Developing the Global Ocean Observing System for Marine Life

Qualities, attributes, and readiness of existing biological Essential Ocean Variable networks

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Community effort!

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What currently exists...

- Many existing global ocean observing infrastructure & programs do not explicitly consider observations of marine biodiversity
- Hundreds of long-term programs measure important marine biological variables around the world but:
  - Not globally coordinated
  - Information on programs (metadata) & raw data may not be easy to find
  - Data may not be openly available or accessible
  - Programs may collect data in different ways

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The Global Ocean Observing System for Marine Life will contribute to a larger-scale, holistic understanding of our oceans relevant to societal needs.
Why a global biological ocean observing system?

• **Integration across larger scales** to have a more **holistic understanding of the global ocean**

• Understand how **human activities & environmental change** are affecting **marine ecosystems**

• **Societal needs**, including sustainability & sustainable development, require **elucidating properties of complex, interconnected, and large-scale systems**

• Relevant to many people such as the **scientific community, intergovernmental processes, & national reporting needs**
Why a global biological ocean observing system?

• UN Decade of Ocean Science for Sustainable Development

• Ocean Obs 2019 Conference

• PICES

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The journey to a globally coordinated ocean observing system for marine life

• A shared value proposition
• Strengthened partnerships & develop leadership
• Build the foundation for implementation
• Implement technological developments
• Expand network coverage
• Advance the use & impact of observations
The journey to a globally coordinated ocean observing system for marine life

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Strengthening partnerships & developing leadership requires a coordinating framework:

- Essential Ocean Variables (EOVs) provide an approach to coordinating the ocean observing community

<table>
<thead>
<tr>
<th>Functional Groups</th>
<th>Diversity and Biomass</th>
<th>Distribution and Abundance</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Microbes</td>
<td>Benthic Invertebrates</td>
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<tr>
<td></td>
<td>Phytoplankton</td>
<td>Fish</td>
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<tr>
<td></td>
<td>Zooplankton</td>
<td>Turtle - Bird Mammal</td>
</tr>
</tbody>
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<table>
<thead>
<tr>
<th>Habitat State</th>
<th>Cover and Composition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hard Coral</td>
<td>Macroalgae</td>
</tr>
<tr>
<td>Macroalgae</td>
<td>Seagrass</td>
</tr>
<tr>
<td>Seagrass</td>
<td>Mangrove</td>
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</tbody>
</table>

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Strengthening partnerships & developing leadership requires a coordinating framework:

- Essential Ocean Variables (EOVs) provide an approach to coordinating the ocean observing community

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Strengthening partnerships & developing leadership requires understanding...

- What are the existing marine biological observing networks around the world?
- Which EOVs are being measured by each observing network?
- Where does each observing network sample?
- How long has the network been running & how often does each network sample?
- Can the data obtained by each observing network contribute to the biological ocean observing system?

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Identify existing observing programs measuring EOVs

- **Surveyed** about 200 large scale, long-term observing programs
- **Conducted expert consultations** with EOV champions to identify additional networks
- **Included networks** that were:
  - Marine & coastal
  - In-situ measurements
  - Raw data providers
  - Currently active
- **2 networks to 46 networks** sample each EOV
- **44 networks** from North Pacific

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64% of LMEs that have *marine microbes* are sampled by at least one monitoring network.

2 global networks sample *marine microbes*.

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Marine microbes are sampled in some regions of the North Pacific, but gaps exist.

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Spatial Scale: Marine Phytoplankton

65% of LMEs that have marine phytoplankton are sampled by at least one monitoring network. 4 global networks sample marine phytoplankton.

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Marine phytoplankton are sampled in some regions of the North Pacific, but gaps exist

Survey link: tiny.cc/BioObs
74% of LMEs that have *marine zooplankton* are sampled by at least one monitoring network.

2 global networks sample *marine zooplankton*

*Survey link: tiny.cc/BioObs*
Spatial Scale: Marine Zooplankton

Marine zooplankton are sampled throughout the North Pacific

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82% of LMEs that have *marine fish* are sampled by at least one monitoring network

5 global networks sample *marine fish*

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Spatiale Scale: Marine Fish

Marine fish are sampled throughout the North Pacific

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74% of LMEs that have marine turtles are sampled by at least one monitoring network

3 global network samples sea turtles

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Sea turtles are sampled in most regions where they exist in the North Pacific

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Spatial Scale: Seabirds

26% of LMEs that have *seabirds* are sampled by at least one monitoring network

1 global network samples *seabirds*

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Sea birds are sampled in only a few regions of the North Pacific, many gaps exist.

