The Global Ocean Observing System

Progress towards Implementation of the GOOS 2030 Strategy
Thirteenth GOOS Steering Committee Meeting
April, 2024, Barcelona

The Roadmap for the Implementation of the Global Ocean Observing System 2030 Strategy (GOOS-249, 2020) outlined the key outcomes across each of the 11 GOOS Strategic Objectives which include partnership for delivery, communications and advocacy, evaluating impact, empowering end user applications, authoritative guidance on design, strengthening and expanding the system, open data, supporting innovation, developing capacity, human impact observations, and evolving GOOS governance. This report outlines progress for under each of the GOOS Strategic Objectives as reported from work across the 3 GOOS Panels, the GOOS Regional Alliances, the Expert Team on Operational Ocean Forecasting, the Observations Coordination Group and the GOOS operational centre OceanOPS.

The actions reported on are major ongoing areas of work undertaken by these GOOS components, which are noted in the Project Management System (Monday). The assessment of progress is against the outcomes noted for each Strategic Objective in the 2020 Roadmap for the Implementation of the 2030 Strategy. A summary of key recommendations for action and for ongoing management are in the initial overview section.

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Index

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1. Summary

1.1. Assessment against outcomes

The traffic light system below shows progress against the outcomes noted in the 2020 Roadmap to Implementation 2020. It is provided as a quick guide to reviewing the document and should not replace a more thorough examination of the progress and full assessment under each SO. Generally indicators in orange are suggesting progress but slow, this can be due to many factors, such as the timing of other supportive actions. The items in red are where little progress has been made, and deserve attention.

It is important to note that these outcomes were not originally set up to be management tools but an expression of ambition. In order to streamline this assessment process and provide a more accessible report, it would be better for GOOS to have a simpler reporting system, of say 3 key performance indicators (KPIs) per SO, based around the outcomes with agreed criteria. A final selection of 7-10 key indicators could then be used as a regularly tracked benchmark. Currently there are 48 outcomes, which is perhaps suitable for a once every 4 years deeper dive if required.

Finally, over the course of the 4 years that GOOS has been working towards the implementation of the 2030 Strategy, 9 or the original 72 actions have now been completed, and 3 or 4 new actions are suggested in the recommendations - summarised in the next sectioon, as well as the removal of dormant actions that are not being actively pursued.

Finally the 2020 Roadmap for Implementation was a set of key ideas, developed primarily in 2018 with the 2030 Strategy, around what shape the SOs should take and what partners we might need for achieving our aims. This was based on the input from across GOOS, the legacy of OceanObs'09 and the thoughts embedded in a number of the White Papers from OceanObs'19. GOOS and the landscape in which we operate has evolved, many of the aims remain current, however we need to make sure that we evolve our ambition and goals too. Several recommendations address this, and the sessions at the this GOOS Steering Committee, especially around Data, the Ocean Decade Programmes, the Vision 2030 Paper and setting pour priorities may also influence this.

The recommendation is that after the SC we evolve the reporting to be simpler and reflective of current foci, so that it remains relevant for the next 4 years.

No.	SO1 - partnerships for delivery	
1	A strengthened, responsive and delivery-focused observing system	
2	Strong partnerships with key intermediaries across delivery areas	
3	An increase in fit-for-purpose ocean information products	
4	Improvement in the sustainability of the observing system	

No.	SO2 - advocacy and communications	
1	Significant step-up in external recognition of value of ocean observing system	
2	Increase in longer-term sustained funding for ocean observations	
3	Increase in nations participating in the observing system	
4	Recognition for role that GOOS, WMO, IOC, and our partners play	
No	**SO3 - evaluate impact**	
1	Identification gaps across observing system at global to local scales.	
2	A view of the status of the observing system to meet societal goals	
3	Guidance on how to evaluate observing systems	
4	Information on value to evaluate investment in ocean observing	
5	Network evaluation and metrics.	
6	Forecasting system evaluation and metrics.	
7	Ability to evaluate system for adequacy in meeting societal needs	
No.	**SO4 - empower end users**	
1	GOOS Guide for Operational Ocean Monitoring and Forecasting Systems (DONE)	
2	Case study examples from across GRAs on data integration and delivery	
3	Better understanding of GOOS resources that can be exploited by ocean forecasting	
No.	**SO5 - authoritative guidance on design**	
1	Refined observing designs the essential observations for societal needs w. ROI	
2	Modular design to support implementation decisions at national/regional levels	
3	Greater efficiency in investment towards enhancing observing capacity	
No.	**SO6 - strengthen and expand observing system**	
1	Increased efficiency in use of resources.	
2	A system for identifying, sharing and adopting best practices	
3	Increasing number of observing networks with Technology Readiness Level of 7+	
4	Coordination towards achieving common goals global, regional & national	

5	Expansion and evolution into new areas, identified through requirements	
6	Increased interoperability of ocean data from variety of sources.	
7	Support for sustainability through participation in a global integrated system.	
8	Operational tracking of the observing system against targets for delivery areas	
No.	**SO7 - FAIR Data**	
1	Identified and tracked global observing system data architecture as part of broader earth system data architectures.	
2	Data products based on EOVs and ECVs	
3	More data available, more appropriately, to more users	
4	Availability of meaningful data metrics.	
5	Updated and verified metadata standards across all observations	
6	Production and dissemination standards for forecasting data	
7	More users served - enhanced delivery to end users	
No.	**SO8 - support innovation**	
1	Faster adoption of new technology	
2	Increase scope, efficiency and observational capability	
3	Focused and faster technological development to meet observing challenges	
No.	**SO9 - capacity development**	
1	Greater number of countries actively participating in the GOOS	
2	A greater number of countries with capabilities in ocean forecasting	
3	New practices and data products addressing the needs of diverse countries	
No.	**SO10 - observe human impacts**	
1	Pilot partnership projects for variables related to human activities	
2	Recommendations for implementation of human activity in the EOV framework	
No.	**SO11 - champion effective governance**	

1	Governance architecture for the global ocean observing system, that integrates GOOS and partners in a framework, with clarity in roles, processes and evaluation	
2	Voice for ocean obs/services, with stakeholders contributing to define the message	
3	Improved global observing system delivery, responsiveness and sustainability	
4	Greater support for national systems and their needs for ocean information	

1.2. Recommendations

General

- Assessment: Select 3 key performance indicators (KPIs) per SO, based around the outcomes with agreed criteria. A final selection of 7-10 key indicators could then be used as a regularly tracked benchmark.
- External Summary Report: produce an outward facing report on progress for 2025, can also be used for IOC, NFPs etc.
- Projects: GOOS has some projects fulfilling parts of the action plan - e.g. IMDOS, OBPS, others could also fit in DOOS etc. Would this also be a way of projects reporting out and of evaluating progress/output from the projects.

Strategic Objective

SO1

- Mapping who our key delivery partners for each delivery area, with the value chain, should be a relatively swift task that would aid balance across the delivery areas - the previous mapping of partners was of all potential partners to better understand the sectors and players. Key partners are now better identified, and this will help aid partnership development and co-design processes.
- We need to do more work with partners in the BioEco sphere, CBD, FAO and UNEP.
- BioEco Panel recommends that GOOS develop an engagement strategy with GEA and MEA custodians under which direct partnerships with the UNEP-WCMC and the CDB to facilitate broader EOV reporting into the indicators being developed for the Montreal-Kunming Global Biodiversity Framework and into other frameworks and agreements can be facilitated, to ensure that GOOS obs flow into the indicators for the GBF. Development of this engagement strategy should also consider the role of GRAs in delivering information for national reporting against these agreements and the role of NFPs in facilitating connectivity with national governments. BioEco is happy to work with GOOS on this however GOOS will need to lead this as a sustained partnership.
- Evolve this SO to - Strengthen partnerships and co-design processes for delivery

SO2

- Cost effective sensors: BGC Panel Favour synergy with OARS for low cost sensors development**.** Low cost or cost effective sensors are a popular current theme, however the Dialogues with Industry point to inherent market issues associated with this - we need to be able to offer a market of sufficient size to warrant the investment. Can we suggest that we have a cost effective sensors discussion with industry - for a sensor of suitable market size.

SO3

- BioEco Panel recommends that GOOS develop direct partnerships with IODE and the OTGA to develop a series of courses, if regarded as a priority, more broadly to develop EOV capacity across the whole of the observing system, not just specifically for the BioEco EOVs.
- BioEco Panel recommends that GOOS develop a higher-level agreement with GEO to facilitate broader engagement and collaboration across the whole of the observing landscape, not just specifically between MBON and BioEco.
- To enhance IOC's capacity development needs assessment process through various approaches to ensure a wider representation of communities provide feedback which can be used to target capacity development activities through GOOS, IOC/WMO
- To enable a community of practice for capacity development within GOOS, IOC/WMO that will allow those involved with CD to better integrate activities and add value wherever possible. foster integration and collaboration through networks and WMO/IOC ensuring maximum impacts of capacity development activities e.g co-hosting webinar series, regional to national workshops etc
- Investigate mechanisms to support CD activities within regions or sub-regions or at national levels, particularly through GOOS GRAs- (e.g instrument donation, sharing of training materials, availability of experts to support trainings wherever necessary)
- It is clear that OCG network maturity metrics will be a useful first step, thus OCG should make the work of the network metrics TT a priority.

SO4

- BioEco Panel recommends that GOOS provide some strategic direction to the Indicators Task Team in identifying and mapping the implementation and delivery pathways for indicators being developed. This should include identification of the organisations that indicators will be delivered to and for what purpose, the data pipelines between EOVs and indicators (including data and data products) and how these data pipelines will be facilitated and maintained. Such a strategy would clearly identify where GOOS might be placed within the already established and planned indicator landscape to clearly identify where GOOS indicators could add value rather than duplication.
- For the product and Services Portfolio for ocean prediction centres, suggest that we assess whether the work will be undertaken in the 2024/2025
- Suggest we evolve this SO4 to 'empower and deliver end user applications'. This is a direction of travel for GOOS with EOV products and indicators, noting that GOOS will not do all indicators or products, however we are actively investigating what could be useful EOV products and indicators, e.g. the BGC panel is producing products, the BioEco Panel also under BioEcoOcean Project, and OOPC indicators, including under ObsSea4Clim. This work needs to be grouped and it could be under this SO4, or leave EOV products in SO7 and indicators and services in SO4. We would need to add actions.

SO5

- Increase synergy with Ocean Acidification Research for Sustainability (OARS) Outcomes, in particular OARS Outcomes 1, 2 and 3 (Data quality, Science to Action, Observing strategies) for BCG EOVs.
- Ocean Observing Co-design has some level of support for 4 of the 6 Exemplars, however the core now needs support.
- Recommend that GOOS sets a new action to consider a process for priorities over the next years, and test some applications, to address questions like - what should be the GOOS process for response to this - GCOS recommendations to improve the ocean component of the global climate observing system which were endorsed by the IOC Assembly in 2023 (IOC-A32) and the WMO Congress (Cg-19), and other 'key' requirements setting processes? OCG will discuss at OCG-15, RRR work underwayOcean Observing Co-Design will begin to show assessment results.

- For the RRR, GOOS should pause in Q4 2024 and assess what we have learnt and what we want out of this moving forward, and find an ocean volunteer to run the Application Area if continuation is desired.

SO6

- Building on the surface carbon / WMO GHG Implementation Plan, the BGC panel plans to:
    - contribute to development of SOCONET
    - develop a comprehensive GOOS carbon strategy (2024/2025)
    - encourage ocean community participation in a WMO cross-domain (atmosphere, ocean, land) workshop on longer-term GHG observing activities (2025/2026)
- BioEco Panel plan connection/coordination with the GRAs to expand multi-observations, presenting first to the 2024 GRA Forum in Barcelona. Enhanced connectivity between GRAs and OBIS for delivery of biological observations into OBIS (and ultimately metadata to BioEco portal with information accessible for OceanOPS led assessments) will support greater exposure and coordination of use of biological observations.
- BGC Panel requests that OBPS consider labelling of the contents, for example, practices, best practices, peer reviewed, and endorsed best practices. It is still not clear within GOOS which documents should be used as BP in the immense BP documents repository (Garçon et al., 2024, in prep). Suggests better guidance on use is also required.
- Develop a visualisation or metric to indicate what we have covered for BPs - across GOOS EOVs - BGC, BioEco and OCG.
- BioEco Panel asks that support be provided by GOOS/OCG for facilitating progression of the delivery of biological observations from the networks into OBIS, with AniBOS and BioGO-SHIP as pilots.
- OCG needs to consider how it will support more networks, what its ongoing role is vis a vis smaller networks, integrating across 20 or more networks - need a different structure - support etc. SC could ask OCG to report back on its resolution of these questions and vision for the future around networks
- There should be emphasis placed at GOOS level on harmonisation: of structure, data/metadata (see SO7 as is happening), processes and definitions (metrics, attributes etc - best practices is already done) between BioEco and OCG. There should also be some emphasis placed at GOOS level on harmonisation of what we mean by indicators, and EOV products.
- There are currently different requirements and no process for GOOS level prioritisation - we have placed several items into the Ocean Decade, that follow the thinking about impact areas in the Roadmap to Implementation (marine heatwaves, tropical cyclones, coast, carbon, etc). Beyond the Implementation Roadmap do we have a means of expressing and revising the GOOS priority impact areas? Can GOOS SC agree on a limited but clear set of areas of action for societal outcomes.
- Communications need to consider messaging on sustainability
- Should VOICE link with Boundary Currents (Co-Design) and CoastPredict? Seems some similarity of purpose

SO7

- Complete new GDAC for BGC EOVs. - GDAC Implementation has stalled since the collapse of data management in Bergen. Therefore GOOS SC / GOOS Management Team assistance is sought to support an international conversation about this.
- Data products - make the action across GOOS and have a cross-Panel meeting to discuss. BGC Panel work seems most mature, however needs clarification as to what GOOS means by an EOV Product. Suggest that this is a cross Panel discussion in 2024 as to what this means to each Panel, are these EOV or GOOS Products, do they have identifiable characteristics? If available they should be listed through GOOS web site/Ocean Observing Report Card etc.

- Data flow and tracking, advance the cross-GOOS view of data and metadata flow and tracking. The BioEco Panel recommends that there be continued support and recognition of OBIS as the provider of coordination and monitoring of BioEco data and metadata to ensure continued delivery.
    - extend data tracking,
    - identify what metadata formats, conventions/standards and controlled vocabularies are in use across OCG networks, BioECco networks, BGC.
- Work with global in situ networks to enact OCG Data Implementation Strategy. In particular:
    - Integrate delayed mode data into ERDDAP data services
    - Continue to federate these distributed data nodes within the OCG Federated data node
    - Work with networks to improve metadata exchange with OceanOPS using these services
    - Continue work with IODE to integrate discovery metadata from Federated OCG services into ODIS architecture.

