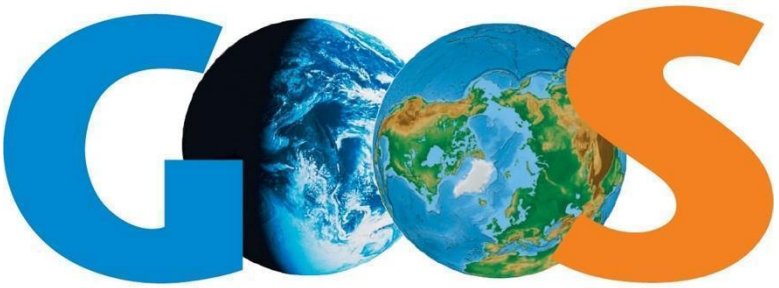

GOOS Implementation Plan & Next Steps

1-5 Year actions integrated across GOOS
analysis towards the implementation of the 2030 Strategy
What resources we need to undertake this, what are potential gaps, how do we structure to support this, how do we work and track moving forward

Prepared for GOOS SC-10
April 2021

Emma Heslop, Programme Specialist GOOS
and the Implementation Plan Task Team
with support from Chanmi Kim

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An integrated ocean observing system that operates from the open ocean to the coast, and with integration across physical, chemical and biological realms, to serve the needs of users from climate, operational services, and ocean health. It works towards integrated delivery chains, that connect observations to data management systems, to modelling, assessments, and to the providers of services to end-users. It integrates initiatives from local, national, regional and global organisations.

1. Introduction

Implementation Plan for GOOS

Implementation planning is as much about process as the plan, it is a means of aligning intent, identifying gaps, weakness and opportunities, a means of strengthening your next organisational steps and then tracking if things go according to plan - so that you can work out why and adjust.

Implementation Planning:

- *a process – aligning people and their work with goals, towards achieving a strategy*
- *can be messy – requires iteration, means taking decisions on what to prioritise, how best to interpret achieving goals, and some level of agreement across an organisation*
- *is an important opportunity – to bring your strategy to life, fast track promising ideas, and shape the organisation to deliver*

GOOS has a great strategy; Launched in May 2019 the Global Ocean Observing System 2030 Strategy has a vision for a fully integrated system that cannot be delivered by GOOS alone and will rely on partnership in areas beyond GOOS core capability. The GOOS Roadmap Towards Implementation of the 2030 Strategy (May 2020, GOOS Roadmap) outlines the eleven strategic objectives of the 2030 Strategy in more detail, envisions outcomes and potential areas of partnership. The GOOS Roadmap was designed for dialogue with partners over roles and co-developing actions. However there is also a need for GOOS to articulate what it is doing to achieve the strategy, in order to communicate effectively with partners and to support an integrated and communicable path towards the implementation of the 2030 Strategy.

The purpose of this document is:

- Bring together the main 1-5 Year actions, integrated across GOOS
- Enable analysis towards the implementation of the 2030 Strategy
- Understand the resources we need to undertake this, what are potential gaps, how could GOOS structure better to support this
- How do we work and track progress moving forward

2. Background

There have been two previous GOOS Implementation Plans:

- GOOS 5-Year Implementation Plan (May 2016 initial outline)
- GOOS Implementation Plan (April 2019 draft for GOOS SC-8)

Both of these took a top down approach, taking the strategy (or earlier elements of the strategy) and developing actions based on knowledge of GOOS and the structure at the time (e.g. OCG and ETOOFS not yet integrated, JCOMM in existence). This process is different, it is both bottom up and top down. However, the work of the earlier plans will not be forgotten, as some important points were raised.

The overarching aim is to provide a process for GOOS to manage and track implementation towards the 2030 Strategy, and to support resource planning and facilitate engagement of external partners. Specific objectives for the planning and planning process are:

- Provide visibility across GOOS of action towards implementing 2030 Strategy
- Enable priority setting, Steering Committee to 'steer' / adjust direction
- Enable gap filling, including through partnerships
- Create cohesive cross-GOOS actions
- Understand interdependencies, and use GOOS resource more effectively
- Identify resource needs and target fundraising activity against action/impact
- Identify and tackle any barriers to GOOS ability to execute
- Support dialogue with partners about roles, where fit in achieving the Strategy
- Track progress towards achieving the Strategy, milestones and output
- Provide visibility of how GOOS is responding to societal needs – action impact
- Integrate/represent Decade Programmes, GOOS Projects

In September 2020 at GOOS SC-9 Part 2 an initial outline and analysis was presented, based on the actions of the GOOS elements, and the next steps outlined. Post SC-9 Part-2 work has been undertaken by the Implementation Plan Task Team in the following areas:

1. Looking across GOOS actions, merging, integrating, clarifying
2. Analysing across the actions and towards strategy implementation
3. Considering how to integrate Decade Programmes
4. Looking at resource needs
5. Assessing software for ongoing management

In considering the Implementation Plan it is important to remember:

- Some GOOS elements are co-sponsored bodies, not 'working' solely towards the GOOS Strategy. These elements, OOPC/Climate and Physics Panel and IOCCP/BGC Panel, have a more complex job in balancing activities and strategic aims of more than one

organisations - recommend that the outcome of the GOOS IP are shared openly with co-sponsors, as most should gain from a well implemented GOOS

- Although cross-GOOS activities have been previously identified, GOOS elements have not previously undertaken a joint planning process, this is a first step not the final destination
- GOOS structure was not designed with 2030 Strategy in mind. Each element has its own TORs, some formed years ago and/or under different structures, e.g. JCOMM. Some review of structure for trajectory may be useful
- Each element has its own work plan cycles, this process may need some alignment of planning process may be desirable longer term
- The 2030 Strategy cannot be implemented by GOOS alone, need to align actions with partners too (see the GOOS Roadmap) or identify clear space for partnership

This document is the result of 7 months of work across GOOS, it is termed the GOOS Implementation Plan, however it is (as stated above), as much about bringing a planning process into place as a 'pal' per se. This document is the first representation of what GOOS elements are collectively doing towards achieving the Strategy. It is the start of Implementation Planning that will enable GOOS to ask itself questions about how we achieve the Strategy, how we resource this, how we work collectively and how we partner. How we achieve the 2030 Strategy needs to be dynamic, however the plan and planning process should enable this reflection and dynamism. The GOOS Implementation Plan is an internal, working document. The Roadmap to Implementation is an external expression of what GOOS anticipates will be undertaken across the Strategic Objectives, it is high level, gives ideas as to the type of action that is needed but is not specific about actions. It also indicates where partners are required. The combination of the Roadmap and the Implementation Plan should allow us to 1) assess how we are working toward the outcomes expressed in the Roadmap, 2) dialogue more effectively with partners about their role and where there are gaps that could be fulfilled through partnership, 3) review the Roadmap and possibly revise.

3. GOOS Mission and Elements

3.1 GOOS Mission

To lead the ocean observing community and create the partnerships to grow an integrated, responsive and sustained observing system.

3.2 GOOS Structure

There are seven elements to the GOOS core team:

- GOOS Steering Committee: a multinational body that provides direction to the GOOS core team in implementing its strategic objectives and building outside partnerships.
- Expert Panels: The Physics and Climate (OOPC), Biochemistry (BGC Panel) and Biology and Ecosystems (BioEco Panel) Panels are vital for identifying user needs and evaluating the system.
- The Observations Coordination Group (OCG): strengthens GOOS implementation by coordinating the system through 12 global observing networks and OceanOPS.
- The Expert Team on Operational Ocean Forecast Systems (ETOOFS): guides initiatives to improve capacity, quality and interoperability of ocean model forecast products.
- GOOS Regional Alliances (GRAs): identify, enable and develop GOOS ocean monitoring and services to meet regional and national priorities.
- GOOS Projects: advance innovation and expand the observing system, services and product delivery by expanding into new areas and capabilities.
- Core X-GOOS Coordination office: The cross GOOS coordination team works full time to enable the GOOS core to function, and to enable connection across GOOS, partners, sponsors, and the observing enterprise.

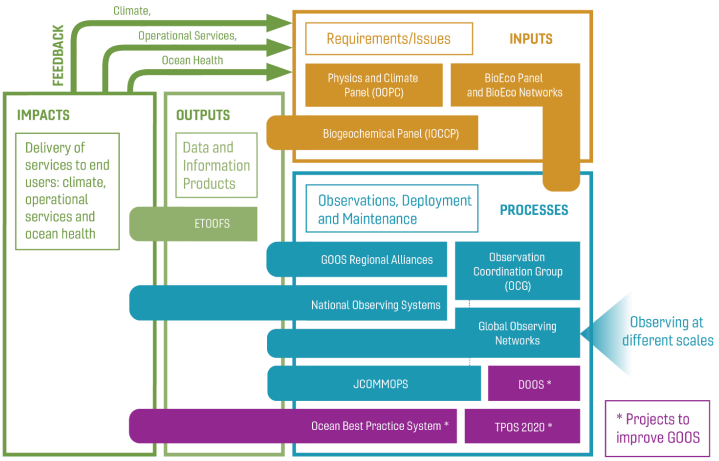

Figure 1: Diagram produced for the GOOS Roadmap for the Implementation of the Global Ocean Observing System 2030 Strategy, indicating where the different elements of GOOS map onto the Framework for Ocean Observing (FOO) structure.

3.3 GOOS Projects

Not included in this iteration of the Implementation Plan. However, there is a need to integrate the GOOS Projects, their unique contribution to GOOS, understand which of the 2030 Strategy Strategic objectives they are supporting, and the connection and integration with other GOOS components, and anticipated impact. To be discussed at GOOS SC-10.

The long term evolution from project to integration within or operation as a sustained part of GOOS could also be indicated.

[Table of GOOS projects and focus TBC post GOOS SC-10]

3.4 GOOS and the Ocean Decade

Three strong and transformative GOOS and co-sponsored Programmes have been put forward to the Ocean Decade around the general theme of an integrated system.

- **Ocean Observing Co-Design** - creating the process, infrastructure and tools for the co-design of a fit-for-purpose GOOS.
- **CoastPredict** - will transform the science of observing and predicting the Global Coastal Ocean, from river catchments, including urban scales, to the oceanic slope waters, and;
- **Observing Together** - supporting communities to bring needed observations and forecasts to users and into global data streams, making every observation count;

With strong partnership the three linked GOOS Ocean Decade programmes are united in being transformational for the Ocean Decade and the Global Ocean Observing System 2030 Strategy. These programmes intersect and it is anticipated that elements will converge to 'one' integrated system by the close of the decade.

Proposals are here.

The three programmes are for now integrated into the list of actions, they represent major decadal X-GOOS activities, as the programmes develop they will need to be further integrated, some actions are perhaps aiding the foundations of these programmes. Equally the support for these programmes need to be addressed and identified. It is likely each programme may have its plan - like a GOOS element - however the core coordinating support should be recognised in the resource planning, how they contribute to the strategic objectives and how they interact with other GOOS actions and elements. This can be developed as the programmes develop.

The programme proposals represent great integrative ideas and partnerships, they have speeded some needed discussion and linking of ideas, particularly between observations and modelling communities. If funded, these programmes have the power to support major transformational initiatives for GOOS and the ocean observing community. They support major parts of the 2030 Strategy. However they will require resources to undertake in any meaningful way and there will be work in the coming months to structure the programmes, and seek this support.

4. Elements linked to GOOS with potential roles in implementation

G7 Future of Seas & Oceans Initiative (G7 FSOI)

The G7 FSOI initiative offers a mechanism to address the challenge of strengthening and sustaining ocean observations through the coordinated actions of the 7 leading nations in ocean observing plus the EU, who together fund more than half of global ocean observations. For more information visit the G7 FSOI website - www.g7fsoi.org.

The G7 members have emphasised the importance of focusing the G7 initiative on issues at the nexus of science and governance that address global ocean observations, working with the Global Ocean Observing System to pilot efforts in areas where the FSOI can add unique value:

- Foster agreements on priorities for coordinated investment
- Catalyse and facilitate authoritative scientific underpinning
- Provide leadership for leading-edge science and technology efforts
- Foster governance / policy agreements between G7 countries'

The G7 FSOI would welcome input/feedback from GOOS on issues the FSOI can help with (problem solving, catalysing action for broader take up), in the context of its implementation planning.

5. Analysis of actions identified across GOOS

In Annex 1 are details on all the 58 actions identified across the GOOS core elements, OOPC, BGC Panel, BioEco Panel, OCG/OceanOPS, ETOOFS, GRAs, and Core X-GOOS Coordination (Paris Office), and which form the basis of the Implementation analysis below. The actions are listed under the 11 Strategic Objectives, in 1, 3 or 5 year timeframe for completion of the action, and are based on information provided by each of the core GOOS elements on their main activities towards achieving the 2030 Strategy. In the 7 months since the GOOS SC-9 Part 2 (September 2020) there have been several meetings of the Task Team to advance the development of the Implementation Plan.Initially this work was on the base of actions, working to remove duplication in activities across elements, to merge similar activities, and to create where appropriate larger X-GOOS action items, as well as to expand the information available on the actions to include key information. Latterly the Task Team has been looking at the analysis and providing some further information on resources.

It needs to be emphasised at this point that this is an iterative process, as we understand more about what we are collectively undertaking, GOOS and its elements can and will adapt the actions. Implementation does not stand still in time, so we need an ongoing process (covered later) in order to track and continue to analyse and adapt.

We will look at:

- analysis on the 1-5 year actions integrated across GOOS
- resources needed
- analysis towards the implementation of the 2030 Strategy
- potential gaps
- structure implications

Take this analysis on the actions as insight into GOOS now, as fuel for discussion, and to help guide our next actions.

Note: The GOOS Decade Programmes have been integrated into the actions, as Decadal scale actions. As the plans for these programmes evolve the actions associated with them may become more integrated, and some actions may be replaced. The GOOS Projects, are noted as a gap in the plan. Work will be undertaken after this SC to understand how best to how to integrate them

5.1 The spread of actions across the SOs

A first look at the spread of the actions across the Strategic Objectives and GOOS elements, and how the actions are led, supported and partnered, as noted above all the actions are available in detail in Annex 1. In the table below, ‘Level’ indicates the ‘level’ of engagement of the action within GOOS. Major X-GOOS actions, are actions that involve all or most of GOOS elements, multi element actions, as the name suggests, involve several GOOS elements, single element actions are being developed by a single GOOS element, and Decade actions are the GOOS Ocean Decade programmes.

Strategic Objectives	No. Actions	Year			Review	Level			
		1	3	5	hi importance 2019	major	multi	single	Decade
SO1: Partnerships to improve delivery	2	1	1	0	*	**1**		1	
SO2: Build advocacy and visibility with stakeholders through communications	4	1	2	1	*	**3**		1	
SO3: Regularly evaluate system impact to assess fit for purpose	7	1	2	**4**		**2**	2	2	1
SO4: Strengthen knowledge and exchange around services, boost local uptake	2	1	1	0				2	
SO5: Provide authoritative guidance on integrated observing system design	6	1	4	1		**1**	5		
SO6: Sustain, strengthen and expand observing system implementation	**11**	0	**6**	**5**	*	**1**	5	4	1
SO7: Ensure GOOS ocean observing data and information are FAIR	**9**	1	**5**	3	*		2	**7**	
SO8: Support innovation in observing technologies and networks	2	1	1	0				1	
SO9: Develop capacity to ensure a broader range of stakeholder participation.	**10**	1	3	**6**	*			**9**	1
SO10: Extend systematic observations to understand human impacts	2	0	1	1			1	1	
SO11: Champion effective governance with partners and stakeholders	3	0	2	1		**3**			
Totals	58	8	28	22		11	15	28	

This shows:

- There are 58 actions identified across the elements, most are longer term actions, i.e. in the 3 and 5 year, which is positive.
- Largest number actions are under SO6, SO7, and SO9. For SO6 this is not surprising, as it is core GOOS activity. For SO7 and SO9 it may also indicate less mature areas where some further consolidation and X-GOOS actions might be developed, as additionally indicated by the high number of single GOOS element actions,
- 2030 Strategy Review response (2019) highlighted five SOs of high importance as the most important areas to focus on (marked with a star in the table). In this context both SO1 and SO2 look low on actions, and lacking in long term vision/actions. There may be some factors behind this, such as the need for other ideas or areas to develop sufficiently, in order for these actions to develop and have impact. However, this clearly indicates the need for more focus on SO1 and SO2 moving forward, and the development of long term plans for these areas.
- SO1, SO4 and SO8 have no long term plans. This is a gap that will need to be thought about and addressed.
- SO3, SO6 and SO9 have several long term actions, this suggests that there may be some further consolidation or assessment of realistic ambition, long term actions by their nature tend to be large and so a number of 5 year actions indicates an area of

large growth or ambition. For SO6 this may be realistic, SO3 System Evaluation may consolidate with the Decade Programme ambition, however SO9 Capacity Development will likely need some work.

- The identification of major X-GOOS and multi element actions, 11 and 15 respectively, indicates that significant collaboration is anticipated. This is a positive outcome, in that a) GOOS elements can more clearly identify where they will be active in actions led by other elements, b) a series of major X-GOOS initiatives have been developed from similar initiatives in different areas. We need to ensure that resources are foreseen to support new X-GOOS actions and that the GOOS elements consider the work and/or interaction for X-GOOS and multi element actions in their work plan. Perhaps regular meetings across GOOS could help with this.
- Just over half the actions are undertaken by a single GOOS element work, single element projects are needed as well as X-GOOS actions
- The 3 GOOS Ocean Decade Programmes - are now identified as decadal, so they are visible but not at this stage mixed with the other actions. As the Decade projects take off, some of the actions will be aiding with foundational work, and they will need to remain connected to GOOS, the IP can be a forum to provide this.

