SCOR Annual Meeting 2024

16-18 October 2024

Qingdao, China
Shangri-La Hotel Qingdao (Hybrid Format)
Function Room 22 (City wing, level 2)

https://scor-int.org/events/scor-2024-annual-meeting/

Block Agenda

	Tues, 15 October	Wed, 16 October	Thurs, 17 October	Fri, 18 October
AM	SCOR Executive Committee Closed Meeting	Opening of 2024 meeting: Reports from SCOR President, SCOR Executive Director, SCOR Capacity Development Committee, ad hoc Finance Committee	Reports from current SCOR Working Groups and projects (remote presenters)	Reports from SCOR Partner Organizations Meeting Summary
PM	Symposium in recognition of the 40th anniversary of the SCOR China-Beijing National Committee	Discussion of new working group proposals Reports from affiliated organizations	Reports from current SCOR Working Groups and projects (remote, in person, and recorded presenters) Reports from Affiliated Projects	SCOR Executive Committee Closed Meeting

SCOR Annual Meeting Day 1. Wednesday, 16 October 2024.

Chair: Sinjae Yoo / Note taker: Peter Croot

Time	Topic	Presenter
9:00	Welcome and introduction to agenda In Memoriam	Yoo
9:15	Report from SCOR President	Yoo
9:30	Report from SCOR Executive Director	Twigg
9:45	Report from SCOR Capacity Development Committee	Zitoun
10:00	Results of the election for SCOR Officers (proposed slate) Announcement of Co-opted member selections	Sicre
10:15	Report from the SCOR ad hoc Finance Committee	Zhang
10:30	**BREAK (30 minutes)**	
11:00	***Presentation of new Working Group proposals*** Each presentation will be 12 minutes, plus 3 min for questions. Data Insight through the Value of Eco-marine-robotics (**DIVE**) [Proposal] DYNamic Approaches for assessing Marine biota responses to changing OXyscape (**DynamOx**) [Proposal] Gas hydrates Multiple Effect in the Ocean (**GasMEO**) [Proposal] Global Integration of Seabird Time Series (**GISTS**) [Proposal] Towards best practices for Measuring and Archiving Stable Isotopes in Seawater (**MASIS**) [Proposal] Global environmental risks of underwater acoustic data signalling: recommendations for a biofriendly underwater Internet of Things (**SAFE-uIoT**) [Proposal] Oceanic Salt Intrusion into Tidal Freshwater Rivers (**SALTWATER**) [Proposal] Bubble-mediated Air-Sea Exchange of climate-relevant and environmentally important gasses (**SCORsASE**) [Proposal]	 Moran Sicre Flossmann Yoo Croot Gobin van Haren Peeken
13:00	**LUNCH (60 minutes)**	
14:00	***Ranking and discussion of new Working Group proposals***	SCOR Executive and National Committees
15:30	**BREAK (30 minutes)**	
16:00	***Affiliated organizations reports*** IABO – Biological Oceanography IAPSO – Physical Oceanography IAMAS – Meteorology and Atmosphere InterRidge	 Gobin van Haren Flossmann Lee/Cheah
17:00	**Adjourn for the day**	
17:30	**Dinner at Shangri-La Hotel – Hosted by SCOR-China**	

SCOR Annual Meeting Day 2. Thursday, 17 October 2024.