SO8

- BGC Panel favour synergy with OARS for low cost sensor development. There is also work ongoing under the Ocean Decade on cost effective sensors. The Dialogues with Industry point to inherent market issues associated with industry investing in the sensors that the ocean observing system would like to see. We need to be able to have a dialogue to discuss market size and requirements. Can we request the Dialogues with Industry initiative to have a cost effective sensor discussion with industry - for a specific area/need.

SO9

- BioEco Panel recommends that GOOS develop direct partnerships with IODE and the OTGA to develop a series of courses, if regarded as a priority, more broadly to develop EOV capacity across the whole of the observing system, not just specifically for the BioEco EOVs.
- To enhance IOC's capacity development needs assessment process through various approaches to ensure a wider representation of communities provide feedback which can be used to target capacity development activities through GOOS, IOC/WMO
- To enable a community of practice for capacity development within GOOS, IOC/WMO that will allow those involved with CD to better integrate activities and add value wherever possible. foster integration and collaboration through networks and WMO/IOC ensuring maximum impacts of capacity development activities e.g co-hosting webinar series, regional to national workshops etc
- Investigate mechanisms to support CD activities within regions or sub-regions or at national levels, particularly through GOOS GRAs- (e.g instrument donation, sharing of training materials, availability of experts to support trainings wherever necessary)

SO10

- BioEco Panel recommends that GOOS utilise the ocean sound implementation plan to identify next steps for SO10.2 and the relevant bodies to carry out these steps - should this be highlighted to the GRAs and OCG, discussion between panels and implementers?
- Will an IMDOS implementation plan be shared? Are there pilots to collaborate on with GRAs/OCG? Do we need a new action defined here for the IMDOS Project?
- The BioEco Panel recommends that GOOS collectively discuss any further development of a new class of human pressure EOVs. This should include identifying the key organisations that need to be engaged in this process and potential linkages with indicator work under SO4 (or wherever indicators sit)
- Basic HAB requirements could be considered under Phytoplankton EOV

SO11

- Need of a clear articulation of structure and where decisions are taken across GOOS
- Add a more general tracking of partners under SO11 where we can also recognise their contribution to GOOS and across the SOs, help cultivate support and recognition
- For the SOFF, GOOS should decide priority of action here, possibilities include. 1) strongly lobbying WMO to a) include more ocean variables, b) include open ocean 2) with partners and sponsors set up an ocean observing fund itself or under a sponsor for all observations under GOOS in SIDS developing countries in open ocean - based on requirements that robustly developed under GOOS process. 3) focus on projects under World Bank or other major climate finance and development funds. Note: priority needs to be given - at moment all approaches being tried, plus more under the Ocean Decade.
- BioEco Panel recommends that GOOS develop a higher-level agreement with GEO to facilitate broader engagement and collaboration across the whole of the observing landscape, not just specifically between MBON and BioEco.

2. Reporting by Strategic Objective

2.1. SO1: Strengthen partnerships for delivery

2.1.1. Actions

SO1: Strengthen partnerships for delivery

Activity		Status	Priority	Lead
1.1 GRA capabilities across the value chain assessment 2	2	On hold	Low	GRAs
1.2 Partnerships for delivery 5	3	Working on it	High	HQ Office
+ Add activity				

2.1.2. Status

Although the partnerships noted below are at their core about delivery, this often means collaboration with different structures and at different levels associated with integrated system delivery, e.g. requirements data, metadata, standards and best practices.

WMO: Partnership with WMO INFCOM has deepened across the last 2 years, a greater recognition of GOOS as an important partner for the future, greater focus on climate and early warning by WMO, and careful work by OOPC, BGC Panel, INFCOM and GOOS HQ secretariats. Key areas of collaboration include:

- GOOS leads the pilot Ocean Application area in the new Rolling Review of Requirements Process, and by this actively involves members of the ocean community in the requirements setting process for existing services
- GOOS was very active in the WMO GHG initiative, ensuring ocean carbon was considered in the implementation plan
- WMO, IOC (GOOS) and OCG cooperate to form the management board for OceanOPS, and supporting DBCP and SOT networks
- Ocean variables are integrated into the new WMO Data Policy (2022)
- Supporting data flow to GTS, and future WIS 2.0
- Ocean Observations side event at the 18th WMO Regional Association I Conference-to improve coordination and collaboration between RA's and GRAs.

Areas under consideration for greater collaboration include at regional/national levels and for modelling (ETOOFS-WIPS). plus the Systematic Observations Financing Facility (SOFF). SOFF is a UN Fund co-created and managed by WMO and is a potential source of funding for ocean observations for SIDS, Africa, LDCs, however the current rules that govern the SOFF are not ocean friendly, namely investment can only be 1) for variables in GBON (Global Basic Observing System, currently only SST and SSP are in GBON, plus to be in GBON a variable needs to be in the RRR (OSCAR) and have technical specifications - so no small or quick task), and 2) for countries EEZs. GOOS should decide if seeking to set up a specific Ocean Fund or pursuing SOFF with WMO making some changes to the funds function would be more efficient. Currently we are looking at everything and we need to set priorities (see SO11).

GCOS: Partnership with GCOS is vital to align the ocean and other domain variables - Ocean ECVs are EOVs, and some of our networks take above ocean ECVs. There has been work to align the variable specification

sheets. It is also vital to capture the requirements of the UNFCCC for climate monitoring across domains, this is expressed through the GCOS Implementation Plan, which was adopted in 2023 year by IOC (IOC Resolution A-32/2 Improving Climate Observations - here). A new Horizon 2030 European ObsSea4Clim Project will take an interesting slant in taking the GCOS indicator areas and testing the observing system delivery for this - sea level, ocean transports, ocean mesoscale, marine heatwaves, stratification and sea ice. Interestingly, these have key cross-connection with the OOPC, the GOOS Ocean Decade Co-Design Programme and the WMO RRR.

IODE: The partnership with IODE encompasses three main areas, 1) Ocean Biodiversity Information System (OBIOS) and the BioEco portal, vital to the delivery of biological and ecological EOV data and the tracking of sustained observing of biological and ecological EOVs respectively, 2) Ocean Data Information System (ODIS) architecture, a federation of systems that uses common conventions to share and exchange their metadata, and adopted by the OCG Data Implementation Strategy (SO7), and 3) The Ocean Best Practice System is a joint project between GOOS and IODE .

Marine Technology Society: The partnership with MTS, has been successful in developing understanding and a set of actions for closer collaboration with industry and government to grow the Ocean Enterprise - the Dialogues with Industry Roadmap. The continued partnership with MTS in the Ocean Enterprise Initiative, which will implement elements of the Dialogues with Industry Roadmap will provide the opportunity to a) collaborate in developing technology needed for GOOS, b) recognition for ocean observing as as an economic sector, which is important to government, c) industry support for recognition of ocean observing as core infrastructure.

2.1.3. Assessment

No.	SO1 Outcomes	Assessment	
1	A strengthened, responsive and delivery-focused observing system	**Progress: On track** **Criteria: partnerships that work towards delivery and a delivery focused observing system** Work with WMO, GCOS< IODE all contributes, as does work under the Ocean Decade Programmes Co-Design, and CoastPredict. We lack a clear BioEco and possibly additional BGC partners	
2	Established strong partnerships with key intermediary user organisations across climate, operational services and ocean health delivery areas	**Progress: on track, but slow in some delivery areas** **Criteria: functioning partnerships with key intermediary/service delivery organisations across 3 GOOS delivery areas** WMO is largest single partner, GCOS important for climate, again lacking similar for Ocean Health	
3	An increase in fit-for-purpose ocean information products (forecasts, indicators, coastal warning) based on sustained observations	**Progress: slow** **Criteria: important to develop some concept of how we would track increased fit-for-purpose** Although with methods such as Co-Design and RR this should be the outcome, it is not clear how we would track this.	

5	Improvement in the sustainability of the observing system individual components, through clarity on how observational data contributes to providing critical services	**Progress: slow** **Criteria: our key partners recognise the importance of GOOS data and advocate and lobby for a sustained system.** Some progress with WMO, more vocal on need for ocean data, MTS partnership also supportive of this aim. But not at stage where partners are stating strongly enough the need for sustained observations and that GOOS is vital	

2.1.4. Recommendations

- SO1: Mapping who our key delivery partners for each delivery area, with the value chain, should be a relatively swift task that would aid balance across the delivery areas - the previous mapping of partners was of all potential partners to better understand the sectors and players. Key partners are now better identified, and this will help aid partnership development and co-design processes.
- SO1: we need to do more work with partners in the BioEco sphere, CBD, FAO and UNEP.
- SO1: Evolve this SO to - Strengthen partnerships and co-design processes for delivery

2.1.5. Comments

- SO1: This SO needs to decide if it would like to A) focus on delivery - in which case I would like to see a tracking of co-design here - SO Strengthen delivery and co-design partnerships - which would allow us to recognise a wider variety of partners win modelling, assimilation etc. B) focus on partnership for everything, which is what some of the previous work under 1.2 has done - noted all partners, however is it then kind of then stuck as not helping any of the areas where the work is happening, I suggest that this is SO Strengthen delivery and co-design partnerships - have a tracking of partners under 11 where we can also recognise their contribution across the SOs and cultivate those that are needed.
- Outcome 4 - this belongs in SO3 - moved
- Remove 1.2 to ‘holding’
- Make 1.1 more specific, too general

2.2. SO2: Advocacy and communications

2.2.1. Actions

SO2: Advocacy and communications

Activity	Status	Priority	Lead
2.1 Value of Ocean Observations Project 3	Near Compl...	Medium	HQ Office
2.3 Advocacy into UN System 5	Working on it	High	HQ Office
2.4 Evolve Ocean Observing System Report Card 2	Working on it	High	OCG/OceanOPS
2.5 Benefits of Ocean Observation Catalogue	Working on it	Medium	GRAs

2.2.2. Status

GOOS continued to implement its Communications Plan, adopted in 2022. In 2023 a total of 16 original GOOS articles were published and shared by GOOS and IOC/UNESCO news, 10 of which were published in external media (Meteorological Technology International, ECO Magazine) and resulted in follow-up interviews with journalists (Marine Technology Reporter/New Wave Media, Meteorological Technology International), or were published on partner/sponsor websites (World Meteorological Organization, Marine Technology Society). GOOS also actively participated in international events and conferences, including COP28, the EuroSea Symposium and General Assembly, Ocean Business 2023 and others.

In 2023, GOOS has also experienced increased engagement on social media channels. 1,200 new followers were organically gathered on LinkedIn this year, 717 new followers on Twitter/X, and 66 new followers were gathered on Facebook.

A GOOS National Focal Point (NFP) messaging document was created to assist the NFPs in consistently communicating about their role and about GOOS. In the document NFPs have some messaging that can be used, when they meet people, make presentations, write emails etc. A NFP standard slide deck and 3 user stories, demonstrating the impact of ocean observation, are being created to support the NFPs in their work and to further facilitate NFP communication.

The UN work should ensure ocean observations are connected to policy, and give visibility at ministerial level to the Global Ocean Observing System. Advocacy in the UN has continued with a focus on climate through COPs, biodiversity through the CBD and BBNJ, and expansion and transformation of ocean observing within the Ocean Decade. GOOS was present at COP-28, Nov-Dec 2023 in Dubai, provided input to the CBD SUBBSTA and will be at CBD COP-16, GOOS is also actively engaged towards the next UN Oceans Conference in Nice 2026. GOOS presented at ISC Meeting May 2023. The GCOS Implementation Plan (GCOS IP, IOC Resolution) also supports and extends GOOS visibility into UNFCCC.

The Ocean Observing System Report Card 2023 (www.ocean-ops.org/reportcard), its 7th edition, was released in October 2023. It was published with a short online video which amplified its impact across social media. Since its first publication in 2016, the Report Card provides a yearly, global and integrated view of the status of the observing system. The Report Card is now fully cross GOOS, and there is work in the background to make the metadata on which the status reporting is based more complete and integrated (see SO6 and SO7). The interactive version of the Report Card has had 2,409 views, while the downloadable PDF was accessed 541 times, as of March 2024. Report Card 2024 production is postponed to 2025, due to transfer of OceanOPS IT systems and the need to restructure OceanOPS. Other actions that can support the Report Card in 2025 include: create a release plan with partners/sponsors, video.

A partnership with IMOCA sailing class and Vendee Globe Race (world class single-handed race) was signed up at IOC/UNESCO in February 2024 with the objective to equip the 40 skippers of the 2024 edition with

observing systems (weather stations as a standard minimal package) and increase this ambition in 2028 (to ocean underway systems). Instruments and coordination (by GOOS/OceanOPS) will be funded by the race foundation and skippers. The idea is that this partnership helps GOOS to broader audiences (e.g. Guardian article on the OceanRace - although this was light on GOOS it did note observations) and have ambassadors for ocean observing, while providing a tangible contribution in terms of observations, including deployment of floats/drifters in remote areas.

A value of Ocean Observations Paper - Socio-economic valuation of ocean observations: A new approach in modelling their value in decision-making (R. Bernknopf, C. Leek, E. Heslop, C. Jolly, and J. Jolliffe) has been developed in partnership with the OECD, and University of New Mexico environmental economist. It is now in final revision and will be published as an OECD Technical Report. It will introduce an applied methodology designed to quantify how continuous observations of Essential Ocean Variables can mitigate risks and foster sustainable management practices. Grounded in economic theory, it outlines a model for assessing the societal benefits of employing EOVs in decision-making processes. The model bridges science and economic theory and offers a framework for analysing EOVs role in optimising resource usage and reducing investment risk. The Executive Secretary of IOC will have a keynote speech in April 2024 at the OECDs Committee for Science and Technology policy ministerial level meeting for the Multistakeholder High-Level Dialogue - Protecting the future with science and technology - The ocean we want by 2030: the role of ocean observation data for research, growth, and wellbeing action and biodiversity. This is high level visibility for GOOS through this ongoing partnership and collaboration with the OECD.

For broader communication and within the framework of the EuroSea project, OceanOPS, in collaboration with Euro-Argo ERIC, developed and published a comic book titled "Journey with Ocean Observers". This resource serves primarily as a valuable tool to support GOOS experts and networks in their outreach, training and capacity development activities. The positive reception from the community has led to volunteers undertaking translations of the book into other languages (currently the book is under translation into German, French and Portuguese). GOOS communication should consider how to make it available to those that could find it useful.

