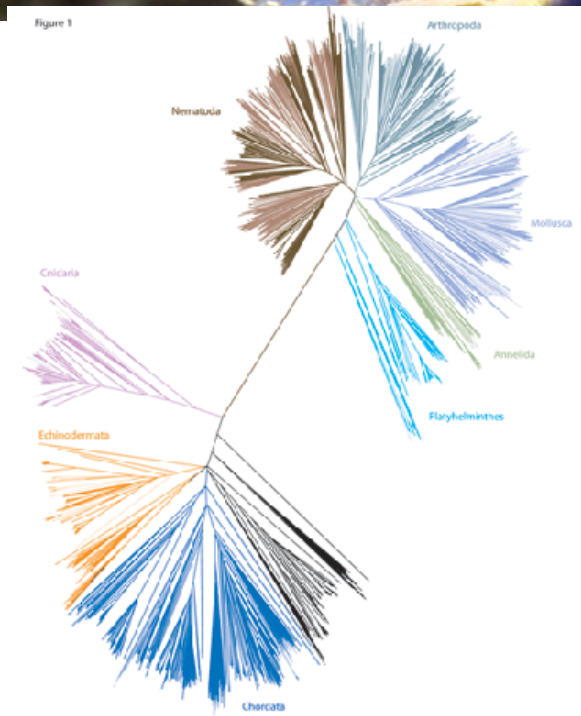
OTN held a workshop December 3-5, 2009, in Faro, Portugal, to discuss plans to deploy a line of acoustic receivers, to be known as the Gibraltar Curtain, spanning the Strait of Gibraltar, between Spain and Morocco, some time next year.

Barcoding





Mitochondrial gene COI
nucleotide sequence



specimens barcoded
19837
species barcoded
3948
unnamed clusters
0

Students Use DNA Barcodes to Unmask "Mislabeled" Fish at Grocery Stores, Restaurants

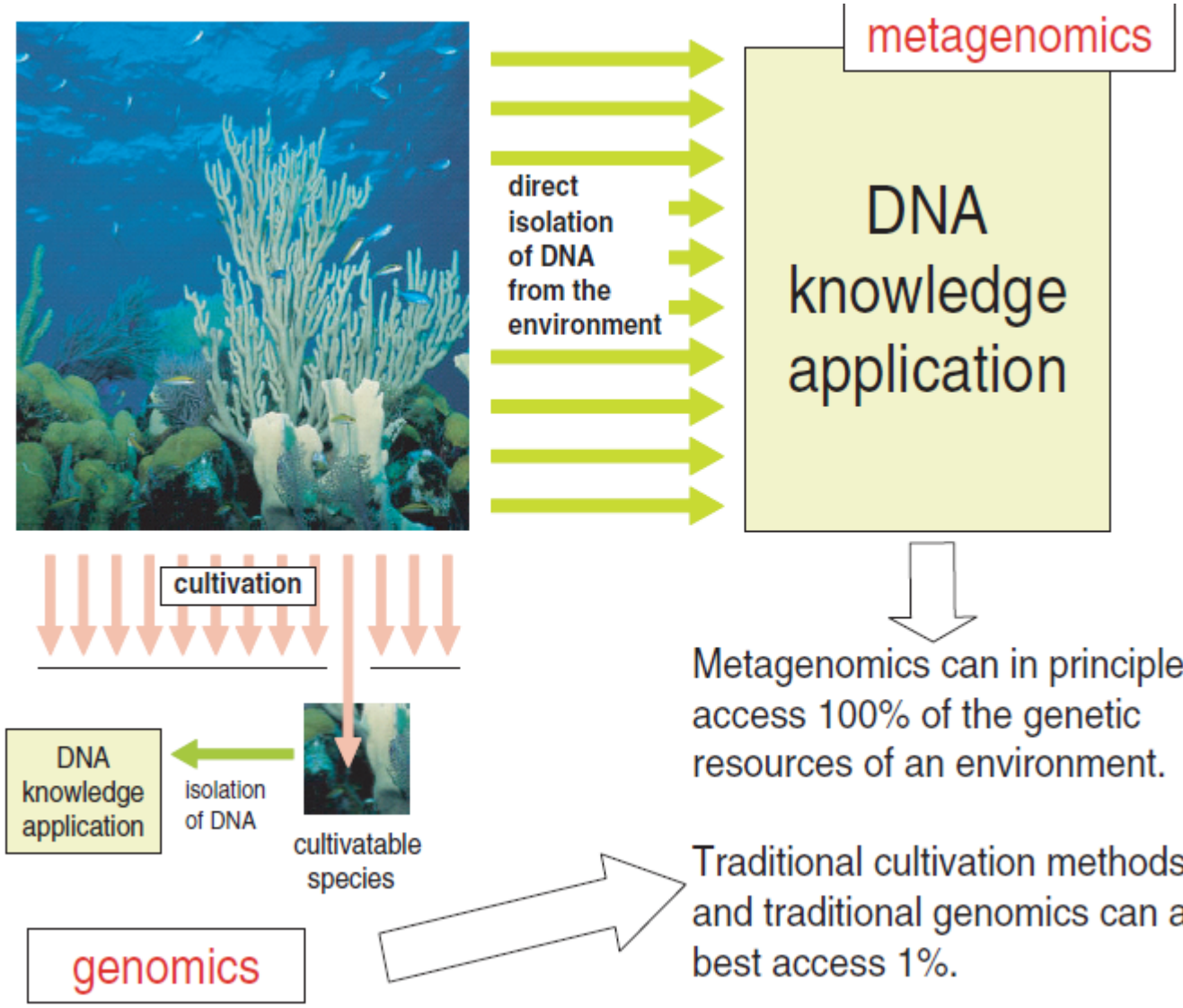
First students to apply DNA barcodes in public marketplace

One-quarter of 56 fish samples from 14 stores, restaurants in Upper Manhattan revealed to be cheaper or endangered fish species

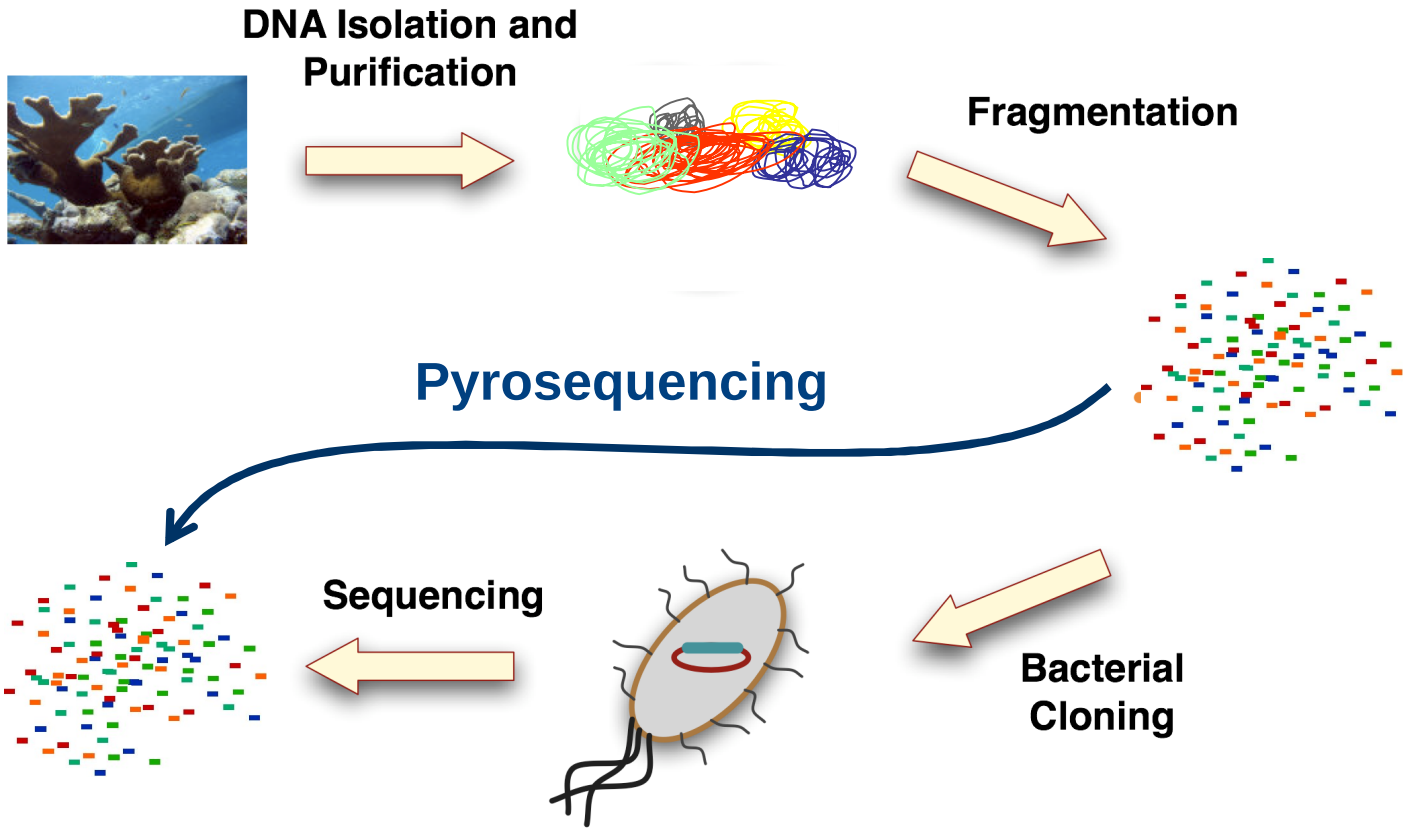
"14 of 56 usable samples were mislabeled – in all cases as higher-priced or more-desirable fish species." Press Release: Rockefeller University & the Trinity School, August 22, 2008.

Acadian Redfish (Sebastes fasciatus), listed as endangered by the International Union for the Conservation of Nature, was one species sold as "Red Snapper."

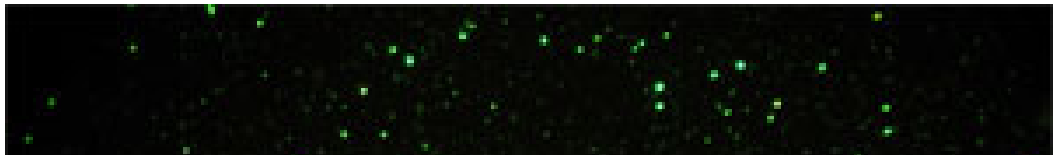
Photo: D. Flescher / FishBase / EOL.


metagenomics
direct isolation of DNA from the environment
DNA knowledge application
cultivation
DNA knowledge application
isolation of DNA
cultivatable species
genomics
Metagenomics can in principle access 100% of the genetic resources of an environment.
Traditional cultivation methods and traditional genomics can at best access 1%.

