



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!



International Science Council



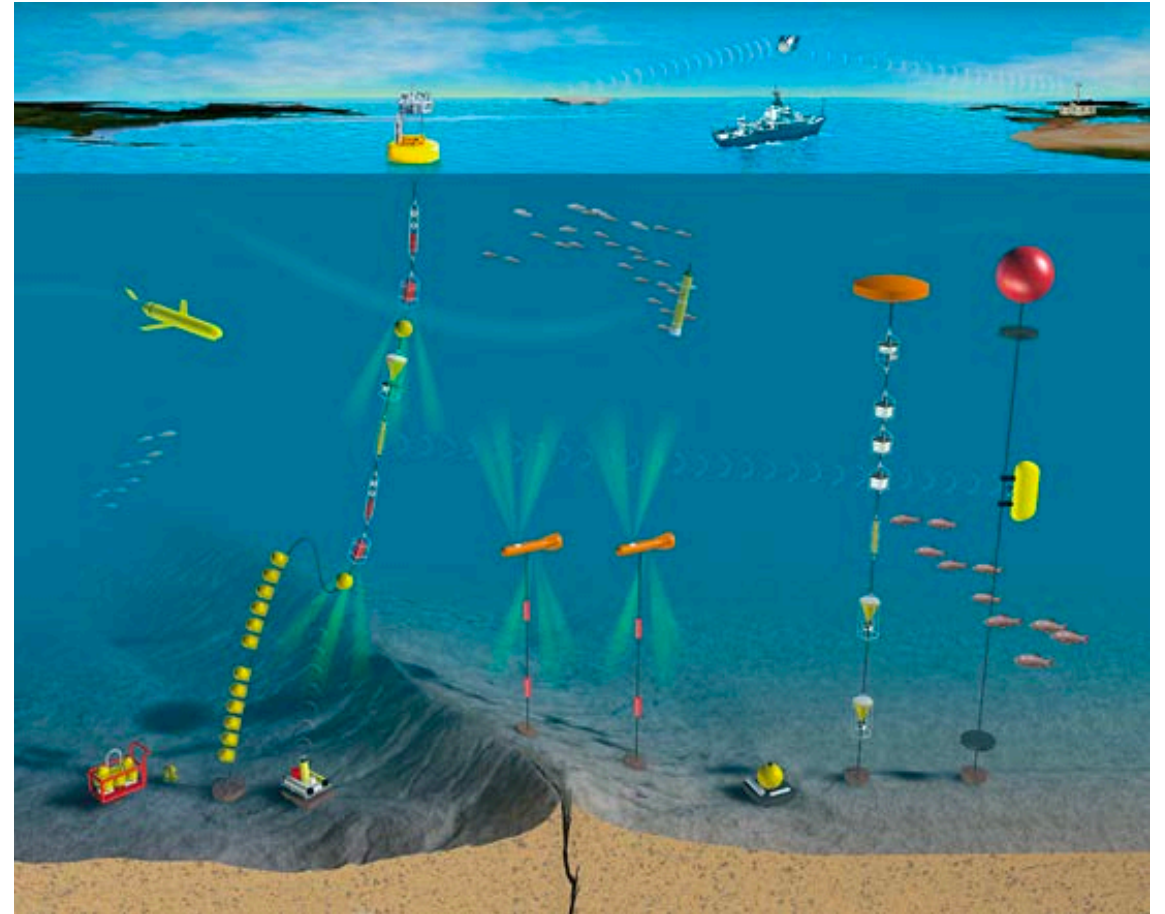
United Nations Educational, Scientific and Cultural Organization



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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**



The Vision

A globally coordinated
& sustained observing
system for marine life

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



2021 United Nations Decade
2030 of Ocean Science
for Sustainable Development

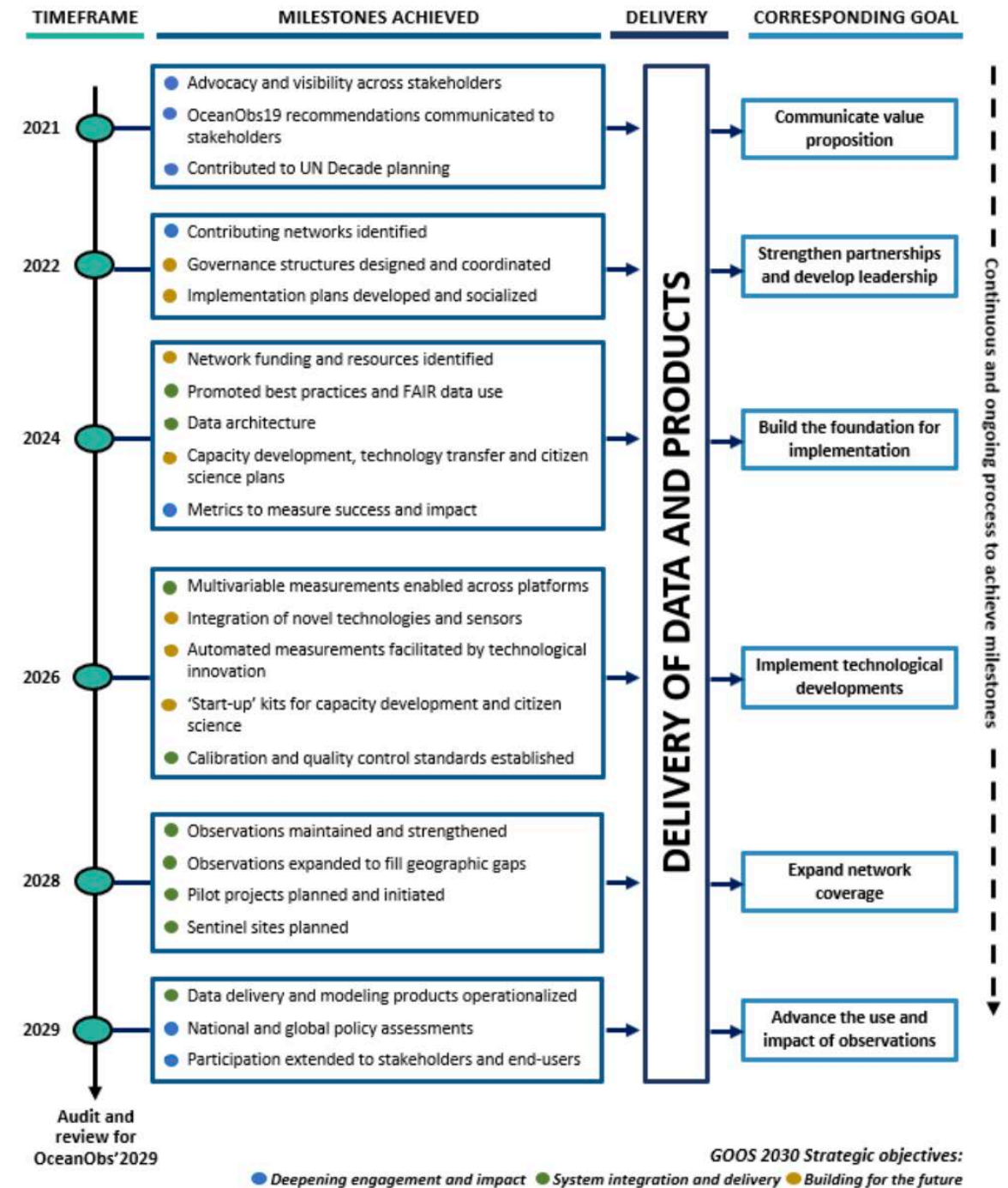
OCEAN
OBS'19



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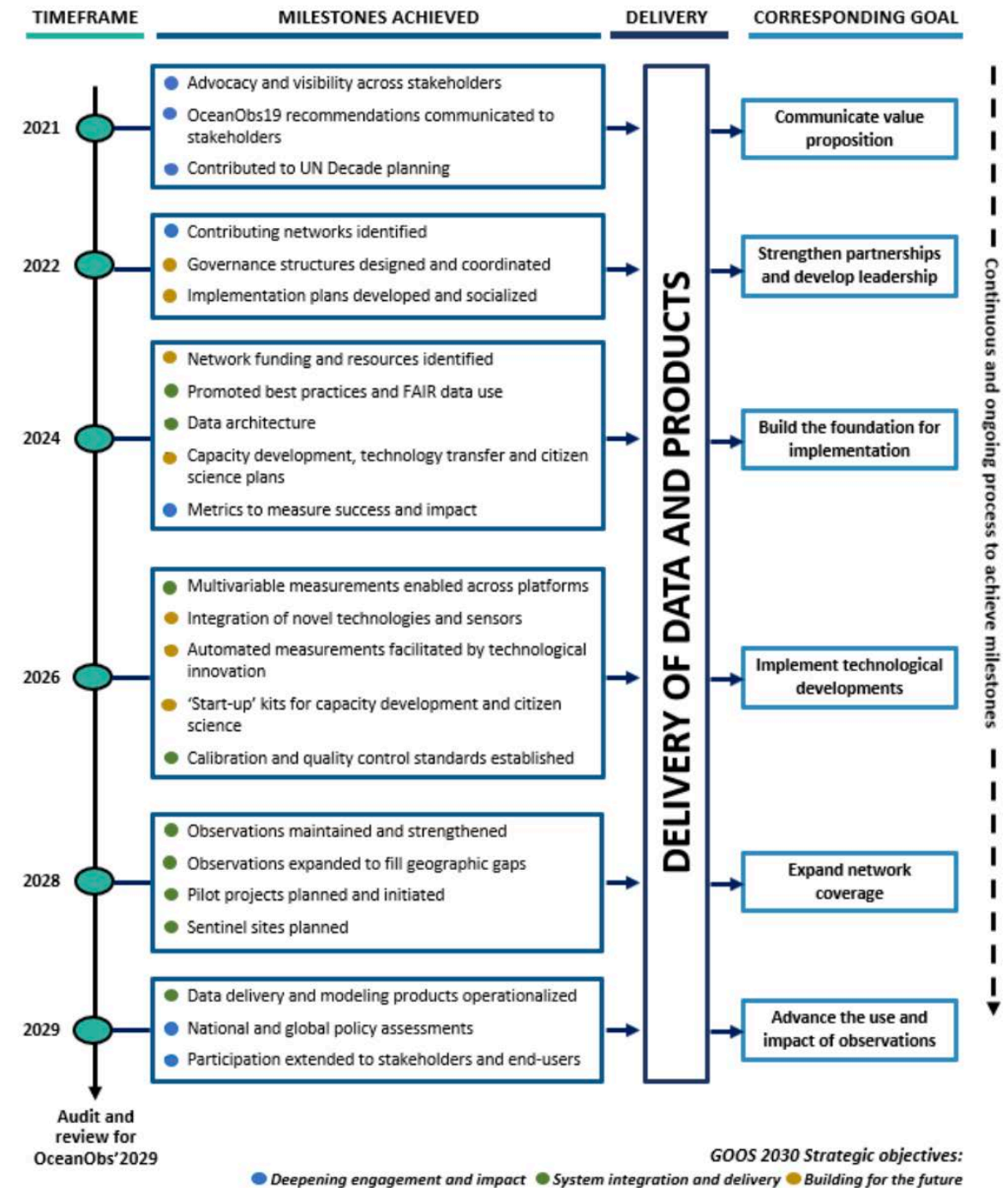
The journey to a globally coordinated ocean observing system for marine life

