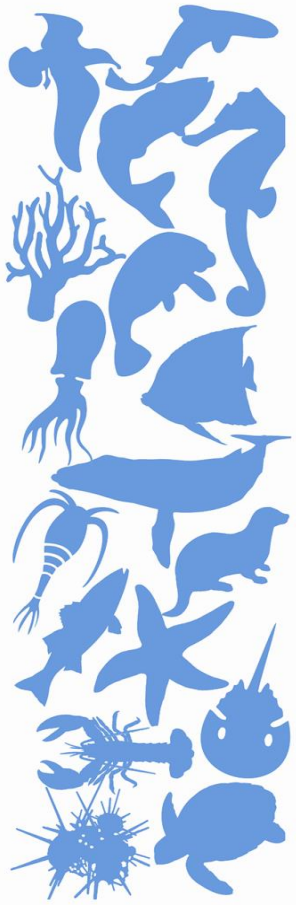
CENSUS OF MARINE LIFE

History of OBIS: Fred Grassle Memorial Lecture



Yoshihisa Shirayama

JAMSTEC, Japan

(CoML SSC; OBIS International Committee)

OBIS
OCEAN BIOGEOGRAPHIC INFORMATION SYSTEM

UNESCO
United Nations Educational, Scientific and Cultural Organization

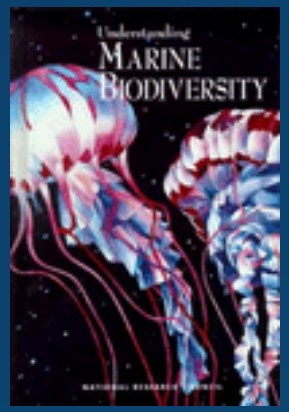
Intergovernmental Oceanographic Commission

Contents

- Early history of Census of Marine Life (CoML) and Ocean Biogeographical Information System (OBIS)
  - OBIS as a database of CoML project
- Development of OBIS in CoML
- OBIS as a legacy of CoML

CENSUS OF MARINE LIFE

Origin of the Census:
A visit to Jesse Ausubel at Swift House by Fred Grassle on 2 July 1996



Understanding MARINE BIODIVERSITY
A Research Agenda for the Nation

Committee on Biological Diversity in Marine Systems,
Ocean Studies Board
National Research Council, *Wash, D.C. 1995*

CHERYL ANN BUTMAN, *Co-Chair*, Woods Hole Oceanographic Institution, Massachusetts
JAMES T. CARLTON, *Co-Chair*, Williams College - Mystic Seaport, Connecticut
GEORGE W. BOEHLERT, National Marine Fisheries Service, Monterey, California
SUSAN H. BRAWLEY, University of Maine, Orono
EDWARD F. DELONG, University of California, Santa Barbara
J. FREDERICK GRASSLE, Rutgers University, New Brunswick, New Jersey
JEREMY B.C. JACKSON, Smithsonian Tropical Research Institute, Panama
SIMON A. LEVIN, Princeton University, New Jersey
ARTHUR R. M. NOWELL, University of Washington, Seattle
ROBERT T. PAINE, University of Washington, Seattle
STEPHEN R. PALUMBI, University of Hawaii, Honolulu
GEERAT J. VERMEIJ, University of California, Davis
LES WATLING, University of Maine, Orono

Slide courtesy of Jesse Ausubel

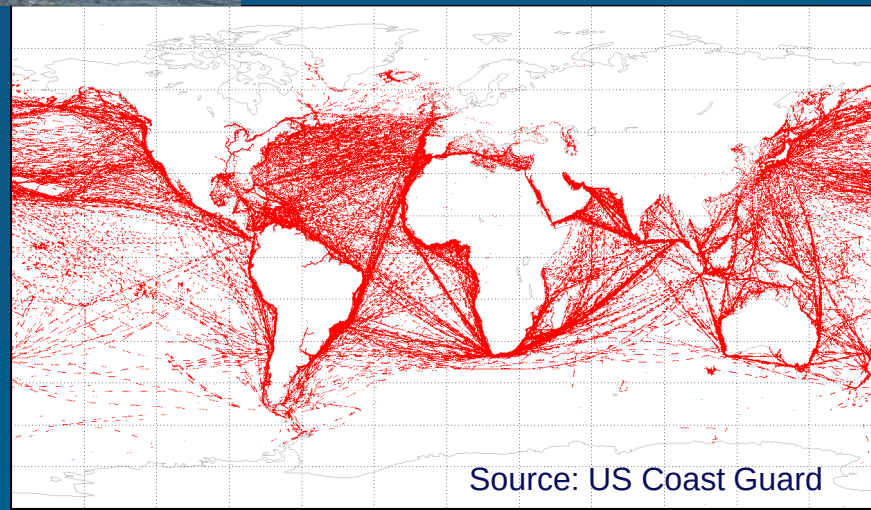
CENSUS OF MARINE LIFE

Three years of feasibility studies ‘97-’99

Could it be done? Would it be done? Should it be done?

Should it be done?
A more crowded ocean and yet an unexplored, unknown ocean

Slide courtesy of Jesse Ausubel



Source: US Coast Guard

Would it be done?

- Different cultures of marine science
  - From near shore to mid-ocean
  - From polar to equater
  - Shallow and deep
  - Small and large


Source: CoML NaGISA


Source: CoML CAML


Source: ArcOD

Slide courtesy of Jesse Ausubel


Source: ArcOD

CENSUS OF MARINE LIFE

Could it be done?

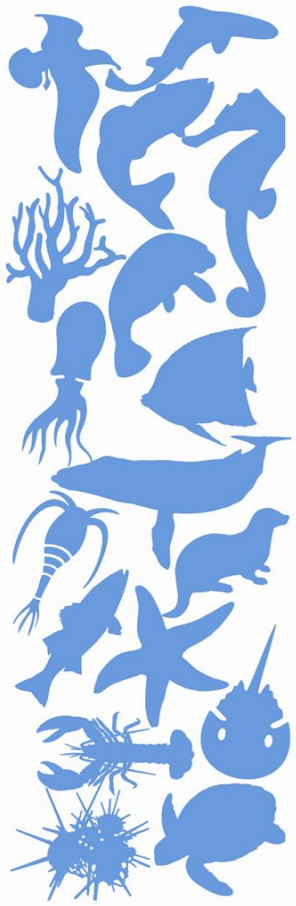
By a concerto of technologies

Slide courtesy of Jesse Ausubel

Image: E. Paul Oberlander

CENSUS OF MARINE LIFE

Census of Marine Life



A decade-long program (2000-2010)
to assess and explain marine life's
diversity, distribution & abundance
- past, present & future

The Known, the Unknown, the Unknowable

The Census of Marine Life: Making ocean life count

(Following slides were mainly produced in 2004 based on the baseline report 2003)

CENSUS OF MARINE LIFE

Grand Challenge Questions
Component Programs

1) What did live in the oceans?

History of Marine Animal Populations (HMAP)

2) What does live in the oceans?

New Field Projects (technologies)

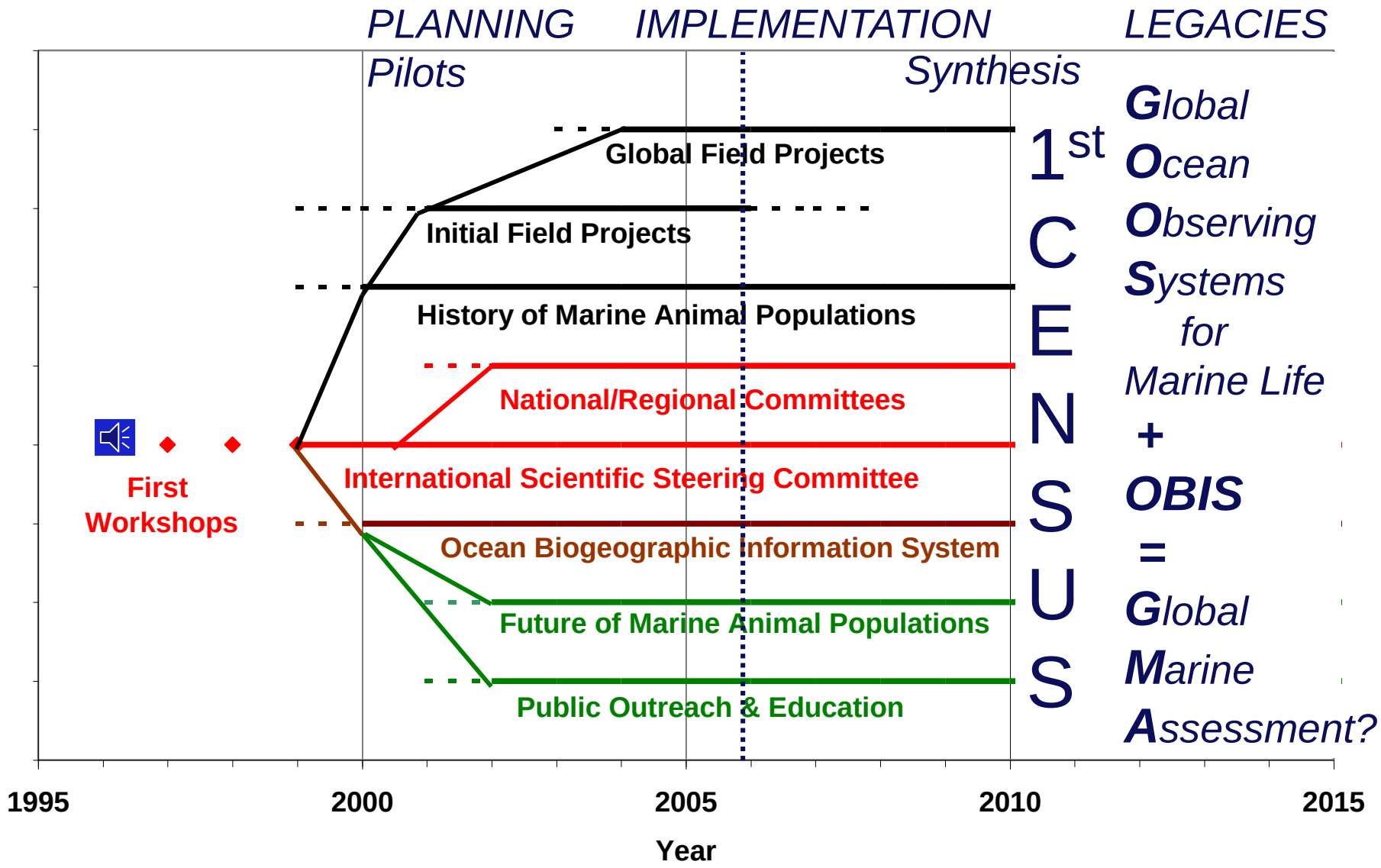
3) *What will live in the oceans?*

Future of Marine Animal Populations (FMAP)

4) *How to access & visualize data on living marine resources?*

Ocean Biogeographic Information System (OBIS)

Program Development: Schedule, Benchmarks



CENSUS OF MARINE LIFE

International Scientific Steering Committee Original Members (in 2000)

