

Table of Contents

Background, Rationale, and Link with EuroGOOS Strategic Priorities	2
Target Audience and Expected Impact	4
Aim, Objectives & general approach	5
Composition and Operation	5
Chair's nomination process, mandate, responsibilities	5
Members nomination and selection process, mandates, responsibilities	6
Mode of Operation	6
Deliverables	7
Indicative Timetable (Gantt chart)	7

1. Background, Rationale, and Link with EuroGOOS Strategic Priorities

Across the European Union, the political will to reduce environmental damage while protecting and restoring natural ecosystems is growing. Promising and ambitious plans have been proposed to reduce negative environmental impact and mitigate climate change (European Green Deal), accompanied by pledges to restore degraded ecosystems and biodiversity (in, e.g., the European Biodiversity Strategy 2030). In support of these instruments, policy makers require focused, sustained, consistent, quality-controlled, and transparent information with regional coverage to rapidly detect the impact of their management and policy decisions on biodiversity. Today, at the European level, there is a lack of harmonised and actionable data on marine biodiversity, despite large collections of such data existing in relative isolation. In order to move towards a sustainable and environmentally conscious society, it is urgent that we rapidly develop and organise our biodiversity observation capabilities to reach the sophistication, organisation, and usability for societal stakeholders demonstrated by physiochemical observation networks, such as ARGO.

Weather forecasts, shipping reports, and oceanographic modelling are cornerstones of human interaction with the oceans. However, there is a significant gulf to span in mainstreaming biological information to the same degree, despite its comparable importance to many sectors of society. It is therefore imperative to work towards creating useful and legible indicators that can easily inform the right stakeholders of the previous, current, and predicted responses and impacts of decision on the marine biosphere.

Consequently, biological observation needs to be integrated in the EuroGOOS framework to ensure a fully integrated European ocean observation system that considers the immense importance played by life in ocean processes but also their economic value to humans as through the provisioning of resources and other ecosystem services. Understanding how life in the ocean will react to climate change and predicting the impact on the businesses that depend on it is crucial, especially as more extreme climate change scenarios are becoming a reality. EuroGOOS provides the suitable framework for bringing together the necessary community to come to a consensus on the right variables and protocols to employ to support decision making and predictive frameworks around the ocean and tying back into impact on human society and economy. A key step in delivering biological and ecological insight to decision makers and policy developers is the establishment of a robust, operations-grade, continental-scale observation system, such as the National Ecological Observatory Network (NEON) in the USA. This operational layer will mediate between the rapid innovations in research and the need for stable, standardised, and inter-calibrated long-term data. This layer will be based on standard operating procedures (SOPs), stringent quality control and assurance mechanisms, standards compliance, and other practices needed to deliver observatory-grade products to both European and international science and society.

Thus, we propose the establishment of a Biological Observation Working Group (BIOGW) to better integrate biological observation into the EuroGOOS framework. Explicitly, BIOGW will contribute to the EuroGOOS 2030 Strategy objectives in the following ways:

1. *Stimulate communities of practice*: The creation of a biological observation working group will create an observatory-grade rallying point for the fragmented biological observation community and connecting it to oceanography;
2. *Advocate for coordinated and integrated European ocean observing and operational oceanography*: through workshops and discussions standards, best practices, and standard operating procedures (SOPs) will be defined and submitted to IOC-UNESCO Ocean Best Practices System, creating a coordinated robust and standardised framework to systematically advance continental biological observation in an operational context. The integration of BIOGW will also contribute to EuroGOOS

capacity to observe and predict biodiversity, climate change, biological resource management and Blue Bioeconomy sectors;

3. *Strengthen and expand partnerships*: BLOWG will enhance EuroGOOS partnerships by engaging new community of users and partners that will potentially bring new members to the organisation, while greatly expanding on the current activities and areas of impact;
4. *Promote sustainability across the value chain of operational oceanography and ocean observing*: BLOWG will identify new value chains in biologically focused operational oceanography and observing not previously considered, expanding the remit and impact of EuroGOOS. Secondly, BLOWG will promote sustainable delivery across these chains by operationalising and coordinating the currently scattered efforts in European biodiversity observation, creating a strong European biological observation network and community.
5. *Mobilise the public on the importance of the ocean and oceanographic services*: The long-term aspect of biological observatories offers an opportunity to engage in activities that go beyond the traditional project lifetimes. It has long been the ambition of biological observatories to be integrated into school and university curricula, as well as develop community-focused outreach programmes by building relationships over time. Furthermore, the “frugal science” approach that the working group will explore will also lend themselves well to citizen science and school project initiatives. This will provide additional tools to engage citizens in understanding the importance of life in the ocean and its relevance to them.