Chair: Sinjae Yoo / Note taker: Peter Croot

Time	Topic	Presenter / EC liaison
9:00	**Introduction to Day 2 session** *Most* working group and project presentations will be **5-8 minutes**, followed by time for questions following each presentation and comments/recommendations by EC liaison. A few partner presentations will take place today rather than Day 3 to accommodate time zone differences.	Yoo
9:10	***Group 1. Working groups disbanded since the 2023 annual meeting*** WG 148 IQuOD WG 153 FLOTSAM WG 155 EBUS	Twigg
9:15	***Group 2. Presenters joining remotely from the Americas*** IIOE-2 – Second International Indian Ocean Expedition IQOE – International Quiet Ocean Experiment GlobalHAB – Global Harmful Algal Blooms JCS – IAPWS/SCOR/IAPSO Joint Committee on Seawater WG 163 CIce2Clouds	 Hood/Sicre Tyack & Recording/Cheah Anderson/Yoo Pawlowicz/van Haren Willis, Steiner/Croot
10:20	***Group 3. Presenters joining remotely from Australia*** SOOS – Southern Ocean Observing System WG 170 PRIMO	 Hancock/Cheah Strzepek/Peeken
10:45	**BREAK (30 Minutes)**	
11:15	***Group 4. Presenters on site*** GEOTRACES – Trace elements and isotopes SOLAS – Surface Ocean-Lower Atmosphere Study IMBeR – Integrated Marine Biosphere Research Project	 Tagliabue/Croot Li/Flossmann Liu/Aliani
12:00	***Group 5. Recorded Presentations*** COBS – Changing Ocean Biological Systems WG 157 MetaZooGene WG 158 C-GRASS WG 162 OASIS WG 164 ConCENSUS	 Recording /Yoo Recording/Gobin Recording /Aliani Recording/Peeken Recording/Gobin

13:00	**LUNCH**	
14:00	***Group 5. Recorded Presentations, Continued***	
	WG 168 4D-BGC	Recording/Cheah
	WG 169 GLUBS	Recording/Croot
14:20	***Group 6. Presenters joining remotely from Europe***	
	IOCCP – International Ocean Carbon Coordination Project	Telszewski/Moran
	WG 165 MixONET	Mitra/Peeken
	WG 166 DMS-PRO	Galí, Hopkins/Peeken
14:50	***Partner organization updates, Part 1***	
	IOC– Intergovernmental Oceanographic Commission of UNESCO	Isensee/Sicre
	ISC – International Science Council	McBride/Sicre
15:15	**BREAK (30 Minutes)**	
15:45	***Group 6. Presenters joining remotely from Europe, Continued***	
	WG 160 ATOMIX	Lenn/van Haren
	WG 161 ReMO	Robinson/Gobin
	WG 167 RUSTED	Perron/Sicre
16:15	***Partner organization updates, Part 2***	
	GESAMP WG 38 – Atmospheric Input of Chemicals to the Ocean	Jickells/Aliani
	POGO – Partnership for Observation of the Global Ocean	Krug/Aliani
17:00	**Adjourn for the day**	
17:30	**Dinner at Shangri-La Hotel (Flying Catch restaurant) – Hosted by international SCOR**	

SCOR Annual Meeting Day 3. Friday, 18 October 2024.

Chair: Sinjae Yoo / Note taker: Peter Croot

Time (am)	Topic	Presenter / EC liaison
9:00	**Introduction to Day 3 session** Presentations will be **5-8 minutes**, plus time (~2-5 minutes) for questions following each presentation.	Yoo
9:10	***International Science Projects***	
	BioGeoSCAPES	Saito
	IOCCG – International Ocean Colour Coordination Group	Recording/Yoo
9:30	***Partner organization updates, Part 3***	
	PICES – North Pacific Marine Science Organization	

	WCRP/CLIVAR – World Climate Research Programme Future Earth/OceanKAN SCAR – Scientific Committee on Antarctic Research	Chiba/Moran Santoso/Flossmann Recording/Twigg Recording/Peeken
10:15	**BREAK (15 minutes)**	
10:30	**Future SCOR meetings:** • Santa Marta, Colombia 2025: Presentation by host committee • Helsinki, Finland 2026 • Call for host in 2027	Ricuarte
10:45	**Summary of recommendations and close of general meeting**	Yoo
11:00	**Meeting Adjourns**	

SCOR Annual Meeting 2024
ANNOTATED AGENDA

Tab 1 - Opening topics

1.1. Welcome and Introduction to the agenda - Yoo

Welcome to the annual meeting of the SCOR annual meeting. Thank you to the hosts from the China-Beijing Committee and the First Institute of Oceanography located here in Qingdao, China. We will have participants from national committees, working groups, projects, and partners meeting in person in Qingdao as well as online from many time zones. The purpose of the annual meeting is for SCOR to select new working groups to fund, to receive updates and provide recommendations or advice to working groups and projects, and to hear about the activities of partner organizations. These presentations also provide an opportunity for the SCOR community to learn more about the activities of the SCOR activities and partners.