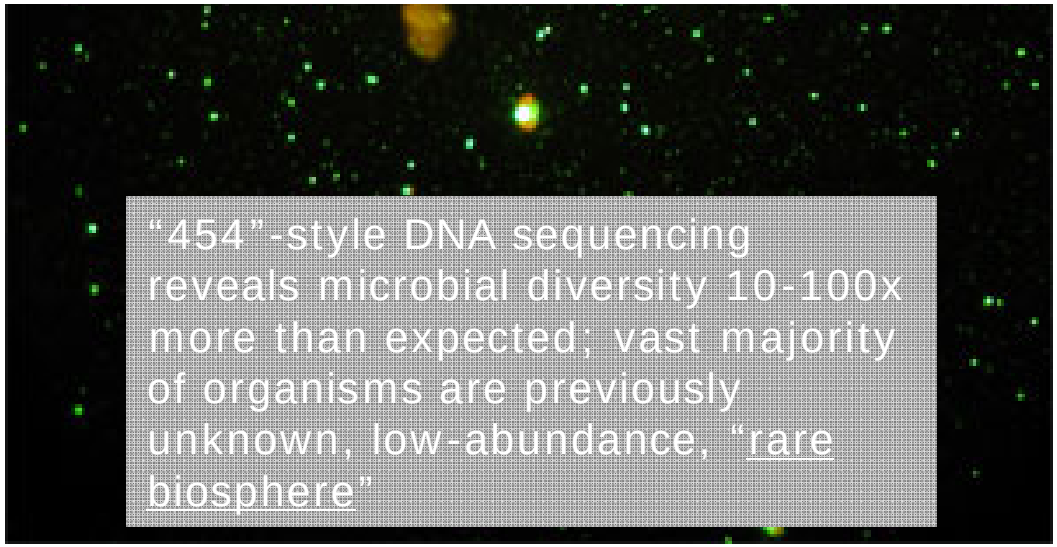
Metagenomics



DNA sequencing



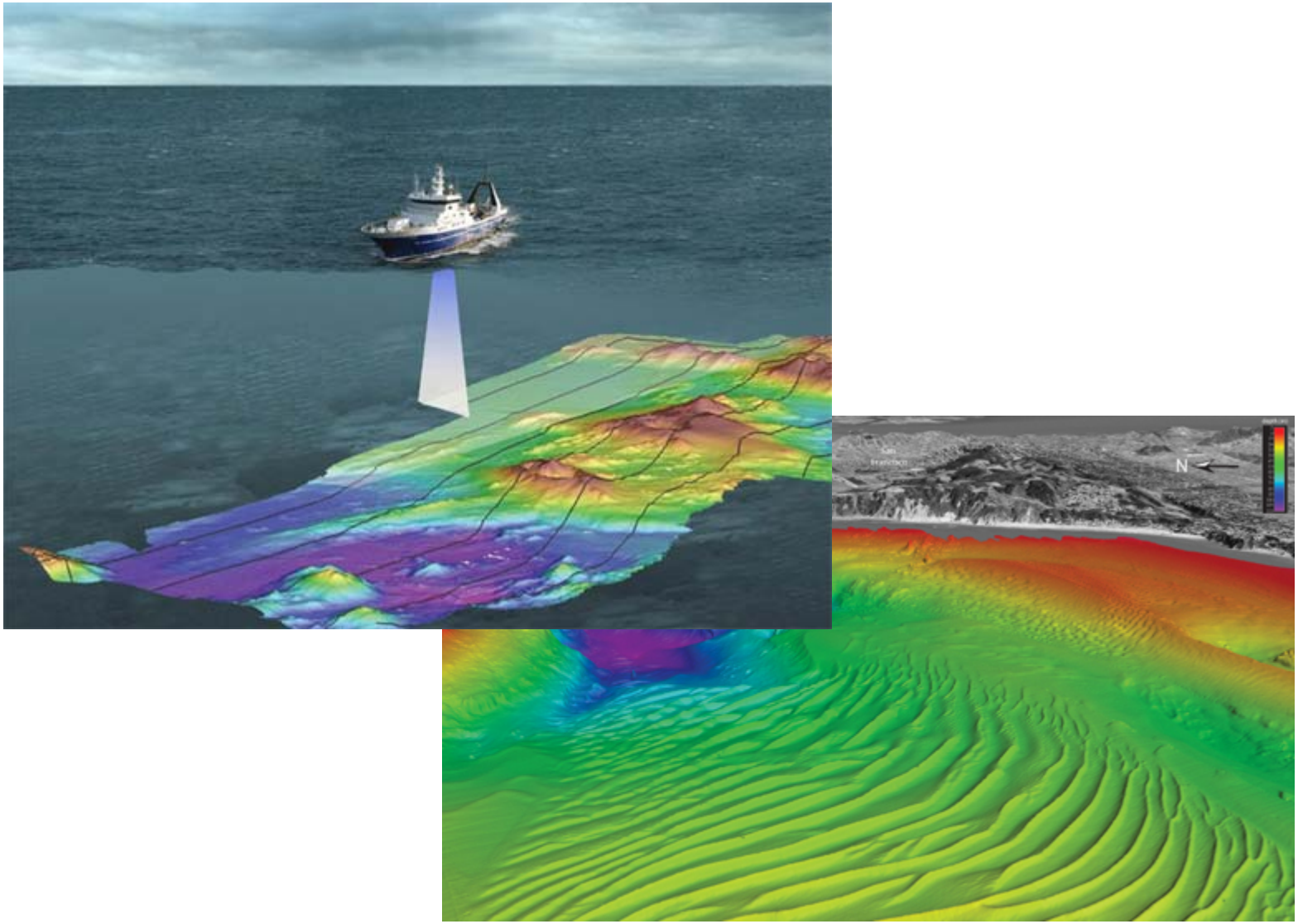
Unveiling the Ocean's Hidden Majority through 454 Tag Sequencing



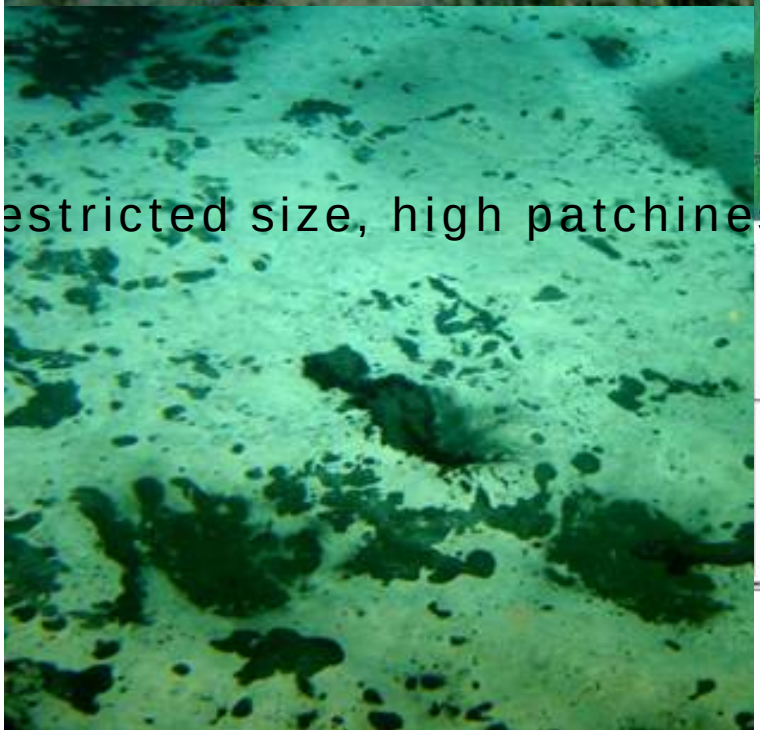
Habitats

- Habitats are formed by interactions between biology, geology, physics and chemistry
- Often a correlation between habitat and biodiversity exists (close or not so close)
- Habitat structure may therefore serve as a predictor of biodiversity
- New observation tools allow for a detailed and rapid mapping of habitats

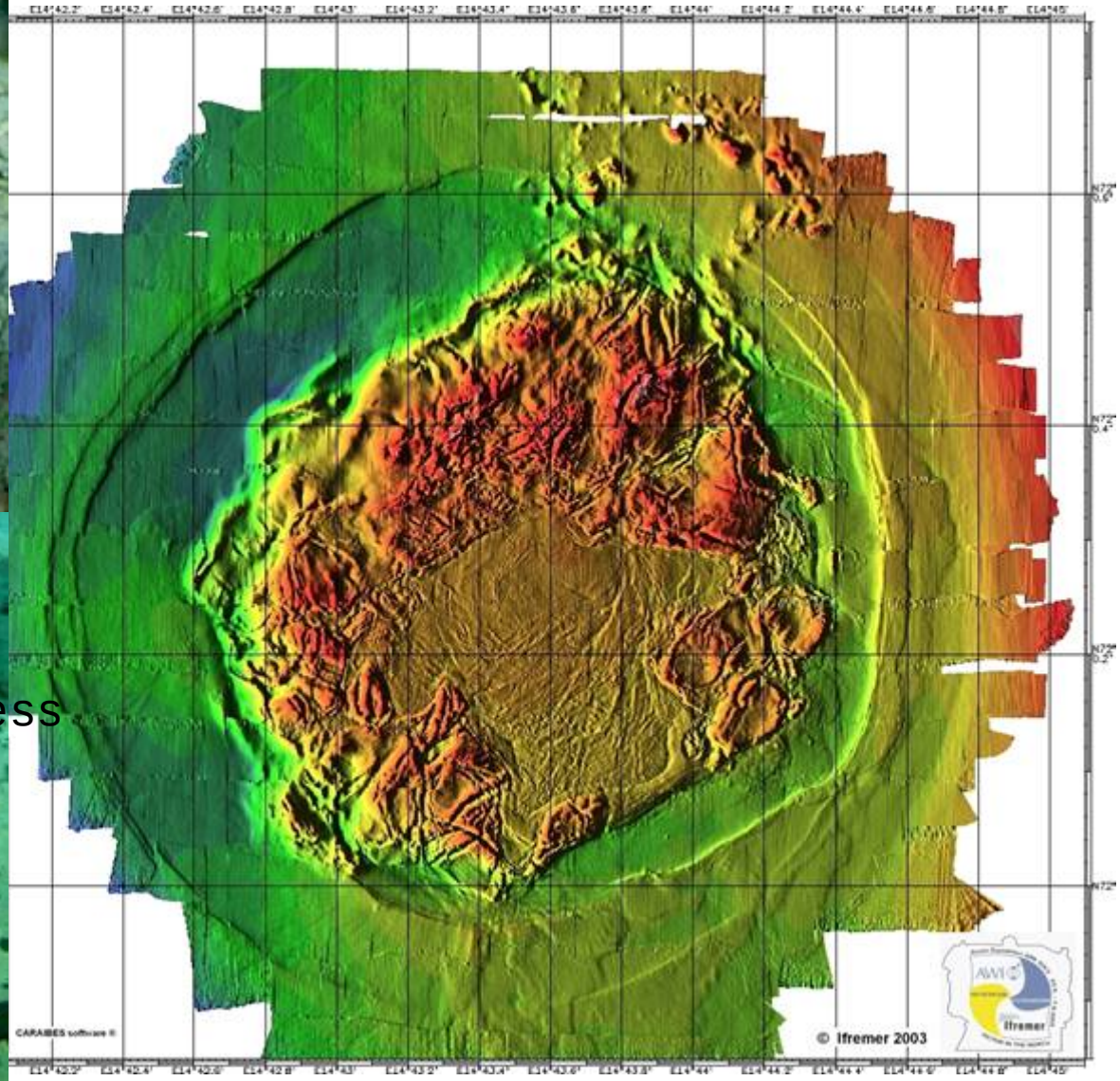
- Still photography and video
- LIDAR
- Acoustic methods
  - Single Beam
  - Multibeam
  - Side-scan sonar


N

Hakon mosby mud volcano at 1250 m on Barents sea slope



estricted size, high patchiness



Microbathymetric mapping (Foucher e

Marine Observation and Data

Data Infrastructure & Integration

On June 24, 2009 the Intergovernmental Oceanographic Commission accepted OBIS as a program under the International Oceanographic Data Exchange (IODE).

OBIS
OCEAN BIOGEOGRAPHIC INFORMATION SYSTEM

IODE International Oceanographic Data and Information Exchange

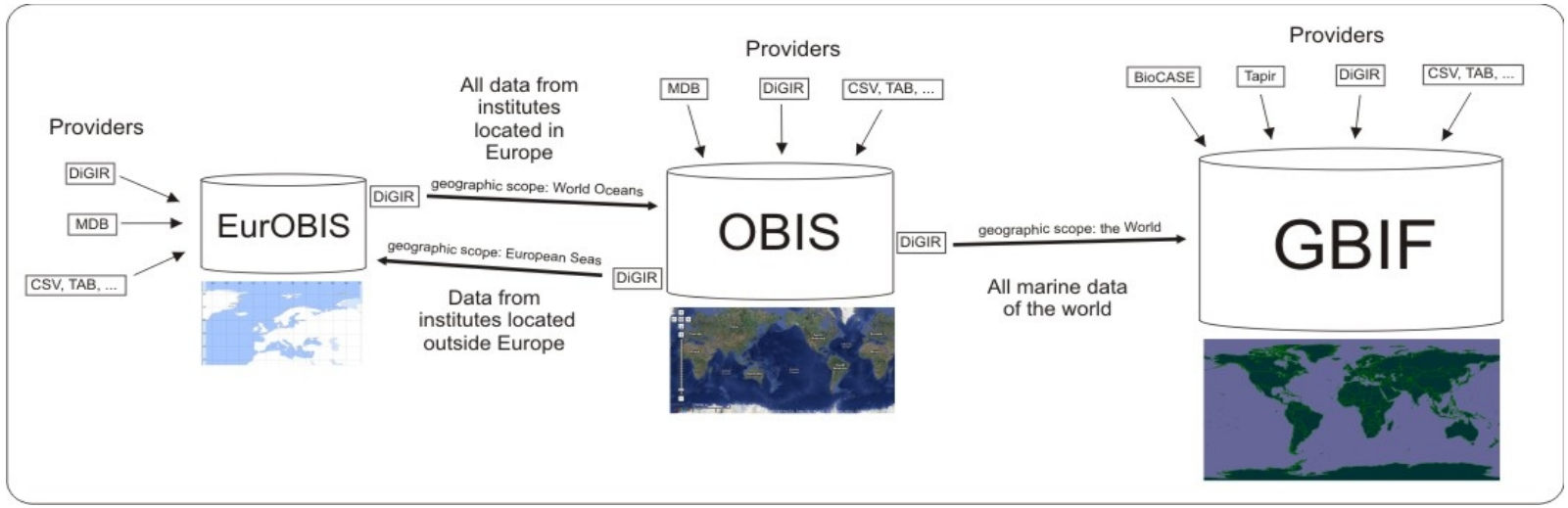
Although the Secretariat of OBIS will remain at Rutgers University, this new status within IOC will help to ensure the global use and maintenance of OBIS into the future.

