

The Global Ocean Observing System



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Advancing measurements of Biological Essential Ocean Variables (EOVs)

GOOS BioEco Panel

Chairs: Samantha Simmons and Nic Bax

International Project Officer: Patricia Miloslavich

Secretariat: Ward Appeltans

<http://goosocean.org/>



Scientific oversight

Expert Panels

Physics



Biogeochemistry



Biology and Ecosystems



GOOS Expert Panels

Physics – Biogeochemistry – Biology and Ecosystems

Tasks

- Identification of and requirement setting for **Essential Ocean Variables (EOVs)**
- Development of EOV implementation **strategies and coordination of observations**
- Promotion of standards and interoperability of **data and information products**



How to define “Essential”? The Biology and Ecosystems Panel process

Relevant changes

Marine biodiversity, ecosystem function, and their services

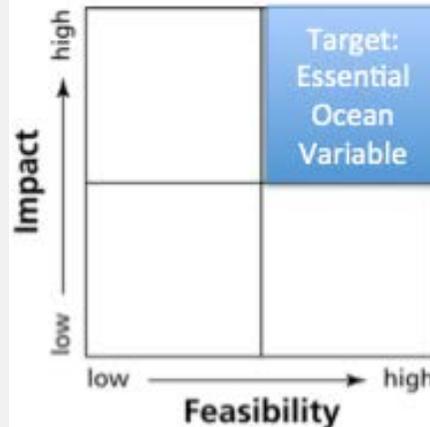


Essential Ocean Variables

Global sustained implementation

Impact

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



Feasibility

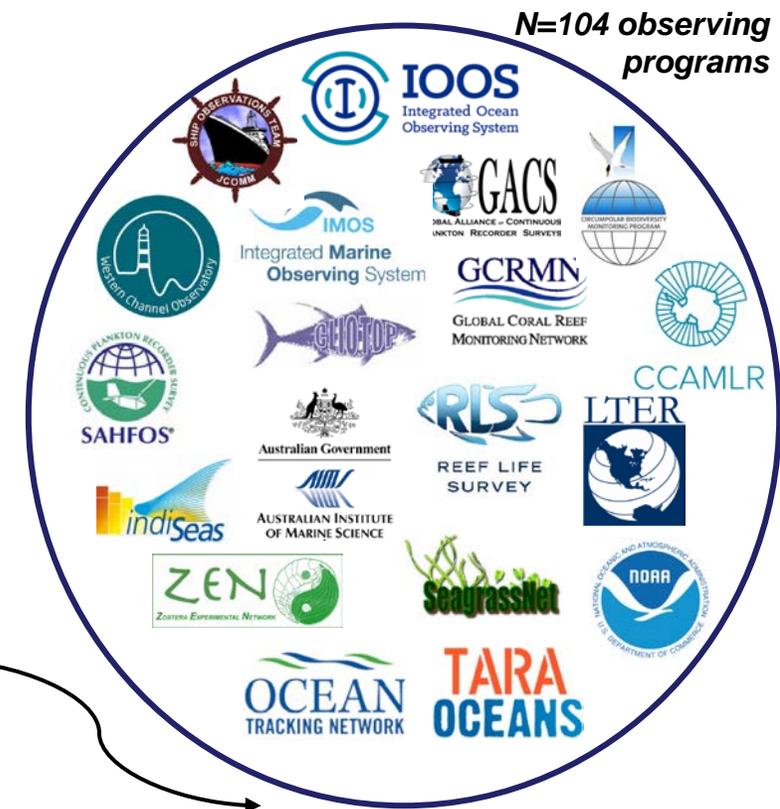
- Scientifically credible
- Technically practical, cost effective and within human capabilities
- Enduring

