



United Nations
Educational, Scientific and
Cultural Organization



Intergovernmental
Oceanographic
Commission



OCEAN BIOGEOGRAPHIC
INFORMATION SYSTEM



Ocean Biogeographic Information System Global Ocean Observing System Biology & Ecosystem

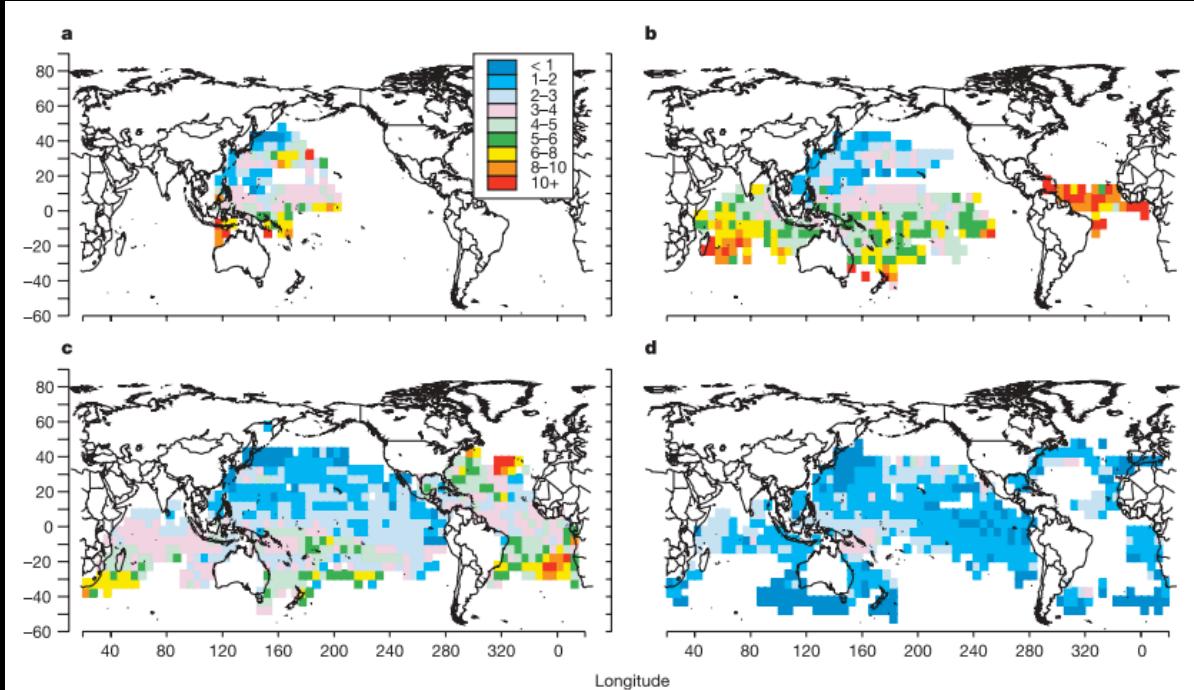
Ward Appeltans

Future Earth 3-5 May 2015, New Haven



Photo credits Sonke Johnsen and Charles Messing

90% of large predator fish stocks are gone



Myer & Worm (2003). Rapid worldwide depletion of predatory fish communities. *Nature*. 423

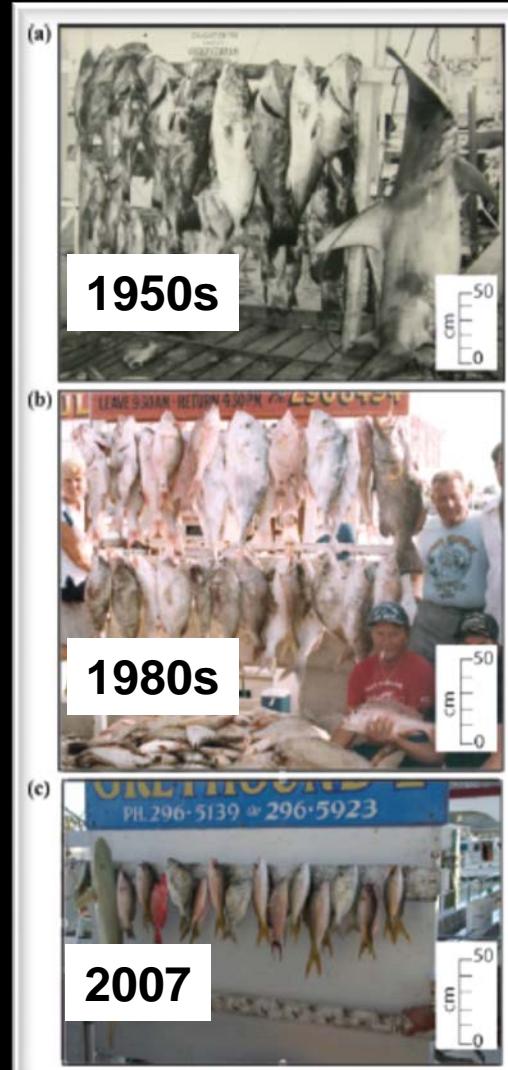
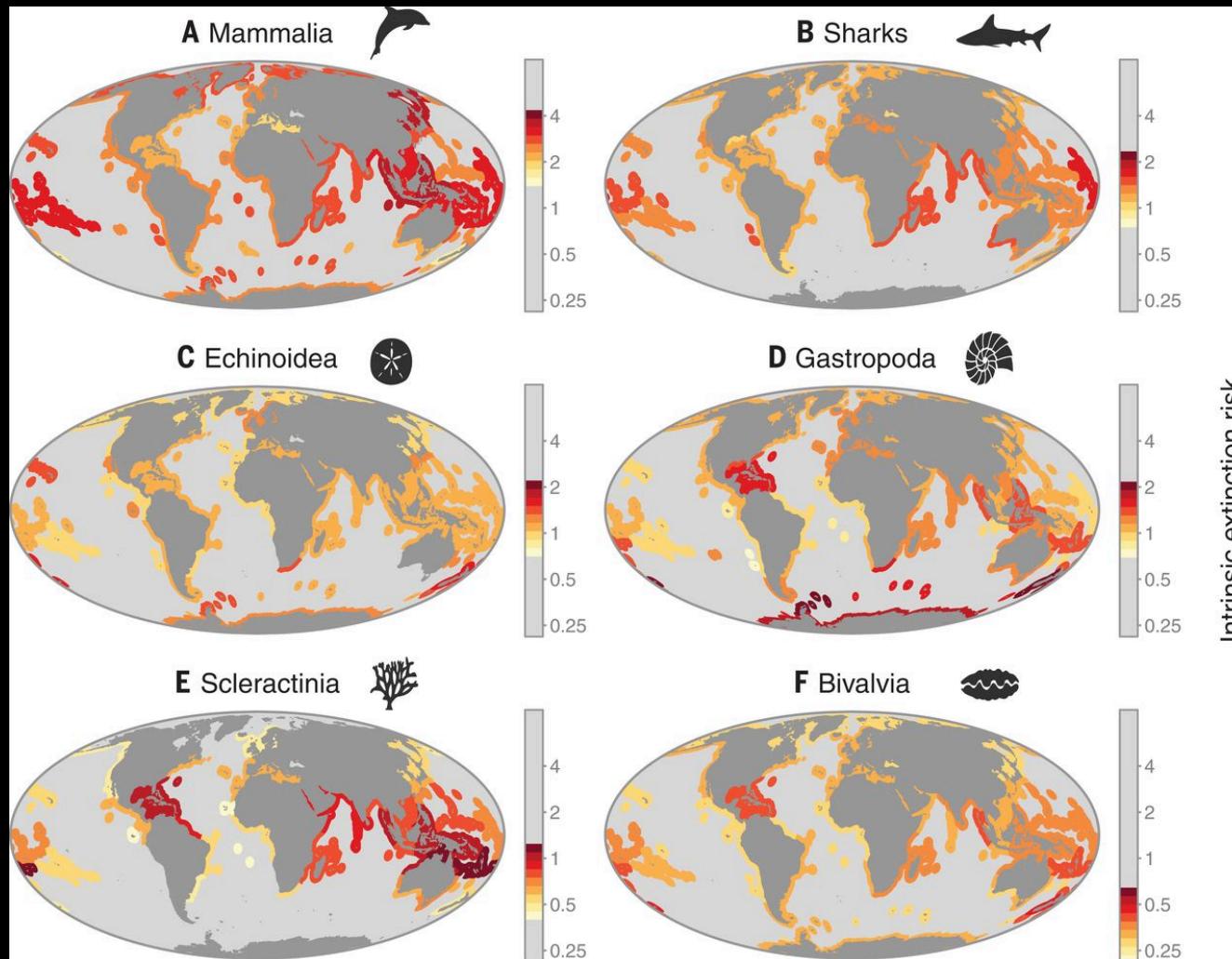


Figure 1. Trophy fish caught on Key West charter boats: (a) 1957, (b) early 1980s, and (c) 2007.

McClanahan (2009) *Cons. Biol.*

Geographic distribution of mean intrinsic risk for present-day genera across coastal biogeographic provinces for six major taxonomic groups.

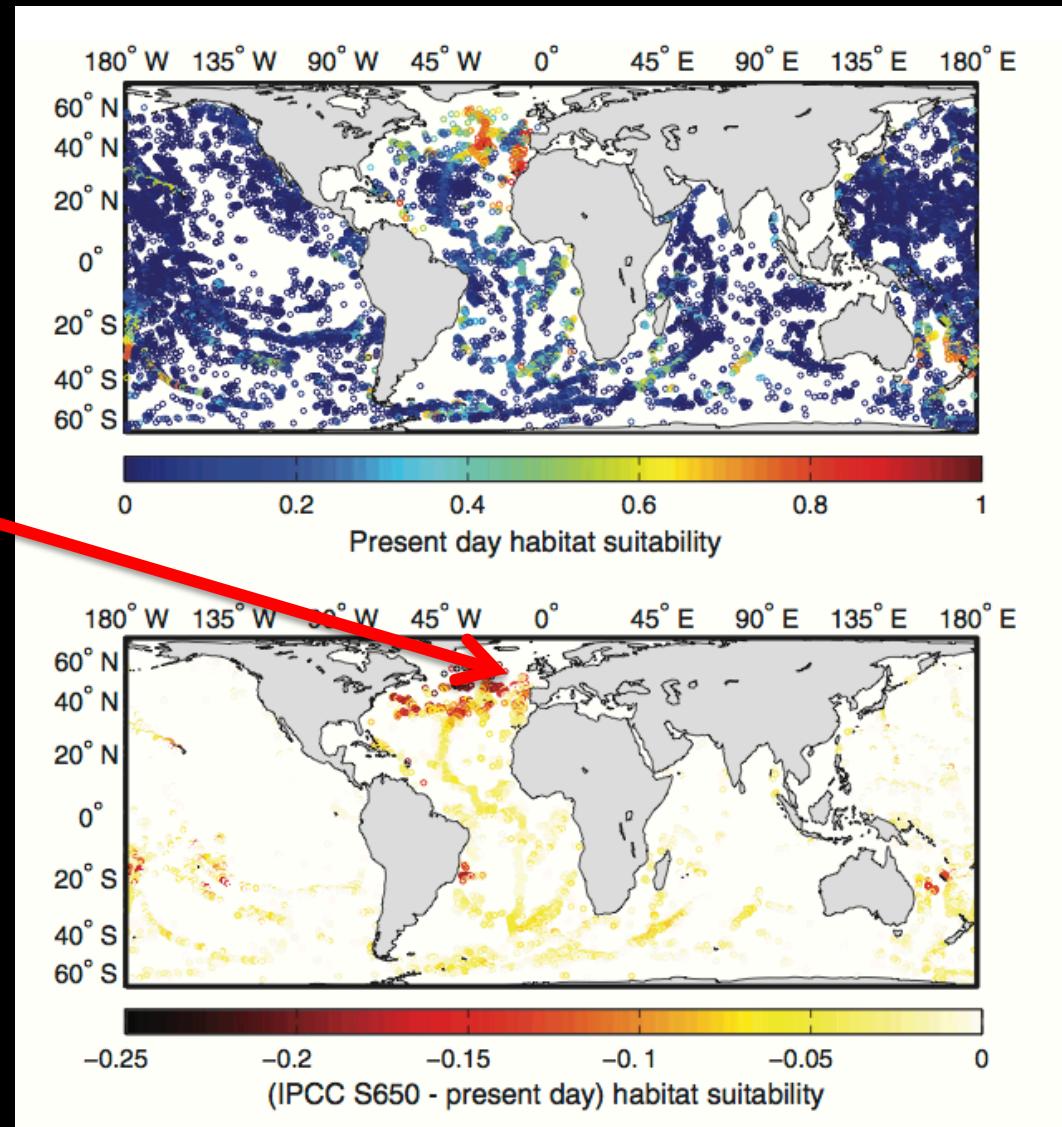


Seth Finnegan et al. Science
2015;348:567-570

Science
AAAS

Cold-water corals are dissolving

Ocean acidification
will affect cold water
corals most in the
North Atlantic

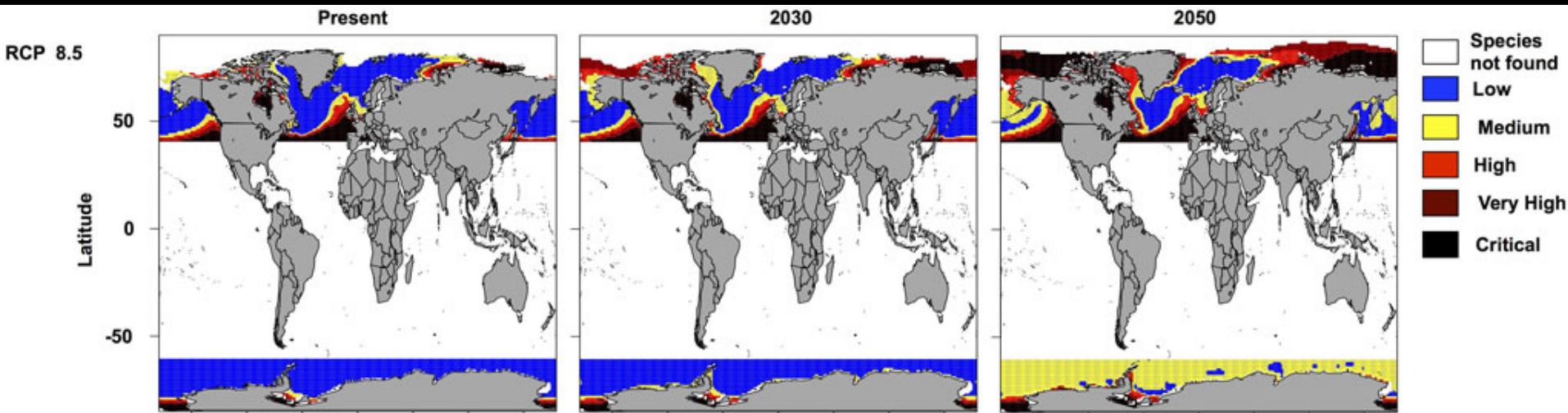


Tittensor, D. P. et al. (2010), Seamounts as refugia from ocean acidification for cold-water stony corals. *Marine Ecology*, 31: 212–225. doi: 10.1111/j.1439-0485.2010.00393.x