The agenda and written reports and presentations are available to review in advance of the meeting on the annual meeting webpage (https://scor-int.org/events/scor-2024-annual-meeting/). Most presentations will be 10 minutes including presentation and Q&A. In some cases, reports will be made via recording or via the SCOR Executive Committee monitor.

In Memoriam – Obituary for scientists involved with SCOR

SCOR will honor the contributions of the ocean scientists lost to the community since the last annual meeting. SCOR acknowledges that the list may not be comprehensive due to the difficulty of tracking the almost three thousand scientists who have been involved in SCOR.

Dr. Robert Fournier (Canada) – 1 December 2023
Robert (Bob) Fournier served as Secretary of SCOR from 1986 to 1992. He was professor emeritus of ocean studies at Dalhousie University at the time of his passing. According to a memoriam by Dalhousie, he was also passionate about outreach and communicating science to the public. Having made an estimated 2,500 appearances on CBC radio and television since 1974, Dr. Fournier helped educate a generation of listeners and viewers on a wide range of scientific topics.

Dr. Steven Vaughn Smith (United States) – 14 April 2024
Dr. Steven Vaughn Smith was emeritus professor at University of Hawai‘i at Mānoa. After retiring in 2003, he also spent time at Centro de Investigación Científica y de Educación Superior de Ensenada (CICESE) in Mexico. Smith was trained as a carbonate geochemist; and his early research focused on coral reefs. He became interested in the biogeochemistry of ecosystems, particularly their roles as net consumers or producers of atmospheric carbon dioxide. Smith was a full member of SCOR WG 62: Carbon Budget of the Ocean (1978), and an associate member of WG 104: Coral Reef Responses to Global Change: The Role of Adaptation (1994). He was a

leader in the International Geosphere-Biosphere Program (IGBP), developing a standardized protocol that allowed reliable comparisons between ecosystems.

Dr. Joris Gieskes (United States) – 19 May 2024
Dr. Joris Gieskes was a marine chemist affiliated with the Scripps Institution of Oceanography for 60 years. After formally retiring in 2004, he continued to be active organizing lectures and contributing to research. He was inducted as an American Geophysical Union Fellow in 2018. He was chair of SCOR WG 10: Oceanographic Tables and Standards (joint with ICES, IAPO [now IAPSO], and UNESCO), which was reconstituted as the Joint Panel on Oceanographic Tables and Standards (JPOTS). Gieskes was an expert in the geochemistry of sediments and pore water.

Dr. S. Kim Juniper (Canada) – 7 June 2024
Dr. S. Kim Juniper was professor in the School of Earth & Ocean Sciences and the Department of Biology at the University of Victoria, the British Columbia leadership chair in ocean ecosystems and global change, and chief scientist for Ocean Networks Canada. Juniper was a member of SCOR WG 99: Linked Mass and Energy Fluxes at Ridge Crests (1993-1997). He was active in multiple international ocean science initiatives, including the Canadian Healthy Oceans research network (CHONe), the Partnership for Observation of the Global Ocean (POGO), OceanObs'19 and OceanObs Next, the North Pacific Marine Science Organization (PICES), the European Marine water Column and Seafloor Observatory (EMSO-ERIC), and served as an advisor to the International Seabed Authority. He had leadership roles in Canadian marine research networks including the Canadian mid-ocean ridge research network (CanRidge; 1993–1996), Canada's contribution to the Joint Global Ocean Flux Study (JGOFS; 1995–1999), the NEPTUNE Canada cabled observatory network (2000–2011), the Canadian Healthy Oceans Network (2008–2024), and Ocean Networks Canada (2011–2024).

A minute of silence will be observed at the annual meeting.