2. Target Audience and Expected Impact

The Biological Observation Working Group (BLOWG) is aimed firstly at current and future operators of biological observation initiatives and sites, to bring together relevant actors in the field and create a continent-wide, coordinated, and operationally focused community of biological observatories in Europe. Secondly, the group wishes to engage with existing observation platforms and initiatives that wish to integrate biological components, helping identify the most suitable protocols and ensuring that these platforms generate data that is interoperable with dedicated biological observatories.

The key messages that the working group will convey and demonstrate are:

1. **Ocean observation is only complete when it includes biological and ecological observation;**
2. **Biological observation needs standards and quality control which need to be adhered to;**
3. **Biological observation should be generating data that is FAIR and useful to stakeholders, concentrating on existing indicators and frameworks such as Essential Ocean Variables (EOVs) and Essential Biodiversity Variables (EBVs);**
4. **The integration of detailed biology into ongoing global and regional ocean modelling efforts is essential to understanding the oceans and human impact on their health and functioning;**
5. **There is a high and multifaceted value of biodiversity to both coastal and inland human society and economy.**

To support these messages, the BLOWG aims to achieve a cultural change in biological observation from a set of individual efforts in isolated stations, to an integrated, and coordinated European effort (with global impact) to further our understanding of life in the ocean and how it interacts with and influences the environment. It is essential that an oceanography-style approach is taken to the monitoring of life in the sea. It is also important to encourage the integration of biology into well-established oceanographic observation efforts, moving away from treating biodiversity as a secondary variable, but rather incorporating it as the essential component it is.

3. Aim, Objectives & general approach

This working group will focus on developing rigorous and operationally focused standard specifications and operating procedures for the generation of quantitative and qualitative biological data products, so that it may be integrated into current ocean observation programmes and modelling efforts:

1. The first priority will be to agree on an initial set of SOPs and data standards for the observation of life via eDNA and multi-omics protocols. These are amongst the most widely used techniques today and also show great promise for capturing large amounts of information about biodiversity with single approaches. Recommendations for their use will also be proposed, showing the strength of each and in which context they are the most useful. How these data may contribute the most effectively to EOVs and EBVs will also be evaluated and recommendations made for best practices.
2. Secondly, the standardisation and SOPs for Imaging will be taken forward. Today, imaging sensors of all kinds are used to monitor changes of plankton community composition and biomass from coastal to open Ocean. However, beside current efforts, there is still a need for clear recommendations for their use depending on the objectives, and standardised protocols. Similarly to eDNA and genomics, how these data may contribute the most effectively to EOVs and EBVs will also be evaluated and recommendations made for best practices
3. Recommendations for new sensor and autonomous platform development and integration with existing approaches will be formulated and implemented.
4. To ensure that the working group does not create a regional silo, we will continuously liaise with the Biological and Ecosystems EOVS Panel (GOOS) and the EBV development groups (GEO BON). Endorsement of SOPs targeting these EVs will be sought, while the working group will propose advancements to the respective Panels, as they arise.
5. Frugal science approaches are promoted. Due to rapid innovation, biological observations are often expensive and rely on advanced technology. However, increased adoption and commercialisation has made many approaches more cost effective, driven by a growing interest in developing fit-for-purpose instruments and protocols, which can be done on small budgets. Such a “frugal science” approach is highly relevant for mobilising poorer countries and regions in ocean observation, empowering them to participate in a global effort to monitor and understand biodiversity. Indeed, this is also relevant in Europe as long-term funding for observation is very difficult to obtain and thus a reduced cost would significantly improve our ability to maintain long-term, well-replicated observatories.
6. The working group will develop a structured obsolescence and on-boarding process for all technologies, methods, and operational models. This is key to protecting the integrity of long-term data series while allowing the integration of novelty. All such processes will include overlapped phase-in phase-out processes to ensure the impact of each replacement is well characterised and acceptable.

4. Composition and Operation

The working group will be led by a Chair, and supported by a co-Chair. Chair is supported by a dedicated officer at the EuroGOOS Office.