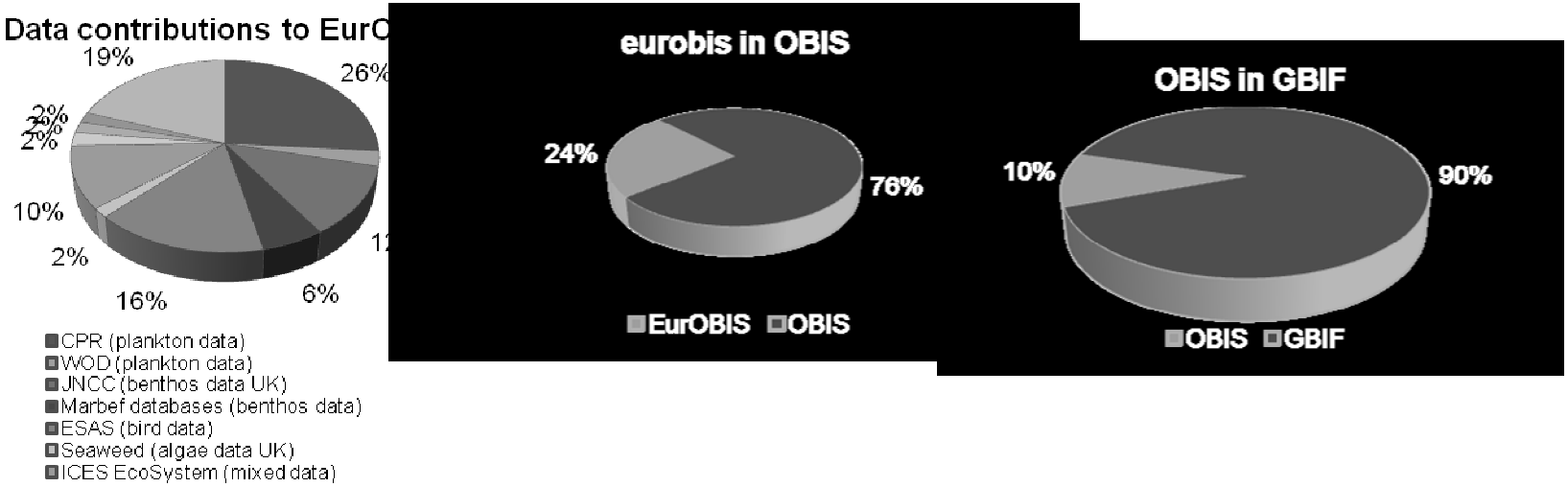
EMODnet Biological Data Portal

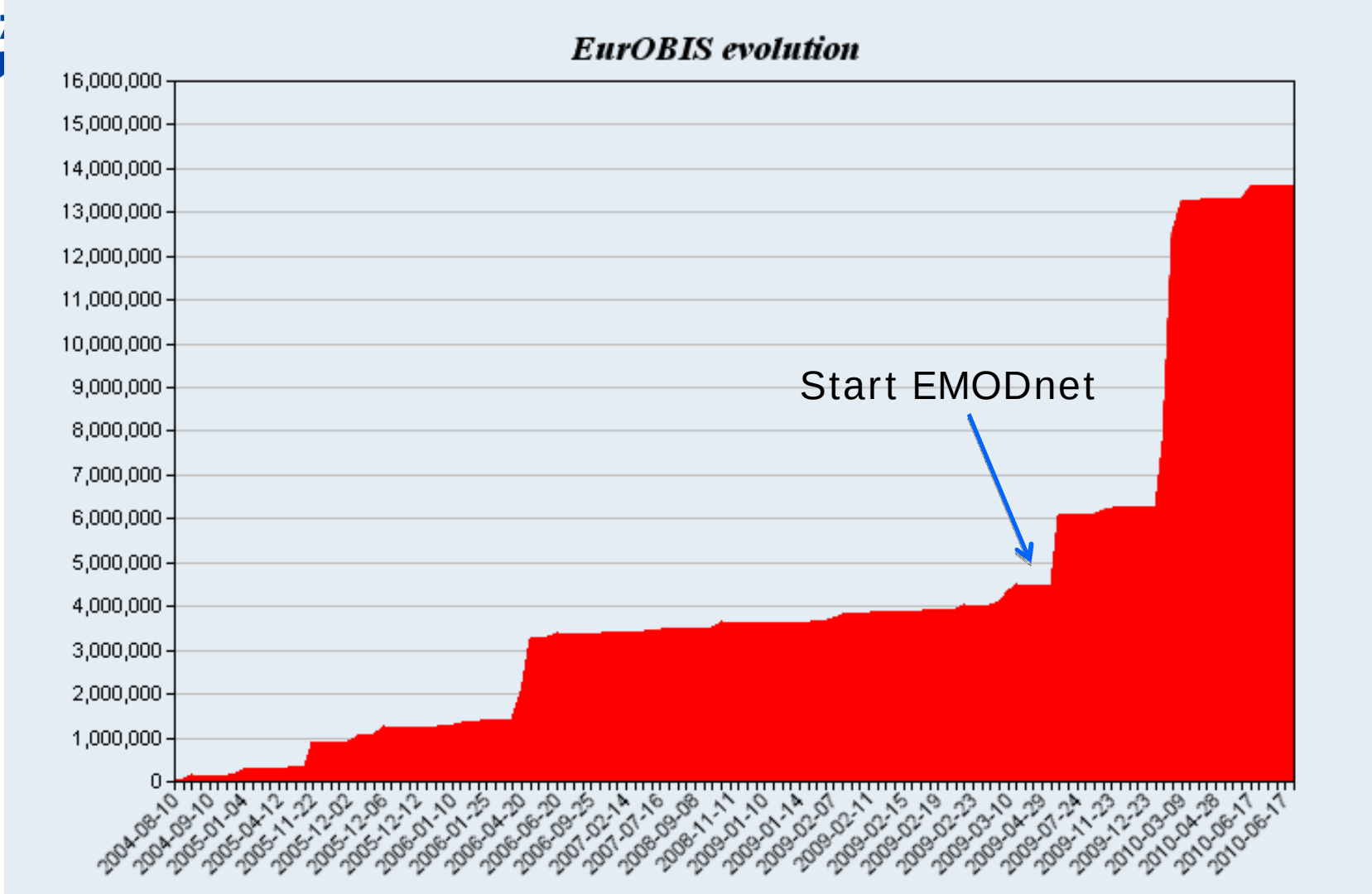
Objectives

- Build data system to provide biological data to EMODnet portal and other European initiatives

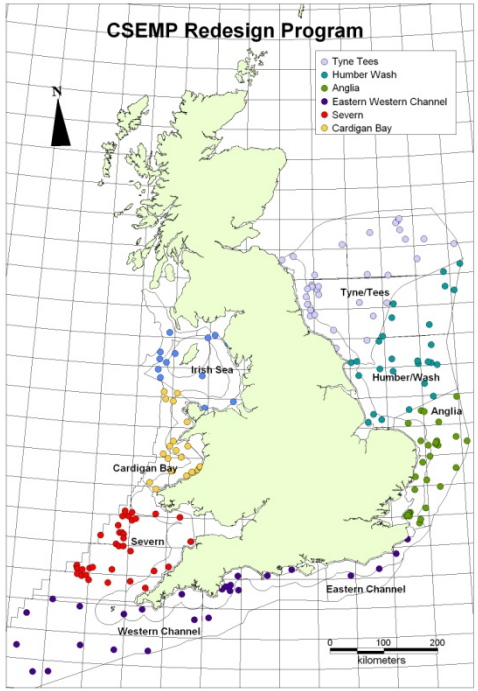
EurOBIS Data flow



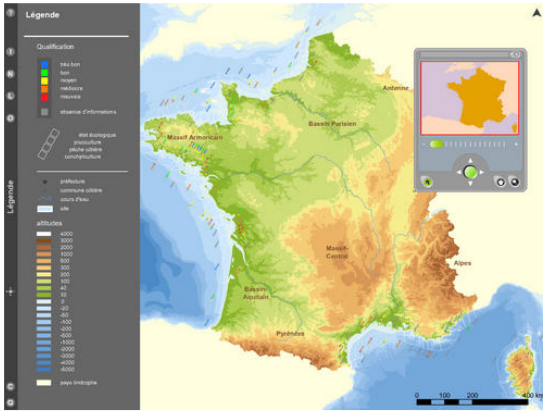



EurOBIS evolution
16,000,000
15,000,000
14,000,000
13,000,000
12,000,000
11,000,000
10,000,000
9,000,000
8,000,000
7,000,000
6,000,000
5,000,000
4,000,000
3,000,000
2,000,000
1,000,000
0
Start EMODnet
2004-08-10
2004-09-10
2005-01-04
2005-04-12
2005-11-22
2005-12-02
2005-12-06
2005-12-12
2006-01-10
2006-01-25
2006-04-20
2006-06-20
2006-09-25
2007-02-14
2007-07-16
2008-09-08
2008-11-11
2009-01-10
2009-01-14
2009-02-07
2009-02-11
2009-02-15
2009-02-19
2009-02-23
2009-03-10
2009-04-29
2009-07-24
2009-11-23
2009-12-23
2010-03-09
2010-04-28
2010-06-17
2010-06-17

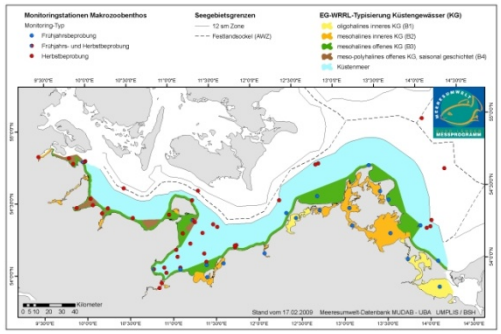
Identified monitoring datasets in focus area: national datasets (in progress)



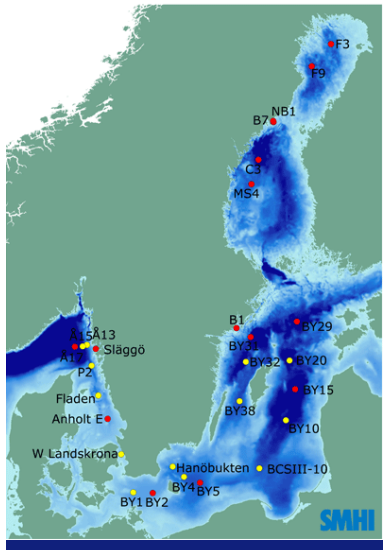
UK CSEMP



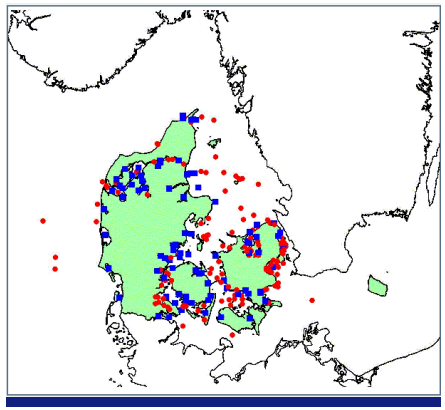
QUADRIGE: French Monitoring (1974)



German Marine Monitoring Programme – GMMP (BLMP)



SHARK: Swedish Monitoring (1972)

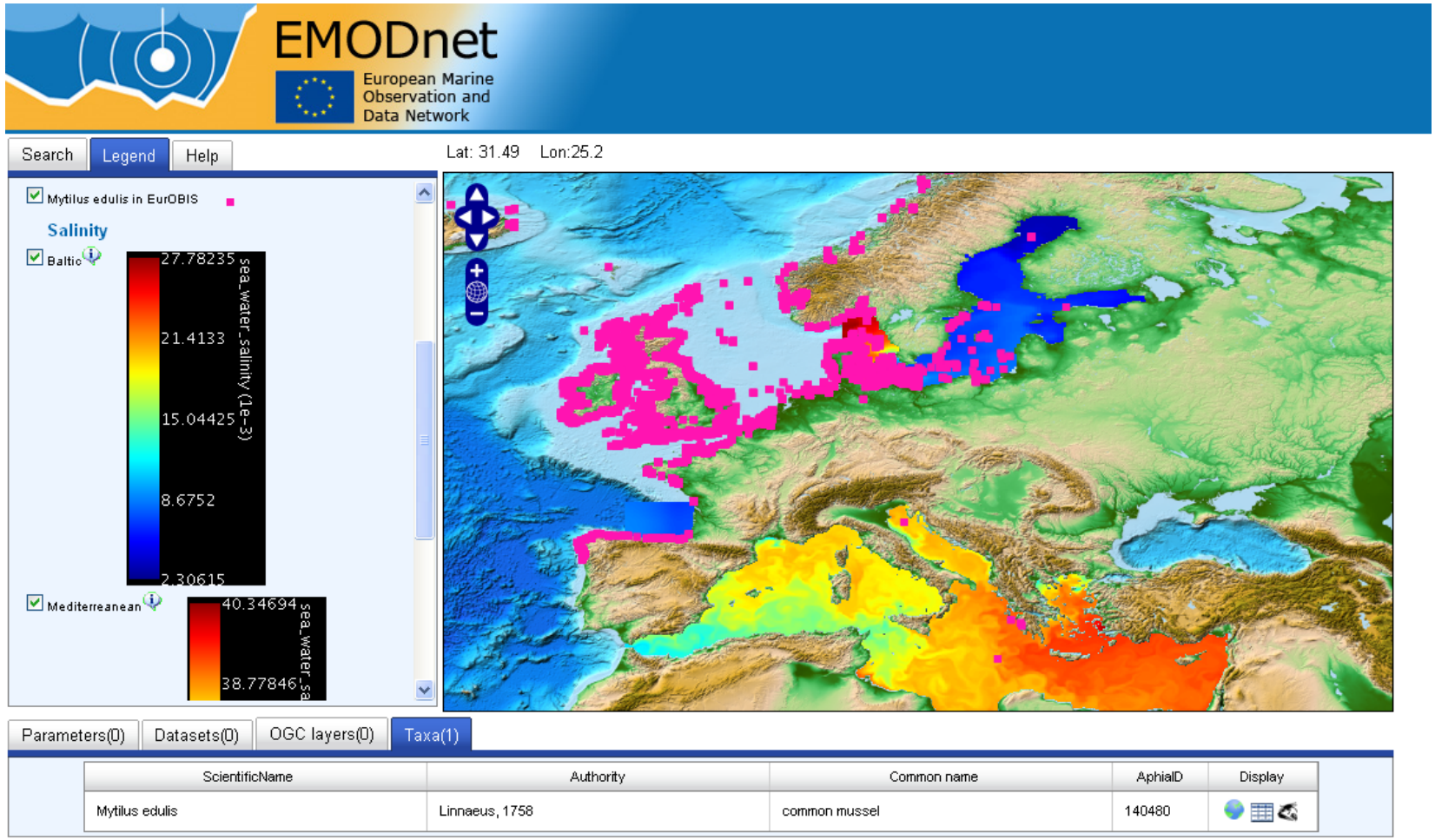


MADS: Danish Monitoring (1970)

.....