1.2. Report of the SCOR President - Yoo

During the past year, SCOR has supported and managed various SCOR activities thanks to the efforts of its Executive Director and Executive Committee. I am pleased to report to you that SCOR is making every effort to advocate ocean science. As for myself, I gave talks introducing SCOR to some Korean institutions: Advanced Institutes of Convergence Technology in February, the Korean Society of Hydrology in June, and the Korean Academy of Marine Science in September. In April 2024, the 2nd UN Ocean Decade Regional Conference & 11th WESTPAC International Marine Science Conference was held in Bangkok, where I attended and gave a talk. I attended the 57th Executive Session of the IOC held in June 2024 in Paris. During the meeting, IOC and SCOR discussed how to further the cooperation between the two organizations. In the IOC Assembly, SCOR made a statement that it will keep supporting the Ocean Decade through its working groups, and large-scale and infrastructural projects. You would remember that the International Year of Basic Sciences for Sustainable Development (IYBSSD), of which SCOR was a part, had been completed successfully last year. The Earth and Humanity Coalition, an UN Decade initiative and an outgrowth of IYBSSD has been initiated this year. SCOR is a member of this. Lastly, the panel of External Review of PICES (North Pacific Ocean Science Organization), in which I have

been participating, has completed and submitted its report. The report assesses the PICES achievements and makes recommendations for the future directions of the ocean science organization.

1.3. Report of SCOR Executive Director - Twigg

The Executive Director will provide an overview of the activities conducted under SCOR based on the reports received in advance of the annual meeting, as well as the activities of the Secretariat.

1.4. SCOR compiled capacity development activities - Zitoun

SCOR capacity development activities include a visiting scholar program, the POGO-SCOR fellowships, travel support to scientists from developing countries to attend meetings and conferences, and the Regional Graduate Networks in Oceanography. Additional capacity development activities are carried out by the SCOR projects through Summer Schools. The 2024 activities under these programs will be reviewed at the annual meeting.

SCOR also builds capacity through the encouragement of early-career and developing-country scientists in SCOR working groups and projects.

1.5. Results of the election for SCOR Officers - Sicre

The SCOR President and all three Vice-President positions (including one available for re-election) were open for nominations for the 2024 elections. The Nominating Committee was chaired by Past President Marie Alexandrine Sicre and with Dan Costa (USA), Alessandro Tagliabue (UK), and Jing Zhang (Japan). Upon nomination of a candidate from Japan, Zhang was resigned from the committee to avoid a conflict of interest in the final selection process. The members reviewed the nominations, prepared a final slate of candidates, and confirmed their availability to serve in the SCOR Executive Committee. The slate of candidates was sent to all nominated members for their comment and/or approval.

Action: Confirm approval of slate of officers proposed by the Nominating Committee.

1.6. Report of the 2023 ad hoc Finance Committee - Zhang

The ad hoc Finance Committee is comprised of nominated members who do not serve on the Executive Committee. Fatima Abrantes (Portugal), Petteri Uotila (Finland), Daniel Weihs (Israel), and Jing Zhang (Japan) compose the 2024 committee. Zhang will report on their task to (1) review the 2023 auditor's report of SCOR's Finances, (2) review the final 2023 budget, (3) consider approval of the 2024 revised budget, (4) consider approval of the 2025 draft budget (including recommending how many working groups can be selected in 2024), and (5) determine dues increases for 2026.

Action: Approve the report of the ad hoc Finance Committee.

Tab 2 - Working Groups

2.1. New Working Group proposals

2.1.1. Data Insight through the Value of Eco-marine-robotics (DIVE) – Moran

Summary: New robotic platforms significantly enhance ocean observations and can fill crucial data gaps-near shore, off-shore, in the deep sea, near and under ice-as they can reach some of the most remote areas of the planet. However, these platforms and the data they acquire are missing a fundamental element that is hindering their uptake into the global ocean observational system: clear FAIR (Findable, Accessible, Interoperable, Reusable) data policies. The primary outcomes of observational oceanographic missions are data and physical samples, but data policies applied in ocean sciences are not fully adopted by the marine robotics community, possibly compromising the quality of the data and limiting its broad use. This is because of the lack of data standards in marine robotics research. DIVE aims at advancing best practices used in marine sciences data management and at ensuring their implementation on behalf of the marine robotics community. These practices include categories such as mission planning strategies, operational procedures, sensor configurations, data formats and post processing standards. Within these categories, there will be instances of calibration and logging requirements, as well as data treatment and processing protocols, and finally metadata attribution and dataset publication guidelines. Marine robots capabilities and the needs of oceanographic observations are continuously evolving; this co-evolution poses a considerable challenge when establishing comprehensive data and observational standards. Ultimately, DIVE wants to explore existing standards that can be harmonised and established within internationally recognised bodies such as ISO (International Organization for Standardization) or IEEE (Institute of Electrical and Electronics Engineers).