- 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**



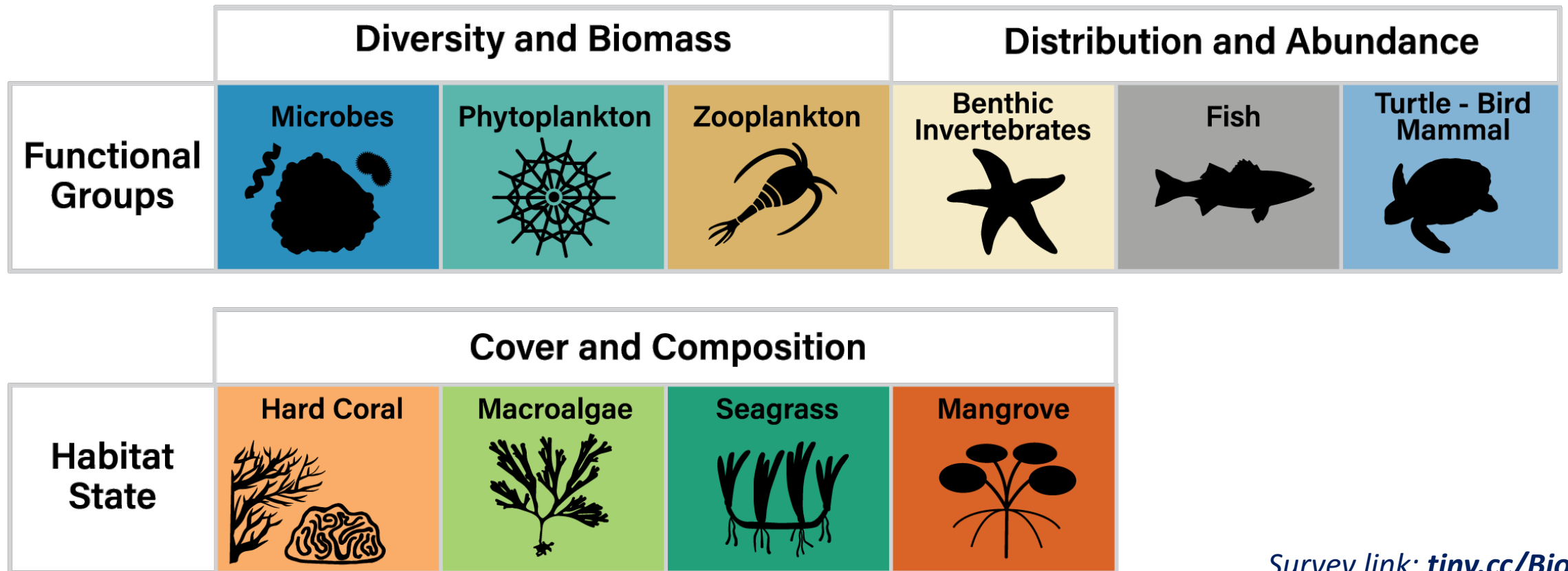
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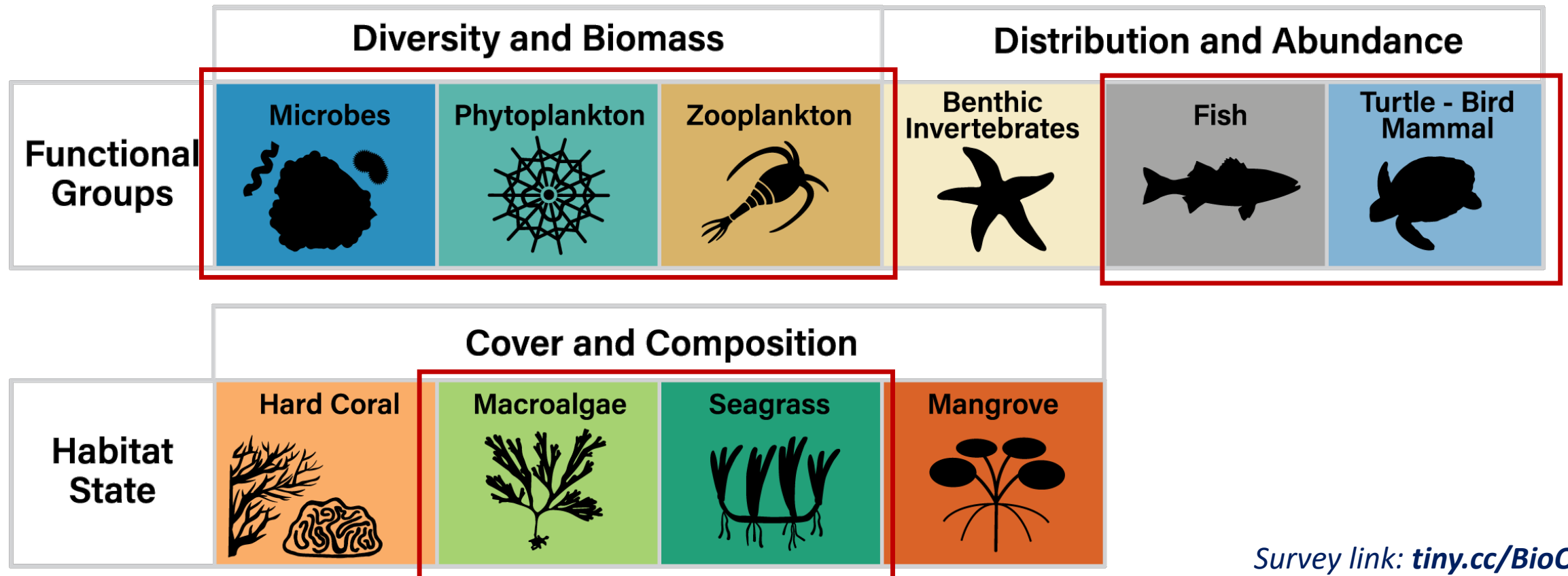
Strengthening partnerships & developing leadership requires a coordinating framework:

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



Strengthening partnerships & developing leadership requires a coordinating framework:

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



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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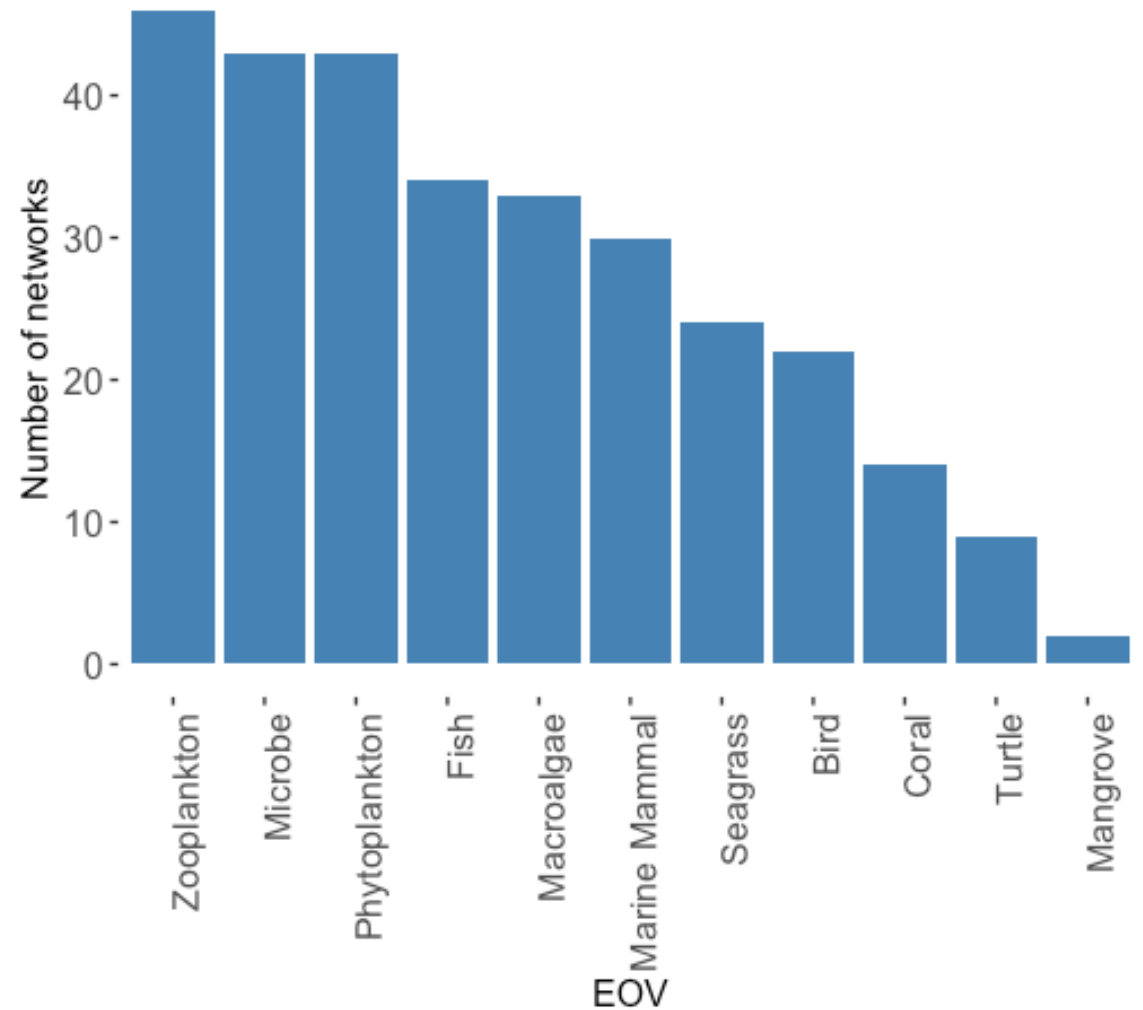
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Identify existing observing programs measuring EOVs

- **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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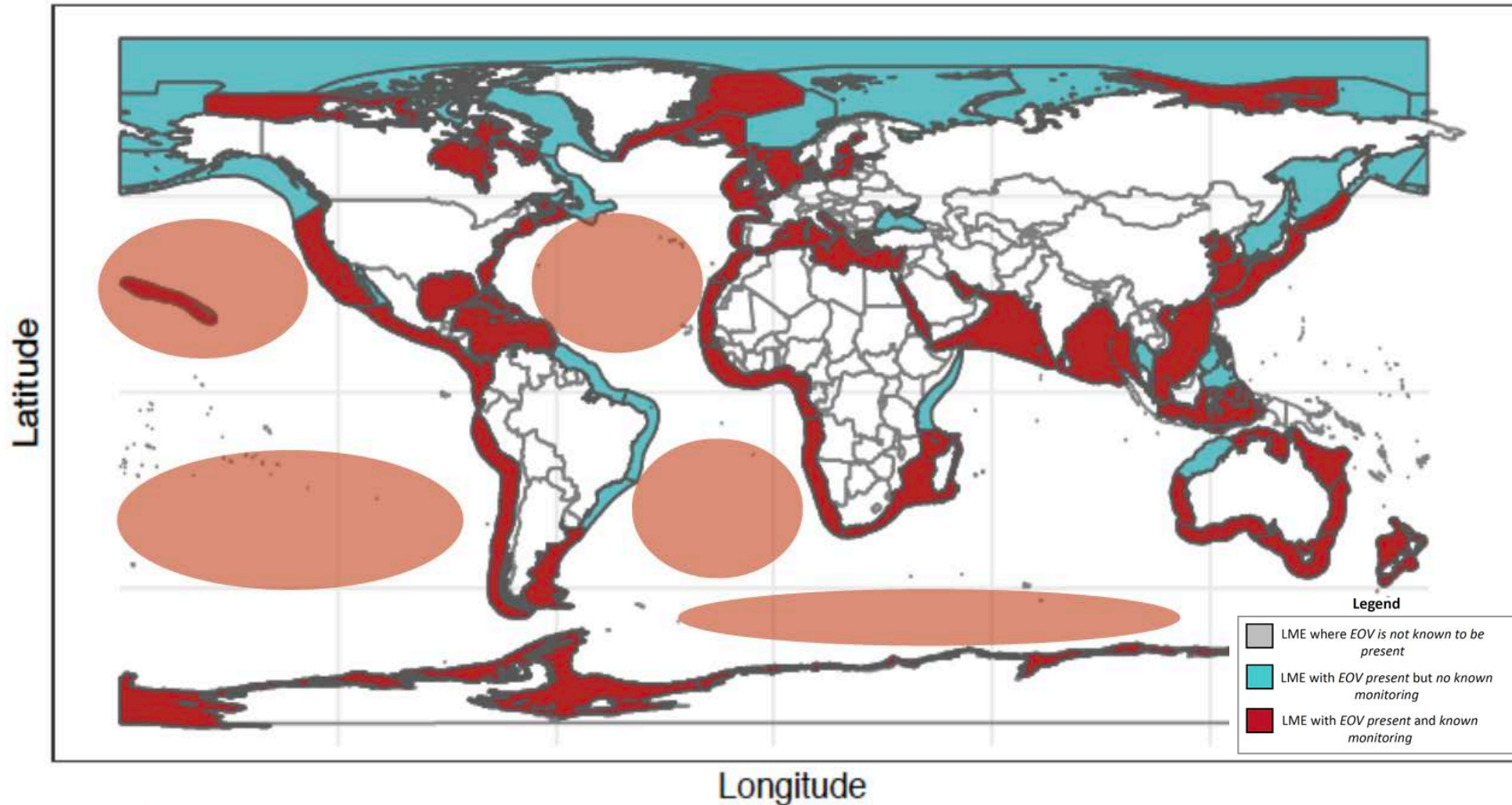