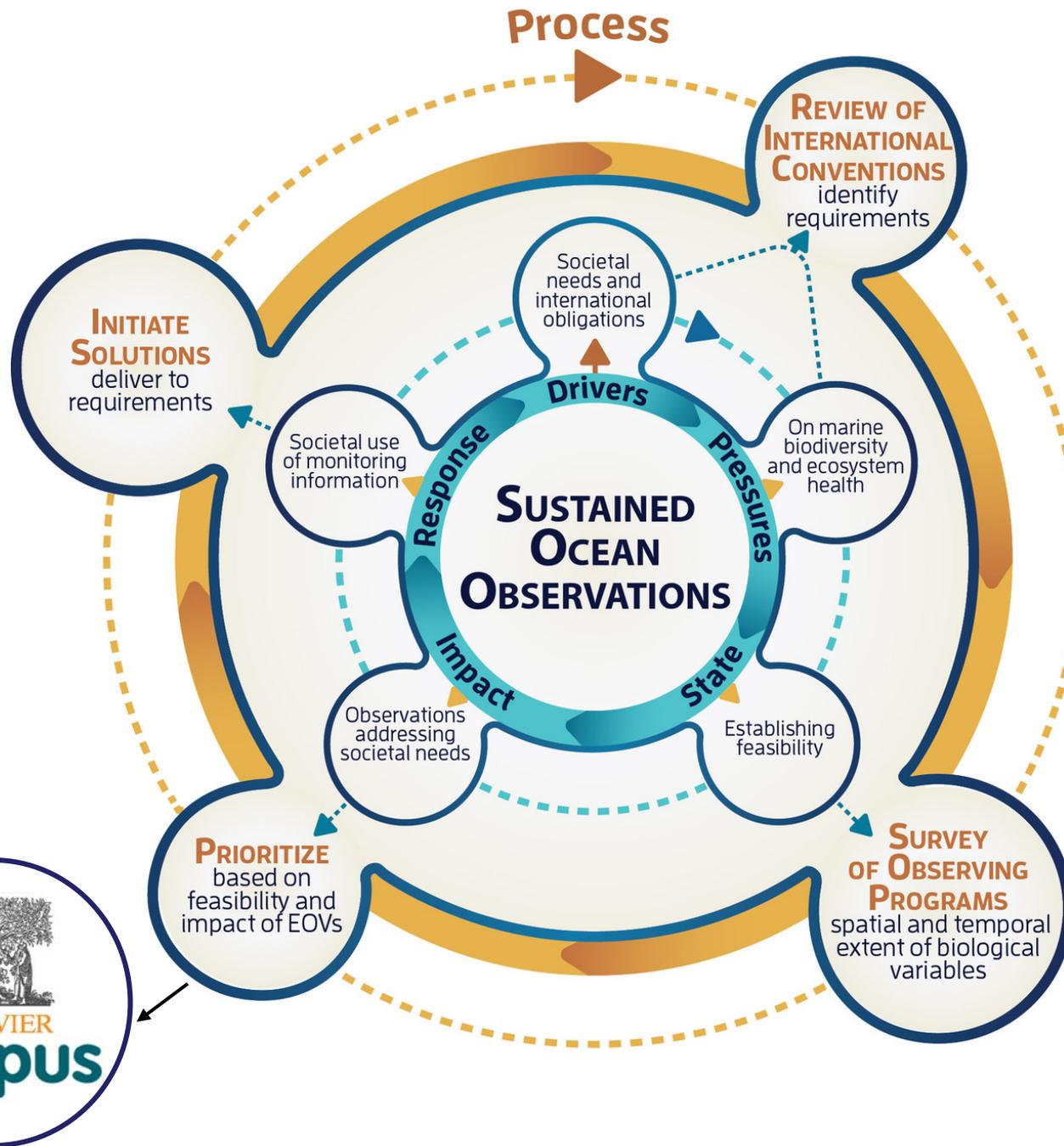
Identifying biological/ecological EOVs

The "DPSIR" model

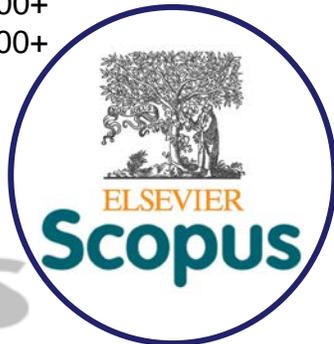






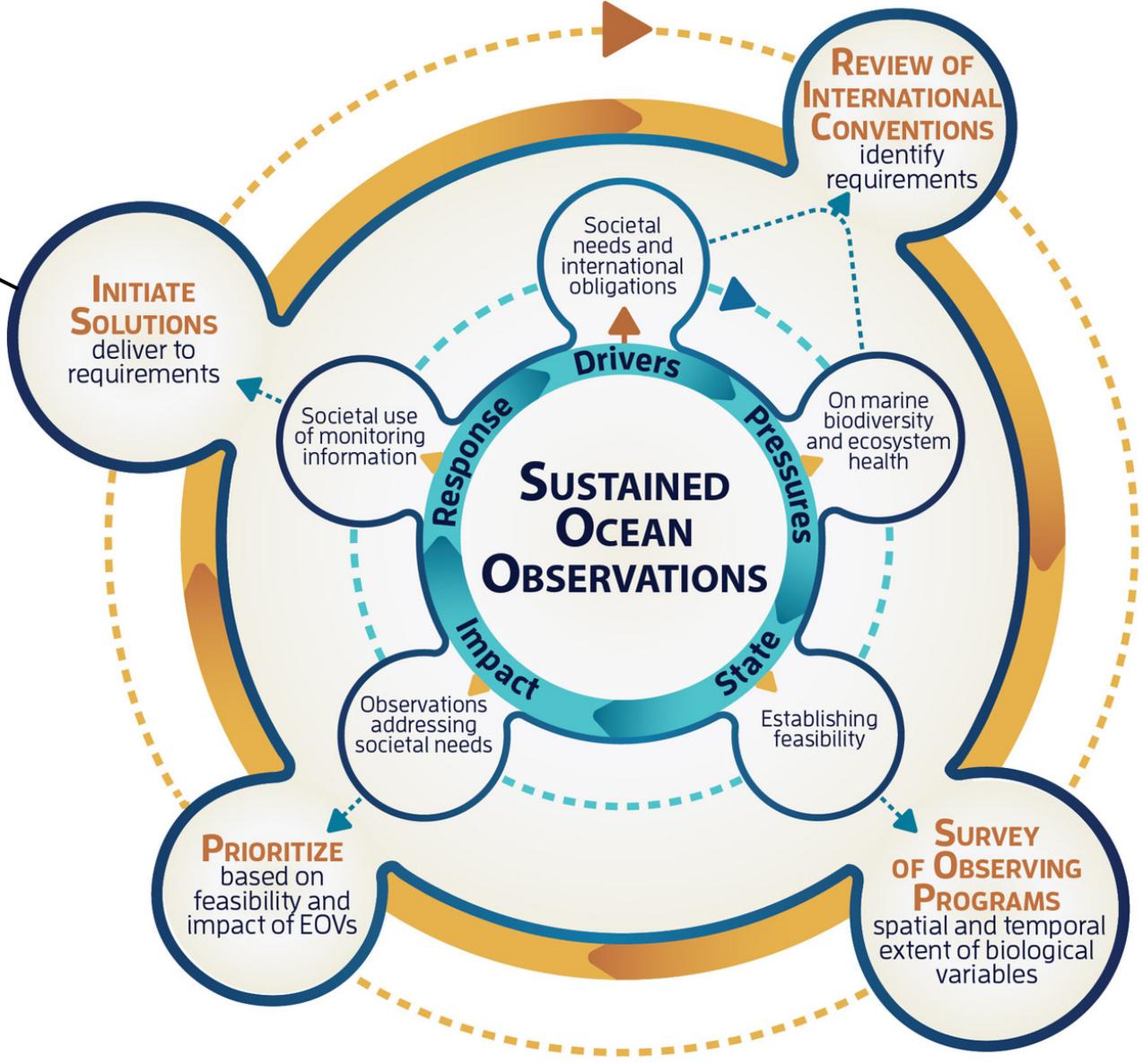


Papers (1995-2016):
Drivers: 12000+
Pressures: 65000+
Variables: 7000+



Process

