GOOS Biodiversity Strategy 2026-2035

GOAL

To enable and evolve an integrated and fit-for-purpose framework for global ocean observing that meets national, regional and global needs for information on marine biodiversity, encompassing the diversity of marine life and the ecosystems that this supports.

RATIONALE & PURPOSE

Marine biodiversity is fundamental to sustaining healthy lives and livelihoods worldwide. Through the combined activity of thousands of marine species, the oceans produce approximately half of the Earth's oxygen and absorb around one quarter of human-generated carbon dioxide emissions, thereby playing a critical role in climate regulation. Beyond these essential functions, marine ecosystems underpin economies and support hundreds of millions of livelihoods. They provide a wide range of critical ecosystem services, including food security for billions of people, coastal protection from storms and erosion, and valuable sources for pharmaceuticals and biotechnology innovations. However, marine biodiversity is facing unprecedented cumulative pressure from overexploitation, climate change, pollution and habitat degradation, while significant knowledge gaps remain regarding their impacts on species richness and long-term population viability. This situation calls for urgent and informed action grounded in robust scientific understanding of the status, trends and resilience of marine ecosystems and their living resources.

Effective marine governance, spatial planning and management rely on diverse scientific expertise and evidence-based information systems to understand marine ecosystem functioning, identify the drivers of ocean change, and develop policy scenarios that support informed and adaptive decision-making at local, regional and global scales. Scaling up local observations to broader geographic levels requires comprehensive, comparable, harmonised, interoperable, and accessible quality data. The GOOS Biodiversity Plan is designed to meet this need by coordinating and strengthening the collaborative global collection, curation, interpretation, and sharing of essential marine biodiversity data.

Local and national requirements for sustainable ocean planning and management

Reliable, timely and quality-controlled information on the status and functioning of marine biodiversity and ecosystems is critical for effective conservation and sustainable ocean planning and management. Yet decision-making remains particularly complex and fragmented at local and national scales, as marine systems frequently extend across multiple jurisdictions, creating transboundary ecological, socio-economic and governance interdependencies. Consequently, many countries face limitations in the capacity and coordination needed to systematically collect, interpret and translate marine biodiversity information into effective management and policy strategies. GOOS and its partners are in a unique position to provide sound, science-based expert guidance and standardised protocols for the collection, management and

sharing marine biodiversity data and to ensure that this is ultimately transformed into interoperable and actionable information to support equitable access across stakeholders and jurisdictions. This is vital to supporting Member States and the private sector with relevant insight to better manage marine resources and to fulfil national and international reporting obligations.

Multilateral Environmental Agreements

Several international agreements promote global cooperation to conserve and sustainably use biological diversity and to address the drivers of changes in biodiversity and ecosystem services[1]. The GOOS Biodiversity Plan aims to support Member States in collecting and integrating the marine biodiversity information they need for reporting under these agreements through a coordinated and unified framework. A deeper scientific understanding of global ocean functioning and the vulnerability and resilience of marine biodiversity is essential to this effort. GOOS can contribute by coordinating and facilitating the development of an integrated global system to detect long-term trends, identify knowledge gaps, combine biological, physical and chemical data, and enhance modelling and forecasting capabilities. This will be crucial for improving our ability to anticipate ecosystem tipping points and responses to multiple stressors.

Convention on Biological Diversity (CBD) - The "Revised Guidance on needs related to implementing the monitoring framework of the Kunming-Montreal Global Biodiversity Framework (KM-GBF)," prepared by the *Ad Hoc* Technical Expert Group (AHTEG)[2] recognises GOOS, the Ocean Biodiversity Information System (OBIS), and the Ocean Data and Information System (ODIS) as key components to bridge science and policy in the KM-GBF for the case of oceans specifically. Together, they can support countries in gathering essential biodiversity data and coordinating sustained, harmonised ocean observations to inform and report progress against GBF targets. As such, the GOOS and complementary IOC programs contribute to a proposed Global Biodiversity Observing System (GBios)[3].

