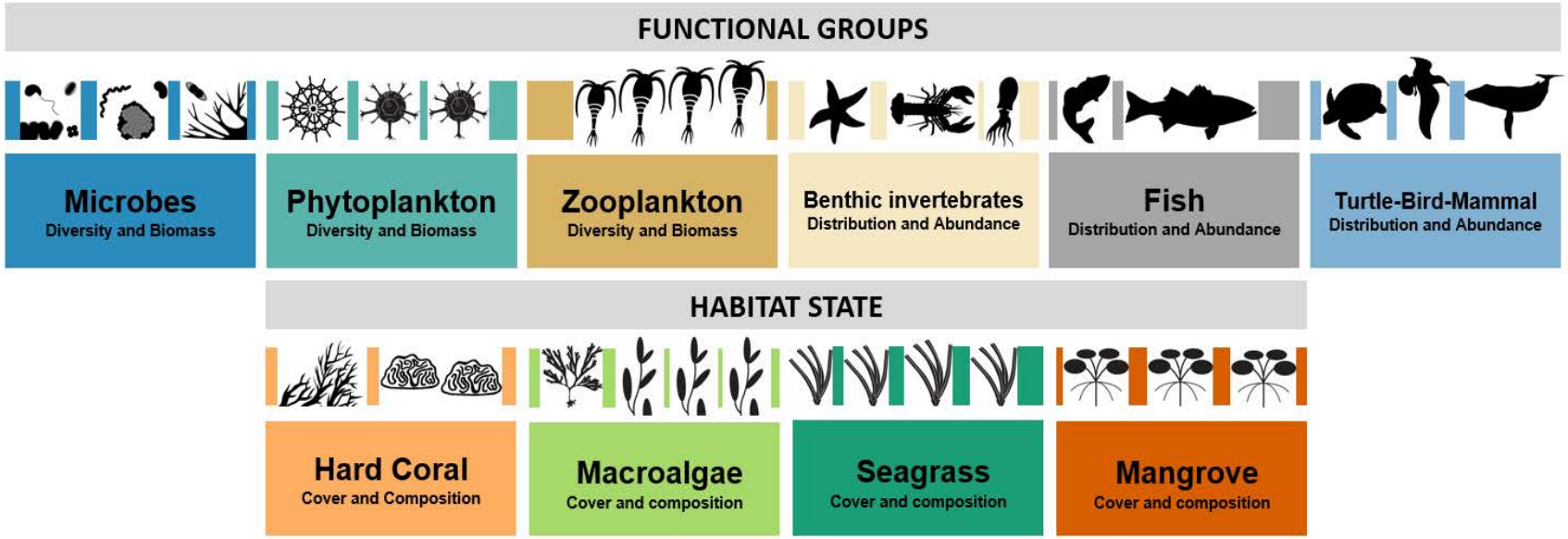
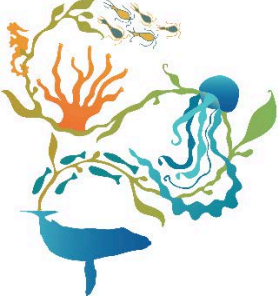
PICES 2018 Annual Meeting, Yokohama
AP-NPCOOS Meeting, Oct 28, 2018

Biology and Ecosystems Panel

# Essential Ocean Variables for Biology and Ecosystem to inform policy in the Decade of Ocean Science for Sustainable Development




**Sanae Chiba,** Patricia Miloslavich, Nic Bax, Daniel Dunn, and members of the GOOS Biology and Ecosystems Panel



Biology and Ecosystems Panel

# GOOS Essential Ocean Variables for Biology and Ecosystem

**WHAT** is that for?

**WHERE** the idea come from?

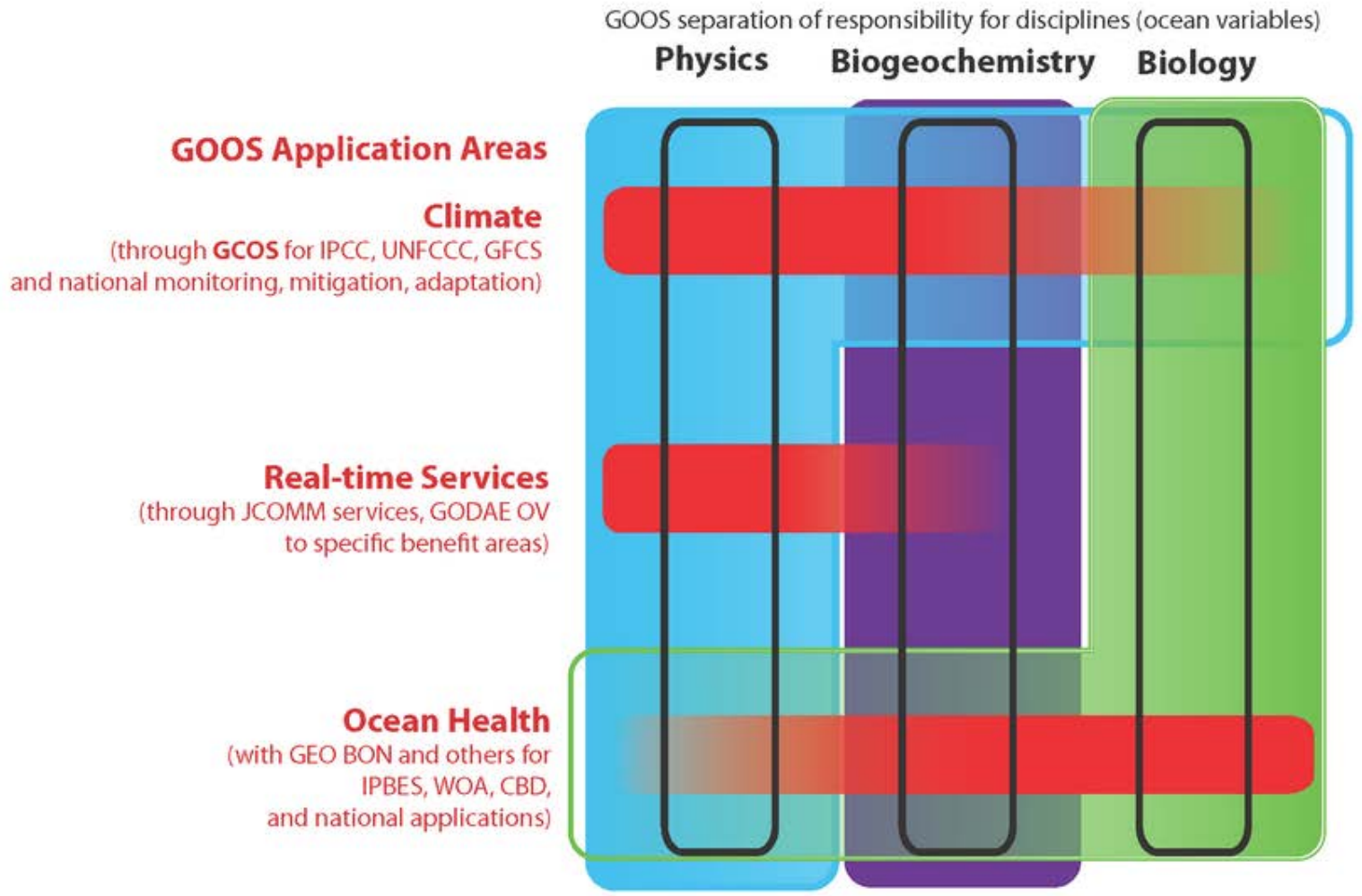
**HOW** were they developed?