Portal online at:

http://bio.emodnet.eu



Thank you for your attention

Still photography and video

BIO-Acrobat

Peter Cranford

a light weight, computer controlled towed system that will enable rapid pelagic (CTD, chlorophyll, total particulate matter and oxygen) and benthic (digital photography and video) bay-scale habitat mapping

Underwater Reconnaissance and Coastal Habitat Inventory = URCHIN

Peter Lawton

an underwater video system for detailed inshore ecosystem research

January 2006

Lidar systems

- Light detection and ranging (lidar) systems operate in visible to near-infrared wavelengths, while radio detection and ranging (radar) emits radiation in longer microwave wavelengths.
- The application of lidar technology to marine biodiversity conservation shows considerable promise for detecting habitats in two major ways.
- First, when combined with optical remote sensing, lidar data enable scientists to calibrate reflectance so they can differentiate between water depth and changes in the sea floor.
- Second, models based on lidar-generated, fine-scale bathymetry data and biophysical parameters affecting the growth and population dynamics of many (reef) organisms (e.g. depth, exposure and suspended sediment concentration) should help us to predict the distribution of benthic communities as well as the processes governing the distribution of these communities.

Acoustic methods

- Excellent results have been obtained in detecting and classifying seabed vegetation by combined application of acoustic methods.
- Single beam echosounder, which enables classification of the seafloor and its vegetation,
- Multi-beam sonar, which generates micro-relief
- Side scan sonar, imaging the seafloor reflectivity and thus enabling the spatial classification of seafloor types and vegetation.

Identified monitoring datasets in focus area: national datasets (in progress)

Country	Groups	Temporal scope
Sweden	benthos, plankton, mammals	1971 - present
Denmark	benthos, plankton, algae	1979 - present
Germany	benthos, plankton, birds, mammals, algae	1973 - present
Netherlands	benthos, plankton, birds, plants, mammals, bacteria	1948 - present
Belgium	benthos, birds	1979 - present
UK	Benthos, birds, macrolagae, plants	1970's - present
Ireland	plankton, mammals	1990's - present
France	benthos, plankton	1987 - present
Spain	plankton	1987 - present
Portugal	*No specific national program*	

Earth observation satellites: green light for EU funding

Industry - 11-05-2010 - 14:45

EU Satellites that observe the Earth's surface for environmental and security purposes came a step closer on Tuesday, when Industry Committee MEPs unanimously approved a draft regulation providing a legal basis for them, plus €107 million for initial operations in 2011-2013. The regulation has still to be approved by the full Parliament, probably in June.

OSPAR

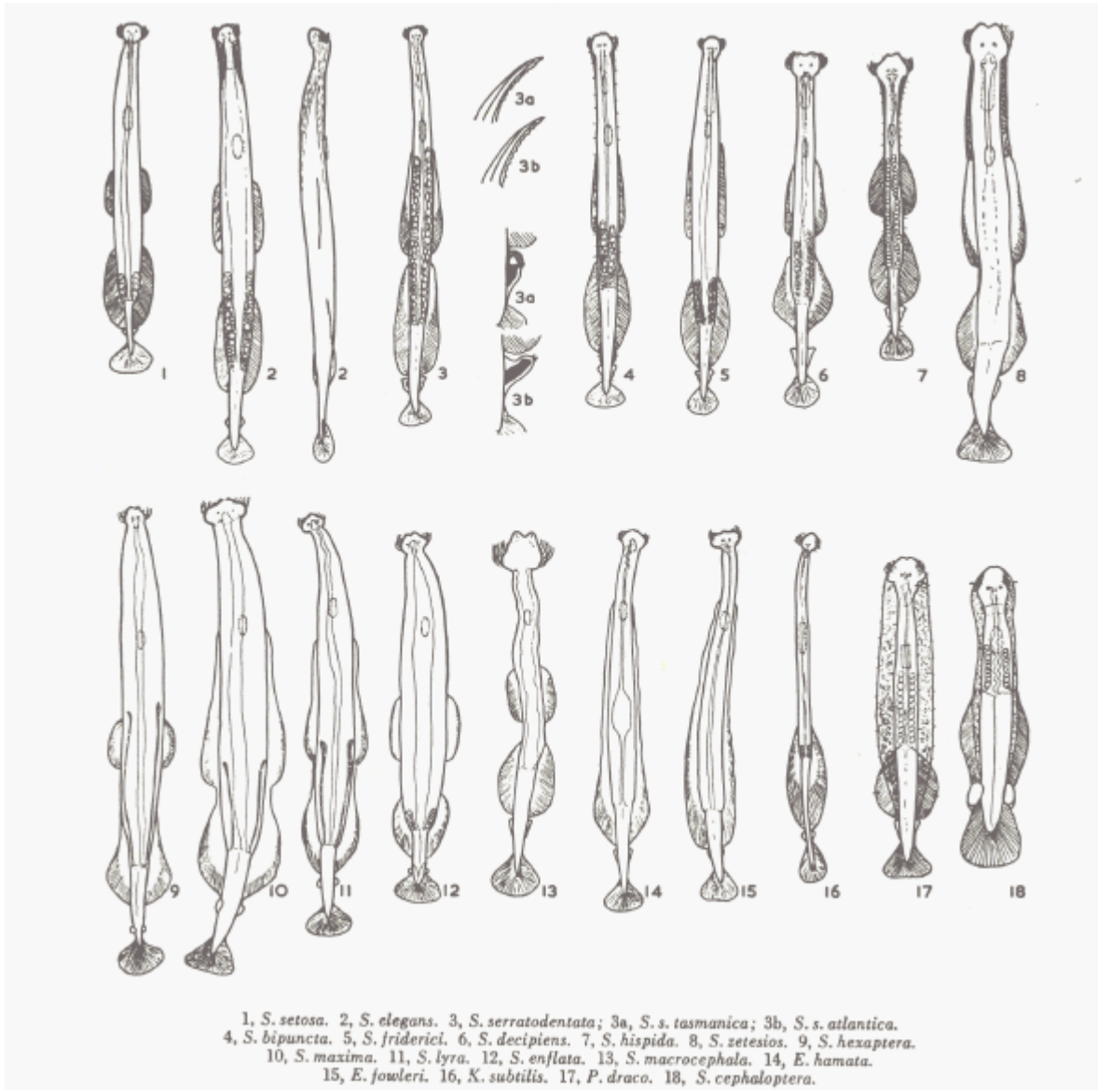
§ The Norwegian Ministry of the Environment will host the Ministerial Meeting of the OSPAR Commission ("the North-East Atlantic Environment Summit") in Bergen, Norway. The 15 countries and the European Union, that are Contracting Parties to the OSPAR Convention, are expected to take urgent actions for the protection of the marine environment but also to celebrate some important achievements for the North-East Atlantic.

§ Important issues for in-depth consideration include:

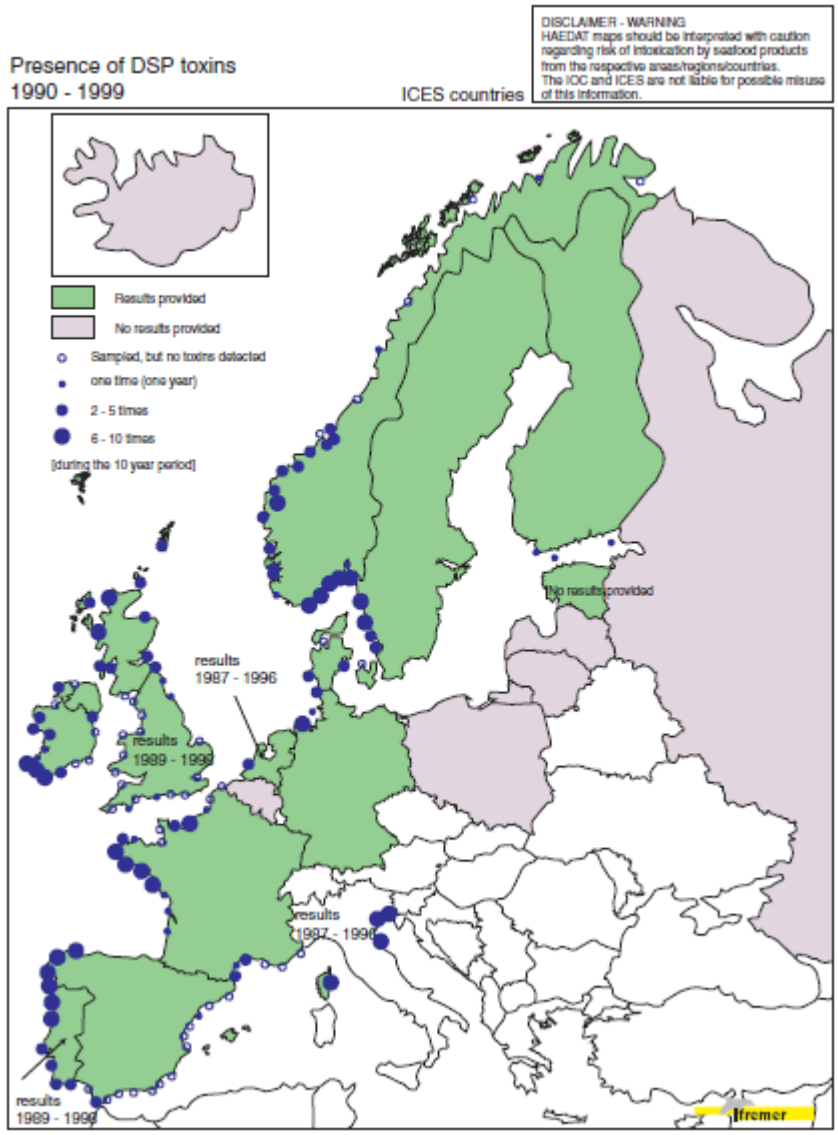
• Actions and measures for the protection of marine biodiversity, including taking forward a coherent and well-managed network of marine protected areas, which may include areas beyond national jurisdiction;

• Climate change and ocean acidification;

• Achieving good environmental status in the North-East



1, *S. setosa*. 2, *S. elegans*. 3, *S. serratodentata*; 3a, *S. s. tasmanica*; 3b, *S. s. atlantica*.
4, *S. bipuncta*. 5, *S. friderici*. 6, *S. decipiens*. 7, *S. hispida*. 8, *S. zetesios*. 9, *S. hexaptera*.
10, *S. maxima*. 11, *S. lyra*. 12, *S. enflata*. 13, *S. macrocephala*. 14, *E. hamata*.
15, *E. fowleri*. 16, *K. subtilis*. 17, *P. draco*. 18, *S. cephaloptera*.


Presence of DSP toxins
1990 - 1999
ICES countries
DISCLAIMER - WARNING
HAEDAT maps should be interpreted with caution regarding risk of intoxication by seafood products from the respective areas/regions/countries.
The IOC and ICES are not liable for possible misuse of this information.
Results provided
No results provided
Sampled, but no toxins detected
one time (one year)
2 - 5 times
6 - 10 times
[during the 10 year period]
No results provided
results 1987 - 1996
results 1989 - 1998
results 1987 - 1996
results 1989 - 1998
Ifremer

ICES home | EcoSystemData | Inventory | Query | Web services

ICES EcoSystemData

Welcome to EcoSystemData, this data warehouse contains marine environmental data from the ICES databases, featuring:

- Coverage of North-East Atlantic, Greenland sea, Baltic sea and Norwegian sea
- Contaminants in biota, sediment and water, fish disease
- Biological communities and aggregated fish trawl survey data
- Oceanographic measurements, such as temperature and salinity
- Data spanning the years 1877-2009
- Data are available to download, read the ICES data policy for conditions

EcoSystemData Online Warehouse

Dataset	Measurements	No of years	Last Updated
Biological community	240 210	30	21/06/2010
Contaminants and biological effects	9 156 392	33	21/06/2010
Fish trawl survey	11 045 569	45	16/02/2010
Oceanographic	235 009 335	121	22/03/2010

Pressures and Impacts

- Physical loss
  - — Smothering (e.g. by man-made structures, disposal of dredge spoil), sealing (e.g. by permanent constructions).
- Physical damage
  - — Changes in siltation (e.g. by outfalls, increased run-off, dredging/disposal of dredge spoil), abrasion (e.g. impact on the seabed of commercial fishing, boating, anchoring),
  - — selective extraction (e.g. exploration and exploitation of living and non-living resources on seabed and subsoil).