- J. Frederick Grassle, Rutgers University, USA (Chair)
- Vera Alexander, University of Alaska, USA
- Patricio Bernal, Intergovernmental Oceanographic Commission, France
- Donald Boesch, University of Maryland, USA
- David Farmer, Institute for Ocean Science, Canada
- Carlo Heip, Netherlands Institute for Ecology, Netherlands
- Poul Holm, Southern Denmark University, Denmark
- Olav Rune Godø, Inst. of Marine Research, Norway
- Yoshihisa Shirayama, Kyoto University, Japan
- Andrew Solow, Woods Hole Oceanographic Institution, USA

CENSUS OF MARINE LIFE

CoML International Scientific Steering Committee (2004)

Fred Grassle (Chair), USA
Victor Ariel Gallardo (Vice Chair), Chile
Vera Alexander, USA
James Baker, USA
Patricio Bernal, France/Chile
D. Chandramohan, India
David Farmer, USA
Serge Garcia, Italy
Carlo Heip, Netherlands/Belgium
Poul Holm, Denmark
Ian Poiner, Australia
Yoshihisa Shirayama, Japan
Myriam Sibuet, France
Mike Sinclair, Canada
Meryl Williams, Malaysia/Australia

CoML

www.coml.org

CoML International Secretariat

Consortium for Oceanographic Research and Education

www.coreocean.org

CoML Education and Outreach

University of Rhode Island Office of Marine Programs

omp.gso.uri.edu

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The SSC braces itself against the Scottish winds

(Aberdeen SSC Meeting, June 2002)

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SSC at Punta Arenus with IAPSO/IABO

CENSUS OF MARINE LIFE

A small group of SSC members gathers for a picture outside the Centro do Mar in Horta

(Azores SSC Meeting, July 2004)

CENSUS OF MARINE LIFE

Fred, Olav Rune Godø and Alasdair McIntyre marvel at the capabilities of the *G.O. Sars*

(Azores SSC Meeting, July 2004)

CENSUS OF MARINE LIFE

Fred watches colleagues ascend in the canopy crane at the Rainforest CRC Field Station in Queensland, Australia

(Cape Tribulation SSC Meeting, August 2005)

CENSUS OF MARINE LIFE

The SSC takes a break from a stressful meeting to enjoy the scenery at Cape Tribulation

(Cape Tribulation SSC Meeting, August 2005)

CENSUS OF MARINE LIFE

Fred follows custom at a Japanese temple to wash his hands

(Nara SSC Meeting, October 2006)

CENSUS OF MARINE LIFE

The participants of the Quito SSC Meeting (June 2007)

CENSUS OF MARINE LIFE

Fred toasts the 30 years of research on chemosynthetic ecosystems since the discovery of the first hydrothermal vent

(Galapagos Islands, June 2007)

CENSUS OF MARINE LIFE

The SSC poses with a colony of chinstrap penguins – or, as Ron O'Dor likes to refer to them, CoML's Antarctic Committee

(Excursion to King George Island, Antarctica, Punta Arenas SSC Meeting, February 2008)

CENSUS OF MARINE LIFE

Fred takes in the spectacular views at King George Island in Antarctica

(Punta Arenas SSC Meeting, February 2008)

CENSUS OF MARINE LIFE

Vera Alexander, Sara Hickox, Fred and Ron O'Dor pose outside the Chilean Antarctic Institute

(Excursion to King George Island, Antarctica, Punta Arenas SSC Meeting, February 2008)

History of OBIS

(Ocean Biogeographical Information System)

- 1997: Initial ideas developed at pre-CoML workshop
- 1998: A web-site to demonstrate the initial concept based on Sloan Funds
- 1999: First OBIS international workshop
- 2000: NOPP funds 8 projects in 15 countries, $3.7 million to initiate OBIS
- 2000: Second OBIS Workshop
- 2001: International Steering Committee formed
- 2001: NSF funds a global portal for OBIS at Rutgers Univ.
- 2001: GBIF marine associate
- 2002: NOPP funds up to $6.0 million for international OBIS
- 2002: Portal begins serving data
- 2003 and on: expansion of data content and functionality

Organization

OBIS International Committee

- Mark J. Costello, Chair, Canada
- Neil Ashcroft, United Kingdom
- Geoff Boxshall, United Kingdom
- Daphne G. Fautin, USA
- Kim Finney, Australia
- Rainer Froese, Germany
- Dennis P. Gordon, New Zealand
- J. Frederick Grassle, USA
- Yoshihisa Shirayama, Japan
- John Wilkin, USA
- Ex-officio: Phoebe Zhang, Karen Stocks, James Wood

Technical Working Group: with representatives from each data contributor

Secretariat: Huntsman Marine Science Center (Mark Costello)

Portal: Rutgers University (Fred Grassle, Phoebe Zhang)

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OBIS International Committee meeting in 2003

CENSUS OF MARINE LIFE

OBIS workshop in San Diego 2004

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OBIS meeting 2004 at Halifax

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NOPP-funded OBIS Members

- BATS Zooplankton (Deborah Steinberg)
- Biogeoinformatics of Hexacorals (Daphne Fautin)
- Cephbase (James Wood)
- FishBase (Rainer Froese)
- Fishnet (Ed Wiley)
- Indo-Pacific Mollusk Database (Gary Rosenberg)
- ZooGene (Ann Bucklin)
- Gulf of Maine Biogeographic Information System (Dale Kiefer)

CENSUS OF MARINE LIFE

OBIS

SEAMOUNTS ONLINE

Zooplankton Genomics ZooGene

FishNet

THE ACADEMY OF NATURAL SCIENCES PHILADELPHIA

Gulf of Maine Biogeographical Information System

National Oceanographic Data Center

FishBase

Biogeoinformatics of Hexacorals

HMAP

Fisheries and Oceans Canada | Pêches et Océans Canada

CephBase

ZOOPLANKTON CENSUS - BERMUDA ATLANTIC TIME-SERIES STUDY

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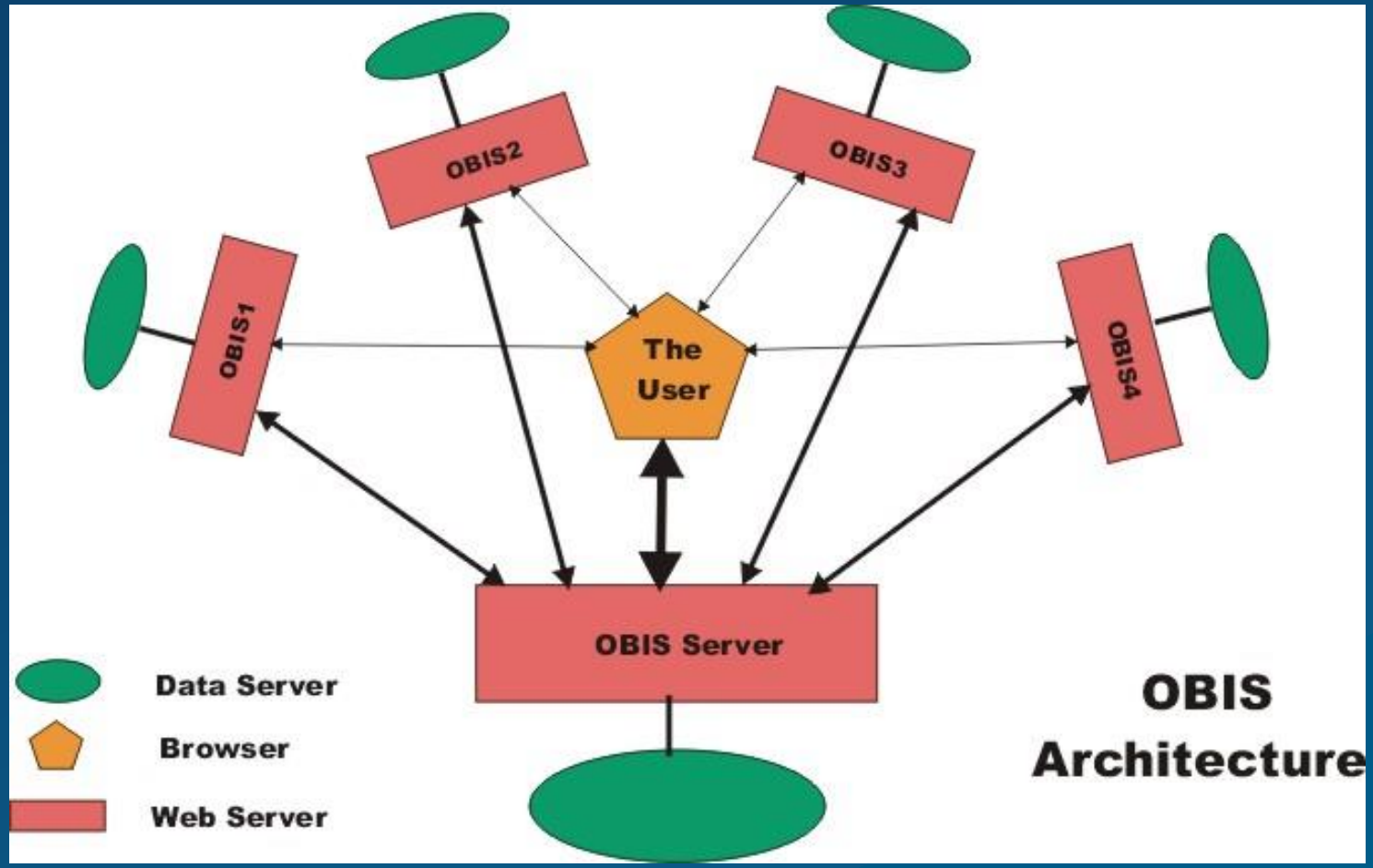
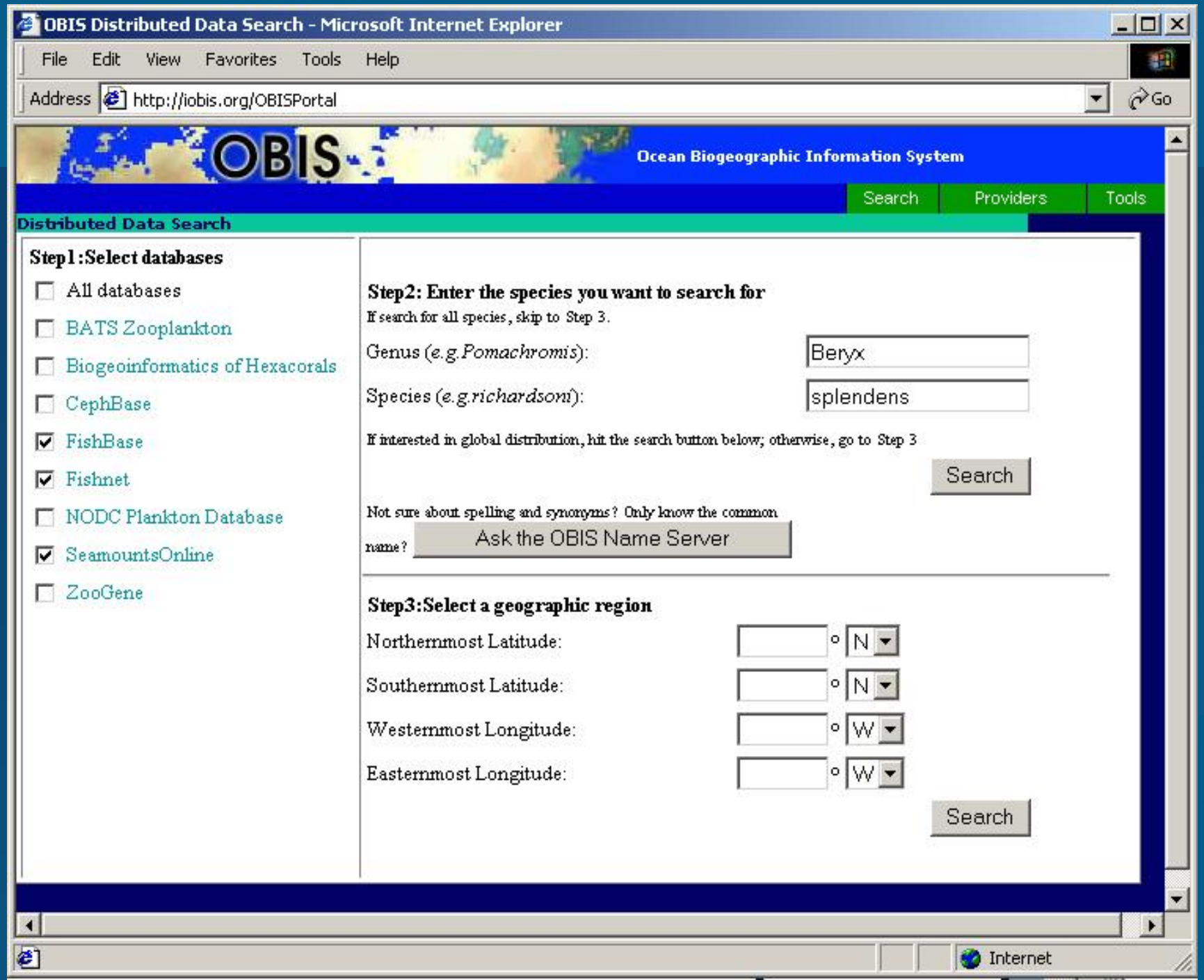
OBIS Architecture