GRAs were invited to help in identifying and developing simple or complex use cases. GRAs can support the development of a template to give guidance to organisations and people on how to write use cases and submit them to Benefits of Ocean Observation Catalogue (BOOC) once it becomes fully operational. Once the prototype has been developed, there are plans to convene workshops on helping people take conceptual ideas and convert them to use cases that can be added into the catalogue. Presently, BOOC has progressed to be a pilot built on GIS. There is also a Google form for partners to help identify use cases for the catalogue. Carl Gouldman, Chairperson of GRA Council will provide an update at the GRF-XI in Barcelona the 8th April

2.2.3. Assessment

No.	SO2 Outcomes	Assessment	
1	Significant step-up in the external recognition of value of the global ocean observing system in climate, operational	**Progress: on track, steady progress** **Criteria: increasing number of UN/other major organisations aware of need for ocean observations, GOOS work, and priorities** Progress has been made in highlighting the need for ocean observations and GOOS core role with UNFCCC, DOALOS, WMO,	

	services, and marine ecosystem health	IOC, ISC, OECD, also with industry. We need more work on CBD and UNEP	
2	An increase in longer-term sustained funding for ocean observations and an external vocal community who are advocates for the need for sustained ocean observation	**Progress: some** **Criteria: a growing community of vocal partners, such as the Ocean Frontier Institute, Marine Technology Society, The Ocean Race, Industry partners, OECD, etc.** Some progress is being made with industry, OECD, UNFCCC, WMO. These organisations are placing ocean observing on the agenda, however this is not with one voice or a coherent message. Increased funding from IOC to GOOS at request of Member States.	
3	Increase in nations participating in the observing system	**Progress: some** **Criteria: Increasing number of nations participating in GOOS networks (OCG-BioEco)** Increased funding and activity in PI-GOOS, IOCARIBE-GOOS and GOOS Africa, and National Focal Points supports this, as well as the work by the BioEco Panel and OBIS for biological and ecological observations.	
4	Recognition for the role that GOOS, WMO, IOC, and our partners play in supporting the global development of an ocean observing system	**Progress: partially on track** **Criteria: Recognition for role of GOOS, WMO, IOC in global ocean observing** Recognition of the importance of the ocean to the success of society has increased, along with awareness of the need for ocean data. What GOOS actually does and its value is not yet widely understood. Steady if not spectacular progress, WMO, GCOS and Ocean Decade work bring some recognition	

2.2.4. Recommendations

- SO2: Opportunity to review the Ocean Observing System Report Card, SO-13, and evolve for the next years

2.2.5. Comments

- Each year there is an opportunity to feature an ocean observing topic at the DOALOS led Informal Consultation Process at UN HQ, the request for topics goes out to DOALOS members in September.

2.3. SO3: Evaluate System to assess fit-for-purpose

2.3.1. Actions

SO3: Evaluate impact

Activity		Status	Priority	Lead
3.1 Network status reporting	4	In Planning	Low	OCG/OceanOPS
3.2 Observing System evaluation/metrics in OceanOPS 3	5	In Planning	Medium	OCG/OceanOPS
3.3 Ocean forecast evaluation and metrics 1	2	Future steps	Low	ETOOFS
3.4 Map of ocean forecasting systems 2		In Planning	Medium	ETOOFS
3.5 Map of networks for biological monitoring 5	6	Working on it	High	BioEco
3.6 Global Ocean Indicators Framework 3	2	Working on it	Medium	OOPC

2.3.2. Status

OceanOPS monitoring: There is a strong need to develop variable oriented and cross-networks performance indicators to deliver gap analysis needed by the GOOS Co-Design Programme, WMO Rolling Review of Requirements and Global Basic Observing Network. This task has been on hold for some time because of a lack of (IT) resources - GOOS needs to consider how we can address this.

At OCG-14, an intersessional Task Team on Observational Network Metrics (TT Metrics) was established to develop a more comprehensive set of cross-network metrics to serve as evaluation criteria of network status (emerging/mature etc.). This is based on the OCG Network Attributes (https://oceanexpert.org/downloadFile/54733), but will be more rigorous with specific measures on for example, sustainability, data and metadata compliance with OCG Data Implementation Strategy, governance structure, and best practices. This work is in progress.

OceanOPS will enhance its monitoring capacity through OCG Data Implementation Strategy, new networks join GOOS (see SO6), but also through a new European projects AMRIT, which is aiming to federate European ocean observing system metadata nodes (in major oceanographic institutes) and so OceanOPS can capture more coastal observing systems and R/V cruises that are not under GO-SHIP to the GOOS monitoring capabilities.

BioEco Monitoring: BioEco Portal now has metadata on some 600+ programmes. Additional funding has been secured to connect the BioEco Portal to ODIS and provide helpdesk and community support through the EU funded projects Marco-Bolo and BioEcoOcean (BioEco EOVs - sister to ObsSea4Clim). This will lead to exchange of metadata. Further development of the BioEco Portal was discussed at the September 2023 BioEco Panel meeting, with additional discussions with OceanOPS, ODIS and OBIS in 2024 to progress connection/interoperability of the systems with the overall goals of supporting strengthening and interoperability of the systems, improving data flow and FAIR data access, increasing visibility of an integrated system and breaking down silos between data from different disciplines.

Overall, GOOS monitoring capacity via OceanOPS and BioEco Portal/OBIS has limitations and is not fully integrated. Technical discussions have started with OBIS to connect the two systems for a more comprehensive view, and the ERDAAP server configuration (data federation through APIs - see SO7) for the

OCG Data Implementation Strategy should also assist in connecting OceanOPS to more metadata harvesting points. Note that In the new EU Project ObsSea4Clim EOV monitoring for climate variables will be done through EMODNet. Insight from more advanced monitoring is one of the attributes that is most frequently requested for reports and by funders, this should be a focus that is addressed across GOOS, as a target within a more comprehensive data and metadata strategy.

Co-Design: Under the Co-Design programme, the emphasis is on working with modelling and user stakeholders co-design observing and information delivery. This includes testing design through Observing System Experiments (OSEs) or Observing System Simulation Experiments (OSSEs) or statistical methods. We do not currently have the methodologies to cost effective or routinely test design, Co-Design has applied to NSF funding for a series of workshops to focus on resolving this through the Exemplar process.

Ocean Forecast Operational Readiness Level: ETOOFS is collaborating with The OceanPrediction Decade Collaboration Centre (DCC) in the creation of an Operational Readiness Level (ORL) for ocean forecasting. The ORL is a tool that serves system developers and users to assess the operational development status of an ocean forecasting system. It supports system managers in understanding the operational capabilities and pinpoint gaps that should be addressed to further mature a system. Additionally, the ORL assists users in gaining a comprehensive understanding of the system's reliability, usability, and strengths. Improving the ORL qualification of a service is a means to identify and implement best practices and standards in ocean forecasting, enhancing the overall operability of the system.

The institutions responsible for operating a service will calculate the ORL for their respective systems. The results will only be public if the institution responsible for the system decides so. The OceanPrediction DCC will supply a software tool for evaluating the operational readiness level through participation in an online survey. At request, ETOOFS will then endorse the Operational Readiness Level evaluation of a system.

Map of ocean forecasting systems: ETOOFS is collaborating with OceanPrediction DCC on the preparation of an online atlas to map the ocean forecasting community and its assets. The atlas will have four sections describing individuals, institutions, forecasting services and user cases related to the world of Ocean Forecasting.

2.3.3. Assessment

No.	SO3 Outcomes	Assessment	
2	Identification of gaps across the observing system (disciplines and domains) and at global, regional, and local scales.	**Progress: on track, but needs more work** **Criteria: set of identified, priority observing gaps** Partial knowledge for the global ocean observing networks, gaps for the zooplankton, seagrass and macroalgae EOVs identified through EuroSea funded workshops with two peer-review publications produced. Plan being developed to identify gaps for application areas Co_design Exemplar projects. TPOS and others have also identified gaps. Global gaps will be indicated in WMO RRR/Statements of Guidance when the next round completes 2025. GCOS notes gaps for climate. No consistent approach across the observing system, however with GCOS, RRR, Co-Design some delivery areas being covered.	

3	A view of the status of the observing system to meet societal goals, including real-time view of status for short term response.	**Progress: some way to go** **Criteria: Views/information on status of the observing system to meet societal goals.** Some of the work mentioned, Co_design and WMO RR needs to advance inorder for this to be possible, plus investment to implement the technical solution (OceanOPS and BioEco Portal). The ObsSea4Clim project will take the GCOS climate indicators and assess fitness to observe climate - this will provide useful input to GOOS.	
4	Guidance on how to evaluate observing systems from a global, regional and national perspective.	**Progress: Some** **Criteria: a best practice or guidelines for this** Work in Co-Design and generally across GOOS is looking at making more common processes for evaluating the observing system based on needs. The work under BioEcoOcean aims to produce guidance for co-creation (co-design and co-production) for BioEco EOVs.	
5	Information on value to evaluate investment in ocean observing	**Progress: initial progress** **Criteria: need both needs and data on gaps, so the two preceding outcomes to reach this one.** Some funding secured to continue improvement of BioEco Portal, connect the Portal with ODIS, and deliver information for reporting by OceanOPS, increasing efficiencies in delivery of metadata.	
6	Network evaluation and metrics.	**Progress: on track for OCG networks** **Criteria: implementation suite of set of objective measures of network readiness and ability to evaluate** Some OCG Metrics regarding delivery data, metadata, best practices, etc., but this is not consistent across OCG networks, progress slowed in last year..	
7	Forecasting system evaluation and metrics.	**Progress: On track** **Criteria: implementation suite of set of objective measures of forecasting system readiness and ability to evaluate** ETOOFS working on specific metrics	
8	Ability to evaluate system for adequacy in meeting	**Progress: slow** **Criteria: evaluation system in place and providing**	

	societal needs	**insight** Theoretically we should be able to do this through OceanOPS - BioEco Portal, i.e. technically it is possible and we are working to connect these entities.. However 1) lack investment to develop evaluation tools, 2) we have partial information on needs (RRR, GCOS, Co_design, others?), 3) we have partial information on the observing system, and need more regional hubs connected to OceanOPS (ERDAAP). Expect advances here in the next 2 years.	

2.3.4. Recommendations

SO3: BioEco Panel recommends a stronger focus on establishing a sustainable connection between the BioEco observing programmes and ODI. There is some funds in EU projects to progress defined pieces of work but there is currently no ongoing (i.e. sustained) support to (i) ensuring ODIS-ARCH specifications across ALL EOVs are completed (BioEcoOcean will only progress a sub-set) and (ii) ensuring ongoing (i.e. sustained) technical support for the Portal is provided

Tracking against targets for evaluation of the integrated system is what many funders, reports, potential supporters, external agencies request, with no idea of the complexity of supplying it. However it is where we need to go and GOOS should plot a pathway to achieving it - across SO4 and SO7. It requires a 1) cross GOOS metadata integration, 2) identification priorities/gaps against society application areas, 3) frameworks/resource/infrastructure to support this. Non-trivial, but as with SO7 we now have the building blocks (network metrics, Co-Design, WMO RRR, GCOS/ObsSea4Clim) we need to ensure we continue to build and integrate these towards this as one of the key goals. This more advanced monitoring is one of the attributes that is most frequently requested for reports and by funders, this should be a focus that is addressed across GOOS, as a target within a more comprehensive data and metadata strategy.

Hopefully the Scoping Workshop observations-modelling interface led by ETOOFS and IOCCP next May 2024 in Xiamen will provide information at least for the BGC EOVs on gaps and evaluation of the system as fit for purpose.

2.3.5. Comments

- Moved 3.1 to SO6
- The outcomes 6 and 7 have been added (i.e. not in IP), however they are a first step, in assessing the system components function. Think we should include and view them as such.

2.4. SO4: Empower end user applications

2.4.1. Actions

SO4: Empower end user applications 2 Activities / 4 Subitems

Activity		Status	Priority	Lead
4.2 Data Integration Products Across GRAs 2	2	Just started	Low	GRAs
4.3 GOOS product and services portfolio for Ocean Prediction centres 2	5	Working on it	High	GRAs

2.4.2. Status

Guide on Operational Ocean and Monitoring and Forecasting Systems: The Guide on Implementing Operational Ocean Monitoring and Forecasting Systems was published on GOOS Website on 26 September 2023 after it was showcased in Ocean Conference is Lisbon in June 2022 (link). Mercator Ocean also working on a WIKI version (for online interactive updates). ETOOFS is still working towards having the guide published also as WMO guidance material - a joint IOC WMO publication, as originally intended when it was initiated under JCOMM.

Integrating BGC and BioEco observations in operational forecasting: Modelling Interface (IOCCP-ETOOF cross-cutting activity) there is a high priority need to include BGC and BioEco data into operational forecasting systems. A Scoping workshop on Synergy of Ocean Observations and Biogeochemical Models,is planned for May 21-23, 2024, Xiamen, China.

Indicators: The work of Ocean Indicators (led by OOPC) has progressed through the interaction with the other two panels. A paper is being drafted which includes definition and criteria for ocean indicators and some initial proposals. One of the key challenges is to ensure that the proposed indicators are really integrative and societally relevant, and that this work is not duplicating what is already being developed in the framework of SDG and others. Some work in pushing the boundaries for climate indicators will be undertaken in the new H2030 EU Project ObsSea4Clim (Physical EOVs - sister to BioEcoOcean), connected to OOPC, and including some analysis and testing for regional implementation. Outcomes from this project should act as recommendations for GOOS. The BioEco Panel has been engaging with the GOOS indicator task team to understand the role of GOOS in delivering indicators to the community. This includes better understanding who and where indicators will be delivered to/into and at what capacity. Further clarification from GOOS is required on who from the business community should be engaged in delivering this SO and the role of the BioEco Panel in (a) developing indicators and (b) implementing the monitoring of those indicators by the business community.

BioEcoOcean and EOV products: The new EU Project BioEcoOcean will look at the relevance of EOVs as data products for stakeholders - co-designing information with the stakeholders. This will deliver insight, products and recommendations for GOOS and the EOV structure.

CoastPredict: The work of CoastPredict is strongly focused in this direction with the GlobalCoast Initiative and 125 pilot sites identified (framework for implementation of CoastPredict), plans for an open, free GlobalCoast digital infrastructure and collaboration with Fugro (cloud services to support public and private

service delivery).

GRAs data products: No progress reported across GRAs. **Product and Services Portfolio for ocean prediction centres:** No significant progress reported to assemble a product and services portfolio.

2.4.3. Assessment

No.	SO4 Outcomes	Assessment	
1	GOOS Toolkit/Guide for Operational Ocean and Monitoring and Forecasting Systems	**Progress: Complete** **Criteria: Guide for Operational Ocean and Monitoring and Forecasting Systems published** The ETOOFS Guide, GOOS reference document, is finalized, published, and warmly welcomed, it is the baseline for next steps work in the OceanPrediction DCC.	
2	Case study examples drawn across GRAs on data integration and delivery by combining physical and biological data streams to increase access to and use of observations	**Progress: slow** **Criteria: Case studies on product development available** Work organised in a few GRAs only, with IMOS, IOOS. Need to assess their progress, share experience with other GRAs	
3	A better understanding of GOOS resources that can be exploited by ocean forecasting centres to develop themselves and their activities, and consequently enrich the end-to-end value chain	**Progress: Not yet started** **Criteria: ??** The (UN Decade) OceanPrediction DCC has started structuring actions connecting ETOOFS (and Guide) with GRAs (ocean prediction centres by regions).	

