

Tracking the Pulse of the Ocean

## Stakeholder Engagement Strategy

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## 1 Executive summary

This Stakeholder Engagement Strategy sets out how BioGeoSea will work with scientific, operational, policy, and societal actors to co-develop, validate, and sustain improved biogeochemical Essential Ocean Variables (BGC EOVS), indicators, models, and data products. BioGeoSea responds to the persistent challenge that changes in ocean biogeochemistry remain insufficiently observed and understood, despite their critical role in ocean health, climate regulation, and human wellbeing. By enhancing BGC EOVS through in-situ observations and modelling, and developing indicators with a focus on acidification, deoxygenation, the biological carbon pump, and greenhouse gas fluxes, the project provides knowledge and tools of direct relevance to European and global policy.

Stakeholder engagement is at the heart of this effort. The Strategy recognises that trusted, actionable biogeochemical information can only be achieved through meaningful participation of those who produce, manage, use, and govern ocean data and knowledge. It therefore frames stakeholder engagement as a continuous, adaptive process that runs across the entire project lifecycle and supports both the scientific quality and the practical uptake of BioGeoSea results.

In BioGeoSea, a stakeholder is any person, group, community, institution, or organisation that is affected by, contributes to, or can influence the activities, outputs, or impacts of the project. Stakeholders are central because they help shape and validate project outputs; ensure that indicators, observations, and models align with user needs, policy frameworks, and international standards; enable the exchange of knowledge, data, and infrastructure; amplify communication and impact; and support the long-term sustainability and accountability of BioGeoSea contributions.

The Strategy pursues five main objectives:

1. Promote coordinated engagement among scientific partners, observing networks, policy bodies, and blue-economy actors to improve monitoring, assessment, and projections of BGC EOVS.
2. Facilitate the integration of biogeochemical, physical, biological, and climate perspectives to address emerging threats to ocean health and co-develop indicators and data products.
3. Support the exchange of methods, standards, and observing practices, strengthening a coherent European contribution to the ocean – climate – biodiversity knowledge system.
4. Ensure that project results are regularly communicated to policymakers, decision-makers, funders, and the wider public, enhancing relevance and trust.
5. Strengthen skills, data practices, and interoperability across the observing and forecasting value chain.

To operationalise these objectives, the Strategy organises stakeholder management into an eight-step circular flow (Figure 1). The process begins by defining the problem at stake, clarifying why engagement is needed, which BioGeoSea challenge it addresses, and what kind of input is required. It then moves to mapping stakeholders across the full ocean-observing value chain (scientific and expert communities, observing networks and research infrastructures, data infrastructures and 1

product developers, policy and funding bodies, blue-economy and industry actors, and civil society and NGOs). On this basis, the project studies stakeholder roles, needs, and constraints, documents initial assumptions, and prioritises engagement using an interest–influence perspective.

Building on that analysis, BioGeoSea designs engagement by developing clear value propositions for different stakeholder groups, selecting suitable formats, ranging from notification and consultation to co-design, validation, and multi-actor forums, and defining timing that is aligned both with project milestones and with external policy windows. Engagement activities are then rolled out in a coordinated way across Work Packages, using a shared stakeholder database, common principles, and strict GDPR-compliant handling of personal data. Stakeholder feedback is used to validate and improve outputs, testing and refining specification sheets, indicators, observing methods, models, data products, and the BioGeoSea software to ensure robustness, usability, and consistency with international frameworks. Validated outputs are then reported and disseminated internally and externally through project reports, scientific publications, data infrastructures, policy briefings, and tailored communication materials that clearly show how stakeholder input has shaped results. Finally, the project revisits earlier steps as scientific understanding, technologies, policy contexts, and stakeholder landscapes evolve, embedding a culture of continuous learning and co-creation rather than treating engagement as a one-off exercise.

Each Work Package applies this flow within its own remit: WP1 for BGC requirements and indicators, WP2 for observations and platforms, WP3 for modelling and projections, WP4 for data products and integration, WP5 for leadership, exploitation and legacy, and WP6 for coordination. The Strategy thus provides a common framework while allowing each WP to tailor engagement to its specific tasks, deliverables, and Key Exploitable Results.

Overall, this Stakeholder Engagement Strategy is designed to make BioGeoSea work more transparent, inclusive, and impactful. By structuring engagement as an iterative, well-documented process, it helps ensure that BioGeoSea outputs are not only scientifically excellent, but also widely adopted, embedded in European and global systems, and sustained beyond the lifetime of the project.

## 2 Introduction

Changes in ocean biogeochemistry remain insufficiently observed and understood, despite their profound influence on ecosystems, climate regulation, and human societies. The BioGeoSea project addresses these gaps by enhancing biogeochemical Essential Ocean Variables (BGC EOVS) through in-situ observations and modelling and transforming them into indicators and services of policy relevance. Through enhanced EOVS requirements, strengthened observational capability, improved modelling and data products, and the co-development of four key indicators (acidification, deoxygenation, the biological carbon pump, and greenhouse gas fluxes), the project contributes critical knowledge to Europe and the global community.

Results will be co-designed, tested, and shared with stakeholders across research, policy, and the blue economy, and disseminated internationally to encourage alignment with global initiatives,

promote uptake, sustain impact. Ultimately, BioGeoSea will reinforce the foundations of long-term integrated ocean observation and deliver higher-quality biogeochemical information to underpin ocean-health monitoring, climate action, and sustainable development.

This Stakeholder Engagement Strategy positions stakeholder participation as a central component of BioGeoSea's approach to transparency, co-creation, and impact generation. It provides a structured and iterative framework that enables the integration of stakeholder feedback into all aspects of the project, supports the adoption and assimilation of project outputs, and fosters pathways for sustained benefit beyond the project lifetime.

### **GDPR and Data Protection Considerations in Engagement Activities**

All stakeholder engagement activities carried out during the roll-out phase must comply with the General Data Protection Regulation (GDPR) and applicable national data-protection laws. This includes the collection, storage, and use of any personal data associated with stakeholders, such as names, institutional affiliations, contact details, meeting participation, or contributions to workshops and consultations.

Personal data may only be processed for legitimate project purposes and exclusively to support the coordination, documentation, and follow-up of engagement actions within BioGeoSea. Work Packages must ensure that stakeholders are informed about how their data will be used, that consent is obtained, and that data are handled securely, stored only for as long as necessary, and shared strictly on a need-to-know basis within the consortium.

The BioGeoSea stakeholder database follows secure-access protocols and maintains appropriate records of processing activities. These measures ensure that engagement activities remain transparent, lawful, and respectful of stakeholder rights while enabling effective collaboration across the project.

## **3 Scope of the Strategy**

Effective ocean observation, modelling, and indicator development require broad collaboration across scientific, operational, policy, and societal actors. BioGeoSea is built on the recognition that meaningful participation is essential for creating biogeochemical information that is trusted, relevant, and actionable. Stakeholder engagement therefore forms a continuous and adaptive process throughout the project, ensuring that BioGeoSea's outputs reflect user needs, international standards, and evolving policy priorities.

To guide this process, the Stakeholder Engagement Strategy establishes the strategic context, objectives, and expected outcomes that underpin stakeholder collaboration in BioGeoSea. It sets out how engagement will be organised, how stakeholders will contribute to the project's scientific and technical advances, and how this collaboration will support long-term adoption and legacy.

### 3.1 Strategic Context: BioGeoSea Vision and Mission

BioGeoSea's Vision and Mission define the overarching framework within which this Strategy operates. They articulate the project's long-term ambition and collective purpose, and they underpin why stakeholder engagement is essential.