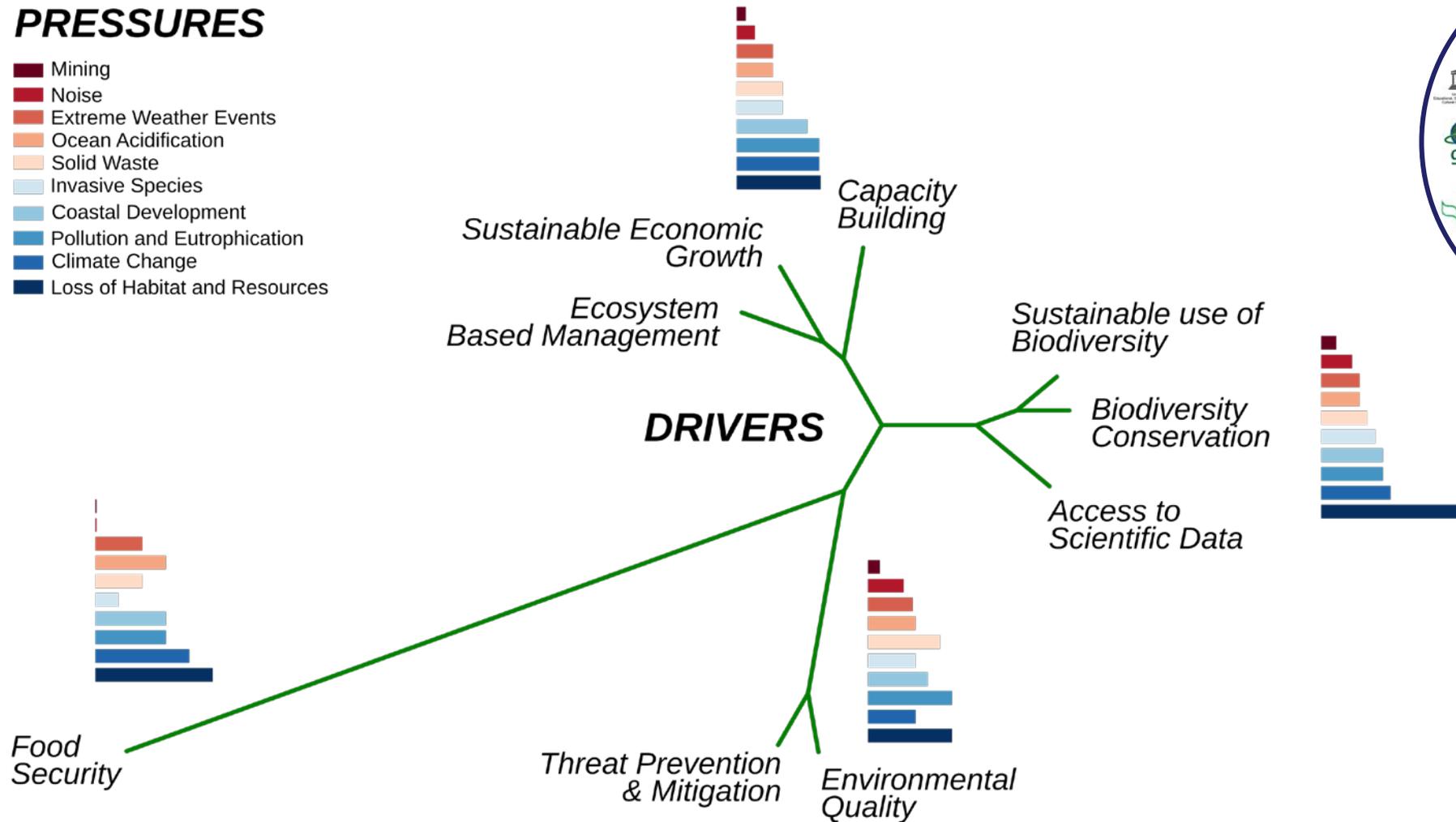
- EOV**
Specifications sheets:
- Sub-variables
 - Derived products
 - Methods
 - Networks
 - Data and information



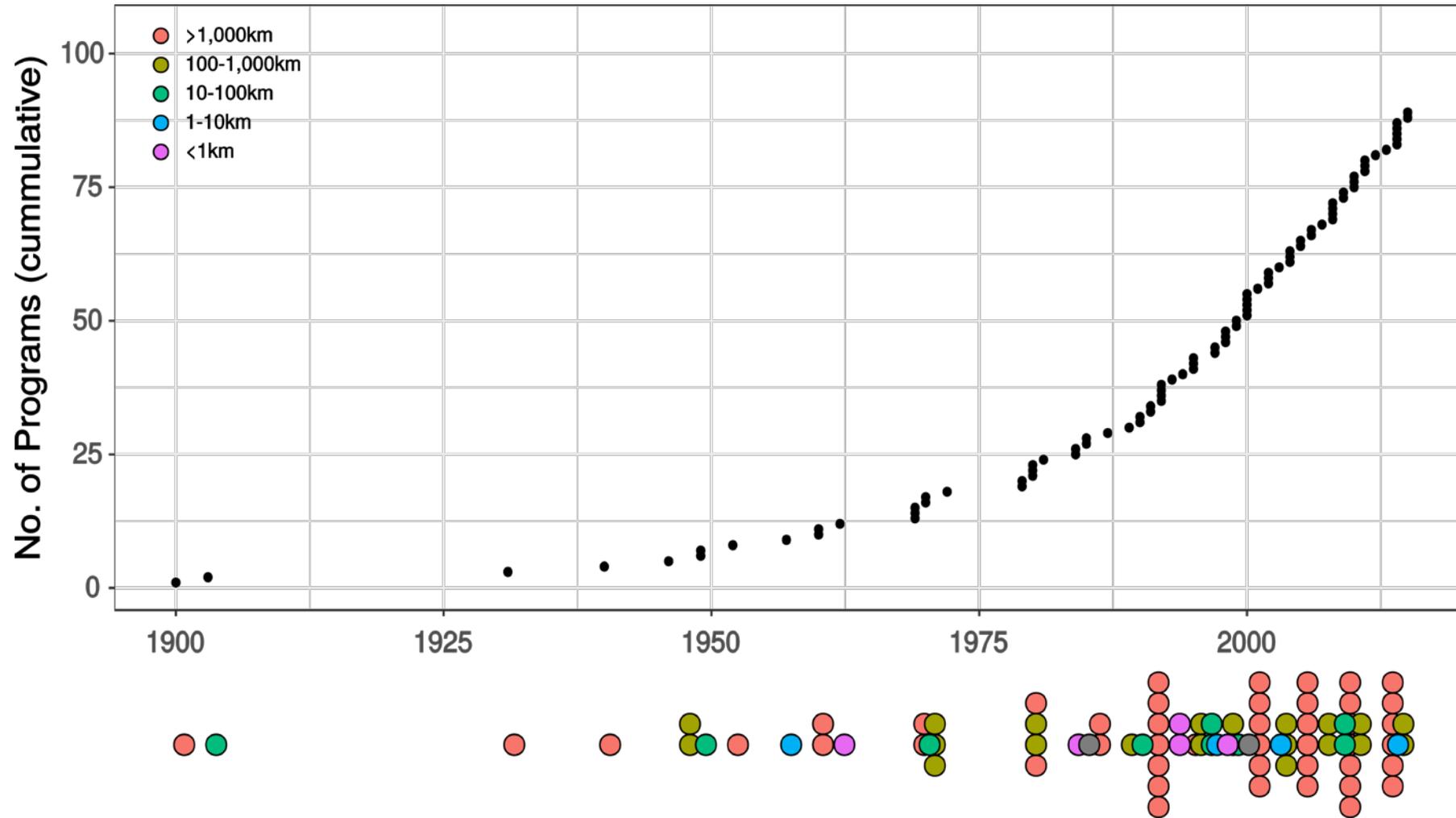
Societal drivers and pressures: analysis from international conventions