Pterapods

'Ocean butterflies' have a key ecological role in polar ocean habitats

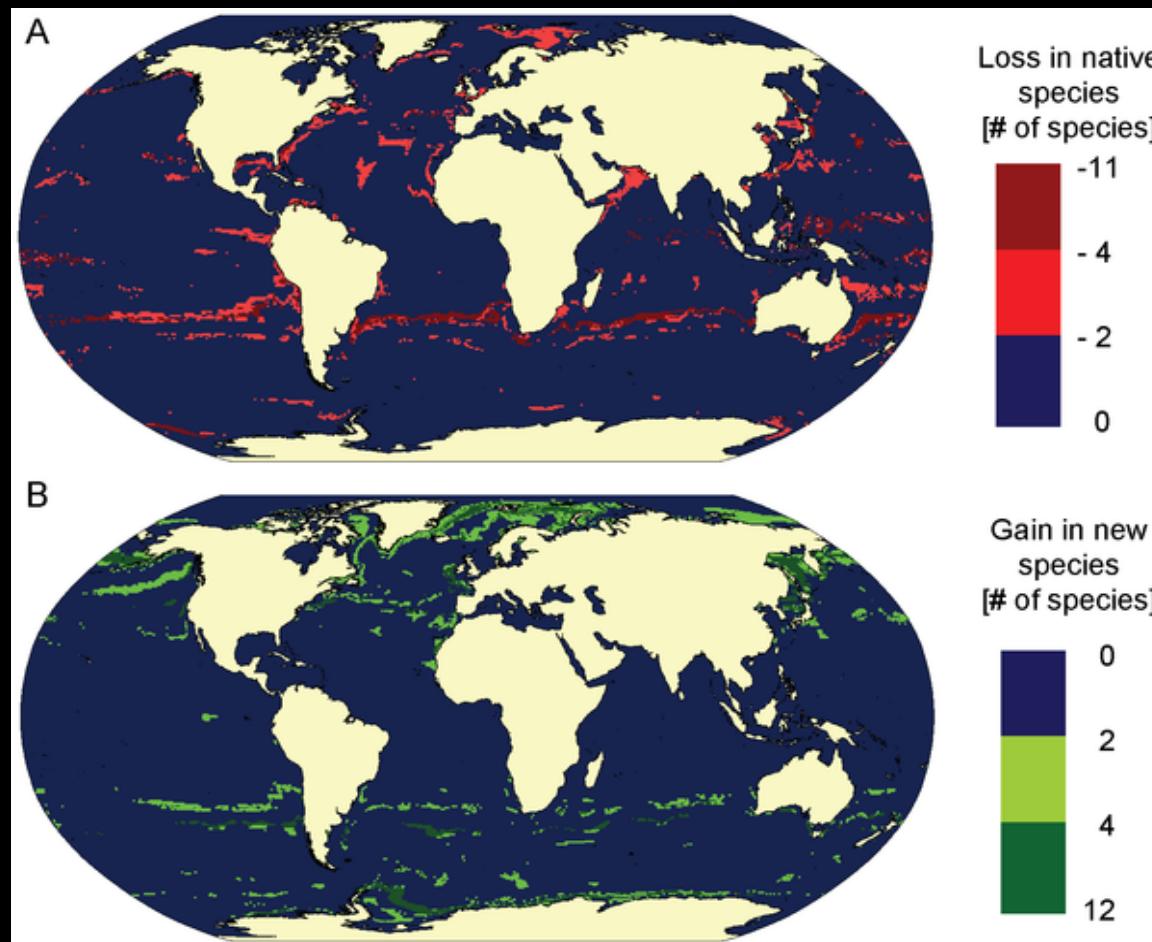


Viable habitat gets squeezed

Complement to work on coral risk

Polar species are disappearing and warmer water species are moving towards the Poles

Projected effects of climate change on marine mammal species richness.



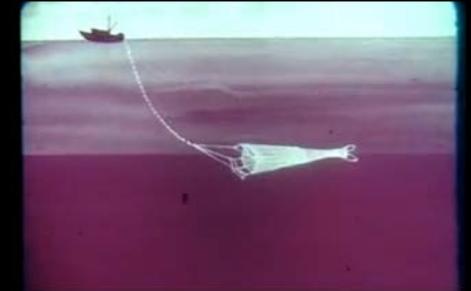
Kaschner K, Tittensor DP, Ready J, Gerrodette T, et al. (2011) Current and Future Patterns of Global Marine Mammal Biodiversity. PLoS ONE 6(5): e19653. doi:10.1371/journal.pone.0019653
<http://www.plosone.org/article/info:doi/10.1371/journal.pone.0019653>



The IOC of UNESCO:

Building knowledge and capacity for sustainable ocean management

- Established in 1960
- Since 1987, Functional autonomy in UNESCO
- 147 Member States
- UN focal point **for ocean science, ocean observations and services, data and information exchange and capacity building**
- UNCLOS: IOC = competent international organization for Marine Scientific Research and Transfer of Marine Technology
- Often gives UNESCO 2 seats at the table (UNFCCC, CBD, Rio+20, etc)



IOC Medium Term Strategy



Vision:

2013 - 2021

Strong **scientific understanding** and **systematic observation** of the changing world climate and ocean ecosystems shall underpin **global governance for a healthy ocean**, and global, regional and national **management of risks and opportunities** from the ocean

The Global Ocean
Observing System



Global Ocean Observing System



Sustained Data and Information products
Framework Requirements
Global System
for Integrated
Ocean Observing
Essential Ocean Variables EOVS
Readiness levels Governed
Concept
Pilot
Mature



OceanObs'09

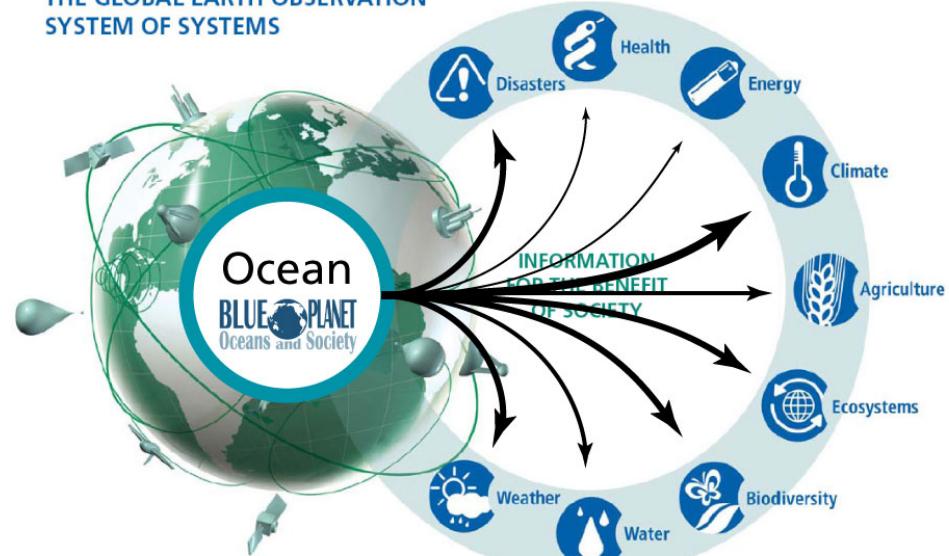
*Ocean information for society:
sustaining the benefits,
realizing the potential*

21-25 September 2009, Venice, Italy

links with GEO



THE GLOBAL EARTH OBSERVATION
SYSTEM OF SYSTEMS

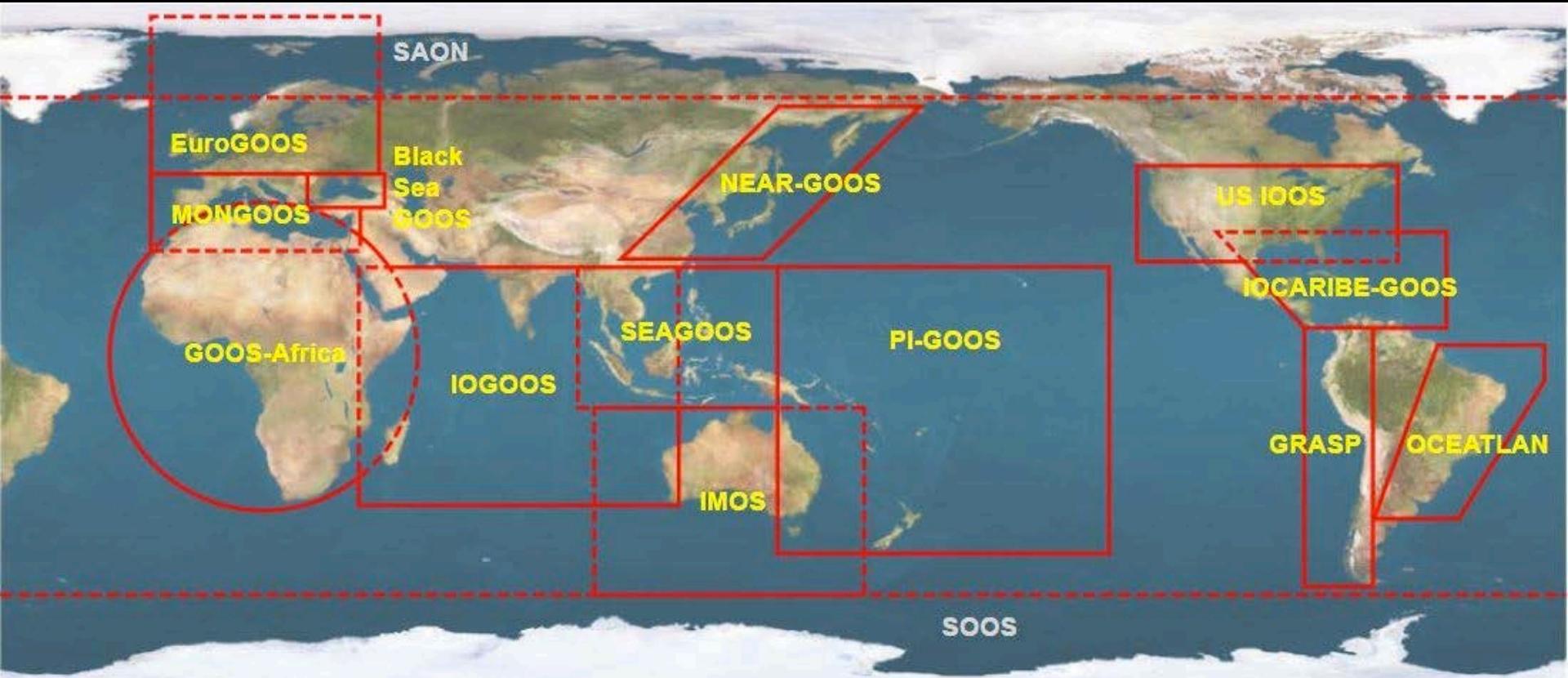


GEOWOW

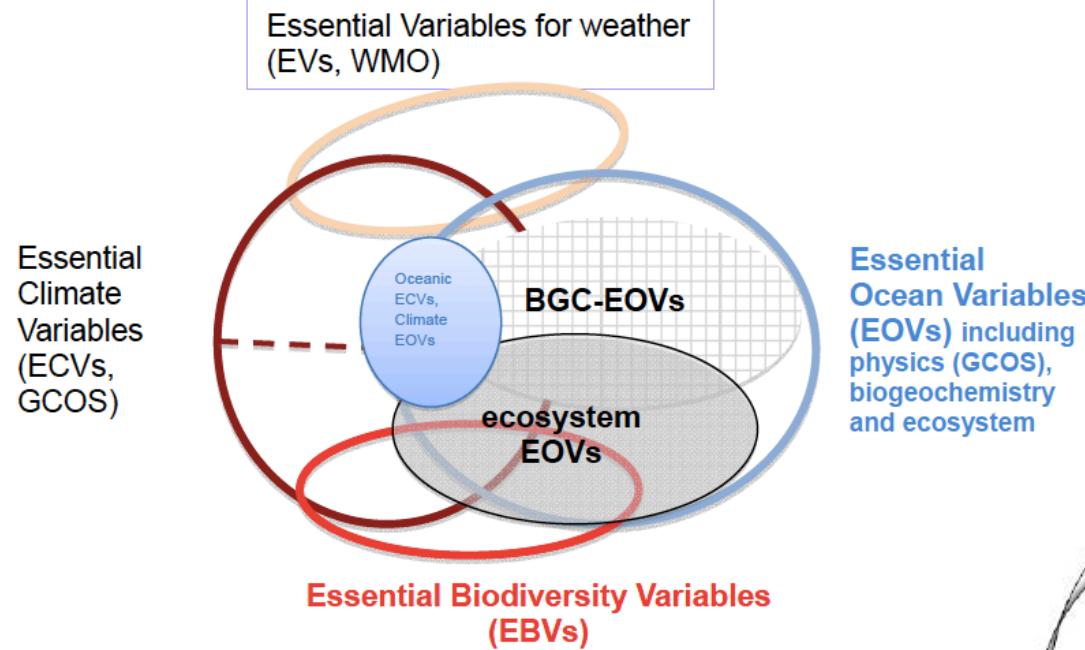
GEOSS interoperability for Weather, Ocean and Water

onesharedocean.org

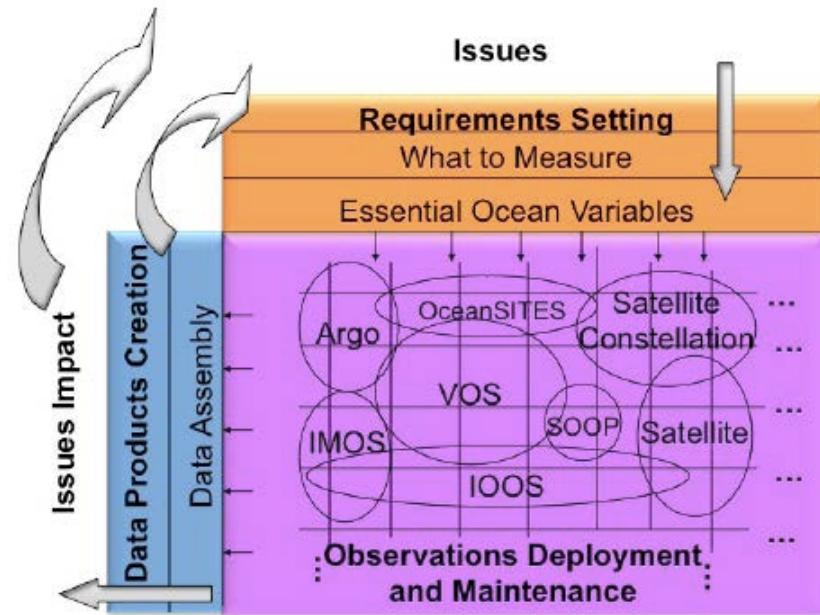
GOOS Regional Alliances



Essential Ocean Variables



Essential
Ocean Variables
(EOVs) including
physics (GCOS),
biogeochemistry
and ecosystem