- Other physical disturbance
  - Underwater noise (e.g. from shipping, underwater acoustic equipment),
  - marine litter.
- Interference with hydrological processes
  - Significant changes in thermal regime (e.g. by outfalls from power stations),
  - significant changes in salinity regime (e.g. by constructions impeding water movements, water abstraction).

Pressures (cont'd)

- Contamination by hazardous substances
  - — Introduction of synthetic compounds (e.g. priority substances under Directive 2000/60/EC which are relevant for the marine environment such as pesticides, antifoulants, pharmaceuticals, resulting, for example, from losses from diffuse sources, pollution by ships, atmospheric deposition and biologically active substances),
  - — introduction of non-synthetic substances and compounds (e.g. heavy metals, hydrocarbons, resulting, for example, from pollution by ships and oil, gas and mineral exploration and exploitation, atmospheric deposition, riverine inputs),
  - — introduction of radio-nuclides.

- Systematic and/or intentional release of substances

  — Introduction of other substances, whether solid, liquid or gas, in marine waters, resulting from their systematic and/or intentional release into the marine environment, as permitted in accordance with other Community legislation and/or international conventions.

Pressures (cont'd)

§ Nutrient and organic matter enrichment

— Inputs of fertilisers and other nitrogen and phosphorus-rich substances (e.g. from point and diffuse sources, including agriculture, aquaculture, atmospheric deposition),

— inputs of organic matter (e.g. sewers, mariculture, riverine inputs).

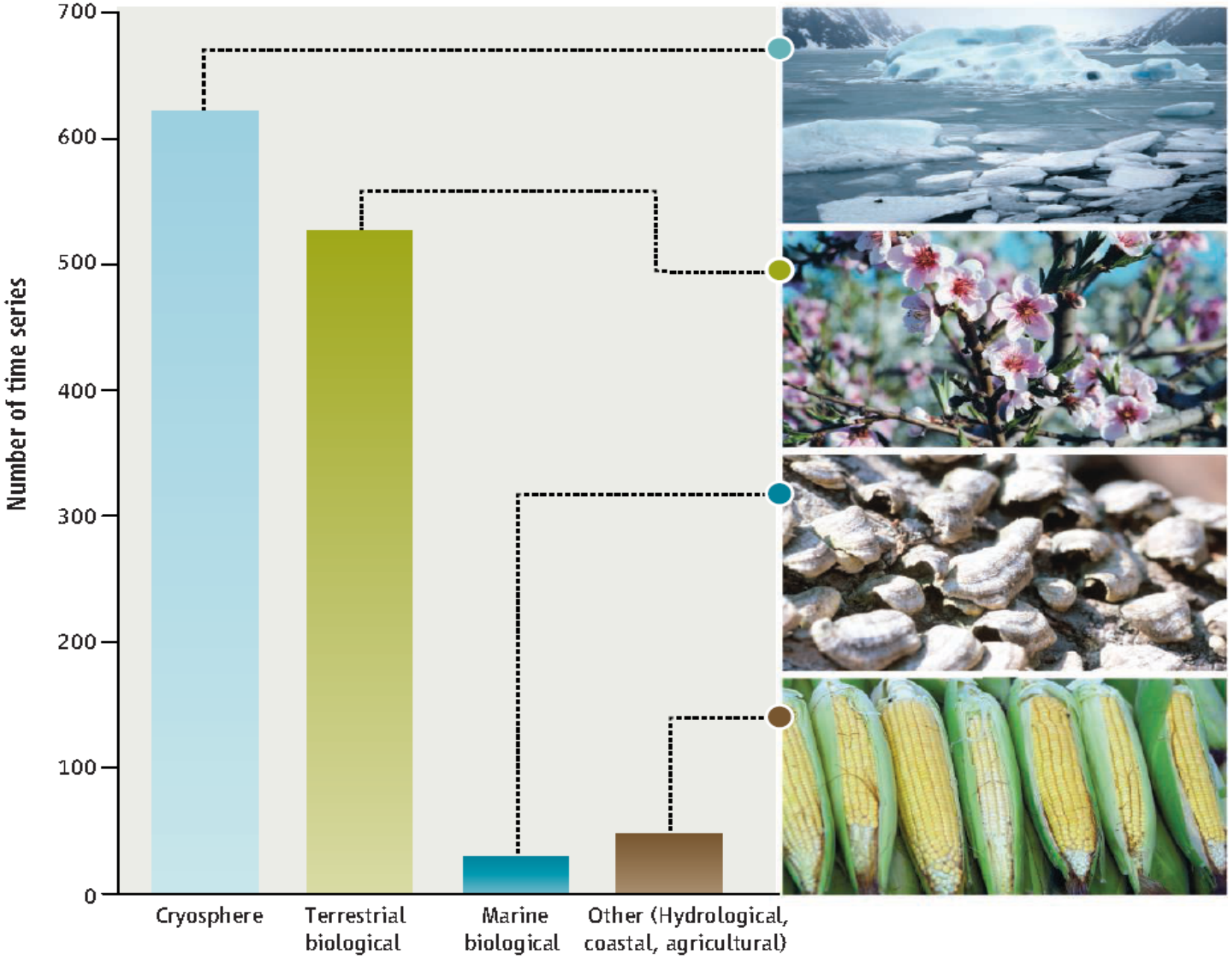
§ Biological disturbance

— Introduction of microbial pathogens,

— introduction of non-indigenous species and translocations,

— selective extraction of species, including incidental non-target catches (e.g. by commercial and recreational fishing).

- The recent IPCC (Intergovernmental Panel on Climate Change) Fourth Assessment Report (1) noted 28,586 significant biological changes in terrestrial systems but only 85 from marine and freshwater systems.



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*).

What changes?

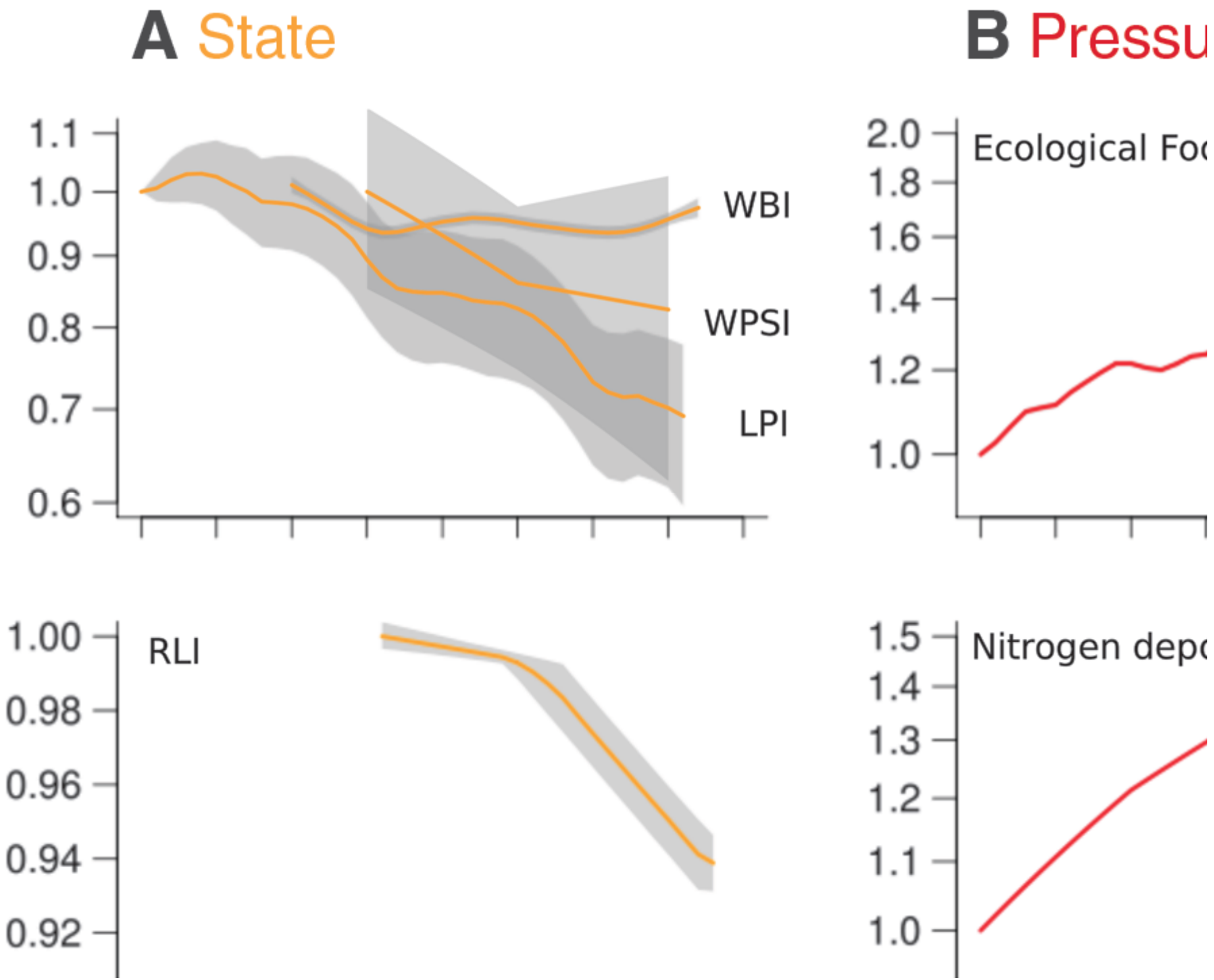
Biodiversity indicators	
Components of biodiversity	
Trends in extent of selected biomes, ecosystems, habitats	
Trends in abundance of selected species	
Coverage of protected areas	
Changes in status of threatened species	
Trends in genetic diversity	
Sustainable use	
Area under sustainable management	
Proportion of products from sustainable sources	
Ecological footprint and related concepts	
Threats to biodiversity	
Nitrogen deposition	
Trends in invasive alien species	
Ecosystem integrity, goods and services	
Marine Trophic Index	
Water quality of freshwater ecosystems	
Trophic integrity of other ecosystems	
Connectivity/fragmentation of ecosystems	
Human-induced ecosystem failure	
Health and well-being of communities	
Biodiversity for food and medicine	
Status of knowledge, innovations, and practices	
Linguistic diversity	
Indigenous and traditional knowledge	
Status of access and benefits sharing	
Access and benefits sharing	
Status of resource transfers	
Official development assistance	
Technology transfer	

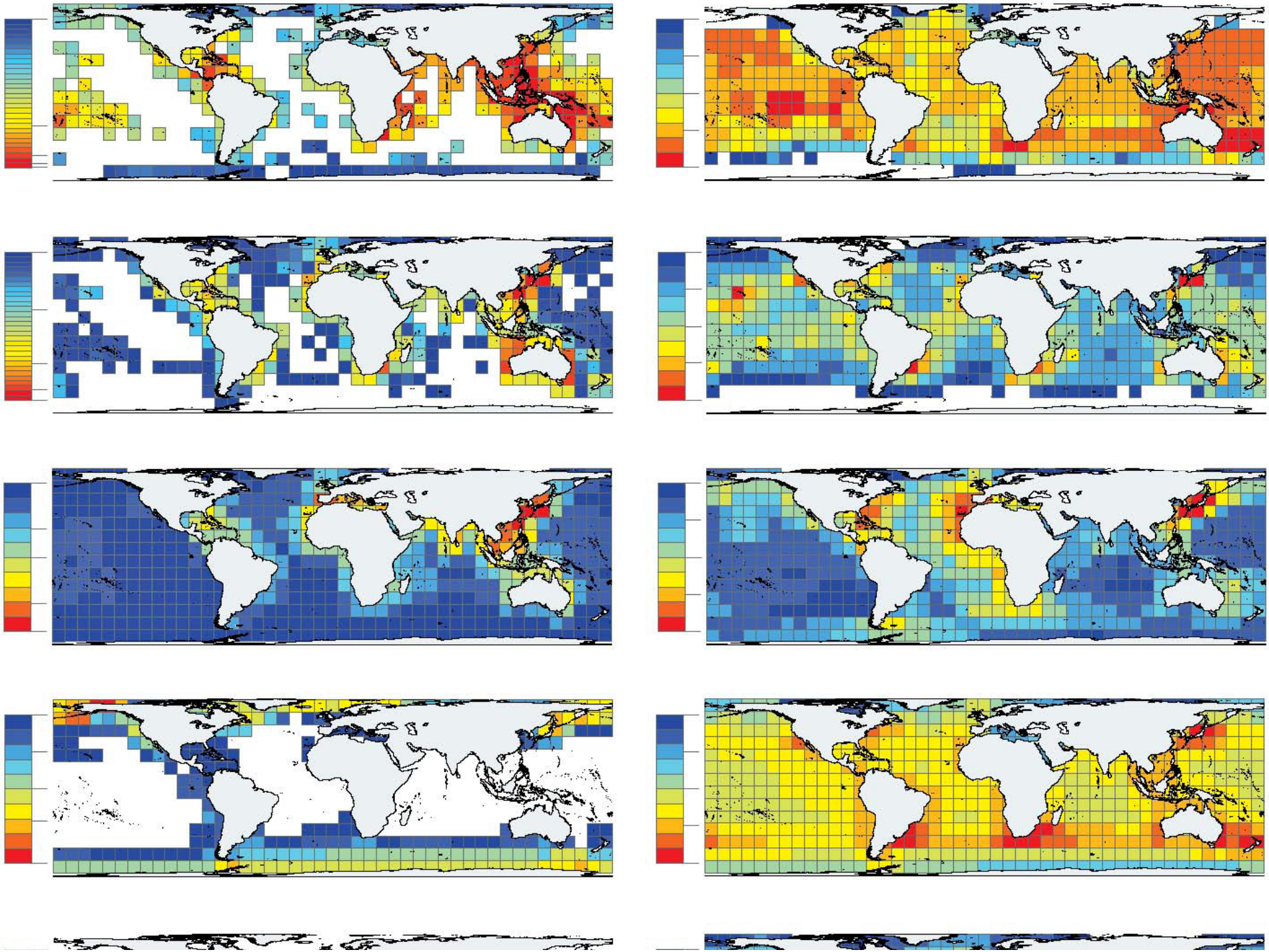
Table 1. Current development of the headline biodiversity indicators within the CBD framework. ■ Fully developed with well-established methodologies and global time-series data, ■ under development, and ■ not being developed. Multiple labels indicate multiple measures under each headline. See also SOM and 2010 Biodiversity Indicators Partnership, www.twentyten.net.