Note For outcome 3 the text is not clear - ETOOFS needs to provide something understandable

2.4.4. Recommendations

- SO4: BioEco Panel recommends that GOOS provide some strategic direction to the Indicators Task Team in identifying and mapping the implementation and delivery pathways for indicators being developed. This should include identification of the organisations that indicators will be delivered to and for what purpose, the data pipelines between EOVs and indicators (including data and data products) and how these data pipelines will be facilitated and maintained. Such a strategy would clearly identify where GOOS might be placed within the already established and planned indicator landscape to clearly identify where GOOS indicators could add value rather than duplication.
- SO4: For the product and Services Portfolio for ocean prediction centres, suggest that we assess whether the work will be undertaken in the 2024/2025

- SO4: Suggest we evolve this SO4 to ‘empower and deliver end user applications’. This is a direction of travel for GOOS with EOV products and indicators, noting that GOOS will not do all indicators or products, however we are actively investigating what could be useful EOV products and indicators, e.g. the BGC panel is producing products, the BioEco Panel also under BioEcoOcean Project, and OOPC indicators, including under ObsSea4Clim. This work needs to be grouped and it could be under this SO4, or leave EOV products in SO7 and indicators and services in SO4. We would need to add actions.

2.4.5. Comments

- Outcome 3 seems poorly worded and not very clear - ETOOFS should reword this.

2.5. SO5: Authoritative guidance on design

2.5.1. Actions

SO6: Strengthening and expanding system

Activity	Status	Priority	Lead	Timeline
6.1 Implementation of multidisciplinary initiative VOICE 2	Working on it	Medium	BGC	28 Mar - 30 Jun
6.2 GOOS Endorsed Best Practices available across EOVs and platforms 1	Working on it	Medium	OCG/OceanOPS	Apr 1, '21 - Dec 31...
6.3 Ocean Observations in EEZs 3	Working on it	Medium	HQ Office	Apr 1, '21 - Dec 31...
6.4 Emerging network integration 5	Working on it	Medium	OCG/OceanOPS	Apr 1, '21 - Dec 31...
6.5 Develop and/or maintain an up to date referenced hardware directory 2	Ready for re...	Medium	BGC	Apr 1, '21 - Dec 31...
6.6 Advancing BGC/BioEco observations across global networks	Working on it	Medium	BioEco	Apr 1, '21 - Dec 31...
6.7 Environmental Stewardship 3	Working on it	Medium	OCG/OceanOPS	Apr 1, '21 - Dec 31...
6.8 Inter-comparison and standards 4	Working on it	High	BGC	Apr 1, '21 - Dec 31...
6.9 Coordinate and expand surface ocean biogeochemistry observations 2	Working on it	High	BGC	Sep 30, '24 - Jul 1...
6.10 CoastPredict	Working on it	High	Ocean Decade	Apr 1, '21 - Dec 31...
6.11 Building the BioEco community 8	Working on it	Medium	BioEco	Apr 1, '21 - Dec 31...
6.12 Marine network additions to GBON/SOFF 1 Open	Working on it	Medium	OCG/OceanOPS	-

2.5.2. Status

Several actions have been finalised:

- A new unified across GOOS EOV (ECV) Specification Sheet is undergoing final testing (BioEco and OOPC to discuss in Cross Panel meeting) it will available on the GOOS website soon
- The GOOS Essential Ocean Variable (EOV) paper " Essential Ocean Variables: the backbone of a sustained and evolving global ocean observing system", has been shared with co-authors for final review. The manuscript will be submitted to Marine Policy at the end April 2023. This includes an agreed GOOS process for evaluation of variables for EOV status.
- Boundary System Task Team: a summary community paper is currently under review in Oceanography. The recommendations provided in the paper have been taken up by the Boundary Currents exemplar in the Observing Co-Design Programme, and can be of interest for GOOS/OCG/GRAs.
- Pilot EOVs added are Marine Debris and Turbulent Diapycnal Fluxes

Good progress has been made in other activities including:

- OASIS (now an Ocean Decade Programme under the Decade Coordination Office for Ocean Observing and with many interactions with GOOS elements): strong mobilisation of a multidisciplinary community around 5 themes, including Observing System Design ; push for an emerging network of uncrewed surface vehicles.
- Design for a pan-tropical observing system in collaboration with CLIVAR: the activity intends to take stock of previous reviews at the tropical basin level and propose an optimised design that will also enable understanding cross-basin ocean-atmosphere coupled phenomena. A satellite event taking place in Barcelona during the Ocean Decade.
- Ocean Heat and Freshwater Cycles Strategy (strongly connected with GCOS and WCRP): this action will implement an objective approach to identifying gaps and major uncertainties in the global climate monitoring system to understand the energy and water cycles and to better constrain their

budgets, and a quantification of the ocean role in those cycles. Community mobilised: workshop held in June 2023, session presented at the Ocean Sciences meeting in February 2024.

The GCOS recommendations to improve the ocean component of the global climate observing system were endorsed by the IOC Assembly in 2023 (IOC-A32) and the WMO Congress (Cg-19). What will be the response from GOOS?.

WMO Rolling Review of Requirements (RRR): GOOS is now leading the Ocean Application Area in the WMO RRR. This is a new 'pilot' area for WMO, and the work is at an initial phase supported by secretariat in Paris and Geneva - as well as experts from OOPC. Two or three application areas will reach the requirement definition stage in 2024, the rest in 2025. The application areas that will be evaluated are Ocean Forecasting and Real-Time Monitoring, Coastal Forecasting, Oceanic Climate Monitoring and Services, Tsunami Monitoring and Detection, Marine Environmental Emergency Response, Maritime Safety (ports - open ocean) and Ocean Biogeochemical Cycles (inactive). This is a big step forward in integrating ocean observing needs into WMO for national and regional agendas. From the RRR requirements for Global Basic Observing Network are set, and variables in GBON are eligible for the Strategic Observing Finance Facility (SOFF).

The RRR work is visible to WMO Members and GOOS is learning how this requirements setting process works in an operational environment under WMO, and if the process will bring value in terms of evaluation and investment. It is expected that the leading role of GOOS/OOPC in the Oceanic Earth System Application Category within the new RRR process will result in a greater uptake of suggestions in terms of ocean observing design by WMO Members. However, it is only partial, GOOS should evaluate the value of this process, with other processes, and what GOOS can use. The new Horizon Europe project ObsSea4Clim (approx. 6 M Euros) will be using the EOV/ECV framework and following the RRR process to improve the climate observing system in Europe including aspects like regionalization of Indicators and improving the connection between the global assessments and the national needs. It will offer recommendations on how GOOS can use the RRR type process.

Ocean Observing Co-Design: has been working to support and advance the six initial Exemplar Projects, of which some are more mature than others. The most mature Tropical Cyclones and Boundary Currents, have engaged with modelling and service provision, Tropical Cyclones has 3 pilot areas, experiments underway and engagement with WMO. Boundary Currents is planning a workshop in September 2024, supported by the DCC Ocean Climate nexus, that will focus on the Agulhas Current, working with users, modelling and observers to design a pilot, and also considering work in other boundary systems. The Carbon Exemplar is focused on defining what observations are required for climate projections, and for the baseline carbon observations that governments and industry need if mCDR is to be considered. Other Exemplars are Marine Heatwaves, Storm Surge and Marine Life and are in the process of defining pilot areas. A proposal has been submitted to the National Science Foundation (US) to fund/support a series of workshops on processes around evaluation of observing system design with the modelling community.

Co-design is aimed at being transformational and means new processes for the co-design of observing systems need to be developed. New processes and ways of thinking; knowledge of services, observing system design assessment with modelers and users, and work on value assessment. Finally integrating these elements to provide some notion of value or return on investment will be important for the longer term sustainability of ocean observing, this is fundamental to delivering impact. Discussions are starting to determine how to best integrate this program into GOOS structure and best practices are being drafted to capture and publish processes of co-design.

Coordination and expansion of the surface ocean CO2 observing network (SOCONET), which provides the measurements used to produce ocean carbon flux estimates (SO 5.3.4) among other applications, is a key

component of the WMO Global Greenhouse Gas Watch (G3W) Implementation Plan currently under consideration by WMO INFCOM and by the next WMO Executive Council in 2024. Surface ocean GHG actions in the plan were generated from recommendations from two workshops held in fall 2023 supported by various levels of facilitation by the BCG panel: Observations within G3W (recommendations from the workshop) and Workshop on Surface Ocean pCO2 Observations (workshop statement). The G3W Implementation Plan also includes actions around observing design and infrastructure for surface ocean GHGs (CO2, CH4, N2O), building interoperable data infrastructure, and design of a comprehensive ocean observing system for assessing climate and biogeochemical feedbacks that affect GHGs, linking surface networks with ocean interior networks.

2.5.3. Assessment

No.	SO5 Outcomes	Assessment	
1	Refined designs for observing the essential global observations required for global societal needs that maximise return on investment	**Progress: More progress is needed** **Criteria: Examples of refined designs that are being used for implementation globally and/or regionally** Several initiatives are making recommendations for an improved ocean observing design (e.g. GCOS) and progress has been made, but uptake of those recommendations is still limited.	
2	A modular design approach to guide and support implementation decisions at regional and national level	**Progress: Low** **Criteria: a modular design approach tested and available** GCOS Implementation Plan Actions, which include recommendations to improve the global ocean observing systems have made its way to IOC and WMO Member States. More follow up is needed to turn this into decisions. GOOS National Focal Points may serve as a conduit to influence decisions at regional and national level. Co-Design is working on a modular approach, but this will take another 2 years to be more fully tested.	
3	Greater efficiency in investment towards enhancing observing capacity	**Progress: On track** **Criteria: evidence of frameworks being supported** OCG networks are being built around EOVs. Engagement in the WMO RRR may also bring some investment in some areas of interest for WMO members.	
4	Transparency in establishing and communicating on design requirements	**Progress: On track** **Criteria: Documented processes** Still some effort to be done in this space, but the	

		EOV Adoption Process is now adopted and the EOV paper will soon be submitted. The process will also enrich by connection with other communities (GEO, ObsSea4Clim Horizon Europe project, GCOS, WMO RRR). Co-design will start to consolidate learning and support process development.	

2.5.4. Recommendations

- SO5: Increase synergy with Ocean Acidification Research for Sustainability (OARS) Outcomes, in particular OARS Outcomes 1, 2 and 3 (Data quality, Science to Action, Observing strategies) for BCG EOVs.
- SO5: Ocean Observing Co-design has some level of support for 4 of the 6 Exemplars, however the core now needs support.
- SO5: Recommend that GOOS sets a new action to consider a process for priorities over the next years, and test some applications, to address questions like - what should be the GOOS process for response to this - GCOS recommendations to improve the ocean component of the global climate observing system which were endorsed by the IOC Assembly in 2023 (IOC-A32) and the WMO Congress (Cg-19), and other 'key' requirements setting processes? OCG will discuss at OCG-15, RRR work underwayOcean Observing Co-Design will begin to show assessment results.

2.5.5. Comments

Panels and Co-design discuss and rationalise the actions

- EOV and boundary currents v close to complete
- Add OASIS (OOPC/BGC/SOLAS) and add WMO RRR
- ocean heat and freshwater - separate from GCOS?
- No BioEco design work? Happening in Marine Life, OBON, MarcoBolo?

2.6. SO6: Strengthen and expand the ocean observing system

2.6.1. Actions

SO6: Strengthening and expanding system

Activity	Status	Priority	Lead
6.1 Implementation of multidisciplinary initiative VOICE 2	Working on it	Medium	BGC
6.2 GOOS Endorsed Best Practices available across EOVs and platforms 1	Working on it	Medium	OCG/OceanOPS
6.3 Ocean Observations in EEZs 3	Working on it	Medium	HQ Office
6.4 Emerging network integration 5	Working on it	Medium	OCG/OceanOPS
6.5 Develop and/or maintain an up to date referenced hardware directory 2	Ready for re...	Medium	BGC
6.6 Advancing BGC/BioEco observations across global networks	Working on it	Medium	BioEco
6.7 Environmental Stewardship 3	Working on it	Medium	OCG/OceanOPS
6.8 Inter-comparison and standards 4	Working on it	High	BGC
6.9 Coordinate and expand surface ocean biogeochemistry observations 2	Working on it	High	BGC
6.10 CoastPredict	Working on it	High	Ocean Decade
6.11 Building the BioEco community 8	Working on it	Medium	BioEco
6.12 Marine network additions to GBON/SOFF 1	Working on it	Medium	OCG/OceanOPS
6.13 Optimal carbon flux observing system blueprint 2	Working on it	High	BGC

2.6.2. Status

Oxycline observing: The implementation of multidisciplinary initiative VOICE (Variability of the Oxycline and its Impact on the Ecosystem) is towards an integrated regional multidisciplinary observing systems in the Eastern Boundary Systems (EBSs) for observing variability of the oxycline and its impact on the ecosystem, and towards increasing readiness levels across the observing value chains for these systems. Done through providing global coordination of regional pilots initiated through resources external to GOOS 9100kS for regional workshops). A regional pilot 1 day workshop VOICE/CLAP was held during the GOOD-OARS-CLAP-COPAS Summer School November 2023, La Serena, Chile: multidisciplinary observation network CEAZAMar to accommodate local scallop aquaculture cooperative stakeholders needs. Predictive dynamical coupled models at local scale (3 km - 100 m) (short-term/seasonal/climate change) to address ecosystem services management and planning and link with Decade Collaborative Center for Ocean Prediction (DCC-OP) Regional Team South and Central America.

Expansion observing networks: OCG is expanding in supporting new emerging networks, developing the capacity to better engage for BGC and BioEco expansion of observations on existing platforms, and harmonising data and metadata flow (see SO7). At its next session, OCG-15 in May 2024, OCG will endorse two new networks, Smart Cables and the Fishing Vessel Observing Network (FVON). OCG will also consider emerging network requests from SOCONET (The Surface Ocean CO_2 Reference Observing Network) and for USV (Unmanned Surface Vehicles). FVON has published a nice summary paper (https://www.frontiersin.org/articles/10.3389/fmars.2023.1176814/full) and is developing fast, also exciting progress for Smart Cables has been published in Science Magazine[1] There was also interest from the Ship Based Ecological Time Series and Integrated Marine Debris Observing System (IMDOS). These are all relevant and community supported expansions of observing capacity and interest remains high in joining OCG, for recognition and to be harmonised in data, metadata, best practices etc. In addition, there have

[1] https://lnkd.in/d-Ueh4Sj

been requests from both BioEco Panel and BGC Panel to engage with OCG around expansion of observations on existing platforms, OCG 13, and 14. OCG-15 will explore a collective plan for observing and data/metadata. Ideas currently underway include; supporting and learning from pilot projects in this space, BioEco GO-SHIP, AniBOS, BGC Argo. Linking OceanOPS and the BioECO Portal/OBIS (see SO7). With the increase in emerging networks, OCG will consider its support structure at OCG-15, including OceeanOPS support to these emerging observing networks. OCG is also revising its understanding of what will constitute an OCG network, in terms of 'global', platform vs. theme, etc. This was raised several times at OCG-14 and will be discussed at OCG-15, with outcomes shared across the GOOS Exec. OceanOPS is also going to create **service level agreements** for support which will also help clarify support obligations from networks and vice versa from OceanOPS.