#### **BioGeoSea Vision**

An integrated observing system that delivers the insight and knowledge we need about ocean biogeochemistry from and for society, the blue economy, science, and policy in a timely and transparent manner, enabling informed decisions.

#### **BioGeoSea Mission**

BioGeoSea enhances biogeochemical Essential Ocean Variables, integrates observing systems, advances data products, improves models, and develops new ocean indicators. By turning trusted data into actionable insight, the project delivers the tools and knowledge needed to support climate adaptation, ocean-health monitoring, and sustainable ocean management.

The stakeholder engagement process ensures that this vision and mission translate into usable, relevant, and adopted outputs, consistent with the commitments of the Grant Agreement to:

- Co-design BGC EOV specifications with experts and observing networks;
- Validate indicators with users across research, policy, and the blue economy;
- Align project methods and products with European and international frameworks (Copernicus, EMODnet, GOOS, GCOS);
- Increase the accessibility, interoperability, usability, and uptake of BGC data, models, and services.

### 3.2 Definition of Stakeholder in BioGeoSea

In BioGeoSea, a **stakeholder is any person, group, community, institution, or organisation that is affected by, contributes to, or can influence the activities, outputs, or impacts of the project.**

Stakeholders are central to BioGeoSea because they:

- **Shape and validate project outputs**

They contribute scientific, operational, and policy expertise to co-design, refine, and validate BGC EOVs, indicators, observing requirements, models, and data products.

- **Ensure relevance, alignment, and uptake**

They help align BioGeoSea outputs with user needs, policy frameworks, operational systems, and international standards, supporting adoption across Europe and globally.

- **Enable knowledge, data, and infrastructure exchange**

They share insights, best practices, data, and observing capacity, improving interoperability, data quality, and the efficiency of the observing and forecasting value chain.

- **Strengthen communication, impact, and visibility**

Through their networks, they have a potential to amplify project messages, broaden reach, and enhance the credibility and use of BioGeoSea's results.

- **Support long-term sustainability and accountability**

They ensure continuity of observations and indicators beyond the project lifetime, while contributing to transparent, user-driven, and trustworthy decision-making.

### 3.3 Strategy Objectives

The BioGeoSea Stakeholder Engagement Strategy aims to:

1. Promote coordinated engagement among scientific partners, observing networks, policy bodies, and blue-economy actors to enhance monitoring, assessment, and projections of biogeochemical (BGC) EOFs.
2. Facilitate the integration of biogeochemical, physical, biological, and climate perspectives to address emerging threats to ocean health and support the co-development of indicators and data products.
3. Promote the exchange of methods, standards, and observing practices to support a more coherent European contribution to the ocean–climate–biodiversity knowledge system.
4. Ensure that project results are regularly communicated to policymakers, decision-makers, funders, and the wider public, increasing relevance and fostering trust.
5. Strengthen the skills, data practices, and technical interoperability needed to link biogeochemical, physical, and biological components across the observing and forecasting value chain.

Collectively, these objectives support BioGeoSea's long-term contribution to ocean-health monitoring, climate policy, and sustained coordination across the European and global BGC EOF community.

## 4 BioGeoSea Stakeholder Management

BioGeoSea follows a circular, adaptive stakeholder engagement process. Rather than treating engagement as a one-off activity, the project applies an iterative flow that starts from the problem to be addressed and returns to it as knowledge, needs, and contexts evolve. This flow is illustrated in the Stakeholder Strategy diagram (see Figure 1).

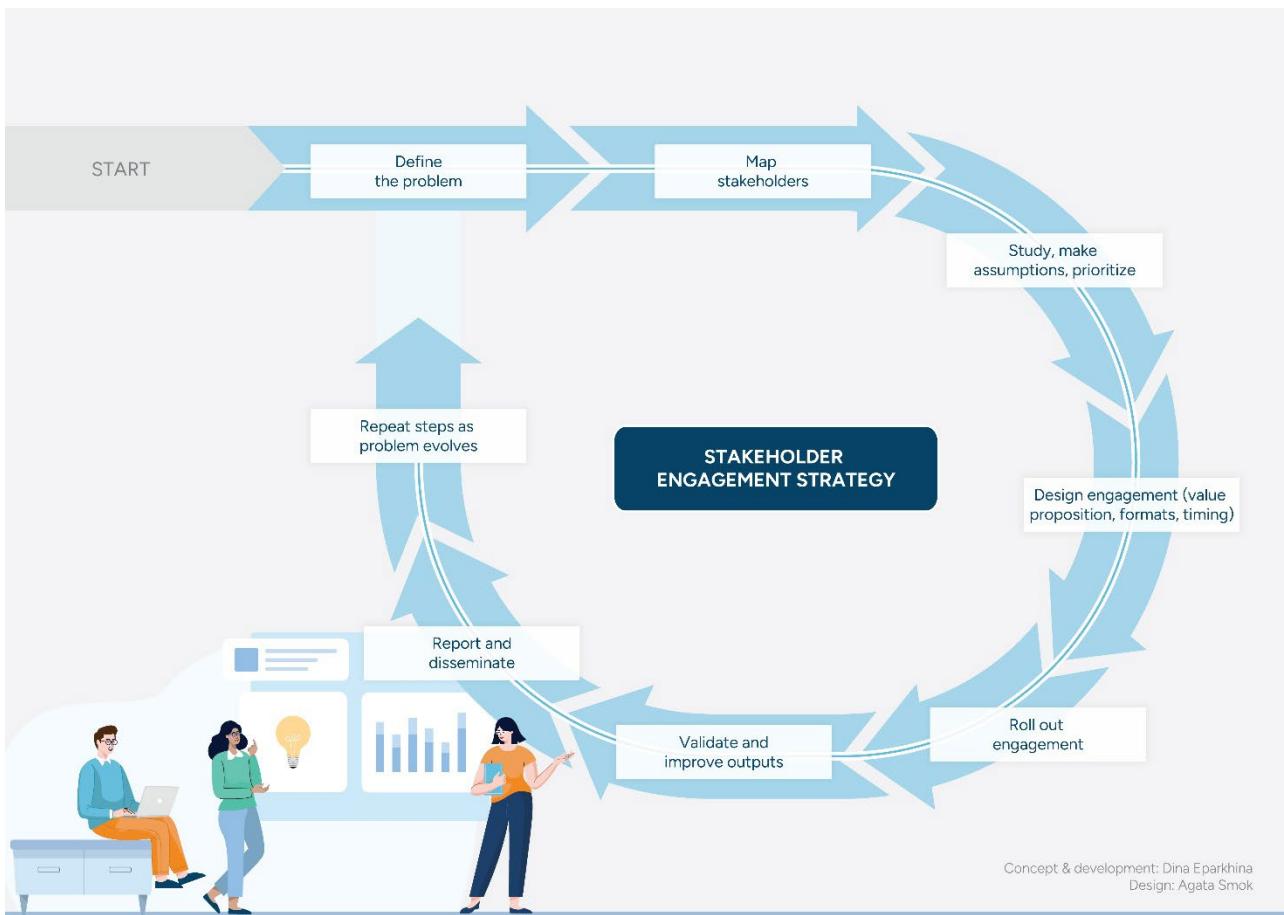


Figure 1. BioGeoSea Stakeholder Engagement Flow

This strategy explains each step and provides a common framework for all partners. At the same time, each Work Package (WP) must interpret and apply the steps in its own context, using the commitments and activities described in the Grant Agreement:

- **WP1 'BGC Requirements, Specification Sheets & Indicator Development'** uses the flow to co-design and validate BGC EOV specifications and indicators with scientific experts, observing networks, policy actors, and blue-economy users.
- **WP2 'Enhancement & Standardisation of BGC Observations'** applies the flow to engage observing networks, sensor developers, and monitoring agencies when improving measurement methods, platforms, and BGC observing capability.
- **WP3 'Modelling, Simulation & Projection of BGC EOVs and Indicators'** uses the flow to work with modelling centres, climate services, and scientific users to identify modelling needs, validate outputs, and ensure the relevance of projections and analyses.
- **WP4 'Data Products, Integration & Global Coordination'** applies the flow to coordinate with data infrastructures and synthesis products, ensuring that BGC data formats, QC procedures, and integration pathways meet user and system requirements.
- **WP5 'European Leadership, Exploitation & Legacy'** uses the flow to connect project outputs, especially indicators, data products, the BioGeoSea software as a service, and the policy paper, to policymakers, assessment bodies, and blue-economy actors.