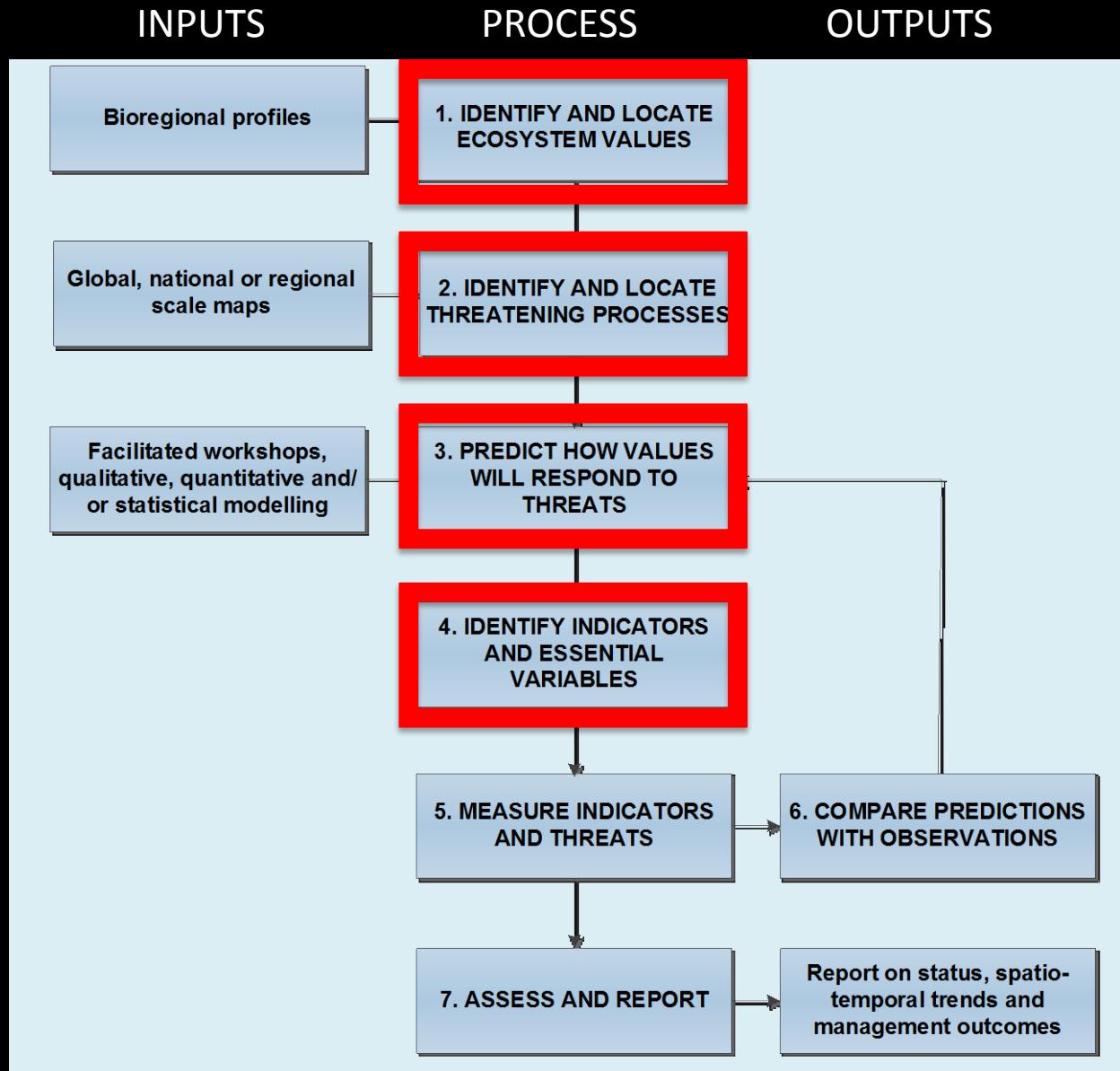
GOOS Biology and Ecosystems

Developing a framework for sustained
biological and biogeochemical ocean observing
systems



13-15 Nov 2013
EOV meeting
Australia

EOVs & Indicators process



Hayes et al. (in press)
Identifying indicators and
essential variables for marine
ecosystems. *Ecological
Indicators*.

GOOS Strategic Mapping Visualization

Draft: 30 Mar 2015. Hover over or click on nodes or links to visualize connections.

Framework for Ocean Observing

REQUIREMENTS

Global conventions/ mandates	Societal Benefit
Mandate	Societal Benefits
UNFCCC	Climate Services Adaptation Climate Change Climate Projection Weather Forecasts Biogeochemistry and Climate Monitoring ocean health
MSFD	Ocean Ecosystem Health; Sustain Ecosys Offshore Pelagic Fisheries Key Marine Species Biodiversity Efficient Maritime Economy Human Health Ocean Hazards Food Security
IOC/WMO	
BioDiversity	

OBSERVATIONS

DATA & PRODUCTS





OCEAN BIOGEOGRAPHIC
INFORMATION SYSTEM

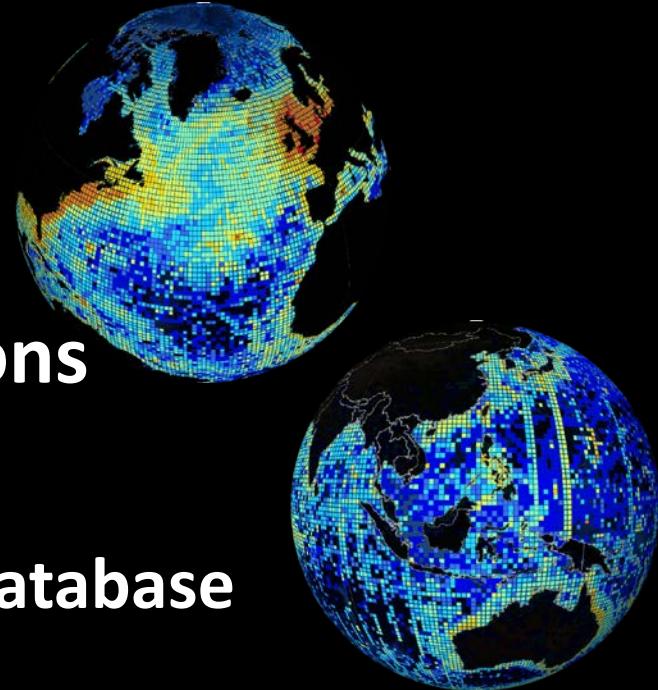
43,000,000 species **observations**

116,000 marine species

1,801 databases in **1** central **global database**

500 data providers, **56** countries

1,000 papers have cited OBIS



Science (10)

nature (4)



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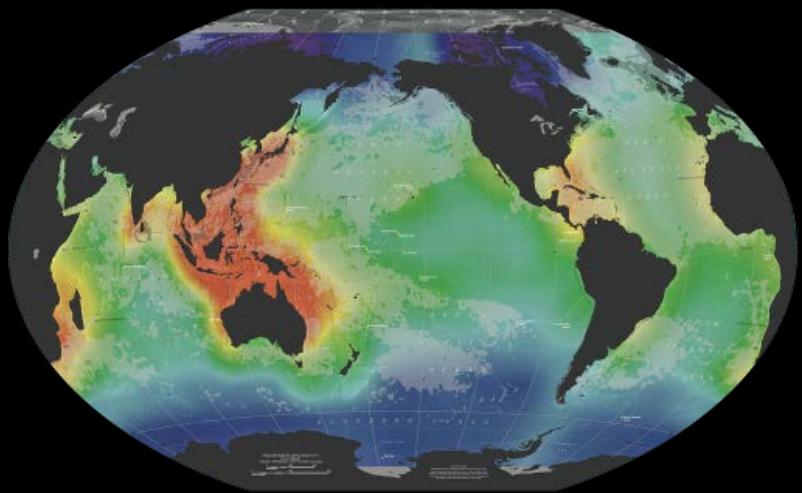
Intergovernmental
Oceanographic
Commission



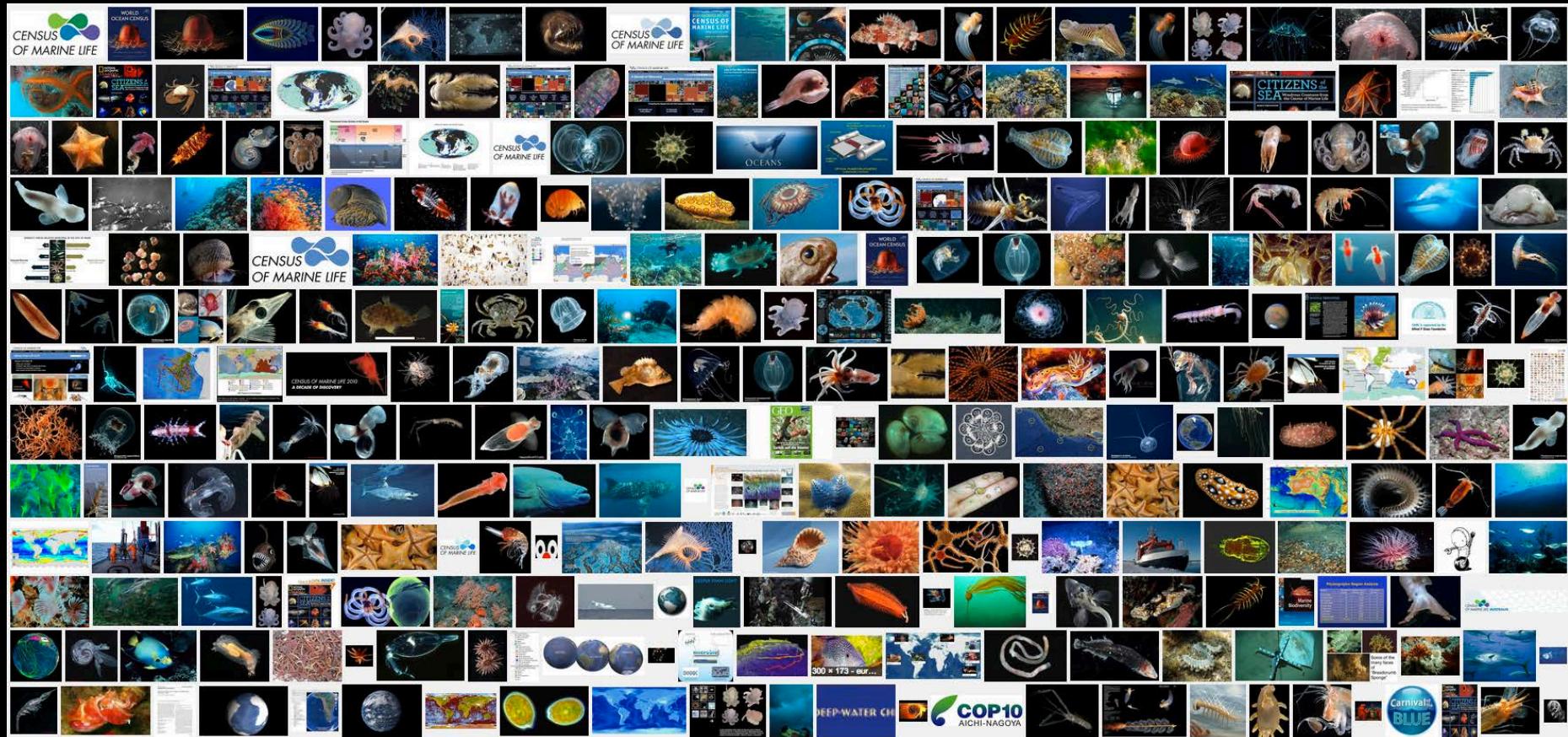
UNGA (A/RES/69/245) – recognizes IOC-
UNESCO's OBIS contribution to Marine
Sciences

Census of Marine Life

2000 - 2010



*OBIS was established as the data repository
and information dissemination system for
CoML*





Overall goals

OBIS has a **mandate under the United Nations (UNESCO-IOC)**, to contribute to the protection of marine ecosystems by assisting in identifying marine biodiversity hotspots and large-scale ecological patterns, **in all ocean basins**.

Our mission is to build and maintain a **global alliance** that collaborates with scientific communities to **facilitate free and open access** to, and **application** of, biodiversity and biogeographic data and information on marine life.



GBIF

On 13 October 2014, IOC and the Global Biodiversity Information Facility (GBIF) signed an agreement to enhance the quality and scope of marine biodiversity data through closer collaboration, building on each others strengths and recognizing each others roles.



