MARCO-BOLO

STRENGTHENING BIODIVERSITY OBSERVATION IN SUPPORT OF DECISION MAKING

Deliverable 6.2

Three co-design/co-creation/stakeholder consultation workshop reports, with recommendations/decisions for the project workplan

3 November 2025

Lead beneficiary: UNESCO

PUBLIC

Funded by the European Union

Funded by the European Union under the Horizon Europe Programme, Grant Agreement No. 101082021 (MARCO-BOLO). Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or European Research Executive Agency (REA). Neither the European Union nor the granting authority can be held responsible for them.

UK Research and Innovation

UK participants in MARCO-BOLO are supported by the UKRI's Horizon Europe Guarantee under the Grant No. 10068180 (MS); No. 10063994 (MBA); No. 10048178 (NOC).

Document Information

Grant Agreement	101082021
Project Acronym	MARCO-BOLO
Project Title	MARine COastal BiOdiversity Long-term Observations

Deliverable Number	D6.2
Work Package Number	WP6
Deliverable Title	Three co-design/co-creation/stakeholder consultation workshop reports, with recommendations/decisions for the project workplan
Lead Beneficiary	7 - UNESCO
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Due Date	31.07.2025
Submission Date	03.11.2025
Dissemination Level	PU
Type of Deliverable	R: Document

Version 1.0	31.07.2025, Lisa Benedetti (UNESCO)
Version 2.0	05.08.2025, Lisa Benedetti (UNESCO)
Version 3.0	27.08.2025, Lisa Benedetti (UNESCO)

Executive Summary

The MARCO-BOLO project aims to structure and strengthen European coastal and marine biodiversity observation capabilities, linking these to global efforts to understand and restore ocean health, hence ensuring that outputs respond to explicit stakeholder needs from policy, planning and industry.

To this end, MARCO-BOLO has established and is engaging regularly with a Community of Practice (CoP) made up of (Marine and Coastal) Biodiversity Data Generators and Data users from marine observatories, data infrastructures, and other relevant stakeholders across the EU and internationally. The overall aim of the CoP is to ensure that project outcomes are stakeholder-driven and marine data flows and knowledge uptake are optimised while improving governance based on biodiversity observations.

The project has 7 Work Packages (WPs), with WP6 responsible for facilitating stakeholder engagement amongst the technical WPs 1-5 through the CoP, as well as developing Knowledge Transfer material from WP Deliverables and wider outputs. To facilitate this effort, WP6 established a core group of the CoP during early stages of the project composed of project partners and representatives from key organisations (EuropaBON, Biodiversa+, MBON, GOOS, EuroGOOS, EMODnet, ICES, Mercator) who meet online every 6 months to provide advice and help steer overall stakeholder engagement for the project. The CoP is chaired by UNESCO as WP6 co-lead.

To enable stakeholder engagement and consultation, two major CoP events and three Co-design/Co-creation Workshops were planned. In the first two years of MARCO-BOLO, WP6 convened the first CoP and three Co-design/Co-creation Workshops, all held mainly online, with the exception of the second workshop. The aim was to bring together relevant partners and end-users through a phased approach to set up necessary feedback loops for the development of products that consider end-user needs and requirements. This effort as a whole will inform the development of knowledge transfer assets (T6.3) and impact pathways for effective uptake by stakeholders during the project's final stages, ensuring a continuing legacy.

MARCO-BOLO also engages regularly with relevant EU Projects, including OBAMA-NEXT, DiverSEA and BioEcoOcean, to exchange on stakeholder engagement methods, needs, key actors and planning in an effort to limit duplication and avoid stakeholder fatigue. MARCO-BOLO has also continuously engaged with EuropaBON and Biodiversa+ as key stakeholders of the project which has been a positive outcome of the CoP.

This report is Deliverable 6.2 of the project, which provides a summary of the three co-design/co-creation/stakeholder consultation workshops and weblinks to the full workshop reports, with main conclusions and recommendations/decisions for the project workplan that have and are being considered by the MARCO-BOLO Coordination team and Project Implementation Committee (PIC) composed of WP (co)leaders.

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1. Objective of this report

The main objective(s) of this report is to provide an overview of the three co-design/co-creation workshops that were held with stakeholders representing the user community, present the outcomes and commitments, and provide general recommendations from these workshops to inform future project developments.