- **WP6 'Project Management & Cross-Domain Coordination'** applies the flow to ensure coherence across WPs, coordinate high-level interactions, and align with sister projects and international initiatives.
- **WP7 'Ethics Requirements'** ensures that engagement activities comply with ethical, data-protection, and participation standards across all WPs.

The following sections describe each step in more detail, including how WPs can use them when planning and reporting their stakeholder engagement.

#### 4.1 Step 1 – Define the Problem

Effective stakeholder engagement in BioGeoSea begins by clearly defining the problem or question that the engagement activity seeks to address. This ensures that engagement is purposeful, aligned with the scientific and operational work of each WP, and directly supports the co-development and uptake of project outputs.

The aim of this step is to:

- Identify why stakeholders need to be consulted;
- Establish a clear, actionable problem that relates to the BioGeoSea work plan, deliverables, and Key Exploitable Results (KERs);
- Provide a basis for selecting appropriate stakeholders, engagement formats, and timing.

Every engagement activity should be able to state:

*"What problem are we trying to solve, and what do we need stakeholders to help us clarify, validate, or decide?"*

This clarity is crucial for avoiding generic engagement and for ensuring that stakeholder contributions lead to concrete improvements in BioGeoSea outputs.

The Grant Agreement clearly states the core challenges BioGeoSea must address. BioGeoSea is clear: ocean biogeochemistry is poorly observed, creating major knowledge gaps for understanding ocean health and climate processes. In the context of stakeholder management, all WPs must define problems related to gaps in observing capability, data availability, process representation, and indicator readiness and use.

Several specific challenges are addressed by the project, which calls for a clearer and targeted goal setting in the stakeholder engagement:

- To address the problem of definition and specifications for EOVS that were traditionally shaped mainly by science, WP1 will lead the work and ensure that the updated EOVS specifications and indicators meet policy, operational, and blue economy needs.
- To address the need to harmonise methods, improve data interoperability, and integrate BGC observations within international systems, WP2 and WP4 must define engagement goals related to measurement standards, data pipelines, quality control (QC) methods, and integration with global infrastructures (GOOS, EMODnet, Copernicus Marine, IMDOS).

- To address misalignment between scientific outputs and decision-maker needs, WP1, WP3, WP4, WP5 must define problems ensuring that outputs reflect regulatory, managerial, operational, and industry needs.
- To tackle the problem of insufficient mechanisms to test and validate indicators and models with real users, all WPs must define problems requiring iterative feedback, testing, piloting, and refinement. In addition, to ensure long-term adoption and legacy, WP5 must define problems around foresight, uptake, alignment, and long-term incentives for adoption.

Each WP must translate these challenges into precise, engagement-ready questions. Below are representative examples (Table 1):

*Table 1. WPs and engagement modes*

Work Package	Engagement mode
<b>WP1 – BGC Requirements &amp; Indicators</b>	<ul style="list-style-type: none"> <li>• High-level challenge: EOV specifications and indicators must become fit for policy, operational and societal use.</li> <li>• Engagement question example: <i>"Are the proposed revisions to the oxygen and inorganic carbon specifications and associated indicators usable and meaningful for MSFD, Regional Sea Conventions, and blue economy?"</i></li> </ul>
<b>WP2 – Observations &amp; Platforms</b>	<ul style="list-style-type: none"> <li>• High-level challenge: Improve, validate and harmonise observational capability.</li> <li>• Engagement question example: <i>"Which observing platforms and sensors are most suitable for monitoring the four BioGeoSea key phenomena in different regions, and what operational constraints must be considered?"</i></li> </ul>
<b>WP3 – Modelling &amp; Projections</b>	<ul style="list-style-type: none"> <li>• High-level challenge: Ensure model outputs match user needs for climate services and assessments.</li> <li>• Engagement question example: <i>"What biogeochemical processes, outputs, and formats are needed by climate services and assessment bodies for improved projections and decision support?"</i></li> </ul>

Work Package	Engagement mode
<b>WP4 – Data Integration &amp; QC Products</b>	<ul style="list-style-type: none"> <li>High-level challenge: Improve interoperability and integration with global data systems.</li> <li>Engagement question example: <i>"What quality levels, formats, and metadata requirements are needed by global synthesis products (e.g. GO2DAT, GLODAP, SOCAT, IMDOS, EMODnet) to incorporate BioGeoSea datasets?"</i></li> </ul>
<b>WP5 – European Leadership, Exploitation &amp; Legacy</b>	<ul style="list-style-type: none"> <li>High-level challenge: Ensure long-term uptake and policy relevance.</li> <li>Engagement question example: <i>"Which visualisations, dashboards, and support features should the BioGeoSea software include to enable policymakers and managers to use the indicators in planning and assessments?"</i></li> </ul>
<b>WP6 – Coordination</b>	<ul style="list-style-type: none"> <li>High-level challenge: Ensure coherent engagement, avoid duplication, and align with international initiatives.</li> <li>Engagement question example: <i>"Are engagement activities across WPs aligned with GOOS, GCOS, Copernicus Marine, and sister projects to ensure maximum efficiency and visibility?"</i></li> </ul>

For every engagement activity (workshop, bilateral meeting, survey, user testing, etc.), WP teams should:

- Link the problem to the work plan;
- Identify relevant Tasks, Deliverables, Milestones, or KERs;
- Write a one-sentence problem statement which is clear, simple, and written in non-technical language;
- Specify what input is required (e.g. requirements, operational constraints, validation, prioritisation, usability, feasibility, risk);
- Check feasibility, define if this can be addressed by the relevant stakeholders within project life-time and scope; and
- Document the problem.

This ensures that stakeholder engagement remains intentional, directed, and accountable.

## 4.2 Step 2 – Map Stakeholders

Stakeholder mapping is a core component of BioGeoSea's engagement approach. Because the project touches every stage of the ocean-observing value chain, from requirements-setting to data delivery, model improvement, and policy uptake, its stakeholders are numerous, diverse, and distributed across multiple knowledge domains. Mapping them early provides a shared understanding of who the project must collaborate with, who will benefit from its outputs, and who may influence long-term adoption. This step ensures that engagement remains focused, proportionate, and tailored to the needs of each Work Package.

Stakeholder mapping helps the project:

- Identify all actors who influence, contribute to, or will use BioGeoSea's outputs;
- Clarify where co-design, validation, and uptake are required;
- Prioritise engagement based on interest, influence, and relevance;
- Avoid duplication and reduce stakeholder fatigue across WPs;
- Provide each WP with a structured baseline for targeted engagement.