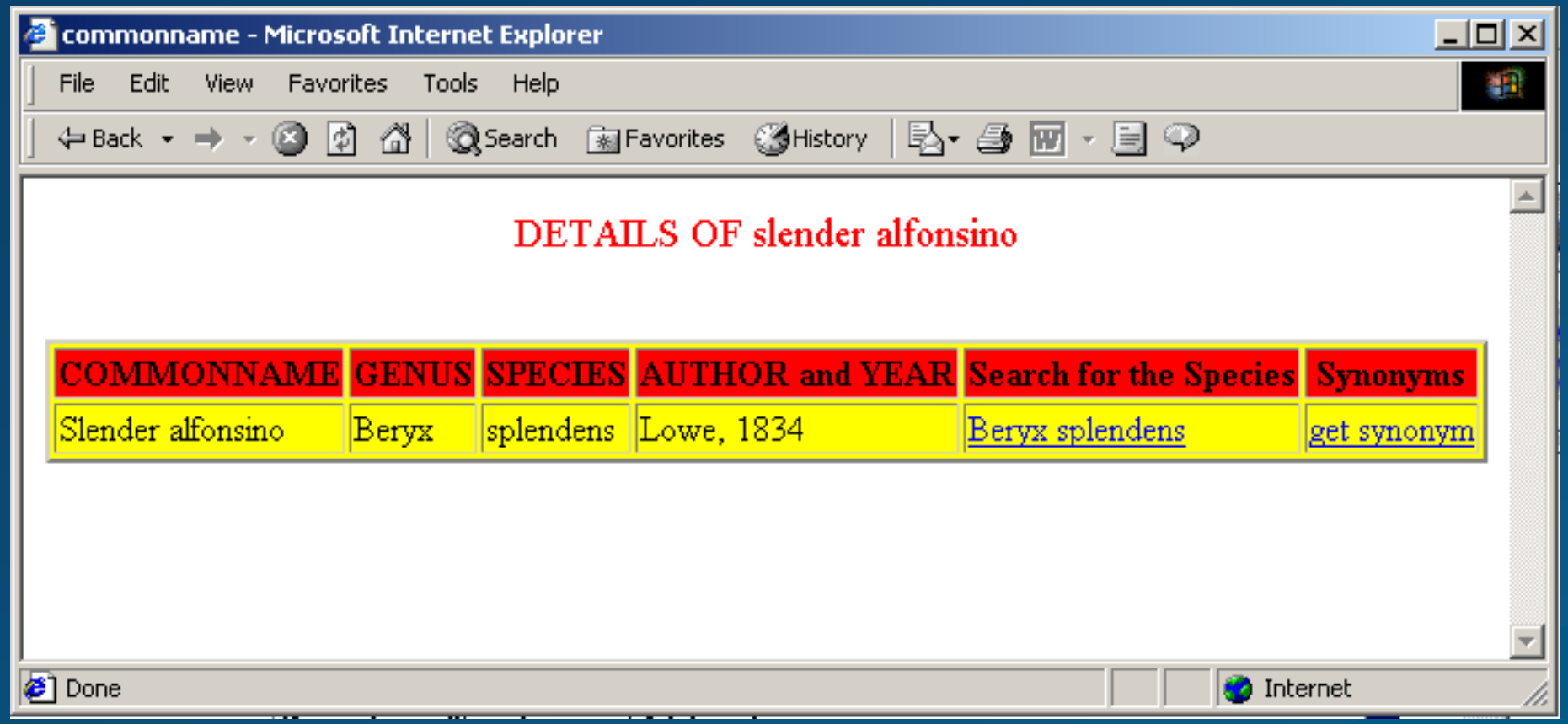
CENSUS OF MARINE LIFE

www.iobis.org

CENSUS OF MARINE LIFE



CENSUS OF MARINE LIFE



CENSUS OF MARINE LIFE

Dataset Extent Mapping - Microsoft Internet Explorer provided by America Online

File Edit View Favorites Tools Help

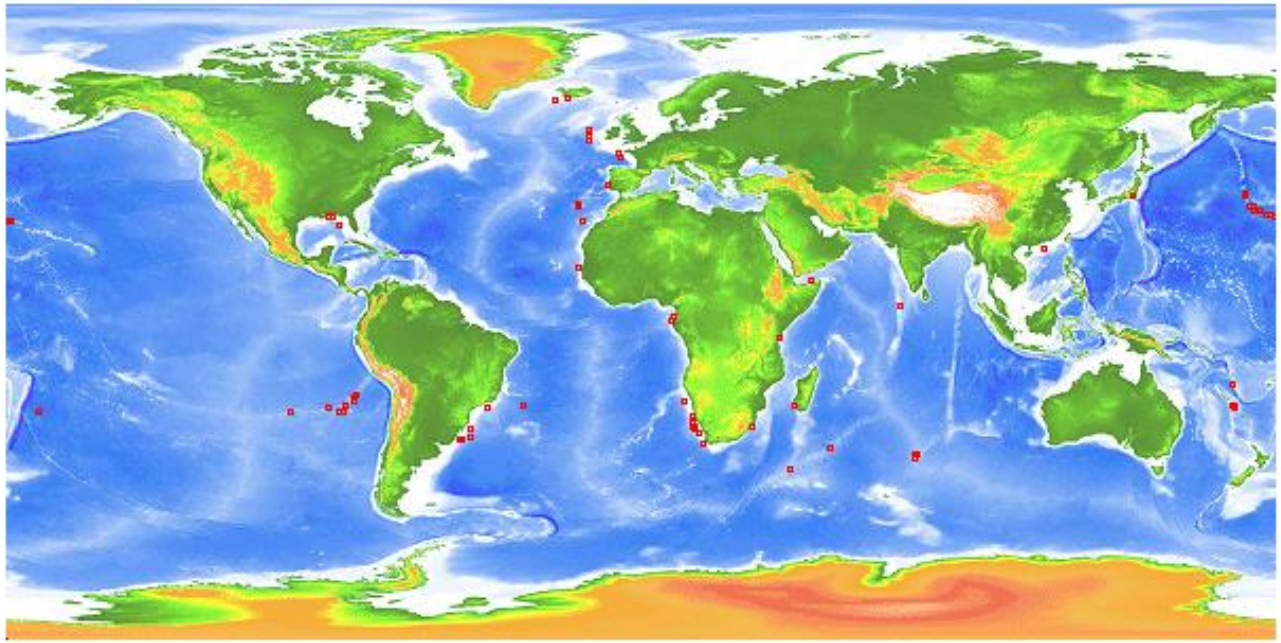
Address http://www.marine.csiro.au/cgi-bin/cs_map.pl Go Links

Dataset extent

Global Distribution of *Beryx splendens*

CSIRO MARINE RESEARCH

c-squares

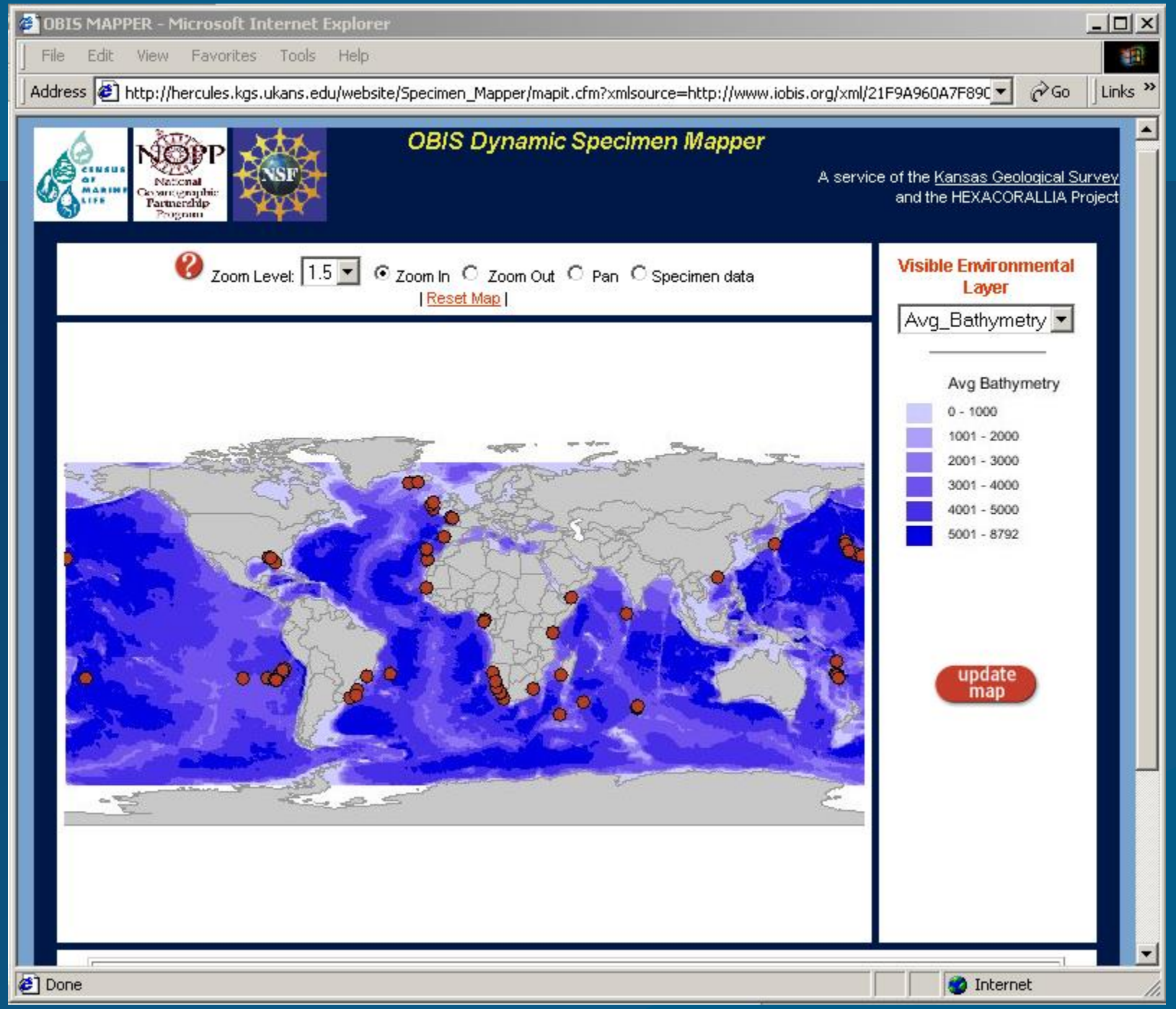


World map Change... Enlarge...