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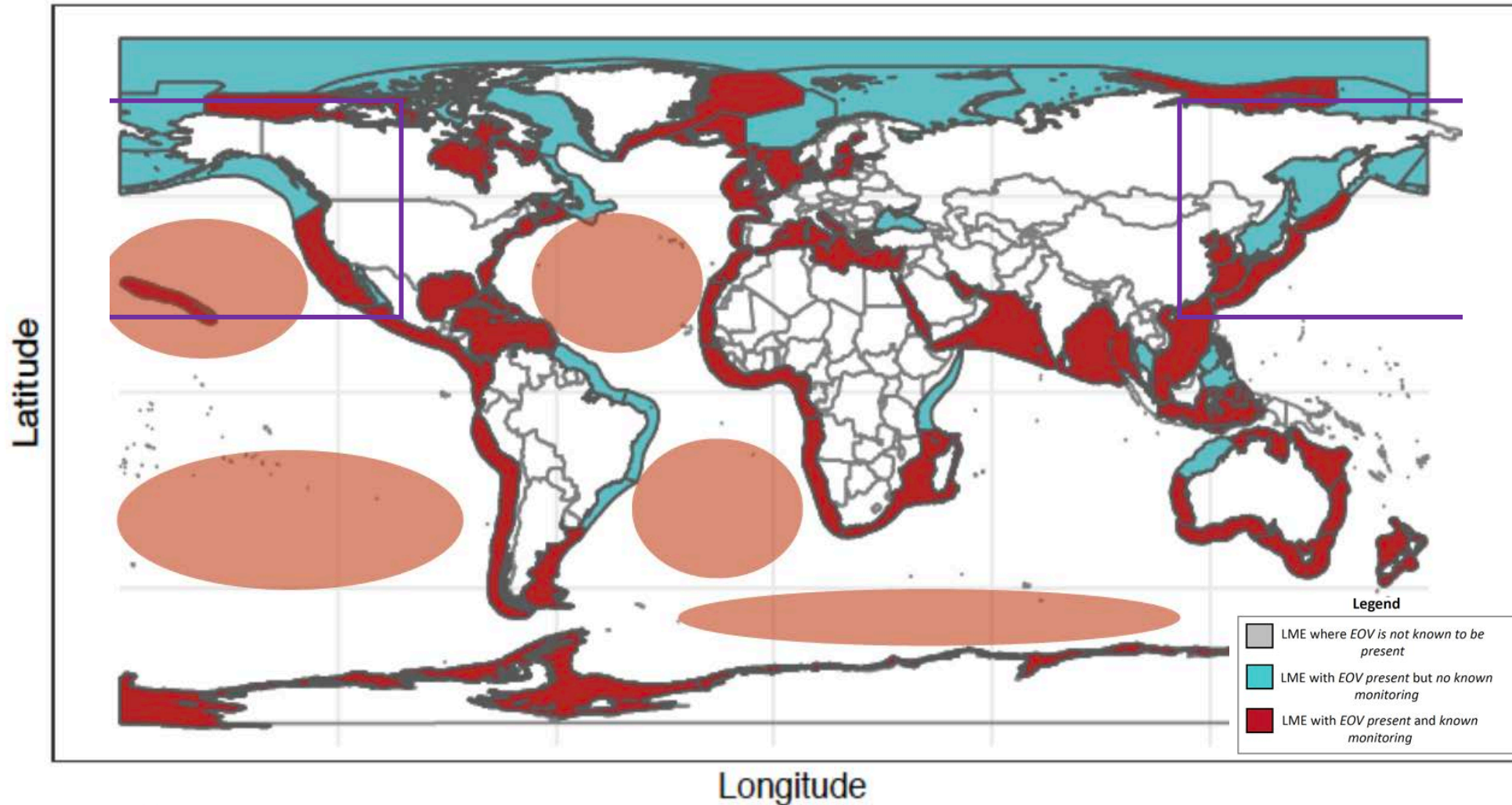
Spatial Scale: Marine Microbes



64% of LMEs that have *marine microbes* are sampled by at least one monitoring network
2 global networks sample *marine microbes*

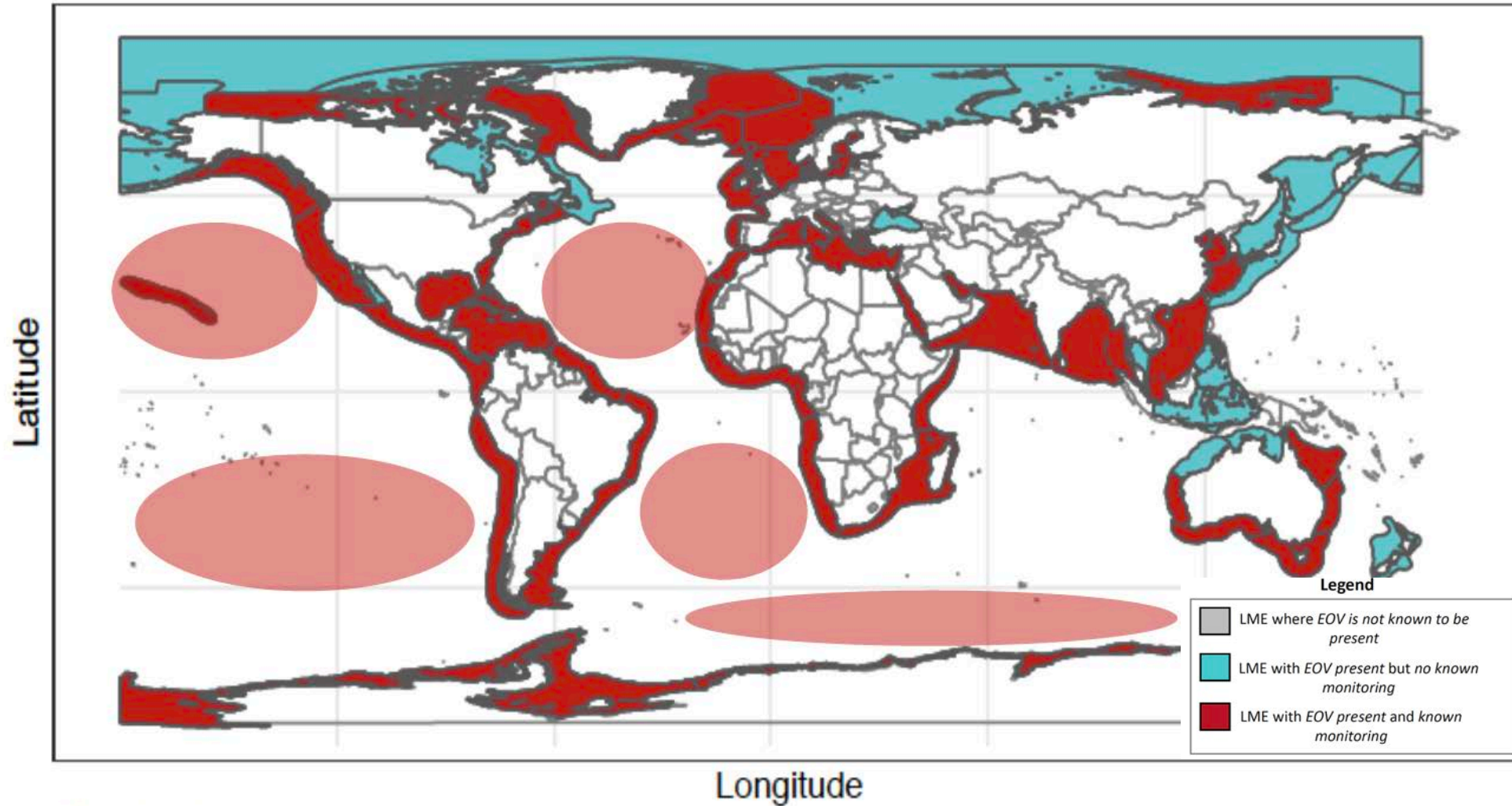
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Spatial Scale: Marine Microbes