5.2 Partners

A list of acronyms however…

- WMO noted as a partner in 19 actions; WMO (6), WMO INFCOM (9), WMO Comms (2), WMO SERCOM (1), WMO GBON (1)
- IODE noted in 18 actions; IODE (4), IODE OBIS (9), IODE OTGA (5)
- OceanPredict in 11 actions
- IOC 9 actions; IOC (3), IOC OSS (3), IOC Comms (2), IOC MSP (1)
- UNEP 7 actions ; UNEP (4), UNEP WCMC (3)
- Mercator 6 actions
- RCN OO19 6 actions
- MBON 6 actions
- GCOS 4 actions
- CoastPredict 4 actions
- NOAA 4 action
- WCRP 4 actions
- 3 actions; Geo Blue Planet
- 2 actions; DOALOS, OECD, CMEMS, IMOS, IOOS, MTS, ESA, ICOS, OASIS, OmicBON
- 1 actions; MEDIN, IRSO, MarineLife 2030, SOCIB, JAMSTEC, CEOS, FOA, MOi, ISC, C3S, ISA, SoFar, ECMWF, NASA, IMO, CBD, POGO, OTC, EDNA Network, SOLAS, NCEAS, Scripps, CLIVAR, GSAMP, SeaDataNet, EMODnet, The Ocean Foundation, C-GRASS, GOMON, GCRMN, BRUVs, IPBES, WOA, RLS

This shows:

- 58 different partners identified, 36 only mentioned in a single action, can the 22 in more than 1 action be considered more active partners?

- WMO, IODE, OceanPredict and IOC featured in many actions - superpartners - with links to different components, we should perhaps have an overview or strategic link - with such organisations to help support the actions efficiently. The WMO OOIS Study Group is looking at this from WMO perspective, with respect to GOOS and IODE.
- Links to other new Ocean Decade programme proposals are already referenced - MarineLife 2030, OASIS, BOON, Odyssey, etc. This is positive, and indicates connected leading edge work.
- Satellite community are referenced, CEOS, ESA, NASA, but perhaps no strategic link
- End user service partners integrated into a few actions
- Low connection with commercial partners
- Some partnerships are foreseen rather than yet engaged
- Information will be useful for developing action 1.2 in SO1 Partnership for Delivery.

5.3 Action leadership and collaboration

LEAD	**13**	**7**	**12**	**11**	**12**	**3**	**9**	**1**	**0**
Involved	**6**	**8**	**16**	**17**	**24**	**12**	**10**	**6**	**1**
	Core Coord	OOPC	BGC	BioEco	OCG/ OceanOPS	GRAs	ETOOFS	GOOS SC	Projects

This shows:

- Many elements of GOOS self-integrate without core-coordination
- Role of GOOS SC in actions is low. Would we expect more champions from the SC?
- The BGC Panel, BioEco Panel, OCG/OceanOPS and Core X-GOOS coordination are leading more projects
- BGC Panel, BioEco Panel, and OCG/OceanOPS are involved in more actions than other elements
- It might be more efficient to have regular group meetings, where several cross-GOOS activities are discussed and evolved at once.
- (GOOS projects not yet linked in)

Detail on the actions by element in Annex 2

6. Resources

Existing resource base - GOOS core support
GOOS resource base today, in terms of staff (FTE - Full Time Equivalents) that are employed or provided in-kind to undertake the coordination/implementation work of GOOS.

GOOS Element	FTEs	Funding source	Location
Core Coordination	2.65	IOC	Paris, France
OOPC	1.00	NOAA	Geneva (WMO hosted), Switzerland
BGC Panel	2.00	NSF, SCOR, EuroSea, IOC	Sopot, Poland
BioEco Panel	1.00	CSIRO, AIMS, EuroSea, IOC	Hobart, Australia
IODE/OBIS	0.10	IOC	Oostende, Belgium
OCG	0.65	IOC, WMO, NOAA	Paris, Geneva (WMO), Washington DC, USA
Networks	0.35	IOC, WMO	Paris, Geneva (WMO)
OceanOPS	6.00	National contributions from USA (68%), Monaco, EU, France, Australia, Canada, China, Germany, Japan, Italy, India, and South Africa. Plus EU, IOC/GOOS, and new from WMO in 2021	Brest, France
ETOOFS	0.25	IOC	Paris, France
GRAs	0.25	IOC	Paris, France
Total	**14.25**		

In 2021, WMO will fund a new OceanOPS leadership position, to be recruited in the next months, additionally a metadata expert funded by NOAA will be recruited. Some roles will move around and **this will take OceanOPS to 7 FTEs, and GOOS Total to 15.25 FTEs** by September 2021**.**

- **Most GOOS elements appear profoundly under resourced in terms of support**
- OceanOPS is one of the largest components in terms of FTEs, it is an operational centre under GOOS
- If a BioEco equivalent of OceanOPS is needed we should leverage the existing infrastructure as far as possible, and consider carefully what resources will be needed and plan for this.
- GOOS has support in funding these positions from a number of sources, there is also support in-kind in terms of staff and of hosting the staff in different locations. **GOOS should recognise this support and give visibility and thanks to these organisations for their contribution to support GOOS.**

Resources GOOS needs to implement the planned actions

The table below provides an estimate of the additional human resources required to achieve the 58 actions as outlined in Annex 1. A number of more ambitious actions require new resources to implement, however not all actions require additional support.

This is an estimate, for planning purposes, based on the input of the elements of GOOS. The FTEs could be converted to $, however it is useful to understand the scale, location and timing for the human resource needs. Any request for funding would need further work.

SO	Num.	Action	Resource (FTE) 2021	2022	2023	2024	2025	Location
SO1	1.1	GRA assessment for forecasts and services						
SO1	1.2	Partnerships for delivery	0.5	1.0	1.0	1.0	1.0	X-GOOS Core
SO1					0.5	0.5	0.5	BioEco Panel Hub
SO1				0.2	0.6	0.6	0.6	Anywhere
SO1					1.0	1.0	1.0	Mercator
SO2	2.1	Value of Ocean Observations Project						
SO2	2.2	GOOS Communications Plan		0.5	0.5			X-GOOS Core
SO2	2.3	GOOS National Focal Point role developed	0.25	0.5	0.5			X-GOOS Core
SO2	2.4	Evolve Ocean Observing System Report Card		1.5	1.5	1.5	1.5	OceanOPS
SO3	3.1	Network status reporting	0.5					Anywhere
SO3	3.2	Observing System evaluation and metrics		0.5				Anywhere
SO3	3.3	Ocean Forecast evaluation and metrics		0.2	0.2	0.2	0.2	Anywhere
SO3	3.4	Global map of ocean forecasting systems		0.2	0.2	0.2	0.2	Anywhere
SO3	3.5	Develop an interactive map of networks and metadata for biological monitoring	0.5	0.5	0.5	0.5	0.5	IODE OBIS
SO3	3.6	Global Ocean Indicators Framework	1.0	1.0	1.0	1.0	1.0	Anywhere
SO3	3.7	Observing System Co-Design (ObsCoDe)						
SO4	4.1	Toolkit/Guide on Operational Ocean and Monitoring and Forecasting Systems						
SO4	4.2	Data Integration Products Across GRAs						
SO4	4.3	Establish and promote a GOOS product and services portfolio for Ocean Forecasting centres			0.3			Anywhere
SO5	5.1	Essential Ocean / Climate Variables Stewardship & GCOS						
SO5	5.2	GOOS EOV Review						X-GOOS Core
SO5	5.3	Observing System Evaluation and Reviews						
		5.3.1 Strategy for Ocean Heat and Freshwater Cycles						
		5.3.2 Observing System Evaluation and Strategy for the Ocean-Atmosphere Interface and Boundary Layers						
		5.3.3 Observing System Evaluation and Strategy for Boundary Systems						
		5.3.4 Optimal carbon flux observing system blueprint						
SO5	5.4	GOOS Evaluation and Review Framework	0.5	0.5	0.5			Anywhere

SO5	5.5	Regional network coordination/OO19 synthesis	0.5	0.5	0.5			Anywhere
SO5	5.6	Observing System Design around EOVs			1.0	1.0	1.0	X-GOOS Core
SO6	6.1	Implementation of multidisciplinary initiative VOICE			1.0	1.0	1.0	BGC Panel Hub
SO6	6.2	GOOS Endorsed Best Practices available across EOVs and platforms		0.5	0.5			Anywhere
SO6	6.3	Ocean Observations in EEZs		0.5	0.5			X-GOOS Core
SO6	6.4	Emerging and existing network integration	1.0	1.0	1.0			OceanOPS
SO6		Emerging and existing network integration		0.5	0.5			X-GOOS Core
SO6	6.5	Develop and/or maintain an up to date referenced hardware directory						
SO6	6.6	Advancing BGC/BioEco observations across global networks						
SO6	6.7	Environmental Stewardship			0.5	0.5	0.5	Anywhere
SO6	6.8	Inter-comparison and standards						
SO6	6.9	Coordinate and expand surface ocean biogeochemistry observations						
SO6	6.10	CoastPredict						
SO6	6.11	Building the BioEco community		1.0	1.0	1.0	1.0	BioEco Panel Hub
SO7	7.1	Data Flow mapping OCG networks						
SO7	7.2	Metadata standardisation global networks						
SO7	7.3	Support a Global Data Assembly Centre for BGC EOVs		1.0	1.0			BGC Panel Hub
SO7	7.4	OCG Data Strategy						
SO7	7.5	Establish OpenGTS Prototype						
SO7	7.6	Description of production & dissemination standards for Ocean Forecasting Systems		0.4	0.4	0.7	0.7	Anywhere
SO7	7.7	BioEco EOV data available through OBIS	0.5	0.5	0.5	0.5	0.5	IODE OBIS
SO7	7.8	Create new and sustain existing BGC data synthesis products		0.5	0.5	0.5	0.5	Anywhere
SO8	8.1	Speed integration new technology	0.25	0.25				Anywhere
SO8	8.2	Clear directive on use of biomolecular approaches including eDNA to support biological EOVs						
SO9	9.1	Organize global online trainings on operational ocean monitoring and forecasting system	0.5					Mercator
SO9	9.2	Enhance existing and develop new technical capacity building resources (including online)						
SO9	9.3	Implementing ocean monitoring and forecasting system with the engagement of GRAs						
SO9	9.4	Cross network integrated capacity development						
SO9	9.5	Partner with MBON, OBIS and WCMC on capacity exchange						
SO9	9.6	Ocean monitoring and forecasting system centre evaluation/assessment		0.25	0.25	0.25	0.25	Mercator
SO9	9.7	Capacity Exchange Materials and Workshops for Developments or Expansion of GRAs		1.0	1.0	1.0	1.0	Anywhere
SO9	9.8	Market and capability building for EOV reporting in support of the global biodiversity framework indicators and assessment	0.5	0.5	0.5	0.5	0.5	Anywhere

SO9	9.9	Co-development of biodiversity and marine habitat indicators with the business community			0.5	0.5	0.5	Anywhere
SO9	9.10	Observing Together??						
SO10	10.1	Establish coordination Integrated Marine Debris Observing System		1.0	1.0			Anywhere
SO10	10.2	Incorporate/link to the human pressure indices	1.0	1.0	1.0	0.5	0.5	Anywhere
SO11	11.1	GOOS Structure evaluation and evolution						
SO11	11.2	GOOS Governance evolution						
SO11	11.3	Develop a GOOS Resourcing Team		1.0	1.0	2.0	2.0	X-GOOS Core
		Total	7.5	18.0	22.5	16.5	16.5	

This shows:

- GOOS will need an additional 7.5 FTE by the end of 2021, more than doubling to 18 by end of 2022, with growth slowing to 22.5 in 2023.
- **To implement the actions outlined within this Implementation Plan the human resources dedicated to GOOS core work will need to more than double, increase by 260%, in 2 years**
- The need declines in 2023 and 2024 however there are also a lower number of longer term actions and 3-year actions will end, however we might assume that there will be additional action and so the 2023 level would likely remain.
- It is also worth noting that some SOs and insight from this analysis might indicate the identification of additional resource needs. This should be updated post SC-10.

Location of resource need
Note this is an estimate.

Resource Location	2021	2022	2023	2024	2025
X-GOOS Core	0.8	4.0	5.0	4.0	4.0
OceanOPS	1.0	2.5	2.5	1.5	1.5
BGC Panel Hub	0.0	1.0	1.0	1.0	1.0
BioEco Panel Hub	0.0	1.0	1.5	1.5	1.5
IODE OBIS	1.0	1.0	1.0	1.0	1.0
Mercator	0.5	0.3	1.3	1.3	1.3
Anywhere	4.3	8.3	9.2	6.2	6.2
Total	**7.5**	**18.0**	**21.5**	**16.5**	**16.5**

- There are needs to develop GOOS resource in two new locations IODE OBIS (Osetend, Belgium) and at Mercator (Toulouse, France)
- A number of staff could potentially work ‘remotely’ from anywhere (as has been well demonstrated by the pandemic). This can open the option for support to be provided in-country to support projects.
- Are the resources for IODE OBIS sufficient, given the scale of OceanOPS?

Resource need by SO

Resource by SO	2021	2022	2023	2024	2025
SO1	0.5	1.2	3.1	3.1	3.1
SO2	0.3	2.5	2.5	1.5	1.5
SO3	2.0	2.4	1.9	1.9	1.9
SO4	0.0	0.0	0.3	0.0	0.0
SO5	1.0	1.0	2.0	1.0	1.0
SO6	1.0	3.5	5.0	2.5	2.5
SO7	0.5	2.4	1.4	1.7	1.7
SO8	0.3	0.3	0.0	0.0	0.0
SO9	1.0	1.8	2.3	2.3	2.3
SO10	1.0	2.0	2.0	0.5	0.5
SO11	0.0	1.0	1.0	2.0	2.0
Total	**7.5**	**18.0**	**21.5**	**16.5**	**16.5**

- SO8 New Technology and SO4 Services and local uptake will need some additional focus and/or resource in the future.
- SO6 has many actions, peaks at 2023 and then declines. The pattern of resource requirement here could be looked at in more detail.
- In general the resource need is spread across the SOs.

Additional resource needs in $

The resource needs in $ for the actions, again in addition to any 'normal' funding are given as total per year below. This is perhaps less well defined than the FTE needs, however the information can aid decision making and can be refined later.

Travel/Other				
2021	2022	2023	2024	2025
435,000$	275,000$	165,000$	200,000$	115,000$

GOOS Decade Programme needs

The GOOS Ocean Decade programmes need 582,120,000$ across 10 years. CoastPredict only provided costs for the coordination office - so this is likely much higher, perhaps of order 8 million $.

Ocean Decade Programme funding needs are an order of magnitude bigger. The charge was to be transformative and think BIG so we should be prepared to articulate strongly the need (branding and pitches), and to be clear on the support required to initiate and achieve transformation

IOC Funding

The IOC core GOOS biennial funding level is noted below, in 'normal' years 80% of this is used in supporting travel. For 2020 - 2021 we have the opportunity to use some of these funds for other 'contract' work, e.g. communications. In 2022-2023 there will likely be cut to the funding level as resources across the IOC are redirected to support the Ocean Decade. It seems, at this stage, unlikely that we will return to the same levels of travel as previously supported. However with and without the reduction there is not sufficient budget available to support the ambition of GOOS.

Years	$ biennial	% travel	Notes
Previous	$464,994.00	80%	flat funding is in real terms approx reduction 2-5%
2020-2021	$435,000.00	0%	No travel makes funds available for other work
2022-2023	$291,450.00	???	Reduction of 33% anticipated across IOC (Decade)

Summary on resources

It is clear that **GOOS will need to undertake some serious fundraising in order to fulfill its intentions.** The Task Team discussed the resource needs and was in favour of putting forward a clear and well justified 'big ask' for what GOOS needs to undertake the Implementation of the Strategy. This has some advantages and some disadvantages that are discussed later (see SWOT) and recommendations made as to the next steps. **The 'big ask' is of order 22 additional people and 300K$ a year, more than double GOOS support across elements today.**

It is also clear that the needs of the GOOS Ocean Decade Programmes could cast a shadow over the needs of GOOS in the Implementation Plan, this is a real risk and should be considered. GOOS will need to 'ask' for both the Implementation Plan and Ocean Decade, perhaps integrating the support and initial projects within the Implementation Plan may be one way of asking for both. Thought is needed in this area, as creating additional and separate structures is neither efficient, integrated, nor likely fundable. There is also a risk that if the Decade Programmes are well funded but not integrated that GOOS will essentially work for the Decade Programmes. The Decade Programmes were intended to be transformational for GOOS and the Decade.

Finally, and with awareness of the findings of the Report into the Support Structure of GOOS, which will be discussed at the SC. The following observations can be made, with regard to funding:

- GOOS will need to work to be 'investable', this may involve some of the following elements; a clear structure, defined timelines and outcomes, trust in the teams ability to execute (for the funds provided), accountability and governance/oversight.
- Nations find it easier to invest nationally and so GOOS may need to consider what this could look like. Could this be through developing new 'centres of excellence' for aspects of the plan, innovation centers that nations invest in nationally for global impact? In a sense this already exists with the BioEco Panel, OceanOPS, BGC Panel,

and could perhaps be extended with recognition given for this role. With more centres, more core coordination is needed, however a % could go towards this.

- Staff that can work 'anywhere' could be provided in-kind by countries. This would require a more consistent and organised method than now, and so carries an organisational overhead. However it is worth considering as it is also a method for; training new leadership, capacity development, and communicating and connecting countries to GOOS activities.

Some additional work to compare the scale of the big 'ask' in comparison with some other global coordination systems (WMO?) could be useful.