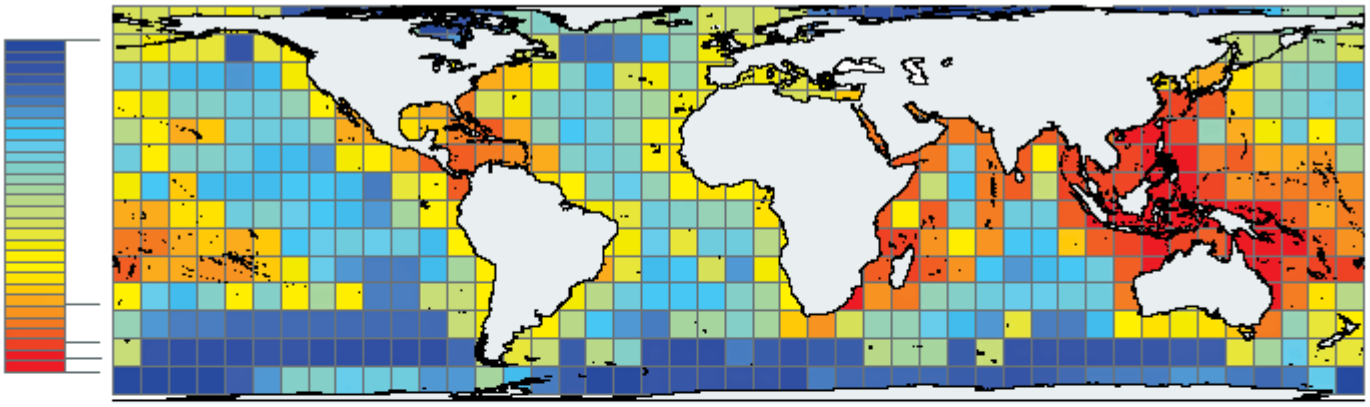
Table 1 SEBI 2010 indicators within CBD focal areas and headline indicators

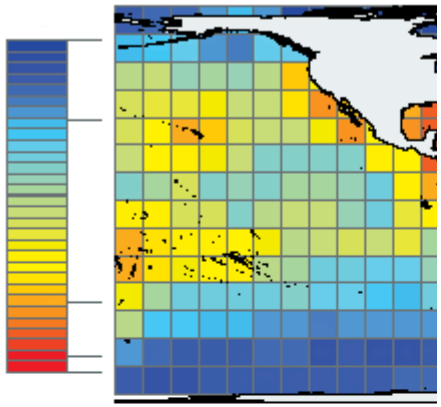
CBD focal area	Headline indicator	SEBI 2010 specific indicator
Status and trends of the components of biological diversity	Trends in the abundance and distribution of selected species	1. Abundance and distribution of selected species a. birds b. butterflies
	Change in status of threatened and/or protected species	2. Red List Index for European species
		3. Species of European interest
	Trends in extent of selected biomes, ecosystems and habitats	4. Ecosystem coverage
		5. Habitats of European interest
	Trends in genetic diversity of domesticated animals, cultivated plants, and fish species of major socio-economic importance	6. Livestock genetic diversity
	Coverage of protected areas	7. Nationally designated protected areas
		8. Sites designated under the EU Habitats and Birds Directives
Threats to biodiversity	Nitrogen deposition	9. Critical load exceedance for nitrogen
	Trends in invasive alien species (numbers and costs of invasive alien species)	10. Invasive alien species in Europe
	Impact of climate change on biodiversity	11. Impact of climatic change on bird populations
Ecosystem integrity and ecosystem goods and services	Marine Trophic Index	12. Marine Trophic Index of European seas
	Connectivity/fragmentation of ecosystems	13. Fragmentation of natural and semi-natural areas
		14. Fragmentation of river systems
	Water quality in aquatic ecosystems	15. Nutrients in transitional, coastal and marine waters
		16. Freshwater quality
Sustainable use	Area of forest, agricultural, fishery and aquaculture ecosystems under sustainable management	17. Forest: growing stock, increment and fellings
		18. Forest: deadwood
		19. Agriculture: nitrogen balance
		20. Agriculture: area under management practices potentially supporting biodiversity
		21. Fisheries: European commercial fish stocks
		22. Aquaculture: effluent water quality from finfish farms
	Ecological Footprint of European countries	23. Ecological Footprint of European countries
Status of access and benefits sharing	Percentage of European patent applications for inventions based on genetic resources	24. Patent applications based on genetic resources
Status of resource transfers	Funding to biodiversity	25. Financing biodiversity management
Public opinion (additional EU focal Area)	Public awareness and participation	26. Public awareness

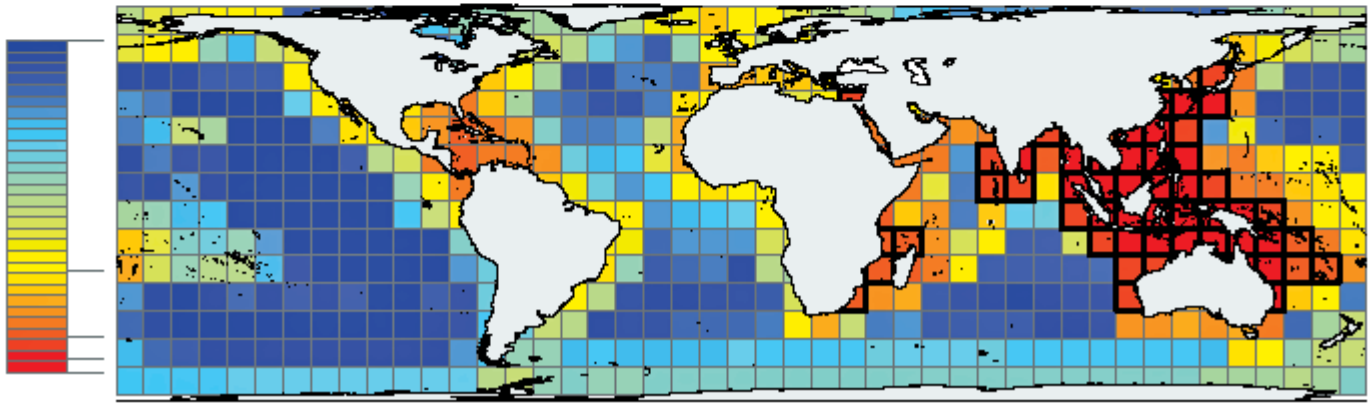
- To Carlo: Taken into account your experience in the marine Biology/biodiversity realm, we think that it will be very useful for the whole marine research community and policy makers present at the forum to learn a bit more on those disciplines in relation to observing/monitoring systems. As you know, when speaking about “Observatories”, it seems that we usually are more informed about the abiotic component on marine ecosystems that the biotic one.
- As a result, an overview of your field in relation to the forum topic with references of key projects and international initiatives would be of great added value to potentially (ideally) promote a new generation of “multitask/multipurpose” observatories, in line with a coherent geographical coverage.
- Could you provide me with a title?


A State
B Pressu
1.1
1.0
0.9
0.8
0.7
0.6
WBI
WPSI
LPI
2.0
1.8
1.6
1.4
1.2
1.0
Ecological Foo
1.00
0.98
0.96
0.94
0.92
RLI
1.5
1.4
1.3
1.2
1.1
1.0
Nitrogen depo









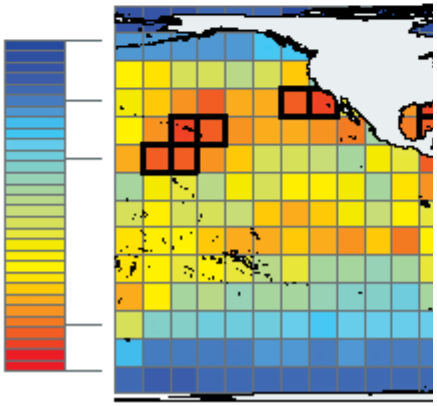
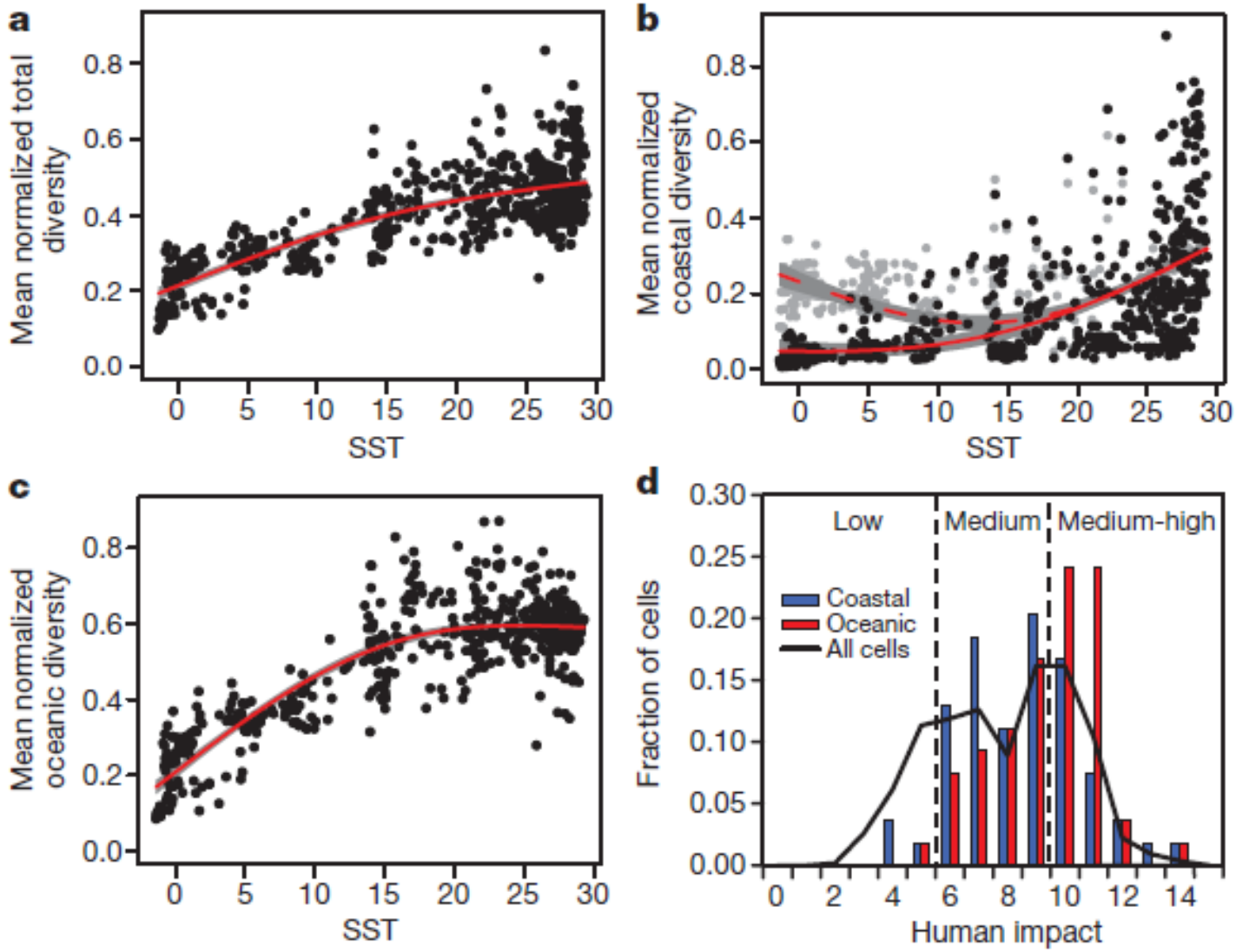
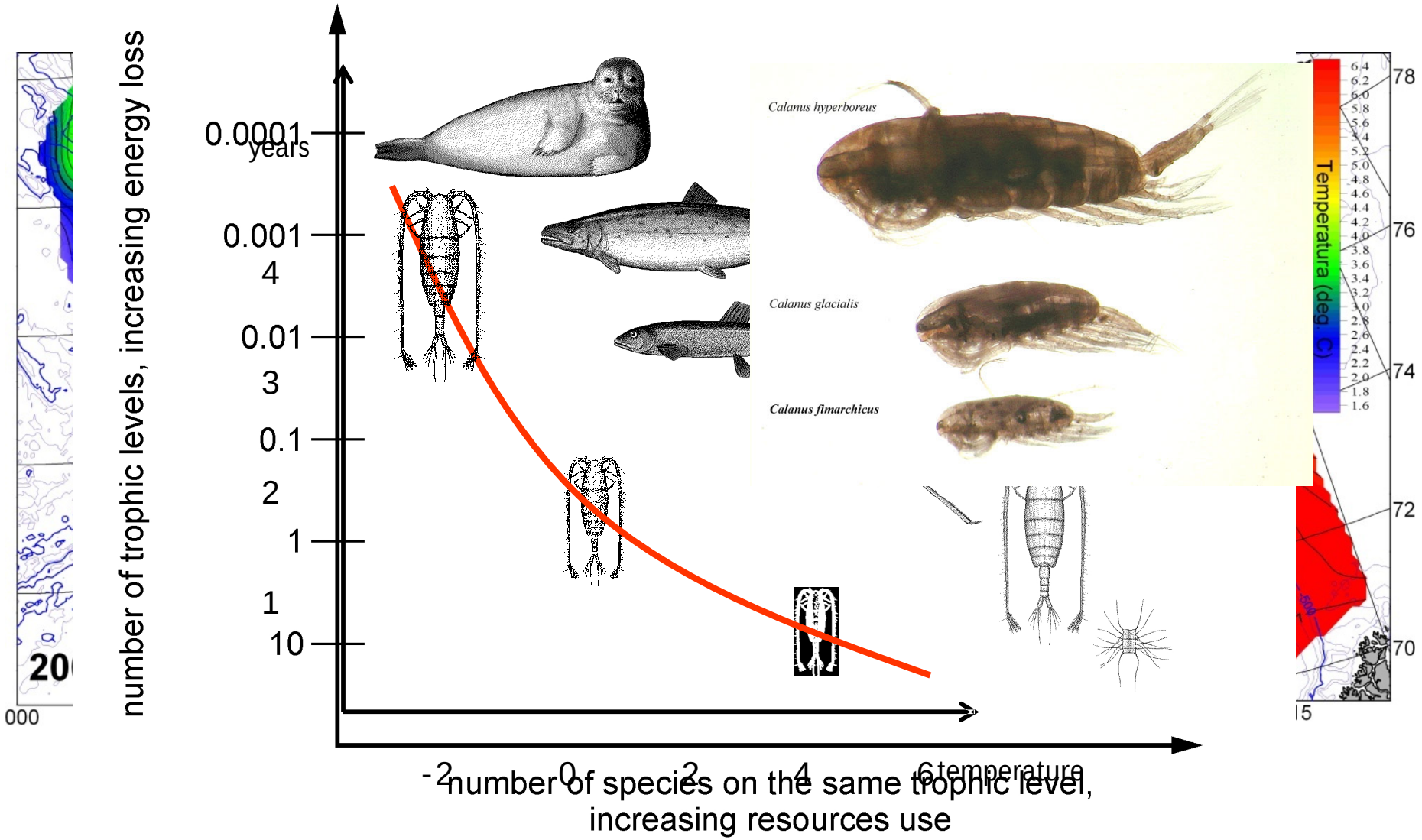