This aligns with the BioGeoSea's ambition to work in co-development with stakeholders, scientific communities, monitoring agencies, policymakers, and blue-economy actors and to ensure regular consultations, collaborative activities, and validation exercises.

Stakeholder mapping begins by identifying the broad categories of actors relevant to the project. These categories reflect the ocean-observing value cycle: scientific and expert communities involved in BGC EOV development; observing networks and data providers; data infrastructures and synthesis products; sister projects and European initiatives; policy and governance bodies; blue-economy and industry users; civil society; and international coordination structures such as GOOS, GCOS, and the UN Ocean Decade. This provides a structured starting point for all WPs.

The BioGeoSea stakeholder mapping has started at the BioGeoSea Kick-Off Meeting (September 2025 – Figure 2) and with the preparation of Milestone 1 (November 2025). Six key stakeholder groups were identified and are summarized in Table 2 below.



Figure 2. Stakeholder mapping session at the BioGeoSea kick-off meeting in Brussels, 30 September 2025

Table 2. Stakeholder groups

Category	Stakeholder
<p><b>1. Scientific and Expert Communities - these actors inform requirements, indicator development, modelling, and best practices</b></p>	<ul style="list-style-type: none"> <li>• Intergovernmental Panel on Climate Change (IPCC)</li> <li>• Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES)</li> <li>• Global Climate Observing System (GCOS)</li> <li>• Global Ocean Observing System (GOOS) and its relevant panels and initiatives, e.g. International Ocean Carbon Coordination Project (IOCCP), BioEco Panel, etc.</li> <li>• European Global Ocean Observing System (EuroGOOS)</li> <li>• Scientific Committee on Oceanic Research (SCOR)</li> <li>• Ocean Best Practices System (OBPS)</li> <li>• UN Ocean Decade OceanPredict Programme</li> <li>• Surface Ocean CO<sub>2</sub> Mapping (SOCOM)</li> <li>• Surface Ocean–Lower Atmosphere Study (SOLAS)</li> <li>• Global Carbon Project</li> <li>• EU projects: BioEcoOcean, ObsSea4Clim, GEORGE, TRICUSO, others</li> </ul>
<p><b>2. Observing Networks, Monitoring Bodies &amp; Research Infrastructures - essential for data collection, sensor validation, and long-term continuity</b></p>	<ul style="list-style-type: none"> <li>• EuroGOOS Task Teams and other networks of ocean observing platforms (OceanSITES, SOCONET)</li> <li>• ERICs and Research Infrastructures (RIs) (e.g. Euro-Argo, ICOS, EMSO, GO-SHIP, JERICO, EuroFleets)</li> <li>• OceanOPS</li> <li>• Marine Environmental Time Series – Research Coordination Network (METS-RCN)</li> </ul>

Category	Stakeholder
	<ul style="list-style-type: none"> <li>• National monitoring programmes and research vessels</li> <li>• Satellite observing bodies (e.g. ESA)</li> </ul>
<p><b>3. Data Infrastructures and Product Developers - these groups ensure data accessibility, interoperability, and integration.</b></p>	<ul style="list-style-type: none"> <li>• Global Ocean Oxygen Database and ATlas (GO2DAT)</li> <li>• Global Ocean Data Analysis Project (GLODAP)</li> <li>• Surface Ocean CO<sub>2</sub> Atlas (SOCAT)</li> <li>• MarinE MethanE and NiTrous Oxide database (MEMENTO)</li> <li>• Carbon Inventory of the Mediterranean Sea (CARIMED)</li> <li>• International Marine Debris Observing System (IMDOS)</li> <li>• European Marine Observation and Data Network (EMODnet), especially Chemistry and Physics</li> <li>• SeaDataNet</li> <li>• Ocean Data and Information System (ODIS)</li> <li>• National data centres</li> <li>• Copernicus Marine Service (CMEMS)</li> </ul>
<p><b>4. European &amp; International Policy, Governance &amp; Funding Bodies - critical for policy uptake, alignment, foresight, and legacy</b></p>	<ul style="list-style-type: none"> <li>• European Commission DGs (MARE, ENV, CLIMA, RTD, JRC) and Executive Agencies (REA)</li> <li>• National ministries (transport, tourism, environment, trade, agriculture)</li> <li>• MSFD authorities</li> <li>• Regional Sea Conventions (HELCOM, OSPAR, Barcelona Convention, Black Sea Commission, UNEP)</li> <li>• International Council for the Exploration of the Sea (ICES)</li> <li>• IOC / UNESCO</li> <li>• WMO</li> <li>• JPI Oceans</li> <li>• High-level agendas (e.g. G7 Future of the Seas and Oceans Initiative)</li> <li>• Funding agencies &amp; ERA networks</li> </ul>
<p><b>5. Blue Economy &amp; Industry Actors - stakeholders needing indicators, data,</b></p>	<ul style="list-style-type: none"> <li>• Fisheries and aquaculture (including bivalve aquaculture)</li> <li>• Shipping companies</li> <li>• Cruise tourism</li> </ul>

Category	Stakeholder
<b>models, or tools for operational decisions</b>	<ul style="list-style-type: none"> <li>• Eco-tourism operators (scuba diving, snorkelling)</li> <li>• Marine carbon removal (mCDR) companies</li> <li>• Offshore wind and marine energy</li> <li>• Oil &amp; gas (e.g., ENI, Total)</li> <li>• Desalination companies</li> <li>• Insurance companies</li> <li>• Technical inspection companies</li> <li>• Consultancy companies</li> <li>• Food and Agriculture Organization of the United Nations (FAO)</li> </ul>
<b>6. Civil Society, NGOs &amp; Communication Stakeholders</b>	<ul style="list-style-type: none"> <li>• Relevant for public engagement and ocean literacy (as required by project's outreach)</li> <li>• NGOs focused on climate, biodiversity, and ocean health</li> <li>• Science communicators</li> <li>• Ocean literacy initiatives</li> <li>• Blue-economy networks</li> <li>• Media &amp; outreach organisations</li> <li>• General public (e.g., via indicators and outreach materials)</li> </ul>

Each WP then identifies its specific subset of stakeholders from the categories above, based on its tasks, deliverables, and expected outputs. This tailored approach ensures that engagement is aligned with the scientific and operational goals of each WP, rather than adopting a one-size-fits-all model.

For example:

- WP1 focuses on GOOS panels, EOV experts, policy actors;
- WP2 focuses on observing networks, RIs, and sensor developers;
- WP3 focuses on modelling communities, OceanPredict, CMEMS;
- WP4 focuses on global data infrastructures and synthesis products;
- WP5 focuses on policymakers, blue-economy actors, and global alignment partners;
- WP6 focuses on leadership initiatives (GOOS, GCOS, IOC, UN Ocean Decade).

The list above is comprehensive but not static. New initiatives, datasets, policy developments, and scientific advances will appear throughout the project. For this reason, stakeholder maps will be updated regularly (at least annually and before major engagement cycles), allowing the project to remain responsive to opportunities and global developments in ocean observation, modelling, and policy.

### 4.3 Step 3 – Study, Make Assumptions & Prioritise

Once stakeholders are identified and categorised, the next step is to analyse their roles, expectations, and potential contributions to BioGeoSea. This phase helps each WP understand how and why different actors matter to their tasks, and ensures that engagement efforts are targeted, proportionate, and aligned with project needs. It also creates a clear basis for co-design, validation, and the uptake of BioGeoSea outputs.