7. Impact vs Roadmap Outcomes - how does this measure up

So far this analysis has been based on the 'bottom up' view across the SOs, where is GOOS activity focused, how are we undertaking it. Here we try and look 'top down', where are we in terms of our ambition? Does the impact match the anticipated outcomes as put forward in the Roadmap? What does the collective impact look like?

Here we use the anticipated impacts articulated for the actions detailed in Annex 1. This analysis is just a start, the impacts need more work, not all actions have an articulation of impact, and greater consistency is also required, plus some deeper analysis for 3 and 5 year timeframes. Looking at the stated ambition and comparing this with the ambition foreseen in the Roadmap, a qualitative % is placed on the achievement of the implementation impact towards the decadal outcomes of the Roadmap. Despite the additional work that needs to be done on the impacts and the subjective nature of the analysis, some insight can be gained.

Strategic Objectives	Ambition IP (% towards Roadmap)	Impact (Implementation Plan)	Outcome (Roadmap)
SO1: Partnerships to improve delivery	20%	- enhanced service delivery to end users and visibility for ocean obs\ervations in services	- A strengthened, responsive and delivery-focused observing system; - Established strong partnerships with key intermediary user organizations across climate, operational services and ocean health delivery areas - An increase in fit-for-purpose ocean information products (forecasts, indicators, coastal warning) based on sustained observations - Ability to evaluate system for adequacy in meeting societal needs (also see Strategic Objective 3 – SO3) - Improvement in the sustainability of the observing system individual components, through clarity on how observational data contributes to providing critical services

SO2: Build advocacy and visibility with stakeholders through communicating with key users and national funders.	70%	- increased understanding of the value of ocean observations in services meeting user needs - broader reach in terms of recognition of need for sustained ocean observing, the role of GOOS, and other components of the observing system (nations, community, partners), greater support for GOOS, greater support for sustainable funding. Improved cohesion and connection with more 'distant' pieces of GOOS through improved internal communication - increased observing capacity, efficiency and visibility of the impact of ocean observations in vital services - Visibility of observing system and role with funders, tracks results of investment resources in GOOS; shows the better recognition of growth in capability and gaps in the system, supports 'integrated view' and integration more generally, encourages raising of standards and increased integration of the system	- Significant step-up in the external recognition of value of the global ocean observing system in climate, operational services, and marine ecosystem health areas - 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 - Increase in nations participating in the observing system - An observing system that meets national, regional and global needs - Recognition for the role that GOOS, WMO, IOC, and our partners play in supporting the global development of an ocean observing system
SO3: Regularly evaluate system impact to assess fit for purpose	70%	- improvement to system performance, and more system wide view for engagement with funders - observing system efficiency, tools for integrated design, information on gaps - values for users - enhanced delivery of services from a fit-for-purpose and more cost effective GOOS	- Operational tracking of the observing system against targets for climate, operational services, and marine ecosystem health, understanding change in capability or quality and impact - Identification of gaps across the observing system (disciplines and domains) and at global, regional, and local scales - A view of the status of the observing system to meet societal goals, including real-time view of status for short term response - Guidance on how to evaluate observing systems from a global, regional and national perspective - Increased efficiency of information to evaluate the application of resources to meet requirements
SO4: Strengthen knowledge and exchange around services and products, to boost local uptake	10%	- increase knowledge, capacity and visibility of GOOS	- Broader access and increased use of ocean data - Increased innovation in ocean data services - Building capacity and strengthening partnerships for delivery - Improved decision making in the marine environment - Enhanced impact for users of observing system at local/regional level

SO5: Provide authoritative guidance on integrated observing system design, synthesizing across evolving requirements and identifying gaps.	60% (some this ambition in ObsCoDe - SO3)	- provide guidance for monitoring of biology and ecosystem EOVs across diverse platforms, monitoring efforts and observing networks - ability to assess and report on observing system against EOV?, transparency of GOOS process, access points for involvement An optimal carbon flux observing system to allow estimate of annual ocean carbon uptake - transparency of GOOS process - will support develop implementation plans for all EOVs for the period 2025-2030	- Refined designs for observing the essential global observations required for global societal needs that maximize return on investment - A modular design approach to guide and support implementation decisions at regional and national level - Greater efficiency in investment towards enhancing observing capacity - Transparency in establishing and communicating on design requirements
SO6: Sustain, strengthen and expand observing system implementation through GOOS and partner communities, promoting standards and best practice, and developing metrics to measure success	60% (missing Projects input)	- harmonisation, data interoperability, efficiency, capacity development - enabling increase in EOV observations from EEZ - additional data streams available, strengthen observing capacity and delivery - enabling high quality ocean measurements - increase observing capacity and support ocean health and the blue economy - a responsible observing system - inter-comparable data of known quality - improved delivery of services in coastal zone that are reliant on ocean information	- Increased efficiency in use of resources - More uses of data and more users served - enhanced delivery to end users across an integrated observing system - A system for identifying and sharing of best practices and adoption of common approaches - Increasing the number of observing networks, sensors and platforms with a Technology Readiness Level of 7 or more - Coordination towards achieving common goals across global, regional and national systems - Expansion and evolution into new areas, identified through requirements and supporting emerging communities focused on solving global needs - Increased interoperability of ocean data from variety of sources - Support for sustainability through participation in a global integrated system
SO7: Ensure GOOS ocean observing data and information are findable, accessible, interoperable, and reusable, with appropriate quality and latency	70%	- greater support where needed for network data support to increase data flow, improved connection with downstream users, understanding of OceanOPS role in metadata - data interoperability, traceability, accessibility - Initiation of program to have data available and summaries online for all biological EOVs - simplify access and m2m interface to all data from global networks, reduce friction in data delivery - simplify access and interface to all data from global networks, reduce friction in data delivery - major increase in use of data collected across the BioEco networks, advances in ocean resource management	- An identified and tracked global observing system data architecture as part of broader oceanographic, atmospheric, and earth system data architectures - Data products based on Essential Ocean Variables and Essential Climate Variables available in a timely manner, with appropriate quality - More data available, more appropriately, to more users - Availability of meaningful data metrics
SO8: Support innovation in observing technologies and networks.	50%	- speed technology to market, raise quality of service, make cost savings, evolve feedback from users to industry, issues with sensors for deep ocean applications, Develop standards for sensors	- Faster adoption of new technology - Increase scope, efficiency and observational capability - Focused and faster technological development to meet new observing challenges, including geographic equity

SO9: Develop capacity to ensure a broader range of beneficial stakeholder participation.	20% (missing Projects input)	- Increase visibility and engagement of GOOS, GRAs and partners - efficiency and increased participation - Operational Ocean Forecasting Systems in SIDS and African countries identified - ability to understand CBD trends globally, mitigation, action etc	- a greater number of countries actively participating in the global ocean observing system; - a greater number of countries with capabilities in ocean forecasting - new best practices and data products addressing the needs and capacities of increasingly diverse participating countries
SO10: Extend systematic observations to understand human impacts on the ocean.	10%	- IMDOS approved as a GOOS Project and work on implementation - expand relevance of GOOS to society, especially in area of Ocean Health	- A pilot project, in partnership with other organizations in this area, around variables related to human activities, potential initial targets are ocean noise, marine plastics, and harmful algal blooms - Recommendations for the implementation selected human activity variables within an integrated global ocean observing system, and their implementation in the EOV framework
SO11: Champion effective governance for global in situ and satellite observing, together with partners and stakeholders	30%	- evolution to a more fit for purpose GOOS governance to support inward investment and to deliver on the 2030 Strategy - increased funding for GOOS led initiatives	- A governance architecture for the global ocean observing system, that integrates GOOS and partners in a framework, with clarity in roles, processes and evaluation - A clearly articulated voice for ocean observations and services, with multiple stakeholders contributing to define the message - Improved global observing system delivery, responsiveness and sustainability - Greater support for national systems and their needs for ocean information

This shows:

- **SO1, SO4, SO9, SO10 and SO11 appear to be lacking in ambition,** in terms of not aiming for the broader range of outcomes expressed in the Roadmap. Some of these areas have a lower number of actions and as identified earlier lack long term actions/ambitions.
- **SO6 is perhaps not hitting all the elements** foreseen in the roadmap, perhaps something to look at given the number of action and resource required for this strategic objective
- SO2, SO3 and SO7 appear to be hitting a number of the key areas/ideas for action
- Post SC-10 the Implementation Task Team could take some of the SOs for analysis of the actions, against ambition.
- **GOOS expression of the impacts/benefits of the actions will need to be much tighter, if we are going to be able to well justify the 'ask' for resources.**
- In the future (2025?) GOOS could review the Roadmap and the SOs to see if it is consistent with changes in environment, Ocean Decade etc.

8. Gaps

Gaps in the GOOS Implementation Plan that could be considered - note this is different to gaps in the ocean observing. Not all of those gaps will be filled by GOOS, we need to be more clear about this. Below are some notes on the gaps in the Implementation Plan, and in this against the implementation Roadmap.

- GOOS Projects to be represented, plus description of aim/role in GOOS
- Connections between outcomes and impact. Theory of Change can help (Annex 3), plus clarity of where this takes place in GOOS.
- Connections to communications. There are gaps between the outputs of GOOS elements and what GOOS communicates - what is the procedure, how far in advance, how identify, some process needs to be in place? This is not difficult to fix, but it is important.
- Some areas lack long term plans, SO1, SO4, SO8, do we need partnership/additional expertise to guide this.
- IP lacks a 'start up' facility to get Decade Programmes going - where does this happen? Likely 18 - 24 months support this before programme specific funding secured.
- For some SOs there is some distance between the expressed ambition (Roadmap outcomes) and the impacts. Suggest that the Task Team suggest look at this by SO, consider what GOOS does and what we partner to fully support
- Partnership with the satellite community has no strategic level view

9. Structure

The Implementation Plan can be used to provide some questions around the GOOS Structure. The SC-9 Part 1, suggested a GOOS Structure TT, the following could be topics for priorities now and for the Task Team to consider:

- We need additional strategic thinking in some areas - SO4 Products, SO7 Data, SO8 New Technology, SO9 Capacity Development. Do we need additional SC members, a Task Team, specific support, or new entity, with the expertise to lead and champion these areas?
- The GOOS Ocean Decade Programmes highlight the need to integrate observation and modelling - an integrated observing and forecasting system - how do we better do this with GOOS structure? What is the role of ETOOFS and of OceanPredict (a superpartner), again do we need additional SC members, a Task Team, specific support or a new entity, with the expertise to lead and champion these areas?
- BioEco Panel could require more investment to develop the networks and data/metadata for BioEco observations, as well as support the actions envisioned around delivery to assessments etc. In the physical space this is handled by different components, could a BioEco OCG and a BioEco OceanOPS be envisioned? It could make connections easier and be more understandable from the outside of GOOS?

- SO10 Human Impacts, cannot be undertaken by GOOS alone, do we ask another organisation to fulfil this role, do we partner with other organisations to do this? What is the long term strategy?
- The GOOS National Focal Points will be another structure in some sense, the roles and responsibilities and interplay between regional bodies such as GRAs, GOOS Projects such as AtlantOS, IOC Focal Points, Argo Focal Points, and GOOS National Focal Points/or committees, and also major national systems. Could this be better structured? How do other fields such as meteorology do this? Or is this an inherently messy space and we just work with a multitude of groups that will gradually coalesce to more specific roles as the ocean observing field matures?

The table below gives some insight into the relative roles of the GOOS elements across the Strategic Objectives.

Strategic Objectives	GOOS element								
	Core Coord	OOPC	BGC	BioEco	OCG/ OceanOPS	GRAs	ETOOFS	GOOS SC	Projects
SO1: Partnerships to improve delivery	■	▨	▨	■		■	■	▨	
SO2: Build advocacy and visibility with stakeholders through communications	■	▨	▨	▨	■	▨	▨	▨	
SO3: Regularly evaluate system impact to assess fit for purpose	■	■	▨	■	■	▨	■		
SO4: Strengthen knowledge and exchange around services, boost local uptake					▨	■	■		
SO5: Provide authoritative guidance on integrated observing system design	■	■	■	▨	▨	▨	▨	▨	
SO6: Sustain, strengthen and expand observing system implementation	■	▨	■	■	■	▨	▨		▨
SO7: Ensure GOOS ocean observing data and information are FAIR			■	■	■		■		
SO8: Support innovation in observing technologies and networks	▨			■	■				
SO9: Develop capacity to ensure a broader range of stakeholder participation.	■	▨	■	■	■	■	■		
SO10: Extend systematic observations to understand human impacts	▨		■	■	▨			■	
SO11: Champion effective governance with partners and stakeholders	■							▨	

■ • Lead & participate
▨ • Participate only

10. SWOT Analysis - on a big 'ask' for resources for the GOOS Implementation Plan

To help understand more about a big 'ask' for resources, as potential major action to support implementation, the SWOT below is provided (Strengths and Weaknesses are internal factors - Opportunities and Threats are external factors).

Strengths	**Weakness**
Visible Get the conversation out there - what it will take to make a difference (similar to Decade	No <u>one</u> entity to 'ask' (positioning only?) Cannot be just for advice - needs to be for infrastructure*

idea) GOOS has some control over the message Links to the governance discussions - coherence	What is the structure for this 'ask', what am I investing in? Planning is one thing - asking is another - there will be adjustment through dialogue - need to be prepared for and to support this process i.e. need resource to engage in the process of the 'ask´negotiation/dialogues
Opportunities Message that funding needs to be more cross government, environment, transport, etc. than just science research funded - different 'ocean' commitment Message that the ask is big because it is seriously important Ask but be prepared to be opportunistic in securing - funding for packages/ in nation investments Offering recognition of support Hire expertise to help craft this Change to more operational (seen by some as an opportunity)	**Threats** GOOS 'ask' could cast a shadow over our implementation base - GOOS big 'ask' in competition (see opportunities.. shift dialogue). Need to position our 'ask' with awareness Ocean Decade 'asks' can cast a shadow over broader GOOS infrastructure needs Change to more operational (seen by some as a threat)

*as an analogy consultants are often employed for advice, highly paid but generally not persistent, project based

11.Conclusions & Recommendations - Discussion for SC

Implementation development:

- Increase focus and resource on SO1 Delivery Partnerships:
    - Delivery TT to define role more clearly, how does this interplay with the SO7 Data
    - how do partners with many more connections have an oversight/view
    - There are already three strands to Action 1.2 this is not clear
    - Gap between impact and Roadmap outcomes
- Increase focus and resource on SO2 Communications - 2019 high importance:
    - feedback from community and national Focal Points to communicate on importance of sustained observing/sustained funding. However this is not all that will be required, more need to be done to communicate on what GOOS does, how processes/structures work and highlight our outputs, our advice
    - There are many outputs coming up in the IP, across GOOS, we need to prepare ahead of time - elements of GOOS should be connected to comms.
    - There will be the need to communicate around the need for funding GOOS Implementation plus Decade Programmes.

- Work on some of the SOs:
    - SO7 Data needs work to connect the many single actions
    - SO9 Capacity Development needs work on the long term plans, many single elements, and the gap between impact and Roadmap outcomes
    - SO4 Services and local uptake, and SO8 New Technology have no long term plans this needs some review
    - SO6 resources
    - SO10 Human Impacts
    - SO11 needs to look at impacts and the Roadmap outcomes

GOOS - resources/structure

- Communicate on the big 'ask', with knowledge of some of the issues raised above, this will drive clarity of messaging internally and externally around structure/impact/investability
- Employ support for fundraising. Focus on reaching out, marketing and exploring investing options, informing on the interplay between 'big' ask and practical reality
- Review structure:
    - BioEco network, data and metadata development (BioEco OCG/OceanOPS) resource needs
    - a role to manage data interface and overview SO7 actions - resources/structure
    - a role to manage modelling interface (ETOOFS?) - resource/structure
- Think strategically about infrastructure, as was done for the cross cutting Decade programmes;
    - to support this Implementation Plan what will be the resource configuration? The resources section of this report initiates this, but can go further to map this across GOOS.
    - What is the role of partnership? How do these infrastructure components connect into existing ecosystems, such as for ocean data, products and market development for products. What is GOOS unique role? What can be better undertaken in partnership, or by partners under agreement.
- Recognise the support GOOS receives for its core work in-kind and funding. Develop some specific actions around recognition here with communications and core cross GOOS coordination
- Develop some oversight of the multiple connections with Superpartners, to support communication with these partners and efficiency.
- Revise the Roadmap (in 2022?)
    - to be more inclusive of ocean observing and forecasting, it is not sufficiently inclusive of ETOOFS
    - inclusive of partner roles and GOOS roles in SOs
- SC members take some interest and/or stake in specific SOs or actions, suggest that GOOS SC discuss its role in the IP and actions

For Process:

- The Implementation Plan Task Team persists and continues to work on planning together
- Have regular (bi-monthly?) meetings of the Implementation Plan Task Team
    - discuss cross-GOOS activities
    - review actions around specific SOs
    - bring larger decisions to the GOOS SC
- Actions in this document are placed in a project management online software tool so that the GOOS elements can access and update actions, we can develop Gantt views of actions and present the types of customised views (tables) developed in this report. This will facilitate updating and tracking of progress. If successful and useful to the GOOS team, the tool can also be used to communicate across GOOS on joint actions. The project management software Monday being tested and assessed, Airtable is the alternative. This document becomes a live system that the GOOS Implementation Plan team accesses.
- Report out regularly (6 months) to GOOS SC

ANNEX 1: GOOS Actions by Strategic Objective

This Annex holds the detail on the actions as discussed with the GOOS elements in the second half of 2020. The details of each action are laid out under the 11 Strategic Objectives, under 1, 3, or 5-year time-frames.