The BioEco Panel (OBIS) will now regularly engage with the OCG and work to pilots/identify areas in which biological observations are being collected by the networks. Initial discussions have identified AniBOS and Bio GO-SHIP as networks that are already collecting observations that link directly to BioEco EOVs as potential pilot networks for focusing efforts. Discussions to progress this will take place at OCG-15.

BioEco EOV implementation: and the development of best practices at multiple scales is developing well through projects such as EuroSea, Marco-Bolo, BioEcoOcean and through broad engagement with diverse communities, including G7 FSOI, DOOS, POGO, SOOS and MBON. In addition we have facilitated and are planning sessions, workshops and symposia at various conferences to expand our outreach into the community in developing EOV specification sheets and structuring data schemas and pipelines for data and metadata delivery into OBIS. BioEco EOV implementation is being advanced through SCOR working groups (C-GRASS, CONCENSUS), POGO and IQOE (ocean sound).

BGC surface carbon (action relocated from SO5): A coordinated surface ocean CO2 reference network (SOCONET), integrated within relevant elements of IOC-UNESCO and WMO, is being formalised as the backbone of monitoring, reporting and verification (MRV) efforts to properly incorporate ocean sinks in global carbon assessments and stocktakes as well as reporting on marine carbon dioxide removal interventions. The climate quality observational data will feed directly into carbon monitoring systems to aid in accurate and timely assessments of surface ocean carbon levels, carbon uptake by the ocean, and changes thereof. Uniquely designed and distributed surface ocean CO2 reference network will be a tightly coordinated activity to create monthly air-CO2 flux maps, assess surface ocean health as it pertains to ocean acidification; and to quantify ocean mitigation potential to reduce atmospheric CO2 increases. Specific actions underway:

- establishment and formalisation (ToR and 12 month Workplan) of the SOCONET Steering Committee (SC)
- Formal integration of SOCONET into the GOOS Observations Coordination Group as an 'emerging' network and pilot implementation of SOCONET in OceanOPS dashboard
- drafting and preparation of the SOCONET Implementation Plan.

Expand coastal observing and forecasting - CoastPredict: has made significant progress towards implementation which will have two components: 1 - implementation at Pilot Sites; 2 - establishment of a shared global cloud-based platform for free and open access to data, models, cloud-based computing and knowledge exchange. A global network of over 120 Pilot Sites from 32 Regions of the Global Coastal Ocean was identified through a survey in 2023 (www.coastpredict.org/globalcoast/). A considerable amount of baseline information has been gathered for these Pilot Sites including the priority challenges, product and service needs, initial stakeholder mapping, and existing observing and predicting capacity. Implementation with local Pilot Site partners will involve demonstration of an integrated coastal ocean observing and prediction system at Pilot Sites in response to local needs. Implementation will leverage international

cooperation and commonalities between different regions / Pilot Sites through the GlobalCoast network and enabled by the global cloud. Fundraising for both components is underway, with an initial focus on 'candidate regions' in the global south that may be eligible for funding.

Best Practices and Standards: GOOS Endorsed Best Practices play a crucial role in promoting standardisation, interoperability, and quality assurance in ocean observation activities, ultimately contributing to improved understanding and management of the marine environment. There are currently 9 "GOOS endorsed" best practices available via the Ocean Best Practices System repository. Although this isn't a huge quantity, it takes time and encouragement to produce cohesive, inclusive best practices, many of which are being created from scratch. The networks have gained more traction recently with regards to Best Practices, one new best practice is from Argo and stems from 2 recent Frontiers in Science papers. The endorsement process is implemented and practices are searchable by EOV, platform and endorser.

The OBPS Steering Group has expanded considerably in the past year, bringing in diverse voices from around the globe. As OBPS moves towards a new strategic plan, an Advisory Board will be implemented, comprised of senior external experts, selected on the basis of the priority needs and representing research, applications, policy and data/ information communities of ocean and related sciences value chain; drawn from a diverse range of disciplines, geographic regions, gender, and career stages. Currently, the key strategic objectives of the Ocean Best Practices System (OBPS) up to 2025 are as follows:

- Trusted Archiving and Convergence
- Interoperability and Convergence Acceleration
- Community-Led Capacity Development
- Facilitation of Federated Network

The OBPS annual workshop is well attended (SO9), and various task teams within the OBPS group undertake work, one particularly successful is team is coastal observations in under resourced countries, which has supported the work of COLaB (Coastal Observations Lab in a Box) which is part of the endorsed Coast Predict program and has 2 workshops planned in 2024. A series of SOP for eDNA were developed and submitted to OBPS under the EuroSea project. Standards will also be one of the issues taken up by the Dialogues with Industry (see SO8), it could be that this public-private interface is where standards could have the most impact in the near term.

WMO GBON/SOFF: From the WMO RRR process the requirements (see SO5) for the Global Basic Observing Network (GBON) are set, and variables in GBON are eligible for the Strategic Observing Finance Facility (SOFF). In GBON now are 2 ocean surface variables (SST and surface pressure) and PI-GOOS has been active in applying for SOFF funding to support for example drifting buoys, however right now SOFF is only accepting land based applications. This is a potentially long process for a wider range of ocean variables being eligible for SOFF, unless WMO takes action to speed the process. WMO also needs to secure more SOFF funds and consider the EEZ vs. open ocean funding dilemma - a read out from WMO on its current thinking about ocean variables and SOFF would also be welcome.

OceanOPS and GOOS regional experts are running regular basin based coordination meetings to identify spatial gaps or oversampling areas, cruise opportunities to address them, and balance the overall distribution. These meetings are gradually expanded beyond core OCG networks and have shown progress in addressing gaps in the Indian and Southern oceans, and decreasing the oversampling in the North Atlantic.

The IOCCP hardware directory (ioccp.org/hardware-directory) continues to be maintained and heavily used by the community.

2.6.3. Assessment

No.	SO6 Outcomes	Assessment	
1	Increased efficiency in use of resources.	**Outcome is unclear here** **Criteria - no idea how we might assess this as OCG.** noting improvements in Argo due to resource constraints? Suggest this would be better associated with design - where it could be tested?	?? move SO5
2	More users served - enhanced delivery to end users across an integrated observing system.	**Progress: slow, but advancing** **Criteria: successful initiatives in this area** Co-Design is successful for Tropical Cyclones and Boundary Currents, with momentum for carbon and marine heatwaves. CoastPredict likewise has clear user targets. VOICE, MarcoBolo, ObsSe4Clim and BioEcoOcean will all also contribute.	
3	A system for identifying and sharing best practices and adoption of common approaches.	**Progress: On track** **Criteria: OBPS supported and endorsed practices coverage across EOVs and networks.** Better connectivity with the OBPS progressing with identification of best practices being facilitated through BioEco EOV implementation, OCG and EC projects.	
4	Increasing the number of observing networks, sensors and platforms with a Technology Readiness Level of 7 or more.	**Progress: On track** **Criteria: increasing the number of emerging and mature networks** 2 networks reached maturity (OceanGliders and HF Radar), deeper understanding of metrics for maturity being developed, TRL level of BioEco EOVs will require support to identify across observing systems and programmes, including GRAs.	
5	Coordination towards achieving common goals across global, regional and national systems.	**Progress: some, but slow** **Criteria: identification of common goals (SO5) and ability to track and coordinate across networks, GRAs and GOOS NFP** Behind, need improved mechanisms for setting priorities and requirements (SO5) first. Work of Co-Design, CoastPredict and GRAs and National Focal Points - mechanism unclear, would we ask that GRAs and NFPs agree to support the mature elements of these initiatives? What about the projects?	

		other programmes in Ocean Decade, plus GCOS and RRR. BGC Panel hope the cross-GOOS novel initiative (carbon?) will address this efficiently. Need a mechanism for value assessment (GCOS, RRR, Co-Design and CoastPredict address this). Can the SC agree on a limited but clear set of priority impact areas for, e.g. Implementation Roadmap/	
6	Expansion and evolution into new areas, identified through requirements and supporting emerging communities focused on solving global needs.	**Progress: underway** **Criteria: evidence of expansion into new areas** A lot happening through the Ocean Decade - Co-Design, CoastPredict and DOOS, OASIS, also VOICE	
7	Increased interoperability of ocean data from a variety of sources.	**Progress: steady, slow progress** **Criteria: Increased ability to combine and link different data sets** Through OCG data mapping, data strategy and now move for cross GOOS data work (SO7). With GO2DAT BGC panel are working in a federated system direction, with this as a subnetwork of ODIS. Using oxygen as a pilot biogeochemical EOV might pave the way on how to build a sustainable, interoperable, and inclusive digital ecosystem for all ocean stakeholders willing to use ocean biogeochemical data. This outcome likely belongs in SO7, as all the work is in this SO.	
8	Support for sustainability through participation in a global integrated system.	**Progress: Not reported or visible.** **Criteria: increased sustained support across OCG, BGC and BioEco networks.** The work undertaken by GOOS has not had an impact yet. The message is not strong enough, the Report Card does a good job, but not enough for sustainable funding). This is becoming critical for some elements RAPID(?), OSNAP? G+BGC Argo , Core Argo. Need to consider communications for sustainability, communications on operational function, data delivered, e.g There should be new opportunities to communicate the need for sustainable ocean observing infrastructure in support of WMO G3W.	
9	Operational tracking of the observing system against targets for climate, operational services, and marine ecosystem health.	**Progress: On track** **Criteria: Ability to track network implementation and system capacity for applications. Report Card is a start.** Progress on the inclusion of biological observations into Report Card, plans for cross-GOOS metadata exchange. Assessment of EOV/application capabilities	

		needs further work. But developments are underway in Co-Design, WMO RRR and BioEco Panel. GRAs are in a better position to identify biological capabilities in their region. Some funding was secured to continue the improvement of BioEco Portal, connect the Portal with ODIS and deliver information for reporting by OceanOPS.	

2.6.4. Recommendations

- SO6: Building on the surface carbon / WMO GHG Implementation Plan, the BGC panel plans to:
  - contribute to development of SOCONET
  - develop a comprehensive GOOS carbon strategy (2024/2025)
  - encourage ocean community participation in a WMO cross-domain (atmosphere, ocean, land) workshop on longer-term GHG observing activities (2025/2026)
- SO6: BioEco Panel plan connection/coordination with the GRAs to expand multi-observations, presenting first to the 2024 GRA Forum in Barcelona. Enhanced connectivity between GRAs and OBIS for delivery of biological observations into OBIS (and ultimately metadata to BioEco portal with information accessible for OceanOPS led assessments) will support greater exposure and coordination of use of biological observations.
- SO6: BGC Panel requests that OBPS consider labelling of the contents, for example, practices, best practices, peer reviewed, and endorsed best practices. It is still not clear within GOOS which documents should be used as BP in the immense BP documents repository (Garçon et al., 2024, in prep). Suggests better guidance on use is also required.
- SO6: Develop a visualisation or metric to indicate what we have covered for BPs - across GOOS EOVs - BGC, BioEco and OCG.
- SO6: BioEco Panel asks that support be provided by GOOS/OCG for facilitating progression of the delivery of biological observations from the networks into OBIS, with AniBOS and BioGO-SHIP as pilots.
- SO5: For the RRR, GOOS should pause in Q4 2024 and assess what we have learnt and what we want out of this moving forward, and find an ocean volunteer to run the Application Area if continuation is desired.
- SO11: For the SOFF, GOOS should decide priority of action here, possibilities include. 1) strongly lobbying WMO to a) include more ocean variables, b) include open ocean 2) with partners and sponsors set up an ocean observing fund itself or under a sponsor for all observations under GOOS in SIDS developing countries in open ocean - based on requirements that robustly developed under GOOS process. 3) focus on projects under World Bank or other major climate finance and development funds. Note: priority needs to be given - at moment all approaches being tried, plus more under the Ocean Decade.
- SO6: OCG needs to consider how it will support more networks, what its ongoing role is vis a vis smaller networks, integrating across 20 or more networks - need a different structure - support etc. SC could ask OCG to report back on its resolution of these questions and vision for the future around networks
- SO6: There should be emphasis placed at GOOS level on harmonisation: of structure, data/metadata (see SO7 as is happening), processes and definitions (metrics, attributes etc - best practices is already done) between BioEco and OCG. There should also be some emphasis placed at GOOS level on harmonisation of what we mean by indicators, and EOV products.
- SO6: There are currently different requirements and no process for GOOS level prioritisation - we have placed several items into the Ocean Decade, that follow the thinking about impact areas in the

Roadmap to Implementation (marine heatwaves, tropical cyclones, coast, carbon, etc). Beyond the Implementation Roadmap do we have a means of expressing and revising the GOOS priority impact areas? Can GOOS SC agree on a limited but clear set of areas of action for societal outcomes.

- SO6: Communications need to consider messaging on sustainability
- SO6: Should VOICE link with Boundary Currents (Co-Design) and CoastPredict? Seems some similarity of purpose
- SO3: It is clear that OCG network maturity metrics will be a useful first step, thus OCG should make the work of the network metrics TT a priority.

2.6.5. Comments

- Move outcome 7 to SO7?
- Consider if outcome 1 is really relevant here in SO5?
- 6.5 The hardware directory - is this complete? can we mark it as such and now incorporate into say the GOOS BGC Panel webpage as an important community service?
- 6.7 environment stewardship is not a major priority for OCG right now, much more to do in data - suggest place as inactive
- 6.8 is this resolved or ongoing BGC panel?
- 6.4, 6.6, 6.9 - are all aspects of expanding and strengthening networks perhaps they could be placed under one action or rationalised across GOOZ in some way
- 6.11: Could it be renamed to indicate the EOV nature of the communities - e.g. Building the EOV network communities? The following subitems should be merged as their review occurs at the same time and they are ongoing work rather than an action - Continually review EOV list and sub variable definitions, Continually revise/update EOV specification sheets. The following subitem should be better defined as it is currently vague in its reference to “protocols” and it is not clear if this subitem has connectivity with other subitems under SO6 or those under SO3 and SO7 - Develop workshops to achieve agreements on protocol. The following sub item should be deleted as it is something already covered by other subitems in this SO and there should be no need to specifically identify components of the observing community on activities that apply to the whole observing community - Assist high-achieving citizen science programs refine and document their workflows including FAIR and open data, where necessary.
- 6.6 - a sub item which identifies that for 6.6. "Training material (online) based on SOP and best practices and published as a training course (by EOV) on the OceanTeacher Global Academy e-learning platform - suggest remove as not current work plan

2.7. Strategic Objective 7: Open Data & Metadata

2.7.1. Actions

SO7: Open Data

Activity		Status	Priority	Lead
7.2 Metadata standardisation global networks 2	1	Working on it	High	OCG/OceanOPS
7.5 Establish OpenGTS Prototype 1	1	Working on it	Medium	OCG/OceanOPS
7.6 Description of production & dissemination standards for Ocean Forecasting S... 2	2	Future steps	High	ETOOFS
7.7 BioEco EOV data available through OBIS 2	2	Working on it	High	BioEco
7.8 Create and sustain BGC data products 5	1	Working on it	Medium	BGC

2.7.2. Status

The **GOOS (OCG) Cross Network Data Implementation Strategy** (GOOS-296) was released in March 2024, this is the first cross-GOOS network data strategy and it is anticipated that over the next 2-3 years the data flow of each of the networks will evolve in line with the strategy, providing greater access through ERDDAP services, including through the federated ODIS architecture and GOOS Global Data and Metadata Hub - link and figure/details below - the strategy ensures that all networks have clear data endpoints that can be harvested in future federated systems. More details can be found in Annex 1.