**WHY** are they useful?

**WHO** will implement them?

# *WHAT is that for?*

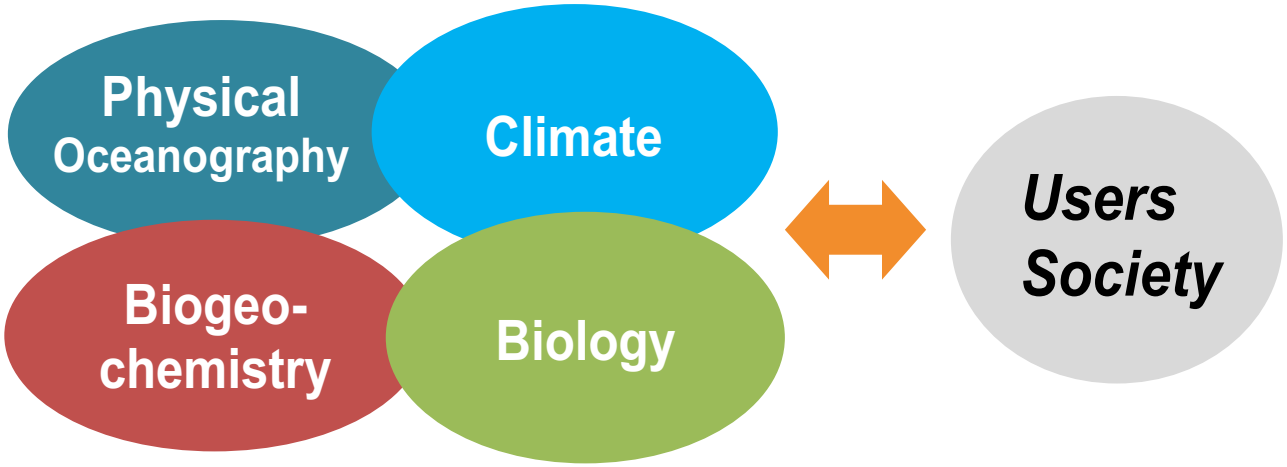
## To Provide Evidences for Better Management of Ocean–related Global Challenges

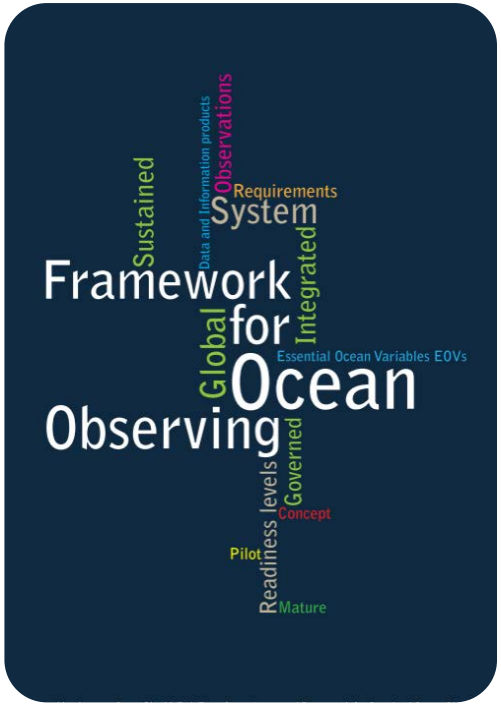



GOOS Panels and Application Areas

# *WHERE the idea came from?*

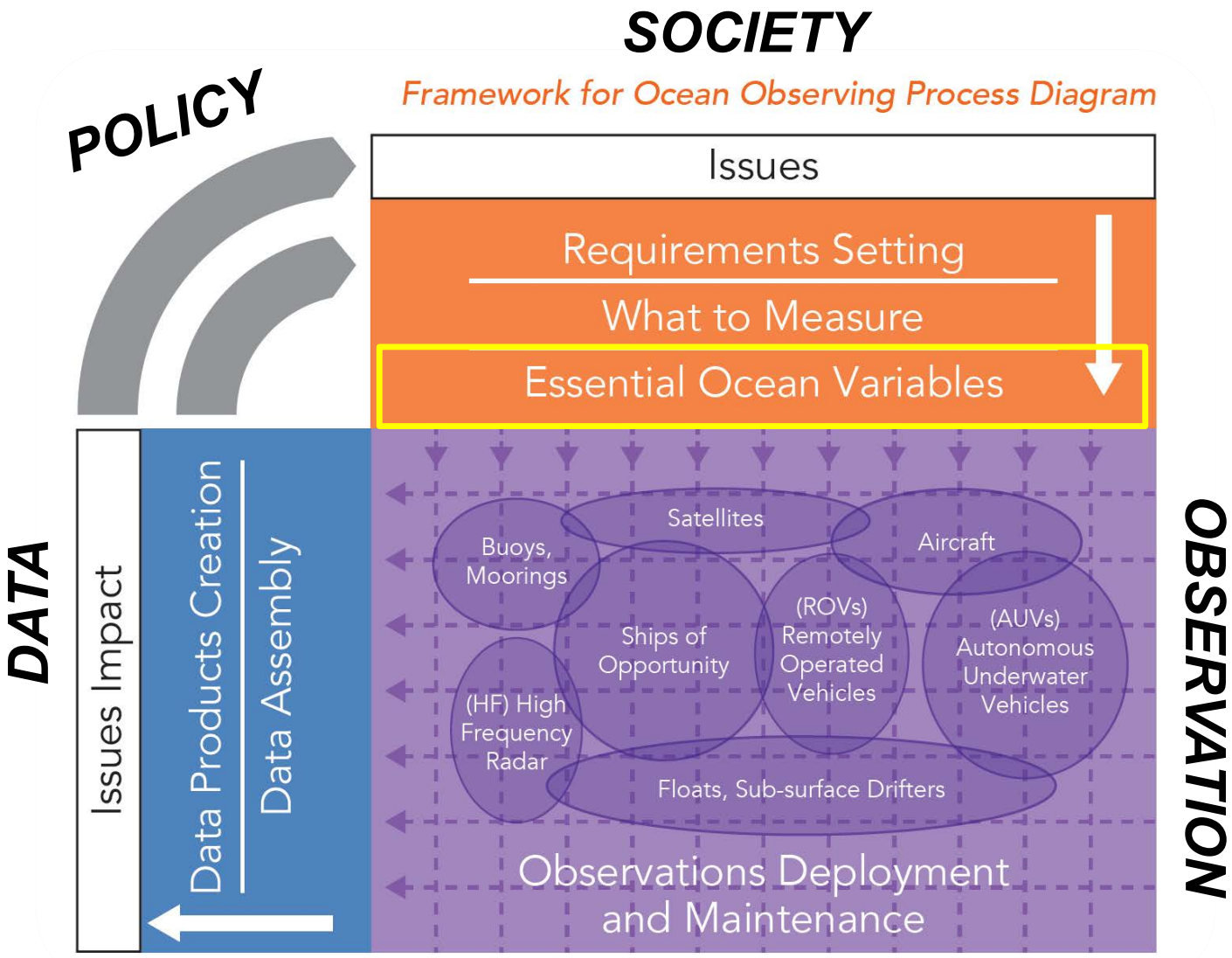

***Major Outcome: Framework of Ocean Observing (FOO)***



# *WHERE the idea came from?*

## Framework of Ocean Observing



# *HOW were they developed?*

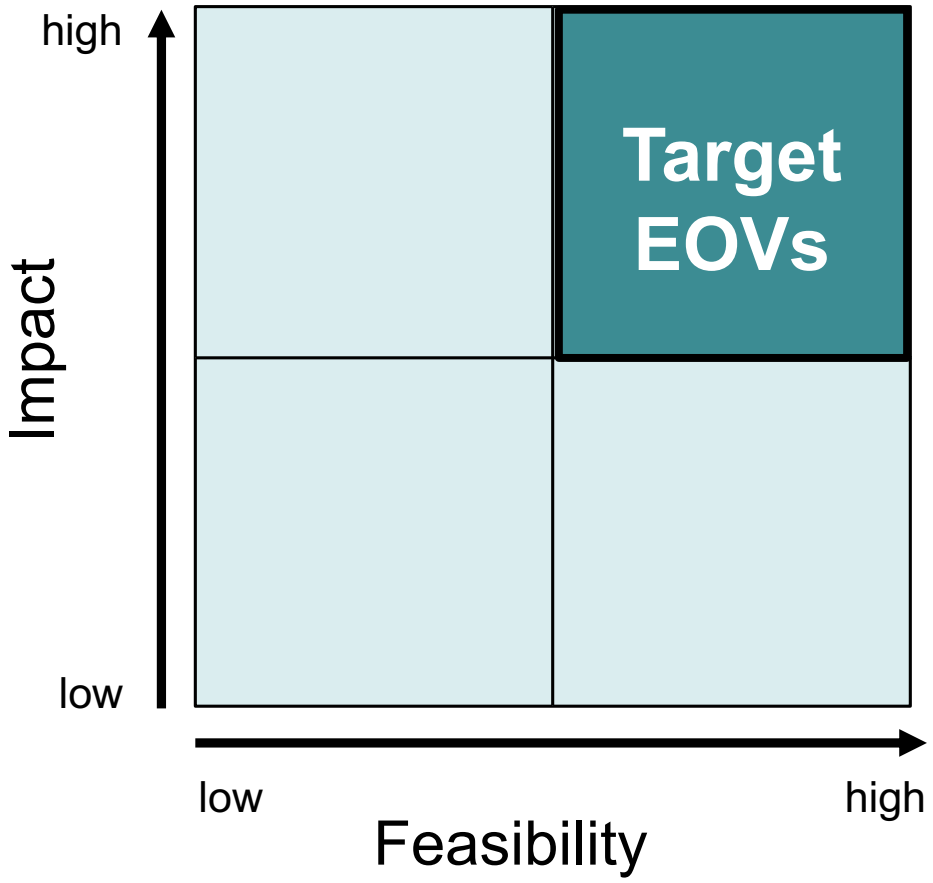
## Criteria of EOVs: Impact vs Feasibility