PRESSURES

- Mining
- Noise
- Extreme Weather Events
- Ocean Acidification
- Solid Waste
- Invasive Species
- Coastal Development
- Pollution and Eutrophication
- Climate Change
- Loss of Habitat and Resources



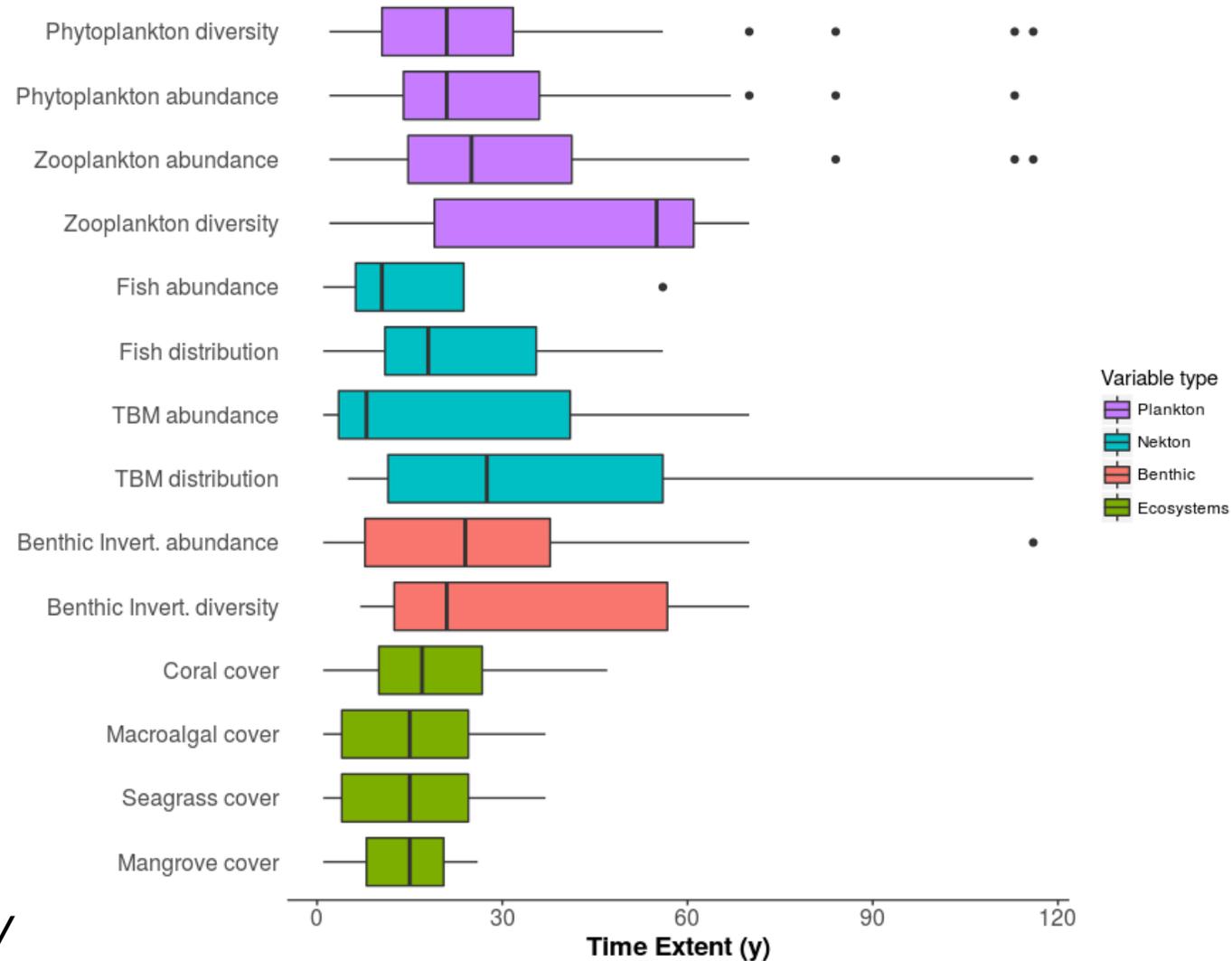
Biological ocean observations: since when?