Figure 2 | Global species richness and hotspots
across taxa. (a) Global marine species richness
for all taxa from Table 1 combined. Richness
values for each taxon were then normalized by
rescaling from zero to one, and averaged across
taxa by cell for all taxa (b), primarily coastal taxa
(c) and primarily oceanic taxa (d). Cells with a
bold outline are hotspots (defined as the 10% of
cells with highest mean richness). Horizontal tick
marks on colour-bars indicate quartiles

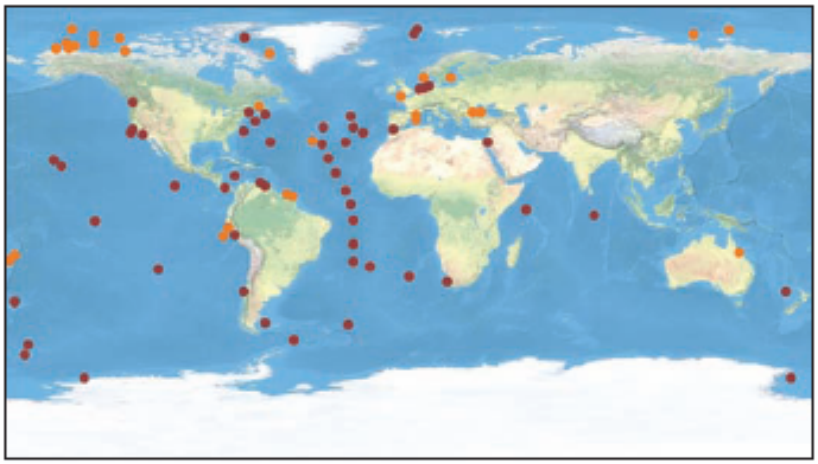

a
Mean normalized total diversity
0.0
0.2
0.4
0.6
0.8
0
5
10
15
20
25
30
SST
b
Mean normalized coastal diversity
0.0
0.2
0.4
0.6
0.8
0
5
10
15
20
25
30
SST
c
Mean normalized oceanic diversity
0.0
0.2
0.4
0.6
0.8
0
5
10
15
20
25
30
SST
d
Fraction of cells
0.00
0.05
0.10
0.15
0.20
0.25
0.30
Low
Medium
Medium-high
Coastal
Oceanic
All cells
0
2
4
6
8
10
12
14
Human impact

June 22, 2010 -- Glider trials
"A mini acoustic receiver was recently deployed on an ocean glider to explore a possible method for gathering tracking data beyond and between POST's existing lines. The mounting trial was successful, so next month the receiver will embark on a second journey..."


number of trophic levels, increasing energy loss
years
0.0001
0.001
4
0.01
3
0.1
2
1
1
10
-2
0
2
4
6temperature
number of species on the same trophic level,
increasing resources use
Calanus hyperboreus
Calanus glacialis
Calanus fimarchicus
Temperatura (deg. C)
78
76
74
72
70

Marine Microbes

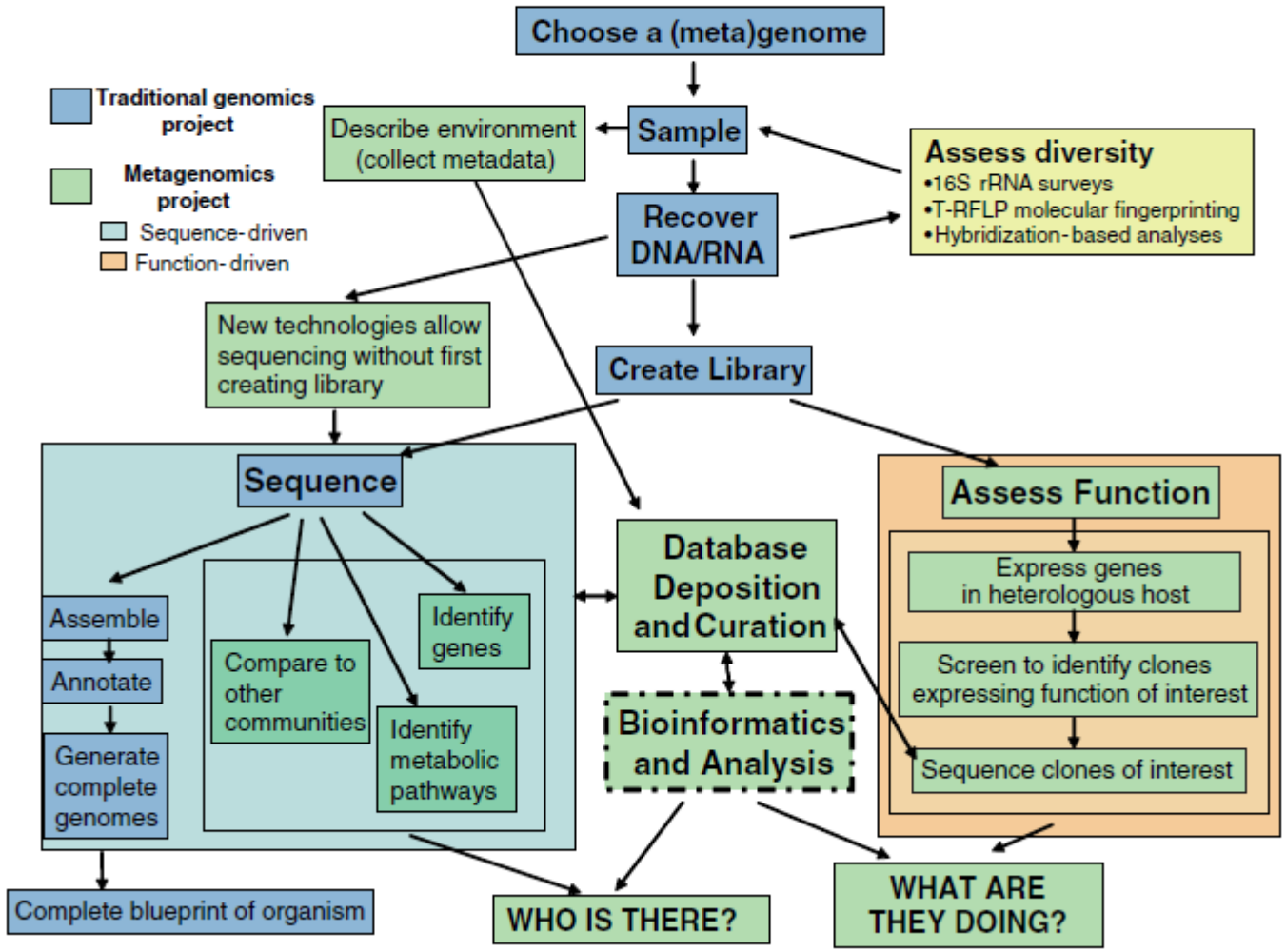
To study and catalogue global marine microbial diversity (Bacteria, Archaea, Protista and associated viruses) within an ecological and evolutionary context.



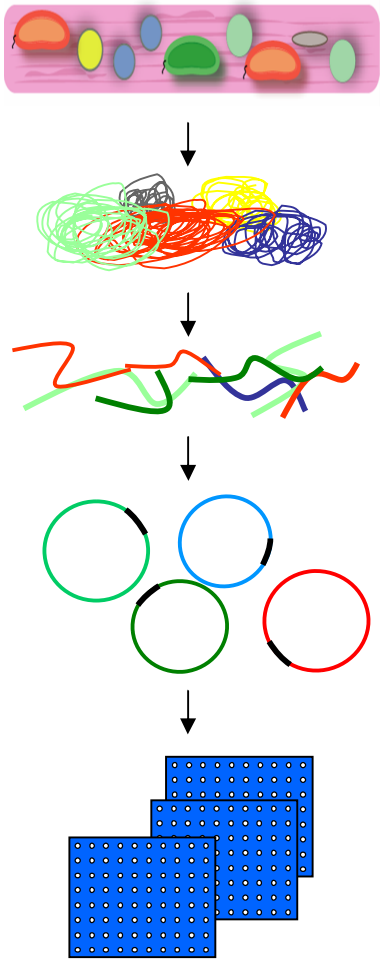
The map shows the locations of samples collected by 40 field projects employing the 454 tag-pyrosequencing technology. Image: ICoMM.

Still shots from a video of Thioploca (bacteria) mats found off the coast of Chile. Image: Carola Espinoza, Universidad de Concepcion.

DESIGNING A SUCCESSFUL METAGENOMICS PROJECT



Environmental Genomics



Microbial community

(extraction bias)

Total community DNA

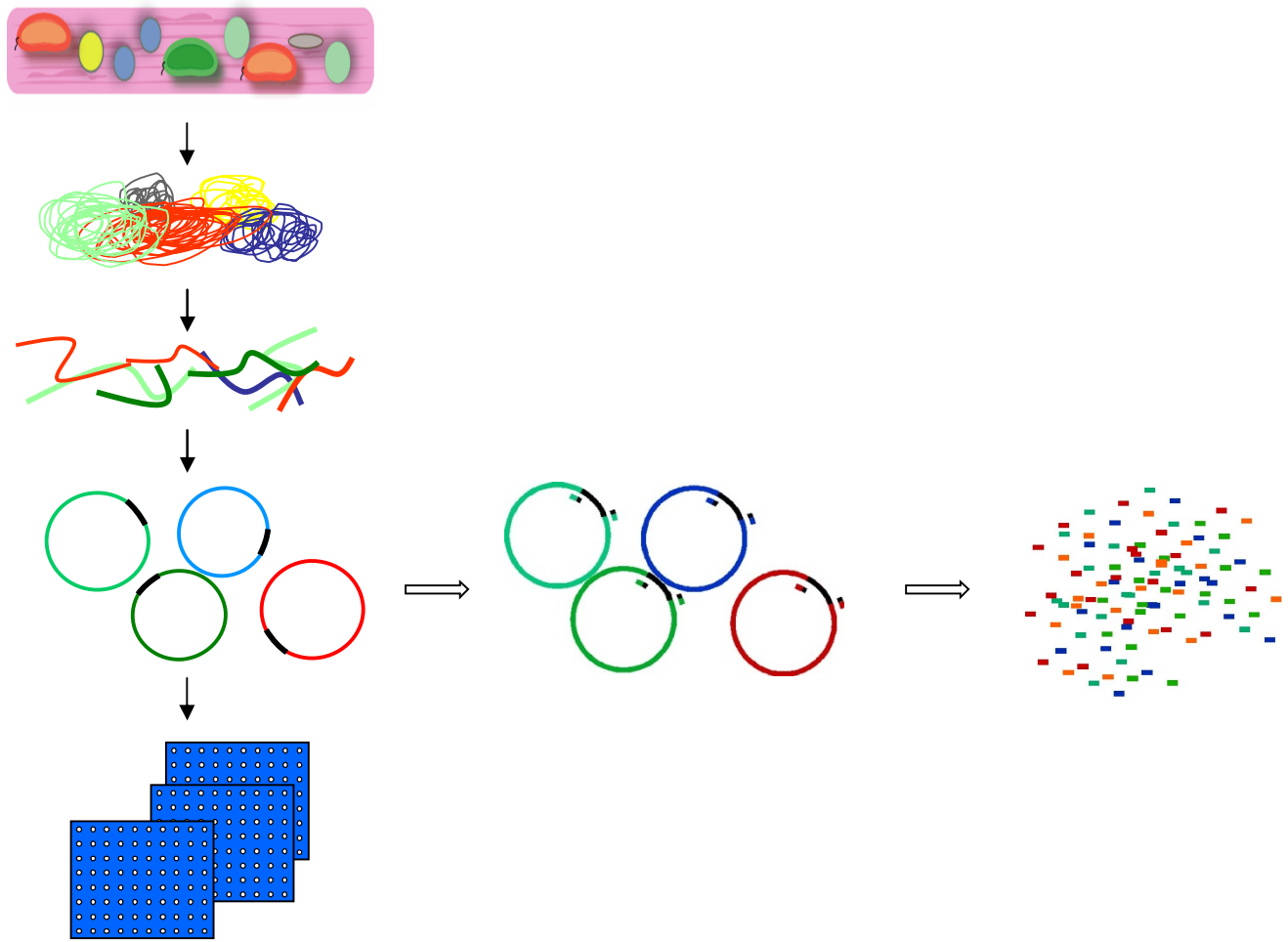
Digested fragments (40-200 kb-long)