Please note, current OBIS search results include only a subset of global data and may also contain erroneous data awaiting verification. This map is indicative only and should not be used as an authoritative of the actual - or complete - distribution of this taxon at this time.
Dataset extent map produced by CMR c-squares mapper

Internet

CENSUS OF MARINE LIFE



CENSUS OF MARINE LIFE

OBIS Content (May 2003)

Today: 861,876 Records

~57,000 species
of 200,000-500,000
estimated known

CENSUS OF MARINE LIFE

Summary of Data Content

	# Species	# Records	# Institutions	Taxonomy	Images
BATS	**~200**	**44,217**	4		
Hexacorals	**7,702**	**>20,000**	7	✓	✓
Cephbase	**786 (all)**	**3,886**	1	✓	✓
FishBase	**27,315**	**1.2mill**	22	✓	✓
Fishnet	**28,000**	**30⁺ mill**	29	✓	
Indo-Pacific Mollusc	**19,875**	**16,261**	4	✓	
ZooGene	**286**	**~500**	4	✓	
(GMBIS)	**-**	**-**	4		

CENSUS OF MARINE LIFE

Additional Data Providers

- Division of Fisheries and Oceans Canada: 60,162 records
- SeamountsOnline – Species from 200+ seamounts globally.
- NODC World Plankton Database – global plankton samples
- History of Marine Animal Populations: 175,785 records

CENSUS OF MARINE LIFE

OBIS: Next Generation

Better search and retrieval

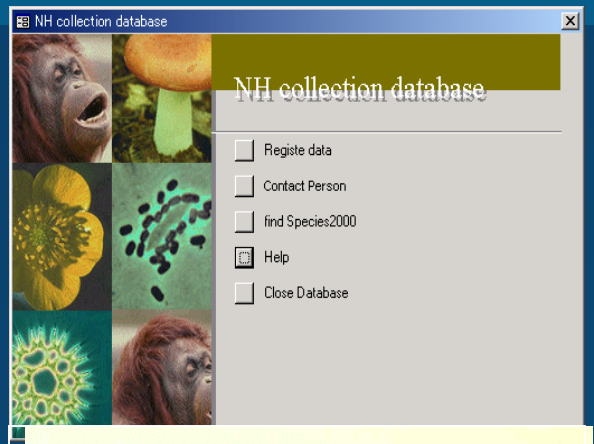
More tools

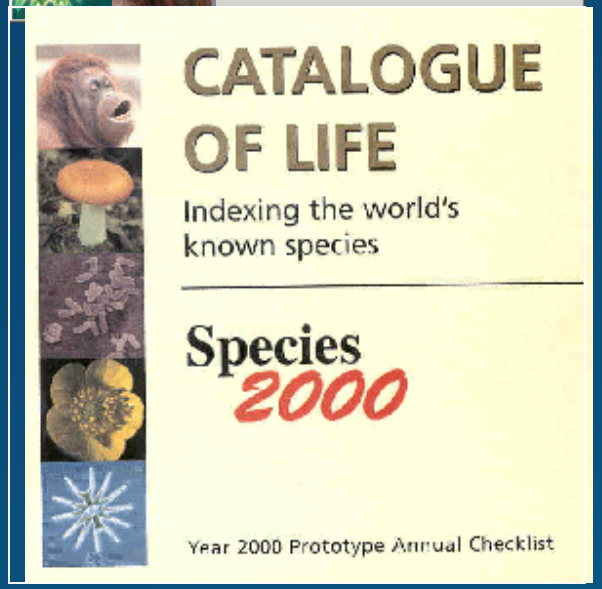
More data types

Technology: metadata for databases, considering web services model (WSDL, UDDI, SOAP and XML).

- Integrate with physical/environmental data

NHCJ Ver. 2.0 (May 2002)





- Multi lingual data fields
  - Referring Species 2000 Annual Checklist (optional)
- Darwin Core access fields (optional)
- Support JPEG, BMP,GIF images
  - Specimen details
  - Collection site details
  - Name, Kingdome to infra specific level
  - Photos/Illustration
  - Contact details to access the specimen

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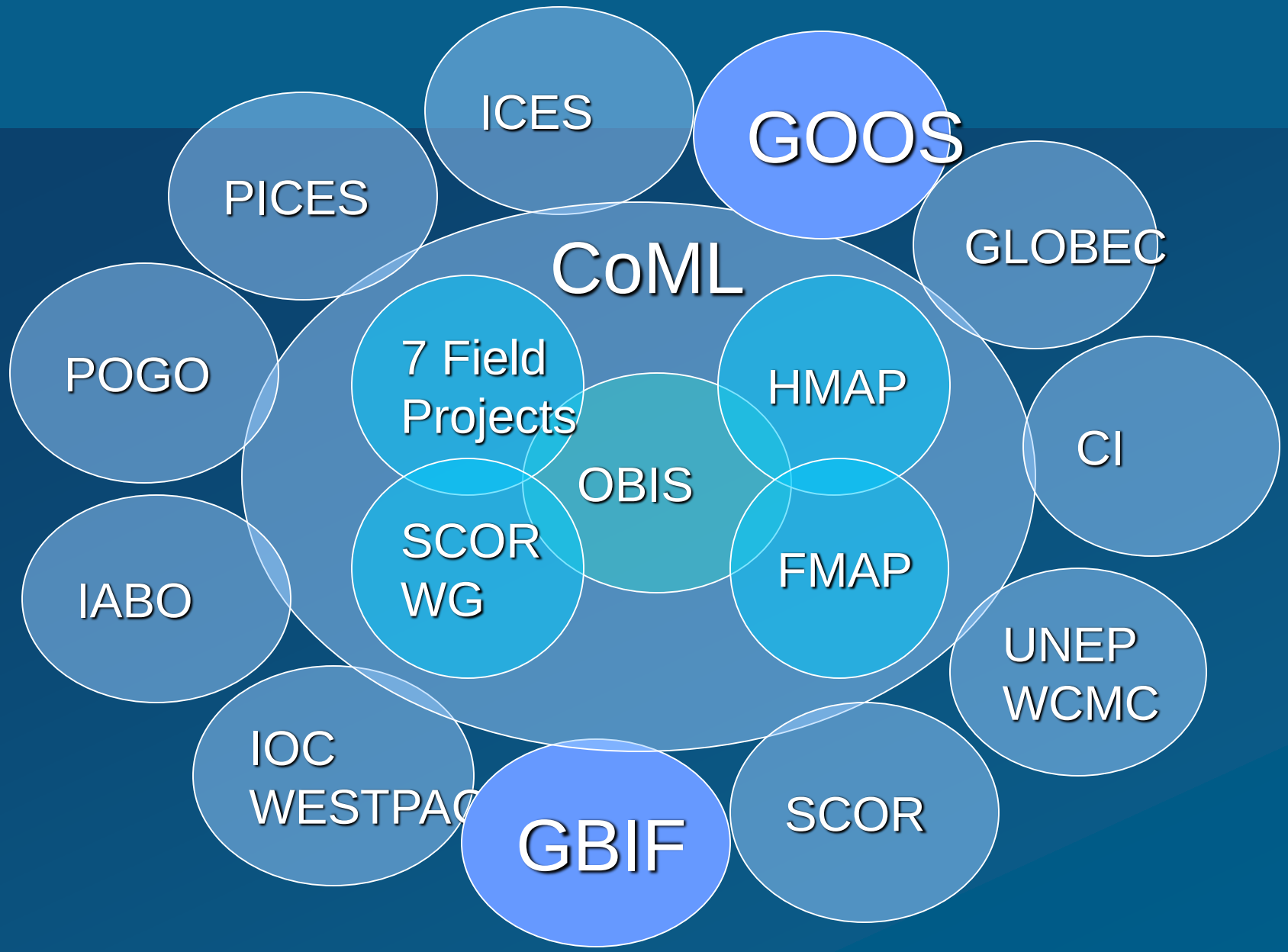
CoML LINKS



CENSUS OF MARINE LIFE

Funding Structure

Current:

- Database development funded by individual grants
- OBIS Secretariat from Sloan Foundation
- Portal development from NSF

Challenge: Continued funding for

- Long-term provider maintenance
- Portal Development
- New providers

Plans: Alliances with

- National data centers
- Public interest user groups
- Industry
- Environmental managers

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OBIS meeting in Germany 2005

CENSUS OF MARINE LIFE

OBIS meeting in Germany 2005

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Woods Hole MPC meeting
July '06 that created EOL