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

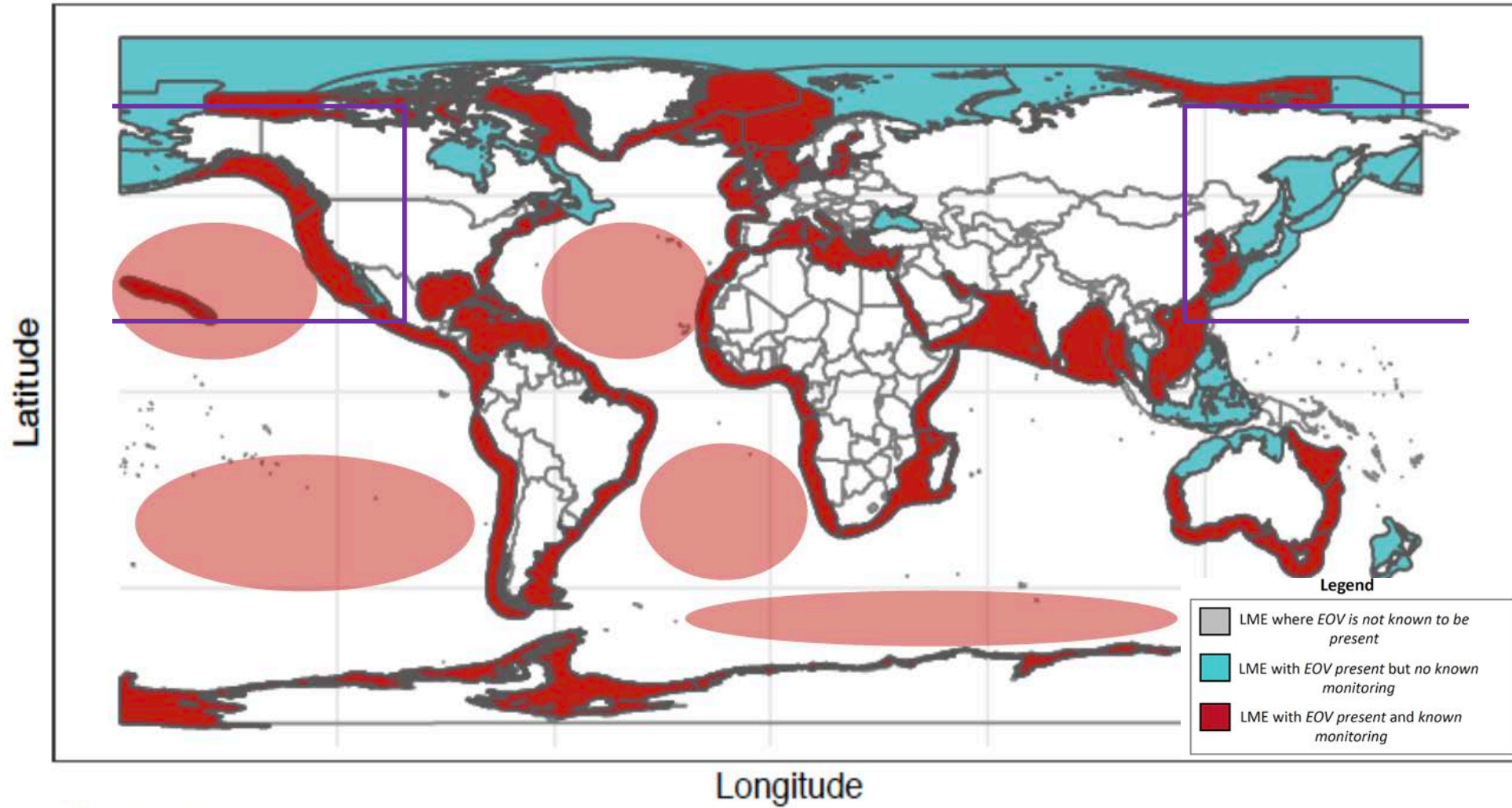
Spatial Scale: Marine Phytoplankton



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

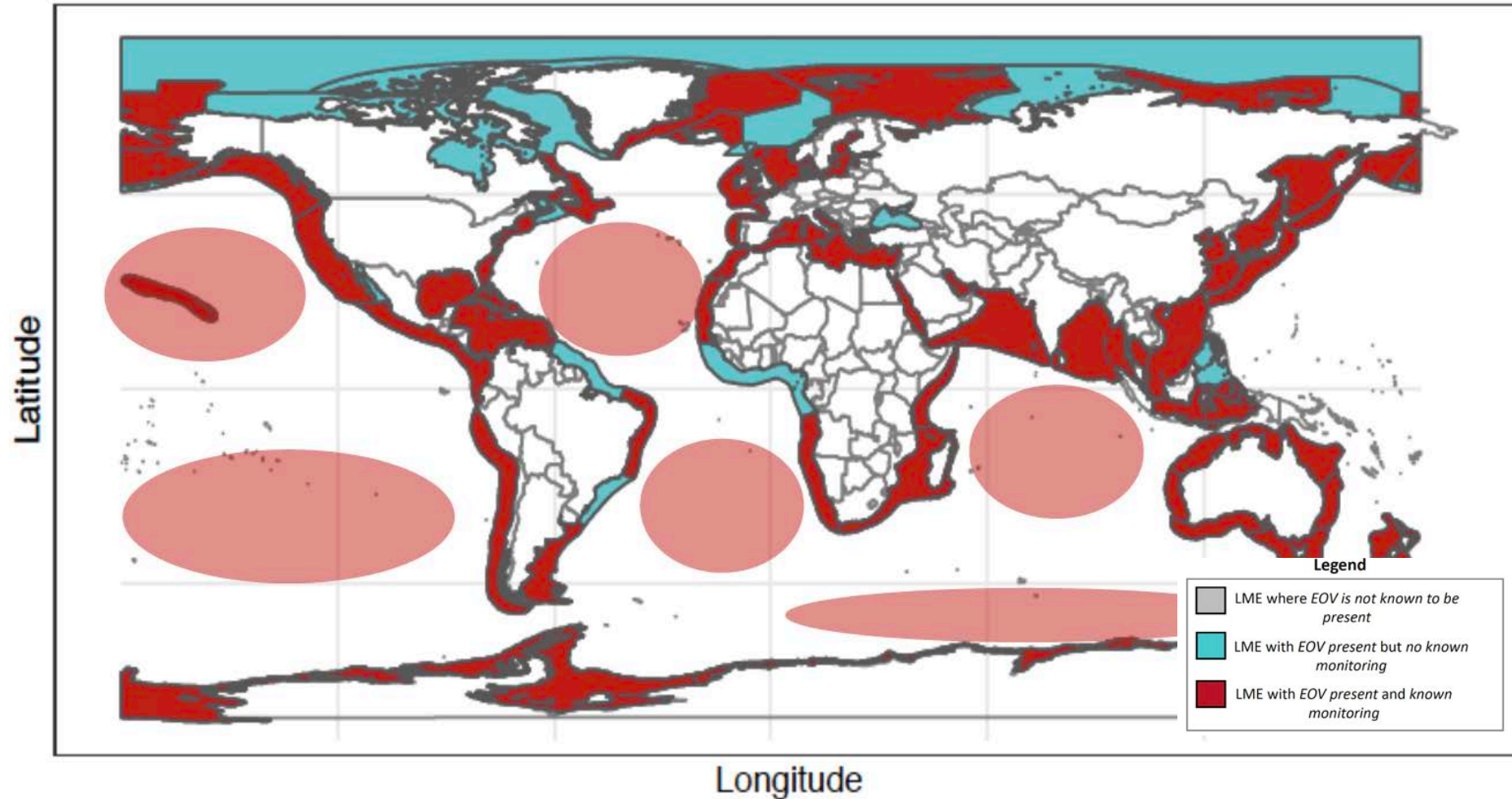
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Spatial Scale: Marine Phytoplankton



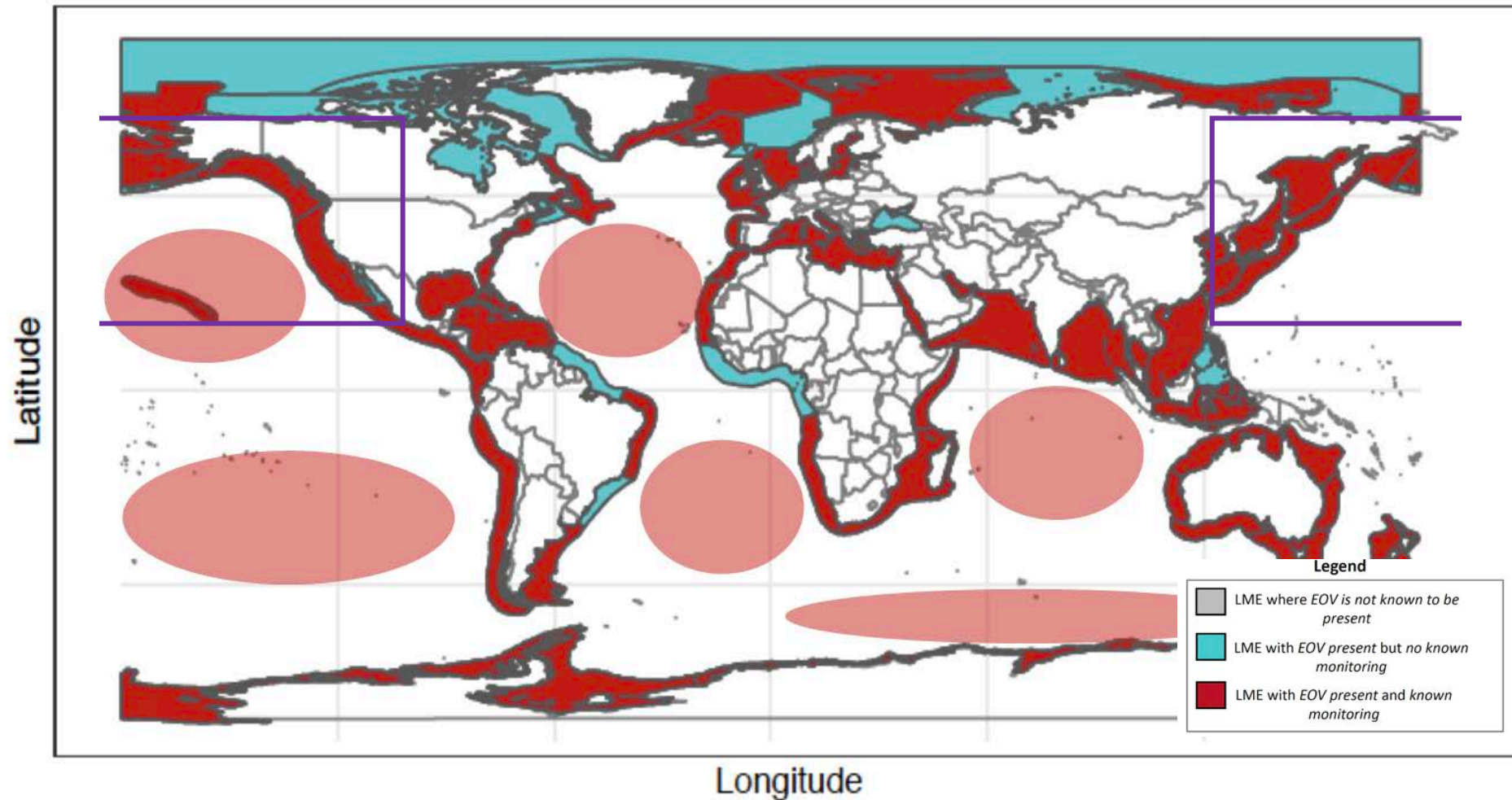
Marine phytoplankton are sampled in some regions of the North Pacific, but gaps exist

Spatial Scale: Marine Zooplankton



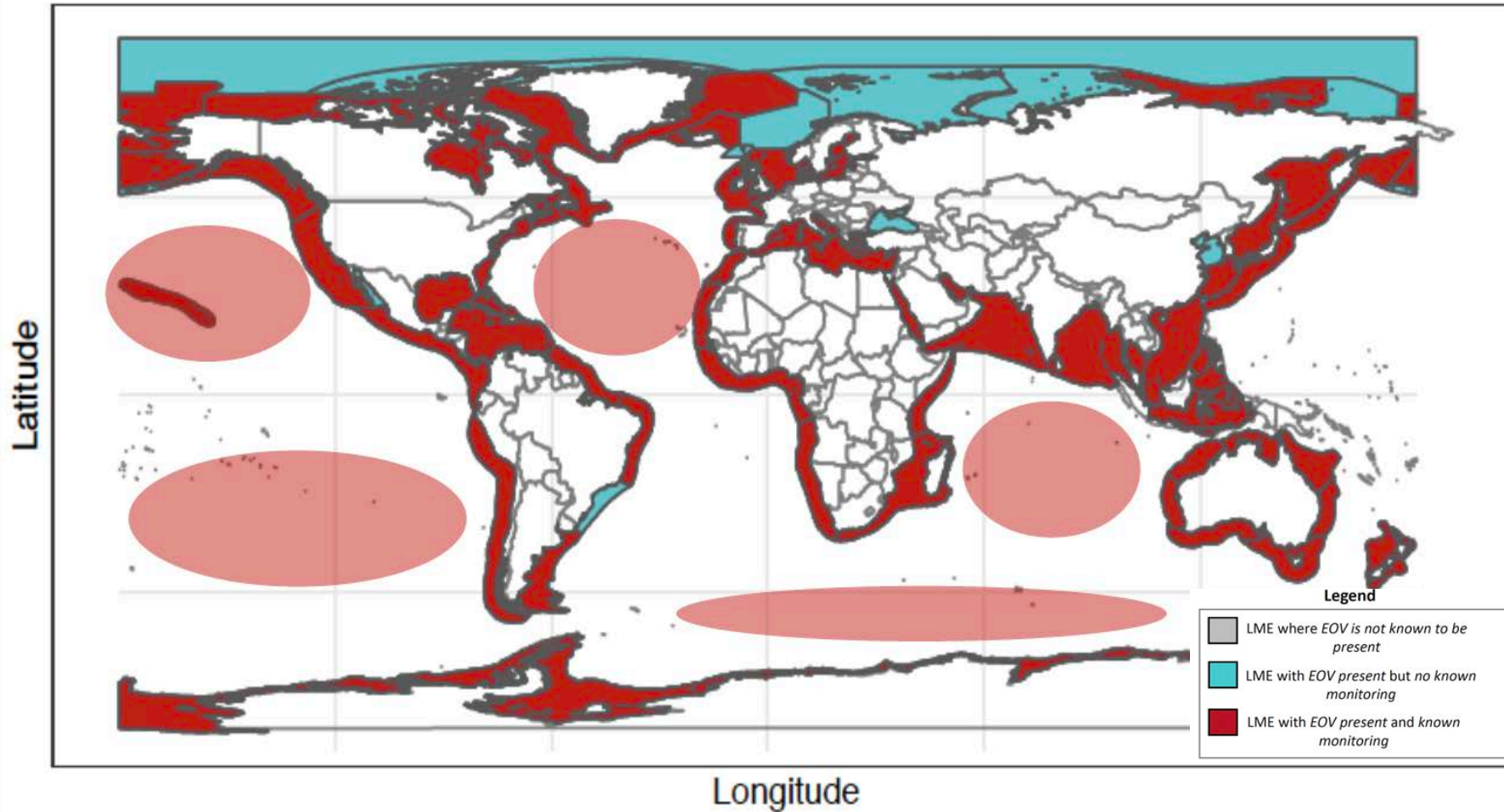
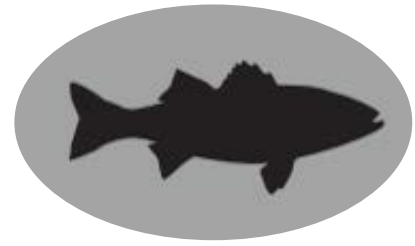
74% of LMEs that have *marine zooplankton* are sampled by at least one monitoring network
2 global networks sample *marine zooplankton*