Biodiversity Beyond National Jurisdiction (BBNJ) - GOOS can play a critical role in supporting the implementation of the BBNJ agreement through coordinating monitoring of marine biodiversity in areas beyond national jurisdiction. The GOOS Essential Ocean Variables (EOV) framework is a foundational framework[4] to achieve a fit-for-purpose ocean observing system that provides information for the effective implementation of this agreement.

Other agreements and initiatives - At least 14 global Multilateral Environmental Agreements (MEA) and over 50 regional MEAs (Biological diversity | InforMEA) are in place to address

[1] United Nations Information Portal on Multilateral Environmental Agreements: https://www.informea.org/en/mea-topic/biological-diversity

[2] CBD/COP/16/INF/4. 2024. Revised Guidance on needs related to implementing the monitoring framework of the Kunming-Montreal Global Biodiversity Framework. Conference of the Parties to the Convention on Biological Diversity. Sixteenth meeting. Cali, Colombia, 21 October–1 November 2024. Item 10 of the provisional agenda. Mechanisms for planning, monitoring, reporting and review.

[3] Gonzalez, A., Vihervaara, P., Balvanera, P. et al. 2023. A global biodiversity observing system to unite monitoring and guide action. Nat Ecol Evol. https://doi.org/10.1038/s41559-023-02171-0.

[4] Martín Míguez B & Heslop E, et. al. (2026) GOOS Essential Ocean Variables: the backbone of a sustained and evolving global ocean observing system. Front. Mar. Sci. 13:1737002. doi: 10.3389/fmars.2026.1737002

challenges concerning biodiversity change. These require monitoring to inform progress of local and national strategies and legal frameworks[5]. Some examples of MEAs requiring marine biodiversity observations include:

- *The Ramsar Convention on Wetlands (1971)***-** Promotes the designation of Ramsar Sites (wetlands of international importance).
- *The Bonn Convention (Convention on Migratory Species)***-** Facilitates international cooperation on the protection of migratory species.
- *The International Union for Conservation of Nature (IUCN)* **-** Maintains the Red List of Threatened Species.
- *The United Nations Framework Convention on Climate Change (UNFCCC)* - Recognizes the role of marine biodiversity in the processes that affect greenhouse gas concentrations and the potential impacts of changes in greenhouse gases on marine life.

Other global information requirements

Needs of the World Meteorological Organisation (WMO) - Comprehensive and widespread information on marine biodiversity is key for quantifying with great certainty processes that underpin the biological carbon pump and global carbon dioxide (CO_2), methane (CH_4), and nitrous oxide (N_2O) fluxes and concentrations. The WMO is leading the design and pilot of the **Global Greenhouse Gas Watch (G3W)** using satellite, ground, and modelling observations and outputs. While its current focus is on surface CO_2, CH_4 and N_2O air fluxes, a clear understanding of the diversity, abundance, and distribution of marine life, their changes and contribution to the carbon cycle will be important to inform the design and operation of the G3W.

Needs of the Global Climate Observing System (GCOS) - As numerical climate models become increasingly sophisticated and incorporate a broader range of Earth system processes, they require high-quality biological data to accurately represent and predict how marine ecosystems and living resources respond to, influence, and potentially mitigate or amplify climate change. Biodiversity observations are therefore fundamental to comprehensive and integrated climate monitoring. GCOS has defined Essential Climate Variables (ECVs) that include Marine Habitats and Plankton, each encompassing several GOOS EOVs.

Needs of the GEO BON Marine Biodiversity Observation Network (MBON) - GEO BON developed the Essential Biodiversity Variables (EBVs) to generate standardised biodiversity indicators needed to assess marine ecosystem health, detect trends, support conservation decisions, and contribute to global biodiversity monitoring frameworks. MBON helps to network and coordinate the government, private, and academic sector communities to converge on essential marine biodiversity information and data collection, management, and publication strategies. MBON is a collaboration with GOOS and OBIS.