Encyclopedia of Life

CENSUS OF MARINE LIFE

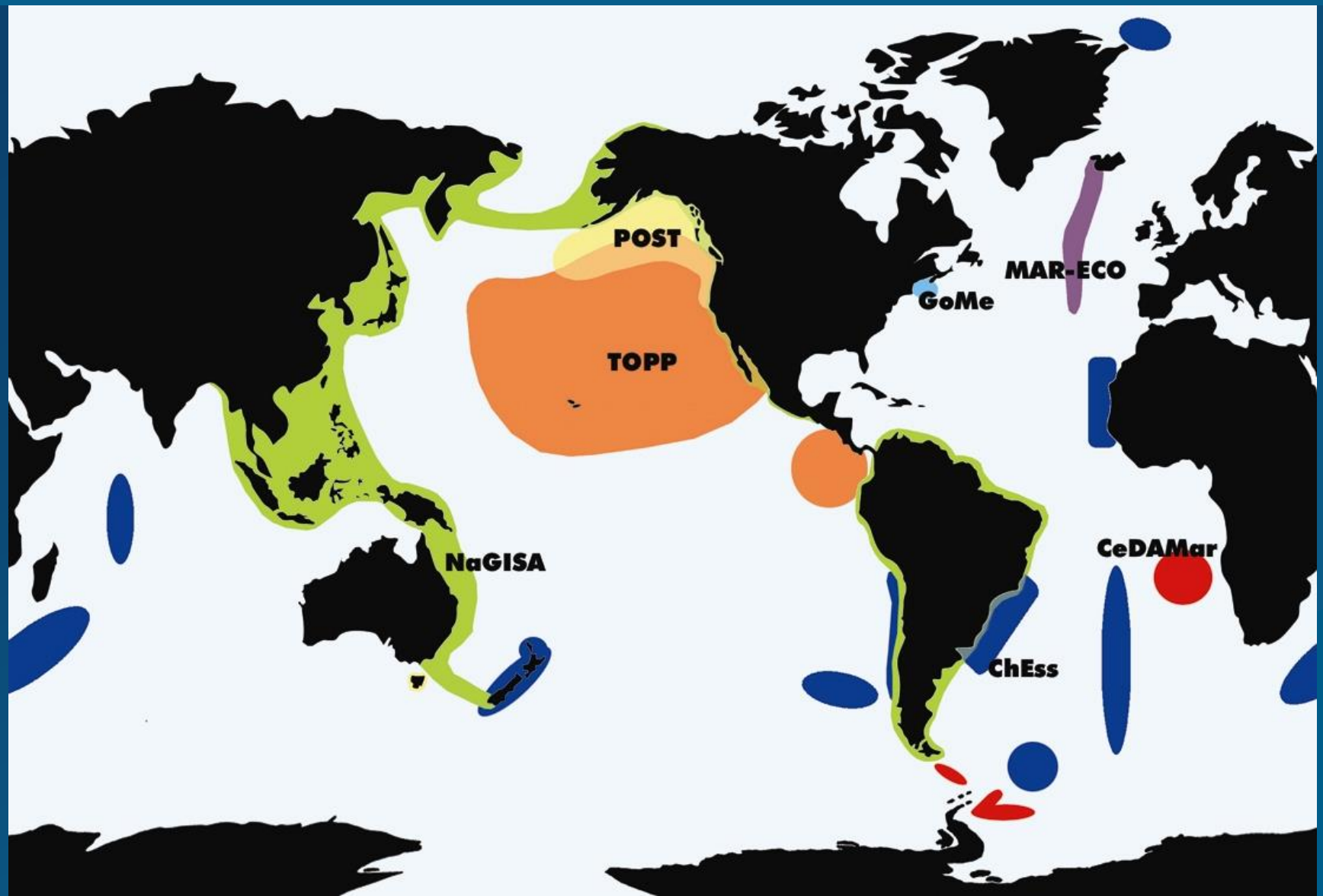
Meeting with EOL

CENSUS OF MARINE LIFE

Meeting with EOL

CENSUS OF MARINE LIFE

Initial Project Map



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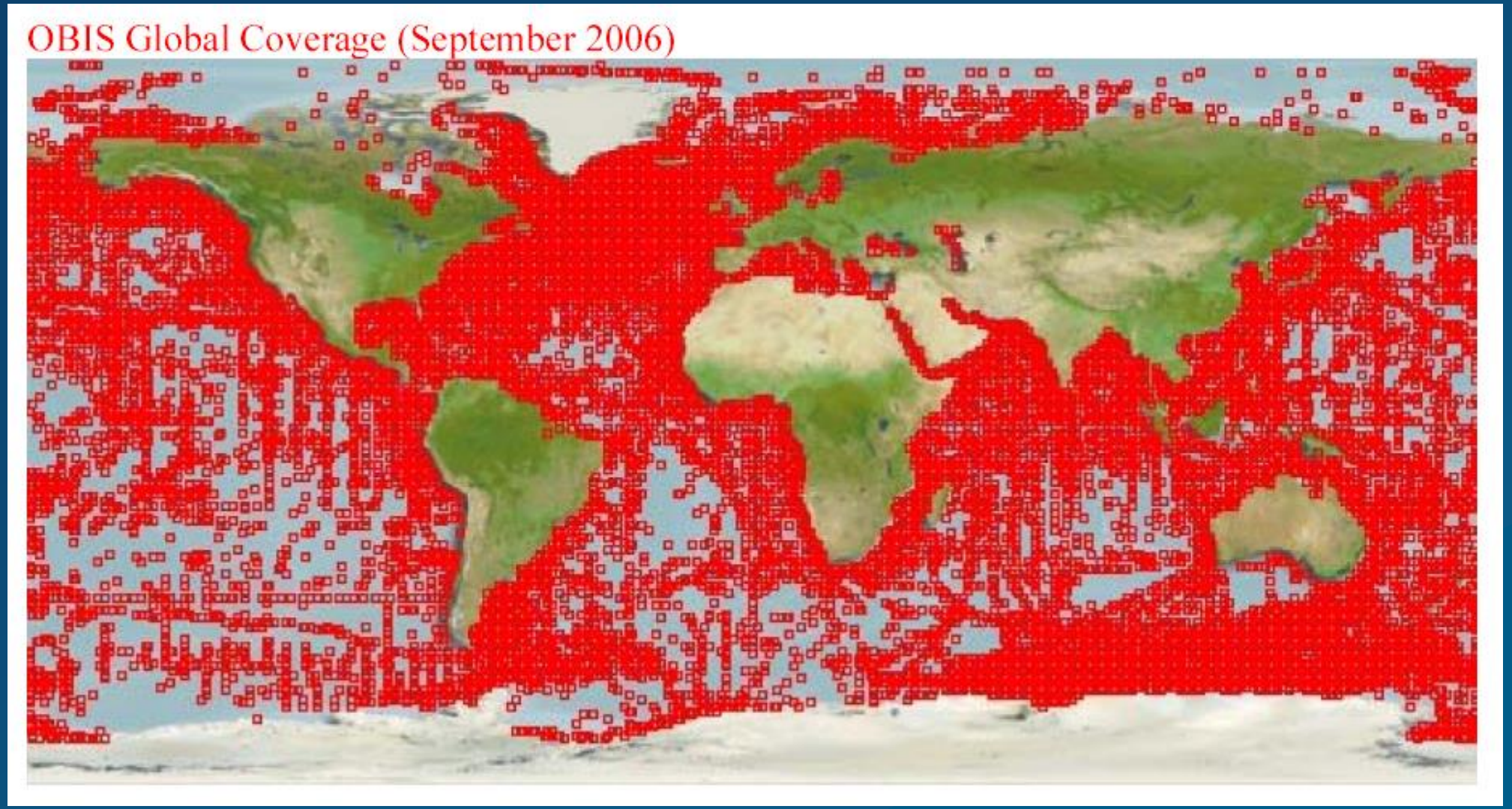
OBIS Datapoints



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OBIS Records in 2006

OBIS Taxonomic Categories

- details last updated 2006-10-12

Total Records in cache : 10111509
Number of Data Sources : 146

Category	No. of Names Held (chiefly marine species)	No. of Species with OBIS Point Data	Number of Records	Approx. no. of Global Species	
All categories	*163808* list names	*75708* list taxa	*8116879*	*3.5 million? [200000+ marine]*	clickable map

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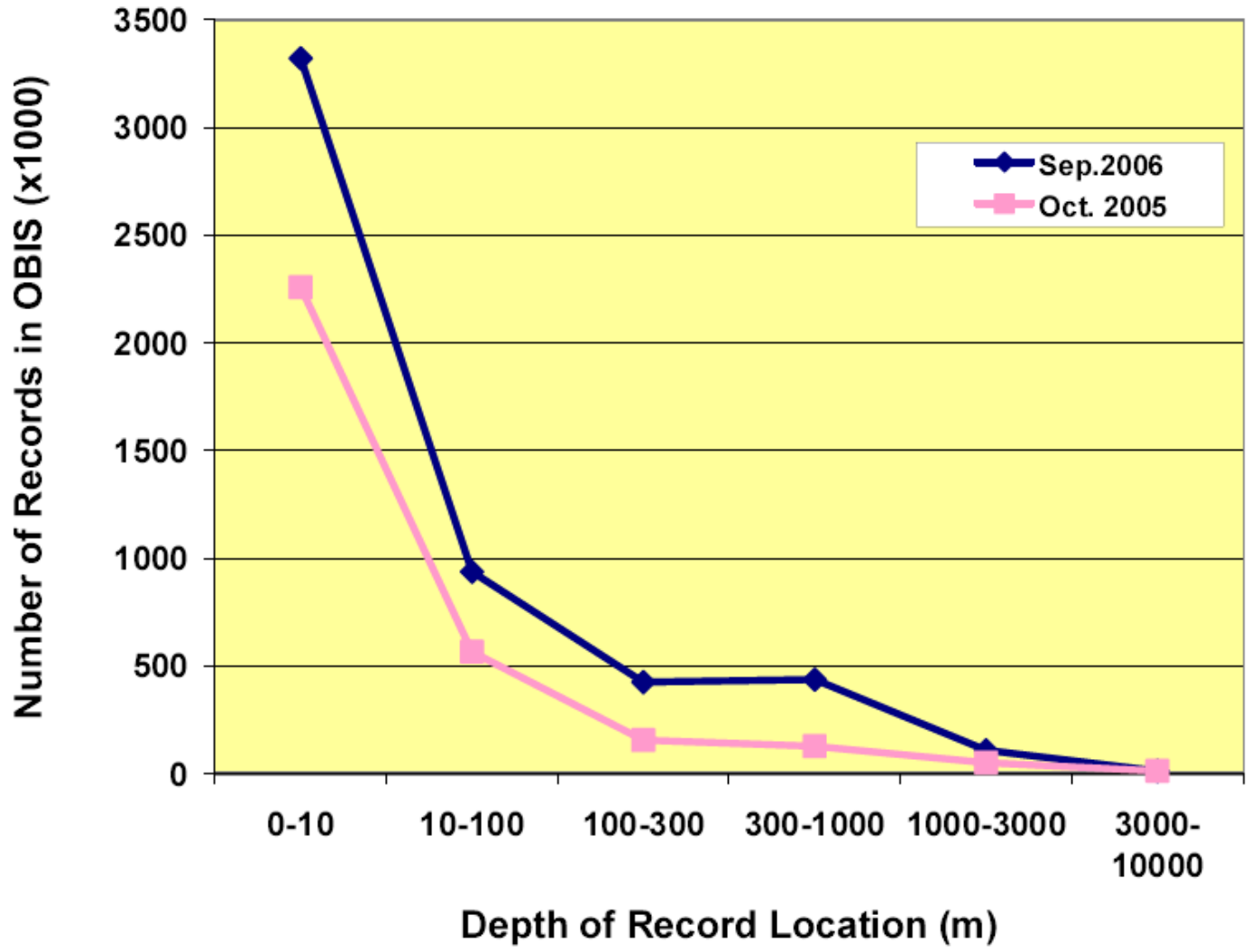
OBIS meeting at Los Banos 2006