(cloning bias)

Cloning into BAC/fosmid-vectors

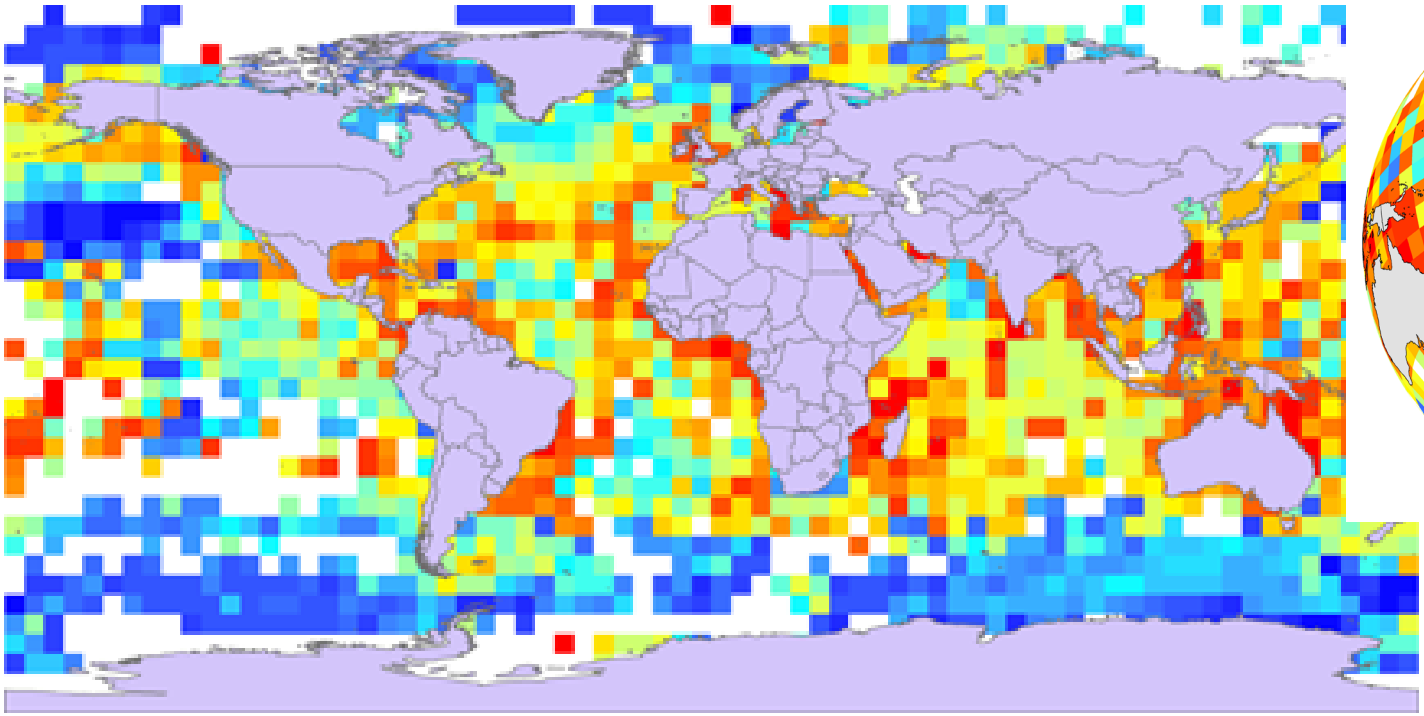
Hosting in *E. coli*

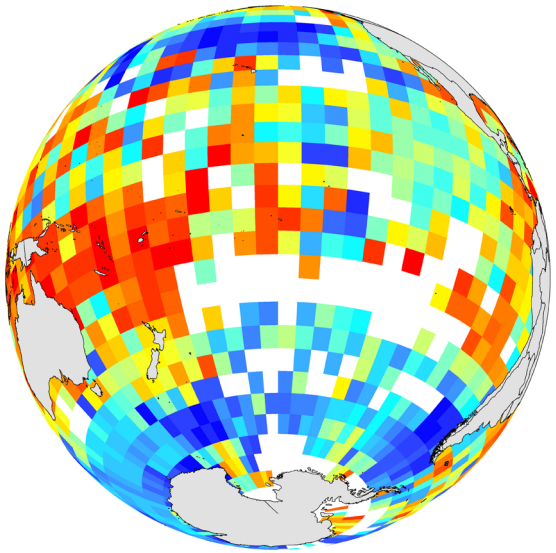
Metagenomics



CoML & Ocean Observing

Biological data infrastructure (OBIS)





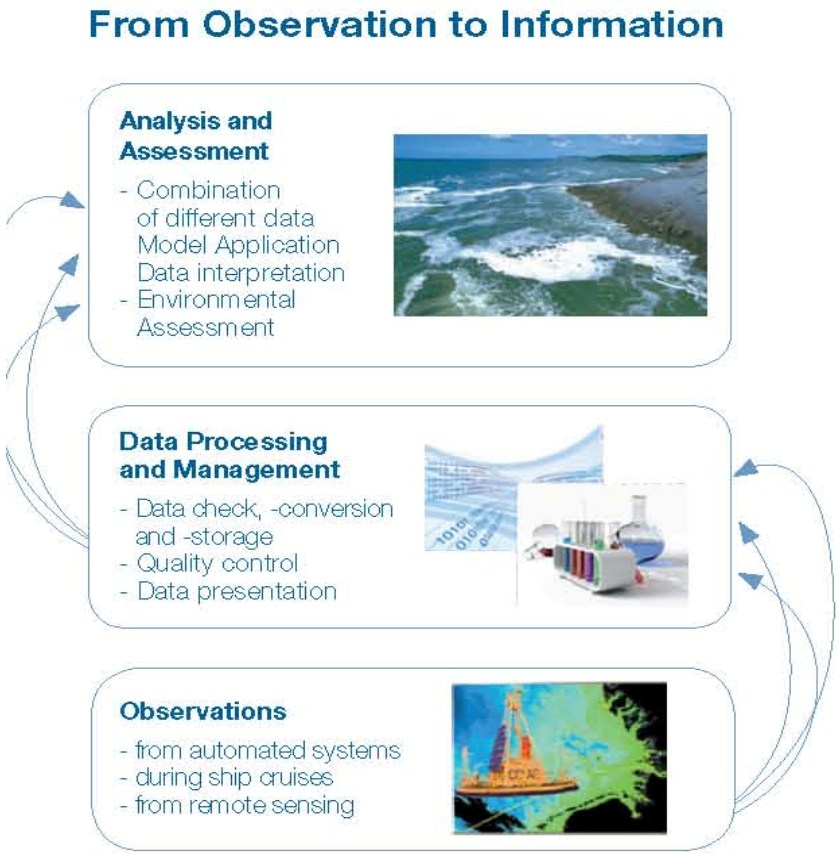
Images: Edward Vanden Berghe, OBIS

Maps of marine biodiversity based on the total number of distribution records in each five by five degree square in OBIS.
Red represents the highest number of species, blue the lowest, white no data.

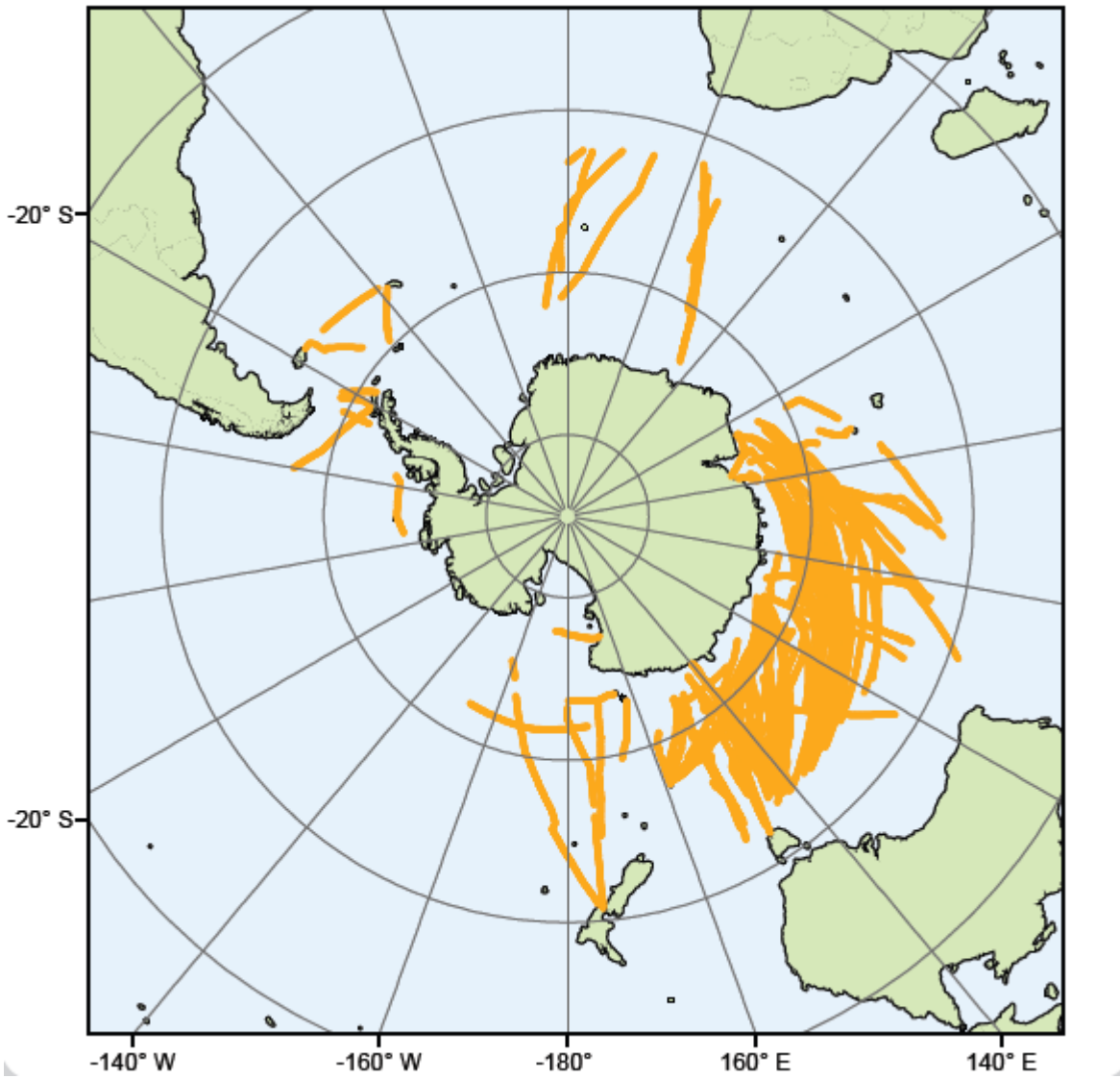
EMODnet ?

European Marine Observations and Data Network

- An Integrated Maritime Policy for the European Union (DG MARE)
- Address whole chain “from observation to information”
- Need to unlock access to existing data AND fill existing gaps
- Complementary to other initiatives
- Data Management
  - EMODnet as a system of systems
  - Organize a common data management approach accepted by all actors to ensure that data are available to all
  - Interoperability by adopting EU-INSPIRE principles



EMODnet
European Marine Observation and Data Network


-20° S
-20° S
-140° W
-160° W
-180°
160° E
140° E

Presence of specially adapted fauna

- è eg Sibloglinid worms and large mussels
- è reduced or no digestive system and
- è bacterial endosymbionts which fix carbon for their host
- è energy from sulphide or methane oxidation reactions

Biology is visible indicator of