Action: Consider as new SCOR working group.

2.1.2. DYNamic Approaches for assessing Marine biota responses to changing OXyscape (DynamOx) – Sicre

Summary: Deoxygenation is predicted to worsen over the next decades which will affect marine life, especially in coastal habitats. Deoxygenation will lead to loss of biodiversity and ecosystem services, exacerbating the already detrimental effects of rising temperature, acidification, and pollution. The dynamic nature of oxygen availability in marine ecosystems is however not yet considered in correctly predicting the responses by marine species and adaptation by communities. The DynamOx (DYNamic Approaches for assessing Marine biota responses to changing OXyscape) will bring together experts to advance research on oxygen dynamics in marine systems, providing standards for empirical research which will develop new actions for the effective management against deoxygenation. Specifically, DynamOx will (i) quantify the extent oxygen fluctuation in shaping the marine benthic communities physiology and ecological interactions, (ii) provide guidelines for appropriate 'mimicry' of oxygen environmental variability in controlled dynamics laboratory experiments, and (iii) implement mechanistic models to account for organismal variation in oxygen fluctuating environment. Additionally, DynamOx will (iv) develop a set of new indicators to capture the ecological relevant oxygen variability and provide guidance on environmental oxygen logging and, analysis. Lastly, DynamOx will (v) interact directly with society, policy-makers and science communicators to produce science-based and media outputs to realistically portray the role of oxygen fluctuations in shaping marine life under a changing ocean. By

providing concrete evidence produced by qualified experts, DynamOx will create an interdisciplinary framework needed to build a new narrative for the ocean under the threat of deoxygenation.

Action: Consider as new SCOR working group.

2.1.3. Gas hydrates Multiple Effect in the Ocean (GasMEO) – Flossmann

Summary: GasMEO WG is the Arctic-Asian-Indo-Pacific interregional geoscientific WG aiming to improve oceanfloor's gashydrate system understanding in view of changing Ocean and its relations to the key Ocean processes including vision of UN Ocean Decade for sustainable development by the consolidation international efforts for research ocean gashydrates within the Ocean Geo- and Ecosystems and enable their sustainable monitoring and exploitation. The overall objective of the WG is the transformative considering geomapping and gashydrates manifestations data sharing by the science-based strategy to provide open asses of the nonconventional gashydrates and their effects to the multiple Ocean phenomena.

Action: Consider as new SCOR working group.

2.1.4. Global Integration of Seabird Time Series (GISTS) – Yoo

Summary: Building upon previous successful projects that began to integrate biological time series across the globe, we will design and implement a SCOR-supported working group to enhance global seabird science by: i) harmonizing datasets on a global scale, (ii) developing priorities and recommendations for future research, with a focus on key questions and long-term monitoring, iii) engaging in outreach activities to connect researchers from regions not yet included in global analyses into the wider community of seabird science, and iv) building capacity for future global integrations of seabird data by engaging early career ocean professionals (ECOP). In a rapidly changing marine environment, there is an increasing recognition of seabirds as ecological indicators of the stability and function of ocean ecosystems. Our proposed SCOR working group will formalize a group of scientists currently collaborating on global seabird meta-analyses (e.g., Sydeman et al. 2021) which are prioritizing the characterization of environmental impacts on seabird reproductive trends.

Action: Consider as new SCOR working group.

