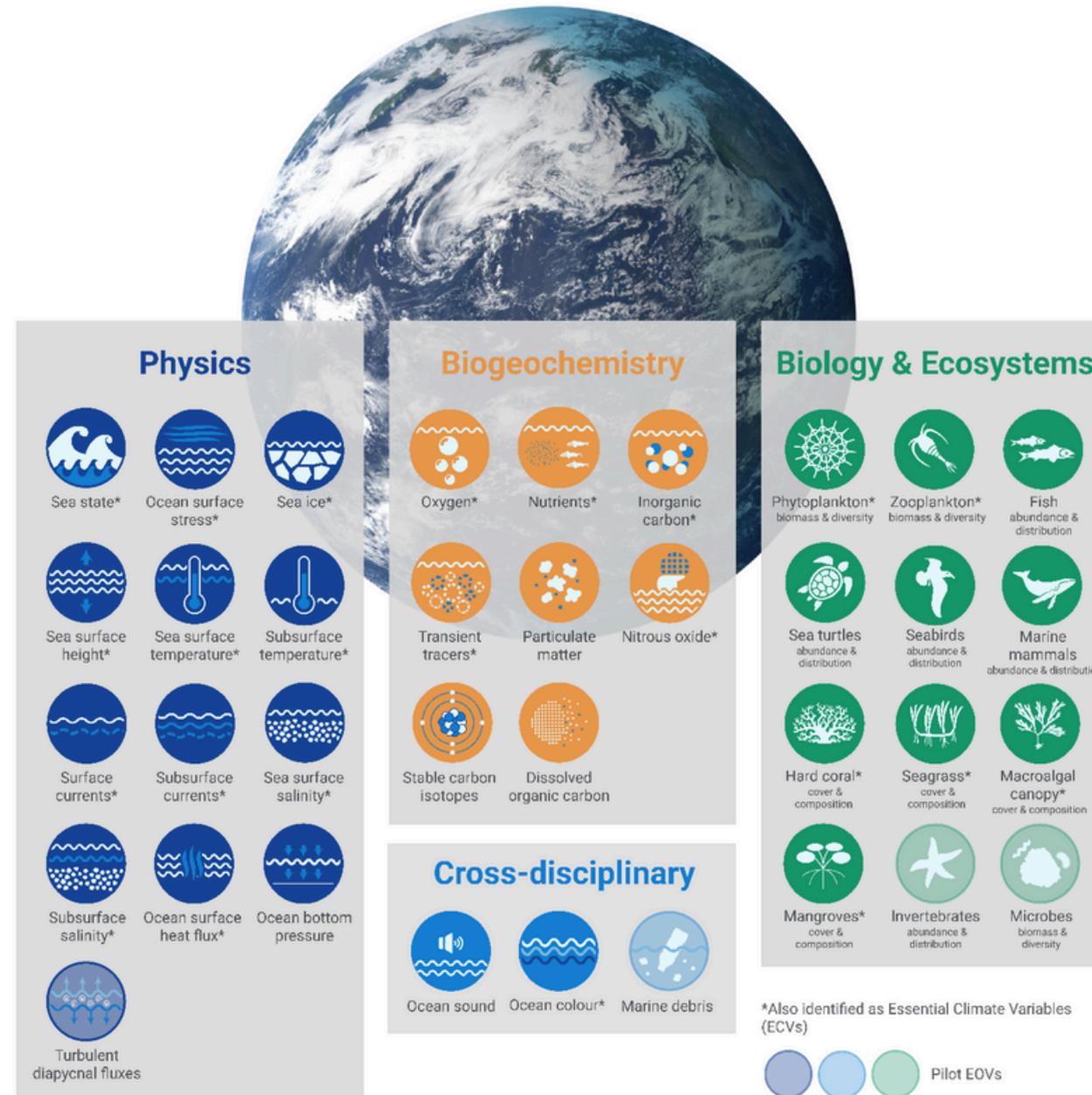


GOOS EOVS Specification Sheet Guide

Anatomy of the EOVS specification sheet and how to use it



Introduction:

The specification sheet serves as a guide for collecting and contributing information on Essential Ocean Variables (EOVs) to the Global Ocean Observing System. It provides examples of how to observe phenomena or processes of interest, specifying the necessary observations and derived products. The sheets offer guidance on the spatial and temporal scales for data collection and detailed data management requirements. They also include information on sensors, technologies, observing approaches, and suggested best practices.