**Impact**

*-Relevant to help solve science questions and address societal needs*
*-Contribute to improve management of marine resources*

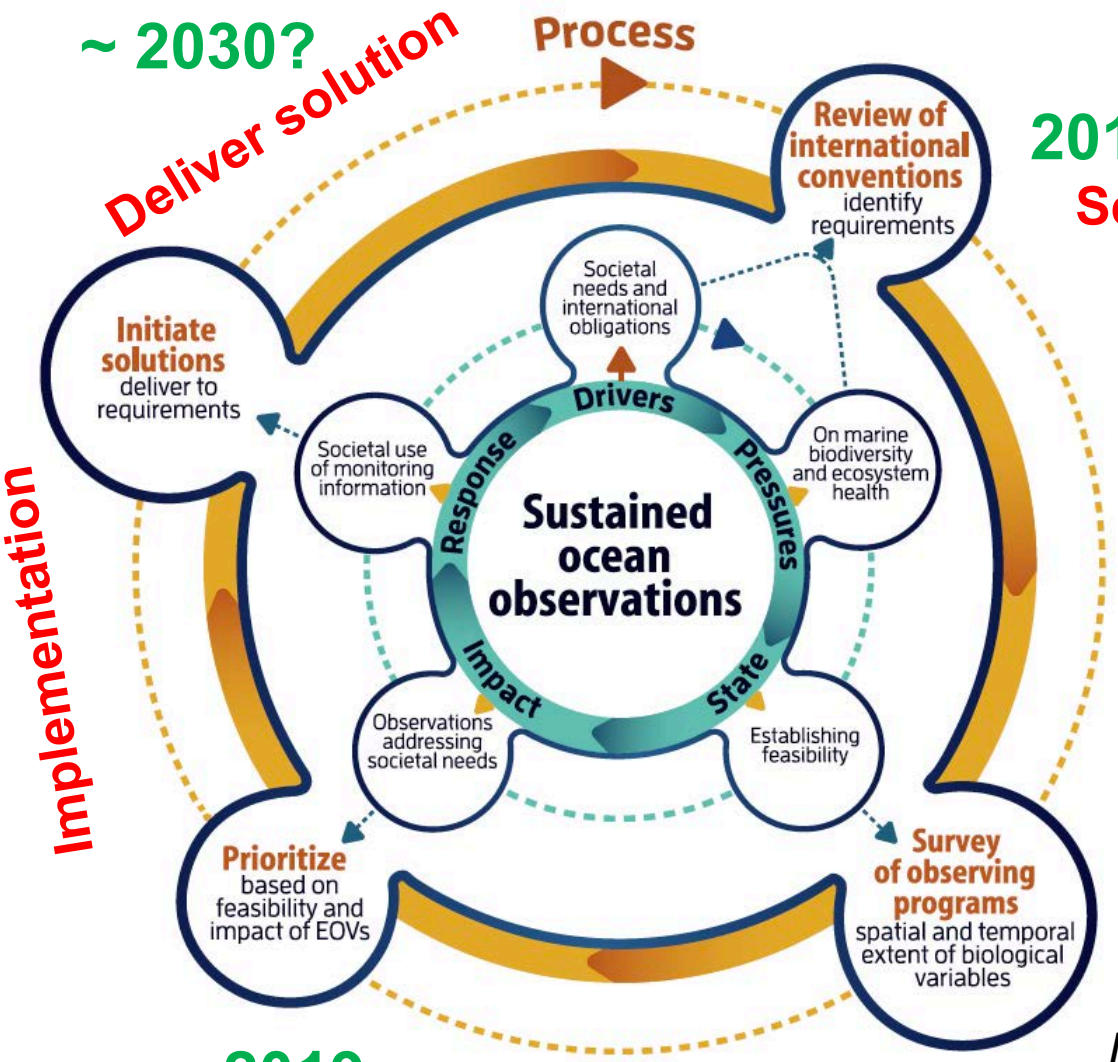
**Feasibility**

*-Scientifically credible*
*-Technically practical, cost effective and within human capabilities*
*-Sustained monitoring*



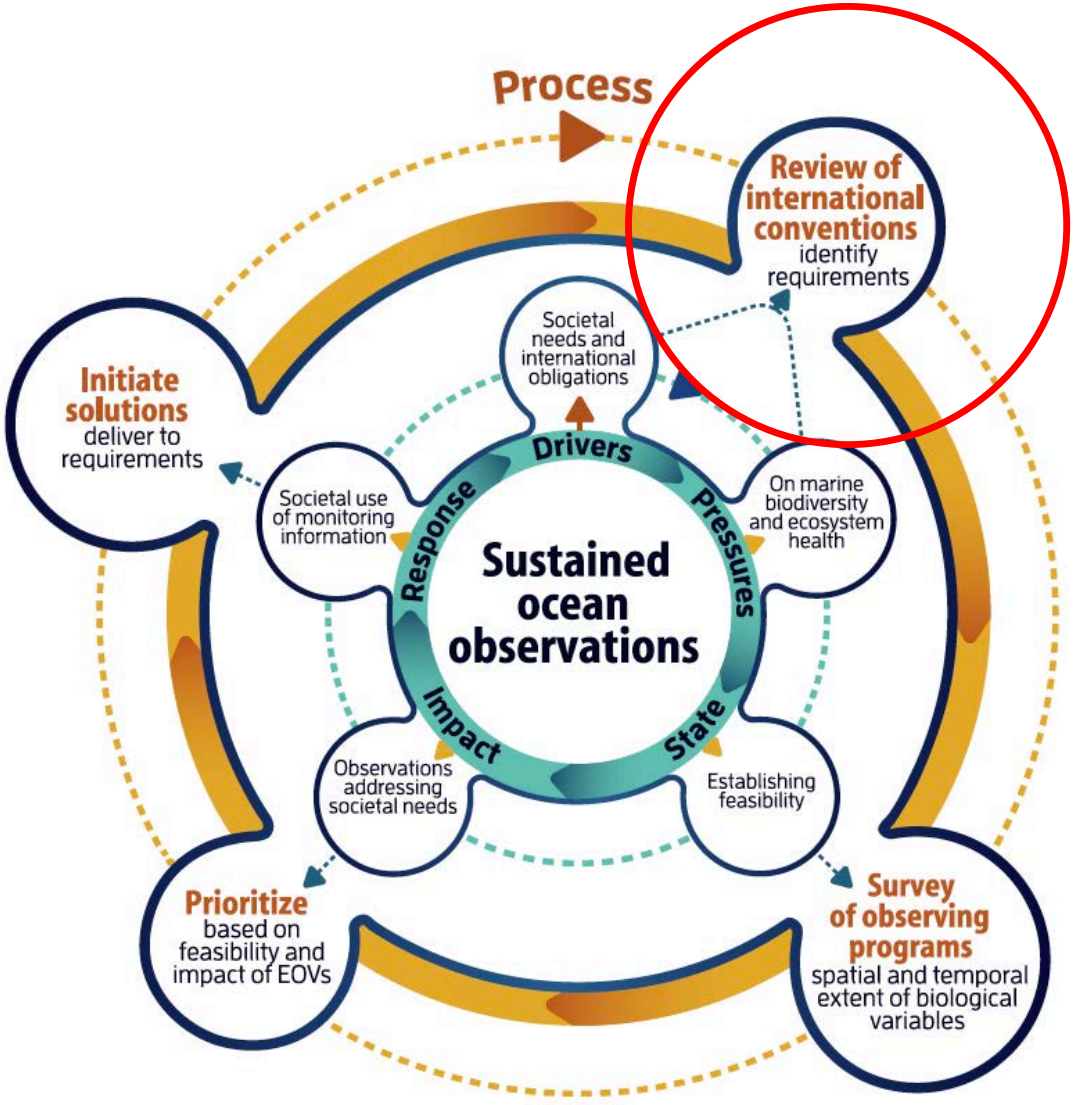
# *HOW were they developed?*

## DPSIR Scheme and Timeline of Bio/Eco EOVs




*See the details in Miloslavich et al. 2018, GCB*

# *HOW were they developed?*




(Miloslavich et al. 2018, GCB)