Spatial Scale: Marine Zooplankton



Marine zooplankton are sampled throughout the North Pacific

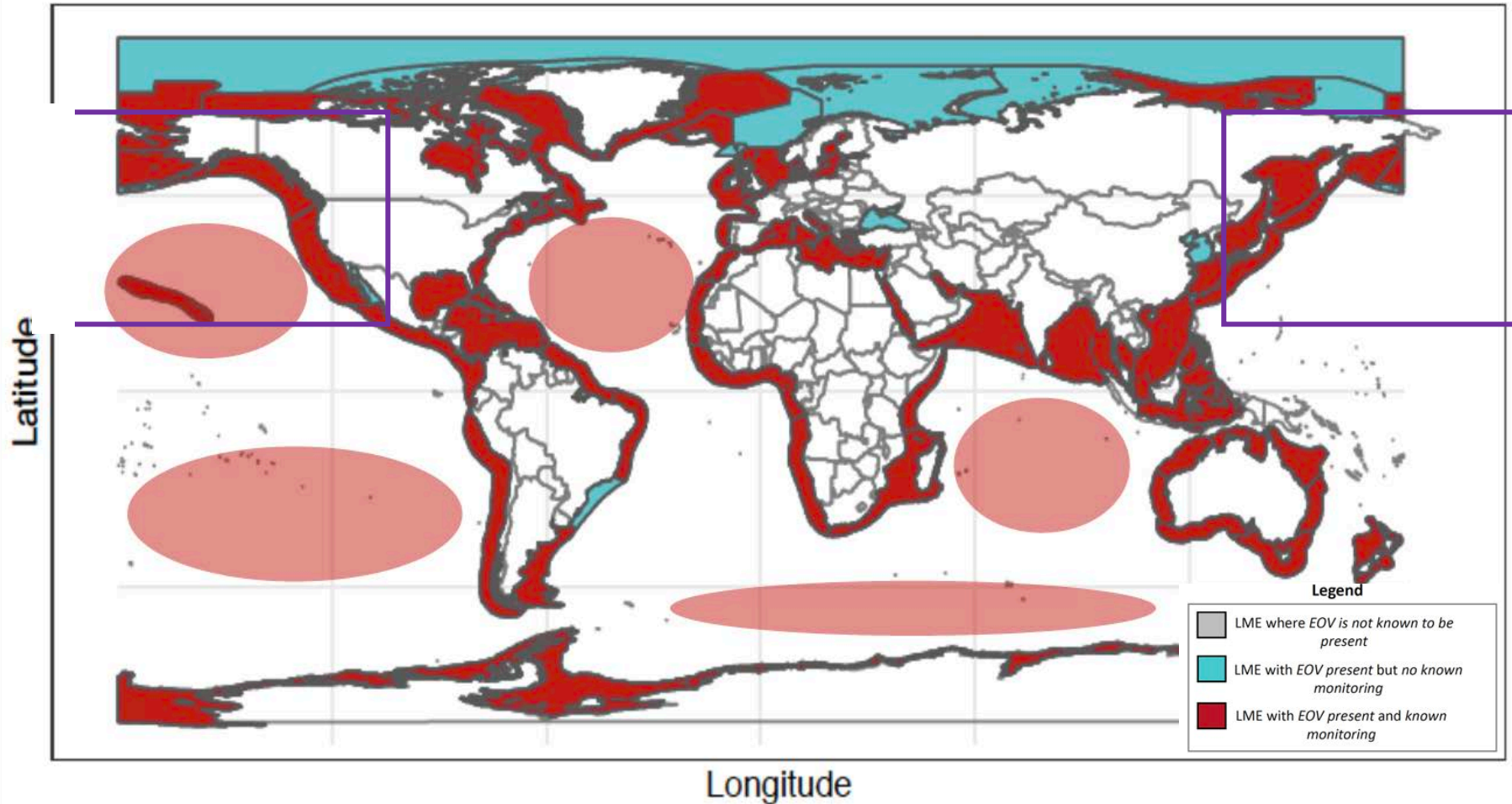
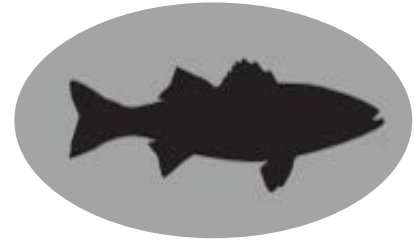
Spatial Scale: Marine Fish



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

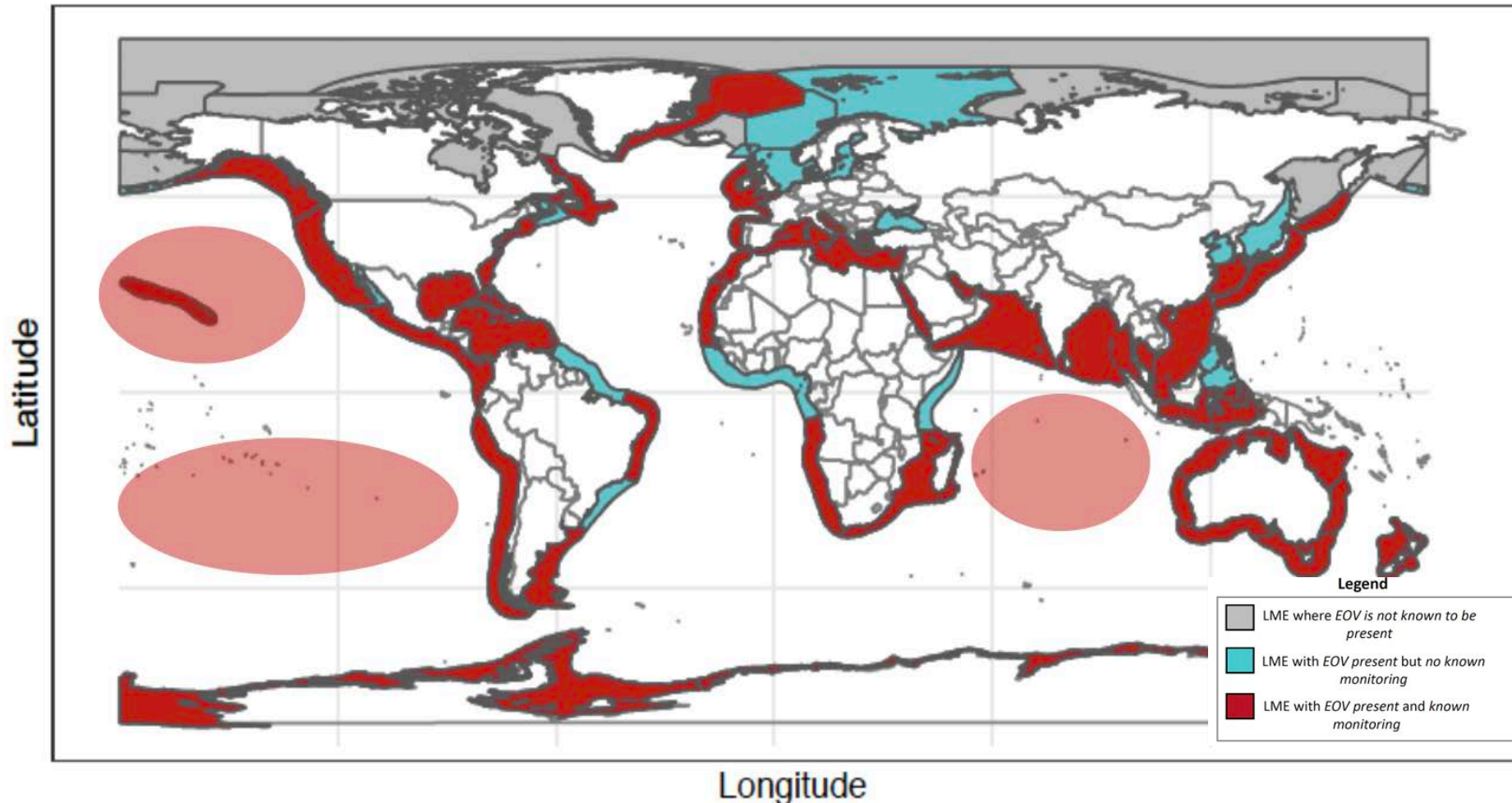
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Spatial Scale: Marine Fish



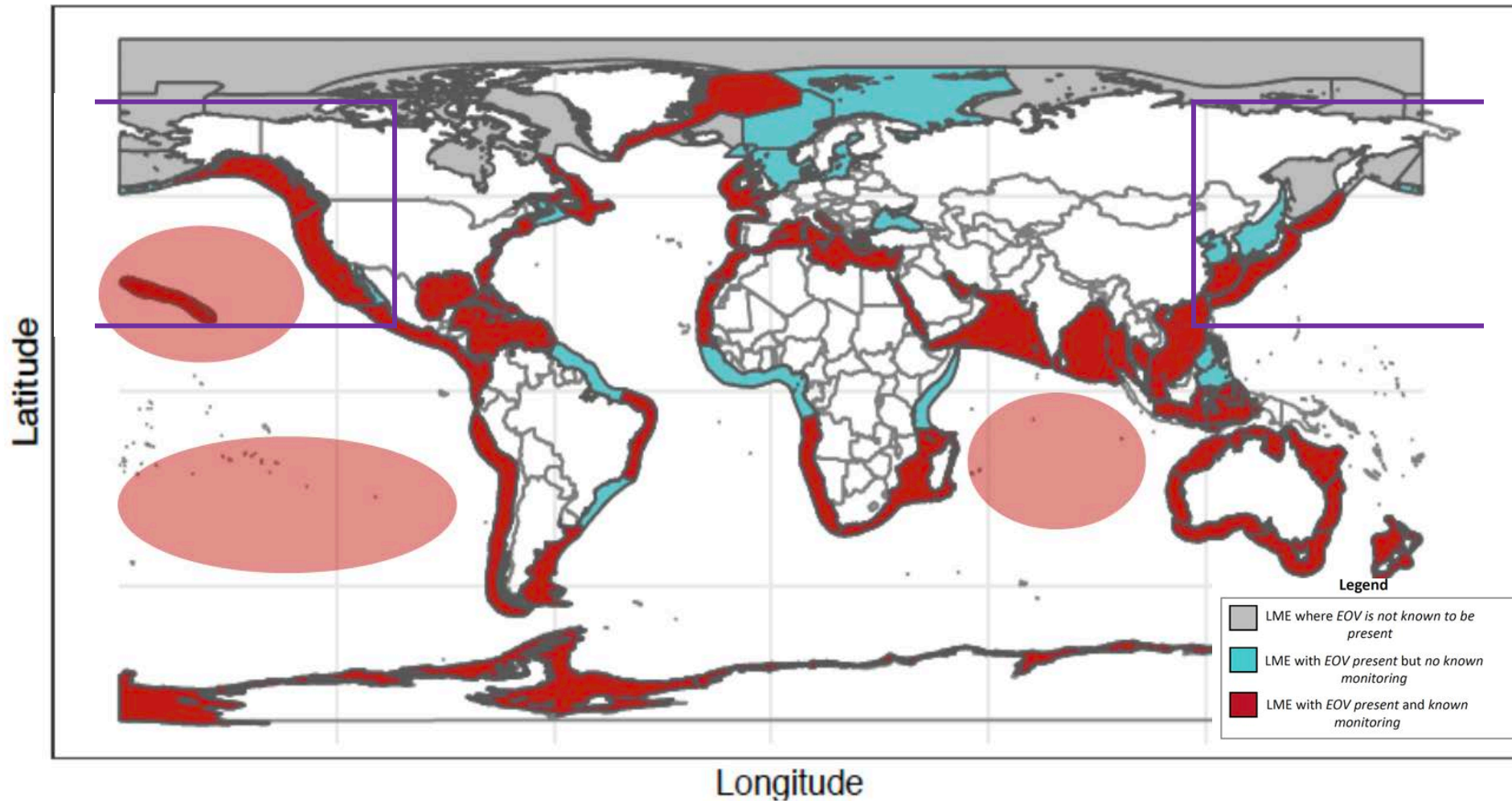
Marine fish are sampled throughout the North Pacific

Spatial Scale: Sea Turtles



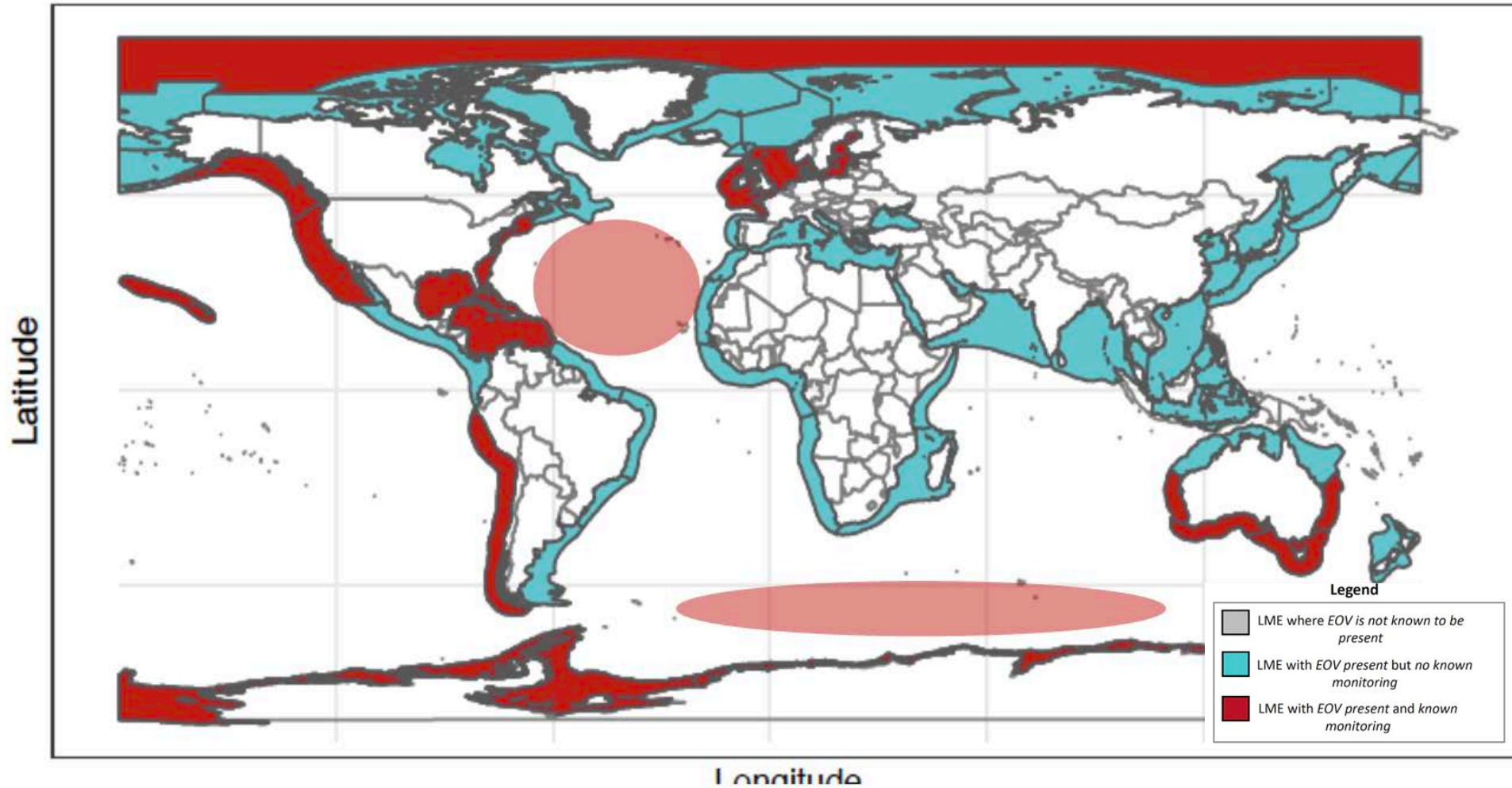
74% of LMEs that have *marine turtles* are sampled by at least one monitoring network
3 global network samples *sea turtles*