To understand stakeholder needs, roles, and motivations, each WP examines the stakeholders mapped in Step 2 to understand:

- Stakeholders' current or potential role in the BGC EOV value chain (e.g. data producer, indicator user, policy advisor, modelling centre, infrastructure manager)
- Their likely expectations regarding BioGeoSea outputs (e.g. improved standards, better forecasts, harmonised data)
- Their specific needs (e.g. validation of indicators, access to data products, improved observing practices)
- Their constraints or limitations (e.g. operational bandwidth, regulatory boundaries, technological readiness)
- Their potential to support or influence adoption of BioGeoSea's indicators, models, or data workflows.

This analysis helps anticipate stakeholder motivations and tailor engagement accordingly. Initial assumptions should be documented and where possible validated through interviews, workshops, co-design sessions, and technical exchanges.

Typical assumptions may include:

- Stakeholders are willing to collaborate if engagement is purposeful and time-efficient;
- Scientific and monitoring actors will prioritise improving data quality and standardisation;
- Policy and governance actors will focus on clear, actionable indicators;
- Blue-economy stakeholders value operational reliability and usability;
- Modelling centres need high-quality, harmonised BGC data to improve forecasts.

These assumptions ensure early planning can begin, while recognising that they will evolve as engagement progresses.

After studying stakeholder roles and initial assumptions, each WP prioritises its stakeholders using an interest–influence matrix. This helps determine the depth, intensity, and frequency of engagement required (see Figure 3).

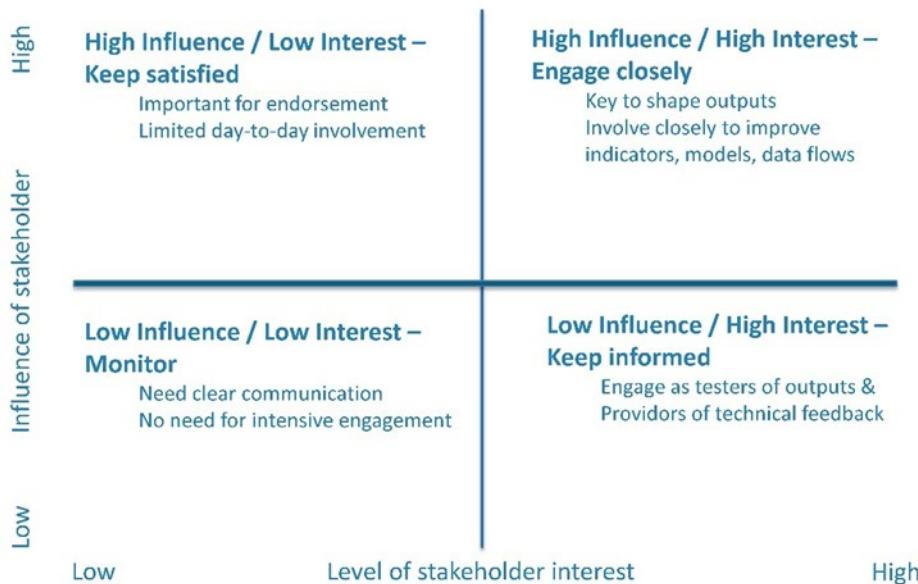


Figure 3. BioGeoSea Interest-Influence matrix

The prioritization is developed through an interactive Miro board template of the Influence-Interest matrix, developed by WP1 and 5 in December 2025 and shared with the consortium, and a spreadsheet which sets the prioritisation relative to the problems/questions to be addressed through the engagement, and the value propositions and engagement format for each stakeholder category (Table 3).

Table 3. BioGeoSea stakeholder engagement template for co-design with consortium (Draft, December 2025)

Matrix Stakeholder Engagement								
Fichier Édition Affichage Insertion Format Données Outils Extensions Aide								
J5	A	B	C	D	E	F	G	H
1	Group	Stakeholder	Question	Level of Influence	Assumption	Value Proposition	Data / Input Provided	Engagement Format
2	Scientific and Expert Communities - these actors inform requirements, indicator development, modelling, and best practices	Intergovernmental Panel on Climate Change (IPCC)						
3		Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES)						
4		Global Climate Observing System (GCOS)						
5		Global Ocean Observing System (GOOS) and its relevant panels and initiatives, e.g., International Ocean Carbon Coordination Project (IOCCP), BioEco Panel, OCG, etc.						
6		European Global Ocean Observing System (EuroGOOS)						
7		Scientific Committee on Oceanic Research (SCOR)						
8		Ocean Best Practices System (OBPS)						
9		UN Ocean Decade OceanPredict Programme						
10		Surface Ocean CO <sub>2</sub> Mapping (SOCOM)						
11		Surface Ocean-Lower Atmosphere Study (SOLAS)						
12		Global Carbon Project						
13		EU projects: BioEcoOcean, ObsSea4Clim, GEORGE, TRICUSO, others						

Prioritization forms the essential bridge between defining the engagement purpose, mapping stakeholders, and shaping the subsequent value proposition and engagement design. It ensures that engagement is proportionate, avoids unnecessary burden on stakeholders, and aligns engagement formats with stakeholder needs. It also supports efficient use of partner time and reduces duplication across WPs.

Stakeholder analysis will inevitably uncover areas where more information is required. For example, some stakeholders may be newly emerging actors (e.g. mCDR companies), while others may have evolving mandates (e.g. EU-level policy organisations or UN Decade coordination structures). By documenting these uncertainties, WPs can plan targeted actions to fill gaps early in the process.

As understanding deepens, WPs revise assumptions, update positions within the interest–influence matrix, and refine priorities. This creates an adaptive, evidence-based engagement process. By the end of Step 3, BioGeoSea should have:

- A clear understanding of stakeholder roles, expectations, needs, and constraints;
- A documented set of assumptions to be validated in subsequent engagement;
- A prioritisation of stakeholders according to interest and influence;
- A rationale for engagement decisions that will guide Step 4 (Design Engagement).

This prepares the project for the next phase: developing purpose-driven value propositions, engagement formats, and timing strategies.

#### 4.4 Step 4 – Design Engagement (Value Proposition, Formats, Timing)

Designing engagement is the stage where the stakeholder analysis from Steps 2 and 3 is transformed into a clear, actionable plan. This step ensures that each WP engages the right stakeholders, in the right way, and at the right moment. Engagement must be purposeful, proportionate, and tailored to stakeholder needs, while supporting the co-design, validation, and uptake processes required by BioGeoSea’s scientific and technical objectives.

A strong value proposition explains why stakeholders should engage with BioGeoSea and what they gain from participating. Each WP develops its own tailored value proposition, aligned with the project’s overarching goals and the specific outputs it delivers.

Key elements of a WP-level value proposition:

- **Stakeholder needs:** What each group wants to achieve (e.g., better forecasts, harmonised data, operational tools, indicators for management).
- **BioGeoSea contribution:** How the project’s outputs help solve their challenges or improve their workflow.
- **Mutual benefits:** What both sides gain: improved indicators, stronger observing systems, better modelling, aligned standards, operational relevance.
- **Pathways for influence:** How stakeholders’ input will shape outputs and how validation loops will incorporate their feedback.

A well-crafted value proposition motivates stakeholders to participate by showing the relevance of their contribution, clarifies expectations on both sides, strengthens the co-design process by highlighting where their input can shape outcomes, and ultimately supports long-term uptake and legacy by demonstrating the lasting value of their involvement.

Once stakeholders are prioritised and the value proposition is clear, formats are chosen to best match stakeholder influence, interest, expertise, and time availability.