2. Three Co-design/Co-creation Workshop summaries and reports

The following section provides a brief overview of the three Co-design/Co-creation Workshops. For the full workshop reports, please refer to publicly available links at the end of each summary.

2.1 1st CoP Event & 1st Co-design/Co-creation Workshop: Making Marine and Coastal Biodiversity Observations Policy Relevant

The 1st Co-design/Co-creation Workshop called "Making Marine and Coastal Biodiversity Observations Policy Relevant" was held together with the 1st CoP event on 23 May 2024. This first mobilisation of MARCO-BOLO's Community of Practice (CoP) was held fully online to be inclusive and not limit participation.

This event had the following objectives:

- Begin the Co-design process by bringing together key actors in the marine biodiversity observations and data landscape in Europe and beyond, introducing these stakeholders to the MARCO-BOLO project, including its activities on monitoring/observing marine biodiversity, data flows, and research and innovation, including modelling;
- Provide a platform for policymakers to exchange and present their needs, requirements, and perspectives;
- Encourage the broader marine biodiversity community to test, use, and adopt the MARCO-BOLO Data Management Plan (DMP), project outputs, and connect EU and global developments in marine biodiversity observations, including the global community Essential Ocean Variables (EOVs) and Essential Biodiversity Variables (EBVs) and connect these to the EU MSFD and other EU and international legal frameworks.

The overarching goal was to gain buy-in from participants and demonstrate how the MARCO-BOLO project, its Data Management Plan (DMP) and other expected project outputs can support EU member states and contribute to major EU environmental policies.

The event brought together over 70 experts and stakeholders in marine, freshwater and coastal biodiversity data. It targeted policymakers at national, regional, and EU levels, including the European Commission, Regional Sea Conventions, national representatives responsible for reporting to marine-related directives, the GOOS BioEco (Global Ocean Observing System Biology

and Ecosystems) Panel, as well as the wider biodiversity monitoring, observation, and scientific community.

Key outcomes of this first stakeholder event include:

- Attended by a diverse range of policy makers across multiple European Commission Directorate-Generals (e.g., DG ENV, MARE, RTD) that brought high-level attention, visibility, and interest in the project;
- Started the process of co-design/co-creation of MARCO-BOLO products, including improving data flows for EU (e.g., MSFD) and global policies;
- Identified potential topics for discussion at future MARCO-BOLO co-design workshops/events and for Knowledge Transfer outputs (Task 6.3);
- Demonstrated both the challenges and benefits of improving interoperability in biodiversity data flows;
- Illustrated the value of Essential Ocean Variables (EOVs) as a complement to Essential Biodiversity Variables (EBVs);
- Identified potential knowledge transfer outputs that would be helpful for the wider biodiversity community;
- Identified key policy needs and requirements and suitability of MARCO-BOLO to assist Member States and Regional Sea Conventions to better report their biodiversity data, helping with data and metadata standards.

Full report of the 1st CoP Event (Milestone 10) and 1st Co-design/Co-creation Workshop: https://zenodo.org/records/17244601

2.2 2nd Co-design/Co-creation Workshop: Solutions for Improving Marine Biodiversity Monitoring

With the project near the end of its second year and building on the outcomes of the 1st Workshop, the 2nd Co-design/Co-creation Workshop was held in person on 6th November in Sitges, Spain. It was conducted in collaboration with the OBAMA-NEXT and GES4SEAS EU Horizon projects as part of The Future of Marine Biodiversity Monitoring in Europe, an initiative launched by the European Commission under the Joint Research Centre (JRC).

The workshop brought together approximately fifty stakeholders, including representatives from the JRC, DG MARE, DG ENV, and various institutions responsible for biodiversity monitoring across EU Member States. Participants also included representatives from organisations such as OSPAR, HELCOM, OBIS, Biodiversa+, EMODnet Biology, and the GOOSBioEco Panel, along with researchers from universities and research centres across Europe.

It was beneficial to pursue this collaboration with JRC because it provided access to national representatives with responsibilities in national monitoring who had been challenging to engage with and bring together in person. In line with this, it is necessary to highlight the benefit of leveraging key EU events as opportunities to engage such stakeholders.

The project's Data Management Plan and new technology-based tools such as eDNA, artificial intelligence, and 3D image analysis, were presented and considered in detail with participants.