Spatial Scale: Sea Turtles



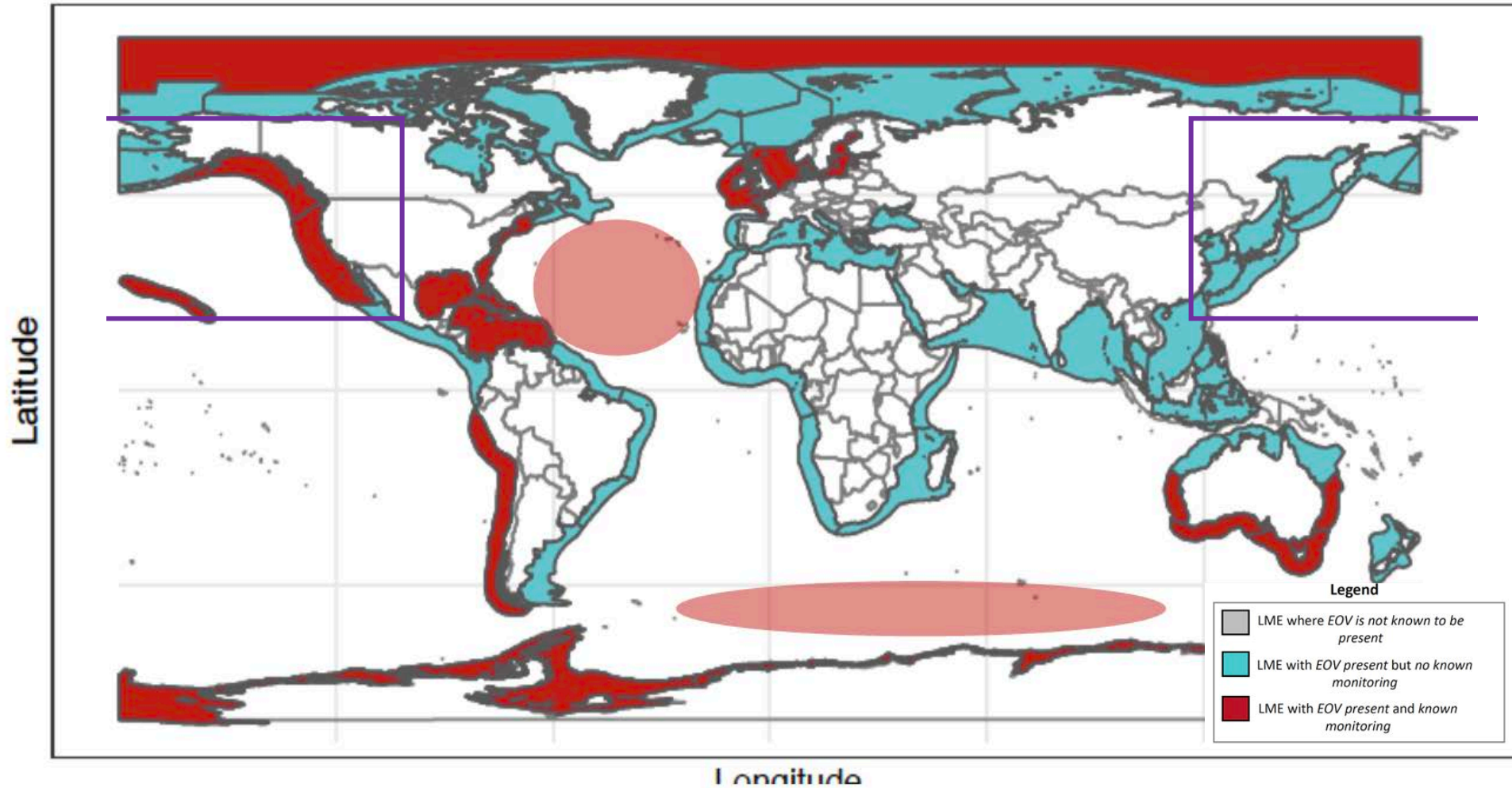
Sea turtles are sampled in most regions where they exist in the North Pacific

Spatial Scale: Seabirds

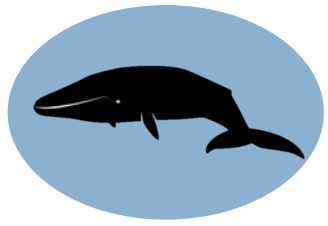


26% of LMEs that have *seabirds* are sampled by at least one monitoring network
1 global network samples *seabirds*

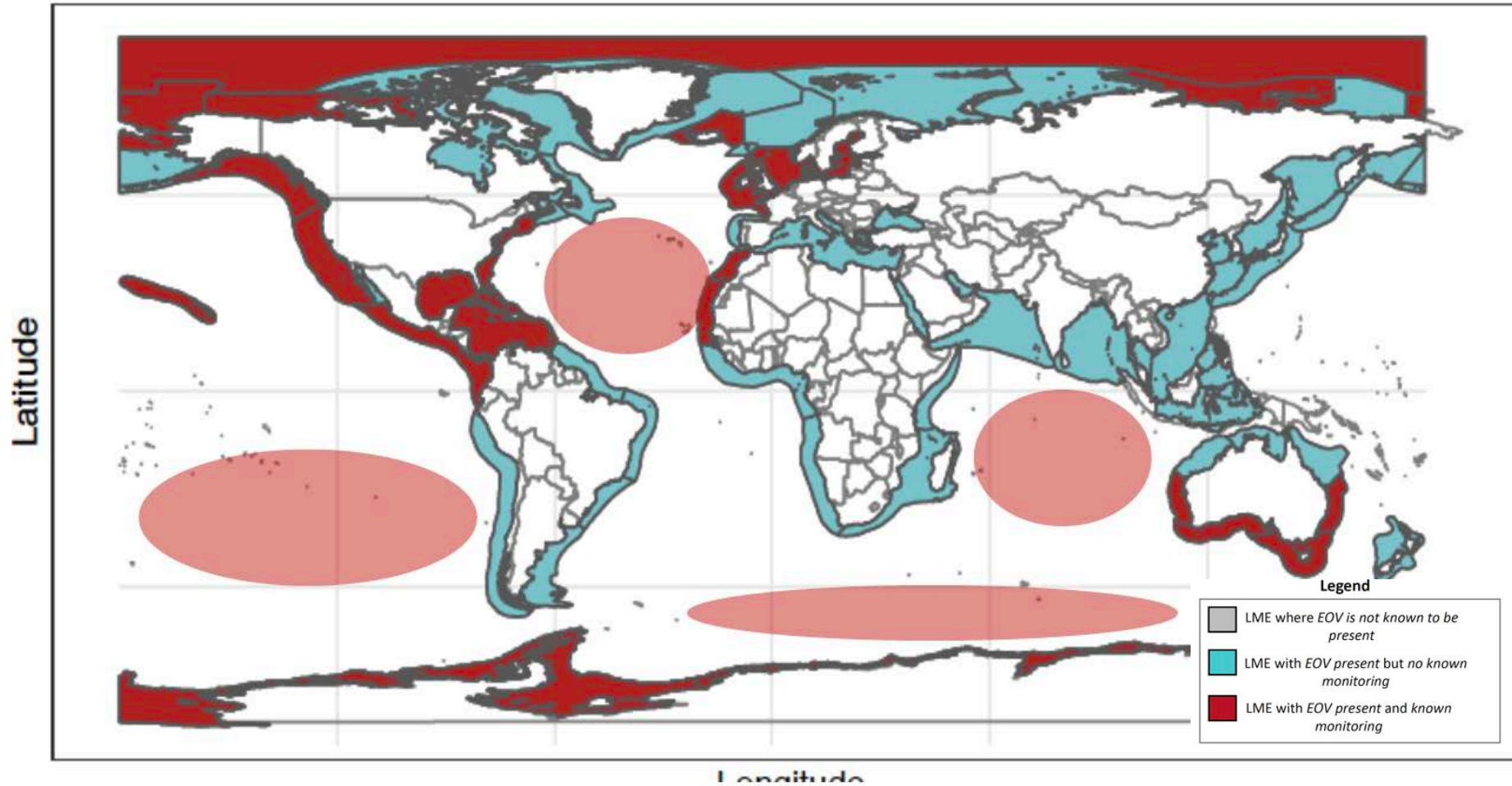
Spatial Scale: Seabirds



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



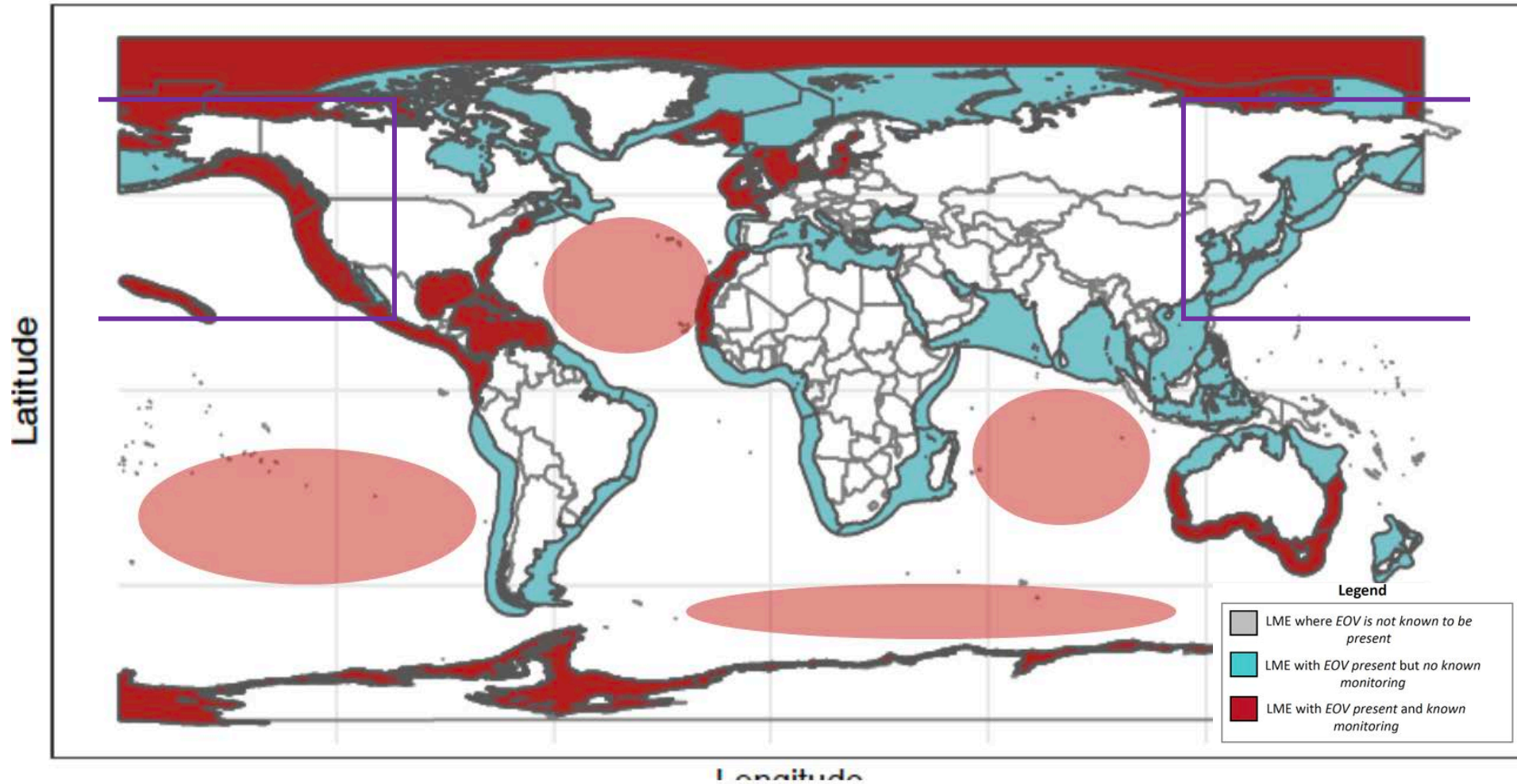
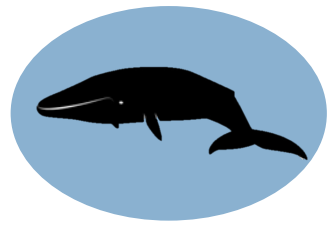
Spatial Scale: Marine Mammals