The engagement formats selected for each stakeholder group must reflect their level of influence, their interest in the project, and the type of contribution expected from them. This alignment ensures that engagement is proportionate, respectful of stakeholder capacity, and tailored to the BioGeoSea needs.

- **High-influence, high-interest stakeholders** (e.g. observing networks, GOOS panels, or modelling centres) should be engaged through co-design workshops, technical meetings, or iterative review cycles, where their expertise can directly shape specifications, indicators, and data workflows.
- **High influence but lower interest stakeholders**, often found in policy or high-level governance roles, require concise and strategic engagement: targeted briefings, focused bilateral meetings, or short consultations that ensure alignment without demanding extensive time commitments.
- **High interest but lower influence stakeholders**, such as technical users, early adopters, or specialist groups, are best engaged through validation activities, testing sessions, or targeted feedback rounds where their detailed input can strengthen the quality and usability of outputs.
- **Low interest and low influence stakeholders** are still important but require lighter engagement, typically through general communication channels such as newsletters or public updates.

BioGeoSea engagement mode, use, and formats are outlined in Table 4.

*Table 4. Engagement mode, use, and formats*

Engagement Mode & Use	Format
<b>Notification</b> Used for lower-interest stakeholders or awareness-raising	Newsletters, email updates, website news items, social media posts, briefing notes
<b>Consultation</b> Used when feedback is needed but intensive co-design is not required	Surveys, semi-structured interviews, questionnaires, targeted feedback request on drafts
<b>Co-design and co-production</b> Used for high-interest, high-influence stakeholders shaping major outputs	Technical workshops, expert panels, focused design sessions, iterative co-development rounds, small working groups
<b>Validation and testing</b> Used when outputs need real-world evaluation	User- testing of the BioGeoSea software, indicator review workshops, prototype demonstrations, pilot deployment with feedback loops, operational product reviews

Engagement Mode & Use	Format
<b>Multi-stakeholder forums</b> Used for system-level alignment across communities and sectors	Multi-stakeholder workshops, roundtables, conference sessions, science-policy dialogues, GOOS or Ocean Decade events

Each Work Package adapts the engagement design to its scientific and operational tasks. For example:

- WP1 uses co-design sessions with GOOS panels and policy stakeholders to refine EOV specifications and indicators;
- WP2 organises technical workshops with observing networks to improve and validate platform methods and sensor performance;
- WP3 conducts iterative exchanges with modelling centres and forecasting community to integrate BGC data and validate model products;
- WP4 holds alignment workshops with global data infrastructures to harmonise workflows and QC/QA;
- WP5 designs policy dialogues, foresight sessions, and software user testing with agencies, industry, and blue-economy actors;
- WP6 ensures that high-level bodies and initiatives (GOOS, GCOS, IOC, Ocean Decade) are engaged strategically to enhance legacy and uptake.

Furthermore, the design of BioGeoSea's engagement approach takes into account several broader considerations that are essential for ensuring lasting value. It is designed with sustainability in mind. A cornerstone of the project's stakeholder engagement is building strong relationships with key actors across the ocean community to ensure that BioGeoSea indicators, workflows, and methods continue to benefit ocean observing, modelling, and management long after the project concludes.

Activities are planned with a strong emphasis on interoperability and alignment with global standards, recognising that the project's outputs integrate into international frameworks. They also reflect BioGeoSea's connection to long-term observing and data systems, ensuring that improvements made within the project contribute to sustained enhancements in ocean monitoring. The stakeholder engagement strategy also acknowledges the important role of sister projects in shaping a coherent European ocean observing landscape, using collaboration to reinforce complementarity and avoid duplication.

Timing of engagement is another crucial point. Engagement must be aligned with project milestones, deliverables, and scientific readiness but also be timely for stakeholders themselves (in particular high-interest, high-influence stakeholders).

Engagement windows are planned so that stakeholders are consulted when their expertise is most valuable, and when the project is ready to respond to their feedback. For example, indicator co-design must occur early enough for input to shape specifications, whereas demonstration of models

or data products must be scheduled once those outputs are available. In contrast, policy-related engagement requires awareness of external cycles such as MSFD updates, UN Ocean Decade events, or emerging EU Ocean Observation Initiative developments.

Coordinating timing across WPs is essential to avoid duplication or stakeholder fatigue. WP1 and WP5 support the alignment of engagement calendars, ensuring that similar stakeholder groups are not approached simultaneously by multiple WPs unless joint engagement is beneficial. Through this coordinated approach, timing becomes a strategic enabler: it ensures that engagement remains purposeful, efficient, and impactful, and that the project builds momentum through well-timed interactions rather than scattered or reactive outreach.

#### 4.5 Step 5 – Roll Out Engagement

Rolling out engagement is the operational phase of the strategy, where planned activities are implemented across the various work streams of BioGeoSea. It is important to ensure that stakeholder interactions are coordinated, purposeful, and documented, and that BioGeoSea's outputs evolve through direct collaboration with the scientific community, observing networks, modelling centres, policy actors, and blue-economy users.

To ensure a consistent, efficient roll-out, Work Packages coordinate their engagement activities with WPs 1, 5, and 6:

- WP1 oversees cross-WP scientific and technical engagement (co-design, requirements, indicator development);
- WP5 coordinates external communication, exploitation, policy alignment, and foresight-related engagement;
- WP6 ensures alignment with overall project management, governance, and international liaison.

Together, these WPs provide a shared structure that allows each WP to implement engagement activities without overburdening stakeholders or duplicating efforts. Each WP leads the engagement that relates to its tasks but follows shared principles and coordination mechanisms.

These responsibilities require each WP to coordinate closely with WP1 and WP5, informing them in advance of any planned meetings or consultation activities so that engagement remains coherent across the project. Engagement must be carried out using the formats defined in Step 4, while ensuring that all interactions are respectful of stakeholders' time and capacities. WPs are responsible for documenting the outputs of these activities, including decisions taken and feedback received, and for aligning their engagement with relevant deliverables, milestones, and levels of scientific readiness.

Regular reporting to the BioGeoSea Steering Committee ensures that progress, challenges, and emerging needs are transparently communicated. Throughout this process, WPs maintain consistent communication with WPs 1, 5, and 6 and use the central stakeholder database managed by WP1 to track interactions and ensure continuity across engagement cycles.

The roll-out phase may involve a broad range of interactions, depending on the WP and the maturity of the outputs. Examples of engagement activities across BioGeoSea include:

- Indicator co-design sessions with GOOS panels and policy users (WP1)
- Technical workshops with observing networks to refine BGC measurement protocols (WP2)
- Model–data comparison exercises with ESM experts and forecasting centres (WP3)
- Harmonisation meetings with global data infrastructures (GO2DAT, GLODAP, EMODnet) (WP4)
- Software demonstration sessions with agencies, researchers, and industry for the BioGeoSea SaaS platform (WP5)
- Policy dialogues and foresight workshops to ensure uptake and relevance (WP5)
- Joint meetings with sister EU projects for alignment and clustering (WP1, WP5).

Documentation is essential for transparency, evaluation, and project reporting. Each WP maintains:

- Records of meetings, workshops, and consultations;
- Lists of participants;
- Summaries of feedback received;
- Follow-up actions and their implementation status;
- Input integrated into deliverables or specifications;
- New or emerging stakeholders identified during engagement.