Intergovernmental Platform on Biodiversity & Ecosystem Services



- OBIS is part of the Technical Support Unit at UNESCO to support the IPBES Task Force on Data and Knowledge





UN WG Biodiversity Beyond National Jurisdiction (UN BBNJ)

The technical experts of the UN Working Group on Biodiversity Beyond National Jurisdiction recognized **IOC's role in data and information sharing**,

And

considered IOC (OBIS) as an appropriate mechanism for the management of biodiversity data in areas beyond national jurisdiction.



A World of
SCIENCE
Vol. 11, No. 4 ■ October - December 2013

18.09.2013 - Natural Sciences Sector
UN sets sail towards better protection of biodiversity in world's largest ecosystem



© Joe Burni

There is overall consensus that we ought to better protect and sustainably manage our precious living resources. It is the wealth and diversity of life that underpins healthy ecosystems and secures the provision of basic services, such as food and oxygen, upon which we all depend. However, agreeing on how this should be tackled is far from easy. The ocean area beyond national jurisdiction represents almost 50% of the Earth's surface.

Post-2015 Agenda



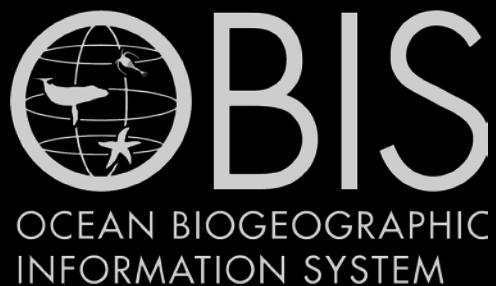
UNITED NATIONS
SUSTAINABLE DEVELOPMENT KNOWLEDGE PLATFORM

Sustainable Development Goals

- **Proposed goal 14. Conserve and sustainably use the oceans, seas and marine resources for sustainable development**
 - 14.a increase scientific knowledge, develop research capacities and transfer marine technology taking into account the Intergovernmental Oceanographic Commission Criteria and Guidelines on the Transfer of Marine Technology, **in order to improve ocean health and to enhance the contribution of marine biodiversity to the development of developing countries**, in particular SIDS and LDCs



DIPS-4-Ocean Assessments



OCEAN BIOGEOGRAPHIC
INFORMATION SYSTEM

HARMFUL ALGAE INFORMATION SYSTEM

Harmful Algae Event Database
(HAEDAT) IOC-ICES-PICES



Taxonomic Reference List of Harmful Micro Algae

Global Ocean
Biodiversity
Indicators

**DIPS-4-Ocean
Assessments**
444K US\$
2015-2016

Global
HAB
Status Report



United Nations
Educational, Scientific and
Cultural Organization



Intergovernmental
Oceanographic
Commission



Global Ocean Biodiversity Indicators



PhD grant: Global Trends In Marine Biodiversity From Unstructured Data



Species traits and QC tools

PhD grant: Predictor selection for marine species distribution modeling



PhD grant: Biogeography of marine species and the impact of climate change

The production of a taxonomically comprehensive **marine equivalent of the Living Planet Index**



United Nations Educational, Scientific and Cultural Organization

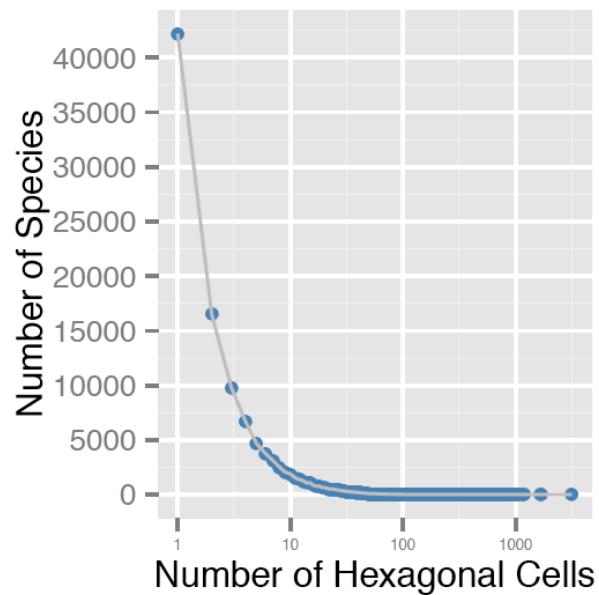
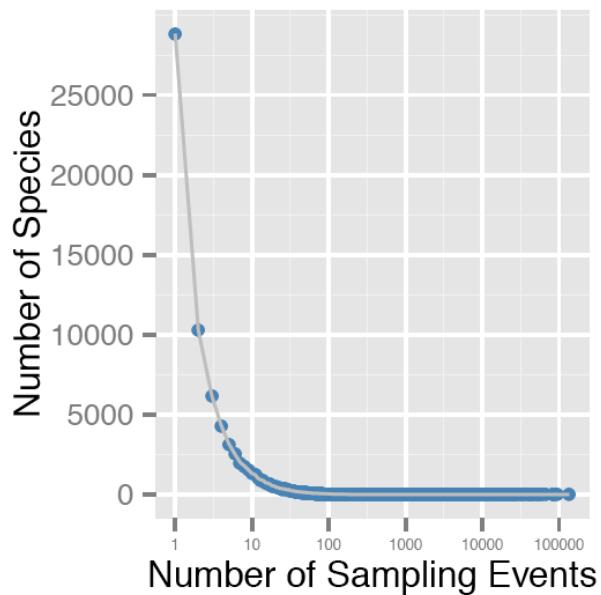
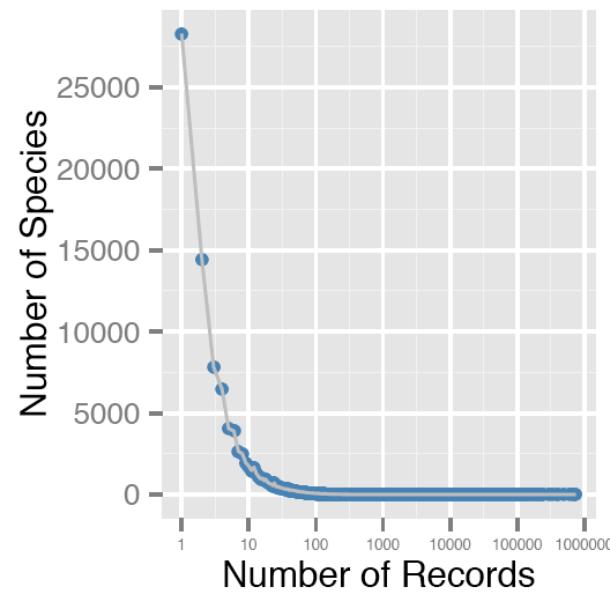