The specification sheets contribute to the standardisation of oceanographic data collection and analysis. By offering a common framework for describing variables and their metadata, they ensure that data from different research groups can be easily combined and compared. This enhances our collective understanding of the ocean and helps address specific societal needs and scientific questions, showcasing the system's capabilities.

While the specification sheets offer a quick guide to collecting observations, it's important to note that they should be complemented by a comprehensive implementation plan for the EOVS, which includes detailed information.

Instructions:

This document offers guidance on how to use the specification sheet template. The accompanying infographic illustrates the structure of the specification sheets and details the information provided in each section, highlighting their role within the ocean observing value chain. Each section is aimed at communicating information to relevant stakeholders. For example, the background and justification provides high level information aimed at policy and decision makers, while the data and metadata section is aimed at data managers.

The guide includes different symbols:

 Click this symbol to access instructions for the information required in the field. Please read the instructions carefully, as some may include useful hyperlinks to additional information and resources.



Click this symbol to view an example of a completed section of the specification sheet.

Essential Ocean Variable (EOV) Specification Sheets

Background & Justification

Defines the societal & scientific drivers, pressures, & applications related to the EOV



Applications

EOV data informs decision making to meet societal requirements

Phenomena to Observe

Provides examples of processes, events, or ocean properties to observe with the EOV based on societal and scientific drivers

Data Management & Information

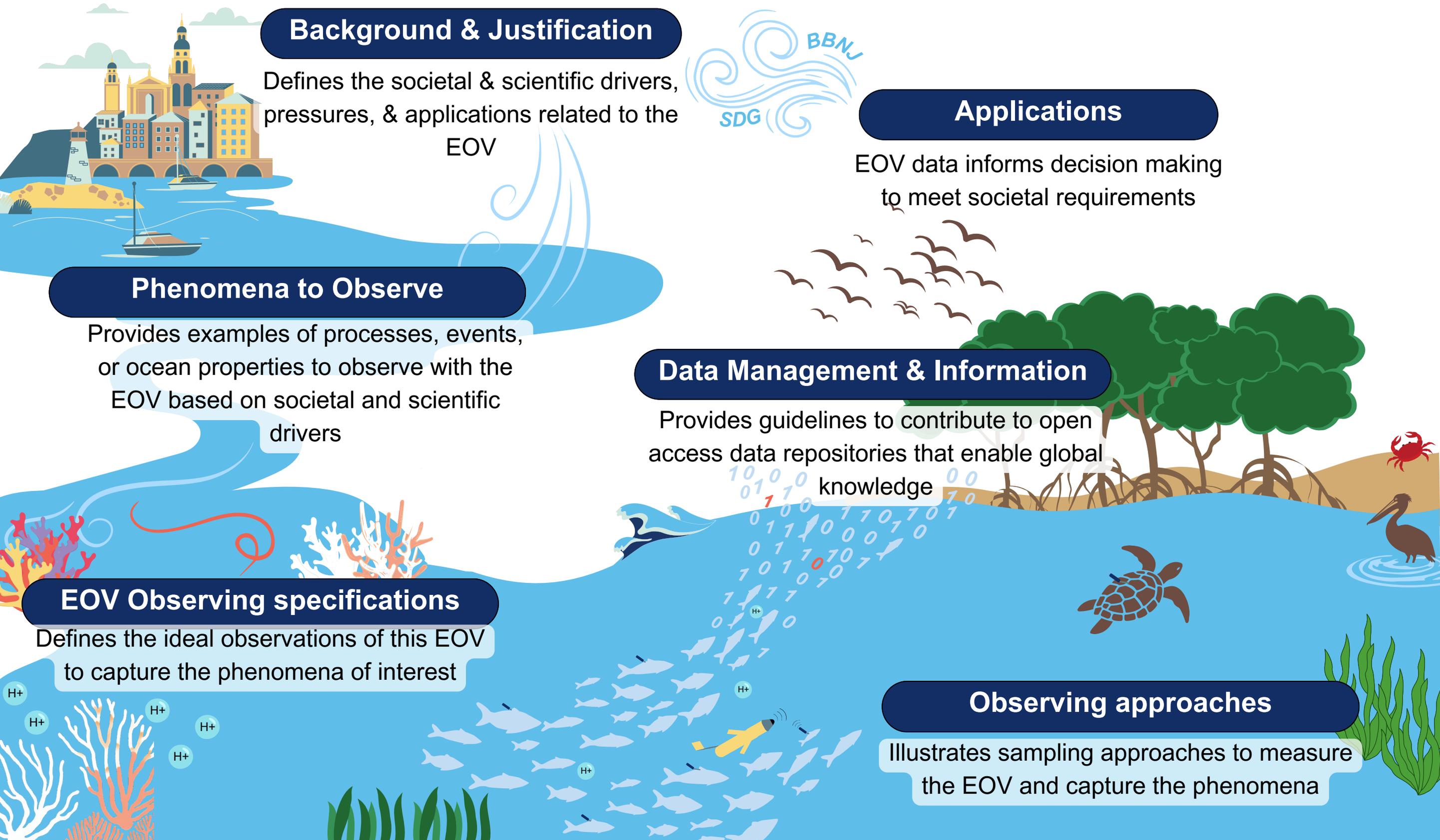
Provides guidelines to contribute to open access data repositories that enable global knowledge

