MBON
Marine Biodiversity Observation Network

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Huge investments have gone into ocean observing systems —
But there is still no systematic effort to observe life in the sea

MBON Goal: Enable the effort to characterize how marine biodiversity is changing and how it affects us
Primary observations of change in state of biodiversity
In-situ monitoring
Essential Biodiversity Variables
Essential Ocean Variables
Essential Climate Variables
Observations of drivers & pressures
Observations of policy & management responses
High-level indicators of biodiversity & ecosystem services (e.g. for IPBES)
Ecosystem structure
Ecosystem function
Scenarios for biodiversity & ecosystem services (e.g. for CBD)
Genetic composition
Species traits
Species populations
Community composition
Ecosystem service valuation & other data
Auxiliary attributes (slow changing)
Observations of biodiversity & ecosystem services (e.g. for CBD)

GEO BON EBVs
Pereira et al. (2013)

EOVs are the primary observations needed to model and build the EBVs (multidimensional data cubes)

Framework for Ocean Observing (2012)
Global Ocean Observing System (GOOS)
Essential Ocean Variables (EOVs)

EBVs are not measured. They are derived (multidimensional data ‘cubes’)
Satellite-derived Chlorophyll distribution

MBON Pole to Pole in the Americas
PI: Enrique Montes

http://marinebon.org
http://marinebon.org
### Evolving technology matrix

<table>
<thead>
<tr>
<th></th>
<th>Microbes/Phyto</th>
<th>Zooplankton</th>
<th>Fish</th>
<th>Top Predators</th>
<th>Benthos, habitat forming</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Optics/Imaging</strong></td>
<td>X</td>
<td>X</td>
<td>X</td>
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<td>X</td>
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<tr>
<td><strong>Animal tracking</strong></td>
<td></td>
<td></td>
<td></td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>(satellite, underwater)</td>
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<td></td>
<td></td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td><strong>Acoustics</strong></td>
<td></td>
<td>X</td>
<td></td>
<td>X (active)</td>
<td>X Active, passive (noise)</td>
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<tr>
<td><strong>Genomics</strong></td>
<td>X</td>
<td>X</td>
<td></td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td><strong>Platforms with samplers</strong></td>
<td>AUVs, float,</td>
<td>AUVs,</td>
<td>AUVs</td>
<td></td>
<td>AUVs, moorings,</td>
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<td></td>
<td>moorings,</td>
<td>moorings</td>
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<td>satellites</td>
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<tr>
<td><strong>Data and visualization</strong></td>
<td>X</td>
<td>X</td>
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</tr>
</tbody>
</table>
MBON
MARINE BIODIVERSITY OBSERVATION NETWORK
AN OBSERVING SYSTEM FOR LIFE IN THE SEA
Finding:

- Record high diversity in 2014–2016
- N Pacific heatwave compressed upwelling habitat against the coast
Finding: Borealization of the Chukchi Sea Shelf

Northward expansion of predators:
- demersal fish and large invertebrates
- reorganization of benthic food web
Finding:

Diversity difference between protected and unprotected areas has decreased over time.

High relief reefs have higher diversity.
Warming of the Gulf of Maine (GoM) affects valuable fisheries and marine mammals (critically endangered N Atlantic right whales).

The Calanus Index. based on monthly measurements of C. finmarchicus abundance, W Gulf

Abundance levels now 30-50% of historical levels in late summer through winter. [y-axis is log scale](Ji et al. 2021 and GoM MBON data).
Distribution of 16 groups of similar coastlines

Coastline characteristics of the Florida Keys National Marine Sanctuary (Florida Keys US MBON site)

Output:
CSU - Coastal Segment Units

Coastal and Marine Ecological Classification Standard (CMECS) labels for global coastal segments at 1 km

Sayre et al., 2021
https://doi.org/10.5670/oceanog.2021.219
Output:
MBON and OBIS/GBIF collaboration
Mapping data flow: collection to publication

Examples:
- Rockfish (California/Pacific)
- Reef fish (Florida keys/Atlantic)
- Satellite data (early alert dashboards)
- Pole to Pole Data Viewer
- IOOS MBON Portal
**Addressing Sanctuary Needs: data tools**

Processes and products being shared across programs and regions

Collaboration between sanctuaries, IEA, MBON expanding to Gulf of Mexico

Collaboration of IEA with MBON

**Developed by Sanctuaries MBON**

MARINE long-term monitoring data

Gulf of Mexico IEA meeting with FKNMS, including Sanctuaries MBON partners, to expand collaboration apply IEA products and processes to the sanctuary.

Collaboration of IEA with MBON/MBARI
Capacity Building – Field sampling

Pole to Pole MBON

Marine Biodiversity Observation Network

U.S. MBON
MBON Pole to Pole
MarineGEO
Developing Essential Biodiversity Variables (EBVs)

Global classification of surface waters at 5 km pixel res.

**2017-1**

“Ecosystem Extent” EBV using satellite-derived seascape maps

Capacity Building – Field and satellite data / applications
Challenge 2: Develop solutions to ecosystem stressors

Challenge 9: Develop capacity and equitable access

Challenge 10: Understand values and services, humanity’s relationship with ocean

Our Partners

And a long list of academic and government partners
Thank You!

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