Intergovernmental Oceanographic Commission (IOC) - The IOC Medium Term Strategy for Healthy Ocean Ecosystems[6] seeks to enable Member States to meet High-Level Objectives that require improved global ocean biodiversity information through sustained observations of biological and ecosystem (BioEco) EOVs. Biodiversity information will also be critical for Member States that seek implementation of the IOC's Sustainable Ocean Planning and

[5] Ocean Decade Vision 2030 White Papers - Ocean Decade: https://oceandecade.org/publications/ocean-decade-vision-2030

[6] IOC-UNESCO, 2022. IOC Medium-Term Strategy, 2022–2029. UNESCO, Paris (IOC Information Document, 1412).

Management strategy (SOPM)[7] to support and inform decision-making and adaptive management. Biodiversity information is also fundamental for advancing the goals of the UN Decade of Ocean Science for Sustainable Development[8].

MAIN OBJECTIVES AND ACTIONS

To address the above requirements, the GOOS Biodiversity Plan for 2026-2035 focuses on four Objectives, each supported by a set of Actions (see Table 1 for details on tasks for implementation).

Objective 1- Mature the global ocean observing system for biology and ecosystems Essential Ocean Variables.

A mature Global Ocean Observing System coordinates comprehensive, sustained and standardised ocean observations, enabling the collection and dissemination of complementary, consistent, and fit-for-purpose information on ocean physics, geochemistry, and biology, and facilitating data aggregation across regions and over time. It also allows monitoring data ingestion, assessing the performance of diverse observing networks, and quantifying the impact and policy relevance of the information they generate.

To achieve this vision, GOOS will strengthen and champion the global observing framework for ocean biology and ecosystems through the implementation of GOOS Essential Ocean Variables (EOVs), reinforcing best practices, enhancing data flows, and improving the integration, visibility, and accessibility of datasets on marine biodiversity. In collaboration and with support from OBIS, GOOS Observations Coordination Group (OCG), external partners and the ocean biodiversity monitoring communities, the GOOS expert panel for Biology and Ecosystems (BioEco Panel) will map observing networks for each BioEco EOV, evaluate their performance for (meta) data collection and sharing, best practices, identify capacity gaps, and coordinate efforts to enhance biodiversity monitoring and facilitate data delivery and integration at all scales (from local to global).

This will be achieved by:

A 1.1 Facilitating the adoption of best practices and promoting the use of standardised approaches for collecting, managing and delivering data for all BioEco EOVs, in alignment with FAIR (Findable, Accessible, Interoperable, and Reusable)[9] and when applicable with CARE (Collective Benefit, Authority to Control, Responsibility, Ethics)[10] principles.

A 1.2 Supporting the development of data and metadata delivery pipelines that promote the interoperability, accessibility and traceability of marine biodiversity datasets at local, regional and global scales.

[7] IOC-UNESCO, 2025. IOC/A-33/4.1.Doc(1). IOC-Wide Strategy on Sustainable Ocean Planning and Management (2025–2030) and Implementation Plan (2025-2027).
[8] IOC-UNESCO, 2024. Ocean Decade Vision 2030 White Papers – Challenge 2: Protect and Restore Ecosystems and Biodiversity. Authors: Muller-Karger, F. E. et.al.(The Ocean Decade Series, 51.2. Paris, UNESCO-IOC). https://doi.org/10.25607/y60m-4329.
[9] https://doi.org/10.1038/sdata.2016.18
[10] https://doi.org/10.5334/dsj-2020-042

A 1.3 Strengthening a central gateway, as well as regional portals, to increase the visibility of observing networks and programmes collecting BioEco EOVs data, increase awareness on data availability worldwide, and highlight observational and capacity gaps by EOV (BioEco Portal/other).

A 1.4 Developing and implementing an evaluation framework to regularly assess the maturity state of BioEco EOVs' observing capacities and identify where additional capacity is needed.