EOV Observing specifications

Defines the ideal observations of this EOV to capture the phenomena of interest

Observing approaches

Illustrates sampling approaches to measure the EOV and capture the phenomena



Essential Ocean Variable Specification Sheet

Document title



Background and justification

Lorem ipsum dolor sit amet, consectetur adipiscing elit. In fringilla bibendum risus sit amet molestie. Quisque rhoncus blandit orci. Nullam viverra erat at euismod venenatis. Quisque porta sodales lectus, a aliquet ex finibus vel. Nam rutrum dignissim pharetra. Proin tellus dui, ultrices in est at, vehicula elementum ante. Nullam iaculis et lacus vitae eleifend. Ut at nisi maximus, euismod risus eu, efficitur tortor. Maecenas posuere tempus ligula, eget molestie lacus euismod ut. Praesent nec mauris at turpis accumsan tincidunt. Integer non pulvinar diam. Nulla facilisi. Interdum et malesuada fames ac ante ipsum primis in faucibus. Pellentesque habitant morbi tristique senectus et netus et malesuada fames ac turpis egestas.

Lorem ipsum dolor sit amet, consectetur adipiscing elit. In fringilla bibendum risus sit amet molestie. Quisque rhoncus blandit orci. Nullam viverra erat at euismod venenatis. Quisque porta sodales lectus, a aliquet ex finibus vel. Nam rutrum dignissim pharetra. Proin tellus dui, ultrices in est at, vehicula elementum ante. Nullam iaculis et lacus vitae eleifend. Ut at nisi maximus, euismod risus eu, efficitur tortor. Maecenas posuere tempus ligula, eget molestie lacus euismod ut. Praesent nec mauris at turpis accumsan tincidunt. Integer non pulvinar diam. Nulla facilisi. Interdum et malesuada fames ac ante ipsum primis in faucibus. Pellentesque habitant morbi tristique senectus et netus et malesuada fames ac turpis egestas.

Integration with Global Observation Frameworks

The Global Climate Observing System (GCOS) developed the Essential Climate Variable (ECV) framework to define necessary observations for monitoring Earth's climate (Bojinski et al., 2014). Some EOVs, including ocean physics, biogeochemistry, and biology/ecosystems variables (GCOS, 2022a; GCOS, 2022b), are also ECVs.