<http://dev.iobis.org/goos/>



Biological ocean observations: since when and what?



<http://dev.iobis.org/goos/>



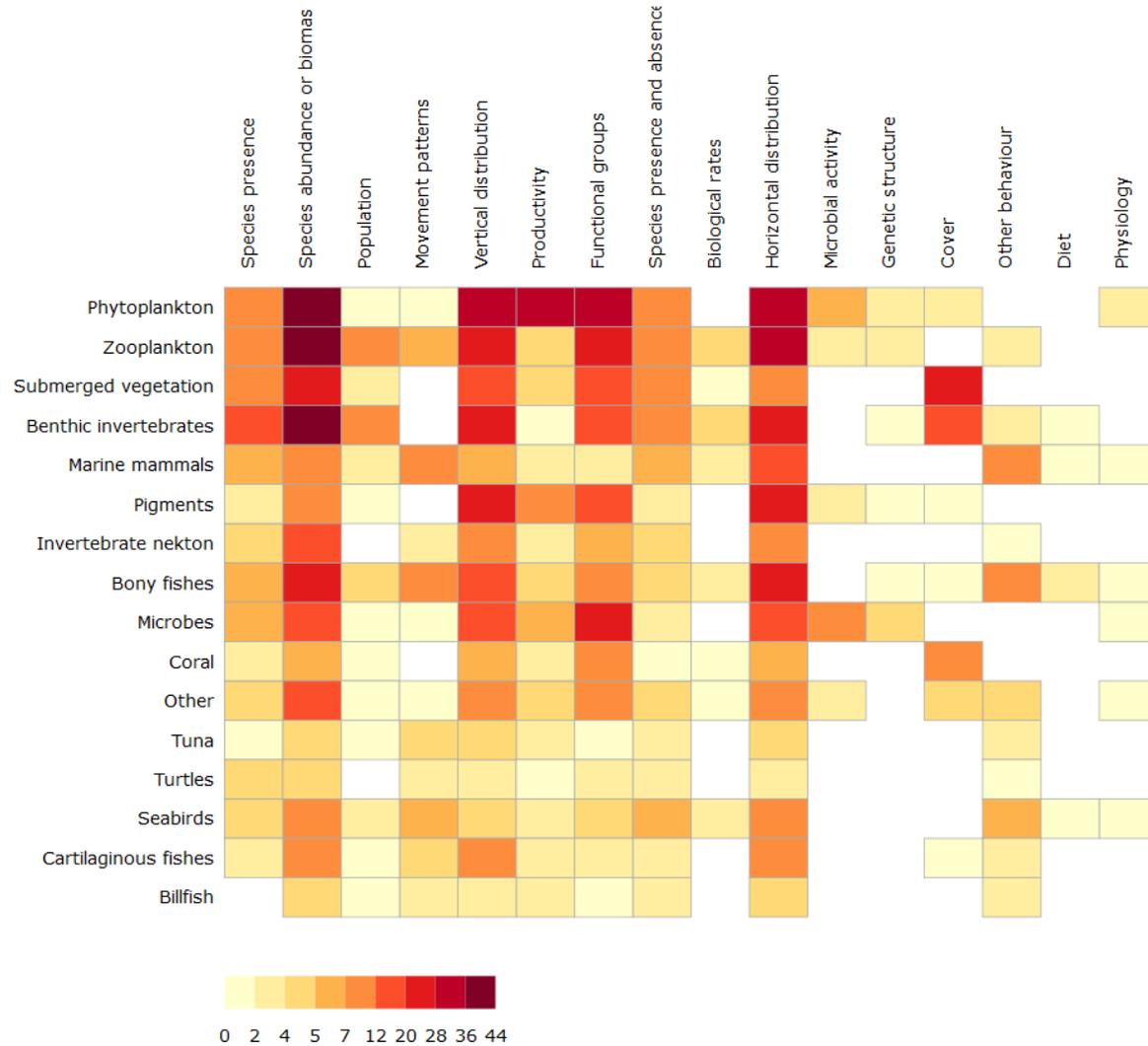
GOOS

Essential Ocean Variables

Gap Analysis

Cluster Analysis

Map



<http://dev.iobis.org/goos/>



“Essential”: How to prioritize?

0	0	0	0	1	3	0	0	0	1	3	4	5	2	2	Turtles
0	0	0	1	2	3	0	0	0	2	2	0	4	3	4	Billfish
0	0	0	1	2	4	0	0	0	2	2	1	5	4	5	Tuna
0	0	1	1	0	0	0	0	12	2	1	3	7	7	6	Coral
0	0	1	2	0	0	0	0	20	4	8	9	21	14	12	Vegetation
0	0	0	1	2	4	0	0	1	2	2	3	12	8	8	Sharks and Rays
0	0	0	0	1	3	0	0	0	2	4	5	16	11	11	Nekton Invertebrates
1	1	2	2	7	7	0	0	0	3	6	5	12	4	9	Seabirds
1	1	2	2	11	10	0	0	0	2	6	6	12	6	13	Mammals
0	0	0	1	0	0	1	3	1	8	2	3	12	25	20	Pigments
0	1	0	1	0	1	5	11	0	6	3	6	16	14	13	Microbes
0	3	0	1	0	1	2	7	3	31	9	10	44	31	30	Phytoplankton
2	1	2	5	8	8	1	0	1	4	5	7	27	17	21	Bony Fish
1	0	5	8	2	0	1	0	13	1	8	14	38	23	22	Benthic Invertebrates
0	0	5	10	3	6	2	2	0	5	9	9	43	27	30	Zooplankton
Diet	Physiology	Biological rates	Population size	Behavior	Movement	Genetic structure	Microbial activity	Cover	Productivity	Species presence/absence	Species presence	Species presence/abundance	Vertical distribution	Horizontal distribution	

1) Level 1 (red)

- Diversity, abundance and distribution of phytoplankton (and pigments), zooplankton, benthic invertebrates, bony fish, microbes, mammals, and submerged vegetation.
- Diversity and abundance birds and sharks
- Cover of submerged vegetation, corals and benthic invertebrates