Key outcomes and conclusions of the second workshop include:

- Stakeholders were highly motivated to interact with MARCO-BOLO and researchers in general. This was reflected in the interest and willingness of participants to discuss and provide feedback on MARCO-BOLO products;
- There was general support for the organization and interest in participating in future co-creation events;
- It was recommended that future events be held online considering the diversity of products and reflecting the need to target specific stakeholders to solicit feedback from the actual user communities;
- It was recommended that any future stakeholder consultation have concise, clear and targeted messages with sufficient time allocated to engage and discuss with participants, thus guaranteeing discussions that are really effective for the co-creation process;
- It was decided that a meeting with the different Regional Seas Conventions (RSCs) would be held, including OSPAR, HELCOM, Black Sea Convention, and Mediterranean Convention, to demonstrate the usefulness of the MARCO-BOLO data strategy, also exploring how the RSCs could be part of its consequent deployment[1];
- There was consensus to continue pursuing close collaboration with Biodiversa+ including the possibility of the co-organisation of future workshops. OBAMA-NEXT and BioEcoOcean projects would be invited to participate to leverage efforts across different EU projects.

Full report of the 2nd Co-Design/Co-Creation workshop: https://zenodo.org/records/17244778

2.3 3rd Co-design/Co-creation Workshops: Targeted online sessions

With the project in its third year and building on the outcomes of the 1st and 2nd Workshops, the 3rd Workshop was held fully online the last week of June 2025.

In an effort to ensure better coordination and collaboration amongst WP6 and technical WPs, at the 2nd General Assembly (GA) of the MARCO-BOLO project, WP6 met with technical colleagues and task leads from technical WPs 1-5 to discuss and identify potential products for co-design at the third workshop.

After a number of products were identified as suitable candidates, it was decided that instead of an in-person 3rd workshop, it would be more effective to organize short targeted online sessions with selected stakeholders representing specific user groups to achieve a true co-design approach. After further consultation with technical WPs the following products were selected:

[1] Meeting held 6th March 2025 where the MARCO-BOLO data management plan and ODIS publication pathways were presented and potential implementation by the RSCs discussed.

- D2.4 - Report on the definition of eDNA-based EBVs with associated eDNA-based EBVs datasets and efficiency of eDNA for detecting/quantifying taxa/species of interest;
- T2.3 - Comparison of spatial and temporal eDNA-based vs traditional observations: D2.3 Report on the congruence between traditional and eDNA-based biodiversity observations, and their robustness across bioinformatics issues and diversity metrics;
- T5.2 - Application of integrative approaches on established biological indicators: D5.2 Scientific document demonstrating the value of novel observation approaches for established biological indicators;
- T5.3 - Spatial mapping of Blue Carbon benefits: D5.3 Scientific document describing potential for satellite remote sensing to estimate blue carbon at regional scales within European coastal systems.

Significant effort was made to identify and invite suitable representatives from various stakeholder groups to participate in each workshop. The number of participants was kept limited to ensure interactive and engaging discussions between technical leads and stakeholders.

Altogether, the three workshops brought almost fifty external biodiversity and marine data experts and other stakeholders including representatives from DG ENV, DG RTD, DG MARE, CINEA, Regional Sea Conventions, GOOS BioEco Panel, sister EU Horizon projects (Biodiversa+, EuropaBON, OBAMA-NEXT, BioEcoOcean), national institutions, academia and research, private sector, and other organizations responsible for marine biodiversity monitoring across the EU, UK and internationally. Among these, countries such as Belgium, Denmark, England, Finland, France, Germany, Italy, Norway, Scotland, Spain, Sweden, and other countries were represented.

Key outcomes and conclusions of the targeted online sessions include:

Workshop on eDNA and AI Imaging Approaches for Biological Indicators (T2.3 & T5.2)

The discussions between technical colleagues and participants on eDNA and AI imagining approaches for biological indicators (T2.3 and T5.2) highlighted the importance of investigating the cost effectiveness of using eDNA methods and comparing those to 'traditional' and AI imaging approaches. The task leads agreed that it would be highly beneficial to conduct this cost analysis and to compile a recommendations document which includes cost-effectiveness. A limitation with this would be obtaining accurate costings from organisations so they will be investigating whether this is possible.

The need to align eDNA methods with current traditional methods was also highlighted to allow both to be incorporated and be complementary to each other when measuring biodiversity and calculating indicators for MSFD monitoring of Good Environmental Status.