***Identify Important Drivers and Pressure => Impact***
***Survey***
***: 24 bodies***

# HOW were they developed?

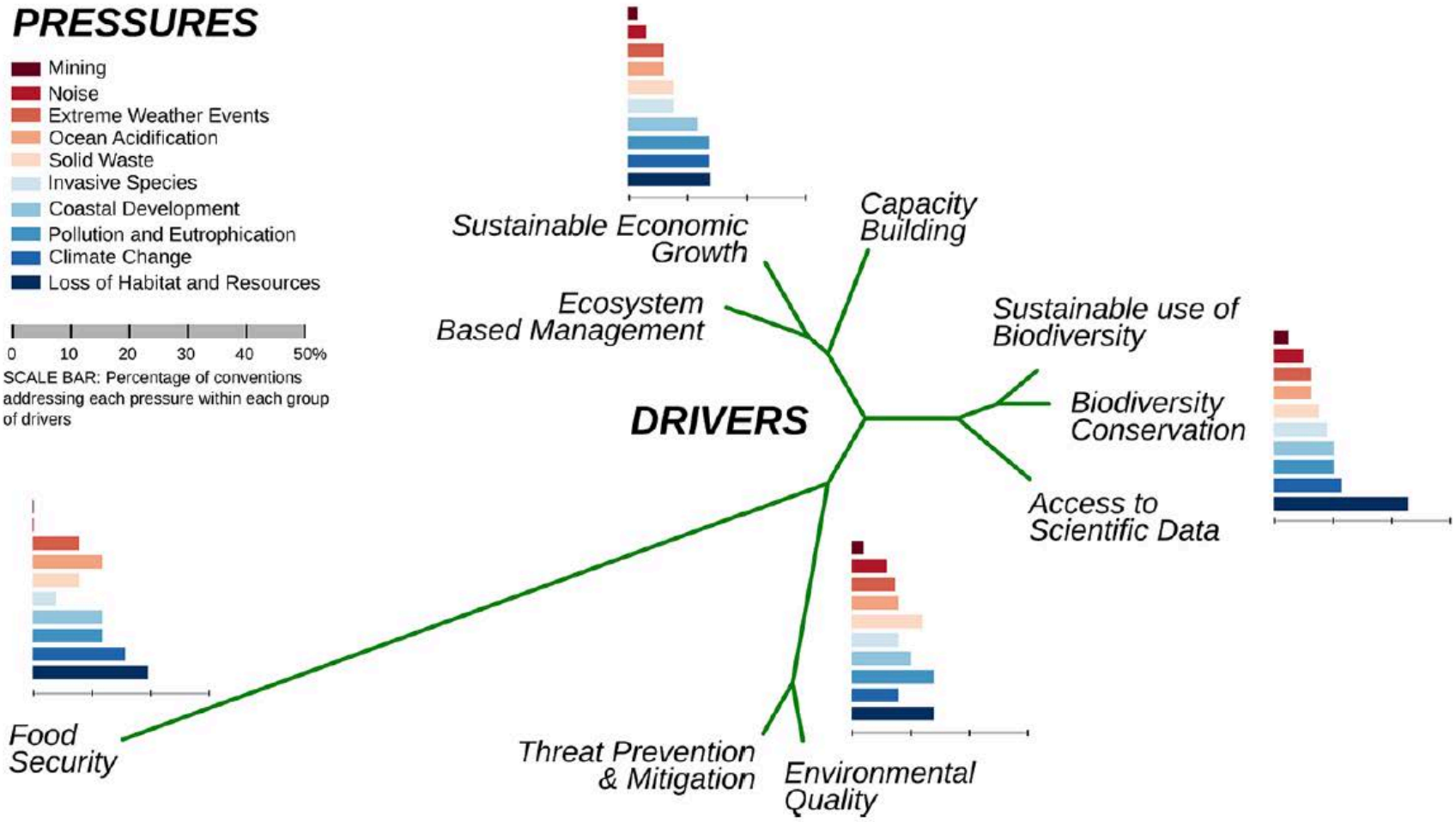
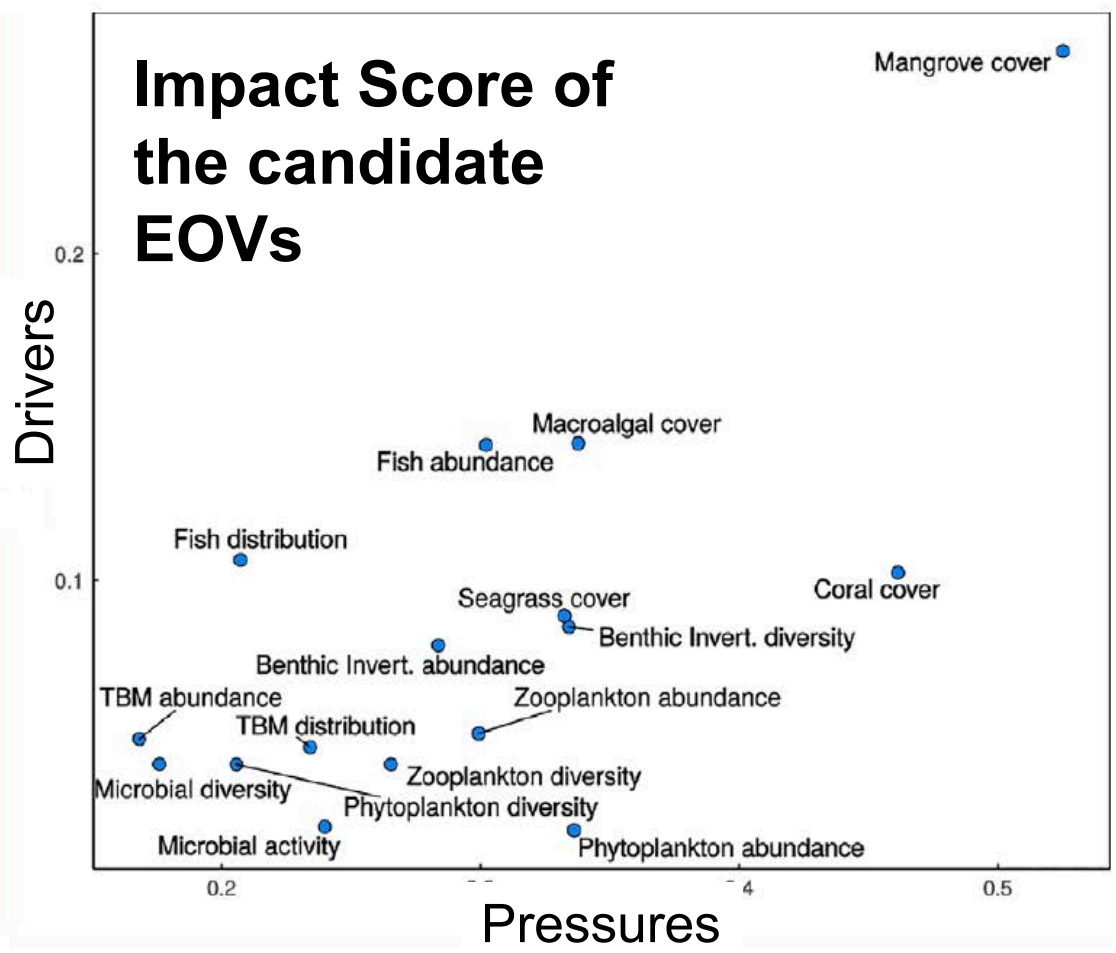