Intergovernmental
Oceanographic
Commission

DIPS workshop, likely November 2015

Two third of known species are uniques

AND 30% – 90% of marine species are still undescribed

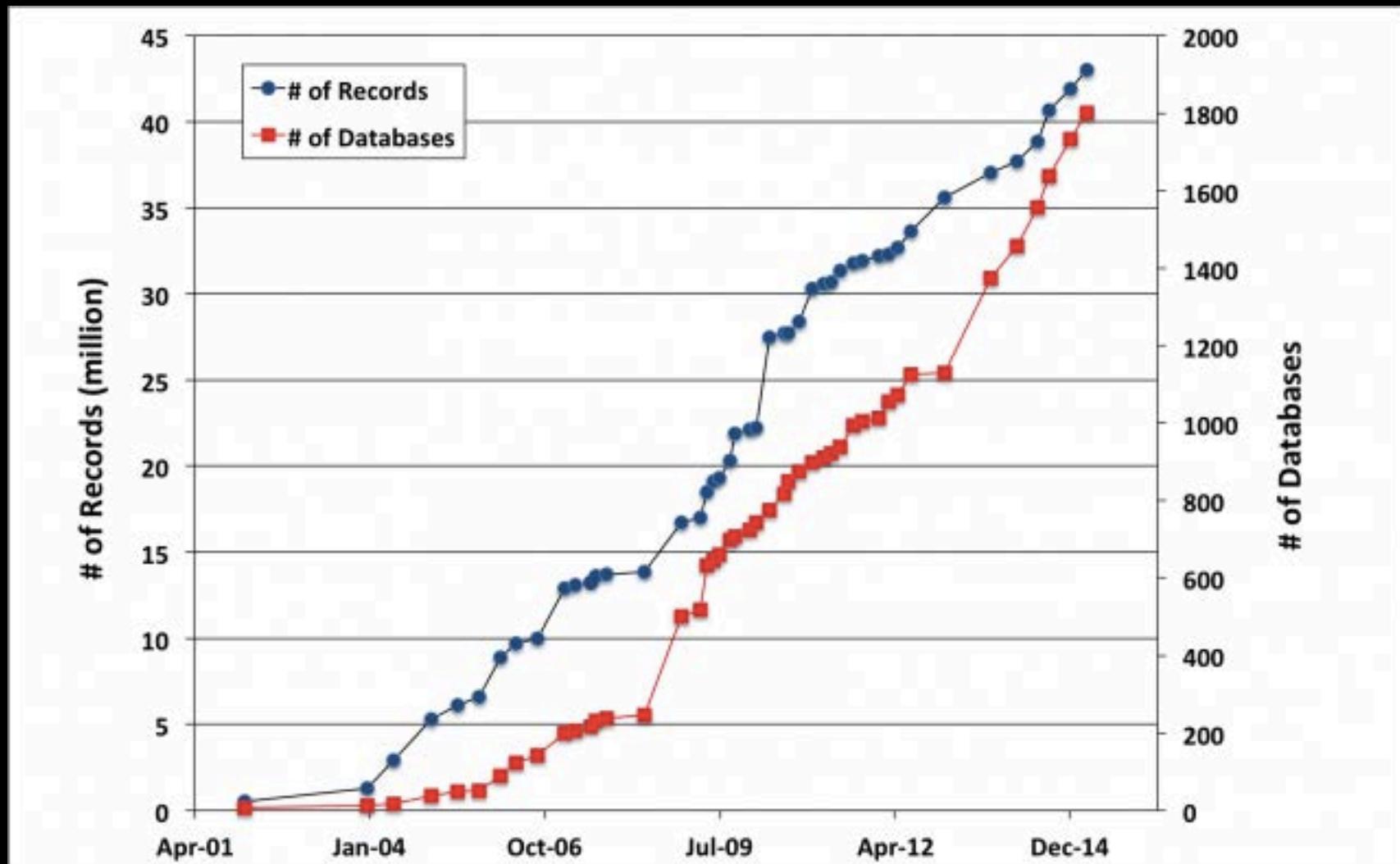


The Magnitude of Global Marine Species Diversity

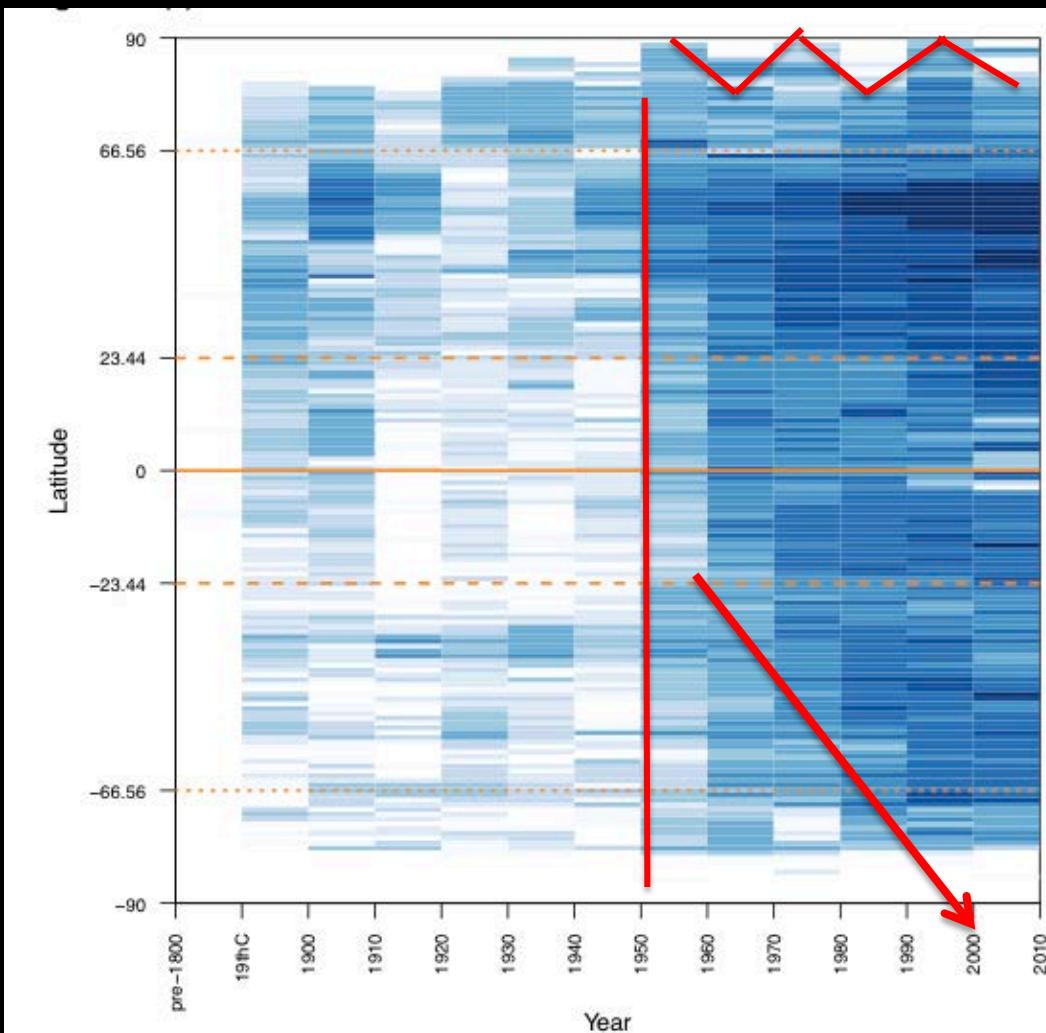
Current Biology 22, 2189–2202

- Ward Appeltans,^{1,2,96,*} Shane T. Ahyong,^{3,4} Gary Anderson,⁵ Martin V. Angel,⁶ Tom Artois,⁷ Nicolas Bailly,⁸ Roger Bamber,⁹ Anthony Barber,¹⁰ Ilse Bartsch,¹¹ Annalisa Berta,¹² Magdalena Błazewicz-Paszkowycz,¹³ Phil Bock,¹⁴ Geoff Boxshall,¹⁵ Christopher B. Boyko,¹⁶ Simone Nunes Brandão,^{17,18} Rod A. Bray,¹⁹ Niel L. Bruce,^{19,20} Stephen D. Cairns,²¹ Tin-Yam Chan,²² Lanna Cheng,²³ Allen G. Collins,²⁴ Thomas Cribb,²⁵ Marco Curini-Galletti,²⁶ Farid Dahdouh-Guebas,^{27,28} Peter J.F. Davie,²⁹ Michael N. Dawson,³⁰ Olivier De Clerck,³¹ Wim Decock,¹ Sammy De Grave,³² Nicole J. de Voogd,³³ Daryl P. Domning,³⁴ Christian C. Emig,³⁵ Christer Erséus,³⁶ William Eschmeyer,^{37,38} Kristian Fauchald,²¹ Daphne G. Fautin,³⁹ Stephen W. Feist,⁴⁰ Charles H.J.M. Fransen,³³ Hidetaka Furuya,⁴¹ Oscar Garcia-Alvarez,⁴² Sarah Gerken,⁴³ David Gibson,¹⁵ Arjan Gittenberger,³³ Serge Goafas,⁴⁴ Liza Gómez-Daglio,³⁰ Dennis P. Gordon,⁴⁵ Michael D. Guiry,⁴⁶ Francisco Hernandez,¹ Bert W. Hoeksema,³³ Russell R. Hopcroft,⁴⁷ Damià Jaume,⁴⁸ Paul Kirk,⁴⁹ Nico Koedam,²⁸ Stefan Koenemann,⁵⁰ Jürgen B. Kolb,⁵¹ Reinhardt M. Kristensen,⁵² Andreas Kroh,⁵³ Gretchen Lambert,⁵⁴ David B. Lazarus,⁵⁵ Rafael Lemaitre,²¹ Matt Longshaw,⁴⁰ Jim Lowry,³ Enrique Macpherson,⁵⁶ Laurence P. Madin,⁵⁷ Christopher Mah,²¹ Gill Mapstone,¹⁵ Patsy A. McLaughlin,^{58,59} Jan Mees,^{59,60} Kenneth Meland,⁶¹ Charles G. Messing,⁶² Claudia E. Mills,⁶³ Tina N. Molodtsova,⁶⁴ Rich Mooi,⁶⁵ Birger Neuhaus,⁵⁵ Peter K.L. Ng,⁶⁶ Claus Nielsen,⁶⁷ Jon Norenburg,²¹ Dennis M. Opresko,²¹ Masayuki Osawa,⁶⁸ Gustav Paulay,⁶⁹ William Perrin,⁷⁰ John F. Pilger,⁷¹ Gary C.B. Poore,¹⁴ Phil Pugh,⁷² Geoffrey B. Read,⁴⁸ James D. Reimer,⁷³ Marc Rius,⁷⁴ Rosana M. Rocha,⁷⁵ José I. Saiz-Salinas,⁷⁶ Victor Scarabino,⁷⁷ Bernd Schierwater,⁷⁸ Andreas Schmidt-Rhaesa,⁷⁹ Karen E. Schnabel,⁴⁵ Marilyn Schotte,²¹ Peter Schuchert,⁸⁰ Enrico Schwabe,⁸¹ Hendrik Segers,⁸² Caryn Self-Sullivan,^{62,83} Noa Shenkar,⁸⁴ Volker Siegel,⁸⁵ Wolfgang Sterrer,⁸⁶ Sabine Stöhr,⁸⁷ Billie Swalla,⁶³ Mark L. Tasker,⁸⁸ Erik V. Thuesen,⁸⁹ Tarmo Timm,⁹⁰ M. Antonio Todaro,⁹¹ Xavier Turon,⁹⁶ Seth Tyler,⁹² Peter Uetz,⁹³ Jacob van der Land,^{33,97} Bart Vanhoorne,¹ Leen P. van Oeveren,³³ Rob W.M. van Soest,³³ Jan Vanaverbeke,⁵⁹ Genefor Walker-Smith,¹⁴ T. Chad Walter,²¹ Alan Warren,¹⁵ Gary C. Williams,⁶⁶ Simon P. Wilson,⁹⁴ and Mark J. Costello,^{96,98}
- ⁸WorldFish Center, Los Baños, Laguna 4031, Philippines
⁹ARTOO Marine Biology Consultants, Southampton SO14 5QY, UK
¹⁰British Myriapod and Isopod Group, Ivybridge, Devon PL21 0BD, UK
¹¹Research Institute and Natural History Museum, Senckenberg, Hamburg 22607, Germany
¹²Department of Biology, San Diego State University, San Diego, CA 92182, USA
¹³Laboratory of Polar Biology and Oceanobiology, University of Łódź, Łódź 90-237, Poland
¹⁴Museum Victoria, Melbourne, VIC 3000, Australia
¹⁵Department of Life Sciences, Natural History Museum, London SW7 5BD, UK
¹⁶Department of Biology, Dowling College, Oakdale, NY 11769, USA
¹⁷German Centre for Marine Biodiversity Research (DZMB), Senckenberg Research Institute, Wilhelmshaven 26382, Germany
¹⁸Zoological Museum Hamburg, University of Hamburg; Zoological Institute und Zoological Museum, Hamburg 20146, Germany
¹⁹Department of Zoology, University of Johannesburg, Auckland Park 2006, South Africa
²⁰Museum of Tropical Queensland, Queensland Museum, and School of Marine and Tropical Biology, James Cook University, Townsville, QLD 4810, Australia
²¹National Museum of Natural History, Smithsonian Institution, Washington, DC 20013-7012, USA
²²Institute of Marine Biology, National Taiwan Ocean University, Keelung 20224, Taiwan
²³Marine Biology Research Division, Scripps Institution of Oceanography, La Jolla, CA 92093, USA
²⁴National Systematics Lab, National Marine Fisheries Service, National Oceanic and Atmospheric Administration, Washington, DC 20560, USA
²⁵School of Biological Sciences, The University of Queensland, Brisbane, QLD 4072, Australia
²⁶Dipartimento di Scienze della Natura e del Territorio, Università di Sassari, Sassari 07100, Italy
²⁷Laboratory of Systems Ecology and Resource Management, Université Libre de Bruxelles (ULB), Brussels 1050, Belgium
²⁸Plant Biology and Nature Management Research Group, Vrije Universiteit Brussel (VUB), Brussels 1050, Belgium
²⁹Centre for Biodiversity, Queensland Museum,

Growth of data in OBIS



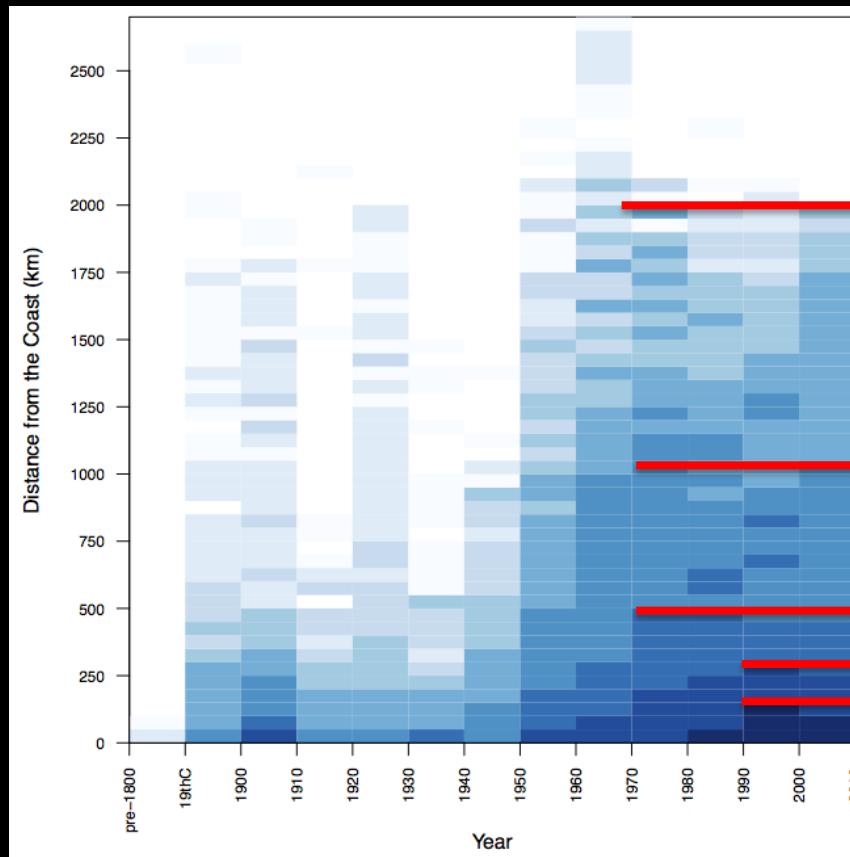
Nr of records through time (latitude)



Global monitoring
since 1950

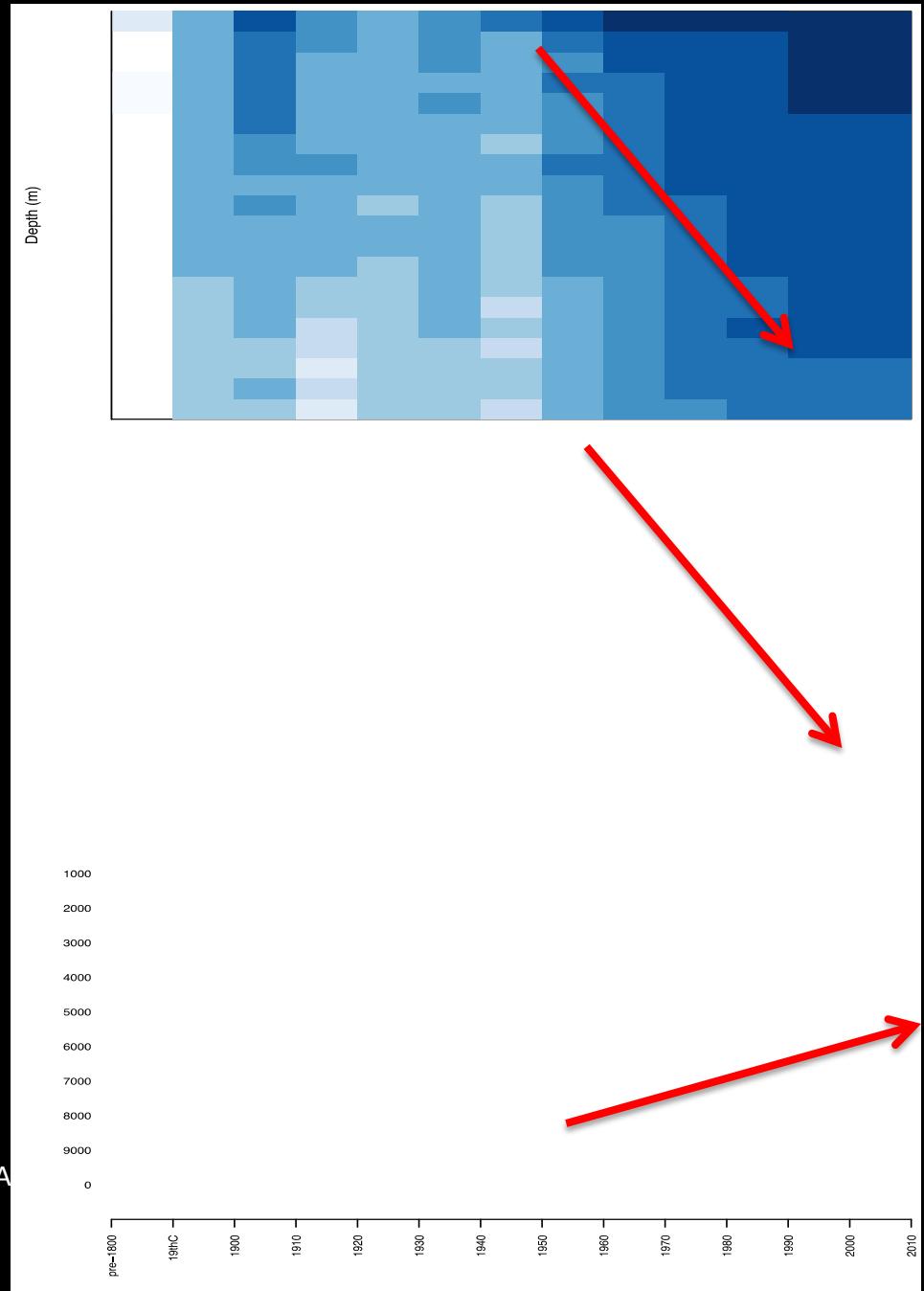
Progressively
increased in the
Southern
Hemisphere

Nr of records through time (distance from nearest land)