For each action there is a rational and description, and milestones/output for actions that are in 3 - 5 years timeframes, plus a consistent set of information to support analysis and coordination across GOOS, including output/ impact, lead and GOOS elements involved, external partners, resource requirements, dependencies (is there something that the action depends on), links to other Strategic Objectives, links to one of the Decade Programmes. Mitigation is a way of recognising what you might need to do to ensure your dependency is not a weakness.

SO1: Partnerships to improve delivery

Year 1

None

Year 3

1.1 GRA assessment for forecasts and services

Lead: GRAs

Plus:

Capture the strength of GRAs and their association with other agencies.

Year 1-2 (2021-2022)

- An initial phase would involve a preliminary study on GRAs - forecasts, services and assessment (FS&A) and showcase success stories, including via the Benefits of Ocean Observing Catalog (BOOC) among other outlets.
- The second phase is to evolve a methodology to develop interconnection among GRAs and Initiate dialogue during the next GRA Forum 2021.
-

Year 3 (2023)

- The third phase would be to develop a pathway to deliver and sustain FS&A - with support of successful GRA (e.g. but not limited to EuroGOOS). Overall bring visibility/highlight services rendered by GRAs to member states through communication with GOOS Focal Points;

Output/Impact: GRA capabilities, needs to be assessed and improved collaboration and knowledge sharing; capacity exchange opportunities identified; develop pilot project to support upcoming GRAs / ??

Connection Actions: 1.2 (ETOOFS)

Connection Decade: ForeSea, OceanPredict, CoastPredict

SO	No	Other SOs	Action	Year	Lead	Partners	Resource	Dependencies	Action level
SO1	2.1	SO6	GRA assessment	1-3	GRAs	EuroGOOS, NOAA		GRAs appetite to work on this	Single element

			for forecasts and services						

Mitigation:

Year 5

1.2 Partnerships for delivery
Lead: X-GOOS Core, BioEco Panel, ETOOFS, Delivery Partners TT
Plus: OOPC, BGC Panel, SC

Coordinate work across GOOS in partnership development for delivery – i.e. across the value chain from observations to end users. Notes.

Year 1-2 (2021-2022)

- **Delivery Partners TT:** List key partners, categorise, identify priorities, focal points and projects/actions identified and visible, value chain overview plan for long-term, assess communication with partners. TT to define its task ongoing after this first stage.
- **BioEco Panel:**
  - Draft a decadal plan to grow international community support for biological observing in collaboration with MBON, OBIS, and WCMC
  - Examine BioEco Panel membership to ensure progress on all EOVs and membership spanning coastal to open ocean interests.
  - Engage in collaborative discussions to ensure BioEco EOV development is representative of GOOS partner interests.
  - Establish regional biology and ecosystem EOV implementation efforts in the US (Interagency Ocean Observation Committee task team) and Europe (EuroSea project)
- **Cross GOOS Core - WMO:**
  - Establish key connections with WMO that support strategic aims of both organisations.
  - Assess the role of the informal group of Ocean Experts that interface into the many SC, SG, EG with WMO. If needed provide support for example for quarterly calls, to discuss cross GOOS/WMO issues.
  - WMO/GOOS identify key joint work, co-design projects, coordinated actions, to expand and strengthen observing system implementation and delivery in critical areas. For example ObsCoDe, Observing Together, EEZ, etc
- **ETOOFS:**
  - review and describe the actual partnership ETOOFS / Ocean Predict on ocean modelling & forecasting
  - prepare a first inventory of ocean forecast delivery points
  - formalize the partnership ETOOFS / OceanPredict

Year 3-5 (2023-2025)

- BioEco
  - Ensure contribution of biology and ecosystem EOVs to ecological forecasting (partnership with OceanPredict and CoastPredict)
  - Identify parameters and input data needed to forecast future changes in extent and cover or biomass of all EOVs/Provides basis for evaluating proposed societal response to global extinction crisis
- **ETOOFS**
  - organize and formalize a partnership GOOS/Copernicus (CMEMS) to foster consistent delivery mechanism benefitting GOOS users worldwide

Output/Impact: planned development of partnerships, visibility of and for partners, structured two-way flow of information, focal points for contact within GOOS, identification of joint projects, and communication on the value of ocean observing and / enhanced service delivery to end users and visibility for ocean obs\ervations in services
Connection Actions: 5.8
Connection Decade: ObsCode, CoastPredict, Observing Together

SO	No	Other SOs	Action	Year	Lead	Partners	Resource	Dependencies	Action level
SO1	1.1	SO2, SO3, SO6, SO7, SO9	Partnerships for delivery	1-5	Cross-GOOS Core & BioEco Panel & ETOOFS	WMO/INFCOM WMO/SERCOM IODE/OBIS UNEP/WCMC OceanPredict CoastPredict Mercator	0.5 FTE/yr X-GOOS Core years 1 from 2022 1 FTE/yr (take on WMO management plus others as grows) 0.5 FTE/yr for BioEco years 3-5 + 25K$ 0,2 FTE in 2022 and then 0,6 FTE/yr from 2023 for ETOOFS	Value from both sides, finding GOOS champions for each relationship, communications	X-GOOS major

SO2: Build advocacy and visibility with stakeholders through communicating with key users and national funders.

1 year

2.1 Value of Ocean Observations Project
Lead**: Core X-GOOS Coordination**
Plus: GRAs
GRAs need to add something in here about their work - connect Use Case catalogue action to this one…?

Joint project with OECD, 1) survey of flow of data within an economy, through survey of main oceanographic data centre and their users (initial survey with UK MEDIN, to be expanded), 2) evaluation of methods for measuring the value of ocean observations, best practice recommendations. These 2 projects are foundation pieces, it is anticipated that GOOS would continue work with the OECD in this area.

Year 1-2 (2021-2022)

- Deliver report on OECD-GOOS-MEDIN Survey flow of data - communicate on findings
- Initiate survey with other national centres
- Hire someone to write an evaluation of methods paper
- Assess if what any next/ongoing action might be

Output / Impact**:** Value of Ocean Observations Report and Best Practice Paper /increased understanding of the value of ocean observations in services and the flow of ocean data in economies
Connection Actions:
Connection Decade:

SO	No	Other SOs	Action	Year	Lead	Partners	Resource	Dependencies	Action level
SO2	2.1	SO1, SO6, SO7	Value of Ocean Observations Project	1	X-GOOS Core	OECD MEDIN	40K$ in 2021 for consultant to work on methods paper	Funds	Single element

Mitigation**:** Ensure the work is communicated

3 year

2.2 GOOS Communications Plan
Lead**: Core X-GOOS Coordination**
Plus: OOPC, BGC Panel, BioECo Panel, OCG/OceanOPS, ETOOFS, GRAs

Develop a GOOS Communications Plan with an outside agency that can be supported by GOOS core coordination with agency assistance. Develop a range of discrete actions, through which the agency and GOOS will learn about impact and user needs.

Year 1-2 (2021-2022)

- Web update - improved GOOS website (easier to navigate, with content for both observing community and for policy makers/funders/public – duel function)
- 6 user stories (3 per delivery area), and a series of discrete communications pieces
- Learning regarding impact and use of information
- Development of Communications Plan

Year 3 (2023)

- Implementation Communications Plan

Output / Impact**:** Revised website and GOOS Communications Plan / broader reach in terms of recognition of need for sustained ocean observing, the role of GOOS, and other components of the observing system (nations, community, partners), greater support for GOOS, greater support for sustainable funding. Improved cohesion and connection with more 'distant' pieces of GOOS through improved internal communication
Connection Actions: 1.2, 2.3, 2.4, 5.3
Connection Decade: ObsCode, CoastPredict, Observing Together

SO	No	Other SOs	Action	Year	Lead	Partners	Resource	Dependencies	Action level
SO2	2.2	All	GOOS Communications Plan	1-3	X-GOOS Core	WMO Commss IOC Comms	60K$ in 2021 for agency to develop plan and specific projects 0.5 FTE/from 2022	Excellence of agency	X-GOOS Major

Mitigation**:** Rigorous selection process, carefully prepared call

2.3 GOOS National Focal Point role developed
Lead: Core X-GOOS Coordination
Plus: SC

GOOS National Focal Point (NFP) role updated and connection with NFPs established. Consider their role in GOOS, how structure, interaction, governance. Encourage work towards GOOS national committees where appropriate.

Year 1-2 (2021-2022)
- Review and revise ToRs
- Develop a plan meetings, communications, reporting etc. for GOOS National Focal Points
- Initial regional meetings (like EOOS)

Year 3 (2023)
- initial national report

Output / Impact**:** empowered GOOS National Focal points/committees supporting ocean observing coordination in each country, contributing to GOOS governance / increased observing capacity, efficiency and visibility of the impact of ocean observations in vital services
Connection Actions: 2.2
Connection Decade:

SO	No	Other SOs	Action	Year	Lead	Partners	Resource	Dependencies	Action level
SO2	2.3	SO1, SO6, SO7, SO11	GOOS National Focal Point role developed	1-3	X-GOOS Core	EOOS	0.25 FTE 2021 0.5 FT/yr from 2022	Resource	X-GOOS Major

Mitigation**:**

5 Year

2.4 Evolve Ocean Observing System Report Card
Lead: OCG/OceanOPS
Plus: Core X-GOOS Coordination, BGC Panel, BioEco Panel

Evolve the Ocean Observing System Report Card to become a cross-GOOS publication, use EOVs as a reporting framework for progress toward the desired global ocean observing system.

Year 1-2 (2021-2022)
- EOV/metadata pilot - two additional EOVs will be integrated into the Report Card through OceanOPS from BioEco and BGC realms for publication in 2022.
- Learning from this pilot a cross-GOOS plan can be made addressing:
    - Resourcing for the expanded remit
    - Identify/agree audience - perhaps initially report to the IOC, see below

Year 3-5 (2023-2025)
- Expanded audience and scope of reporting.
- Biennial reporting to the United Nations on global ocean observing system status,

Output / Impact**:** Status and progress report - a GOOS communications tool / Visibility of observing system and role with funders, tracks results of investment resources in GOOS; shows the better recognition of growth in capability and gaps in the system, supports 'integrated view' and integration more generally, encourages raising of standards and increased integration of the system
Connection Actions: 2.2, 3.2, 3.5, 3.6, 5.2, 6.9
Connection Decade: ObsCoDe Programme

SO	No	Other SOs	Action	Year	Lead	Partners	Resource	Dependencies	Action level
SO2	2.3	SO3, SO6, SO7	Evolve Ocean Observing System Report Card	1-5	X-GOOS Core	IOC/OSS IOC Comms IODE/OBIS WMO Comms	1.5 FTE at OceanOPS from 2022 [in addition to the 0.5 FTE today, 0.5 FTE BGC-SOCONET 0.5 FTE BioEco links 0.5 FTE design and editorial/management] Design/production/year - $15K Web upgrade 10K $ 2022	Sufficient resource to work on cross GOOS reporting - this will be a major work	X-GOOS Major

Mitigation**:** Consider core office communications support to aid OceanOPS

SO3: Regularly evaluate system impact to assess fit for purpose

1 year

3.1 Network status reporting
Lead: OCG/OceanOPS and BioEco Panel
Plus: BGC Panel, BioEco Panel

Develop some reporting standardisation across networks, use is for network management, building blocks for system view and more immediately for the Report Card. Aim is that this is an aid to networks in identifying gaps, and providing tools to help with design dimensioning and implementation plans, as well as proving some systematic synthetic views of network status. A connection with the BioEco panel should be established.

Output / Impact*:* enhanced network tools and visualisations / improvement to system performance, and more system wide view for engagement with funders
Connection Actions: 3.1
Connection Decade: ObsCode

SO	No	Other SOs	Action	Year	Lead	Partners	Resource	Dependencies	Action level

SO3	3.1	SO7	Network status reporting	1	OCG/OceanOPS		0.5 FTE/yr +50k	Ability monitor network status accurately	Multi element

Mitigation**:** Targeted OCG sessions on metadata and then metrics

3 year

3.2 Observing System evaluation and metrics
Lead**:** OCG/OceanOPS
Plus: BCG Panel, BioEco Panel, OOPC

This now looks like the first steps towards ObsCoDe - we can start but ultimately this should be a part of ObsCoDe leading to sustained and usable infrastructure.

Aim to provide centralized monitoring and performance evaluation of all observing networks carrying out EOV observations. Develop metrics for supporting the monitoring the adequacy of the GOOS vs requirements and applications. Consider OCG 3-tiered approach: 1) network metrics (3.2), 2) system metrics at an EOV level, incorporating some ability to assess adequacy through work with GOOS Panels and WMO (e.g. OSCAR RRR), ultimately 3) system assessment from user needs perspective e.g. WIGOS. This will require work on consistent metadata cross-panel and work on characterising requirements. Based on OceanOPS technology provide tools to help with system status, working towards assessment against requirements (user/design), and longer-term support for cross-platform design dimensioning and implementation plans.

Year 1-2 (2021-2022)

- Initial pilot for system level metrics after discussion at OCG-12, with a concrete outcome that will evolve the Report Card
- integrating an initial BGC and BioEco EOV through the OceanOPS platform for visualisation within the Observing System Report Card (Action 2.4), with a concrete outcome that will evolve the Report Card. e.g. three EOV views integrated into Report Card with some assessment on adequacy.
- Develop understanding of the integration challenges for metadata and visualisation

Year 3 (2023)

- Pilot with BGC Panel, support centralized monitoring and performance evaluation of all observing networks carrying out biogeochemistry EOV observations

Output / Impact: regular information on the status of EOV observations measured by GOOS networks, visualisations and tools at system level / observing system efficiency, tools for integrated design, information on gaps
Connection Actions: 2.4, 3.5, 6.9
Connection Decade: ObsCode

SO	No	Other SOs	Action	Year	Lead	Partners	Resource	Dependencies	Action level
SO3	3.2	SO2, SO5, SO6, SO7	Observing System evaluation and metrics	1-5	OCG/OceanOPS	WMO (GBON)	0.5 FTE 2022 [plus see 2.4] To develop an inclusive pilot will need resources. Deeper work through ObsCoDe,	Additional resources	Major X-GOOS

							resource noted elsewhere		

Mitigation**:**

3.3 Ocean Forecast evaluation and metrics
Lead**:** ETOOFS
Plus:

The objective is to release a GOOS guide for Ocean Forecasts evaluation and metrics presenting standard metrics for the intercomparison and validation of ocean reanalyses and forecasts. Metrics are defined to assess the accuracy of the different ocean variables estimated by ocean forecasting systems.
This will be based on the 20 years+ work of OceanPredict in this matter, and operational implementation of a first series of KPIs by CMEMS and other groups in the world. Metrics are defined to ensure standardized methods between forecasting centres : (1) to assess the internal performance of each simulation / forecast with the same KPIs (e.g. comparison obs/model, comparison analysis/forecast) and (2) intercompare simulations and forecasts from different centres in a consistent ways (comparison forecast/forecast).
The guide will provide ocean forecasting centres and candidate ocean forecasting centres with a comprehensive description of methods and standards to be applied.

Year 1-2 (2021-2022)

- Inventory with the Ocean Predict / Intercomparison & Validation task team and the CMEMS Product quality working group of mature metrics
- Release of a first draft of a GOOS/ETOOFS Guide on Ocean Forecast evaluation and metrics

Year 3 (2023)

- Consultation with ocean forecasting centres worldwide and release of the guide on Ocean Forecast evaluation and metrics

Output / Impact: consistent information on the accuracy of ocean predictions within the GOOS network of ocean forecasting centres, identification of weaknesses (capacity development priorities, scientific challenges), metadata information for users
Connection Actions: 2.4
Connection Decade:

SO	No	Other SOs	Action	Year	Lead	Partners	Resource	Dependencies	Action level
SO3	3.3	SO1, SO4, SO7	Ocean Forecast evaluation and metrics	1-3	ETOOFS	OceanPredict, Mercator, CMEMS	0,2 FTE/y from 2022		Single element

Mitigation**:**

5 year

3.4 Global map of ocean forecasting systems

Year 1-2 (2021-2022)

- Develop inventory of ocean forecasting centres with a first classification vs main characteristics (input data, proposed ocean variables, geographical coverage, operational commitments, …)

Year 3-5 (2023-2025)

- **Set an interactive map of ocean forecasting centres capacities to monitor Essential Ocean Variables**

Output / Impact: Assessment of ocean forecasting systems capacities to monitor the marine environment; quick view of status and evolutions, and expected quality/value for users
Connection Actions: 3.1
Connection Decade:

SO	No	Other SOs	Action	Year	Lead	Partners	Resource	Dependencies	Action level
SO3	3.4	SO1	Global map of ocean forecasting systems	1-5	ETOOFS		0.2 FTE/y from 2022	Additional resources	Single Exement

Mitigation**:**

3.5 Develop an interactive map of networks and metadata for biological monitoring
Lead**:** BioEco Panel
Plus: OCG/ OceanOPS

Develop an online platform through OBIS that visualises the extent of biological monitoring in the global ocean, of networks and metadata. The platform will be developed in Year 1 using the global survey response from the PEGASuS/Future Earth project. The initial survey identified biological monitoring programs that cover 7% of the ocean surface but were unable to identify active, long-term programs collecting biological observations in a majority of the surface ocean (~93%). Gaps in biological observations were observed off the coasts of Latin America and the Caribbean, Eastern Europe and the Caspian Sea, Asia, parts of Oceania, Africa, the Arctic, in the deep oceans and areas beyond national jurisdiction. Additionally, there were programs that were not captured either due to 1) programs not responding to the survey, 2) programs were located in countries where English is not the primary language or in cases where the contributors do not speak English, or 3) because programs did not publish data in platforms established by the international observing community (e.g., OBIS, GBIF).