2.1.5. Towards best practices for Measuring and Archiving Stable Isotopes in Seawater (MASIS) - Croot

Summary: The stable isotopic composition of seawater and the carbon isotopic composition of dissolved inorganic carbon are essential ocean tracers that have been widely measured since the 1960s. They fingerprint current changes in the hydrological and bio-geochemical cycles, as well as anthropogenic carbon penetration. However, substantial issues of data collection, quality control, and compilation have amplified: common reference materials in seawater are not available; analysis methods have strongly diversified; regular intercomparison exercises are lacking; and, as a result, large differences exist between data sets. These differences if they persist will hinder the community effort from making full use of stable isotopes to identify climatic changes. This working group intends to remedy the current

issues of data collection, quality control, and compilation of stable isotopes in seawater, as well as to improve international networking and a varying degree of national capacity. We will assess the validation stage of the available datasets, as well as corresponding metadata and where and how they are communicated. This effort will lead to a report of best practices from sample collection to measurement and quality control, and will include recommendations on reference materials. We will review current methods for bias adjustment in archives and make recommendations to standardize these bias adjustments and work towards complementing existing databases. In parallel, the working group will promote intercomparison exercises, and will actively carry out capacitybuilding, as the measurements techniques are now widely available and at a cost that is accessible to a larger number of countries and research institutions.

Action: Consider as new SCOR working group.

2.1.6. Global environmental risks of underwater acoustic data signalling: recommendations for a biofriendly underwater Internet of Things (SAFE-uIoT) – Gobin

Summary: Underwater data communications are increasingly important for ocean science, supporting widespread use of remote and autonomous systems and sensors. Acoustic modems transmit and receive data over useful ranges underwater, as opposed to light or radio waves which are absorbed rapidly. High-rate digital communications are a norm in modern society, and international and national standards committees (ISO/IEC JTC1/SC41/WG7) are currently developing new standards for a future 'underwater Internet of Things' (uIoT). Global deployment of uIoT will entail a new input of sound into an already noisy underwater environment, leading to degradation and possible loss of habitat to marine animals, and potential impacts on human divers. To enable a sustainable uIoT system for the future, uIoT standards need to prioritize reduction of possible negative impacts of widespread use of modem sounds, shown to be aversive to seals and porpoises in captive studies. The interlinking aims of SAFE-uIoT are to assemble a uniquely skilled group of global experts to quantify the risk of negative effects to animals and humans from underwater modem networks, to engage with the standards committees to develop a bio-friendly uIoT, and to detail a longer-term research strategy to address critical knowledge gaps. The work will engage diverse international expertise and coordinate closely with existing ISO standards committees to support development of a minimally impactful (and therefore sustainable) uIoT for data signalling to support ocean science. The work will advance our understanding of how biological processes are affected by anthropogenic soundscapes, building capacity for sustainable management of the world's oceans.

Action: Consider as new SCOR working group.

2.1.7. Oceanic Salt Intrusion into Tidal Freshwater Rivers (SALTWATER) – van Haren

Summary: About two-thirds of global freshwater supplies come from surface waters such as the tidal fresh region of estuaries. A number of coastal and open-ocean processes may affect the oceanic salt intrusion into estuaries and tidal rivers, including sea-level rise, changing ocean circulation, changing tides, and wind events. However, we have little understanding of how these processes work in concert with extended drought to drive the extreme salt intrusion under climate change. This gap in scientific

understanding has been exposed in a number of headline news reports on the salt contamination of drinking water supplies in tidal rivers. Three outstanding issues have been identified. First, there has been no international effort to synthesize the regionally distributed scientific findings on this emerging topic and identify priorities for future research. Second, the salt content of the riverine/seawater mixture includes salts produced during runoffs from the land surface and may have a relative salt composition different from that of seawater. Third, hydrodynamic models used to study the salt intrusion employ a number of numerical schemes, varying grid resolutions, and different parameterization schemes for unresolved subgrid processes. Best practices are needed to guide the model development. This SCOR Working Group will bring together an international team of experts to discuss recent research on salt intrusion around the world. Our goal is to develop a global synthesis of this emerging topic, discern the roles of global climate change and local oceanic processes, and develop tools for observing, modeling and analyzing salt intrusion into tidal rivers.

Action: Consider as new SCOR working group.