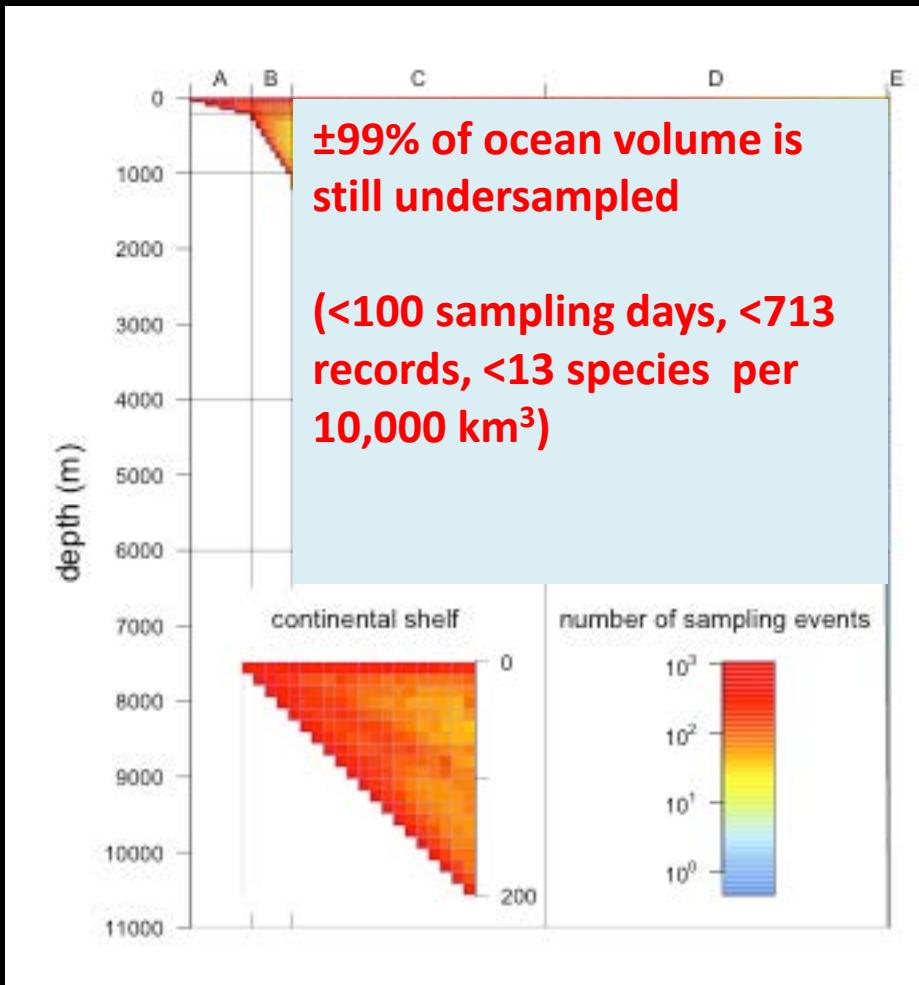
Nr of records through time

(sampling depth)



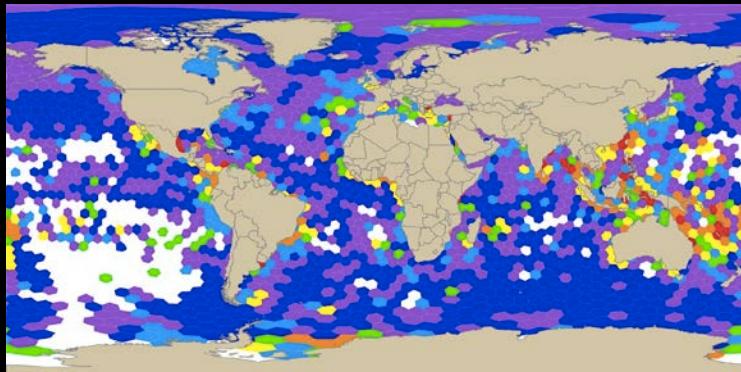
Appeltans W., Dujardin F., Flavell M., Miloslavich P., Webb T.
(2015). Biodiversity Baselines in the Global Ocean. In: Fischer A
et al (Eds). Open Ocean Technical Assessment Report for the
GEF Transboundary Water Assessment Programme (TWAP).
UNEP, IOC-UNESCO. In press.

Sampling effort per depth volume

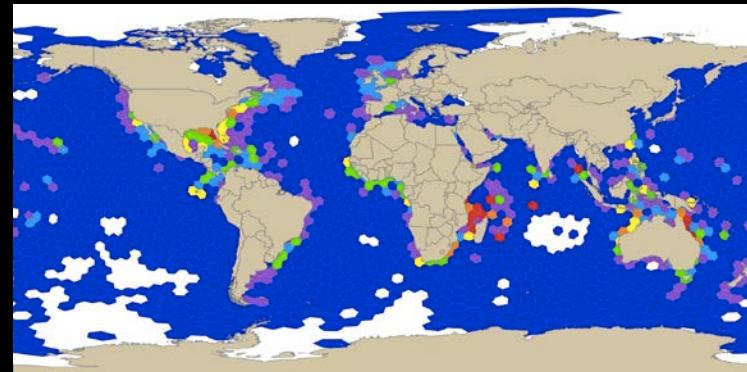


Global Ocean Biodiversity Indicators

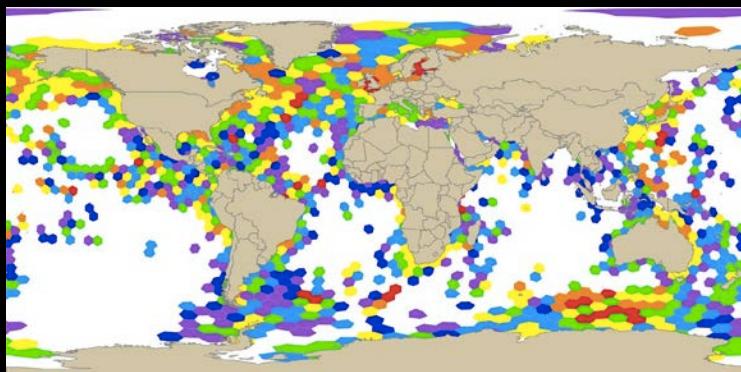
Where are the biodiversity hotspots?



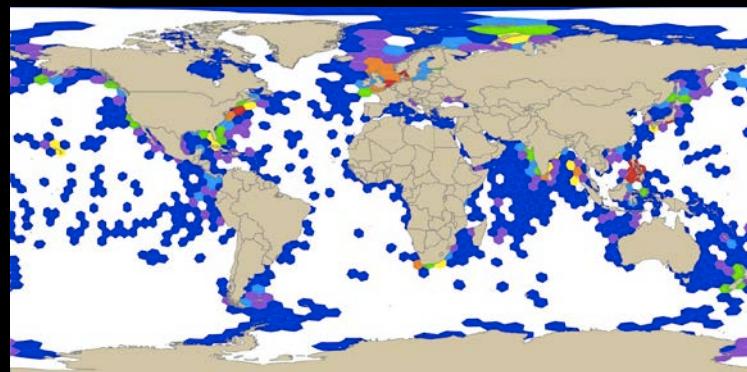
Where are the most threatened species?



Where are the knowledge gaps?

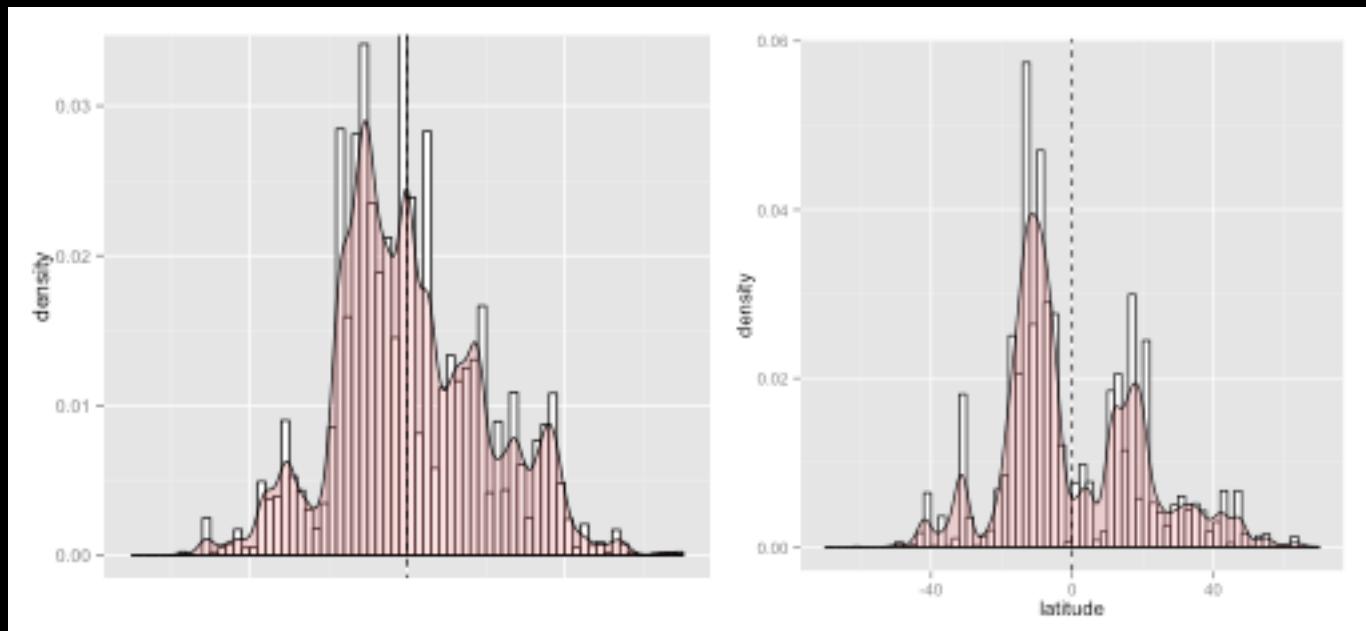


Can we detect marine species extinctions?



Global Ocean Biodiversity Indicators

Are species moving away from the Equator?



Before 1990

After 1990



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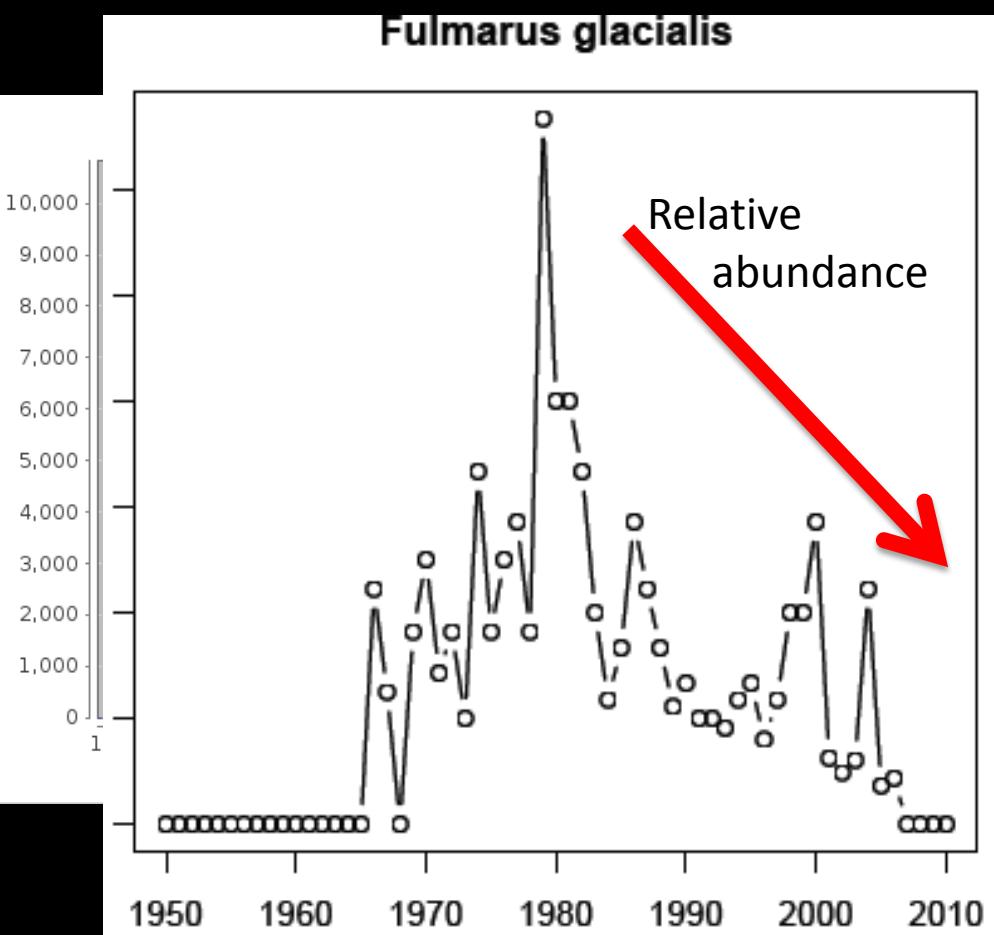
Intergovernmental
Oceanographic
Commission

Global Ocean Biodiversity Indicators

Are the most common species always the most common?