The Essential Biodiversity Variables (EBVs) defined and curated by the Group on Earth Observations Biodiversity Observation Network (GEO BON) complement the GOOS biological and ecosystem (BioEco) EOVs (Muller-Karger et al., 2018; Bax et al., 2019). The EOVs represent the basic observations of a particular parameter or process. EBVs are time series of biodiversity observations across genes, species populations, communities, or ecosystems. Thus, EOVs may be seen as the building blocks for GEO BON. The EOVs can be used to synthesise the EBVs as time series of BioEco EOV sub-variables at one location, or as time series of gridded, mapped, or modelled EOVs (Jetz et al., 2019).

The GOOS Biology and Ecosystems Panel collaborates with the Physics and Climate and Biogeochemistry Panels to advance EOVs, advocating for the need for biological observations, information management, and applications. GOOS, MBON, GEO BON, and OBIS work together to standardise guidelines and data management for EOVs, EBVs, and ECVs.

Current observing networks and coordination

Diverse networks and communities are collecting observations of biology and ecosystems EOVs at different scales and in different regions. An initial baseline survey conducted in 2019/20 identified 203 active, long-term (>5 years) observing programs systematically sampling marine life. These programs spanned about 7% of the ocean surface area, mostly concentrated in coastal regions of the United States, Canada, Europe, and Australia (Satterthwaite et al 2021). This information can be found in the GOOS BioEco Metadata Portal, which is continually updated. To consult the latest information, please visit: <https://bioeco.goosocean.org>

Contributes to:

1. EOV information

ESSENTIAL OCEAN VARIABLE (EOV)	
DEFINITION	
EOV SUB-VARIABLES	
SUPPORTING VARIABLES	Environmental
	EOV related
DERIVED PRODUCTS	

2. Phenomena to observe - what we want to observe with this EOVS

This section presents an example of priority phenomena for GOOS that can be (partly) characterised by this EOVS's sub-variables. This list is not exhaustive but serves to provide general suggestions on how observation efforts can structure their planning and implementation.

The GOOS application area(s) the phenomena are relevant for are depicted as follows: Climate , ocean health , operational services 

PHENOMENA TO OBSERVE		Phenomena #1	Phenomena #2	Phenomena #3
PHENOMENA EXTENT	HORIZONTAL			
	VERTICAL			
	TEMPORAL			
RESOLUTION TO OBSERVE PHENOMENA	HORIZONTAL			
	VERTICAL			
	TEMPORAL			
SIGNAL TO CAPTURE				
SUB-VARIABLES NEEDED TO MEASURE				
SUPPORTING VARIABLES NEEDED				

3. GOOS Observing Specifications or Requirements

This section outlines ideal measurements for an optimal observing system for this Essential Ocean Variable (EOV). It offers guidance on creating a long-term system to observe key phenomena related to the EOV. These values are not mandatory, and no single system is expected to meet all requirements. Instead, the combined efforts of various observing systems should aim to meet these goals. Observations at different scales are also valuable contributions to global ocean observation if shared openly.

EOV								
PHENOMENA								
EOV SUB-VARIABLE					DEFINITION			
	Resolution			Timeliness	Uncertainty Measurement	Stability	Sampling approach	References
	Spatial Horizontal	Spatial Vertical	Temporal					
IDEAL								
DESIRABLE								
MINIMUM								

4. Observing approach, platforms and technologies

This table provides examples of approaches and technologies used to collect this EOV to help observe priority phenomena

APPROACH / PLATFORM	APPROACH #1	APPROACH #2	APPROACH #3
EOV SUB-VARIABLE(S) MEASURED			
TECHNIQUE / SENSOR TYPE			
SUGGESTED METHODS AND BEST PRACTICES			
SUPPORTING VARIABLES MEASURED			