Objective 2- Facilitate the use of marine biodiversity data in decision-making at all geographic scales

The GOOS BioEco Panel will collaborate with GOOS partners and the ocean biodiversity monitoring communities to engage end-users and relevant stakeholders to advance the BioEco EOVs framework. This will promote its application in decision-making for sustainable ocean uses, from local and national planning to global policy reporting, including consideration of biodiversity indicators and reporting under the various MEAs.

This will be achieved through the following Actions:

A 2.1 Identify the specific biodiversity information needs and data gaps for informed ocean policy and management at national, regional and international scales, including information products and services.

A 2.2 Facilitate delivery of operational, fit-for-purpose BioEco EOV data, including both near real-time and delayed-mode observations.

A 2.3 Contribute to the development of freely available BioEco EOV data products, indicators and analysis tools that are user-friendly and readily applicable.

A 2.4 Demonstrate the value of BioEco EOV data streams to support policy development and decision-making, building user confidence in their application.

Objective 3- Strengthen capacity and expand global observing coverage

The GOOS Biodiversity Plan aims to expand and support capacity building and enhance cross-sectoral coordination in marine biodiversity monitoring to improve coverage and ensure global standards in data collection, management and delivery are followed.

This will build on the work of the BioEco Panel, but also on existing efforts from several other GOOS components and IOC initiatives, such as GOOS Regional Alliances, the OceanTeacher Global Academy (OTGA), OBIS, and UN Ocean Decade programmes. Strategic partnerships with organisations such as the Marine Biodiversity Observation Network (MBON), the Partnership for Observation of the Global Ocean (POGO), and private sector stakeholders will further amplify these efforts, contributing to a more inclusive, coordinated and comprehensive global ocean observing system.

This will be achieved through the following Actions:

A 3.1 Secure complementary long-term collaborations with BioEco EOVs' observing networks worldwide and enhance coordination among them, aligning efforts and improving efficiency in ocean monitoring and data collection, management and publication.

A 3.2 Increase awareness and recognition of BioEco EOVs and of the value of the EOV framework in supporting ocean biodiversity information flow at all geographic scales.

A 3.3 Expand and support the adoption of BioEco EOVs data and metadata standards across observing communities.

A 3.4 Facilitate the development and delivery of training tools and workshops that support the full life cycle of ocean BioEco observations, from collection to application.

Objective 4 - Drive innovation and promote the adoption of emerging technologies for ocean biodiversity monitoring

Expanding the collection of BioEco EOVs, and enabling fit-for-purpose monitoring and broad geographic coverage and frequent, repeated, and sustained measurements for deeper understanding and forecasting of marine life, requires the identification and adoption of innovative and cost-effective technologies. Emerging approaches such as environmental DNA (eDNA), optical and acoustic sensors, autonomous platforms, new capabilities like Artificial Intelligence, and inclusive initiatives like citizen science, allow broader geographic coverage and more frequent, and in some cases, near real-time biodiversity monitoring. Realising the full potential of traditional and emerging methods will depend on strategic collaboration and targeted efforts to address critical funding gaps.

This will be achieved by:

A 4.1 Fostering the maturation and application of innovative observing technologies with broad potential, including Artificial Intelligence, and those capable of delivering real-time information for planning and operational services.

A 4.2 Identifying critical technology needs and advancing their development to enable efficient observation of BioEco EOVs and support their widespread adoption and implementation.

A 4.3 Facilitating the integration of BioEco EOVs in data platforms traditionally used for physical and biogeochemical EOVs' collection, as well as fostering the improvement of existing data pipelines to enable the inclusion of novel data types such as eDNA**.**