CENSUS OF MARINE LIFE

OBIS meeting at Los Banos 2006

CENSUS OF MARINE LIFE

OBIS Vertical Coverage



CENSUS OF MARINE LIFE

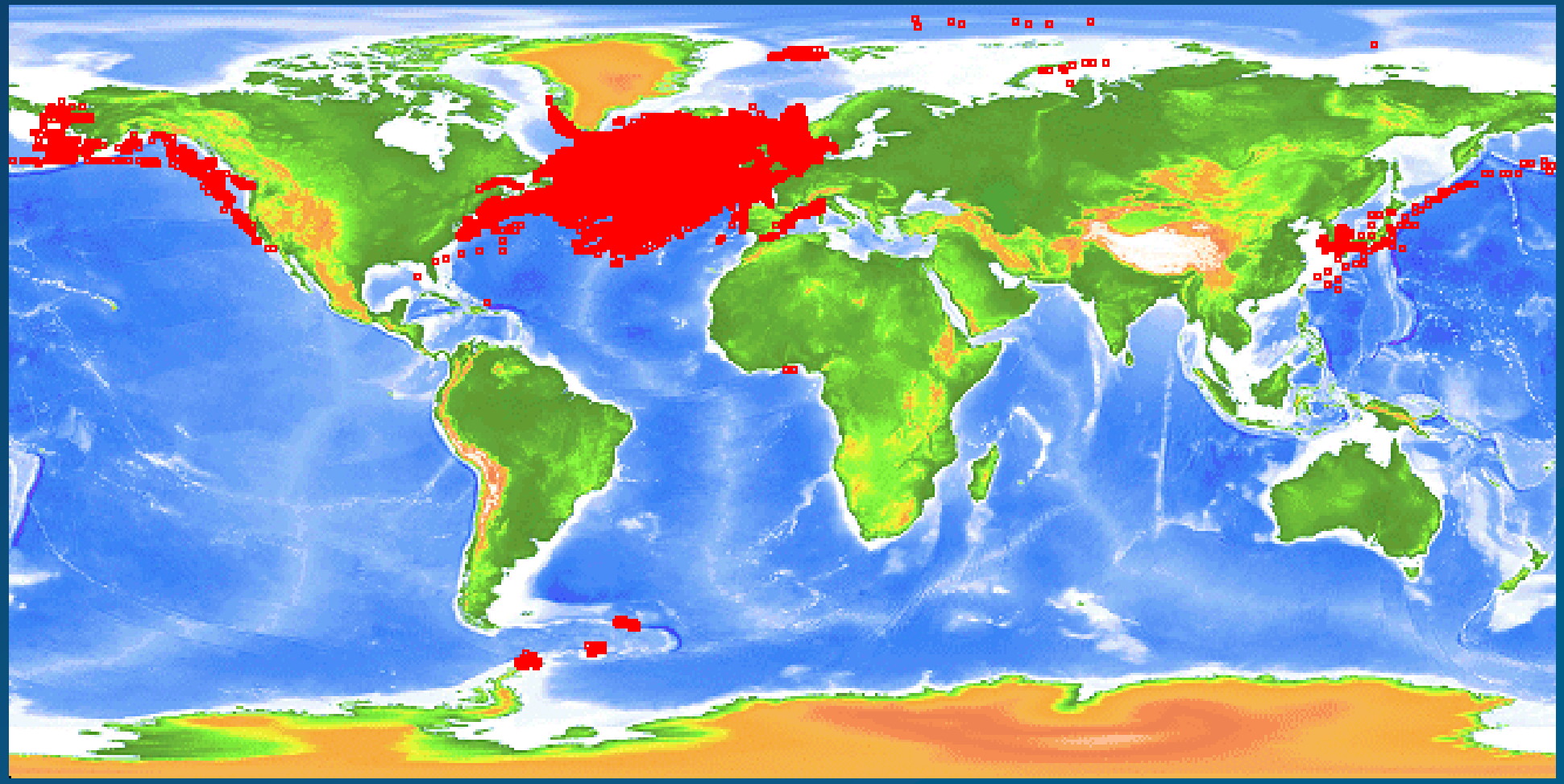
Numbers of species

	Total OBIS	Total world	% in OBIS	
Vertebrata	13,887	14,272	97%	vertebrates
Nematoda	2,004	4,200	48%	round worms
Cnidaria	3,516	7,598	46%	anemones+corals+
Annelida	2,594	8,080	32%	worms *
Other	629	2,197	29%	other
Tunicata	241	1,286	19%	tunicates
Crustacea	5,584	30,472	18%	crustaceans
Mollusca	5,708	32,813	17%	molluscs
Pycnogonida	141	940	15%	sea spiders *
Echinodermata	802	6,700	12%	echinoderms
Bryozoa	528	5,700	9%	mat animals *
Nemertea	115	1,250	9%	ribbon worms *
Porifera	310	6,000	5%	sponges
Platyhelminthes	0	6,795	0%	flatworms *

CENSUS OF MARINE LIFE

For example, the distribution of the copepod *Calanus*
Although generally correct, it does reflect sampling biases

Species level detail is problematic and requires QC



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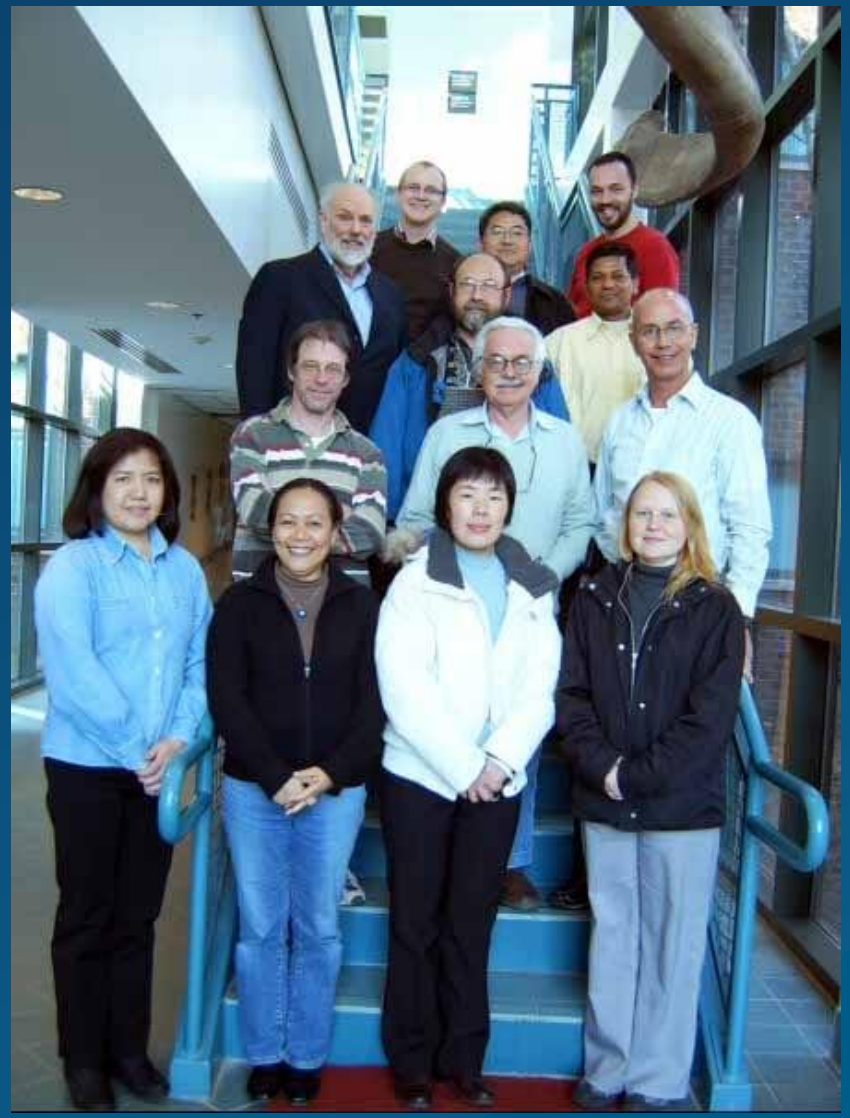
OBIS meeting in 2007

CENSUS OF MARINE LIFE

OBIS Governing Board, inaugural meeting 4/28/08

CENSUS OF MARINE LIFE

OBIS meeting in 2008



Census Summary 2000-2010

It can be done

>2,700 scientists

>80 countries

>540 field expeditions

~US$650 million

>1,200 new species +
5000 await description

>100,000 EOL pages for
marine species

~35,000 marine species
with DNA barcodes

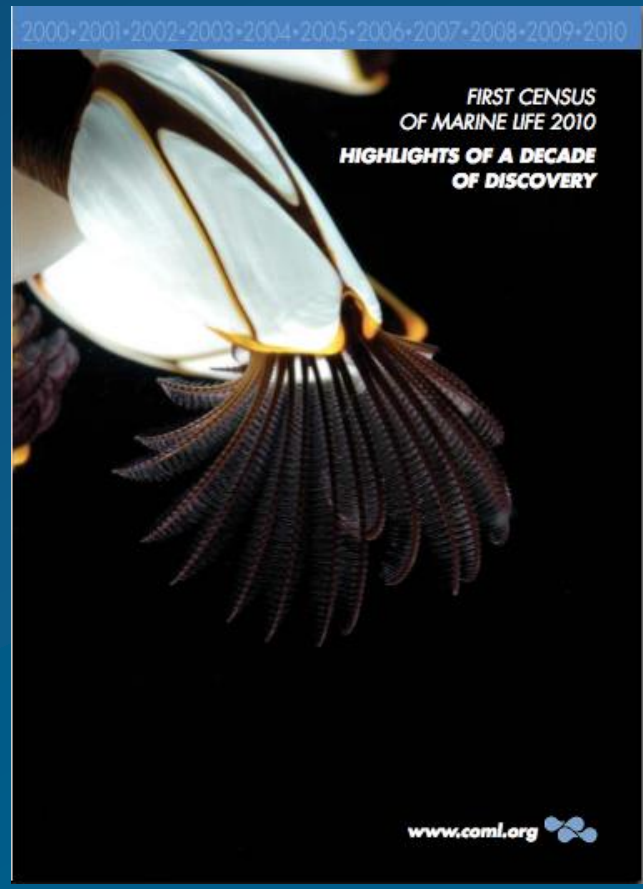
2,600 publications + books, maps, videos,

films, paintings, sculptures, songs…

New protected areas…

Marine Life is:

- richer
- more connected
- more altered
- yet unknown, unexplored



Highlights available in 11 languages

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Average known diversity in 25 regions