The Open Access to GTS project (Open-GTS) has evolved from prototype to a demonstrator project and has been used effectively over the last two years to exchange Saildrone USV meteorological and oceanographic data on the GTS (USV community also interested in becoming an emerging network). Under this initiative, we have also included data from a Science RoCS[2] vessel called the Xaymaca. The effort is expanding to incorporate data from the emerging Fishing Vessel Oceanographic Network (FVON, will be accepted as an 'emerging' network at the next OCG-15 meeting). Over the coming months, the Open-GTS will engage in a WMO Information System (WIS) pilot to exchange 2024 Saildrone Data with WIS 2.0, with ERDDAP as the data broker.

Network metadata harmonisation: for the flow of metadata into OceanOPS, this is metadata on the 'system' such as operating program, agencies, operations, hardware, sensors and telemetry, data availability. The standardisation and harmonisation for this metadata that are tracked, used and distributed to ensure data are FAIR and the system can be visualised and work is in progress to implement across the OCG networks in line with the OCG data implementation strategy (documented on line and OceanOPS API). Machine-2-Machine automation has advanced at OceanOPS and the API is routinely providing metadata to WIGOS/OSCAR and delivering unique (WMO WIGOS) identifiers to network platforms.

National tools and integration:The recently funded European Project AMRIT (500K Euros for OceanOPS) will develop tools for national users, building on OCG Data Implementation Strategy and unification of metadata (and data) through APIs and cloud based solutions.

[2] https://sciencerocs.org/

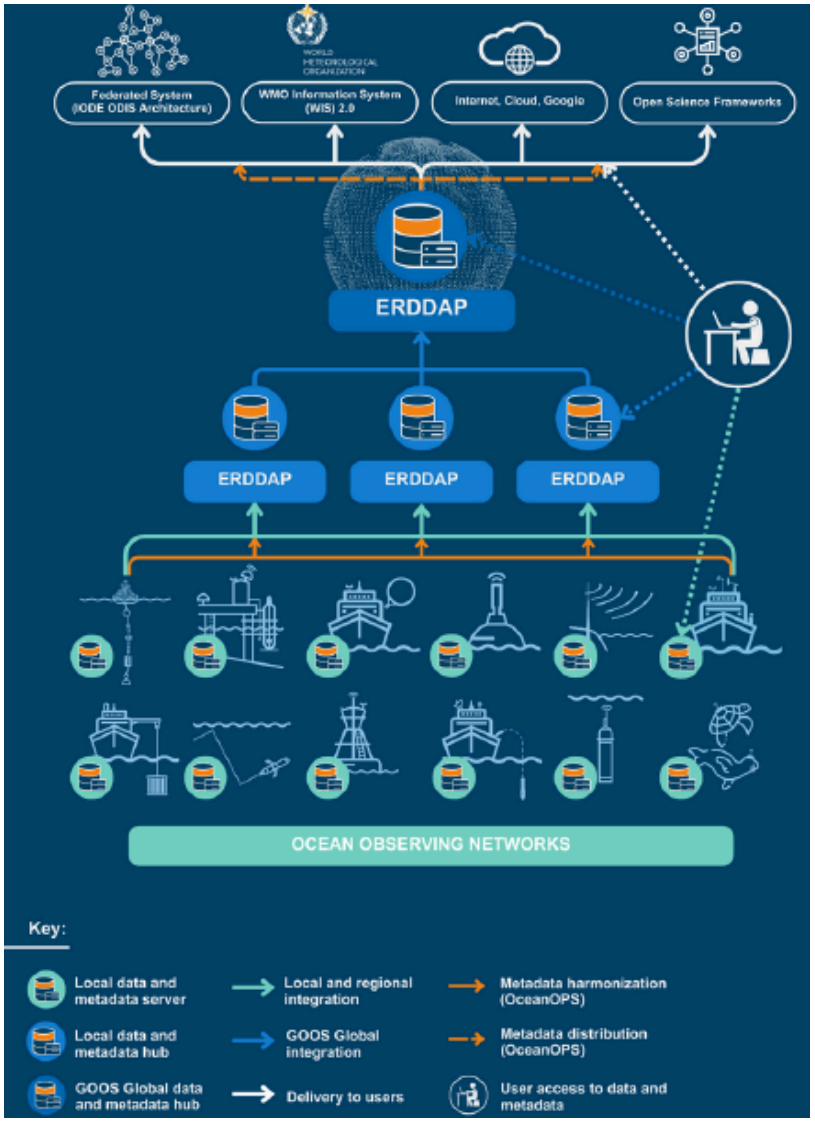


Figure from the OCG Data Implementation Strategy - to visualise the system and federated connections

GDAC for BGC EOVs: The mission here is to create and maintain a GDAC for BGC EOV data, and as relevant design new data repositories capable of integrating EOV data from many heterogeneous sources. The work carried out during last year on building the global ocean oxygen database and atlas GO_2DAT as a first pilot is the following:

1. Goal: The open-access GO_2DAT will comply with the FAIR and CARE principles, providing access to data from the coastal and open ocean, measured from Eulerian and Lagrangian platforms, adopting a community- agreed metadata format, fully documented QC/QF procedures.
2. Done: Work to produce best practices, documented metadata format and consistent quality control (QC) procedure and quality flagging (QF) system for open and coastal ocean oxygen data (Garçon et al., 2024, in prep.).
3. The GO2DAT portal will become a subnetwork of ODIS. ODIS will link all oxygen data nodes through a JSON-LD+schema.org based, decentralised interoperability architecture. GO_2DAT metadata requirements have been approved and QC/QF being proposed. Role of GO2DAT: entity that patrols ODIS for O2 data, harvests it, uplifts it, and then recirculates the uplifted data via ODIS to all other

systems interested in O2 data (ensuring compatible data standards for frictionless import). Done: Translation from Excel metadata sheets into JSON-LD

4. Future work: This will allow us to attribute uncertainties to the data. These uncertainties provide the data user with the information required to make informed decisions whether to include data in an analysis or not.

The ultimate goal is that 1) using oxygen as a pilot biogeochemical EOV, this will create a blueprint on how to build a sustainable, interoperable, and inclusive digital ecosystem ocean biogeochemical data users. 2) such access ensures the reproducibility of ocean oxygen content (and later other variables) in the ocean and to minimise the current underestimation of deoxygenation by IPCC models.

BioEco Data available through OBIS: Data schemas and data management are being progressed in some BioEco EOVs (e.g. seagrass) through SCOR working groups. Further progress is planned through the new EU Project BioEcoOcean, which will facilitate the flow of data into the BioEco Portal and OBIS for diverse BioEco EOVs. The BioEco Panel is also linking with the Marco Bolo project which is providing funding to connect OBIS and the BioEco Portal to ODIS with the plan to connect the metadata from observing programs in the Portal with the metadata from the OBIS datasets. Some funding was secured to continue improvement of BioEco Portal, and to connect the Portal with OBIS, and deliver information for reporting by OceanOPS, increasing efficiencies in delivery of metadata. BIOECO-OBIS serves as the primary data repository for biological observations with nodes for coordination distributed around the world and collaboration with GBIF to ensure all marine biological data are aligned with our specifications and requirements. Better connecting GRA biological observations with OBIS will enhance the visibility of data and expand findability and use.

Create and sustain BGC data products: related to the above there is work underway to develop quality controlled data synthesis products with unprecedented spatial (vertical and horizontal) and temporal (sub-seasonal to multi-decadal) resolution: SCOR WG 168 Coordinating the development of gridded 4D data products from BGC Argo observations Future work : Each GO2DAT product will be provided with a documented QF and with information about the quality, source and treatment of the data used for their production. It is envisioned that the synthesis product will be scalable to accommodate new observing systems and to facilitate continuous updates as new data become available (Grégoire et al., 2021).

From ETOOFS there is no documentation production and dissemination standards, aside from a chapter on BGC in the Operational Ocean Forecasting Systems (OOFS) Guide - link.

Across GOOS (Panels, OCG, OceanOPS) we are now initiating development of a data and metadata strategy towards an integrated GOOS digital ecosystem, leveraging off the developments noted above in the different components, such that users will be able to find and access these different data seamlessly.

2.7.3. Assessment

#	SO7 Outcomes	Assessments	
1	An identified and tracked global observing system data architecture as part of broader oceanographic, atmospheric, and earth system data architectures.	**Progress: On track** **Criteria: maps or schemas available, or real time tracking** Data flow mapping for 13 GOOS (OCG) networks complete, and theGOOS OCG Data Implementation Plan has been endorsed by OCG networks and released. Bio-Eco Data flow	

		mapping being facilitated for BioEco EOVs through SCOR Working Groups and the BioEcoOcean Project.	
2	Data products based on Essential Ocean Variables and Essential Climate Variables available in a timely manner, with appropriate quality.	**Progress: on track BGC** **Criteria: EOV Products available** GLODAP and SOCAT mature, but lack sustained funding. Ship-based BGC time-series data product development on track. Global Ocean Oxygen Atlas development on track (see above). However needs clarification as to what GOOS means as EOV of GOOS Products. The BGC Panel is the most advanced, the BioEcoOcean could contribute (BioEcoOcean), and Physics (ObsSea4Clim). Suggest that this is a cross Panel discussion in 2024 as to what this means to each Panel, are these EOV or GOOS Products, do they have identifiable characteristics? If available they should be listed through GOOS web site/Ocean Observing Report Card etc.	
3	More data available, more appropriately, to more users.	**Progress: slow but essentially on track** **Criteria: authoritatively report on % data from GOOS networks that reaches appropriate endpoints for harvest (real time and delayed mode).** OBIS serves as the primary BioEco data repository for biological observations with nodes for coordination distributed around the world and collaboration with GBIF. Data is increasing into OBIS now and BioEco data flows are strengthening. [BioEco, OCG]. GOOS OCG Network RT data for many networks tracked (not all), DM data not tracked. Some delayed-mode data from networks (DBCP, AniBOS, etc.) tracked now through the OCG ERDDAP Hub[3]. Working with other networks to increase availability of data through ERDDAP services. Need to decide how and if OceanOPS will progress tracking to all networks and to dilated mode. Can we track BGC data? Review capability across GOOS.	
4	Availability of meaningful data metrics.	**Progress: Some** **Criteria: availability of data metrics and tracking** OCG global ocean networks have a traffic light system for attributes. more detailed metrics mature/emerging networks are underway, but not finalised. Linked to outcome 3 - could be merged?	
5	Updated and verified metadata standards across all observations.	**Progress: On track** **Criteria: set of documentation on metadata standards** Metadata standards exist for OceanOPS required metadata (this supports FAIR data , planning and visualisation), most networks have a format defined (OCG could track this). Metadata standards already developed by OBIS, with data schemas for BioEco EOVs being developed through SCOR working groups and the EU Marco Bolo and BioEco Ocean projects. [BioEco]	

[3] https://osmc.noaa.gov/erddap/info/index.html

	Production and dissemination standards for Ocean Forecasting data dissemination.	**Progress:** Only OOFS guide which is the basis of this work. No other dissemination standards have been addressed yet. **Criteria: set of documentation on standards, tacking of compliance?**	

2.7.4. Recommendations

- SO7: Complete new GDAC for BGC EOVs. - GDAC Implementation has stalled since the collapse of data management in Bergen. Therefore GOOS SC / GOOS Management Team assistance is sought to support an international conversation about this.
- SO7: Data products - make the action across GOOS and have a cross-Panel meeting to discuss. BGC Panel work seems most mature, however needs clarification as to what GOOS means by an EOV Product. Suggest that this is a cross Panel discussion in 2024 as to what this means to each Panel, are these EOV or GOOS Products, do they have identifiable characteristics? If available they should be listed through GOOS web site/Ocean Observing Report Card etc.
- SO7: Data flow and tracking, advance the cross-GOOS view of data and metadata flow and tracking. The BioEco Panel recommends that there be continued support and recognition of OBIS as the provider of coordination and monitoring of BioEco data and metadata to ensure continued delivery.
    - extend data tracking,
    - identify what metadata formats, conventions/standards and controlled vocabularies are in use across OCG networks, BioEco networks, BGC.
- SO7: Work with global in situ networks to enact OCG Data Implementation Strategy. In particular:
    - Integrate delayed mode data into ERDDAP data services
    - Continue to federate these distributed data nodes within the OCG Federated data node
    - Work with networks to improve metadata exchange with OceanOPS using these services
    - Continue work with IODE to integrate discovery metadata from Federated OCG services into ODIS architecture.

2.7.5. Comments

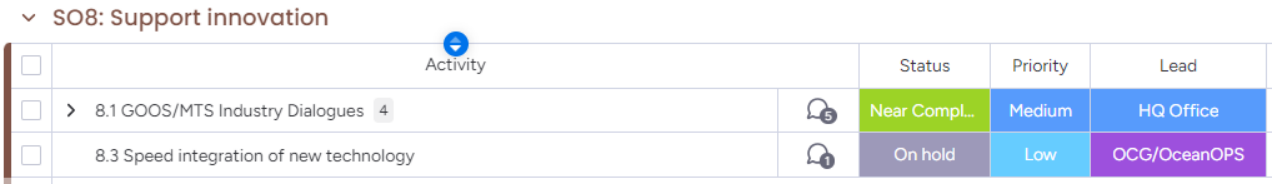
7.3 is complete it can go

Suggest we have a new major cross-GOOS Action - 7.9: Data and metadata integration across physics, biogeochemical and BioEco data - based on recent discussions, to be refined through SC-13 and OCG-15.

Suggest 7. 8 BGC EOV Data Product - is a cross GOOS Data Product Action, after cross panel discussion

2.8. SO8: Support innovation

2.8.1. Actions



2.8.2. Status

The Dialogues with Industry is a groundbreaking collaboration between GOOS, the Marine Technology Society (MTS), the National Ocean and Atmospheric Administration (NOAA), and industry representatives. The Dialogues with Industry marks new pathways for industry and the public sector to collaborate in solving key issues that inhibit the development of an expanded ocean observing system that can deliver the ocean data society will need tomorrow. In 2023 the Dialogues with Industry series was completed, the Synthesis Report released and in February 2024 the the Dialogues with Industry Roadmap was released. Developed over the past year, the Roadmap identifies 26 high-priority action pathways across three key areas: Improving the Marketplace, Collaboration for Societal/Governmental Change, and Shaping the Future. MTS has received 4M$ over 4 years to continue the collaborative work. This gives great visibility to GOOS with industry, will likely lead to a better definition of what standards are required and give us mindshare with governments that look at blue economic growth.