33% of LMEs that have *marine mammals* are sampled by at least one monitoring network
3 global networks sample *marine mammals*

Survey link: tiny.cc/BioObs

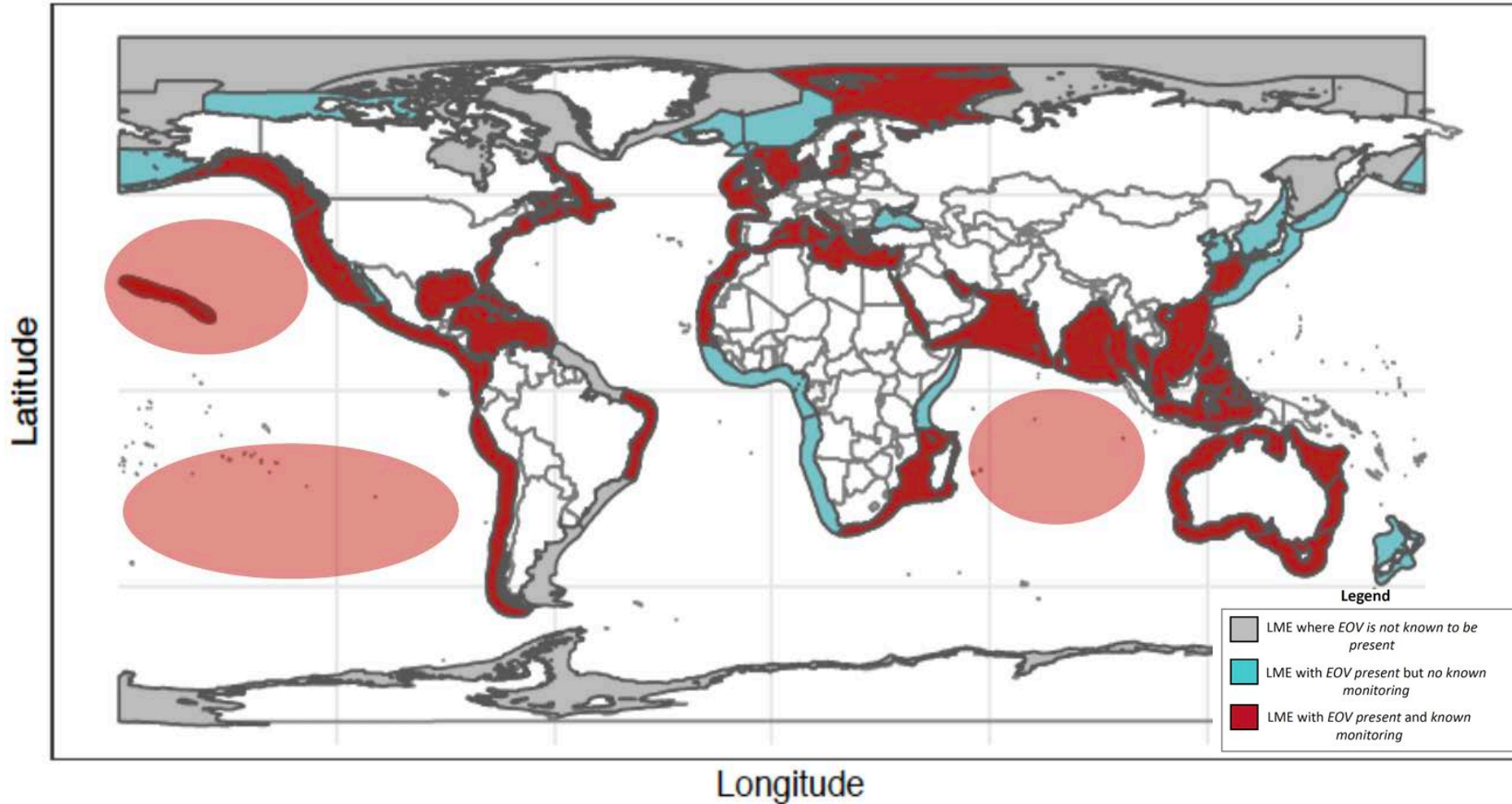
Spatial Scale: Marine Mammals



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

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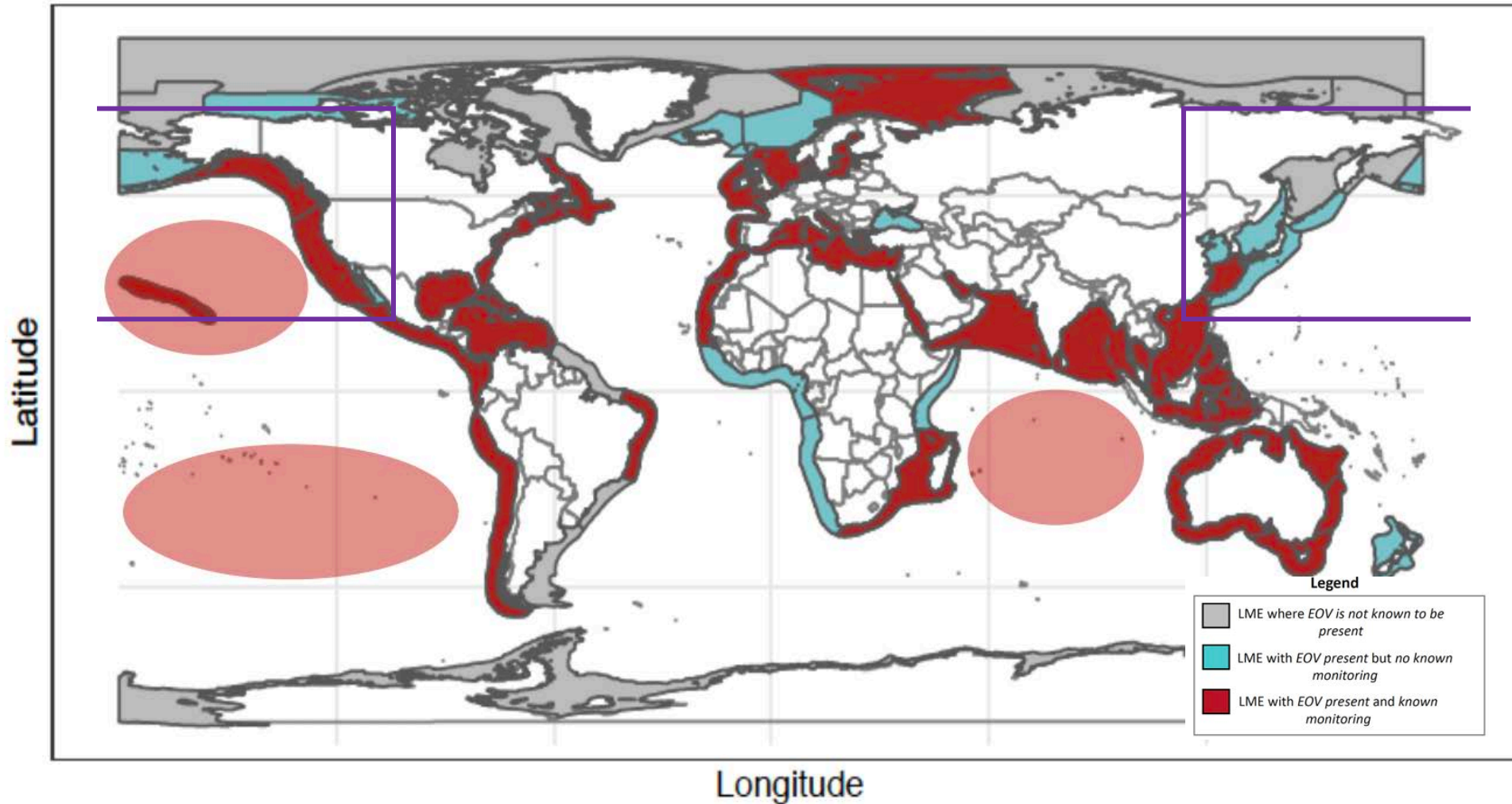
Spatial Scale: Seagrass



71% of LMEs that have *seagrass* are sampled by at least one monitoring network
2 global networks sample *seagrass*

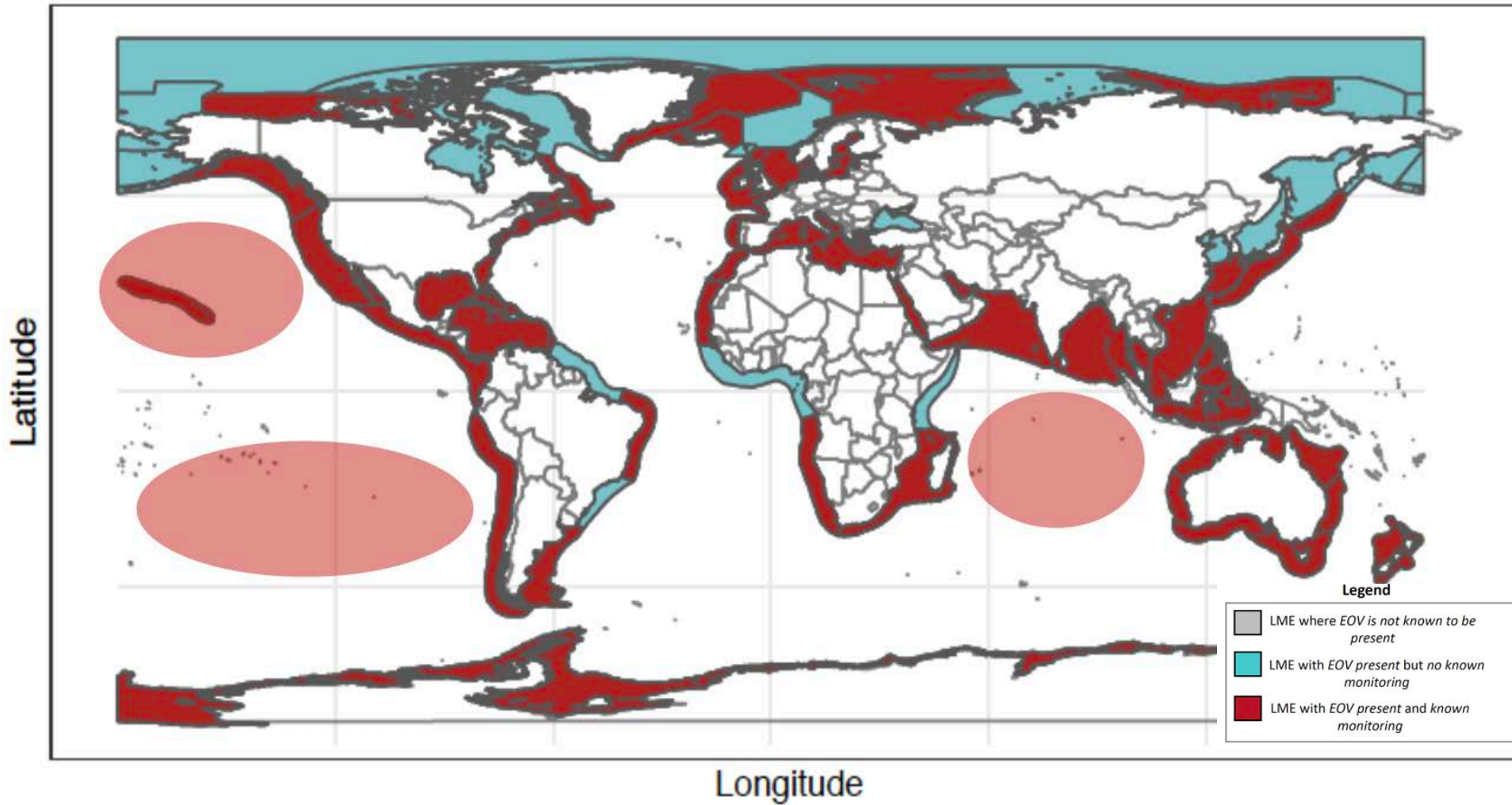
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Spatial Scale: Seagrass