~10,000 known species in average region

Source: Costello, Miloslavich, et al., 2010, PLoS One. 8,000 views

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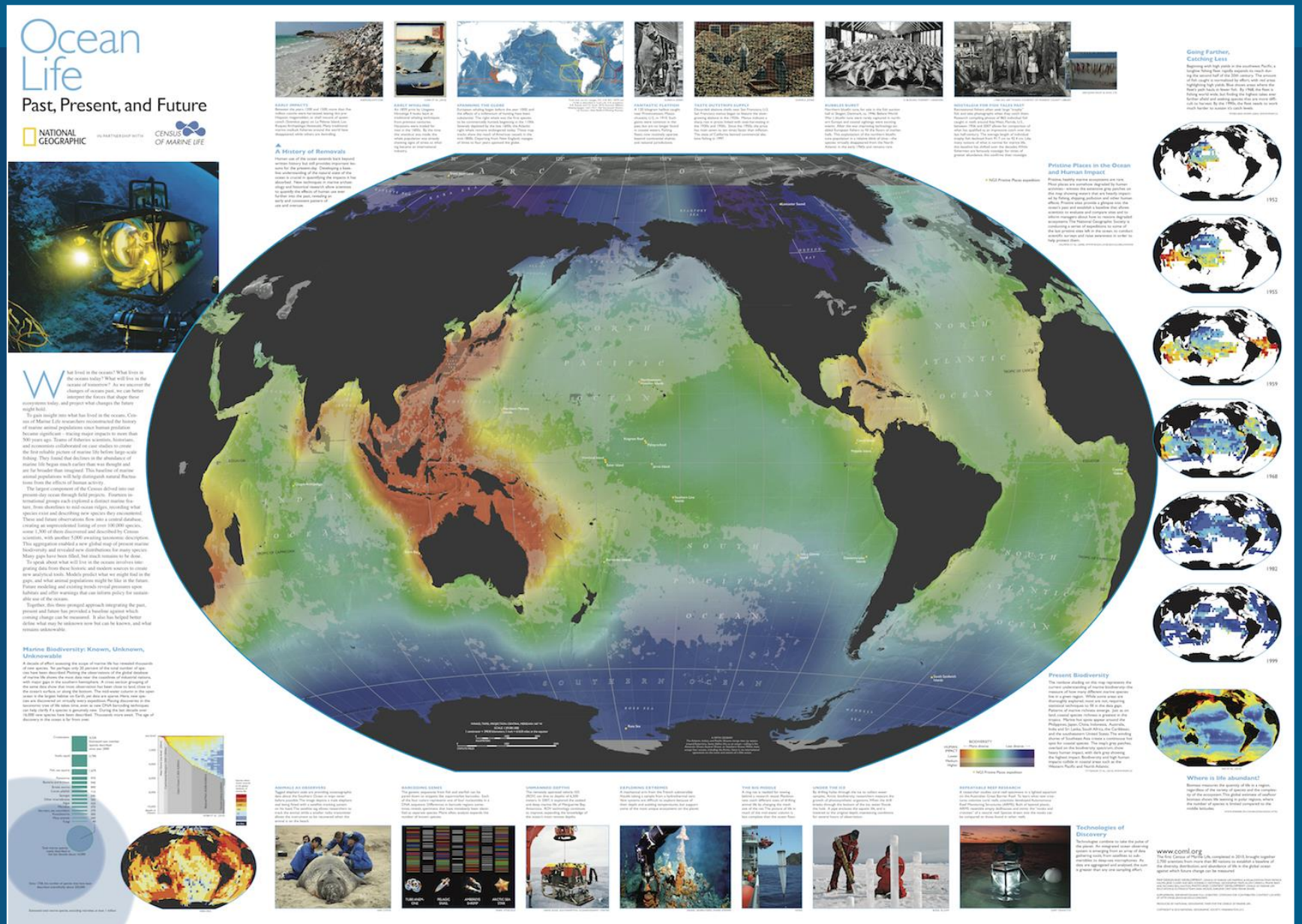
National Geographic wall map
Halpin et al.

A DECADE OF DISCOVERY
CENSUS OF MARINE LIFE 2010



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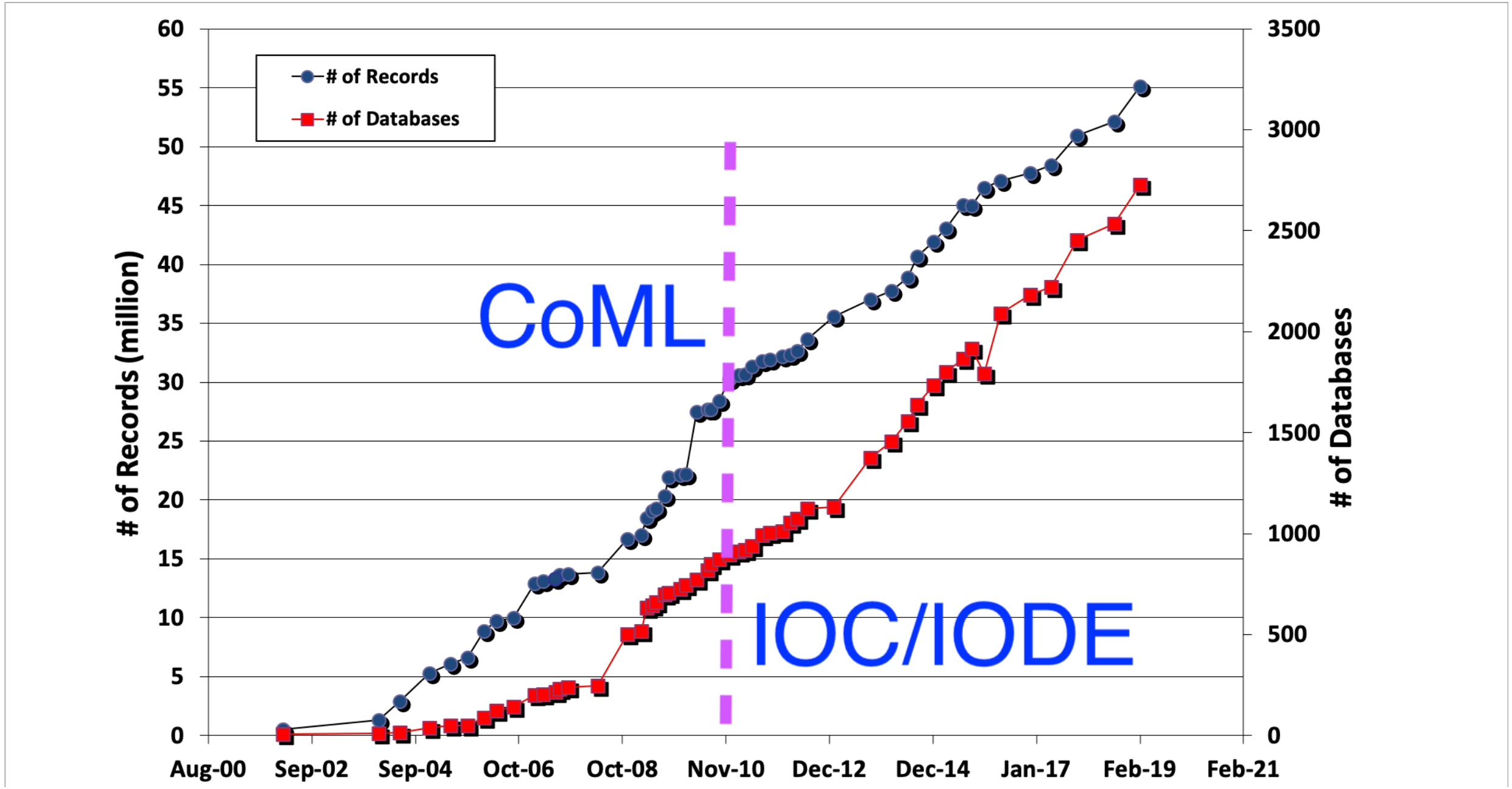
The spirit of a ship's crew: a culture of pulling together
Marine biology can succeed as Big Science

CENSUS OF MARINE LIFE

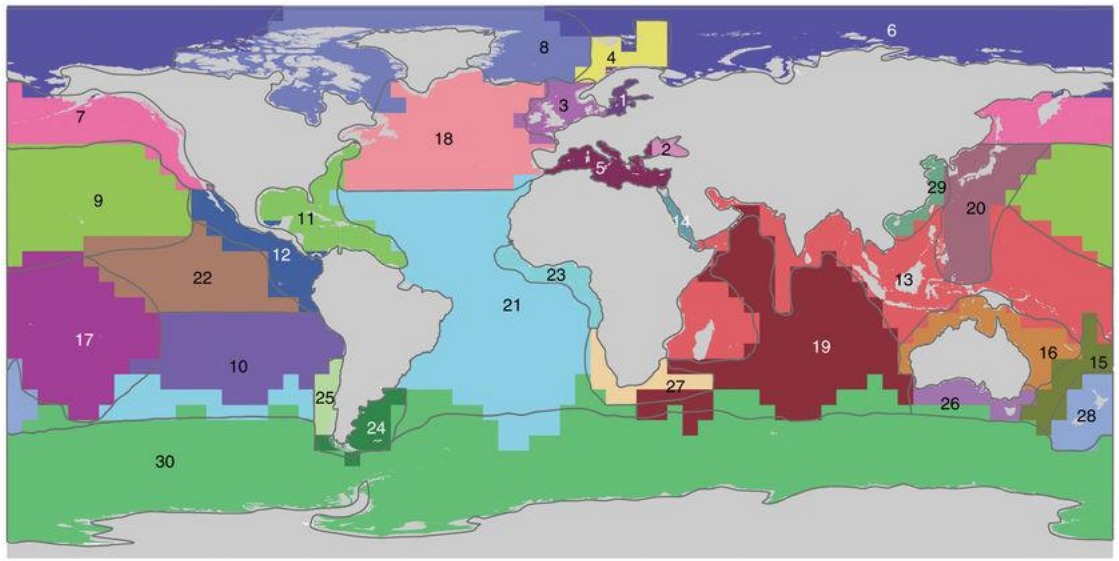
CoML attendees at Prize dinner: Susan Poiner, Jesse Ausubel, Patricia Miloslavich, Victor Gallardo, Myriam Sibuet, Ian Poiner, Yoshihisa Shirayama, Mari Shirayama

Chairman Ian Poiner


# of Records
# of Databases
CoML
IOC/IODE
# of Records (million)
# of Databases
0
5
10
15
20
25
30
35
40
45
50
55
60
0
500
1000
1500
2000
2500
3000
3500
Aug-00
Sep-02
Sep-04
Oct-06
Oct-08
Nov-10
Dec-12
Dec-14
Jan-17
Feb-19
Feb-21