4.1 Chair's nomination process, mandate, responsibilities

Chair must be a representative of a EuroGOOS member organization¹, but the EuroGOOS Executive Directors Board may nominate a first Chair from outside the EuroGOOS membership to initiate new

¹ <http://eurogoos.eu/about-eurogoos/members>

activities relevant for the organisation and following the implementation of the EuroGOOS 2030 Strategy. The Chair is approved by the EuroGOOS General Assembly. A call for candidates for the co-Chair will be launched as soon as the working group has been established. The co-Chair is elected by the members of the group and approved by the EuroGOOS Executive Directors Board. The mandate, role and responsibilities of the Chair and co-Chair are the same. Co-Chair takes on the role of Chair if the Chair is unable to act. The Chair's mandate is for three years, renewable once, upon re-election for a two-year term.

Chair is responsible for:

- Oversight of the working group;
- Alignment of the working group's work with its Terms of Reference and with the EuroGOOS Strategy;
- Developing the Working Group yearly implementation plan in line with the above;
- Reporting to the EuroGOOS General Assembly and EuroGOOS Executive Directors Board (including both at physical meetings and in writing);
- Regularly reviewing the membership of the working group (e.g. once a year);
- Regularly liaise with the EuroGOOS Office to follow up on the working group's alignment with the other EuroGOOS activities (at least monthly);
- Represent the working group at external meetings.

4.2 Members nomination and selection process, mandates, responsibilities

Members are invited from the EuroGOOS membership with an interest in expanding biological observation, as well as other working groups and task teams who wish to integrate biological parameters in their platforms (e.g., Ferrybox, BGC Argo). Members are selected based from the pool of nominations by the Chair and the EuroGOOS Office, keeping in mind the spread and representativeness in expertise, geographical representation and the gender balance. In addition, to ensure a strong representation of biological observations and data expertise, BLOWG members will be invited outside the current EuroGOOS membership and involvement in its subsidiary bodies.

Members do not have an established mandate unless the activity is terminated. However, membership is reviewed by the Chair and the EuroGOOS Office on a regular basis and can be terminated if the member does not fulfil the below responsibilities.

Members' responsibilities are to:

- Participate in the working group activities;
- Deliver outputs as required, orally or in writing, in a timely manner;
- Represent the activity at external meetings, upon agreement with the Chair and the EuroGOOS Office;
- Attend working group meetings;
- Follow-up on the developments related to the working group's activity, to ensure the working group's work is timely and topical.

5. Mode of Operation

The Terms of Reference for the Biological Observation Working Group (BLOWG) are developed by the EuroGOOS Office in liaison with the Chair, and submitted first to the EuroGOOS Directors Board and then to the EuroGOOS General Assembly for approval.

Once approved at the EuroGOOS General Assembly, the working group Chair and the EuroGOOS Office launch a call for member nominations (see item 4.2).

When the membership of the working group is established, the working group is regarded as operational. In most cases, a physical kick-off meeting will be organized to agree the Terms of Reference

with all the members and develop the first annual implementation plan. EuroGOOS Office oversees the communication related to the working group activities.

The group operates based on its Terms of Reference and annual implementation plans. Its activities are reviewed at the EuroGOOS Executive Directors Board meetings (four times a year) and the EuroGOOS General Assembly (annually).

6. Deliverables

The working group will work as a forum to guide emerging and existing ocean observation on biological protocols and sampling tools, ensuring that future platforms are interoperable, within Europe, and beyond. Thus, the working group will serve as a contact point for existing initiatives, such as Ferrybox, fixed platforms, Argo and gliders, to identify the most appropriate tools and protocols to deploy.

In addition to acting as a source of advice, the working group will also be working with the biological observation community to agree on protocols and SOPs which will be published and submitted to IOC-UNESCO Ocean Best Practices System (oceanbestpractices.org). The first one will focus on molecular approaches, first of all providing guidelines on when to use different protocols, followed by recommended protocols. A similar deliverable will follow on quantitative imaging, covering different technologies. Further topics and priorities will be set by the group. The aim is to publish at least one set of standards per year.

7. Indicative Timetable (Gantt chart)

The schedule below is indicative. It will be prepared based on the above guidelines and the implementation plan.

	04/21	05/21	06/21	07/21	08/21	09/21	03/22	06/22
Terms of Reference	X							
Selection of Chair / Co-Chair						X		
Approval by Exec. Board		X						
Approval by General Assembly		X						
Call for member nominations			X					
Kick-off meeting						X		
Report 1 - Recommendations for use of molecular tools - eDNA & genomics							X	
Protocol 1 - Molecular Tools, Protocols & Standard Operating Procedures								X
Report 2 - Recommendations for use of imaging observation techniques and platforms								TBC

Protocols 2 - Imaging Tools, Protocols & Standard Operating Procedures									TBC
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