The BioEco Panel has been maintaining close engagement with communities looking at methodologies and technologies associated with the use of eDNA. The Panel has clearly identified that eDNA is not its own EOV but rather a technique/approach that could be used to measure a number of sub-variables across multiple EOVs. Panel members are currently involved in some of these efforts through the Ocean Decade program OBON, OBIS through EU projects Marco-Bolo and eDNAquaPlan, and institutional efforts progressing in the field. Appropriate standards are being developed by these communities for new observational technologies which will be tested and incorporated in the specification sheets. This includes the development and testing of workflows and data schemas.

2.8.3. Assessment

No.	SO8 Outcomes	Assessment	
1	Faster adoption of new technology	**Progress: some tangible progress** **Criteria: ??** EuroSea developed SOPs for integrating eDNA technology into ocean observing and through Marco-Bolo and BioEcoOcean projects, eDNA and other remote sensing technologies will be tested for inclusion in biological monitoring. Other elements under the Ocean Enterprise Initiative could aid this.	

2	Increase scope, efficiency and observational capability	**Progress: On track** **Criteria: new technology expanding observings scope integrated into GOOS** This is happening with eDNA as noted above, and the planned Dialogues with Industry around HABs, BioEco observations, carbon, should provide mechanisms to assist through shared public-private priorities to expand scope with technology that we need.	
3	Focused and faster technological development to meet new observing challenges, including geographic equity	**Progress: Slow** **Criteria: ??** There are several recommendations in the Dialogues with Industry Roadmap that if successful work support these aims.	

2.8.4. Recommendations

SO8: BGC Panel favour synergy with OARS for low cost sensor development. There is also work ongoing under the Ocean Decade on cost effective sensors. The Dialogues with Industry point to inherent market issues associated with industry investing in the sensors that the ocean observing system would like to see. We need to be able to have a dialogue to discuss market size and requirements. Can we request the Dialogues with Industry initiative to have a cost effective sensor discussion with industry - for a specific area/need.

2.8.5. Comments

8.2 can be identified as complete with ongoing development of the BioEco EOV specification sheets facilitating the identification of appropriate standards, platforms and automation for global monitoring as developed through international programmes such as OBON, SCOR working groups and POGO. This will avoid duplication of efforts and support connectivity between programmes. Much of the work identified under this SO is being conducted under OBON, SCOR and POGO and translation of the outputs from that work to the EOVs is being facilitated through direct linkages of the Panel with these groups (identified under SO3, SO6 and SO9. With the identification of SO8.2 as complete the sub items listed under this SO should be deleted and merged into ongoing activities associated with the relevant subitems of SO3, SO6 and SO9.

2.9. SO9: Guide capacity development

2.9.1. Actions

SO9: Guide capacity development

Activity	Status	Priority	Lead
9.3 Implementing ocean monitoring and forecasting system with the engagement o...	Future steps	Medium	ETOOFS
9.4 Cross network integrated capacity development	Unknown	Low	OCG/OceanOPS
9.5 Partner with MBON, OBIS and WCMC on capacity exchange 3	On hold	Low	BioEco
9.6 Ocean prediction centre evaluation/assessment	In Planning	Medium	ETOOFS
9.7 Capacity Exchange Materials and Workshops for Developments or Expansion ... 4	Future steps	Low	GRAs
9.8 Market and capability building for EOV reporting in support of the global biod... 1	On hold	Low	BioEco
9.9 Co-development of biodiversity and marine habitat indicators with the business ...	On hold	Low	BioEco
9.10 Observing Together - GOOS Ocean Decade Programme	Working on it	High	Ocean Decade

2.9.2. Status

OCG Capacity Development task team aims to enhance engagement with the networks, seek funding opportunities to enable in-person training sessions and capacity building opportunities, launch Seminar Series on ERDDAP and continue with the seminar Series on the impact of Network Ocean Observations on society including social scientist perspective. Several workshops undertaken to connect with new country representatives, who want to learn more about observing, some schools outreach and webinars for professionals. **BGC Panel** are very active in training to develop new technical biogeochemistry capacity, mainly through summer schools. **BioEco** has undertaken work to define implementation for transmission across the EOV networks, with MBON and other partners. **Ocean Decade Observing Together Programme:** has projects underneath it but we have no means to support the work - solutions need to be sought.

Activities across GOOS summarised in the table below.

	Type of event	Aimed at	Attendees	Description	Partners
OCG	Showcase / tour	School kids	4000	OCG-14 May 2023 in South Africa had a large outreach event organised that showcased the impact of ocean observations on society - 3 day event had participation from organisations across South Africa.	

OCG	Webinar (series)	ocean professionals	60 - 200 per webinar	WMO Information System 2.0 (WIS 2.0), Argo Data IOC/UNESCO information data related resources and the Ocean InfoHub Project, ASAP, Upper air profiles at sea and ERDDAP	
DBCP - OCG	Workshop	SIDS, Africa, LME young professionals	30 in person, 50 online Tunisia, May 120 for online session November	Mediterranean Training Workshop on Ocean Observations and Data Applications May 2023, Tunisia. Plus November 2022 online session with special secession on carbon and biogeochemistry observations. Funding provided to those who had not previously engaged in DBCP/GOOS, laying the groundwork for future initiatives.	Tunisian National Institute of Meteorology (INM), Ministry of Transport, IOC, WMO
SOT - OCG	Training workshop	Port meteorological officers (PMOs)	37 from 24 countries	7th Port Meteorological Officer (PMO) Training workshop, in Fiji, Oct 2023. Objective to get more countries in the Pacific involved in PMO as this is a gap. Region is working on strengthening its observing capacity including VOS. Solomon Islands were supported with 2 wave buoys (Scripps). Pacific Community has plans to further strengthen capacity through deployment of buoys.	Pacific Community (SPC), WMO, Scripps
BGC	Summer School - training workshop	early career scientists	28 from different parts of the world	3rd "Instrumenting our ocean for better observation: a training course on a suite of biogeochemical sensors" was held in June 2023, in Sweden. Lectures and hands-on workshops, to teach best practices for biogeochemical sensors, data and critical thinking for optimum sampling strategy in the context of local, regional and global and climate, operational services, and ocean health: oxygen particulate organic carbon, pH, pCO2, nitrate.	Kristineberg Marine Research Station in Sweden, IOCCP, Integrated Carbon Observation System Ocean Thematic Centre (ICOS OTC), NOAA, Ocean Frontier Institute, and Carbon to Sea.

BGC	Summer School	early career scientists	33 young researchers from 17 countries	GOOD-OARS-CLAP-COPAS Summer School in Chile, November 2023, 15 world experts, presentations on ocean acidification and deoxygenation as well as practical sessions on modelling, laboratory experiments, shipboard measurements and analysis, communication training and an introduction to ethics in science.	IOC, SCOR, PICES, EGU, IAEA -OA-ICC, OARS, GOOD, IRD, OCB, CEAZA, FCM, ESMOI, COPAS COASTAL, Uni. Catolica del Norte, COROA, IOCCP (SCOR)
BioEco	Various workshops	ocean professionals		BioEco have contributed to and facilitated sessions, workshops and symposia at various conferences to expand our outreach into the community in building awareness, understanding and capacity in EOV implementation. Involving continued engagement directly with MBON through participation of MBON.	MBON
BioEco	Leadership	ECOPS	several	Development of EOV co-lead roles provides an opportunity for direct engagement and capacity development of Early Career Researchers in implementing EOVs and engaging with international communities.	

2.9.3. Assessment

No.	SO9 Outcomes	Assessment	
1	A greater number of countries actively participating in the global ocean observing system	**Progress: on-track** **Criteria: number of countries in BioEco Portal and OceanOPS tracking systems, inc. number of SIDS and African countries** 71 countries in the BioEco Portal and 84 countries tracked by OceanOPS.	
2	A greater number of countries with capabilities in ocean forecasting	**Progress: on-track** **Criteria: number of countries with sustained ocean forecasting centres tracked by ETOOFS** ETOOFS and Decade Collaborative Centre	

		for Ocean Prediction have started an inventory of ocean forecasting centres worldwide	
3	New best practices and data products addressing the needs and capacities of increasingly diverse participating countries	**Progress: some progress** **Criteria: entrance of BP from under represented countries, participation in OBPS Workshops tracked** **Criteria: projects in developing countries that have connection to services - Co-Design, CoastPredict.**	

2.9.4. Recommendations

SO9: BioEco Panel recommends that GOOS develop direct partnerships with IODE and the OTGA to develop a series of courses, if regarded as a priority, more broadly to develop EOV capacity across the whole of the observing system, not just specifically for the BioEco EOVs.

SO9: To enhance IOC's capacity development needs assessment process through various approaches to ensure a wider representation of communities provide feedback which can be used to target capacity development activities through GOOS, IOC/WMO

SO9: To enable a community of practice for capacity development within GOOS, IOC/WMO that will allow those involved with CD to better integrate activities and add value wherever possible. foster integration and collaboration through networks and WMO/IOC ensuring maximum impacts of capacity development activities e.g co-hosting webinar series, regional to national workshops etc

SO11: BioEco Panel recommends that GOOS develop a higher-level agreement with GEO to facilitate broader engagement and collaboration across the whole of the observing landscape, not just specifically between MBON and BioEco.

SO1: BioEco Panel recommends that GOOS develop an engagement strategy with GEA and MEA custodians under which direct partnerships with the UNEP-WCMC and the CDB to facilitate broader EOV reporting into the indicators being developed for the Montreal-Kunming Global Biodiversity Framework and into other frameworks and agreements can be facilitated, to ensure that GOOS obs flow into the indicators for the GBF. Development of this engagement strategy should also consider the role of GRAs in delivering information for national reporting against these agreements and the role of NFPs in facilitating connectivity with national governments. BioEco is happy to work with GOOS on this however GOOS will need to lead this as a sustained partnership.

SO9: Investigate mechanisms to support CD activities within regions or sub-regions or at national levels, particularly through GOOS GRAs- (e.g instrument donation, sharing of training materials, availability of experts to support trainings wherever necessary)

2.9.5. Comments

- 9.1 is done remove

- ETOOFS to consider its 2 actions - 9.6 and 9.3 are they still separate entities
- 9.8 Is this better placed in SO6?
- 9.9 does this belong in SO4 now (or wherever we place indicators)
- 9.10 does not have any possibility of support right now, although it is a relevant programme?
- 9.5 - this should be in SO1 (most likely) and rephrased to match what is intended - GOOS develop an engagement strategy with GEA and MEA custodians under which direct partnerships with the UNEP-WCMC and the CDB to facilitate broader EOV reporting into the indicators being developed for the Montreal-Kunming Global Biodiversity Framework and into other frameworks and agreements can be facilitated, to ensure that GOOS obs flow into the indicators for the GBF
- No update from ETOOFS or GRAs, suggest place these actions on hold.

2.10. SO10: Observe human impacts on the ocean

2.10.1. Actions

SO10: Observe human impacts on the ocean

Activity	Status	Priority	Lead
10.2 Incorporate/link to the human pressure indices 2	On hold	Low	BioEco

2.10.2. Status

Integrated Marine Debris Observing System (IMDOS) was endorsed as GOOS project in 2023 and so in the future we will need the Project to report out on progress (suggests the implementation is maturing to the stage where we could consider integrating GOOS Project reporting). Joint initiative by GOOS, GEO BP & UNEP GPML; strategic 3-way partnership established , involving many other international organisations, expert WGs, NGOs, etc. as well as GOOS structures (GOOS Panels, OCG, OceanOPS, OCG, OBPS, GRAs). An interim International Steering Committee, Project Office and Terms of Reference established; no sustained funding secured beyond 2023.

Following the identification of a series of pilot projects relating to pressures (as listed in SO10 outcomes), the BioEcoPanel has worked with POGO, the IQOE and SCOR to develop an implementation plan for an Ocean Sound EOV. This was finalised and published in September 2023. The implementation plan contains a series of recommendations for further establishment of this EOV, including what is needed for building a self-sustaining observation network for the EOV.

2.10.3. Assessment:

No.	SO10 Outcomes	Assessment	
1	A pilot project, in partnership with other organisations in this area, around variables related to human activities, potential initial targets: (1) ocean noise, (2) marine plastics, and (3) harmful algal blooms	**Progress: on track** **Criteria: projects developing in this area** POGO and the IQOE (SCOR and POGO funded) have developed an implementation plan for the Ocean Sound EOV, published in 2023. IMDOS is now a GOOS Project	
2	Recommendations for the implementation selected human activity variables within an integrated global ocean observing system, and their implementation in the EOV framework	**Progress: partially on track** **Criteria: recommendation developed and provided to GOOS implementation** Ocean Sound EOV implementation plan published 2023 and available in OBPS	

2.10.4. Recommendations

- SO10: BioEco Panel recommends that GOOS utilise the ocean sound implementation plan to identify next steps for SO10.2 and the relevant bodies to carry out these steps - should this be highlighted to the GRAs and OCG, discussion between panels and implementers?
- SO10: Will an IMDOS implementation plan be shared? Are there pilots to collaborate on with GRAs/OCG?
- SO10: The BioEco Panel recommends that GOOS collectively discuss any further development of a new class of human pressure EOVs. This should include identifying the key organisations that need to be engaged in this process and potential linkages with indicator work under SO4 (or wherever indicators sit)
- SO10: Basic HAB requirements could be considered under Phytoplankton EOV
- SO10: do we need a new action defined here for the IMDOS Projects

2.10.5. Comments

- 10.1 is complete
- 10.2: The following item should be better defined as they are currently vague, poorly articulated and have no clear deliverable - Recommendation on incorporating human pressure EOVs, to develop human pressure EOVs - check with the panels but perhaps it should be reworded?

2.11. SO11: Champion effective governance

2.11.1. Actions

SO11: Champion effective governance

Activity		Status	Priority	Lead
11.1 GOOS support structure project	2	On hold	Low	HQ Office
11.2 GOOS Governance evolution 1	3	Working on it	High	HQ Office
11.3 GOOS National Focal Points developed 5	4	Working on it	Medium	HQ Office
11.4 Develop a Fund/Resource RaisingTeam 3	1	Working on it	High	HQ Office
11.5 Expanding GOOS GRAs and strengthening regional governance 5	1	Working on it	High	GRAs

2.11.2. Status

There has been progress in defining a structure diagram for GOOS, which will be presented at SC-12. This will aid external understanding of what the different parts of GOOS do and also facilitate structural changes.

The GOOS National Focal Point (NFP) community is developing well, there are now 76 GOOS NFPs. Two dedicated events were organised in 2023, an in person European NFP meeting taking advantage of the EuroSea Final Symposium September 2023 at UNESCO Paris, and the first GOOS National Focal Point (NFP) 'all hands on deck' Forum, a virtual meeting in October 2023, attended by more than 60 NFPs. This fostered interaction between NFPs and GOOS, and between different NFPs. A number of NFPs are looking at developing a national ocean observing committee. GOOS has developed NFP specific messaging to support the NFP in their role. The second NFP Forum is scheduled to take place in October 2024.