Relative abundance



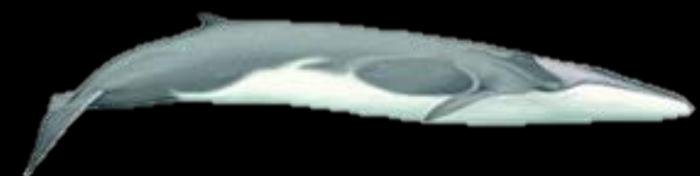
PEAK based on Nr of records



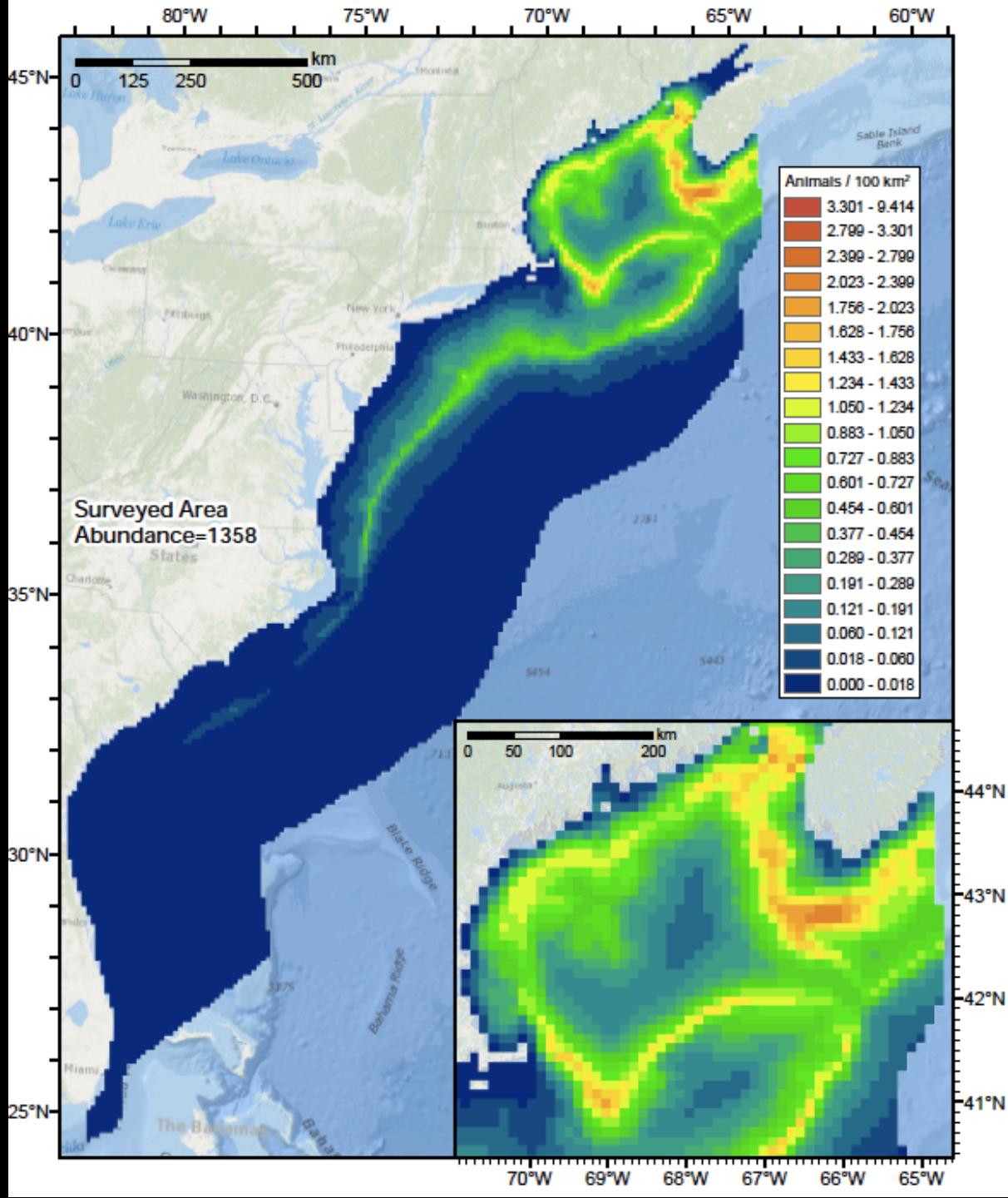
Fulmar observations
in the North Sea

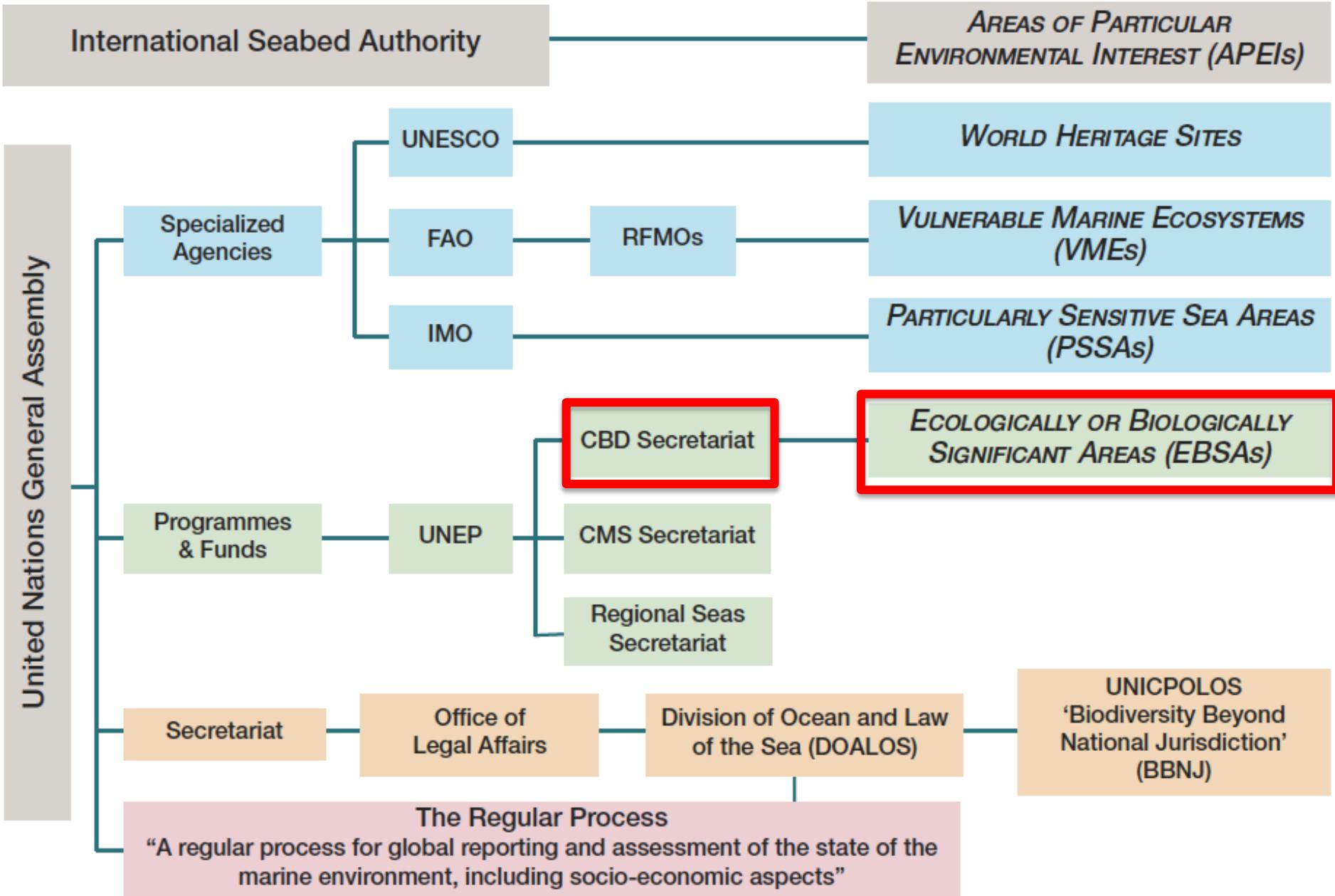
Fin whale: abundance / density season

These models are used to estimate official “takes” for marine mammal protection act and endangered species act regulations in the USA

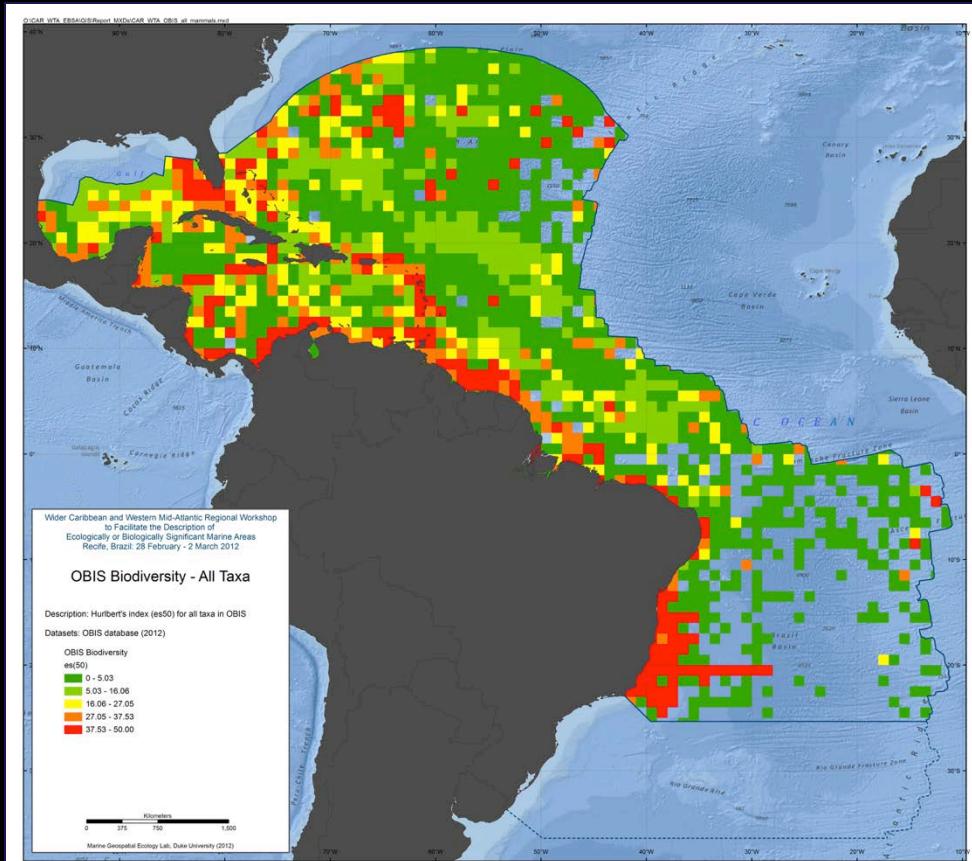


OBIS-SEAMAP

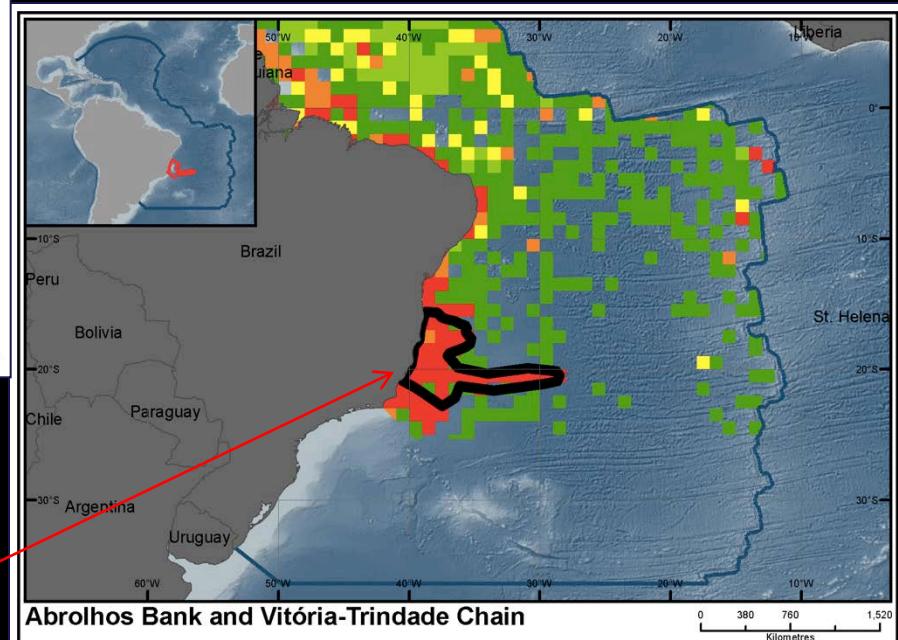




OBIS contributions to the CBD EBSA process

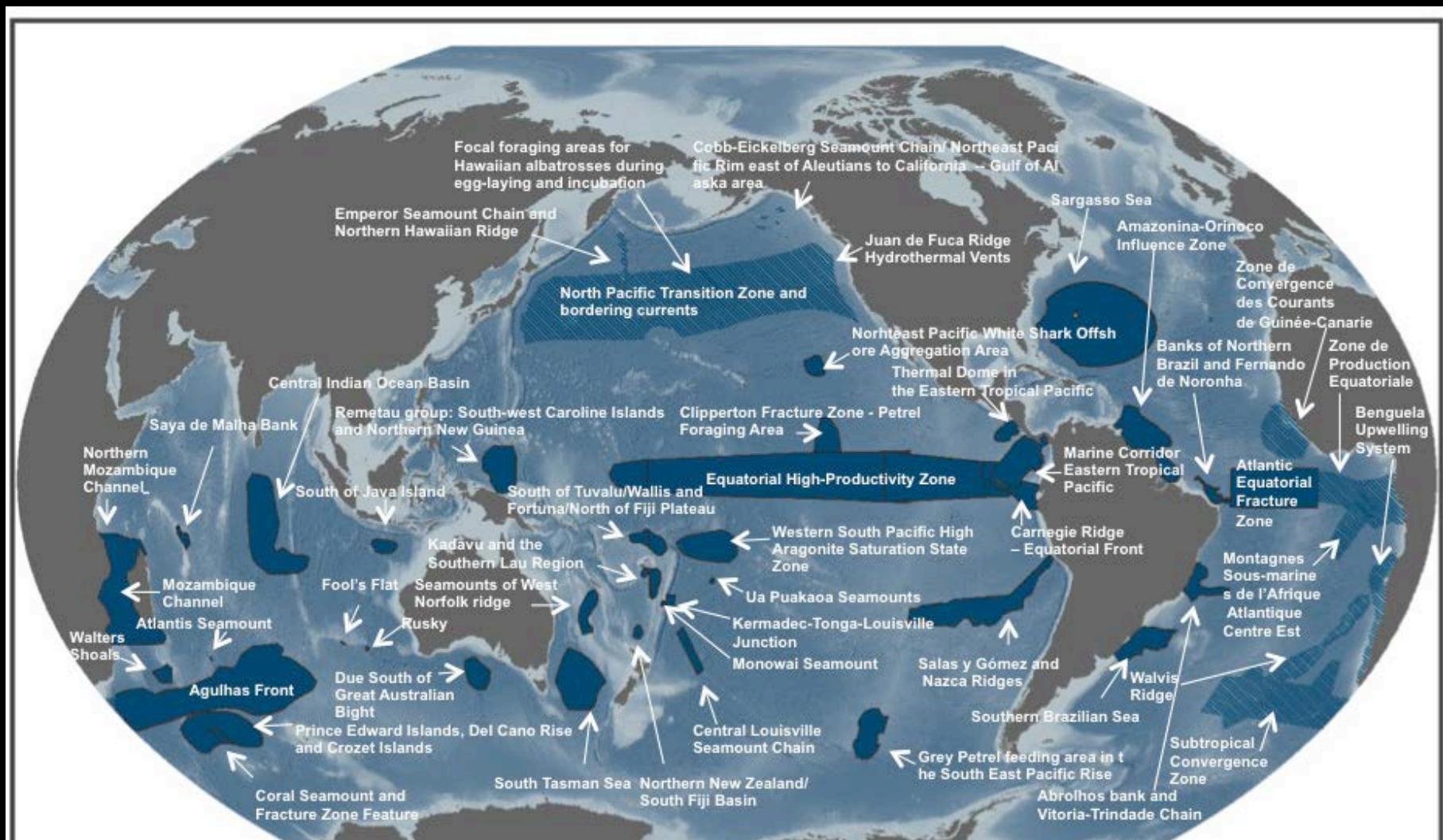


Biological Diversity all taxa
Wider Caribbean and Western Mid-Atlantic workshop, Recife, Brazil, February 2012



Proposed site meeting EBSA criteria:
Abrolhos Bank & Vitoria-Trindade Chain
Described in-part due to high regional biodiversity as depicted using OBIS data.