WP1 and WP5 maintain a centralised stakeholder engagement database (based on Milestone 1) where updates are logged and accessible to all partners. This ensures that stakeholder contributions are visible across the project and that engagement remains coherent over time. Two versions of the stakeholder engagement database are maintained: a version open to all partners – for tracking stakeholder types, organisations, engagement points, results, next steps; and a version complete with the names of individual stakeholders and their emails (or other personal data). Strict GDPR compliance will be ensured for the management of the complete database, only open to a small number of BioGeoSea experts, namely, co-leads of WPs 1, 5, and 6 (six persons).

In rolling out engagement, preventing stakeholder fatigue is an important consideration. Because BioGeoSea engages many actors who are also active in other European and international projects (e.g., BioEcoOcean, ObsSea4Clim, GOOS), avoiding over-engagement is essential. Strategies include:

- Grouping related engagement activities;
- Sharing outputs between WPs to avoid repeating consultations;
- Coordinating invitations through WP1/WP5;
- Using existing forums (e.g., GOOS panels, OceanPredict, EuroGOOS) instead of creating new meetings;
- Ensuring that feedback is visibly integrated into outputs, reinforcing stakeholder motivation to participate.

By the end of Step 5, BioGeoSea stakeholder engagement activities aim to establish a coordinated schedule of engagement activities across all WPs, ensuring that interactions with stakeholders are

timely, efficient, and well aligned. A clear and well-documented record of stakeholder contributions and links to deliverables and milestones will ensure feedback is integrated into the ongoing work. This foundation prepares the project for Step 6, where the outcomes of engagement are validated, refined, and further aligned with stakeholder expectations.

#### 4.6 Step 6 – Validate and Improve Outputs

Validation is a critical stage in the BioGeoSea engagement cycle. It transforms stakeholder interaction into measurable improvements in the project's scientific, technical, and operational outputs. This step ensures that the tools, indicators, methods, models, and data products developed within the project are not only scientifically robust but also relevant, usable, and trusted by the communities that will ultimately adopt them. Validation is therefore an iterative, evidence-driven process that strengthens project quality and supports long-term uptake.

BioGeoSea aims to work through regular consultations, collaborative activities, and validation exercises to ensure its outputs meet the needs of scientific communities, monitoring agencies, policymakers, and blue-economy actors.

Validation serves several complementary purposes. It assesses whether the outputs developed within each WP meet the requirements defined in earlier stages of the project, and it incorporates operational, scientific, and policy feedback before any results are finalised. Through this process, BioGeoSea ensures that its methods, specifications, and data products align with international standards and reflect best practices across observing, modelling, and data communities. Validation also demonstrates the robustness and credibility of project results, providing assurance that they are scientifically sound and operationally reliable. Ultimately, it confirms that outputs are usable by their intended end users and ready for integration into broader systems and decision-making processes.

Validation activities vary across WPs and specific engagement goals but follow the same general principles.

- WP1 – BGC Requirements and Indicators - stakeholders review draft EOV specifications, indicator definitions, and methodological approaches. GOOS panels and policy users provide feedback on clarity, scientific validity, feasibility, and policy relevance.
- WP2 – Observational Enhancements - observing networks and RIs test proposed methods, calibration approaches, and platform enhancements, ensuring that improvements are operationally feasible and compatible with existing infrastructure.
- WP3 – Modelling and Projections - modelling centres and forecasting communities validate model components and assimilation methods.
- WP4 – Data Products and Integration - global data infrastructures validate harmonisation workflows, QC protocols, and data integration strategies, ensuring alignment with international data standards.
- WP5 – Leadership, Exploitation, and Legacy - policy and blue-economy stakeholders assess indicators, tools, and the BioGeoSea software for usability, clarity, relevance, and operational fit. Foresight and governance actors validate long-term alignment and pathways for adoption, with a targeted input from the BioGeoSea Advisory and Foresight Committee.

Validation formats are chosen according to stakeholder influence, interest, and expertise, as defined in Steps 3 and 4. These may include focused expert reviews and targeted consultations, iterative co-design cycles, operational testing, user-experience evaluations, joint validation events with sister projects.

Validation is not a one-off checkpoint but a continuous feedback loop. For each validation activity, WPs/KER developers:

- Document stakeholder input;
- Assess its relevance, feasibility, and implications;
- Integrate revisions into tools, data workflows, models, or indicators;
- Communicate back to stakeholders how their feedback was addressed;
- Identify any remaining gaps requiring further engagement.

This process ensures transparency, builds trust, and creates a sense of shared ownership over the outputs. Validation also checks BioGeoSea's consistency with global standards, interoperability with existing workflows, compatibility with existing observing and data systems, and alignment with policy frameworks such as MSFD.

By the end of this step, BioGeoSea has rigorously tested and refined its outputs with the stakeholders most relevant to each component of the project. The work carried out during validation ensures scientific, operational, and policy alignment, and it strengthens trust and credibility across the diverse communities involved in the biogeochemical observing and modelling landscape. As a result, the project's tools, indicators, and data products can be scientifically robust, operationally meaningful, and ready for broader dissemination and adoption. This solid foundation prepares BioGeoSea for Step 7, where these validated outputs are reported, shared, and communicated across scientific, operational, policy, and public domains.

## 4.7 Step 7 – Report and Disseminate

Reporting and dissemination are essential components of the BioGeoSea engagement cycle. Once outputs have been validated and refined, they must be communicated clearly, accurately, and in a way that supports uptake across scientific, operational, policy, and societal actors. This step ensures that BioGeoSea's results are visible, accessible, and usable, strengthening the project's contribution to European and global biogeochemistry communities and enabling its findings to reach the audiences who can benefit from them most.

Reporting and dissemination serve several interlinked goals, namely to:

- Provide transparency about the development process and demonstrate how stakeholder input has shaped the outputs;
- Make scientific results, indicators, data products, and tools available to users and decision-makers;
- Support alignment with international frameworks by ensuring that updated EOV specification sheets, improved models, harmonised data workflows, and new indicators are communicated to the bodies responsible for their integration into long-term systems.

Progress, findings, and validation outcomes are reported to the BioGeoSea Steering Committee, feed into reports and deliverables, and support cross-WP meetings coordinated by WP1 and WP6.

Internal reporting and documentation via the stakeholder database ensure all partners are aligned, and engagement outcomes are reflected in technical development.

Once internal reporting is complete, BioGeoSea disseminates its outputs externally through multiple channels, adapted to the needs of different stakeholder groups. Examples include:

- Scientific publications, technical reports, and indicator factsheets;
- Contributions to GOOS and GCOS meetings;
- Presentations at conferences and workshops (e.g., Ocean Decade events, EGU, ICOS Conference, EuroGOOS International Conference);
- Targeted briefings for policymakers, advisory bodies, and funding agencies;
- Integration of results into existing data infrastructures (e.g., GLODAP, GO2DAT, EMODnet Chemistry, SeaDataNet);
- Releases of datasets, tools, and prototypes on open-access platforms;
- Communication materials produced by WP5, such as web updates, social media content, infographics, webinars, and short videos.

WP5 ensures dissemination materials are designed to be accessible and tailored, ensuring that technical users receive full scientific detail while policy and blue-economy audiences receive clear, concise, operationally relevant information.

A core element of dissemination is demonstrating how stakeholder feedback has genuinely shaped BioGeoSea outputs. This transparency builds trust and encourages continued engagement. This closes the feedback loop established in Steps 4-6 and creates a clear narrative of co-development.

Dissemination is also designed to support long-term uptake. Once validated in Step 6, BioGeoSea outputs are communicated in a targeted way to ensure they are integrated where they can have lasting impact.