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

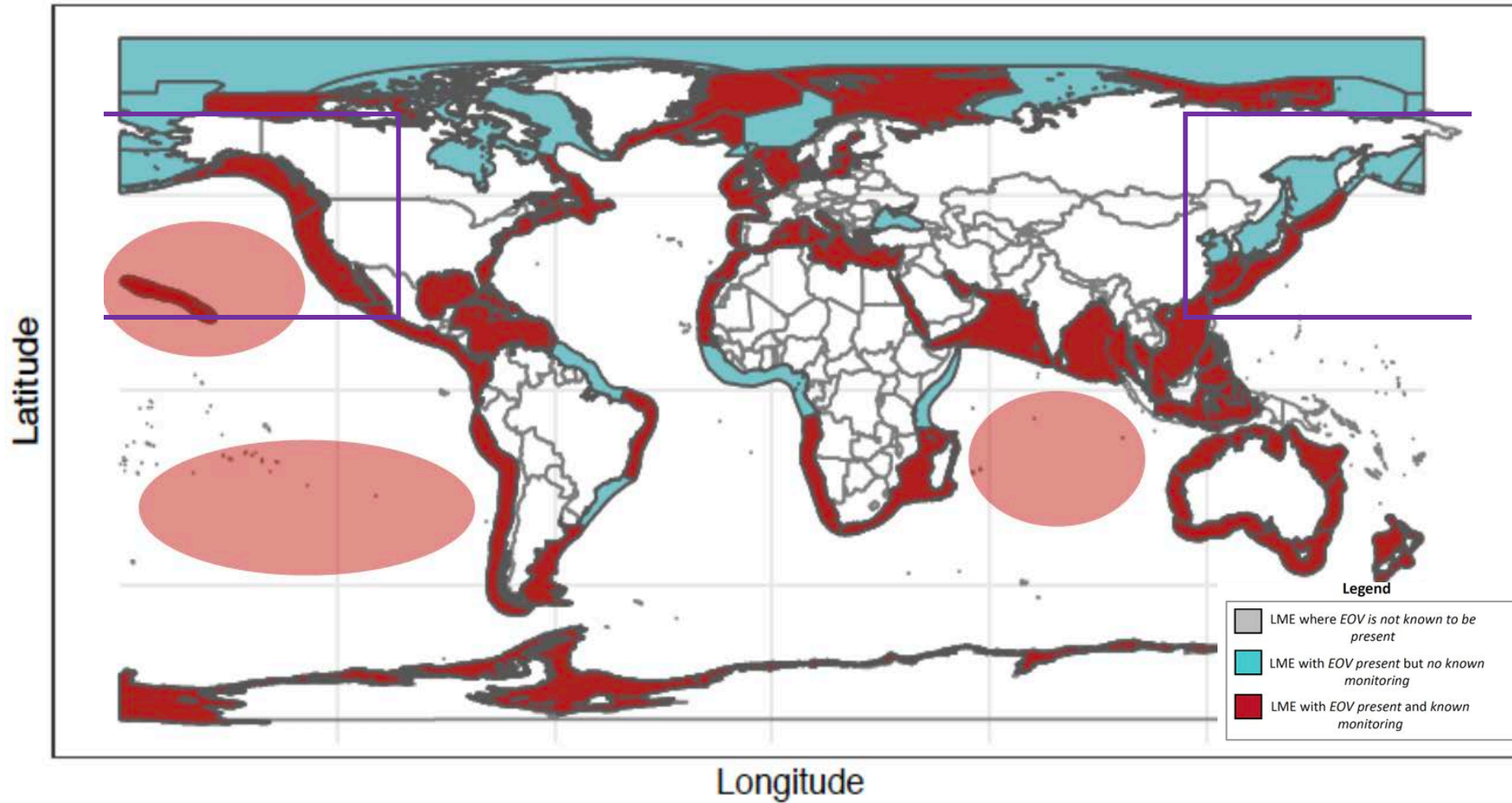
Spatial Scale: Macroalgae



33% of LMEs that have *macroalgae* are sampled by at least one monitoring network
3 global networks sample *macroalgae*

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Spatial Scale: Macroalgae



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

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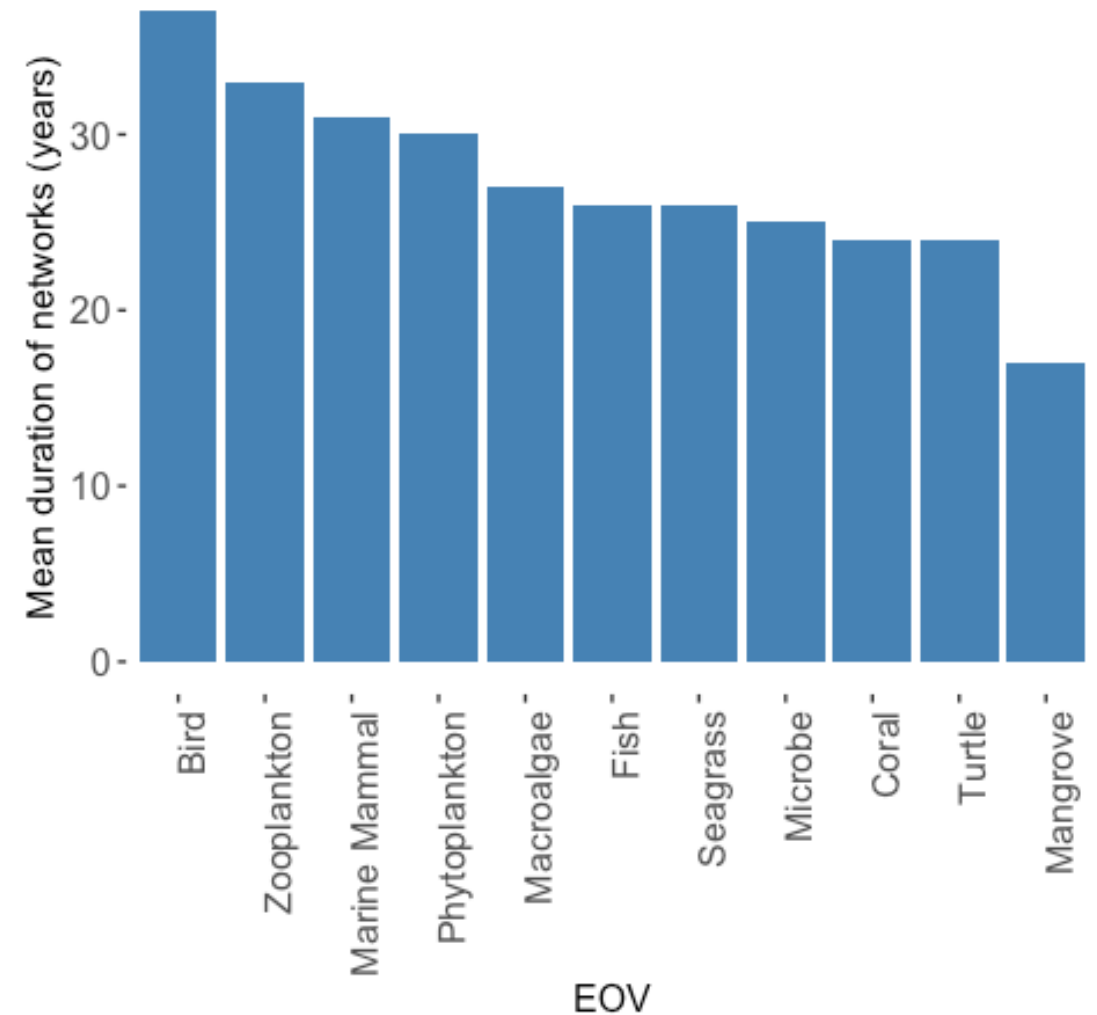
- **How long has the network been running & how often does each network sample?**



- Can the data obtained by each observing network contribute to the biological ocean observing system?

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

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- On average, networks have been sampling each EOJ for between **17 to 37 years**
- Most networks within each EOJ **sample annually or multiple times a year**



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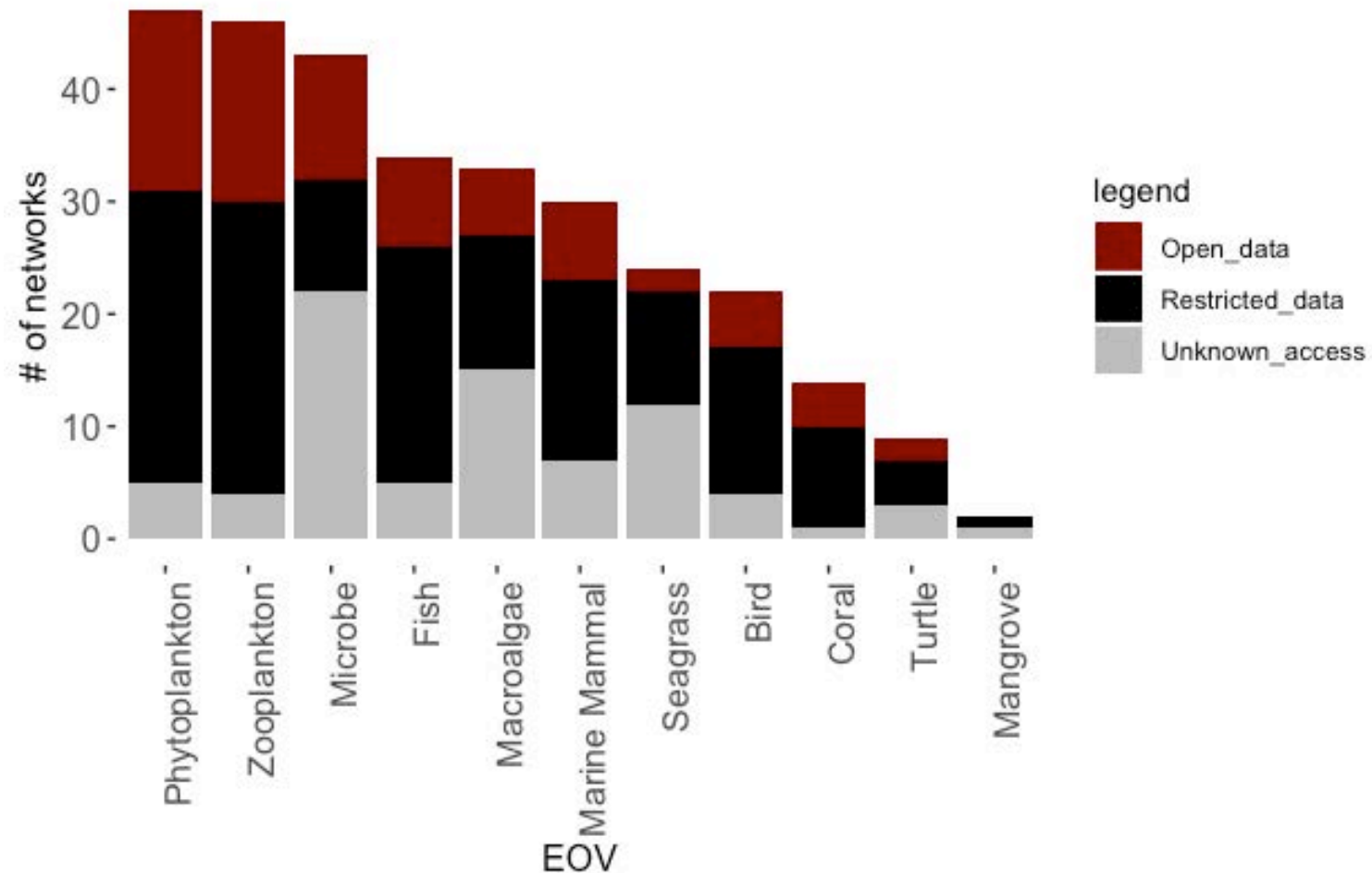
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- **Can the data obtained by each observing network contribute to the biological ocean observing system?**

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



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**

A satellite-style map of the North Pacific Ocean, showing the coastline of North America on the left and the islands of the Pacific on the right. The water is depicted in various shades of blue and green, indicating different depths and possibly chlorophyll concentrations. The text is overlaid on the right side of the map.

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

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 EOVS

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

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



Thank you!

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