APPROACH / PLATFORM	APPROACH #4	APPROACH #5	APPROACH #6
EOV SUB-VARIABLE(S) MEASURED			
TECHNIQUE / SENSOR TYPE			
SUGGESTED METHODS AND BEST PRACTICES			
SUPPORTING VARIABLES MEASURED			

5. Data and information management

Access to data and information is at the core of an ocean observing system. This section provides essential information on how to contribute data to the GOOS

This section needs to include information that is standard across all EOVS on:

- Where to deposit your data (OBIS for BioEco, GCOS and IOCCP to define where)
- Where to add your meta-data (BioEco Portal for BioEco/ OceanOPS for the others?)
- Instructions for submission and data ingest (standards and conventions)
- Data QC
- Data exchange conventions and standards

Individual EOVS to include information on

- Data products
- Data schemas

References

Background information

Bax, N. et al. 2019. A response to scientific and societal needs for marine biological observations. *Frontiers in Marine Science*. <https://doi.org/10.3389/fmars.2019.00395>

Bojinski, S. et al. 2014. The concept of essential climate variables in support of climate research, applications, and policy. *Bull. Amer. Meteor. Soc.*, 95, 1431–1443, doi:<https://doi.org/10.1175/BAMS-D-13-00047.1>.

GCOS, 2022a. The 2022 GCOS Implementation Plan (GCOS-244). World Meteorological Organization, Geneva. <https://library.wmo.int/records/item/58104-the-2022-gcos-implementation-plan-gcos-244>.

GCOS, 2022b. The 2022 GCOS ECVs Requirements (GCOS 245). World Meteorological Organization, Geneva. <https://library.wmo.int/records/item/58111-the-2022-gcos-ecvs-requirements-gcos-245>

Jetz, W. et al. 2019. Essential biodiversity variables for mapping and monitoring species populations. *Nature Ecology & Evolution*. 3, p. 539–551. Doi: 10.1038/s41559-019-0826-1.

Miloslavich, P et al. 2018. Essential Ocean Variables for sustained observations of marine biodiversity and ecosystems. *Global Change Biology*. Volume 24, Issue 6. Pages 2416-2433. <http://dx.doi.org/10.1111/gcb.14108>.

Muller-Karger, F. 2018. Advancing Marine Biological Observations and Data Requirements of the Complementary Essential Ocean Variables (EOVs) and Essential Biodiversity Variables (EBVs) Frameworks. *Frontiers in Marine Science*. <https://doi.org/10.3389/fmars.2018.00211>.

Satterthwaite et al. 2021. Establishing the Foundation for the Global Observing System for Marine Life. *Front. Mar. Sci.* 8. <https://doi.org/10.3389/fmars.2021.737416>

Guides, best practices and methods

Standards and reference materials

Integrated EOV products and visualisations

Contributors

Leading authors

[Insert text]

Contributing authors

[Insert text]