**FIGURE 2** Societal needs as identified from the review of 24 international conventions or agreements relevant to global ocean biology. Drivers are clustered as addressed together by the conventions. Segments between drivers represent similarity, the shorter and closer, the more similar. Horizontal bars represent the pressures addressed concurrently with those drivers within the same conventions [Colour figure can be viewed at wileyonlinelibrary.com]

*(Miloslavich et al. 2018, GCB)*

# *HOW were they developed?*



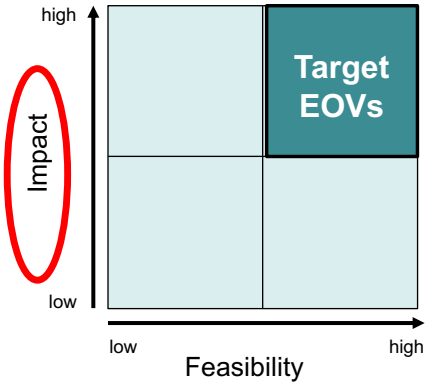
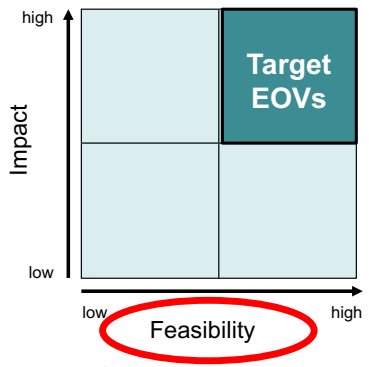




**FIGURE 5** Relevance of the priority variables (i.e., measured by at least two thirds of the observing programs) to address societal drivers and pressures using the Relevance Index (RI). RI estimates how each of the variables addresses the convention's drivers and pressures based on the SCOPUS database. TBM: sea turtles, seabirds and marine mammals. "Fish" includes sharks, rays and bony fish [Colour figure can be viewed at wileyonlinelibrary.com]

*(Miloslavich et al. 2018, GCB)*

# HOW were they developed?

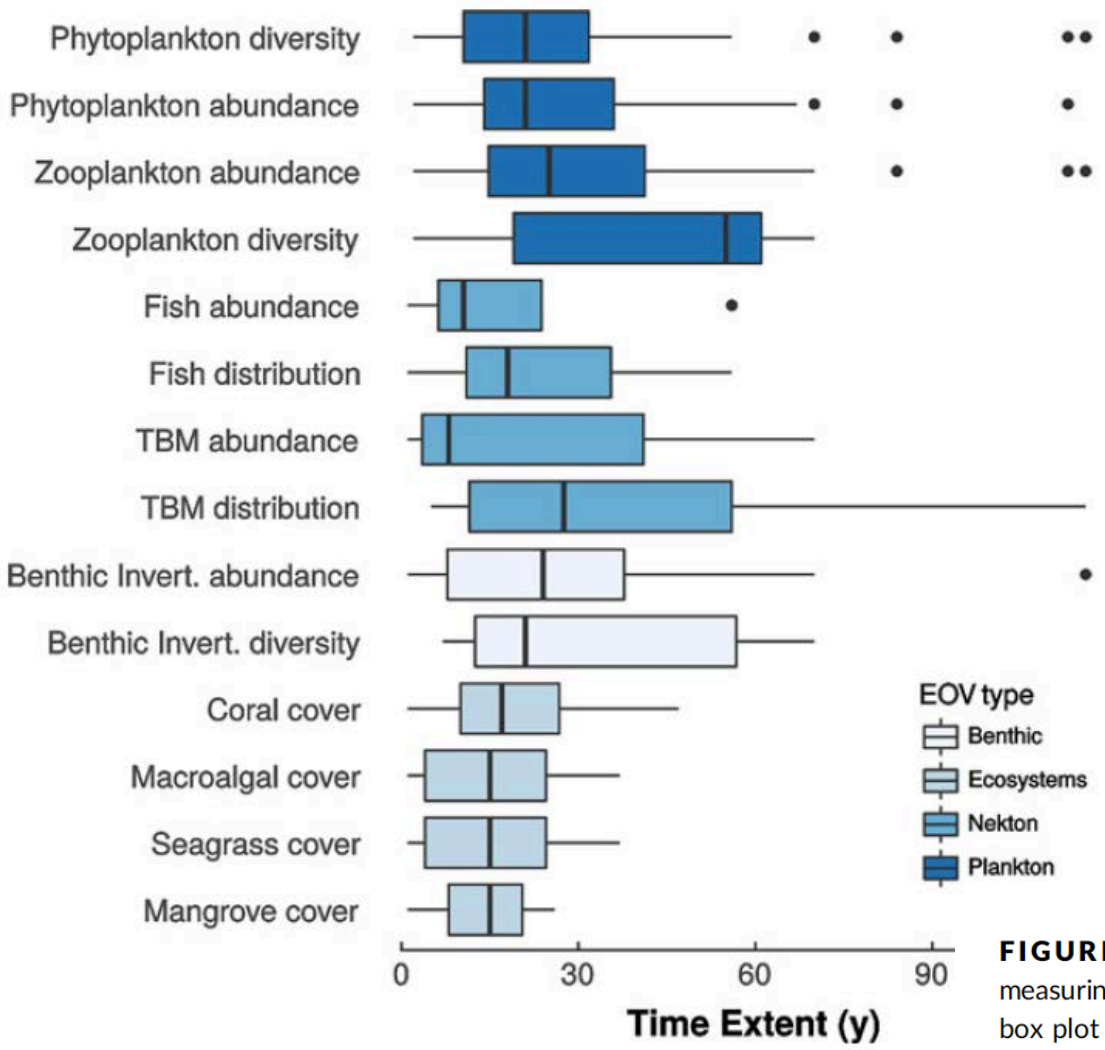




***State of variables =>***
***Feasibility survey :***
***>104 obs. programmes***

**Observation / data integration***

OOI Ocean Observatories Initiative
EMBOS cost www.EMBOS.IU
indiSeas
GACS Global Alliance of Continuous Plankton Recorder Surveys
IGMETS
OCEAN TRACKING NETWORK
CalCOFI California Cooperative Oceanic Fisheries Investigations
IMOS
SOOS
Ocean Networks Canada
SeagrassNet
RLS Reef Life Survey
PISCO
GOA-ON Global Ocean Acidification Observing Network
CARIACO Carbon Retention in a Colored Ocean
AtlantOS