As many programs may have been missed, future work will need to prioritize regional assessments to identify additional observing programs that were not initially findable but could contribute to a globally coordinated ocean observing system. This will be targeted in Year 2-5 with the aim to produce higher resolution regional maps. European biological monitoring programs will be added in Year 2 through the EuroSea project.

The metadata portal will be developed in year 1 and maintained in years 2-5 as more metadata becomes available. In Years 2-5, OBIS will connect with OceanOPS to advance common visualisation, metadata and network monitoring elements. The ultimate goal is to have a seamless interaction between OBIS and OceanOPS to visualise EOV coverage.

Output / Impact:
Connection Actions: 2.4, 3.6
Connection Decade: ObsCode, Marine Life 2030

SO	No	Other SOs	Action	Year	Lead	Partners	Resource	Dependencies	Action level
SO3	3.5	SO2, SO7	Develop an interactive map of	1-5	BioEco Panel	IODE/OBIS	0.5 FTE/yr + 50k at IODE/OBIS		Multi element

			networks and metadata for biological monitoring						

Mitigation**:**
No mitigation possible. This is an essential deliverable, although the delivery platform may change or develop depending on continuation of funding.

3.6 Global Ocean Indicators Framework
Lead**:** OOPC
Plus: BGC Panel, BioEco panel, Core X-GOOS Coordination, OCG/OceanOPS

Will this be core GOOS initiative or will GOOS play a role in a broader initiative - G7-Mercator?
Indicators are powerful tools for establishing a dialogue between science, policy, and the general public, and for facilitating ocean and climate assessments and observing system design through targeted thematic actions. This activity aims to develop a single, comprehensive, internationally-agreed global ocean indicator framework, drawing on existing or developing national, regional, and international activities, e.g. GCOS Global Climate Indicators Framework, Geo Blue Planet, Agenda 2030 SDG Indicators, all relevant regional and national indicator frameworks. A proposal for a GOOS joint panels activity is in development for initial discussion with the other GOOS panels tentatively in September.

BioEco would like to see direct contribution of status of marine habitats to indicators of change in reports to international conventions and agreements by 2025 based on synoptic and published syntheses and reviews of quality assured data.

Year 1-2 (2021-2022)

- A proposal for a GOOS joint panels activity is in development for initial discussion with the other GOOS panels tentatively in September
- Scoping across panels on the definition, criteria and topical organization for a global framework.
- Perspective paper on ocean indicator framework 2021/2022

Output / Impact: An internationally-agreed global ocean indicator framework for assessments, observing system design and evaluation, knowledge and decision-making tools, outreach and communications / ?
Connection Actions:
Connection Decade: ObsCode

SO	No	Other SOs	Action	Year	Lead	Partners	Resource	Dependencies	Action level
SO3	3.6	SO1, SO2, SO4, SO5, SO6, SO10	Global Ocean Indicators Framework	1-5	OOPC	GCOS, RCN OO19 Geo Blue Planet, OECD, UNEP	1 FTE/yr	Ability to consider all existing frameworks and produce something comprehensive and new	Major X-GOOS

Mitigation**:** Linking with previous initiatives and involving the right people who are familiar with the existing indicator frameworks

3.7 Observing System Co-Design (ObsCoDe)
Lead**:** Core X-GOOS Coordination
Plus: OOPC, BGC Panel, BioEco Panel, OCG, ETOOFS, GRAs

The programme aims to build the process, infrastructure, and tools for co-design, creating an international capacity to evolve a truly integrated ocean observing system, matching agile observing and modelling capability with requirements. Creating the process, infrastructure and tools for the co-design of a fit-for-purpose GOOS.

Output/Impact: Strong connections between modelling and observing communities, process, infrastructure, and tools for co-design, evolution for the system and targeted gap filling for cost relevant and impactful observing/modelling system gaps, evolution of modular process, infrastructure and capability that many sizes of system can use / enhanced delivery of services from a fit-for-purpose and more cost effective GOOS
Connections:
Connection Decade: ObsCoDe

SO	No	Other SOs	Action	Year	Lead	Partners	Resource	Dependencies	Action level
SO3	3.5	SO1, SO3, SO6, SO7, SO9, SO10	ObsCoDe	1-5	Core X-GOOS	OceanPredict, WMO INFCOM, WCRP, ECMWF, C3S, IODE/OBIS, MOi, CMEMS, GCOS, MBON, UNEP/WCMC, IOC MSP, IMOS, SOCIB, IOOS	205M$ (10 year total)	Resource	Decadal X-GOOS

SO4: Strengthen knowledge and exchange around services and products, to boost local uptake

1 year

4.1 Toolkit/Guide on Operational Ocean and Monitoring and Forecasting Systems
Lead**:** ETOOFS
Plus: GRAs

Develop and share with meteorological and ocean communities.

Output / Impact: GOOS Toolkit/Guide for Operational Ocean and Monitoring and Forecasting Systems / increase knowledge, capacity and visibility of GOOS
Connection Actions:
Connection Decade:

SO	No	Other SOs	Action	Year	Lead	Partners	Resource	Dependencies	Action level
SO4	4.1	SO9	Toolkit/Guide on Operational Ocean and Monitoring and	1	ETOOFS	Mercator, WMO INFCOM, OceanPredict	20K$/yr [Basic funds needed	ETOOFS contributing experts dedication, Mercator, Member States	Single element

			Forecasting Systems				progressing to dedicated funds]		

Mitigation:

3 year

4.2 Data Integration Products Across GRAs
Lead: GRAs
Plus: OCG, ETOOFS

IMOS has initiated such a project and this would constitute an initial case study, users to learn and expand across GRAs

Output/Impact: 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 / ??
Connection Actions:
Connection Decade:

SO	No	Other SOs	Action	Year	Lead	Partners	Resource	Dependencies	Action level
SO4	4.2	SO7, SO8, SO9	Data Integration Products Across GRAs	1-3	GRAs			GRA commitment	Single element

Mitigation:

4.3 Establish and promote a GOOS product and services portfolio for Ocean Forecasting centres
Lead: ETOOFS
Plus: GRAs, OCG/OceanOPS

The objective is to boost the uptake of GOOS by ocean forecasting centres (that are contributors but also users of GOOS) by developing a fair description of the GOOS product and services relevant for this community of stakeholders. These products and services provided by GOOS can take different forms - observation datasets, indicators, expert reports, standards, guidance, workshops, … - and are usually only partially known by potentially interested parties, and probably difficult to find without guidance. Some of these elements are produced by ocean forecasting centres themselves (e.g. a guide for ocean forecasting Action 4.1) by we miss a comprehensive description. Targeting a specific category of users can help to extract the specific value of GOOS and stimulate uptake. The work will be done for global and regional ocean forecasting centres (open ocean) with the goal to set up a model that could be extended later for coastal modelling centres that CoastPredict will gather.

Year 3-4 (2023-2024)

- Description of the GOOS portfolio (products and services) for ocean forecasting centres

Output/Impact: 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
Connection Actions: 2.2, 3.3, 4.1, 9.1,
Connection Decade:

SO	No	Other SOs	Action	Year	Lead	Partners	Resource	Dependencies	Action level
SO4	4.3		GOOS value for ocean forecasting centres	1-3	ETOOFS	OceanPredict	0.3 FTE in 2023		multi-element

SO5: Provide authoritative guidance on integrated observing system design, synthesizing across evolving requirements and identifying gaps.

SO 55

1 year

5.1 Essential Ocean / Climate Variables Stewardship & GCOS

Lead: OOPC

Plus: BioEco Panel, BGC Panel, OCG

Following the IP call, this action, 5.1 possibly needs some clarifying with regard to the work across GOOS for GCOS and the relationship between this and the GCOS Strategy/Implementation Plan. It may also have some common elements with 5.2 that need to be clarified. This is likely a discussion between OOPC, BGC Panel and BioEco Panel and the EOV TT. I think 5.2 will be kept as a discrete item and this action reworded, made long term and/or looked at in terms of partnership for delivery. Leave here for now - awaiting this dialogue.

Essential Variables provide a framework for generating global data sets from numerous observing system platforms and networks. This activity coordinates the development of global ocean data requirements for applications across ocean health, ocean climate, and operational services, and regularly reviews the status of networks and data sets against internationally-agreed goals.

GCOS Status Report 2020: OCG, BioEco, BGC contributing. It is still underway and is not straightforward to complete as GOOS is not structured to report in the manner GCOS has set up in the report. Once complete does GOOS communicate on the Ocean part of this and what it means for investment – do we support the evaluation sufficiently to do so?

Year 1-2 (2021-2022)

- GCOS is currently discussing ways to modify the next IP for GCOS Status Report. It is clear that the GOOS groups need to decide what would be most useful in the future for an implementation plan, focusing more on a few key 'transformational' priorities for international consensus Harmonize this reporting against climate from GCOS with reporting of status of observing system in general (SO3), is GCOS report to be our focus for reporting against climate targets is it sufficiently rigorous? At the end 2021 we should have defined what we report and the value of this activity within GOOS implementation actions.
- Develop proposal for development of biological EOVs as ECVS – BioEco Panel with OOPC support. Including potential harmonies with terrestrial biological ECVs. Write down a 1-2 page summary of the EOV/ECV process that can be used for reference and be made available on GOOS web page.

Output / Impact*:* further harmonisations of EOV and ECVs, simpler cross-GOOS reporting for GCOS Climate observing status / provide guidance for monitoring of biology and ecosystem EOVs across diverse platforms, monitoring efforts and observing networks

Connection Actions:

Connection Decade:

SO	No	Other SOs	Action	Year	Lead	Partners	Resource	Dependencies	Action level
SO5	5.1	SO1, SO3, SO6	Essential Ocean / Climate Variables Stewardship	1	OOPC	GCOS, WCRP, WMO INFCOM			Multi element

Mitigation: Agreement on complementary formats and review periods

3 year

5.2 GOOS EOV Review
Lead**:** Core X-GOOS Coordination/EOV T
Plus: BGC Panel, BioEco, OOPC

Harmonise the specification sheets, develop a team to discuss and update criteria, process and role EOVs, publish a paper on GOOS EOVs, history, process and future look.

Year 1-2 (2021-2022)

- EOV specification sheets updated, rationalised and harmonised across the GOOS Panels (underway). Specifically targeting where information is needed for external reporting, including for BioEco reporting the CBD post-2020 framework, SDG and IPCC. Identify as a part of this what would trigger an EOV specification sheet revision, what should be the interval.
- GOOS Task Team on EOVs, addressing criteria and process for EOVs, evaluating who is using EOV/ECVs and how, and consulting stakeholders for their needs for reviews - detailed description in report
- Publish GOOS EOV paper, with forward looking components, EOVs now and for future.

Output / Impact: set of revised consistent and more useful (e.g. metrics) specification sheets, published process for EOV evaluation and stakeholder consultation / ability to assess and report on observing system against EOV?, transparency of GOOS process, access points for involvement
Connection Actions:
Connection Decade:

SO	No	Other SOs	Action	Year	Lead	Partners	Resource	Dependencies	Action level
SO5	5.2	SO3, SO11	GOOS EOV Review	1-3	X-GOOS Core		Consultant 6 months full time 30,000$		Multi element

Mitigation**:**

5.3 Observing System Evaluation and Reviews

5.3.1 Strategy for Ocean Heat and Freshwater Cycles
Lead: OOPC
Plus:

Variations in ocean heat and freshwater content affect our ability to predict climate processes such as global warming, sea level rise, cryosphere changes, El Nino events, and global ocean circulation patterns. This activity aims to assess the capability of the current observing system to quantify changes to these reservoirs, to improve the ability to model and predict global and regional climate drivers and impacts, and to develop strategies required to optimize the observing system.

Year 1-2 (2021-2022)

- Workshop will be organised around three main themes:
  1) explore the use of observation-based estimates of ocean H/F transport and storage in model performance;
  2) assess capability of ocean observing system to measure H/F transport and storage;
  3) assess CMIP6 models fitness-for-purpose in diagnosing H/F changes. The workshop will aim to seed research collaborative activities between the ocean observing and the climate modeling community.
- A report and some publications will be produced following the workshop, a specific output of the workshop is to define and implement a set of obs-based diagnostics in model simulations to aid future model-observations comparisons.

Output: GOOS recommendations/communications for an integrated global observing system that allows for Heat and water flux quantification. Revision of the relevant EOV specification sheets to encompass the output of the reviews
Connection Actions: 2.2
Connection Decade: ObsCoDe

SO	No	Other SOs	Action	Year	Lead	Partners	Resource	Dependencies	Action level
SO5	5.3	SO1, SO3, SO6	Observing System Evaluation and Reviews	1-3	OOPC	WCRP CLIVAR; WCRP, RCN OO19		Engagement experts (modelling & observations). Impact will depend on implementation	Single element

5.3.2 Observing System Evaluation and Strategy for the Ocean-Atmosphere Interface and Boundary Layers
Lead: OOPC (OASIS)
Plus: BGC Panel, OCG/OceanOPS, ETOOFS

OASIS (Observing Air-Sea Interactions Strategy) SCOR Working Group #162, in coordination with GOOS Panels, is developing a strategy, implementation plan, and pilot experiment proposals to achieve EOV and ECV requirements for measuring global ocean surface fluxes of heat, moisture, momentum and carbon dioxide. Estimation of air-sea heat, moisture and momentum fluxes is necessary for ocean, weather and climate prediction, including impacts on rainfall and the global supply chains of food and freshwater. OASIS (https://airseaobs.org/)

Year 1-2 (2021-2022)

- Synthesis report with recommendations based on OceanObs19 CWP

Year 3 (2023)

- Guidelines for launching new Uncrewed Surface Vehicle network.
- Ocean Best Practice workshop for other air-sea flux variables.
- Air-Sea flux open source toolbox; Air-Sea flux curriculum
- OASIS observing Air-Sea flux monitoring strategy delivered.

Output: GOOS recommendations/communications for an integrated global observing system that allows for near real-time quantification of air-sea exchanges with required accuracy throughout the global ocean to quantify, model and predict exchanges of heat, momentum, moisture, greenhouse gases and biogenic trace gases. Revision of the relevant EOV specification sheets to encompass the output of the reviews. Strategy,

implementation plan, and pilot experiment proposals to achieve EOV and ECV requirements for monitoring global global Air-Sea fluxes of heat, moisture, momentum and carbon dioxide.
Connection Actions: 2.2
Connection Decade: OASIS, ObsCoDe

SO	No	Other SOs	Action	Year	Lead	Partners	Resource	Dependencies	Action level
SO5	5.3	SO1, SO3, SO6, SO8	Observing System Evaluation and Reviews	1-3	OOPC	GCOS, SOLAS CEOS, RCN OO19		Satellites making near-surface and boundary layer T and humidity measurement with required accuracy	Single element

Mitigation: Direct engagement with the satellite community; articulating the importance of adequate satellite measurements required to address climate issues and SDG goals in UN agreements.

5.3.3 Observing System Evaluation and Strategy for Boundary Systems
Lead: OOPC
Plus: GOOS Panels, GRAs and OCG networks

Including interactions between the open ocean and coastal zone. Ocean climate, ocean health and societal uses of the coastal ocean are impacted by exchanges with the open ocean at the edge of the continental shelf, an area that is particularly difficult to observe and predict because of the complex and dynamic nature of these boundary system environments with high spatial and temporal variability. This activity is developing guidance on observing asset deployments in coastal and boundary current regions through the development of case studies / best practices from well-observed boundary current systems, and through the development of OSSE experiments and pilot experiments.

Year 1-2 (2021-2022)
- series of webinars with guided virtual dialogues between the observing and modeling communities of 6 boundary systems
- community engagement back to back with CLIVAR Workshop “From global to coastal: Cultivating new solutions and partnerships for an enhanced Ocean Observing System in a decade of accelerating change”

Year 3 (2023)
- Publication providing guidance for multi-disciplinary sustained observing systems adapted to each boundary system, including funding strategies and suggestions for OSSE experiments. It will draw on the results of the webinar series, OceanObs19 CWPs and community engagement.

Output: GOOS recommendations/communications for a multi-disciplinary observing approach adapted to each boundary system linking the open ocean and coastal observing system. Revision of the relevant EOV specification sheets to encompass the output of the reviews.
Connection Actions: 2.2
Connection Decade: ObsCoDe

SO	No	Other SOs	Action	Year	Lead	Partners	Resource	Dependencies	Action level
SO5	5.3	SO1, SO3, SO6, SO8	Observing System Evaluation and Reviews	1-3	OOPC	WCRP, CLIVAR, OceanPredict,	5K$ 2022 to support travel and connect with workshop	SEngagement of observations and modeling experts;	Multi element

						CoastPredict, RCN OO19			

Mitigation**:** The webinars series of virtual dialogues will involve both members of the observing and the modeling community.

5.3.4 Optimal carbon flux observing system blueprint
Lead: BGC Panel
Plus: OCG/OceanOPS

Develop a blueprint of an optimal carbon flux observing system to allow annual ocean carbon uptake estimates.

Year 1-2 (2021-2022)

- Blueprint delivered

Output: Blueprint of an optimal carbon flux observing system to allow estimate of annual ocean carbon uptake. Revision of the relevant EOV specification sheets to encompass the output of the reviews.
Connection Actions: 2.2
Connection Decade: ObsCoDe

SO	No	Other SOs	Action	Year	Lead	Partners	Resource	Dependencies	Action level
SO5	5.3	SO3	Observing System Evaluation and Reviews	1-3	BGC Panel	ICOS, IOOS, IMOS CoastPredict RCN OO19		Coordination between GCOS and GOOS on climate EOVs	Multi element

Mitigation:

Note on Impact**:** For impact to work needs action on delivery of results and implementation I believe a couple of things need to come into place across these initiatives. They are in one Action, so this can be looked at and some X-GOOS coordination and understanding can be developed :

1) Pilots identified if needed - to prove dataflow, best practice, taylor delivery to users etc.
2) Partners down the value chain identified and in step with the recommendations, so that when investment is made the results will be delivered swiftly - co-design
3) Clear communications on the results, targeted at regions and nations, a serious attempt to take the recommendations and work on implementation.