Observing networks receive updated methods and specifications that can be incorporated into sustained monitoring programmes, while modelling centres are provided with refined data and indicators that can feed into biogeochemical model developments. Data systems and infrastructures receive harmonised workflows and validated datasets. Policy authorities and governance bodies are informed through concise, relevant materials that support environmental assessments and decision-making processes. Blue-economy and industry actors receive operationally meaningful tools and indicators that can be applied in their planning and management activities.

As part of WP5's leadership and legacy objectives, dissemination also contributes to foresight and alignment with emerging European initiatives, ensuring BioGeoSea influence extends beyond the project lifetime.

## 4.8 Step 8 – Repeat as the Problem Evolves

Stakeholder engagement in BioGeoSea is not a linear sequence of actions but a dynamic, cyclical process (see Figure 1). As the project advances, scientific understanding deepens, data products mature, external policy contexts shift, and new priorities emerge within the European and global biogeochemistry landscape. Step 8 ensures that the engagement strategy remains adaptive and relevant, allowing the partners to revisit earlier stages of the cycle whenever necessary and refine their approaches accordingly.

Ocean biogeochemistry is influenced by rapid developments in observation technologies, modelling capabilities, international coordination processes, and environmental policy agendas. Throughout the project, new challenges may arise, or existing ones may evolve, for example, the emergence of new policy windows, advances in sensor technology, updates to GOOS strategic goals, or shifts in the scientific priorities of sister projects. These changes require BioGeoSea to reassess the problem definition, revisit stakeholder assumptions, or adapt engagement formats and timing. Iteration ensures that project outputs do not stagnate but continue to reflect the needs and realities of the communities they serve.

The cyclic nature of the engagement framework allows WPs to return to earlier steps as new information becomes available. For example:

- If new stakeholders emerge, WPs revisit Step 2 to update the stakeholder map.
- If assumptions prove inaccurate, Step 3 is updated to reflect revised expectations or needs.
- If feedback signals gaps in design, Step 4 is reopened to adjust value propositions or engagement formats.
- If new versions of outputs are developed, further validation under Step 6 may be required.

By allowing such adjustments, the strategy ensures that engagement remains tightly coupled to the development of indicators, methods, data products, and user-focused tools.

Furthermore, this step embeds a culture of continuous learning within the project. Each round of engagement generates new insights, not only about what stakeholders need, but also about how they prefer to collaborate, when they can contribute most effectively, and which formats produce the highest-quality feedback. These lessons help refine future engagement cycles, increasing efficiency, strengthening trust, and deepening stakeholder ownership of BioGeoSea outputs.

By embracing iteration, BioGeoSea maintains an engagement process that is flexible, evidence-based, and resilient to change. The project stays responsive to scientific, operational, and policy developments, ensuring that its results remain meaningful, usable, and positioned for lasting impact. This final step closes the engagement loop and connects directly back to Step 1, reinforcing a continuous cycle of learning, refinement, and co-creation.

## 5 Conclusion

The BioGeoSea Stakeholder Engagement Strategy provides a structured, adaptive, and collaborative framework that supports the project's scientific, operational, and policy ambitions. By embedding stakeholder participation throughout the entire project cycle, from defining problems to validating outputs and ensuring their long-term uptake, the strategy ensures that BioGeoSea's work is not only scientifically robust but also relevant, trusted, and usable across diverse communities.

Through the eight-step engagement flow, all WPs share a common approach to identifying key actors, understanding their needs, designing meaningful engagement, and integrating their contributions into biogeochemical indicators, observing methods, models, and data products. This coordinated process reinforces BioGeoSea commitment to co-development, transparency, and alignment with European and international frameworks and services (e.g. GOOS, GCOS, Copernicus Marine, EMODnet).

The strategy also recognises that engagement is not static. As new scientific developments, policy priorities, and societal needs emerge, BioGeoSea will revisit and refine its engagement approach. This capacity for iteration strengthens the project's resilience, enabling it to respond to evolving contexts and maintain strong links with the communities it serves.

Ultimately, the Stakeholder Engagement Strategy is a foundation for the BioGeoSea long-term impact. By cultivating strong partnerships, supporting knowledge exchange, and ensuring that outputs are relevant and operationally meaningful, the project contributes to a more coherent and integrated European biogeochemistry landscape. It empowers the scientific community, supports policy and management decisions, and enhances the long-term sustainability of ocean observing and forecasting systems.

The BioGeoSea success relies on these collaborative relationships. Through sustained, purposeful, and well-coordinated engagement, the project ensures that its contributions will extend beyond its lifetime and strengthen the collective ability to observe, understand, and restore the ocean.

## 6 List of Acronyms

Acronym	Description/Context
<b>BGC EOVs</b>	Biogeochemical Essential Ocean Variables
<b>BioEco Panel</b>	The GOOS Biology and Ecosystems (BioEco) Panel coordinates global efforts to create a sustained ocean observation system for biological and ecological health, focusing on Essential Ocean Variables (EOVs)
<b>BioEcoOcean</b>	Co-Creating Transformative Pathways to Biological and Ecosystem Ocean Observations
<b>BioGeoSea</b>	Enhancing Biogeochemical Essential Ocean Variables for European and Global Assessments
<b>CARIMED</b>	CARbon, tracers, and ancillary data In the MEDiterranean Sea
<b>CMEMS</b>	Copernicus Marine Service
<b>D</b>	Deliverable
<b>EMODnet</b>	European Marine Observation and Data Network
<b>EOVs</b>	Essential Ocean Variables
<b>ERICs</b>	European Research Infrastructure Consortia
<b>EuroGOOS</b>	European Global Ocean Observing System
<b>GCOS</b>	Global Climate Observing System
<b>GDPR</b>	General Data Protection Regulation
<b>GLODAP</b>	Global Ocean Data Analysis Project
<b>GO2DAT</b>	Global Ocean Oxygen Database and ATlas
<b>GOA-ON</b>	Global Ocean Acidification Observing Network
<b>GOOS</b>	Global Ocean Observing System
<b>IMDOS</b>	Integrated Marine Debris Observing System
<b>IOC</b>	/ Intergovernmental Oceanographic Commission / United Nations Educational, Scientific and Cultural Organization
<b>UNESCO</b>	
<b>IOCCP</b>	International Ocean Carbon Coordination Project
<b>IPBES</b>	Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services
<b>IPCC</b>	Intergovernmental Panel on Climate Change
<b>JPI Oceans</b>	Joint Programming Initiative Healthy and Productive Seas and Oceans
<b>KERs</b>	Key Exploitable Results
<b>MEMENTO</b>	MarinE MethanE and NiTrous Oxide

Acronym	Description/Context
<b>METS-RCN</b>	Marine Environmental Time Series – Research Coordination Network
<b>MSFD</b>	EU Marine Strategy Framework Directive
<b>OCG</b>	Ocean Carbon and Biogeochemistry
<b>ODIS</b>	Ocean Data and Information System
<b>OceanOPS</b>	Global Ocean Monitoring and Observing Program
<b>QA</b>	Quality Assurance
<b>QC</b>	Quality Control
<b>RIs</b>	Research Infrastructures
<b>SaaS</b>	Software as a Service
<b>SCOR</b>	Scientific Committee on Oceanic Research
<b>SOCAT</b>	Surface Ocean CO <sub>2</sub> Atlas
<b>SOCOM</b>	Surface Ocean CO <sub>2</sub> Mapping
<b>SOLAS</b>	Surface Ocean–Lower Atmosphere Study
<b>WP</b>	Work Package
<b>WMO</b>	World Meteorological Organization