# *HOW were they developed?*




**Number of projects which observe the EOV**

**x**

**Temporal coverage**

**x**

**Spatial coverage**

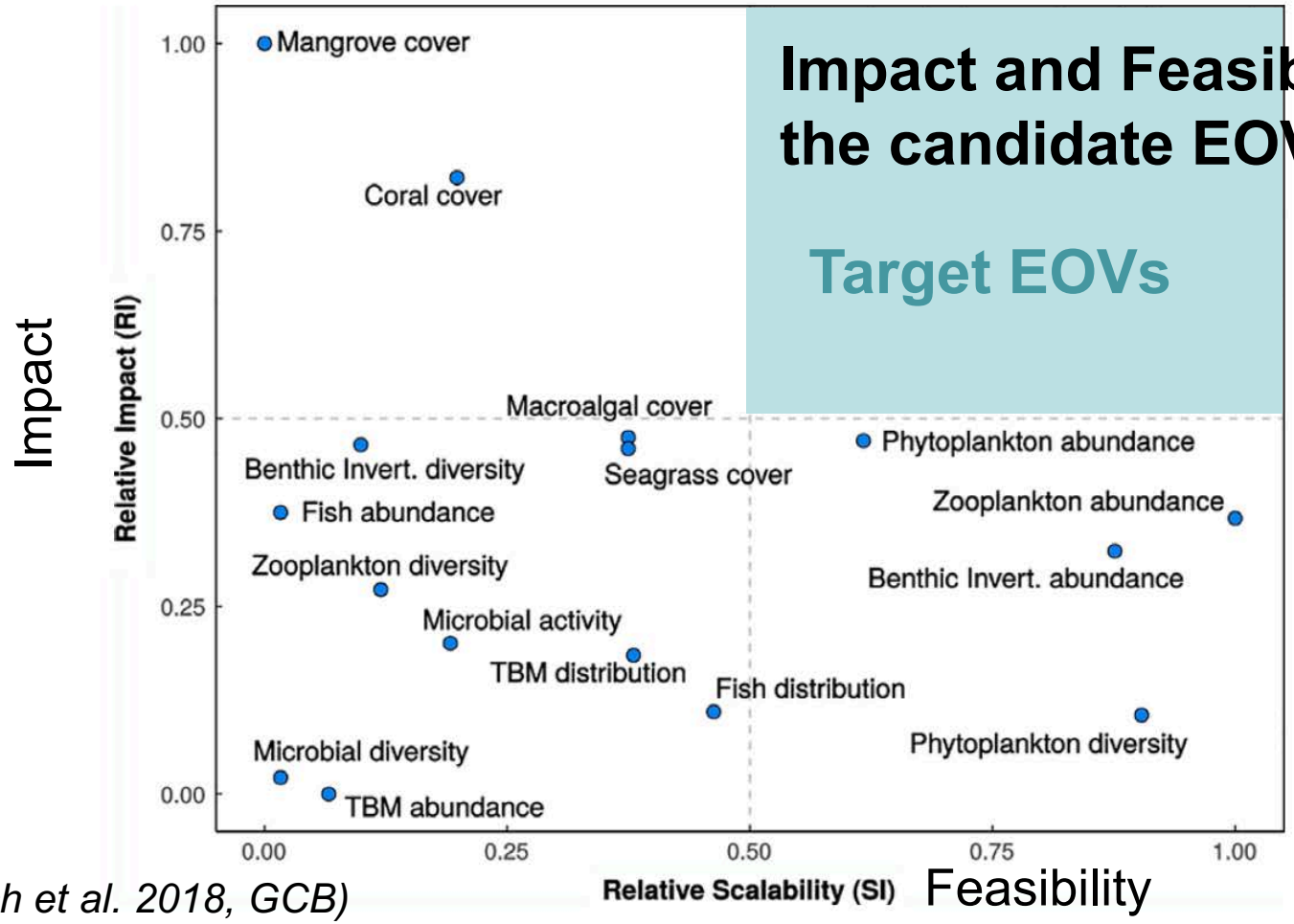
**=**

**Feasibility Score**

**FIGURE 4** Time extent in years of the 104 observing programs measuring the different biological variables. The centre bar of the box plot represents the median, the box extremes the 1st and 3rd quartiles and the whiskers the 5th and 95th percentiles. Black dots represent values above the 95th percentile. TBM: sea turtles, sea birds and marine mammals. "Fish" includes sharks, rays and bony fish [Colour figure can be viewed at wileyonlinelibrary.com]

*(Miloslavich et al. 2018, GCB)*

# *HOW were they developed?*




*(Miloslavich et al. 2018, GCB)*

**FIGURE 6** Relative impact vs. scalability graph for the priority variables (i.e., measured by at least two thirds of the observing programs). "Impact" based on Relevance Index for pressures and "Scalability" based on the Scalability Index (SI) considering spatial cover and temporal extent of observation of priority variables. Both axes were scaled to 0–1 using minimum and maximum values. The shaded grey area in the upper right quartile represents the target area for essential ocean variable investment according to the framework for ocean observing. TBM: sea turtles, seabirds and marine mammals. "Fish" includes sharks, rays and bony fish [Colour figure can be viewed at wileyonlinelibrary.com]

# *HOW were they developed?*

## EOV Specification Sheet for Zooplankton Biomass & Diversity

| Table 1 EOV Information (definitions of terms in glossary) | | | | | |
|---|---|---|---|---|---|
| **Name of EOV** | Zooplankton biomass and diversity | | | | |
| **Sub-Variables** | Biomass overall; biomass or abundance (or presence/absence) by taxon, functional group or size class, | | | | |
| **Derived products** | -<br>- geographical distributions by taxon or functional group<br>- life history timing<br>- community size structure | | | | |
| **Supporting Variables** | (It is assumed that location of the samples and sampled volume will be recorded) | | | | |
| **Phenomena to capture** | 1. Phenology | 2. Biogeography shift | 3. Ecological regime shift | 4. Ocean productivity | 5. Carbon sequestration |
| **Complementary variable** | Temperature Phytoplankton biomass and diversity | Currents Temperature | Physical & BGC & biological EOVs | Phytoplankton Fish | Phytoplankton, Aggregates (BGC) |
| **Temporal Scales of the Phenomena** | Daily to seasonal over annual to decadal scales | Seasonal, annual to decadal | Decadal | Annual to decadal | Annual |
| **Spatial Scales of the Phenomena** | Local to basin scale | 200km – basin scale | Regional to basin scale | Local to global | Basin scale to global |

# *WHY are they useful?*

**Deliver regional, national and high-level International policy for protection of ocean health**

SDG, Decades, Aichi Target

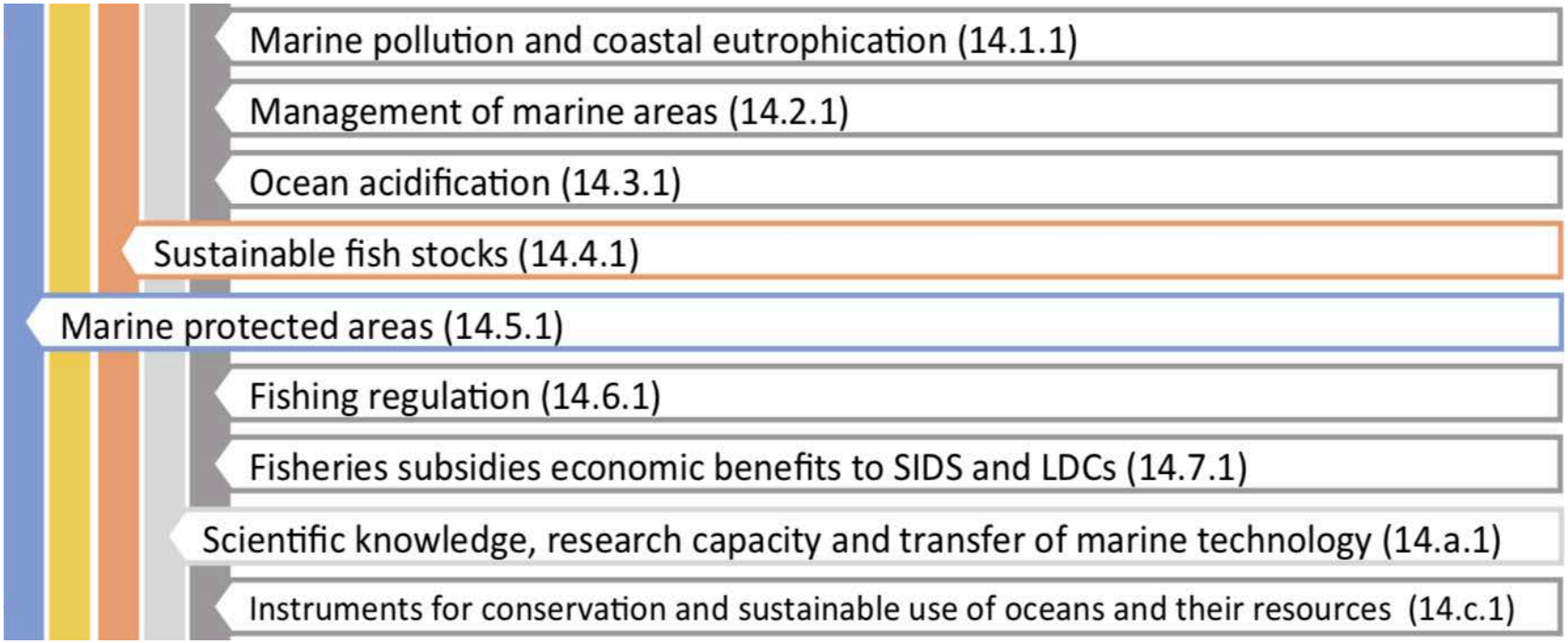



e.g. Development of official indicators

# *WHY are they useful?*


## SDG 14. lack of data to develop indicators

68% of the 93 SDG indicators covering the environmental dimensions of sustainable development cannot be measured due to a lack of data. UNEP Report 2019
https://wedocs.unep.org/bitstream/handle/20.500.11822/27627/MeaProg2019.pdf