Potential impact:

- An optimal carbon flux observing system to allow estimate of annual ocean carbon uptake

5.4 GOOS Evaluation and Review Framework
Lead: OOPC
Plus: BGC and BioEco Panels

Preparing guidelines and best practices on observing system reviews and design studies, including when they should be triggered, and including an evaluation framework along the value chain. **detailed description in report**

Output / Impact: Published best practice for system review stakeholder consultation / transparency of GOOS process
Connection Actions: 2.2
Connection Decade: ObsCoDe

SO	No	Other SOs	Action	Year	Lead	Partners	Resource	Dependencies	Action level
SO5	5.4	SO11	GOOS Evaluation and Review Framework	1-3	OOPC		0.5 FTE yr	Requires resource to complete	Multi element

Mitigation:

5.5 Regional network coordination/OO19 synthesis
Lead**:** OOPC
Plus: BGC Panel, BioEco Panel, OCG/OceanOPS

From the OOPC perspective, this is a very important activity and there was a lot of momentum after OO19, but COVID has clearly impacted all that. Some careful consideration must be given as to how to proceed in the current circumstances (no travel) and who is better positioned to take the lead here. One idea from our panel would be to focus on one issue in particular: e.g., improve regional coordination between the different tropical observing systems. The Decade has perhaps absorbed many of the plans - Leave here for now - awaiting this dialogue.

With the aim of advancing the physics and climate ocean observing system in the next decade. The global observing system is composed of numerous regional networks, and facilitating the coordination and interoperability of those regional networks with each other and with the global observing platforms is a primary role of GOOS. This activity will build on the published plans of regional networks and global platforms from the OceanObs19 conference to develop an internationally-agreed list of priority actions to advance the physics and climate ocean observing system in the next decade.

OOPC plan a Dec 2020 multi day online meeting to cover the OO19 follow-up issues that were meant to be discussed with regional and global observing network / platform representatives at the cancelled OOPC-23 meeting in Cape Town. The goals set out for OOPC-23 were to: a) Assess how to align regional / topical OceanObs'19 recommendations with platform recommendations (and as contributions to the OO'19 Living Action Plan); b) Develop a prioritized list of recommendations that align regional requirements and platform plans to build global coordination; c) Assess knowledge gaps and needs for observations to address them; and d) Based on the OO'19 CWPs and consensus among OOPC members and representatives of regional networks and global platforms, develop a list of priorities needed to advance the physics and climate ocean observing system in the next decade.

Output / Impact*:* An internationally-agreed set of priorities for the next decade to advance the ocean physics and climate observing system in support of the IPCC and other global assessments, Sustainable Development Goals, the UN Ocean Decade of Science for Sustainable Development, and the OceanObs Living Action Plan.
/ ?
Connection Actions: 1.2, 2.2
Connection Decade: ObsCoDe

SO	No	Other SOs	Action	Year	Lead	Partners	Resource	Dependencies	Action level
SO5	5.5	SO1	Regional network	1-3	OOPC	RCN OO19	0.5 FTE yr	Engagement of lead authors,	Multi element

			coordination/ OO19 synthesis					regional network leaders, global observing platform leaders;	

Mitigation**:** Work on facilitating access to EEZs, GOOS, WMO, IOC.

5 year

5.6 Observing System Design around EOVs
Lead**:** X-GOOS Core Coordination / BGC Panel
Plus: BioEco Panel, OOPC, OCG/OCeanOPS

Some of this activity may be now under ObsCoDe however as the Decade programmes are not yet funded we will keep here look at resourcing and links with other actions.

To determine observing targets and develop implementation plans for all EOVs for the period 2025-2030 by (i) reconciling societal and scientific requirements for observations, and by (ii) strengthening or establishing new partnerships between observing networks and relevant expert working groups and the modelling community.

Output / Impact: EOV Implementation Plans published along with EOV-based targets set for the observing system / will support develop implementation plans for all EOVs for the period 2025-2030
Connection Actions: 1.2, 2.2, 2.4
Connection Decade: ObsCoDe, OASIS

SO	No	Other SOs	Action	Year	Lead	Partners	Resource	Dependencies	Action level
SO5	5.6	SO3, SO6	Observing System Design around EOVs	1-5	OOPC	IOC/OSS (GO2NE) OASIS UNEP OceanPredict	1 FTE/yr X-GOOS Core (2023)		Major X-GOOS

Mitigation**:**

SO6: Sustain, strengthen and expand observing system implementation through GOOS and partner communities, promoting standards and best practice, and developing metrics to measure success

1 year

3 year

6.1 Implementation of multidisciplinary initiative VOICE
Lead**:** BGC Panel (Vero Garcon, VOICE leader)
Plus: SC (Francis Marsac), GRAs, OOPC, BioEco Panel, OCG/OceanOPS

Based on the recommendations from the OceanObs'19 Community White Paper initiate implementation of VOICE:Variability of the Oxycline and its Impact on the Ecosystem. There is significant potential for combining with the work of OOPC Task Team on Boundary Currents. Potential large scale integrated GOOS Project?

Provide global coordination of regional pilots initiated through resources external to GOOS. 100kS for regional workshops on details of implementation and engagement of local funders who actually fund observations.

Output / Impact**:** Integrated regional multidisciplinary observing systems in place in the EBSs (Eastern Boundary Systems) for observing variability of the oxycline and its impact on the ecosystem, towards increasing readiness levels for the three FOO pillars/Enhanced ocean observing value chains in the EBSs
Connection: 5.3.2
Connection Decade: Observing Together, ObsCoDe

SO	No	Other SOs	Action	Year	Lead	Partners	Resource	Dependencies	Action level
SO5	6.1	SO5	Implementation of multidisciplinary initiative VOICE	1-3	BGC Panel	AtlantOS, SCOR, OceanPredict	1 FTE/yr from 2023 BGC Panel node	Engagement of lead authors, regional network leaders, global observing platform leaders;	Multi element

Mitigation**:**

6.2 GOOS Endorsed Best Practices available across EOVs and platforms
Lead**:** OCG/OceanOPS
Plus: Core X-GOOS Coordination, BGC Panel, BioEco Panel, ETOOFS, GRAs

Promote international agreements on measurement methodologies and best practices, primary and secondary data quality control and quality assurance procedures, data and metadata formats. GOOS has defined a process to identify community best practices that are mature enough to have broad community support and can be elevated to a 'GOOS Endorsed' best practice. These will be searchable in the Ocean Best Practice System as 'GOOS Endorsed' best practices and will constitute a body of quality ocean observing best practices across EOVs and observation lifecycle.

Year 1-2 (2021-2022)
- Develop visibility of endorsed best practices in the Ocean Best Practice System
- develop tracking
- focus on supporting convergence converge similar best practices and emerging networks

Output / Impact**:** Documented process and a collection of GOOS endorsed Best Practices visible in Ocean Best Practice System / harmonisation, data interoperability, efficiency, capacity development

Connection Actions:
Connection Decade: ObsCoDe, Observing Together, CoastPredict

SO	No	Other SOs	Action	Year	Lead	Partners	Resource	Dependencies	Action level
SO5	6.2	SO4, SO7, SO9	GOOS Endorsed Best Practices available	1-3	OCG/OceanOPS		0.5 FTE/yr from 2022 to assist OCG S&BP lead	Engagement of lead authors, regional network leaders, global observing	Multi element

			across EOVs and platforms					platform leaders;	

Mitigation**:** Careful formalisation with recognition as to the source 'GOOS' community

6.3 Ocean Observations in EEZs
Lead: Core X-GOOS Coordination
Plus: OCG

Work with IOC, WMO and DOALOS on the recommendations from the Ocean Observations in areas under National Jurisdiction (OONJ) Workshop (Feb 2020) towards solving a range of issues raised through the community

Output/Impact: IOC resolution creating a system for supporting access / enabling increase in EOV observations from EEZ
Connection:
Connection Decade:

SO	No	Other SOs	Action	Year	Lead	Partners	Resource	Dependencies	Action level
SO5	6.3	SO4, SO7, SO11	Ocean Observations in EEZss	1-3	OCG/OceanOPS	WMO, DOALOS	0.5 FTE/yr from 2022 at X-GOOS Core (if further action envisione)	Member State appetite to work on this	X-GOOS

Mitigation**:** Value change to states/system clearly articulated

6.4 Emerging and existing network integration
Lead**:** OCG/OceanOPS
Plus: GRAs, BGC Panel

Ongoing work to scan for developing networks and invite to interact with OCG, including working out relationships with new commercial networks, providing some support to assist those that want to develop to be global components of an integrated system – following the OCG Network Attributes. This is an ongoing task, however there are some specific additional challenges to work on in next years, that may define this action further, these include relationship with commercial networks, relationship with other global partners in the observing enterprise such as the ship operators (IRSO).

Some emerging networks are 'incubated' through GRAs or BGC Panel activities before becoming OCG networks or affiliated to OCG networks.

Year 1-2 (2021-2022)

- Continue work with OceanGliders, AniBOS and Tide Gauges
- Engage with and find mutually useful partnership with IRSO
- Engage with and find mutually useful partnership with emerging commercial networks
- Support GOOS/MTS Dialogues with commercial sector
- Formalize the "sailing and science" partners? With a charter/label to frame various civil society contributions to the observing system. Observations in remote locations, visibility, education and citizen science development. Consider how will this be visualised in OceanOPS and Report Card

Output/Impact: integrated and diverse system global networks / additional data streams available, strengthen observing capacity and delivery
Connection Actions: 1.2, 2.2

Connection Decade: Odyssey

SO	No	Other SOs	Action	Year	Lead	Partners	Resource	Dependencies	Action level
SO5	6.4	SO2, SO7, SO9	Emerging and existing network integration	1-3	OCG/OceanOPS	IRSO SoFar MTS	1 FTE/yr from 2021 at OceanOPS 0.5 FTE/yr 2022 GOOS Core Office support increased expansion of networks and connection BioEco networks		Multi element

Mitigation**:**

6.5 Develop and/or maintain an up to date referenced hardware directory
Lead: BGC Panel
Plus**:** OCG/OceanOPS

For commercially available instruments and sensors, a niche service offered by IOCCP to the observing community. Linked to parallel developments in OceanOPS, that are undertaken with SeaDataNet and WIGOS; across all EOVs that OceanOPS track.

Output/Impact: access to state-of-the-art information on instruments and sensors / enabling high quality ocean measurements
Connection Actions:
Connection Decade:

SO	No	Other SOs	Action	Year	Lead	Partners	Resource	Dependencies	Action level
SO5	6.5	SO2, SO7, SO9	EDevelop and/or maintain an up to date referenced hardware directory	1-3	OCG/OceanOPS	IWMO INFCOM, SeaDataNet			Single element

Mitigation:

6.6 Advancing BGC/BioEco observations across global networks
Lead**:** BioEco and BGC Panel
Plus: OCG/OceanOPS

BGC Panel, BioEco Panel and OCG community get together to discuss possible pilot areas to expand collection of multi- observations across OCG networks, focus on finding pilot projects and then expanding. For BGC important areas are GO-SHIP and OceanSITES. Implementing recommendations from SCOR WG 154. Will link with Best Practices, OceanOPS, OBIS.

Fundraising for implementation to occur not just in the US but on a global level, facilitated by GOOS.

Output / Impact**:** expansion of additional observations where they can be integrated and delivered / increase observing capacity and support ocean health and the blue economy
Connection Actions:
Connection Decade: ObsCoDe, GO-SHIP

SO	No	Other SOs	Action	Year	Lead	Partners	Resource	Dependencies	Action level
SO6	6.6	SO4, SO7	Advancing BGC/BioEco observations across global networks	1-3	BioEco Panel (OCG/ OceanOPS)	SCOR NOAA IODE/ OBIS	GOOS regular	Availability of national funding to support the wide-scale extension of existing observing efforts	Multi element

Mitigation**:**

5 year

6.7 Environmental Stewardship
Lead**:** OCG/OceanOPS
Plus: BioEco Panel

Environmental Stewardship framework adopted by OCG. This includes: Network environmental Impact assessments; increasing use of biodegradable/recycled material; support of an Integrated Marine Debris Observing System, and coordinating recovery of stranded instruments (understand when effective, feasible). The action is to implement a process to support networks delivering on environmental stewardship for their network. This is now an OCG Network Attribute.

Year 1-2 (2021-2022)

- Workshop to give direction to OCG-12 for ongoing work
- Increased web presence/material on ES activities across GOOS

Year 3-5 (2023-2025)

- explore pilot activities

Output/Impact: networks with knowledge of environmental impact / a responsible observing system
Connection Actions:
Connection Decade:

SO	No	Other SOs	Action	Year	Lead	Partners	Resource	Dependencies	Action level
SO6	6.7	SO8	Environmental Stewardship	1-5	OCG/ OceanOPS	NOAA	Potential studies and pilots to enact - nothing needed initially will be about comms and footprint reduction - overseeding/efficiency - 2ndly pilots and partnerships	Technology will be one of the dependencies	Single element

							so will need to grow in 2023 0.5 FTE		

Mitigation:

6.8 Inter-comparison and standards
Lead: BGC Panel
Plus: OCG/OceanOPS

Promote international agreements on development and use of certified reference materials. Where appropriate, support producing Certified Reference Materials (CRMs) for EOVs, e.g. through inter-laboratory comparison studies and establishment of central production and /or calibration facilities. Potentially enforcing strict requirements for use of globally-accepted standards, protocols and CRMs across observing networks recognized by the OCG. Results from inter-comparison exercises have been useful for users in choosing a particular sensor or instrument.

There are intercomparison studies happening with DBCP - with the RMICs. Each intercomparison exercise costs around 80-100kS – can we link this to the WMO intercomparison discussion - where services are 'offered'?

BGC has a specific commitment to SOCONET (Surface carbon observations) in this regard

Output/Impact: results from a series of projects, CRMs, and some areas where this is mandatory/ inter-comparable data of known quality
Connection Actions:
Connection Decade:

SO	No	Other SOs	Action	Year	Lead	Partners	Resource	Dependencies	Action level
SO6	6.8	SO7, SO8	EInter-comparison and standards	1-5	BGC Panel	JAMSTEC, SCOR, ICOS OTC, Scripps (Dickson Lab), WMO RMICs			Single element

Mitigation:

6.9 Coordinate and expand surface ocean biogeochemistry observations
Lead: **BGC Panel**
Plus: OCG/OceanOPS (SOOP)

This is to be carried out through the Surface Ocean Carbon Reference Network (SOCONET) to achieve targets set by SOCONET as an observing network under SOOP; the effort would also contribute to the wider Strategy for Surface Ocean Observations as described in the SCOR WG OASIS proposal.

Output/Impact: SOCONET targets achieved; number of parameter measurements expanded beyond pCO_2 / ??
Connection Actions: 2.4, 3.5
Connection Decade: OASIS

SO	No	Other SOs	Action	Year	Lead	Partners	Resource	Dependencies	Action level
SO6	6.9	SO7, SO8	ECoordinate and expand surface ocean biogeochemistry observations	1-5	BGC Panel	OASIS	See other actions [combined with 3.5 and 2.4: 0.5 FTE at OceanOPS office to coordinate SOCONET and gather basic metadata from platform operations carrying bgc eov sensors/ instruments.	interest from BioEco and Physics & Climate Panels	Multi Element

Mitigation**:**

6.10 CoastPredict
Lead**:** Core X-GOOS Coordination
Plus: ETOOFS, OCG, BioEco Panel, BGC Panel, OBPS

GOOS elements of CoastPredict?? This needs work with Coast Predict team, X-GOOS, and GOOS lead Joaquín Tintoré
Transform the science of observing and predicting the Global Coastal Ocean, from river catchments, including urban scales, to the oceanic slope waters.

For funding: The budget estimation is done here only for the University of Bologna International Programme Office and it is briefly exposed here for three years (all amounts are in €). The total is 535000 € for three years and the details are offered in the supplementary material. To be consistent with other GOOS proposals an estimate of 3.3 x 535000€ (in $) placed in resources - this is ONLY for the Bologna International Programme Office.

Output/Impact: coastal ocean observing adequate for societal needs and integrated into GOOS / improved delivery of services in coastal zone that are reliant on ocean information
Connection Actions:
Connection Decade: ObsCoDe

SO	No	Other SOs	Action	Year	Lead	Partners	Resource	Dependencies	Action level
SO6	6.10	SO1, SO3, SO5	CoastPredict	1-5	Core X-GOOS	IODE, OceanPredict, ESA, NOAA, Mercator, EMODnet, The Ocean Foundation	2,120,000$ for the Coordination Office		Decadal X-GOOS

6.11 Building the BioEco community
Lead**:** BioEco Panel
Plus: OCG/OceanOPS

Biological observing is often local, sometimes regional and only rarely global. An important step in building the marine biological monitoring community is to work with existing observation programs to develop a suitable

governance structure that will support existing activities and build access to existing long-term data sets. A second step is to build the communities at the appropriate scale (national, regional or global) to support adoption of agreed best practices (building on the revised OCG network attributes agreed at OceanObs19), and including their formal adoption by GOOS through the Ocean Best Practice portal. Finally, step 3 requires consideration on how to structure a data publication process (e.g through regional or global Global Data Assembly Centres) that will serve to deliver quality controlled data to OBIS and other global portals. Each of these steps is fundamental to building regional and global monitoring systems and each step will require extensive and delicate communication and collaboration.