It is expected that the results of this task will be reported in a scientific document demonstrating the value of novel observation approaches for established biological indicators. Participants were informed that any contributions resulting from this co-creation workshop would be acknowledged in this document and in any future publications.

Workshop on eDNA-based EBVs (D2.4)

Final commitments from the eDNA-based EBVs (D2.4) workshop include general agreement for the need for more case studies, clear standards for EBV data/metadata, and robust pipelines and workflows for using eDNA to measure marine biodiversity observations for indicators.

As part of D2.4, eDNA-based EBVs will be generated and properly deposited in public repositories as discussed during the co-creation workshop and reported in the above section. Notably, eDNA-based plankton EBVs from the Tara Oceans are being generated, and from two long-term time-series: the SOMLIT-Astan off Roscoff, France, and the L4 Station off Plymouth, UK. Four EuropaBON EBVs were identified as feasible to measure with eDNA for plankton:

- Functional composition of marine plankton (based on traits);
- Harmful marine algal blooms;
- Phenology of marine spring phytoplankton bloom;
- Marine ecosystem productivity.

Furthermore, it is planned that GOOS EOVs from the same case studies' datasets following clear standards will be generated.

Participants were made aware that any contribution from workshop attendees will be acknowledged in the final report deliverable for Task 2.4 and any resulting publications. A post-workshop email was shared with all participants and attendees providing contact details should they wish to collaborate further.

Workshop on Spatial mapping of Blue Carbon benefits (T5.3)

Final commitments from the co-design workshop on spatial mapping of blue carbon benefits (T5.3) include improving the modelling of seagrass carbon storage, including focusing on sediment depths of 30 cm and 100 cm and exploring modelling of carbon stocks instead of percentage organic carbon to better align with policy relevance.

Where possible, additional data that were indicated by workshop participants, including substrate information where available, and updated seagrass distribution maps from EMODnet and OBAMA-NEXT projects, will be included in the task deliverable and/or refined model. Participants offered extra datasets for model validation, and there was strong interest in continued collaboration between MARCO-BOLO and OBAMA-NEXT teams.

The Virtual Research Environment tool will be developed further to make the model accessible and user-friendly, with a clear need for policy-relevant outputs such as carbon stocks expressed per hectare. The final task deliverable on contributions of remote sensing to blue carbon mapping, which will include the refined model, are expected to be published in Autumn 2025, with a scientific manuscript to follow.

Participants were sent a follow-up email after the workshop providing contact details should they wish to collaborate further (no email responses were received), and were made aware that contributions would be acknowledged in the final T5.3 report and in the acknowledgements of a paper if results are published in a scientific journal.

Full report of the 3rd Co-Design/Co-Creation workshop online targeted sessions: https://zenodo.org/records/17244832

3. Lessons learned, recommendations and considerations

Overall, the organisation and execution of the three Co-design/Co-creation Workshops addressed in this Deliverable have succeeded in informing the project's workplan and will contribute to the development of knowledge transfer assets for the project. The following are some general lessons learned, recommendations and considerations to date:

1. The connection across natural sciences and social sciences is valuable, and the inclusion of a social sciences component and establishing an informal Community of Practice has undoubtedly been a strength of MARCO-BOLO, diversifying stakeholder awareness of MARCO-BOLO and also bringing in socio-economics that could be further explored. This has enhanced the project's visibility and attracted greater interest from key stakeholders, including high-level policy makers, to participate in the consultation process, thereby strengthening the project's workplan and outcomes.

2. The stakeholder profiling exercise (D6.1) provided invaluable insights on key challenges and recommendations for stakeholders to better access and use marine biodiversity monitoring data. It is noted that results from this were only available at the end of the project's first year. Consequently, the information gathered could not inform the early development of the CoP or clearly contribute to the identification of specific stakeholders to be invited to the Co-design/Co-creation Workshops for specific project outputs, until later stages. However, it provided key information that is being taken up by Task 6.3 Knowledge Transfer which started in April 2025 and contributed to an ongoing exercise by Task 6.3 to consult with the CoP and with MARCO-BOLO partners to identify specific topics of interest e.g., Blue Carbon, in situ marine biodiversity observation sensors and samplers, etc., that could be used to produce targeted Knowledge Transfer outputs for intermediate and/or end users, conducted in collaboration with the technical WPs.

