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


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
Cold-water corals are dissolving

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

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.

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)
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.
Global Ocean Observing System

OceanObs’09
Ocean information for society: sustaining the benefits, realizing the potential
21-25 September 2009, Venice, Italy
links with GEO

[Image of diagram showing connections between various ocean and Earth observation programs]

onesharedocean.org
GOOS Regional Alliances
Essential Ocean Variables

Essential Variables for weather (EVs, WMO)

Essential Climate Variables (ECVs, GCOS)

BGC-EOVs

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

Essential Biodiversity Variables (EBVs)

Requirements Setting
- What to Measure
- Essential Ocean Variables

Issues

Data Products Creation

Data Assembly

Observations Deployment and Maintenance

Argo
OceanSITES
Satellite Constellation
VOS
IMOS
SOOS
IOOS

Issues Impact
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

INPUTS    PROCESS    OUTPUTS

Bioregional profiles

Global, national or regional scale maps

Facilitated workshops, qualitative, quantitative and/or statistical modelling

1. IDENTIFY AND LOCATE ECOSYSTEM VALUES

2. IDENTIFY AND LOCATE THREATENING PROCESSES

3. PREDICT HOW VALUES WILL RESPOND TO THREATS

4. IDENTIFY INDICATORS AND ESSENTIAL VARIABLES

5. MEASURE INDICATORS AND THREATS

6. COMPARE PREDICTIONS WITH OBSERVATIONS

7. ASSESS AND REPORT

Report on status, spatio-temporal trends and management outcomes

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

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.
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.
• 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.
Post-2015 Agenda

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

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

Global Ocean Biodiversity Indicators

Global HAB Status Report

UN World Ocean Assessment

CBD
Global Ocean Biodiversity Indicators

PhD grant: Global Trends In Marine Biodiversity From Unstructured Data

LIFEWATCH.BE
Species traits and QC tools

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

PhD grant: Predictor selection for marine species distribution modeling

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

DIPS workshop, likely November 2015
Two third of known species are uniques

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

Growth of data in OBIS

The graph illustrates the growth of records and databases over time in OBIS (Ocean Biogeographic Information System). The y-axis represents the number of records in millions, ranging from 0 to 45 million, and the number of databases, ranging from 0 to 2000. The x-axis shows the time period from April 2001 to December 2014, marked by key dates such as Jan-04, Oct-06, Jul-09, Apr-12, and Dec-14. The graph shows a steady increase in both records and databases, indicating the growing importance and usage of OBIS for marine data.
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)

±99% of ocean volume is still undersampled

(<100 sampling days, <713 records, <13 species per 10,000 km³)
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
Global Ocean Biodiversity Indicators

Are the most common species always the most common?
Relative abundance

Fulmar observations in the North Sea

PEAK based on Nr of records
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.
From Dunn et al. 2011
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.

Abrolhos Bank and Vitória-Trindade Chain
Area: 388,705 km²

Wider Caribbean and Western Mid-Atlantic Regional Workshop
Workshop to Facilitate the Description of Ecologically or Biologically Significant Marine Areas
Recife, Brazil, 29 February - 2 March 2012

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.

The 1st Global HAB Status Report

OCEAN BIOGEOGRAPHIC INFORMATION SYSTEM

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
HAB Events. Source HAEDAT
"To ensure equitable participation of all States in global initiatives"
OBIS Capacity Building

ODINAFRICA Training Course on Marine Biodiversity Data Management

All lectures remain available online via video and powerpoint

www.oceanteacher.org
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

<table>
<thead>
<tr>
<th>Trait or Status</th>
<th>Categories</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Taxonomy</strong></td>
<td>Phylum, Class, Order, Family, Genus, Species</td>
</tr>
<tr>
<td><strong>Environment</strong></td>
<td>Marine, brackish, freshwater, terrestrial, pelagic, benthic, fossil</td>
</tr>
<tr>
<td><strong>Geography</strong></td>
<td>Locality name (Latitude-longitude coordinates in OBIS)</td>
</tr>
</tbody>
</table>
| **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, detrivore, phototrophic, chemoautotrophic |
| **Body size**   | Maximum body length in mm excluding appendages.  
Maximum total body weight |
| **Reproduction**| Sexual, asexual  
Costello et al (under review). Biological and ecological traits of marine species.|
| **Species status** | Introduced, Invasive, Conservation, Fishery, Aquaculture, Harmful, Ecological Indicator |
Adding filtering options.

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

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