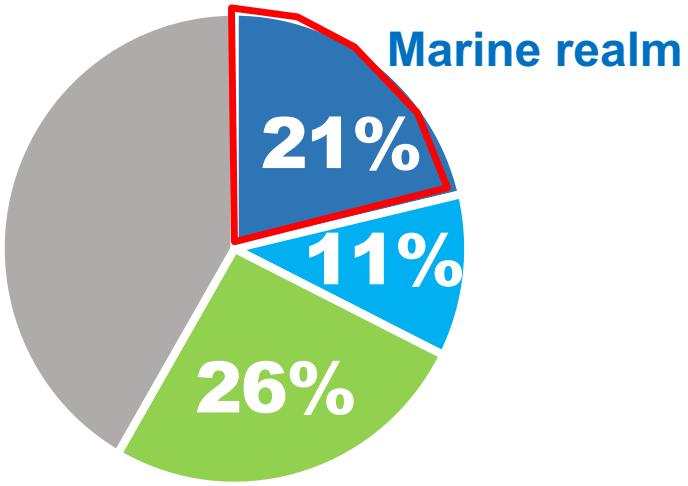



Data are not enough or unavailable

# *WHY are they useful?*

Marine Realm is under-represented for Aichi Target Indicators

- Habitat loss
- Sustainable aquaculture
- Pollution
- Invasive species
- Vulnerable ecosystems
- Genetic diversity
- Ecosystem services
- Resilience & Restoration



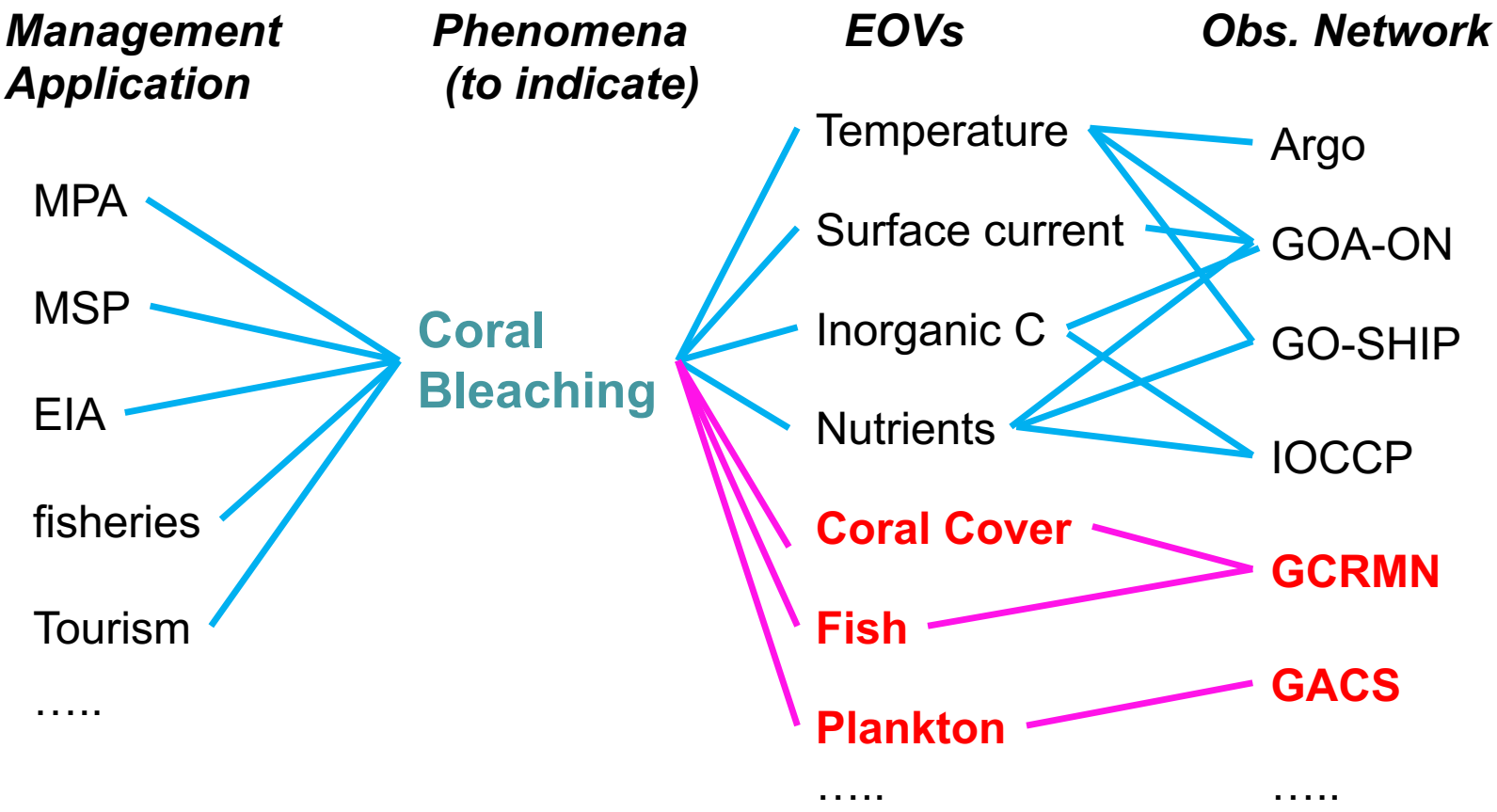

Lack of the efficient protocol to use ocean data to report policy…

Scheme of GOOS EOVs can bring the opportunity

*(Chiba et al. JPR, 2018)*

# *WHY are they useful?*

From EOVs (data) to Indicators (information)
for Management Options




modified from GOOS Strategic Map

# *WHO will implement them?*

## GOOS EOVs for Physics and BGC

| PHYSICS | BIOGEOCHEMISTRY |
|---|---|
| Sea state | Oxygen |
| Ocean surface stress | Nutrients |
| Sea ice | Inorganic carbon |
| Sea surface height | Transient tracers |
| Sea surface temperature | Particulate matter |
| Subsurface temperature | Nitrous oxide |
| Surface currents | Stable carbon isotopes |
| Subsurface currents | Dissolved organic carbon |
| Sea surface salinity | Ocean colour *(Spec Sheet under development)* |
| Subsurface salinity | |
| Ocean surface heat flux | |

Standardization of method and application of operational oceanography for biological variables are unrealistic at present…

**Networking** and **Coordination** of Existing Regional, National and International Observation Programmes is needed….

**To ensure Interoperability of Observation and Data**

# *WHO will implement them?*

## Identify Pilot Projects

**Zooplankton**
Diversity and Biomass

**Hard Coral**
Cover and Composition

**Seagrass**
Cover and composition

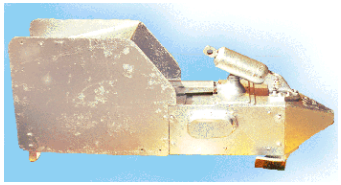
**Turtle-Bird-Mammal**
Distribution and Abundance