Output/Impact:
Connection Actions: 2.4, 3.1, 6.2
Connection Decade: ObsCoDe, Marine Life 2030, BOON

SO	No	Other SOs	Action	Year	Lead	Partners	Resource	Dependencies	Action level
SO6	6.11	SO3, SO6	Building the community	1-5	BioEco Panel	IODE/OBIS, GEO Blue Planet, MBON, OmicBON C-GRASS GOMON, GCRMN, BRUVs, RLS	1FTE/year from 2022 BioEco Panel hub to coordinate community and EOVs noting that EOVs will be addressed in parallel, so the elapsed time to complete each EOV will be more than one year.	Funding	Single element

Mitigation:
Essential item, no mitigation possible beyond delay or reduced number of biological EOVs.

SO7: Ensure GOOS ocean observing data and information are findable, accessible, interoperable, and reusable, with appropriate quality and latency

1 year

7.1 Data Flow mapping OCG networks
Lead: OCG/OceanOPS
Plus: BioEco Panel

Mapping the data and metadata flow across the OCG networks. Initial dialogue with BioEco panel to support consistency in variety areas.

Output / Impact: Maps delivered, gaps and areas for improved efficiency identified, increased visibility of GOOS network data flow a / greater support where needed for network data support to increase data flow, improved connection with downstream users, understanding of OceanOPS role in metadata
Connection Actions: 2.2
Connection Decade:

SO	No	Other SOs	Action	Year	Lead	Partners	Resource	Dependencies	Action level
SO7	7.1	SO6	Data Flow mapping OCG networks	1	OCG/OCeanOPS				Single element

3 year

7.2 Metadata standardisation global networks
Lead**:** OCG/OceanOPS
Plus: BioEco, BGC Panels

Initially across OCG networks, harmonize metadata across networks, for 3 specific needs i) network needs/management, ii) OceanOPS management tools/pushing full metadata to data management/data distribution systems, iii) user needs (data management and beyond).

Year 1-2 (2021-2022)

- OCG/Ocean OPS define metadata standards for for 3 areas
- Integrate cross-GOOS needs.

Output / Impact**:** clear metadata standards for 'global' networks and later cross-GOOS / data interoperability, traceability, accessibility
Connection Actions: 2.4
Connection Decade:

SO	No	Other SOs	Action	Year	Lead	Partners	Resource	Dependencies	Action level
SO7	7.2	SO6	Metadata standardisation global networks	1-3	OCG/OCeanOPS				Single element

Mitigation**:**

7.3 Support a Global Data Assembly Centre for BGC EOVs
Lead: BGC Panel
Plus: OCG/OceanOPS

Support creation and maintenance of a GDAC for BGC EOV data and where relevant (e.g. Particulate Matter EOV) design new data repositories capable of integrating EOV data from many heterogeneous sources.

Output/Impact: ??/ ??
Connection Actions:
Connection Decade:

SO	No	Other SOs	Action	Year	Lead	Partners	Resource	Dependencies	Action level
SO7	7.3	SO4, SO6, SO8	Support a Global Data Assembly Centre for BGC EOVs	1	BGC Panel		1 FTE/yr at BGC Panel in 2022		Multi element

Mitigation**:**

7.4 OCG Data Strategy
Lead**:** OCG/OceanOPS
Plus:

Pilot implementation of the OCG Data Strategy with a common endpoint/interface across all the OCG networks, including thought to user needs (IODE and WMO), to test how integrated access to OCG network data function to increase data availability. Look at the entire lifecycle of data, from collection to access, to include a metadata element, NRT data through GTS, and access to delayed mode data through ERDDAP services.

Output/Impact: cross-network data strategy/ simplify access and m2m interface to all data from global networks, reduce friction in data delivery
Connection Actions:
Connection Decade:

SO	No	Other SOs	Action	Year	Lead	Partners	Resource	Dependencies	Action level
SO7	7.4	SO6, SO8	OCG Data Strategy	1-3	OCG/OCeanOPS	IODE WMO INFCOM	More clear global nodes required - see data mapping there will be resources needed in data centres outside of GOOS	Network ability to implement	Single element

Mitigation**:** Define strategy with the networks, identify support required to implement

7.5 Establish OpenGTS Prototype
Lead**:** OCG/OceanOPS
Plus:

Open GTS pilot established the ability ERDDAP services to support oceanographic communities to upload and download data from the GTS. Will form part of WMO WIS II and search currently underway for national met offices that wish to act as OpenGTS nodes (pilot was with Met Service UK).

Year 1 -2 (2021-2022)

- Plan and business case for establishing a small proto-network for OpenGTS, with WMO. Need a model for how to do this, responsibilities, is this GOOS to define and WMO to operate? is this a co-design project?

Output/Impact: increased data available on GTS, increased availability of GTS data to oceanographic community/ simplify access and interface to all data from global networks, reduce friction in data delivery
Connection Actions:
Connection Decade:

SO	No	Other SOs	Action	Year	Lead	Partners	Resource	Dependencies	Action level
SO7	7.5	SO6	Establish OpenGTS Prototype	1-3	OCG/OCeanOPS	WMO INFCOM	More clear global nodes required - see data mapping there will be resources needed in data centres outside of GOOS		Single element

Mitigation

5 year

7.6 Description of production & dissemination standards for Ocean Forecasting Systems
Lead**:** ETOOFS
Plus:

A number of standards (protocols, formats, KPIs, processes, …) related to ocean forecasts production and dissemination are applied by operational ocean forecasting centres worldwide and shared within sub-groups to ensure interoperability, secure operational dependencies and facilitate data sharing. The integration of big data / cloud / digital technologies and methods during the past years has accelerated this process. The action consists in reviewing existing and relevant standards applied within the GOOS network of operational ocean forecast centres and document them in a single document to serve as reference for the whole community.

Year 2-3 (2022-2023)

- Review of existing interoperability standards applied by ocean forecasting centres and identification of relevant categories requiring further assessment and description

Year 4-5 (2024-2025)

- First list of ocean forecast systems standards and protocols contributing to a FAIR forecast information

Output/Impact: interoperability of ocean forecast centres, FAIR value improved, better integration with digital big data standards
Connection Actions:
Connection Decade: ObsCoDe, DITTO

SO	No	Other SOs	Action	Year	Lead	Partners	Resource	Dependencies	Action level
SO7	7.6	SO1	Description of production & dissemination standards for Ocean Forecasting Systems	1-5	ETOOFS,	OceanPredict, IODE	0.4 FTE from 2022 then 0.7 FTE from 2024		Multi element

7.7 BioEco EOV data available through OBIS
Lead: BioEco Panel
Plus:

Provide a single portal where data on all biological EOVs can be downloaded, including sub-sets of data that have been quality assured and meet agreed standards. The level of synthesis products available and links to other data delivery portals including the UNEP-WCMC Ocean Data Viewer remain to be determined. The OBIS interface will become the primary scientific portal for biological EOV data, especially those used in reporting against goals and targets of the CBD post-2020 framework, UN SEEA EA and potentially SDGs.

Output/Impact: Single portal for global biological EOV data / major increase in use of data collected across the BioEco networks, advances in ocean resource management
Connection Actions:
Connection Decade: ObsCoDe, Marine Life 2030

SO	No	Other SOs	Action	Year	Lead	Partners	Resource	Dependencies	Action level

SO7	7.7	SO3, SO6	BioEco EOV data available through OBIS	1-5	BioEco Panel	IODE/OBIS	0.5FTE/year to integrate two EOVs with OBIS each year + 50k	Funding	Single element

Mitigation**:**
If OBIS is insufficiently resourced to provide single point access to biological EOV data, then alternative data portals would need to be identified and championed (e.g. through a foundation).

7.8 Create new and sustain existing BGC data synthesis products
Lead: BGC Panel
Plus:

Work to ensure sustainability of existing and create new including multi-EOV and multi-platform observations needed to fulfil the end user product requirements for various applications globally (e.g. SDG14 indicators, Global Carbon Budget, IPCC and World Ocean Assessment) and regionally (e.g. harmful algal bloom forecasts, regional carbon budgets, integrated ecosystem assessments).

Output/Impact: ?/?
Connection Actions:
Connection Decade:

SO	No	Other SOs	Action	Year	Lead	Partners	Resource	Dependencies	Action level
SO7	7.8	SO7	Create new and sustain existing BGC data synthesis products	1-5	BGC Panel		0.5 FTE/yr from 2022		Single element

Mitigation:

SO8. Support innovation in observing technologies and networks.

1 year

8.1 Speed integration new technology
Lead**: OCG/OceanOPS**
Plus**: X-GOOS Core Coordination**

Three areas of activity within OCG, 1) sensors, needs and issues cross-network meeting planned to identify the top 5 issues around sensors from the commercial sector that OCG could help address, e.g. diversity in supply, high costs, sub-standard factory quality and calibrations, OCG procurement best practices and advice, OCG-level brokering? etc. and discuss potential solution spaces. 2) discussion with industry about 2-way engagement – draft paper, to ease friction between implementers and manufacturers, grow market and efficiency through information exchange 3) recommending a cooperative arrangements/agreements with new commercial networks (see SO6) new technology/observing service companies to maximize access to ocean data while supporting commercial activities in the ocean observing enterprise, 4) Affordable ocean observation tools is one of the hindrance in developing sustaining ocean observation network by many new/ member states

Year 1 (2021-2022)

- MTS/GOOS industry dialogues initiated

Output / Impact: create an industry-implementers dialogue/ speed technology to market, raise quality of service, make cost savings, evolve feedback from users to industry, issues with sensors for deep ocean applications, Develop standards for sensors
Connection Actions:
Connection Decade:

SO	No	Other SOs	Action	Year	Lead	Partners	Resource	Dependencies	Action level
SO8	8.1	SO6	Speed integration new technology	1	OCG/OceanOPS	MTS, NOAA	Will be required if any 'forum' is developed of ongoing activity envisioned 0.25 FTE 2021/2022	Engagement being sufficiently valuable to industry and observing system	Single element

Mitigation: Dialogue – co-design

3 year

8.2 Clear directive on use of biomolecular approaches including eDNA to support biological EOVs
Lead: BioEco Panel
Plus:

Identify the role of eDNA in supporting existing EOVs and whether or not an additional EOV is required to adequately represent this technique. Close engagement with the community is required if eDNA is to develop appropriate standards, platforms and automation for global monitoring. Ideally this deliverable will be achieved through the existing participation of BioEco panel members on the scientific advisory panel for BOON.

Output / Impact: Agreed approach to incorporating eDNA data into biological EOVs
Connection Actions:
Connection Decade: Biomolecular Ocean Observing Network (BOON)

SO	No	Other SOs	Action	Year	Lead	Partners	Resource	Dependencies	Action level
SO8	8.2	SO1, SO4	Clear directive on use of eDNA to support biological EOVs	1-3	BioEco Panel	eDNA Network, POGO, SCOR, MBON, OmicBON	From BOON	Funding	Single element

Mitigation:
If BOON is unsuccessful in establishing as a program under (or external to) the Ocean Decade, alternative representative bodies of the marine biomolecular community will need to be identified.

5 year

SO9. Develop capacity to ensure a broader range of beneficial stakeholder participation.

1 year

9.1 Organize global online trainings on operational ocean monitoring and forecasting system
Lead**: ETOOFS**
Plus: GRAs

Organize a global online training on operational monitoring and forecasting system to support and promote the OOFS guide (action 4.1) and liaise with the large and diverse community of interested stakeholders. Two back-to-back workshops are foreseen, one for stakeholders willing to know more about the current capacity of ocean forecasting and one for experts eager to learn how to implement their own services based on ocean forecast capacities

Output / Impact: Awareness of ocean forecast capacities, capacity development for emerging centres, training material prepared by expert ready for other sessions

Connection Actions: 4.1 (ETOOFS Guide)
Connection Decade:

SO	No	Other SOs	Action	Year	Lead	Partners	Resource	Dependencies	Action level
SO9	9.1	SO1, SO4	Organize global online trainings on operational ocean monitoring and forecasting system	1	ETOOFS	Mercator, WMO, OceanPredict IODE/OTGA	0.5 FTE (Mercator) - year 2021	Mercator	Single element

Mitigation**:**

3 year

9.2 Enhance existing and develop new technical capacity building resources (including online)
Lead**:** BGC Panel
Plus: OOPC, BioEco Panel, OCG, GRAs, ETOOFS

A portfolio of proposed activities would include: developing a comprehensive online training package for sustained ocean observations starting with ocean acidification data QC product but gradually expanding into other elements of ocean observing value chain applied to key ocean phenomena (e.g. deoxygenation, air-sea fluxes). Lead structure: initially IOCCP with GOA-ON but later shifted to a dedicated capacity development entity (e.g. Ocean Teacher Global Academy) working with GOOS structures on a regular basis.

Output / Impact: ?/?
Connection Actions:
Connection Decade:

SO	No	Other SOs	Action	Year	Lead	Partners	Resource	Dependencies	Action level

SO9	9.2	SO6	Organize global online trainings on operational ocean monitoring and forecasting system	1-3	BGC Panel	IODE/OTGA IOC/OSS/GOA-ON	120K$ 2022 60K$ 2024 [60k$ for OA Online QC Tool 60K$ for 2-weeks hands-on training on BGC instruments and sensors for 30 students every 2 years]		Single element

Mitigation**:**

9.3 Implementing ocean monitoring and forecasting system with the engagement of GRAs
Lead**:** ETOOFS
Plus: GRAs

Engage with Member States at regional level, in particular SIDS and African countries on implementing ocean observing and forecasting systems

Output / Impact: Strengthened, integrated and harmonized observing and forecasting capacity of countries / GRAs. Increase visibility and engagement of GOOS, GRAs and partners
Connection Actions:
Connection Decade:

SO	No	Other SOs	Action	Year	Lead	Partners	Resource	Dependencies	Action level
SO9	9.3	SO1, SO4	Implementing ocean monitoring and forecasting system with the engagement of GRAs	1-3	ETOOFS	Mercator, WMO INFCOM, OceanPredict		Mercator and Member States	Single element

Mitigation:

9.4 Cross network integrated capacity development
Lead**:** OCG/OceanOPS
Plus: Core X-GOOS Coordination

Focused on objectives to increase observing capacity in less developed ocean observing countries, 2) support capacity development within networks. OCG Capacity Development Team developed vision and a plan involving at this stage regional pilot activities and more globally focused training webinars.

Output / Impact: targeted knowledge exchange / efficiency and increased participation
Connection Actions:
Connection Decade:

SO	No	Other SOs	Action	Year	Lead	Partners	Resource	Dependencies	Action level

SO9	9.4	SO6	Cross network integrated capacity development	1-3	OCG/OceanOPS	IODE/OTGA			Single element

Mitigation:

5 year

9.5 Partner with MBON, OBIS and WCMC on capacity exchange
Lead: BioEco Panel
Plus:

To advance EOV implementation and ensure availability of EOV data in global platforms. Including participation in C-GRASS (Coordinated Global Research Assessment of Seagrass Systems) Seagrass EOV implementation and global map, MBON Pole to Pole community of practice and knowledge exchange for the Americas region, and emerging efforts in Africa and Asia Pacific. Develop courses through IODE and continue engagement with MBON, OBIS and WCMC on capacity building through MBON Pole to Pole, EOV implementation workshops, and other regional and thematic activities, in partnership with IOC/OBIS and Ocean Teacher Global Academy

Output / Impact: Advance EOV implementation and ensure availability of EOV data in global platforms
Connection Actions:
Connection Decade: Marine Life 2030, Observing Together

SO	No	Other SOs	Action	Year	Lead	Partners	Resource	Dependencies	Action level
SO9	9.2	SO4	Partner with MBON, OBIS and WCMC on capacity exchange	1-5	BioEco Panel	MBON IODE/OBIS, IODE/ OTGA, UNEP WCMC	Project-based funding	Specific projects	Single element

Mitigation:

Essential to build a global observing network. Only mitigation is delay or delivery of (potentially non-standard) capacity development by external groups.

9.6 Ocean monitoring and forecasting system centre evaluation/assessment
Lead: **ETOOFS**
Plus:

Evaluate progress, impacts and performance of centres implemented in 9.4

Output / Impact: ?? / ??
Connection Actions:
Connection Decade:

SO	No	Other SOs	Action	Year	Lead	Partners	Resource	Dependencies	Action level
SO9	9.6	SO1, SO4	Ocean monitoring and	1-5	ETOOFS	WMO INFCOM	0.25 FTE/y ETOOFS from 2022	Mercator and Member States	Single element

			forecasting system centre evaluation/assessment						

Mitigation**:**

9.7 Capacity Exchange Materials and Workshops for Development or Expansion of GRAs
Lead**:** GRAs
Plus:

Year 1-2

- Develop and publish via Ocean Teacher Global Academy training modules for capacity building or capacity exchange with new or existing GRAs highlighting core activities of a GRA, Essential Ocean Variables to observe, opportunities to partner with existing GOOS components

Year 3-5 (2023-2025)

- Identify interested regions where coordination on GRA establishment or expansion is needed and develop a plan for capacity exchange
- Conduct workshop for African Member States aspiring to establish or contribute to a GRA
- Continue to develop virtual resources for Member States aspiring to form or join GRAs

Output / Impact: New or enhanced National systems and GRAs in Africa and other regions or specific Member States
Connection Actions:
Connection Decade: ObsCoDe

SO	No	Other SOs	Action	Year	Lead	Partners	Resource	Dependencies	Action level
SO9	9.7	SO1, SO2, S04	Capacity Exchange Materials and Workshops for Development or Expansion of GRAs	1-5	GRAs		1 FTE/yr from 2022 to develop material for workshop and virtual interface $50-100K for capacity exchange activities, module development, and workshops	African Member State and other regional or national interest	Single element

Mitigation**:**

9.8 Market and capability building for EOV reporting in support of the global biodiversity framework indicators and assessments
Lead: BioEco Panel
Plus:

Assess links with SO2 or if better placed there.