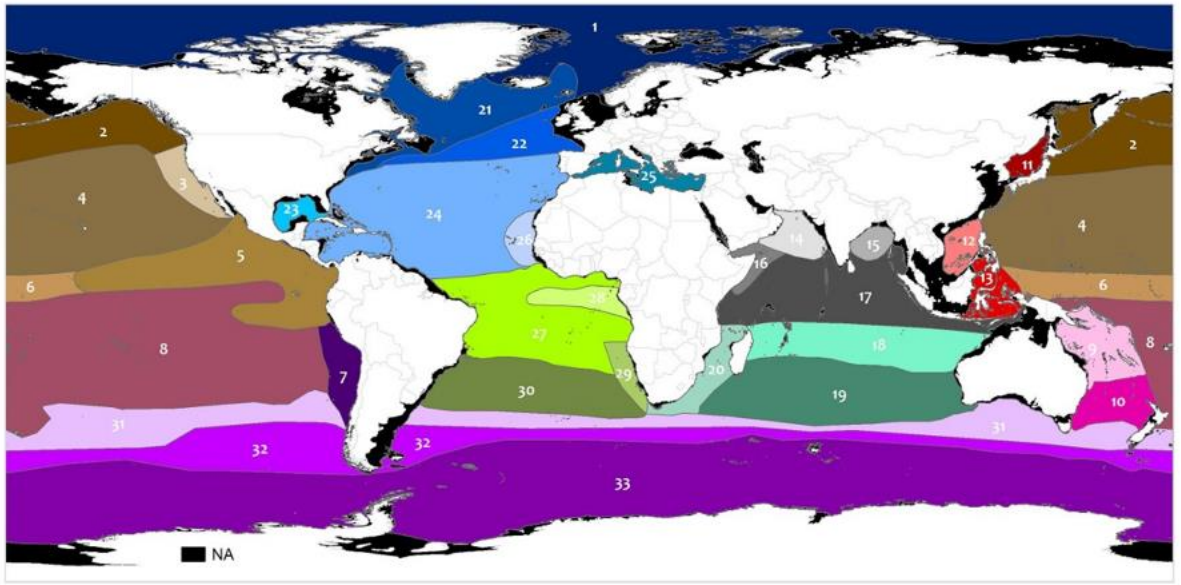
1998 2009 2017

nature COMMUNICATIONS



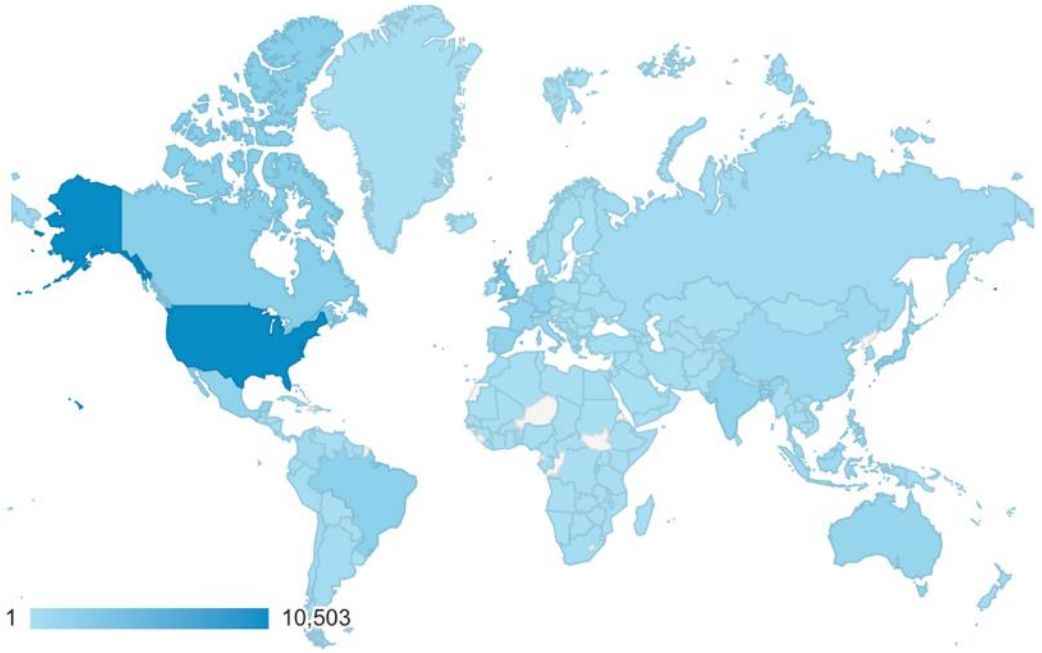
Marine biogeographic realms and species endemicity

DEEP-SEA RESEARCH PART I



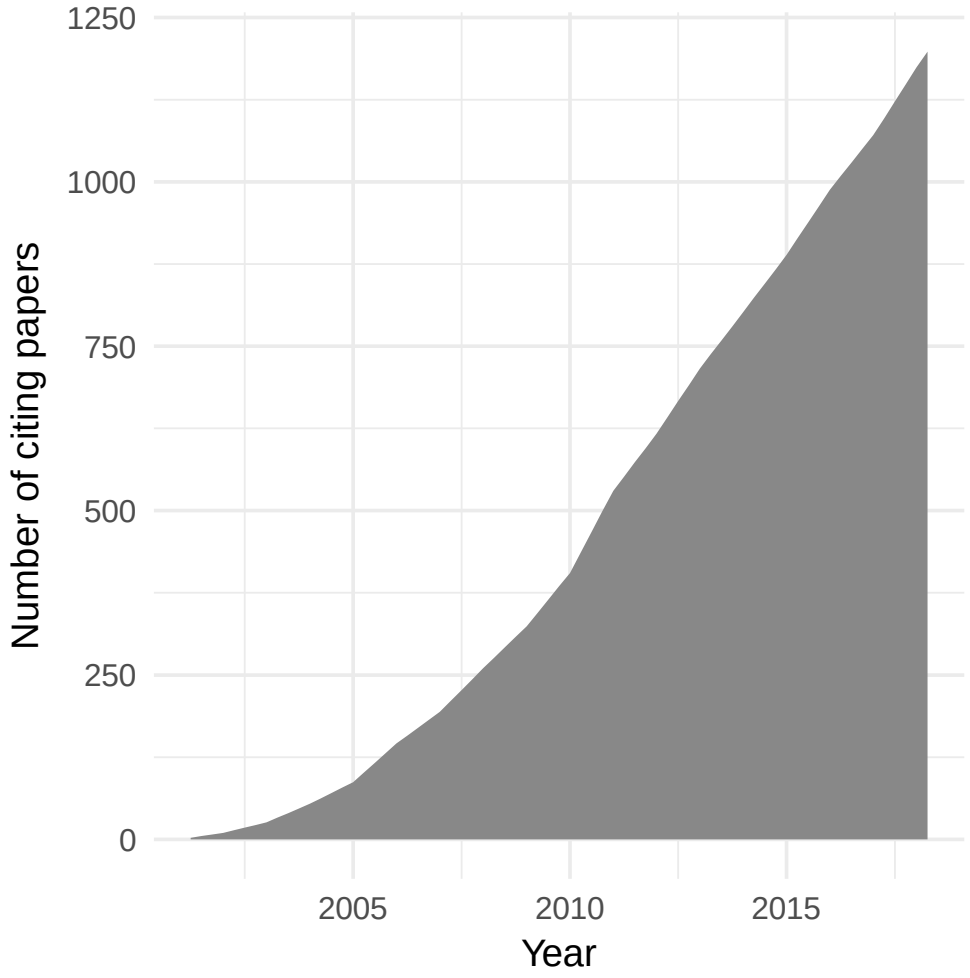
A global biogeographic classification of the mesopelagic zone

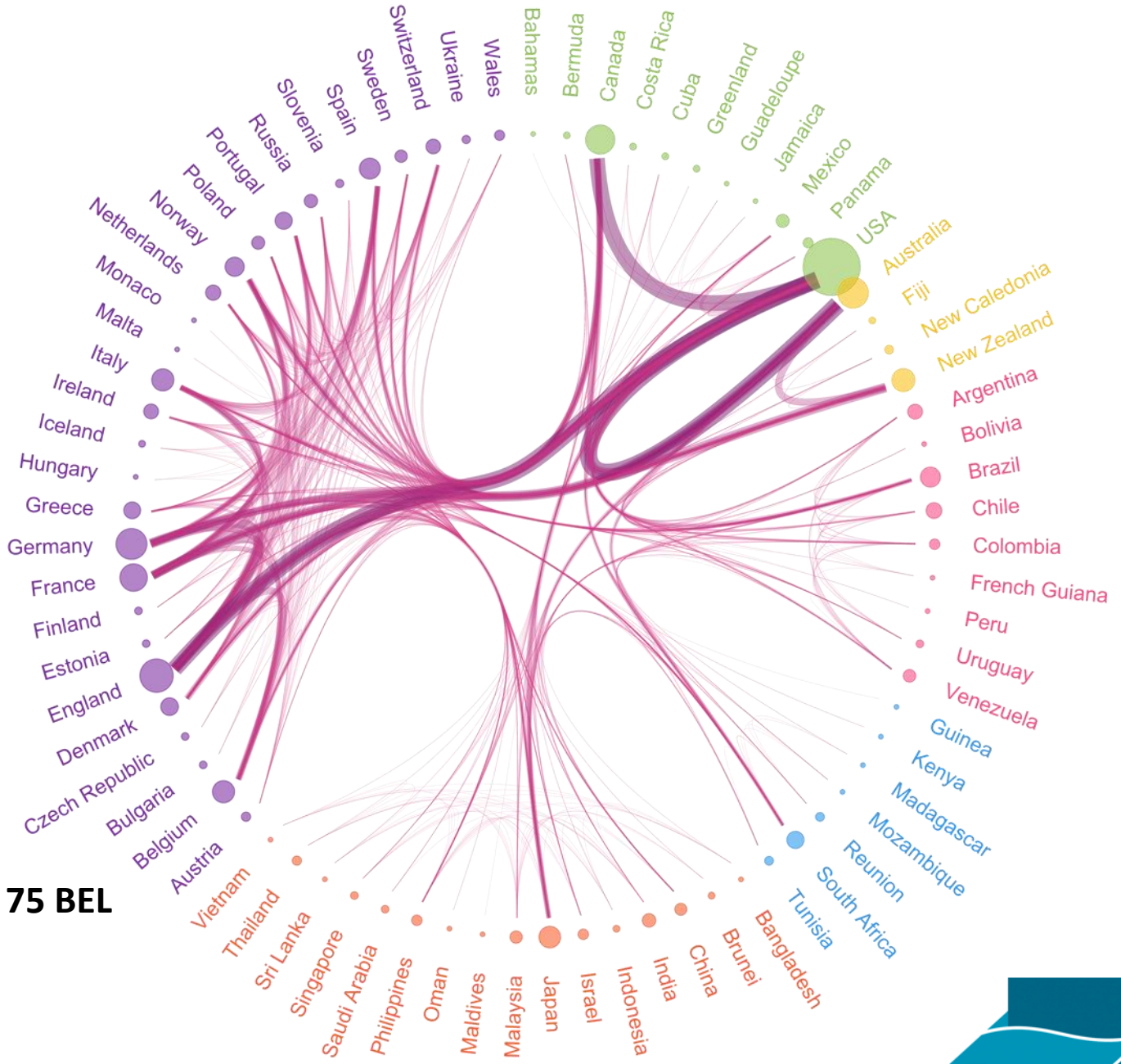
Reaching out to the world



Country	Users
	44,847 % of Total: 100.00% (44,847)
1. United States	10,503
2. United Kingdom	2,957
3. Canada	1,986
4. Brazil	1,767
5. Germany	1,621
6. India	1,551
7. Japan	1,538
8. Spain	1,536
9. Mexico	1,520
10. France	1,358
11. Australia	1,166
12. Italy	952
13. Belgium	950
14. China	847
15. Philippines	724

- 1200 papers
- 2700 authors
- 72 countries





OBIS

Part of Census of Marine Life

Today (2004): Portal with access to 860 000
data points, mapping, range pre
name translation.

Today, OBIS is beyond the original vision!

biology
esource
gement





Thank you for your attention