



Deep Sea Life and Habitats

The Deep Ocean Observing Strategy (DOOS) is being developed under the auspices of the Global Ocean Observing System (GOOS), and will embrace observations below 200 m.

As a GOOS Project, DOOS will be aligned with the Framework for Ocean Observing (Framework). In 2012 the GOOS adopted the Framework as a guide for GOOS activities and alignment. The purpose of the Framework is to assist in the development and delivery of an integrated ocean observing system fit for many purposes.

The Framework describes a clearly defined structure that allows ocean observing providers and users to plug-in at various points within the system. It traces a path from Inputs (requirements or EOVs) to Processes (observations), to Outputs (data and products). To maintain an ocean observing system that is fit-for-purpose, the outputs must properly address the issues that drove the original requirements. This creates a constant feedback loop such that requirements are always science driven and informed by societal needs; and that EOVs are part of the system that responds iteratively to this evolving set of science and societal needs.

A focus on measuring EOVs provides a way for all stakeholders to speak a common language fostering collaboration in this highly voluntary system. EOVs are identified based on how feasible they are to observe and their level of scientific or societal impact. Targeting investments based on EOVs, in conjunction with the evaluation and encouragement of improved readiness levels for sustained observations, ensures a path for research and innovation to shape the evolution of GOOS.

Deep Sea Life & Habitats: Biology & Ecosystem EOVs

The Biology and Ecosystems Panel of GOOS adopted to identify Biology and Ecosystem EOVs was based on a Driver-Pressure-State-Impact-Response (DPSIR) model.

Given the complexity of marine ecosystems and the challenge of selecting key variables that may properly address its changes, the process consisted of:

- Identifying the scientific and societal needs that require sustained biological and ecological oceanographic observations,
- Evaluating the existing time series and identifying information gaps,
- Studying the impact and feasibility of the variables being currently measured and how their monitoring would address societal needs



Societal drivers and pressures were extracted from the mission and mandates of 24 relevant international bodies and conventions. Drivers were clustered around four major groups:

- Sustainable use of biodiversity, biodiversity conservation, and knowledge, Environmental quality and threat prevention and mitigation
- Capacity building, sustainable economic growth, and ecosystem based management
- Food security

Major pressures identified were habitat loss, climate change, pollution and eutrophication, coastal development, invasive species, solid wastes, ocean acidification, extreme weather events, noise, and mining.

The feasibility, given by the current state of large-scale ocean biological observations was evaluated through an on-line survey which provided information on the temporal and spatial scale of observations of different biological variables being carried out for all marine taxonomic groups and marine ecosystems by more than 100 observing programs.

The impact of the variables was inferred through a literature search determining how many publications address each of the drivers and pressures for each of the variables in the marine environment.

GOOS Biology and Ecosystem EOVs

Based on the above analysis, the candidate proposed biological EOVs are:

- Phytoplankton biomass and diversity
- Zooplankton biomass and diversity
- Fish abundance and distribution
- Marine turtles, birds, and mammal abundance and distribution
- Live coral
- Seagrass cover
- Macroalgal cover
- Mangrove cover

The GOOS Biology and Ecosystem Panel is engaged in an ongoing process to develop, with the community a consensus that leads to the global implementation of the proposed GOOS EOVs.



DOOS Biology & Ecosystem EOVs

During the 2016 DOOS Workshop a discussion was held regarding the DOOS Biology EOVs presented in the DOOS Consultative Draft. Many were found to be conceptual in nature and not representative of the underlying EOVs they sought to address.

In response, many of the biologists present drafted a list of potential EOVs and an identification of those that are critical (i.e. primary). The list below reflects this discussion.

Prospective Biological EOVs

- Species specific density/counts (invertebrates and fish – water column and benthos)
- Size-specific body size (mass); specific biomass
- Microbial biomass (diversity/activity)
- Oxygen consumption: O₂ sediment profile / Sediment Community Oxygen Consumption (SCOC)
- Eddy correlation fluxes
- Biohony (animal sound)
- Anthrophony (human sound)
- Light (different wave length)
- Quality of organic matter C/N
- Bioturbation Pb-210
- Cold water coral coverage
- Particulate flux (labile and refractory)
- Connectivity of species (life history groupings) (FST)
- Cover of living habitats (e.g. chemosynthetic ecosystems such as seeps, vents, coral and sponges grounds...)

Supporting

- Bottom currents (Physics)
- Temperature (Physics)
- Nitrogen/phosphorus efflux/influx (Biogeochemistry)
- Chemical profiles of metals such as dissolved Mn (manganese) or particulate iron (Biogeochemistry)
- Eh in water
- CH₄ in water and sediment profile (Biogeochemistry)
- Substrate (soft/hard, composition)
- Sediment geochemistry
- Ocean sound – (frequency, amplitude – time series)
- Geophony (earth sounds)



Next Steps

A DOOS biology, working group will be formed to further refine these, integrate these with the GOOS biology EOVs in the Consultative Draft, and develop associated specifications sheets.