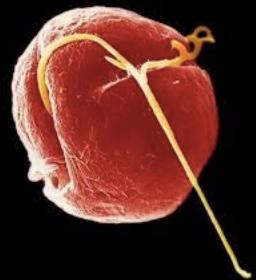
Areas meeting CBD Scientific Criteria for Ecologically or Biologically Significant Marine Areas (EBSAs,
annex 1 to decision IX/20) : areas in ABNJ



Disclaimer: This is an information ONLY for the presentation. Some information on the map is yet to be finalized.
This is NOT for QUOTATION or Distribution.



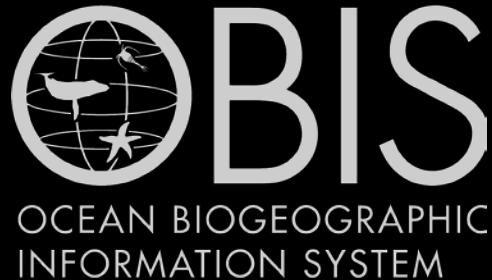
Cyanobacteria



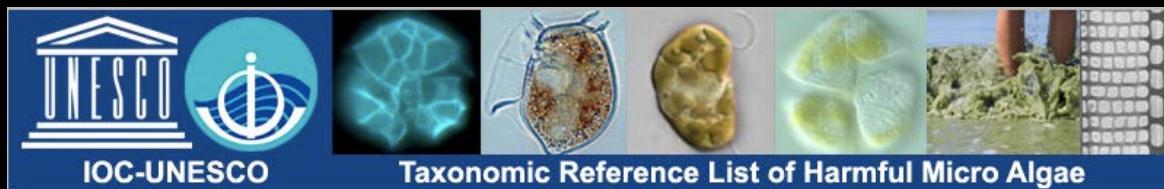
Dinoflagellates



The 1st Global HAB Status Report



156,000 HAB species observations



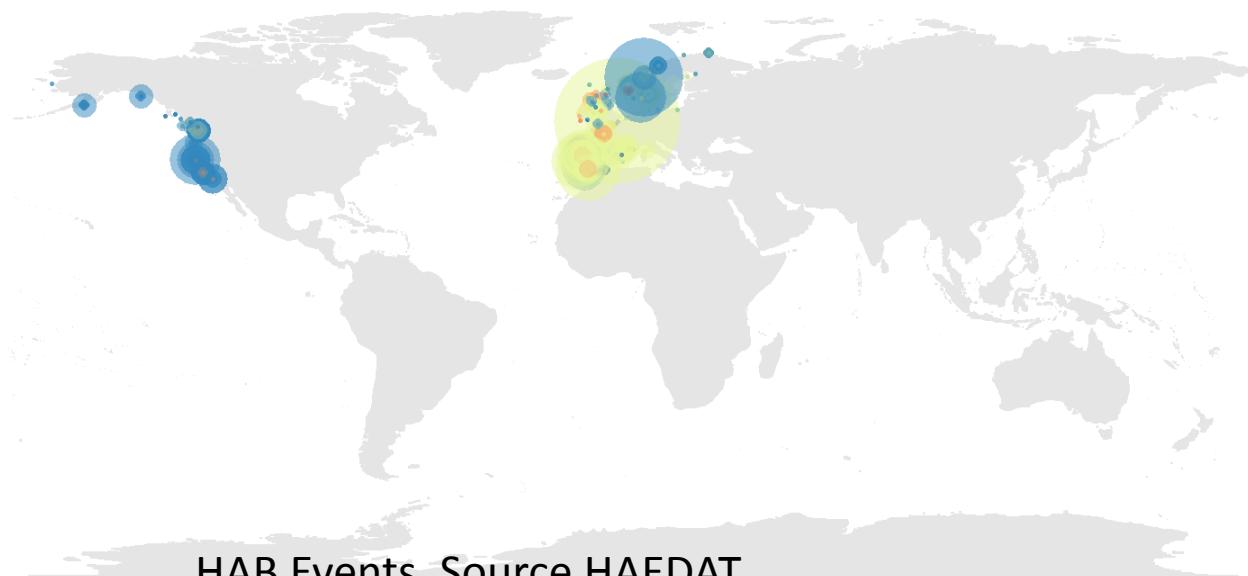
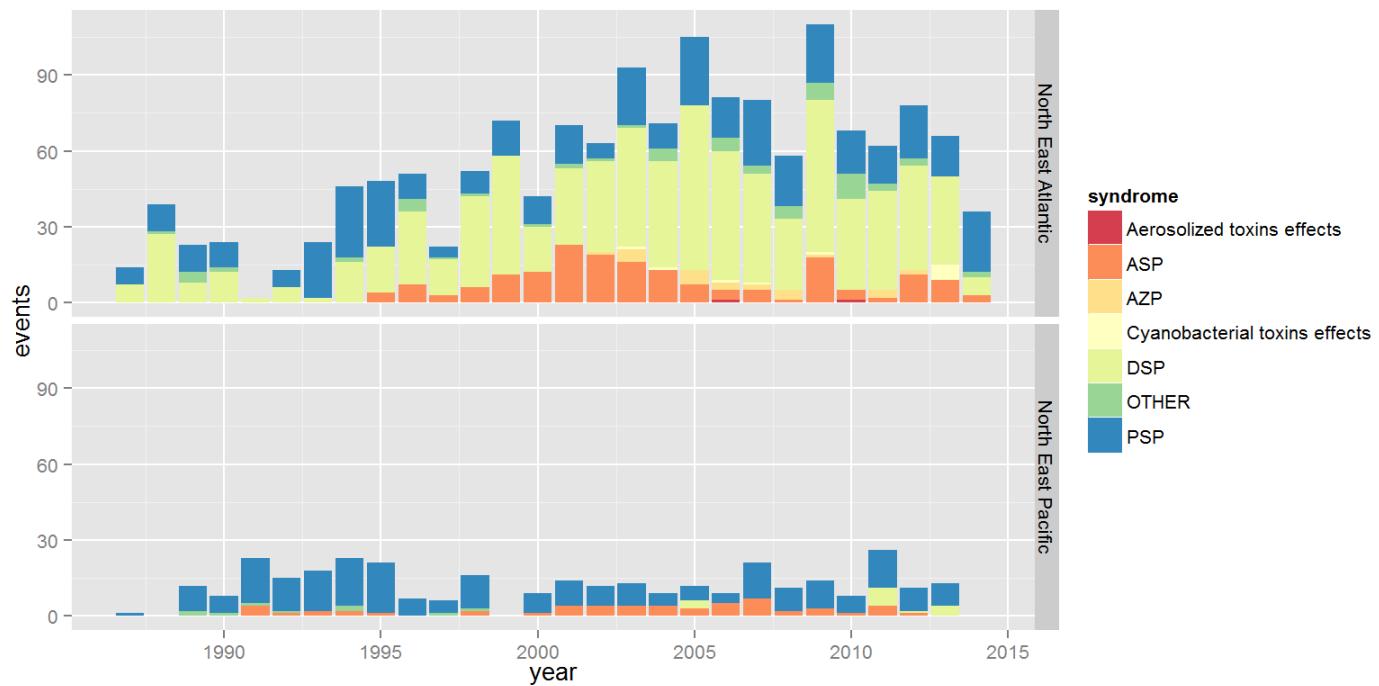
117 species; 124 notes on toxicity and harmful effect

HARMFUL ALGAE INFORMATION SYSTEM

Harmful Algae Event Database
(HAEDAT) IOC-ICES-PICES

4,234 events

29 countries, 37 preparing





IOC Ocean Teacher Global Academy

Regional Training Centres



WWW.OCEANTEACHER.ORG

“To ensure equitable participation of all States in global initiatives”



OBIS Capacity Building

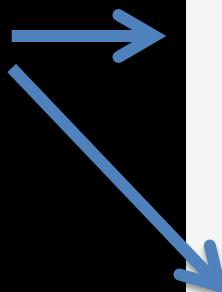
OceanTeacher
A Training Resource for Data & Information Management Related to Oceanography & Marine Meteorology

With the support of the Government of Flanders

ODINAFRICA Training Course on Marine Biodiversity Data Management

www.oceanteacher.org

All lectures remain available online via video and powerpoint



Topic 7

Extracting /using OBIS/WoRMS data

- OBIS Portal (Ward Appeltans)
- WoRMS Portal (Leen Vandepitte)
- OBIS webservices (Mike Flavell)
- Mapping with ArcGIS Online (Frederic Dujardin)



[WoRMS Portal](#) 20.7MB Powerpoint presentation

[OBIS Web Services](#) 6.2MB Powerpoint presentation

[ArcGIS online](#) 7.2MB PDF document

[ArcGIS online exercices](#)

Expanding OBIS with non-biological data

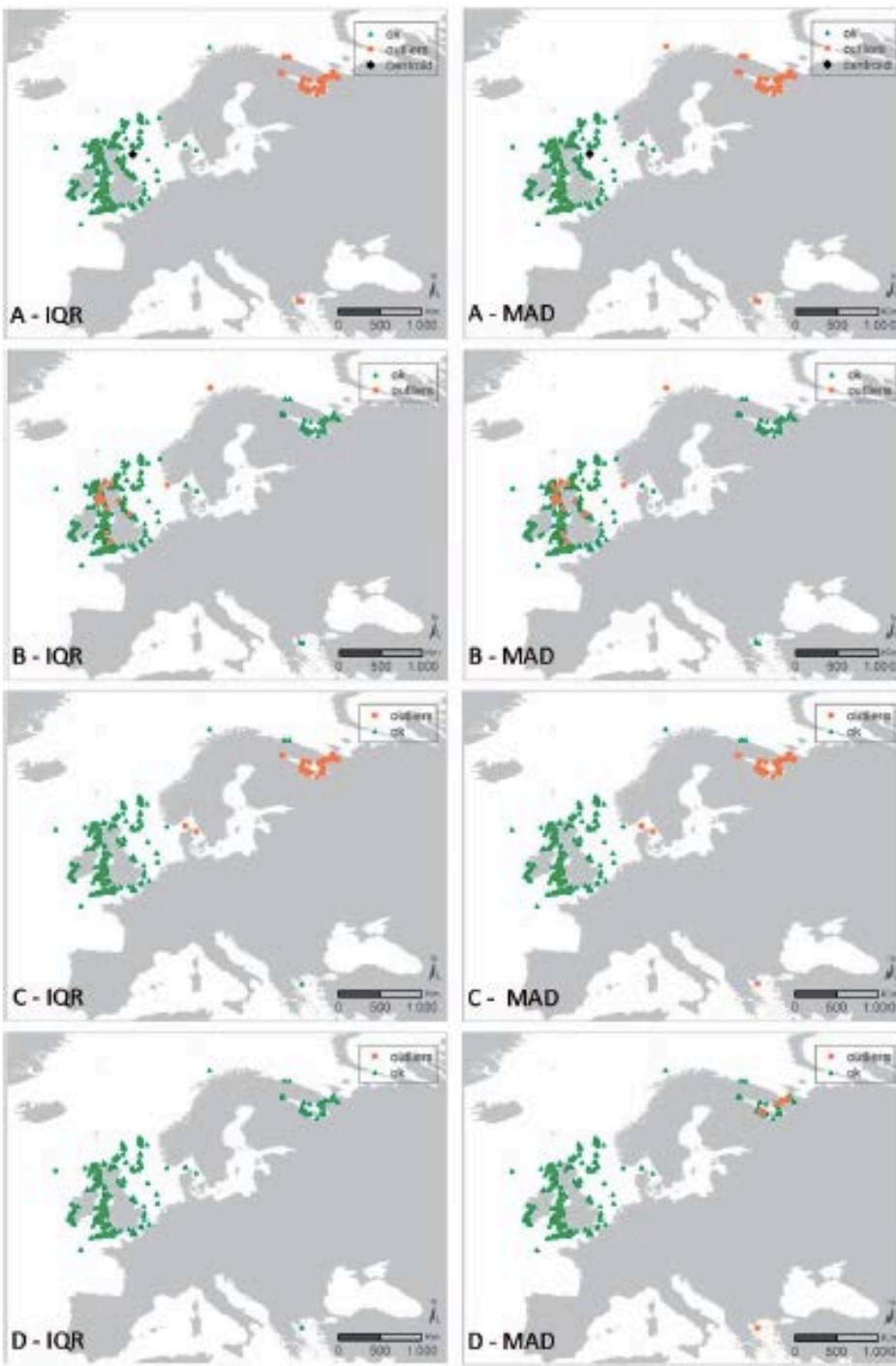
NEW IODE pilot project 2015-2016

1. Ensure mixed data sets stay together
2. Collaboration between OBIS nodes, NODCs and ADUs, that hold mixed data sets
3. Show the benefit of this approach for marine sciences
1. Seek mechanisms for data flow to regional and global repositories

10 classes species traits + status prioritised for WoRMS

Trait or Status	Categories
Taxonomy	Phylum, Class, Order, Family, Genus, Species
Environment	Marine, brackish, freshwater, terrestrial, pelagic, benthic, fossil
Geography	Locality name (Latitude-longitude coordinates in OBIS)
Depth	Intertidal, subtidal, deep-sea (>500 m) Deepest and shallowest depth recorded in (1) literature and (2) in OBIS
Substratum	Mud, sand, gravel (pebble, cobble), boulder, bedrock, biogenic
Mobility	Mobile, immobile (sessile) Potential metres in life-time
Skeleton	Calcareous (aragonite, calcite), chitinous, silicious, exoskeleton, endoskeleton, cell wall
Diet	Carnivore, herbivore, parasite, detritivore, phototrophic, chemoautotrophic
Body size	Maximum body length in mm excluding appendages. Maximum total body weight
Reproduction	Sexual, asexual
Species status	Introduced, Invasive, Conservation, Fishery, Aquaculture, Harmful, Ecological Indicator

Costello et al (under review). Biological and ecological traits of marine species.



Adding filtering options.

QC flags, based on geography,
Bathymetry, salinity,
temperature... (29 QC steps)

Vandepitte et al. The
Journal of Biological
Databases and Curation
(2015)

Message from Mark Costello

- A major obstacle to engaging more scientists and citizens in recording marine biodiversity is the lack of guides to the identification of marine species.