Despite WP6 having dialogue with technical WPs since the project kick-off meeting, there were some challenges in engagement. This may be due to the technical WPs not being allocated specific tasks or resources to collaborate with WP6. WP6 adapted to this by pursuing multiple mechanisms for exchange including Project Implementation Committee (PIC) meetings with WP leaders, joining dedicated technical WP meetings, frequent email exchanges and interactions with technical colleagues to identify products that would benefit from end user input, and a project-wide survey to identify knowledge transfer outputs. Future efforts to engage external stakeholders in a co-design/co-creation process should be more integrated into respective technical aspects. Other lessons learned include also having a milestone for knowledge transfer built into technical work packages, to ensure that technical WP leaders and Task leaders co-design the identification of knowledge transfer topics and the target audience(s).

A related lesson learned is that expected products from technical WPs 1-5 required a certain level of maturity before technical colleagues were prepared to hold interactive discussions with

stakeholders in a workshop format. This includes the time needed to understand and identify the specific stakeholders and individuals who could provide or would be willing to provide targeted feedback on specific products. Consequently, the first and second workshops were targeted at higher-level stakeholders thereby succeeding in attaining high visibility and interest in project outputs, however, user feedback on specific products was limited. In contrast, the third workshop was held when selected products were more mature and suitable stakeholders (end users) to invite were easier to identify and engage with. Therefore this workshop achieved a truer co-design/co-creation interaction between technical colleagues and participants who provided invaluable feedback that will inform product development. A recommendation for future projects is that the timing of workshops be flexible or held at stages when products achieve a certain level of maturity.

Policy makers are key stakeholders for MARCO-BOLO and there was interest from multiple EC DGs to engage. For this reason, WP6 co-design workshops were intentionally focused on policy makers, also inviting wider stakeholders including research and innovation stakeholders. There remains a plan to engage with industry and this will increase in the last year of the project, with an industry stakeholder event planned for Spring 2026 and further mapping and engagement of the private sector at industry led events e.g., Oceanology International 2026.

The project has faced some other challenges with respect to engaging with some stakeholders. For example, the European Environment Agency (EEA) and some national focal points are busy and must be convinced of the added value of engaging with projects. This limitation is a serious bottleneck to implementing change as their perspectives on the reality on the ground are crucial for improving biodiversity monitoring across Europe.

In any case, the project has successfully engaged most key stakeholders from policy, government, research, and academia, including Biodiversa+ and EuropaBON which are also represented as core members of the MARCO-BOLO CoP. These stakeholders engaged in all three workshops and other activities. For example, MARCO-BOLO interacted directly with and represented the marine community during some key discussions relating to the future EU Biodiversity Observation Coordination Centre (EBOCC). Biodiversa+ has especially been a very important and supportive contact point for MARCO-BOLO, sharing information with their partners and acting as an intermediary between environment agencies and MARCO-BOLO and OBAMA NEXT. For example, Biodiversa+ supported the participation of technical colleagues from WP2 at several Biodiversa+ stakeholder events and also collaborated with WP6/WP7 to develop joint communication products. Engagement with Biodiversa+ has likely worked well because of good timing and available funding which allowed MARCO-BOLO to use their project as a vehicle for stakeholder engagement. This collaboration with Biodiversa+ is ongoing in a mutually beneficial manner with MARCO-BOLO serving again as a voice and linkage to the wider marine biodiversity observation community. In this respect, leveraging the MARCO-BOLO CoP and key EU events as opportunities to engage such stakeholders was positive for the project.

Finally, MARCO-BOLO has benefited considerably from the support and commitment of the dedicated Project Officer who for example has facilitated connections with key projects like Biodiversa+ and EuropaBON. Also, visible support from the European Commission was beneficial.

For example, representatives of the various DGs actively participated in the three workshops and related discussions. Further, it can be highlighted that leveraging the Core CoP membership to reach the wider network has been beneficial for the overall stakeholder consultation process of MARCO-BOLO.

4. Next steps

This report will be shared with all stakeholders who participated in the co-design/co-creation process and will be considered by the MARCO-BOLO Project Implementation Committee (PIC) and CoP to inform the Final CoP Stakeholder event tentatively scheduled for September 2026.

The next phase of the consultation with stakeholders will involve the development of knowledge transfer plans and custom materials focused on target audiences, particularly industry, policy makers, and researchers. Core CoP members and the wider community who have engaged with the project will again play a key role by ensuring that such knowledge transfer outputs are widely disseminated.

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