LEAD AND PARTNERS

The GOOS Expert Panel for Biology and Ecosystems

The GOOS expert panel for Biology and Ecosystems (BioEco Panel) will play a central role in implementing the GOOS Biodiversity Plan, building on the extensive experience of its members in coordinating biodiversity observing communities and advancing marine biodiversity and ecosystem observations and their use. In recent years, the Panel has laid strong foundations for this work by identifying the 12 current Essential Ocean Variables for biodiversity (BioEco EOVs), focusing on functional groups, habitat state, plus two cross-disciplinary EOVs ocean sound and ocean colour. These EOVs help connect marine observing communities around the globe and help focus the development of ocean best practices and standards. EOVs can also foster collaboration with other global biodiversity networks like OBIS and MBON to promote the adoption of FAIR data principles and launch and increase data and observing network visibility and integration. Building on these achievements, and through active engagement with other GOOS components, partners, and the wider scientific and user communities, the BioEco Panel will be key in supporting the implementation of the Plan's objectives. Its expertise will be instrumental in expanding monitoring networks and strengthening the delivery of standardised, actionable ocean marine biodiversity information to inform international agreements and decision-making in the face of biodiversity loss and global change.

Integration across GOOS components

A coordinated approach across all relevant GOOS components is essential to support the implementation of the GOOS Biodiversity Plan. In particular, strengthening collaborations with GOOS Regional Alliances (GRAs) and National Focal Points (NFPs) will be key to enhancing regional and national engagement, which is crucial for understanding the needs for ocean biodiversity information and for assessing the maturity of biodiversity observing networks. Close coordination across all GOOS Expert Panels will also be crucial to improve integration across disciplines. This is particularly important for BioEco EOVs, as they depend on physical and biogeochemical environmental variables to provide the scale and context required for biological and ecosystem health assessment.

To support this cross-disciplinary integration, collaboration with the OceanOPS programme, which operates under the umbrella of the GOOS Observations Coordination Group (OCG), will be essential for enhancing cross-disciplinary metadata flow, integration, and observational network interoperability.

Leveraging other IOC programmes and initiatives

The GOOS Biodiversity Plan will strategically build on the complementary work of existing IOC-UNESCO frameworks and programmes that provide essential infrastructure and policy alignment. These include close collaboration with OBIS and the Ocean Data and Information System (ODIS), both operating under the IODE programme to ensure that biodiversity observations are visible, standardised and accessible.

The IOC Medium Term Strategy and the SOPM which provide a roadmap for implementing standardised BioEco EOV observations aligning them with national priorities and the UN Decade of Ocean Science. These initiatives will act as delivery pathways to help mature the global observing system, enhance cross-disciplinary integration, and foster interoperability, ultimately leading to more effective biodiversity monitoring and decision-making at local, national and global scales.

External partnerships

Strategic partnerships beyond IOC-UNESCO will increase the impact and delivery of the GOOS Biodiversity Plan. In particular, continued engagement and collaboration with MBON, and future collaborations with other GEOBON networks (e.g., MoveBON) will improve the coordination of ocean biology and ecosystems observing networks and expand GOOS reach across ocean and biodiversity observing communities to accelerate the development and adoption of BioEco EOVs and standardised biodiversity metrics that also support the development of EBVs.

Collaboration with POGO will support joint advocacy, capacity development, and technology innovation, while closer alignment with the United Nations Environment Programme (UNEP) will enhance the policy relevance of BioEco EOVs within global and regional frameworks, including the KM-GBF and the Regional Seas Conventions.

New partnerships with the UN Food and Agriculture Organisation (FAO) and the International Council for the Exploration of the Sea (ICES) will also offer significant opportunities for a more global reach in fisheries and capacity building, particularly in developing countries and in biodiversity monitoring and regional assessments.

Additionally, engaging the private sector across the entire ocean observing value chain - from technology developers to data user industries - is crucial to drive innovation, promote resource sharing, and the widespread adoption of FAIR and open data principles, all of which are key to advancing the Biodiversity Plan.

IMPLEMENTATION

A detailed, resourced (financially and staffed) and time-bound implementation plan for the coming years will be developed to identify and prioritise specific Tasks to achieve the Actions under each objective, evaluate risks and contingencies for each of them and list their expected outputs. This initiative will be led by the BioEco Panel, in close collaboration with the key partners mentioned above to identify common goals, optimise synergies and ensure alignment of activities. Particular attention will be given to evaluating costs and securing funding and resources for each task.