Acronyms and Abbreviations

CBD: Convention on Biological Diversity

EBV: Essential Biodiversity Variables

ECV: Essential Climate Variables

EOV: Essential Ocean Variables

GCOS: Global Climate Observing System

GEO BON: Group on Earth Observations Biodiversity Observation Network

GOOS: Global Ocean Observing System

IOCCP: International Ocean Carbon Coordination Project

MBON: Marine Biodiversity Observation Network

OBIS: Ocean Biodiversity Information System

ODIS: Ocean Data Information System

OCG: Observation Coordination Group

OOPC: Ocean Observations Physics and Climate Panel

SDG: Sustainable Development Goals

ABCD: Lorem Ipsum Dolor Sit

EFG: Lorem ipsum dolor sit amet consectetur

ABCD: Lorem Ipsum Dolor Sit

EFG: Lorem ipsum dolor sit amet consectetur

ABCD: Lorem Ipsum Dolor Sit

EFG: Lorem ipsum dolor sit amet consectetur

ABCD: Lorem Ipsum Dolor Sit

EFG: Lorem ipsum dolor sit amet consectetur

ABCD: Lorem Ipsum Dolor Sit

EFG: Lorem ipsum dolor sit amet consectetur

ABCD: Lorem Ipsum Dolor Sit

EFG: Lorem ipsum dolor sit amet consectetur

ABCD: Lorem Ipsum Dolor Sit

EFG: Lorem ipsum dolor sit amet consectetur

ABCD: Lorem Ipsum Dolor Sit

EFG: Lorem ipsum dolor sit amet consecteteu

Glossary of terms

Derived products: outputs calculated from the EOV and sub-variables, often in combination with the supporting variables, that contribute to evaluating change in phenomena. For example, evaporation can be determined from sea surface temperature measurements; air-sea fluxes of CO₂ can be derived from inorganic carbon EOV; fish stock productivity can be determined from fish abundance.

Indicators: An indicator can be defined as a 'measure based on verifiable data that conveys information about more than just itself'. This means that indicators are purpose dependent - the interpretation or meaning given to the data depends on the purpose or issue of concern. (BIP definition)

Measurement Uncertainty: the parameter, associated with the result of a measurement, that characterizes the dispersion of the values that could reasonably be attributed to the measurand (GUM)¹. It includes all contributions to the uncertainty, expressed in units of 2 standard deviations, unless stated otherwise

Phenomena: properties (e.g., of a species such as distribution), processes (e.g., of the ocean such as surface ocean heat flux), or events (e.g., such as algal blooms) that have distinct spatial and temporal scales, and when observed, inform evaluations of ocean state and ocean change

Stability: The change in bias over time. Stability is quoted per decade.

Supporting variables: other measurements that are useful to provide scale or context to the sub-variables of the EOV (e.g., pressure measurements to provide information on the depth at which subsurface currents are estimated, sea temperature to understand dissolved inorganic carbon, water turbidity to support estimations of hard coral cover).

Sub-variables: key measurements that are used to estimate the EOV (e.g., counts of individuals to provide an estimate of species abundance (such as fish, mammals, seabirds or turtles), partial pressure of carbon dioxide (pCO₂) to estimate ocean inorganic carbon, or wave height to estimate sea state).

Timeliness: The time expectation for availability of data measured from the data acquisition time.

Lorem Ipsum: Lorem ipsum dolor sit amet consectetur

Lorem Ipsum: Lorem ipsum dolor sit amet consectetur

Lorem Ipsum: Lorem ipsum dolor sit amet, consectetur adipiscing elit. In fringilla bibendum risus sit amet molestie. Quisque rhoncus blandit orci. Nullam viverra erat at euismod venenatis. Quisque porta sodales lectus.**Lorem Ipsum:** Lorem ipsum dolor sit amet consectetur

Lorem Ipsum: Lorem ipsum dolor sit amet, consectetur adipiscing elit. In fringilla bibendum risus sit amet molestie. Quisque rhoncus blandit orci. Nullam viverra erat at euismod venenatis. Quisque porta sodales lectus.

Lorem Ipsum: Lorem ipsum dolor sit amet consectetur

Lorem Ipsum: Lorem ipsum dolor sit amet, consectetur adipiscing elit. In fringilla bibendum risus sit amet molestie. Quisque rhoncus blandit orci. Nullam viverra erat at euismod venenatis. Quisque porta sodales lectus.

Appendix - Additional information

A1. Applications

This table provides examples of applications of this EOV, including contribution to other essential variable frameworks, multilateral environmental agreements, contribution to indicators and GOOS applications

EOV		
CORRESPONDING ESSENTIAL VARIABLES	ECV	
	EBV	
GLOBAL INDICATORS EOVS CAN CONTRIBUTE	SDG	
	CBD	
	CLIMATE	
	OTHER	
GOOS APPLICATIONS		

A2. Readiness level assessment

Essential Ocean Variable Specification Sheet

Sponsored by:



The development of this guide was funded by the European Union under Grant Agreement number 101136748. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or the European Research Agency (REA). Neither the European Union nor the granting authority can be held responsible for them.