Market development for building need and capability for EOV reporting in support of the CBD post-2020 global biodiversity framework indicators, UN System for Environmental Economic Accounting Ecosystem Assessment (UN SEEA EA), and other relevant Multinational Environmental Assessments (MEAs)

The failure to stem or accurately measure the increasingly rapid declines in marine biodiversity across the globe are well recognised. One recent international policy development is the recognition of the need to monitor the change in status of important marine ecosystems/habitats/populations instead of (or in addition to) only monitoring the application of new management instruments. However, in most instances (coral reefs, fisheries and charismatic megafauna are possible exceptions) there is a market failure where scientists are not encouraged to develop the necessary sustained observing infrastructure and decision makers question whether data are sufficiently readily available for national reporting to global conventions. The BioEco panel currently works with the Secretariat to the CBD to support development of improved national reporting and with the UN SEEA EA to identify marine values that can be adopted for annual reporting by National Statistical Offices. If successful, then it is to be expected that these developments will be picked up for reporting by other MEAs including UN SDGs, RAMSAR, World Heritage, etc.

Output / Impact: global reporting capability / ability to understand CBD trends globally, mitigation, action etc
Connection Actions:
Connection Decade: Marine Life 2030

SO	No	Other SOs	Action	Year	Lead	Partners	Resource	Dependencies	Action level
SO9	9.8	SO4	Market and capability building for EOV reporting in support of the global biodiversity framework indicators and assessments	1-5	BioEco Panel	CBD, FAO, UNEP, ISA, MBON, IPBES, WOA	0.5 FTE and is permanent requirement + 35k travel	Official engagement with MEAs	Single element

Mitigation**:**

9.9 Co-development of biodiversity and marine habitat indicators with the business community
Lead: BioEco Panel
Plus:

Co-development for monitoring and reporting of biodiversity and marine habitat indicators with the business community, to improve investment confidence for the business community and their social license to operate. Investment opportunities in marine habitats and communities that can be measured with the biological EOVs are increasing. The UN Decade on Ecosystem Restoration results from the increasing community interest in marine restoration, especially in coastal areas, while the dire long-term prognosis for coral reefs under ocean warming is leading to a race for restoration options. Similarly, ensuring long-term benefits of a healthy ocean for society is the ultimate outcome expected for the UN Decade of Ocean Science for Sustainable Development. Agreed monitoring of the status and trends of marine life, habitats, and effectiveness of restoration activities will improve investor confidence and monitoring of investment returns. Adoption of the biology and ecosystem EOVs with their associated best practice and agreed standards would provide one of the more expedient approaches to track investment opportunities and returns consistently across the globe. Similar rationale applies to other areas where the global business (and/or non-profit communities) invest in marine activities where impacts need monitoring (deep sea mining, coastal and offshore renewable energy. etc.). Recognition of the value of EOVs to promote consistent environmental reporting by international authorities (eg. ISA for deep sea mining, DOALOS in BBNJ negotiations, national environment agencies) would lead to improved environmental monitoring and the ability to aggregate reports from individual operators to address regional and cumulative impacts. Agreed and consistent monitoring and reporting standards would improve maritime industries' social license including through an increased ability to mitigate and offset unavoidable impacts.

Output / Impact: Improved investor confidence, ongoing need for EOV monitoring to measure performance of investments in marine protection, restoration, blue carbon and sustainable development
Connection Actions:
Connection Decade: ObsCoDe, Marine Life 2030

SO	No	Other SOs	Action	Year	Lead	Partners	Resource	Dependencies	Action level
SO9	9.9	SO4	Co-development of biodiversity and marine habitat indicators with the business community	1-5	BioEco Panel	ISA, DOALOS, IMO, MBON	0.5 FTE/yr from 2023 + 35k travel		Single element

Mitigation:

9.10 Observing Together - GOOS Ocean Decade Programme

Lead: Core X-GOOS Coordination
Plus: OCG, ETOOFS, GRAs

Connection Actions:
Connection Decade: CoastPredict, ObsCoDe

SO	No	Other SOs	Action	Year	Lead	Partners	Resource	Dependencies	Action level
SO9	9.10	SO7, SO8, SO9	Observing Together - GOOS Ocean Decade Programme	1-5	X-GOOS Core	IODE/OBPS, CoastPredict, IODE/OTGA, Marine Life 2030	375M$		X-GOOS Decadal

SO10. Extend systematic observations to understand human impacts on the ocean.

1 year

3 year

10.1 Establish global coordination for IMDOS
Lead: BGC Panel
Plus: OCG/OceanOPS

Establish and implement an Integrated Marine Debris Observing System in GOOS

Output / Impact: Marine (Plastics) Debris EOV Specification Sheet / IMDOS approved as a GOOS Project and work on implementation
Connection Actions:
Connection Decade: ObsCoDe

SO	No	Other SOs	Action	Year	Lead	Partners	Resource	Dependencies	Action level

SO10	10.1	SO6, SO7	Establish global coordination for IMDOS	1-3	X-GOOS Core	IUNEP, GEO Blue Planet, NASA, ESA, GESAMP	1 FTE from mid 2022		Single element

Mitigation:

5 year

10.2 Incorporate/link to the human pressure indices
Lead: BioEco Panel/GOOS SC
Plus: Core X-GOOS Coordination

Monitoring ocean health is one of the three major deliverables of GOOS. Existing biological EOVs focus on the state and trends of priority marine habitats, communities, and species. While significant on their own, improved use of the biological EOVs will arise when changes in status and trends can be attributed to particular human activity(ies). The lack of comprehensive data on marine human impacts was noticeable in a recent review of monitoring data to support the marine component of the CBD post-2020 global biodiversity framework.

Attribution requires the collection of trends in the scale and intensity of human activities such as fishing, transport, energy, recreation, pollution and ocean warming. The GOOS community has started to look at some of the human impact variables that require improved monitoring (e.g. marine debris and one component of the ocean sound EOV), but there are many other human impacts that are not recognised as EOVs. Monitoring of some human activities is already well established (eg. commercial fisheries, oil and gas developments, shipping), others have active communities that need support to develop ongoing monitoring (e.g. light pollution, coastal infrastructure), while others are currently struggling to provide useful information (e.g. pollution, invasive species).

This review of availability of marine human impact data is required to guide the GOOS community in identifying their role in supporting further development of these data as EOVs.

The Ocean Health Index is a comprehensive framework used to measure ocean health from global to local scales (http://www.oceanhealthindex.org/methodology/components). Importantly, the data underlying the highly aggregated index are increasingly used as the standard in examining human impacts on the ocean. The first deliverable under SO10.2 will be to work with the National Center for Ecological Analysis and Synthesis (NCEAS) of University of California Santa Barbara, which developed the Ocean Health Index, to identify the pros and cons of l developing a new class of human pressure EOVs.

Activities in years 3-5 will be determined following consideration of this review by the GOOS Steering Committee

Year 1-2 (2021-2022)
BioEco will collaborate with NCEAS and others to provide a recommendation to the SC on whether or how GOOS could incorporate human pressure EOVs.

Year 3-5 (2023-2025)
Depending on the outcome of a review, GOOS exec sets up governance structure and funding to develop human pressure EOVs.

Output / Impact: potential new human pressure EOVs / expand relevance of GOOS to society, especially in area of Ocean Health
Connection Actions:
Connection Decade: ObsCoDe, Marine Life 2030

SO	No	Other SOs	Action	Year	Lead	Partners	Resource	Dependencies	Action level
SO10	10.2	SO6, SO7	Incorporate/link to the human pressure indices	1-5	BioEco Panel	NCEAS	1 FTE/yr 2021 - 2023 0.5 FTE 2024/5 + 25k/yr travel	Interest among parties and uptake of new outputs by others	Multi element

Mitigation:

SO11. Champion effective governance for global in situ and satellite observing, together with partners and stakeholders

1 year

3 year

11.1 GOOS Structure evaluation and evolution

Lead: Core X-GOOS Coordination
Plus: GOOS SC

GOOS SC to discuss the findings of a commissioned report on support infrastructure, the GOOS Implementation Plan and Ocean Decade Programmes. A GOOS TT to examine GOOS structure, develop scenarios and examine pros and cons, in light of the GOOS mission in the 2030 Strategy, and building on GOOS unique advantages and strengths, and the needs of the organisation moving forward with the Implementation Plan.

Output / Impact: Report for SC to consider /evolution to a more fit for purpose GOOS structure to deliver on the 2030 Strategy

Connection Actions:
Connection Decade:

SO	No	Other SOs	Action	Year	Lead	Partners	Resource	Dependencies	Action level
SO11	11.1	All	GOOS Structure evaluation and evolution	1-3	X-GOOS Core				X-GOOS major

Mitigation:

11.2 GOOS Governance evolution

Lead: Core X-GOOS Coordination

Plus: GOOS SC

GOOS SC to discuss the findings of a commissioned report on support infrastructure and GOOS governance.

Output / Impact: Report for SC to consider / evolution to a more fit for purpose GOOS governance to support inward investment and to deliver on the 2030 Strategy

Connection Actions:
Connection Decade: ObsCoDe

SO	No	Other SOs	Action	Year	Lead	Partners	Resource	Dependencies	Action level
SO11	11.1	All	GOOS Governance evolution	1-3	X-GOOS Core	IOC, WMO, UNEP, ISC	25K$ in 2021, 50K$/yr for 2022 - 2023, 25K$ in 2024 to run the project/TT or whatever is set up - likely a senior consultant		X-GOOS major

Mitigation:

5 year

11.3 Develop a GOOS Funding Team
Lead: Core X-GOOS Coordination
Plus:

GOOS Implementation Plan and Ocean Decade Programmes, how we resource GOOS for the future. There are examples where a resourcing focused team has functioned. Sources include foundations/philanthropists, commercial partnerships, EU/government. To attract funding, GOOS delivery and reporting will need some work, plus GOOS will learn something about engagement with funders through the Decade.

Year 1-2 (2021-2022)

- Analyse findings of commissioned report on support infrastructure, discuss what GOOS needs to do to provide attractive funding projects
- Look at the TORs and scope of a GOOS resourcing team, focused on developing relationships for resourcing GOOS projects to enhance the observing system coordination (SC-9 action).
- Learn from Ocean Decade fund raising experience

Output / Impact: TORs for SC to consider/increased funding for GOOS led initiatives
Connection Actions:
Connection Decade:

SO	No	Other SOs	Action	Year	Lead	Partners	Resource	Dependencies	Action level
SO11	11.3	All	Develop a GOOS Funding Team	1-5	X-GOOS Core		1 FTE 2022-2023, 2 FTE 2024 - 2025		X-GOOS major

Annex 2: Detail on the actions and which element is leading

SO	Num.	Action	Core Coord	OOPC	BGC	BioEco	OCG/ Ocean OPS	GRAs	ETOOFS	GOOSSC	Projects
SO1	1.1	GRA assessment for forecasts and services						LEAD			
SO1	1.2	Partnerships for delivery	LEAD			LEAD			LEAD		
SO2	2.1	Value of Ocean Observations Project	LEAD								
SO2	2.2	GOOS Communications Plan	LEAD								
SO2	2.3	GOOS National Focal Point role developed	LEAD								
SO2	2.4	Evolve Ocean Observing System Report Card					LEAD				
SO3	3.1	Network status reporting				LEAD	LEAD				
SO3	3.2	Observing System evaluation and metrics					LEAD				
SO3	3.3	Ocean Forecast evaluation and metrics							LEAD		
SO3	3.4	Global map of ocean forecasting systems							LEAD		
SO3	3.5	Develop an interactive map of networks and metadata for biological monitoring				LEAD					
SO3	3.6	Global Ocean Indicators Framework		LEAD							
SO3	3.7	Observing System Co-Design (ObsCoDe)	LEAD								
SO4	4.1	Toolkit/Guide on Operational Ocean and Monitoring and Forecasting Systems							LEAD		
SO4	4.2	Data Integration Products Across GRAs						LEAD			
SO4	4.3	Establish and promote a GOOS product and services portfolio for Ocean Forecasting centres							LEAD		
SO5	5.1	Essential Ocean / Climate Variables Stewardship & GCOS		LEAD							
SO5	5.2	GOOS EOV Review	LEAD								
SO5	5.3	Observing System Evaluation and Reviews									
		5.3.1 Strategy for Ocean Heat and Freshwater Cycles		LEAD							
		5.3.2 Observing System Evaluation and Strategy for the Ocean-Atmosphere Interface and Boundary Layers		LEAD							
		5.3.3 Observing System Evaluation and Strategy for Boundary Systems		LEAD							
		5.3.4 Optimal carbon flux observing system blueprint			LEAD						
SO5	5.4	GOOS Evaluation and Review Framework		LEAD							
SO5	5.5	Regional network coordination/OO19 synthesis		LEAD							
SO5	5.6	Observing System Design around EOVs	LEAD		LEAD						

SO6	6.1	Implementation of multidisciplinary initiative VOICE			LEAD						
SO6	6.2	GOOS Endorsed Best Practices available across EOVs and platforms					LEAD				
SO6	6.3	Ocean Observations in EEZs	LEAD								
SO6	6.4	Emerging and existing network integration					LEAD				
SO6	6.5	Develop and/or maintain an up to date referenced hardware directory			LEAD						
SO6	6.6	Advancing BGC/BioEco observations across global networks			LEAD						
SO6	6.7	Environmental Stewardship					LEAD				
SO6	6.8	Inter-comparison and standards			LEAD						
SO6	6.9	Coordinate and expand surface ocean biogeochemistry observations			LEAD						
SO6	6.10	CoastPredict	LEAD								
SO6	6.11	Building the BioEco community				LEAD					
SO7	7.1	Data Flow mapping OCG networks					LEAD				
SO7	7.2	Metadata standardisation global networks					LEAD				
SO7	7.3	First user interface for biological EOV data on OBIS				LEAD					
SO7	7.4	Support a Global Data Assembly Centre for BGC EOVs			LEAD						
SO7	7.5	OCG Data Strategy					LEAD				
SO7	7.6	Establish OpenGTS Prototype					LEAD				
SO7	7.7	Description of production & dissemination standards for Ocean Forecasting Systems							LEAD		
SO7	7.8	BioEco EOV data available through OBIS				LEAD					
SO7	7.9	Create new and sustain existing BGC data synthesis products			LEAD						
SO8	8.1	Speed integration new technology					LEAD				
SO8	8.2	Clear directive on use of biomolecular approaches including eDNA to support biological EOVs				LEAD					
SO9	9.1	Organize global online trainings on operational ocean monitoring and forecasting system							LEAD		
SO9	9.2	Enhance existing and develop new technical capacity building resources (including online)			LEAD						
SO9	9.3	Implementing ocean monitoring and forecasting system with the engagement of GRAs							LEAD		
SO9	9.4	Cross network integrated capacity development					LEAD				
SO9	9.5	Partner with MBON, OBIS and WCMC on capacity exchange				LEAD					
SO9	9.6	Ocean monitoring and forecasting system centre evaluation/assessment							LEAD		
SO9	9.7	Capacity Exchange Materials and Workshops for Developments or Expansion of GRAs						LEAD			

SO9	9.8	Market and capability building for EOV reporting in support of the global biodiversity framework indicators and assessment				LEAD					
SO9	9.9	Co-development of biodiversity and marine habitat indicators with the business community				LEAD					
SO9	9.10	Observing Together	LEAD		LEAD						
SO10	10.1	Establish coordination Integrated Marine Debris Observing System			LEAD						
SO10	10.2	Incorporate/link to the human pressure indices				LEAD				LEAD	
SO11	11.1	GOOS Structure evaluation and evolution	LEAD								
SO11	11.2	GOOS Governance evolution	LEAD								
SO11	11.3	Develop a GOOS Resourcing Team	LEAD								

Annex 3: Theory of Change and the GOOS IP Process

Looking at the Theory of Change (not in vast detail but from the useful documents that Nic Bax provided), the following could be useful:

The theory of change is a useful guide to for influencing change in a societal/collective state - it asks the proponent of the change to consider what the situation, barriers to success, go/no go points, and not just the specific action and outcome, but how to achieve the right influence with this for the desired change - all useful

One can recognise much in the Theory of Change, as a mix of business strategy and 101 sales and marketing (particularly for B2B, but not only). Another area that has similar ideas is the stakeholders analysis/work with Eurosea. In general, this is all drawing from the same concepts for analysis. We are using business strategy and elements of sales theory in this Implementation Planning (we can use more but that will depend on appetite and time), so I think we are on the right track.

The Theory of Change documents looked at took a very end-to-end approach and did not seem to embody cycles and feedback. In general, using off the shelf or 'cookie cutter' formats, can mean going through unnecessary hoops and perhaps losing sight of the key points to the questions in hand along the way. I prefer to take the principals of strategy, and sales and marketing, and apply what is needed for the situation, with the addition of any extra ideas that come from reading or re-reading along the way. For example the Theory of Change asks you to note the roles of partners and I think that would be a useful addition.

The Theory of Change looks like it is most useful for policy/opinion, community change, and with this implementation plan we are building, selling and influencing. However I do think that it could be a useful concept for some of the specific actions - for example looking at effecting change towards more sustained funding sounds like a good exercise for his approach, communications, partnership for policy change, could all be areas that could benefit from using some of the ideas in this process.

In summary, this is an interesting topic and if we (GOOS) want to take some time to look a little at the basics of strategy, sales and marketing and Theory of Change and discuss how they can be used in our work, it would likely be time well spent.