GOOS will report to the IOC Executive Council in June 2024 and to the SC-12 on its response to the recommendations contained in the report it commissioned from Neville Smith in 2021. From this a structured pathway for any change in governance will be developed, guided by input from the GOOS Sponsors and IOC Member States.

GOOS has worked to support and revitalise GRAs in the Pacific Islands, Africa and the Caribbean, this will be further supported by additional IOC and for Africa NORAD funding.

GOOS was successful last year in attracting increased regular budget funding from IOC. This was in part due to the return of the US to UNESCO and also from pressure from Member States, led by the UK, for UNESCO to increase funding to the IOC. This has led to a long term increase in the funding from IOC. At the IOC Assembly in 2023 Member States also requested that GOOS, IODE, Capacity Development and Regional work gain a larger increase. GOOS also has an increase in permanent staff, with a P3 recruited to support the GRAs and NFPs. Compared to the last biennium GOOS' finances are in reasonable shape and some investment can be made across GOOS for key issues.

GOOS was also successful last year in attracting EU Horizon 2030 funding support, through the BioEcoOcean, Marco Bolo, and ObsSea2Clim projects (including support for GOOS personnel directly, IODE for developing ODIS and BioEco Portal, Best Practices, EOVs, indicators, Co-Design Exemplars and RRR work etc.,), and to support OceanOPS in tracking more of the observing system, beyond the OCG networks through the AMRIT project. In addition, the Dialogues with Industry has been successful in attracting 4 years of support from NOAA, via MTS. Other proposals have been submitted for NSF funding for the Co-Design

Programme. The GOOS Decade Coordination Office for Ocean Observing and HQ are working together to look at funding for GOOS Programmes and the DCO itself, including from industry. CoastPredict is also actively working with industry and on global funds. GOOS gained a small level of support for GOOS Africa from NORAD funds at IOC.

This will not be enough to expand GOOS to support the services and output that the community, funders and Member States want to see. In the next biennium GOOS should dedicate effort to attract more support, the following have all been discussed, however some priority will be required:

- staff through secondments - data, OceanOPS, etc.
- move beyond Horizon 2030 projects and leverage UNESCO agreements to seek more direct funds for global;/european relevant projects
- develop support, leveraging the Ocean Decade where possible, with philanthropists and industry
- leverage World Bank, climate , green/blue global funds
- Create an"Ocean SOFF"
- better leverage WMO SOFF

All actions will require some HQ resource, input on priorities is important.

2.11.3. Assessment

No.	SO11 Outcomes	Assessment	
1	A governance architecture for the global ocean observing system, that integrates GOOS and partners in a framework, with clarity in roles, processes and evaluation	**Progress slow** **Criteria: governance architecture evolved**	
2	A clearly articulated voice for ocean observations and services, with multiple stakeholders contributing to define the message	**Progress: On track (40%)** **Criteria: Clear messaging for ocean observations, partners that advocate for us** This is ontrack but belongs in SO2	
3	Improved global observing system delivery, responsiveness and sustainability	**Progress: slow - on track** **Criteria: ??** see comment below. Not sure this is relevant here – more success of the strategy overall	
4	Greater support for national systems and their needs for ocean information	**Progress: On track (30%)** **Criteria: more NFP committees, more visibility, more active GRAs / NFPs** Specific comms planned for NFP support, 76 National Focal Points, increased activity in PI-GoOS< IOCARIBE GOOS, GOOS Africa.	

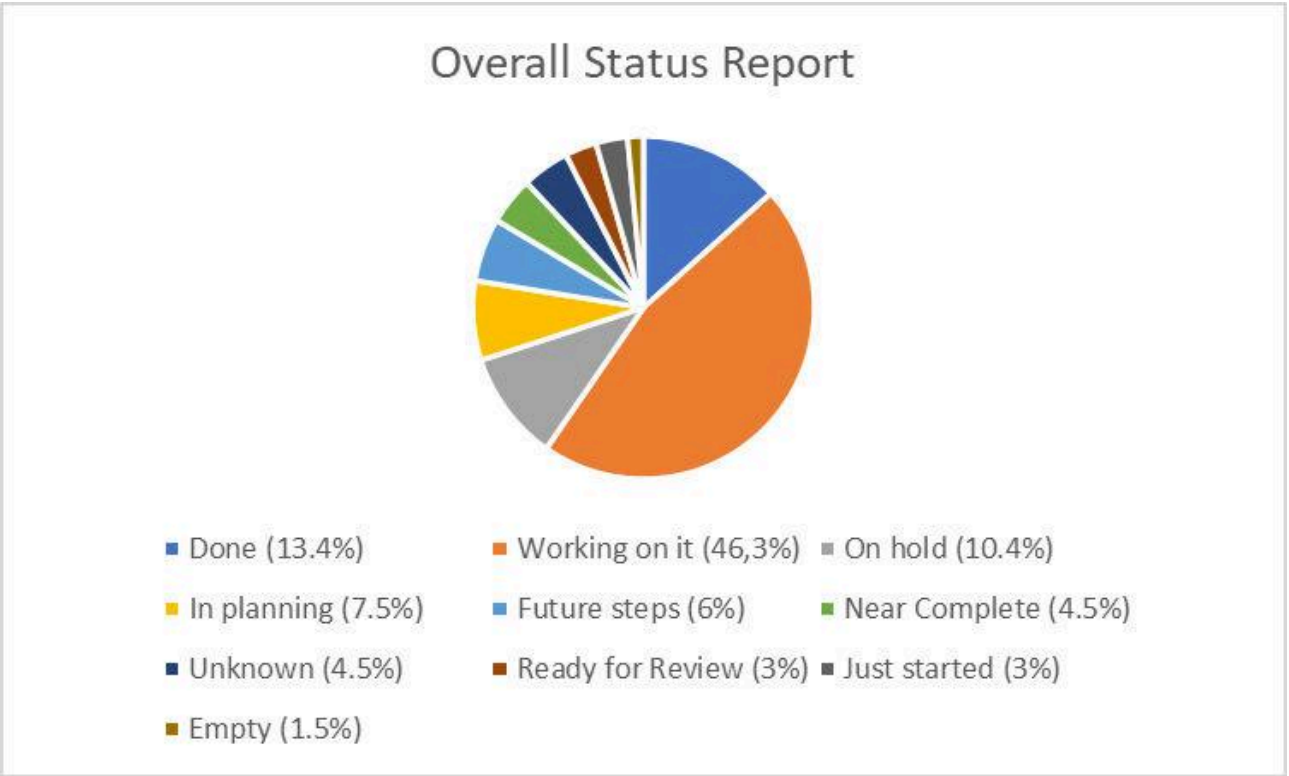
2.11.4. Recommendations

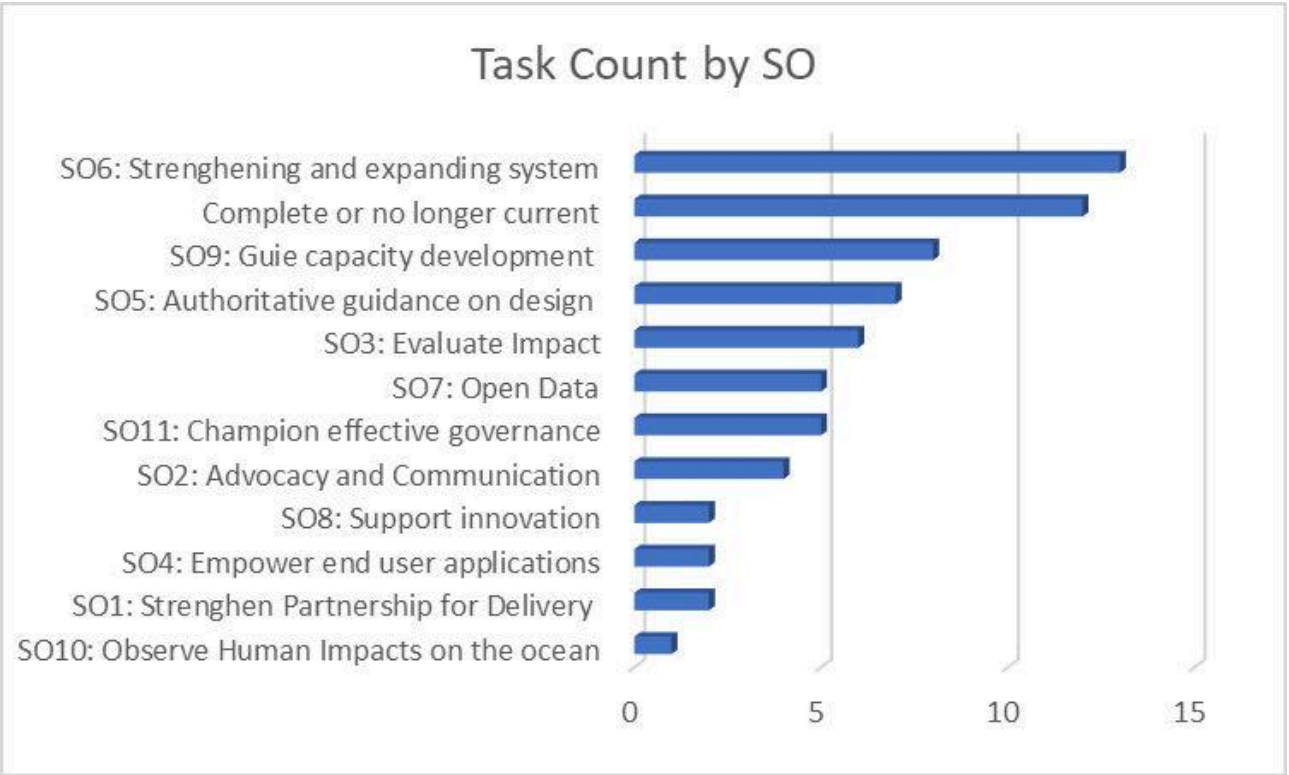
- SO11: Need of a clear articulation of structure and where decisions are taken across GOOS
- SO11: Add a more general tracking of partners under SO11 where we can also recognise their contribution to GOOS and across the SOs, help cultivate support and recognition

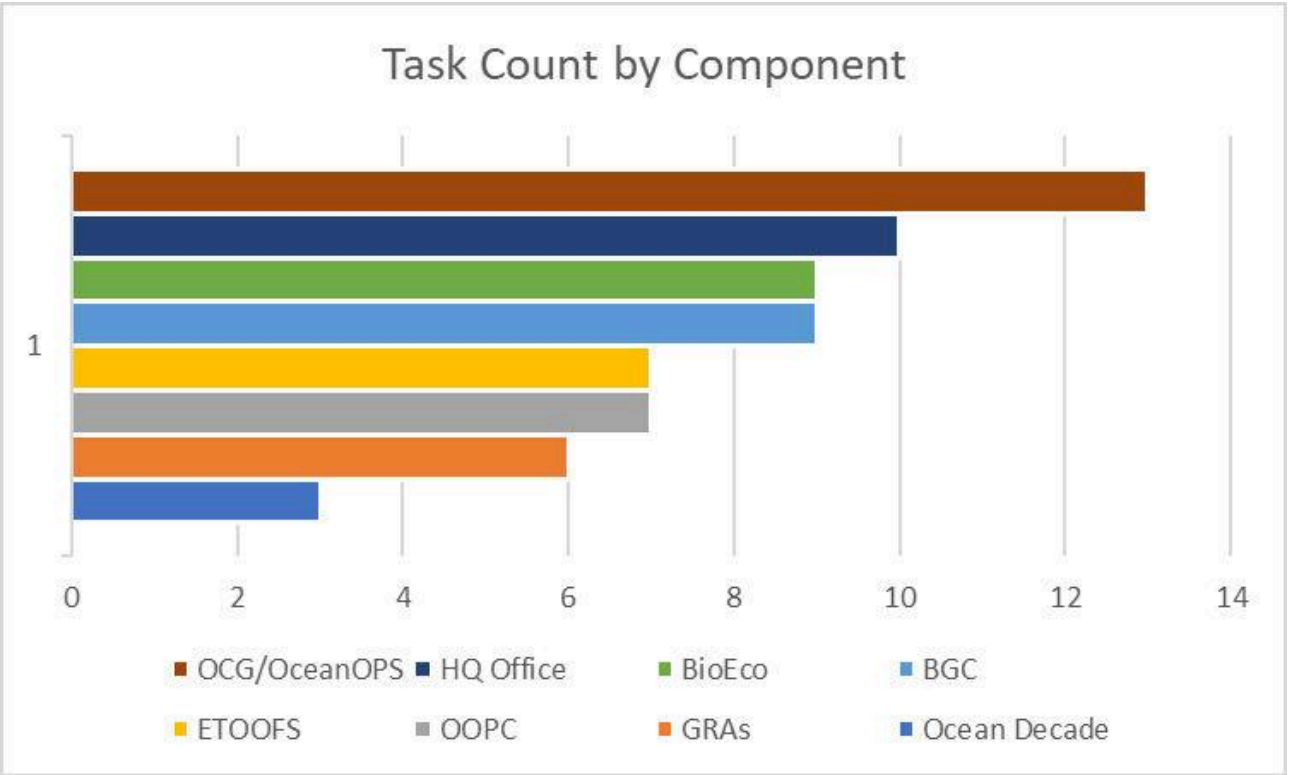
2.11.5. Comments

- Outcome 3 seems to be an overall success of the strategy type outcome - suggest that we maybe take a few key items from across the SOs and use these to track the success of the implementation overall - not sure it is relevant to use to track progress

Annex 1 - Summary Figures







LIST OF ACRONYMS

ODIS – Ocean Data and Information System
OBIS – Ocean Biodiversity Information System
FAIR – Findable, Accessible, Interoperable, Reusable
AniBOS – Animal Borne Ocean Sensors
G7 FSOI – G7 Future of the Seas and Ocean Initiative
DOOS – Deep Ocean Observing System
POGO – Partnership for Observation of the Global Ocean
SOOS – Southern Ocean Observing System
MBON – Marine Biodiversity Observation Netrok
IQOE – International Quiet Ocean Experiment
SCOR – Scientific Committee on Oceanic Research
C-GRASS - Coordinated Global Research Assessment of Seagrass System
ConCENSUS - Advancing standardisation of COastal and Nearshore demersal fish visual CENSUS techniques
GBIF – Global Biodiversity Information Facility
IODE – International Oceanographic Data and Information Exchange
OTGA – Ocean Teachers Global Academy
SOP – Standard Operating Procedures
OBON – Ocean Biomolecular Observing Network
GEO – Group on Earth Observations
GEA - Global Environmental Assessment
MEAS - Multinational Environmental Assessment

WCMC - World Conservation Monitoring Centre
CBD – Convention on Biological Diversity
NFP – National Focal Point
OBPS – Ocean Best Practices System