2) Level 2 (orange)

- Diversity and abundance of mammals and seabirds,
- Distribution of microbes, invertebrate nekton, submerged vegetation, mammals
- Cover of corals and benthic invertebrates
- Behavior and movement of bony fish

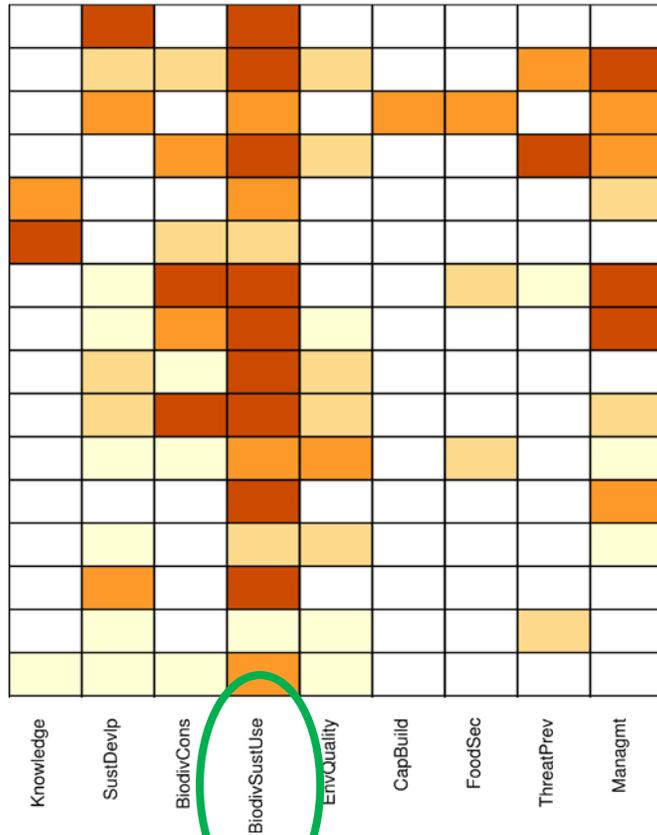
3) Level 3 (yellow)

- Diversity, abundance and distribution of tuna, billfish, coral
- Movement of turtles, billfish, tuna, sharks, invertebrate nekton, seabirds, zooplankton
- Etc...

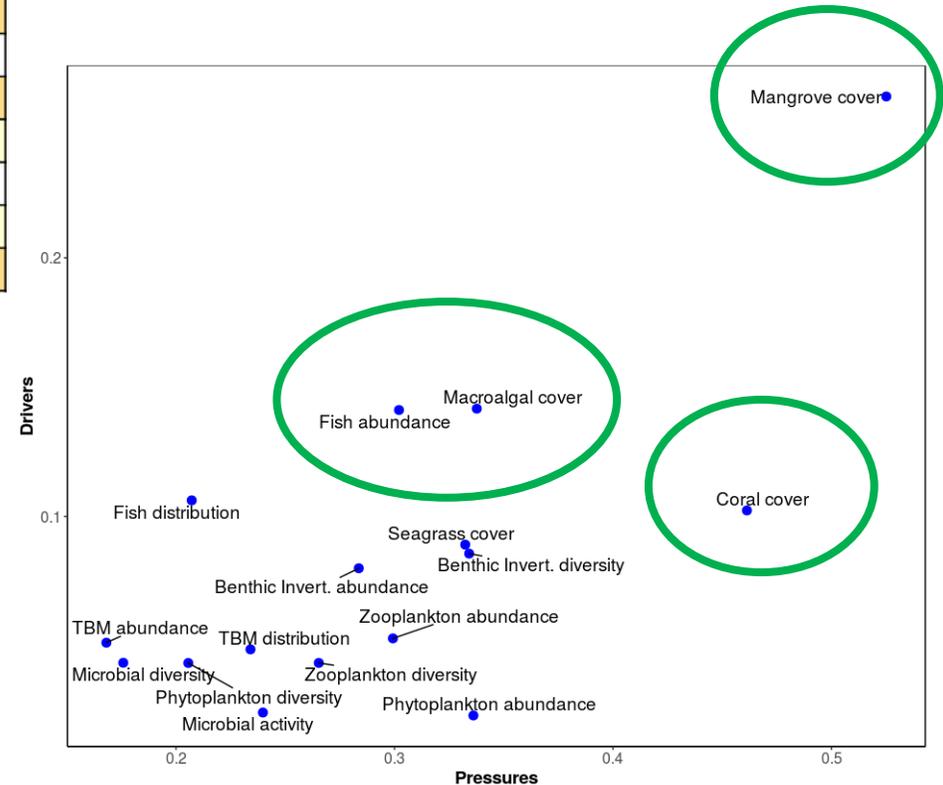
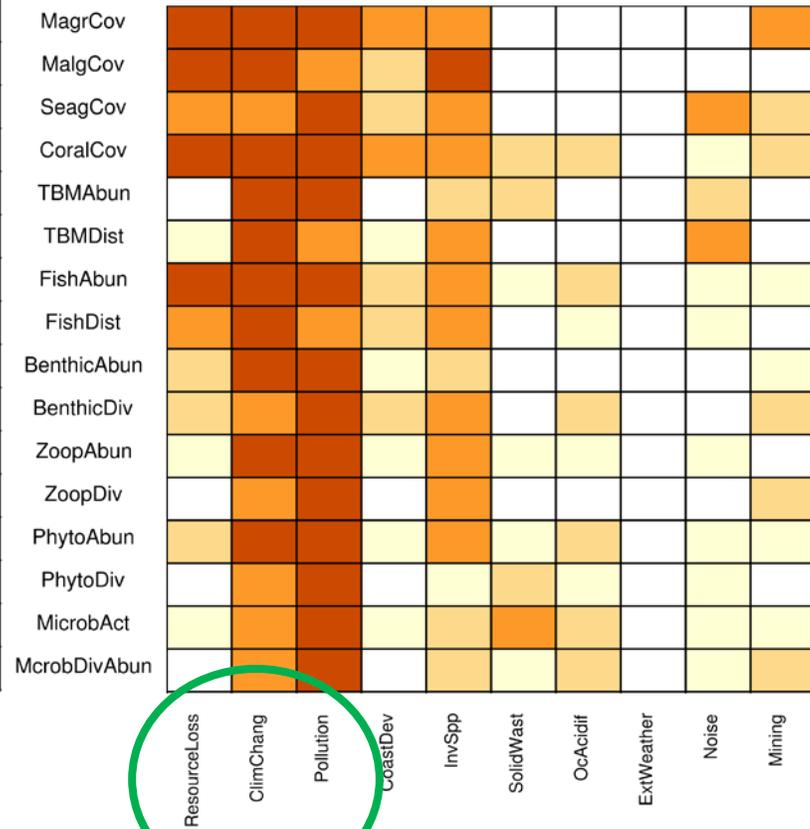