GACS
GLOBAL ALLIANCE OF CONTINUOUS PLANKTON RECORDER SURVEYS

GCRMN
GLOBAL CORAL REEF MONITORING NETWORK

MarineGEO
THE TENNENBAUM MARINE OBSERVATORIES NETWORK

ATN
ANIMAL TELEMETRY NETWORK



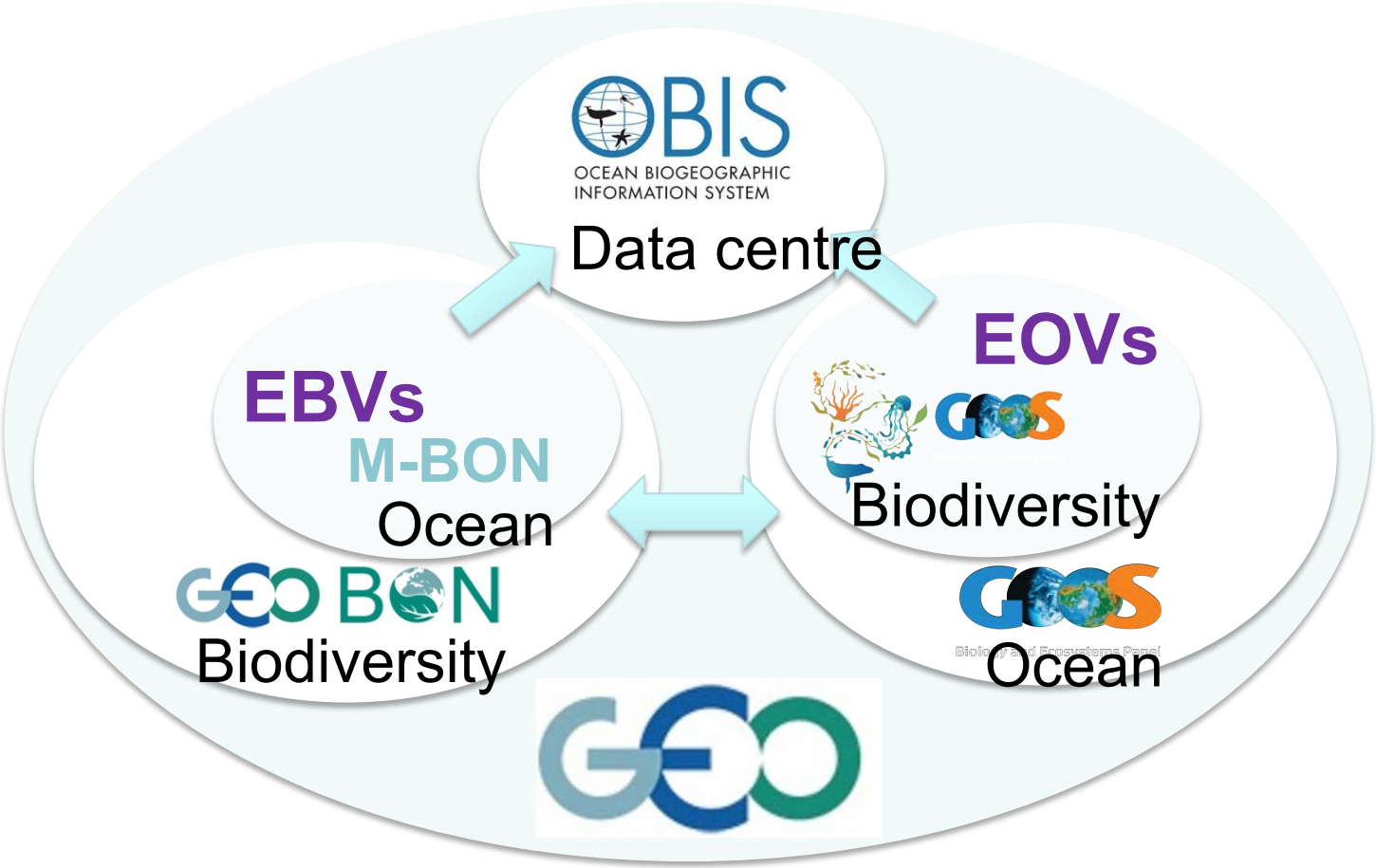
ICRI
INTERNATIONAL CORAL REEF INITIATIVE

SeagrassWatch

SeagrassNet

# *WHO will implement them?*

## GEO-BON EBVs vs GOOS-Bio/Eco EOVs




*Have developed in parallel… but now communicating*

# *WHO will implement them?*

***How can PICES community collaborate with, contribute to and benefit from GOOS-BEP EOVs implementation processes?***

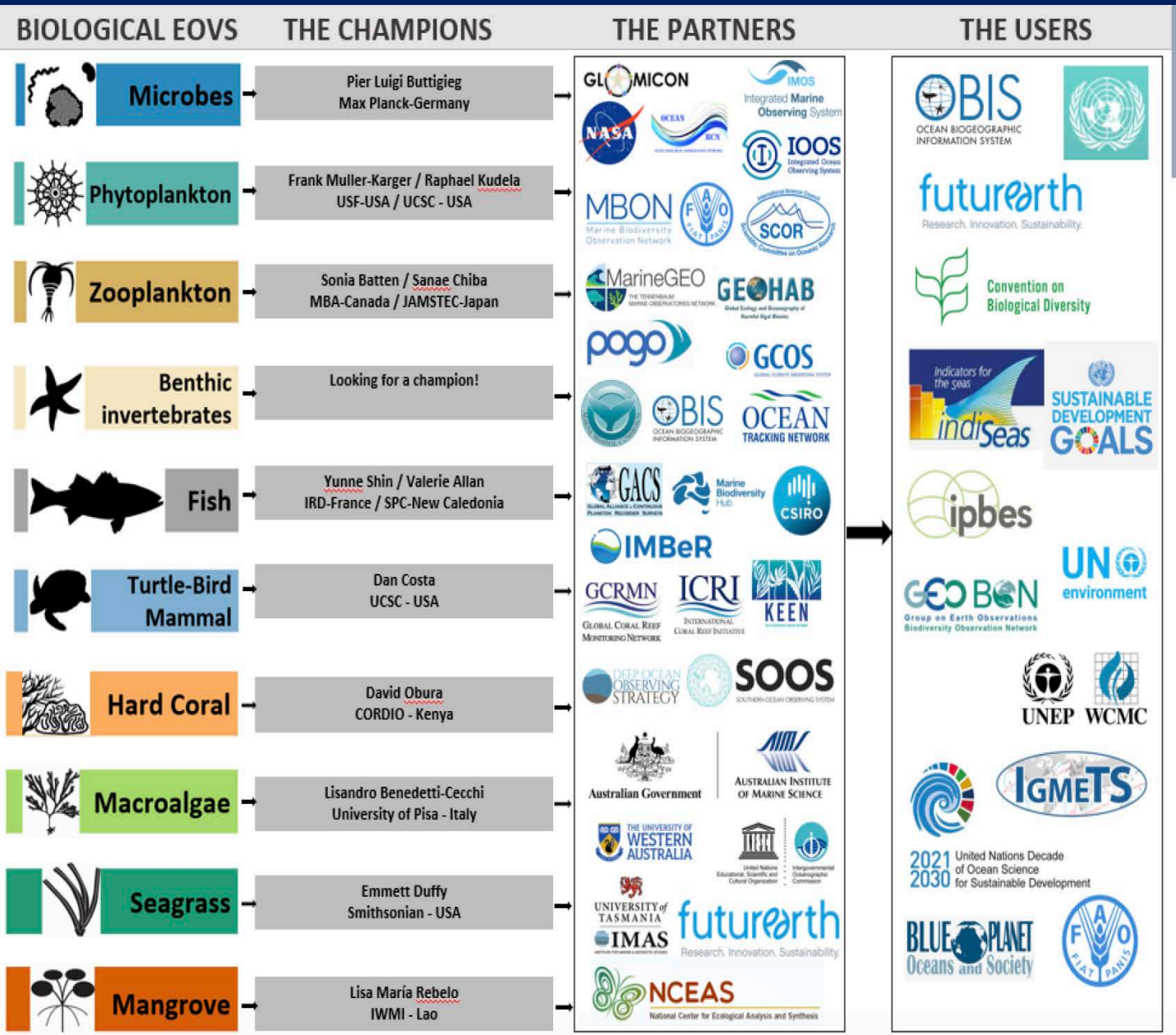
*See the talk of*
*Erin Satterthwaite*

# Challenges to develop global observation network

•• There is a gap between policy (social) need and science efforts.
•• We currently have communities of practice rather than observing networks
•• Most mature observing networks are local/regional (IMOS in Australia, IOOS in the USA)
•• There are many "individual" or local efforts contributing but not much integration
•• Sustainability is not global but on a case to case basis
•• There is heterogeneity in technology, capacity and funding – automatization very limited
•• The best practices consist of a collection of methods rather than one method
•• Some of the "networks" (e.g. International Group for Marine Ecological Time Series -IGMETS) only compile and synthesize past observations; there is no coordinate global plankton observation system
•• There typically has not been a willingness to collaborate in a sustained manner without funding support.

***If you want to go fast, go alone. If you want to go far, go together…."***

# Thank you!




## Partnerships

Science and technology

Policy and sustainability

Business and industry

Civil society and NGOs

Funders and donors