Survey link: tiny.cc/BioObs
33% of LMEs that have marine mammals are sampled by at least one monitoring network

3 global networks sample marine mammals

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**Spatial Scale: Marine Mammals**

Marine Mammals are sampled in **only a few regions of the North Pacific, many gaps exist**

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71% of LMEs that have seagrass are sampled by at least one monitoring network

2 global networks sample seagrass

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**Spatial Scale: Seagrass**

Seagrass are sampled in ***some regions of the North Pacific, but gaps exist***

*Survey link: tiny.cc/BioObs*
33% of LMEs that have macroalgae are sampled by at least one monitoring network. 3 global networks sample macroalgae. 

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Macroalgae are sampled in some regions of the North Pacific, but gaps exist.

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Strengthening partnerships & developing leadership requires understanding...

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Temporal resolution: Many networks are long-term & sample on regular intervals

- Many networks are long-term & sample on regular intervals
- On average, networks have been sampling each EOV for between 17 to 37 years
- Most networks within each EOV sample annually or multiple times a year
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Data access: Similar distribution of data access across EOVs

- Fewer than a third of networks meet open data standards
- Data & metadata follow FAIR data principles
  - Findable
  - Accessible
  - Interoperable
  - Reuse

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Key features of observing networks

**Mission** – addresses scientific questions relevant to national and regional science, policy and management needs.

**Spatial scale** – serves local and national needs but contributes (or aspires to contribute) to a global operational system, including regular reporting to support globally relevant indicators.

**Sustainability** – surveys produce information on trends over time and are intended to be repeated in the future (Historic data can also be useful and should be archived).

**Best practice** – network recognizes global accepted standards from data collection to end-user delivery, and is responsive to new technologies, SOPs, data management and delivery.

**FAIR data standards** – network has clear mechanisms for data attribution and provenance leading to open data, has documented SOPs used for data collection, and adequate metadata to support interoperability, data aggregation and reuse.

**Capacity development and technology transfer** – supports extension of SOPs and best practices supporting local/regional and/or global needs and priorities.
Conclusions: Global

• There are **existing measurements for biological EOVs in many places around the world**

• Many networks are **long-term & sample on regular intervals**

• A third or less of networks meet **open data standards**

• Most EOVs are in the **pilot stage, requiring greater spatial coverage & increased data access** to move toward mature systems according to the Framework for Ocean Observing (FOO)

• **Results are preliminary**: Not all observing networks have been identified or responded

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Conclusions: North Pacific

• Zooplankton & fish sampled throughout the North Pacific
• Microbes, phytoplankton, seagrass, macroalgae, seabirds, turtles, and marine mammals are sampled in some parts of the North Pacific
• A few long-term programs exist
• Regional assessments may be required to provide the detail necessary to prioritize future network development needs

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Future Directions

• Ongoing, **community effort**

• More **consistent & regularly updated network metadata** is required to more accurately assess readiness, opportunities, and gaps in coverage

• Continuing to **identify additional observing networks**, especially at the local & national levels

• **Surveying more observing networks** to obtain additional information to further assess readiness

• “**Landscape network map**” of data providers, data aggregators, and users to understand the connectivity of programs and networks for each EOV

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Why join the movement toward a globally coordinated biological observing system?

- Develop **professional relationships** with other people around a shared vision
- Increase opportunity for **scientific & stakeholder collaborations**
- Answer questions at larger scales to **discover new societal & scientific insight**
- Leverage resources across networks for **mutual benefit**
- **Decrease resources** used by individual observing programs
- Utilize existing platforms to **decrease redundancy & increase cost efficiency**
- Foster a **global perspective** to inform local actions
- **Co-design standards**, protocols, and resources to increase efficiency & **streamline efforts** for individual programs
- **Encourage the development of new multipurpose technologies** through strengthened multidisciplinary collaborations

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How can you contribute?

• Ensure we are including your networks- fill out the survey below
• Support in integrating biological essential ocean variables into the existing observing networks in your region
• Develop partnerships with other complimentary programs in your region
• Make sure metadata for observing programs is available online, complete, & updated regularly
• Input data into the Ocean Biogeographic Information System, to ensure that your data and network are discovered
• Input best practices into the Ocean Best Practices System
• Communicate your observing needs to local, regional, and global observing systems
• Support in fostering a culture change toward collaboration, shared resources, & data

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Thank you!

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