How do biological variables address societal drivers and pressures?

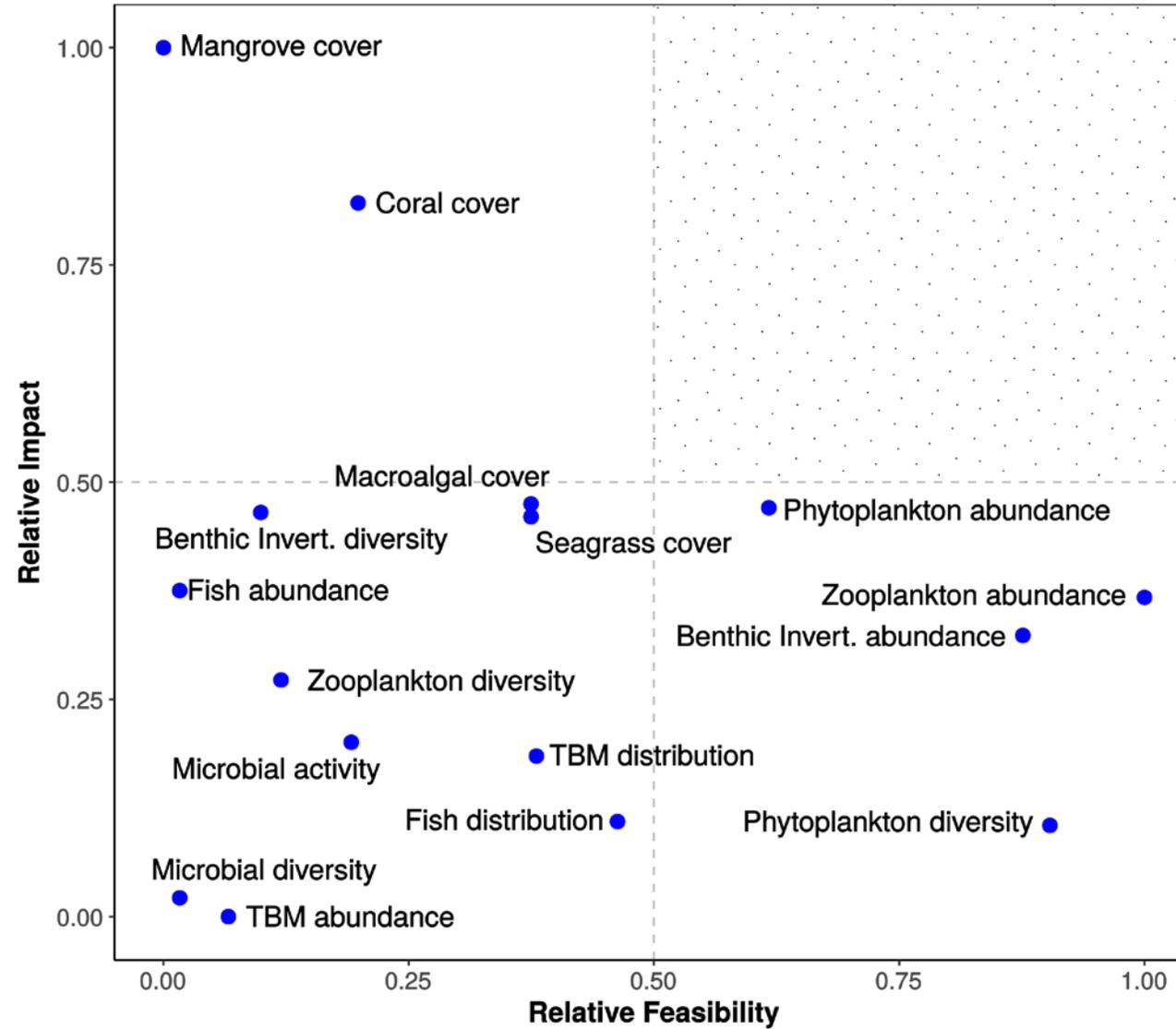
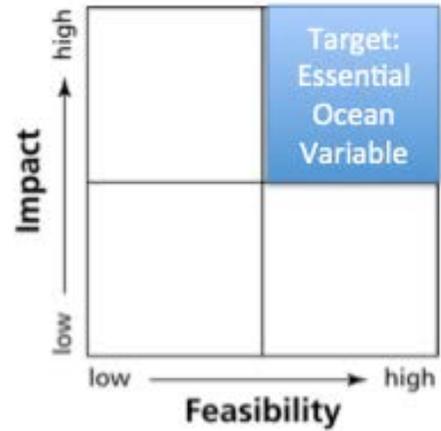
DRIVERS



PRESSURES

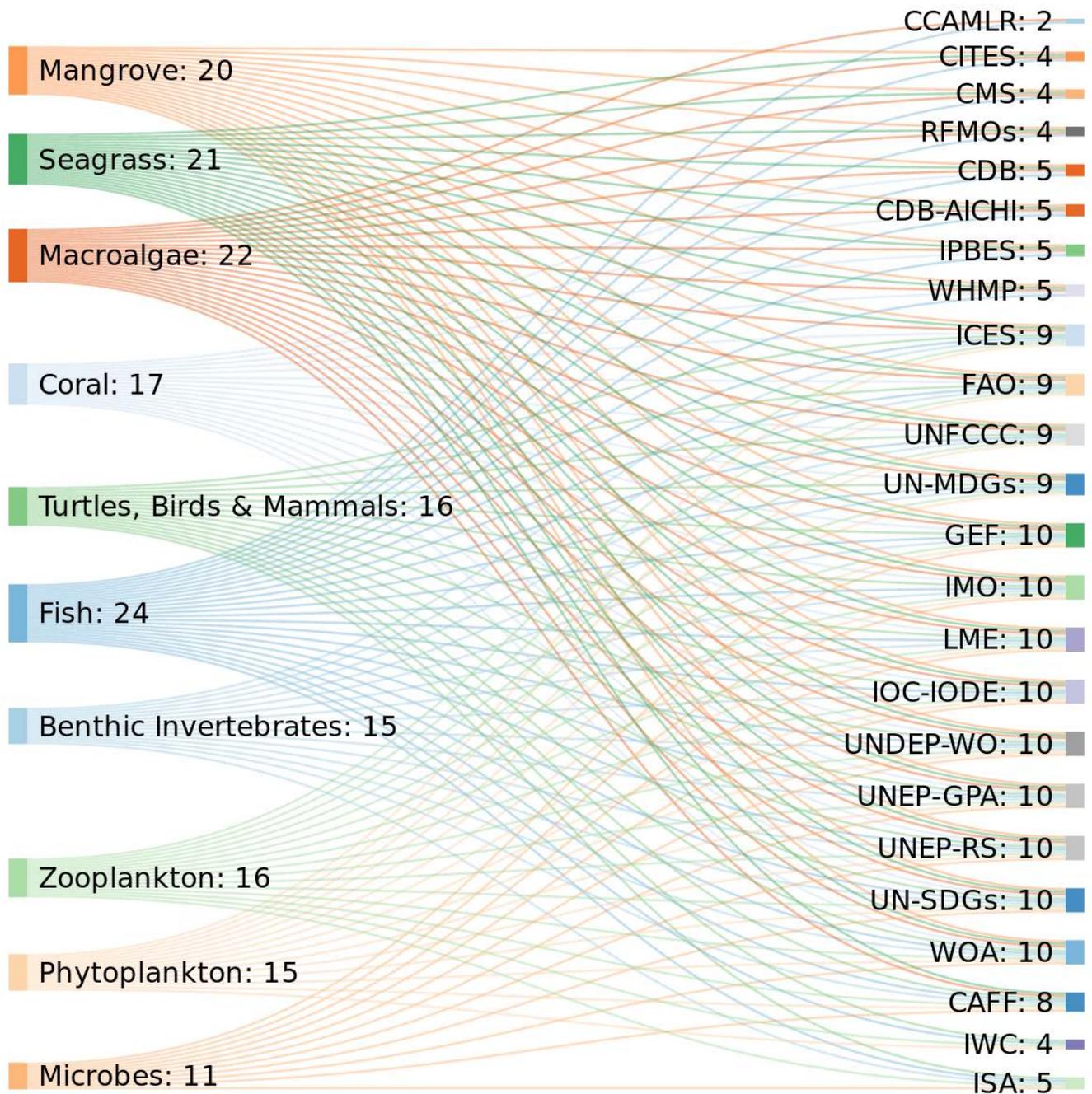


Essential Ocean Variables: based on impact / feasibility



How do these variables address societal pressures?

Back to conventions →



Essential Ocean Variables: all GOOS panels

CONCEPT **PILOT** **MATURE** *also ECV [sometimes aggregated]

Physics

- Sea State*
- Ocean surface vector stress*
- Sea Ice*
- Sea level*
- SST*
- Subsurface temperature*
- Surface currents*
- Subsurface currents*
- SSS*
- Subsurface salinity*
- Heat flux*

Biogeochemistry

- Oxygen*
- Inorganic macro nutrients*
- Carbonate system*
- Transient tracers*
- Suspended particulates
- Nitrous oxide*
- Carbon isotope (^{13}C)
- Dissolved organic carbon
- Ocean colour*

Ocean sound - IQOE

Biology and Ecosystems

- Phytoplankton* diversity and biomass
- Zooplankton* diversity and biomass
- Fish abundance and distribution
- Turtle, bird, mammal abundance and distribution
- Live coral*
- Seagrass cover*
- Mangrove cover*
- Macroalgal canopy*

Emerging:

- Microbe diversity and biomass
- Benthic invertebrate abundance and distribution



Specification sheets at: goosocean.org/eov

Following steps

Validation

- with scientific community (**spec sheets**, papers)
- with policy makers (e.g. CBD)
- with GCOS (Essential Climate Variables)

Specification sheets (8 EOVs)

1. Background
2. Information: sub-variables, derived products
3. Requirements: drivers, questions, phenomena
4. Observing networks: technical specifications
5. Future observing networks
6. Data and information creation
7. Links and references

Peer reviewed specification sheets at:
goosocean.org/eov



Following steps

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Integration

- across networks and across disciplines
(e.g. IMSOO Workshop 2017)
- standardize methods and data collection
(e.g. SCOR Working Groups)

Implementation

- globally coordinated, global coverage
- intercomparable, open access data
- to support international reporting needs

→ **CAPACITY DEVELOPMENT!**
→ **FUNDING!**





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THANK YOU!!!!

*Sonia Batten – SAHFOS - Canada
Lisandro Benedetti-Cechi –UP - Italy
Dave Checkley – Scripps - USA
Sanae Chiba – JAMSTEC - Japan
Emmett Duffy – Smithsonian - USA
Albert Fischer – IOC - France
John Gunn – AIMS - Australia
Eduardo Klein – USB - Venezuela
Raphael Kudela – UCSC - USA
Francis Marsac – IRD - France
Frank Muller-Karger – USF - USA
David Obura – CORDIO – Kenya
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