2.1.8. Bubble-mediated Air-Sea Exchange of climate-relevant and environmentally important gasses (SCORsASE) – Peeken

Summary: It has been long recognized that bubble-mediated gas transfer constitutes a significant portion of global air-sea exchange. Yet, this process is often neglected in Earth System Models, contributing to the disagreement between present estimates of air-sea gas fluxes and observations, especially in high exchange conditions like storms. This has major implications for our ability to constrain ocean and land sinks of carbon, the supply of oxygen to the interior ocean, and produce accurate future projections of the ocean's role in regulating climate. Current knowledge of bubble-mediated processes comes from isolated field/laboratory experiments and modeling efforts, which are limited in scope. Bubble formation, transport, lifespan, and effects on the overall gas exchange on relevant scales have rarely been examined in a consistent way for gasses of varying properties under a range of conditions using multiple independent approaches. The fundamental problem is our inability to represent the underlying chemical and physical processes behind bubble-mediated exchange, knowledge about which is scattered among disciplines and research groups that often do not overlap. The proposed working group will define the current gap in our mechanistic understanding of the processes, mapping out a route to explicit bubble-resolving gas exchange parameterizations. By leveraging cross-disciplinary expertise, we will identify and promote activities needed to refine the conceptual representation of exchange processes at high winds. We will strengthen capacity by offering training/workshops on air-sea interactions, determining recommended practices, and engaging the broader air-sea community, especially modelers, to incorporate up-to-date high wind speed exchange mechanisms in their work.

Action: Consider as new SCOR working group.

2.2. Current Working Groups

Three working groups disbanded between the 2023 and 2024 annual meetings. WG 148 IQuOD disbanded after submission of a final publication, WG 153 FLOTSAM disbanded after representation at the Fourth Intergovernmental Negotiating Committee (INC-4) for an internationally binding treaty on

plastic pollution, and WG 155 EBUS was disbanded by SCOR after determination that the working group was not making expected and requested progress.

2.2.1. WG# 157. Toward a new global view of marine zooplankton biodiversity based on DNA metabarcoding and reference DNA sequence databases (MetaZooGene) – Bucklin (recorded)/Gobin

Members of WG 157 attended the ICES-PICES 7th International Zooplankton Production Symposium, presenting 13 oral presentations and 3 posters in the session "Shedding new light on zooplankton: Unveiling communities, ecology, and evolution through integrated approaches." Members also chaired a workshop on "Reference sequence databases for global zooplankton biodiversity: Optimization, applications and user guidelines." The working group held its last meeting in combination with the conference, including invited early career scientists and guests. The working group has continued to contribute to the MetaZooGene UN Ocean Decade Action (No. 102.2). The working group created the MetaZooGene Atlas and Database Web page (https://metazoogene.org/mzgdb/) and published two journal publications in the last year.

Action: Disband the working group.

2.2.2. WG# 158. Coordinated Global Research Assessment of Seagrass System (C-GRASS) – Duffy (recording)/Aliani

Over the past year the C-GRASS working group focused on completing the manuscript laying out specifications for the Global Ocean Observing System's Essential Ocean Variable 'Seagrass Cover and Composition' (TOR objective 2) and an associated data schema (TOR objective 3). This involved a continuing conversation with GOOS panel members, a GOOS public webinar presenting the approach, and a meeting of the C-GRASS working group, and other seagrass researchers, at the joint meeting of the International Seagrass Biology Workshop 15 (ISBW) and World seagrass Association in Naples, Italy, in June 2024. That meeting at ISBW15 included 9 working group members from 7 countries, along with several other seagrass researchers. The EOV MS has gone through several drafts with substantial input from an international group of co-authors and we are confident we will submit it for publication in a peer-reviewed journal by the end of 2024. Working group members also co-led or participated in several workshops at ISBW, including one exploring plans for global seagrass mapping co-led by Duffy.

Action: Disband the working group only after publication of deliverables.

2.2.3. WG# 160. Analysing ocean turbulence observations to quantify mixing (ATOMIX) – Lenn/van Haren

Over the last 12 months, the ATOMIX working group has met virtually on a regular basis to fulfil the terms of references. Notable advancements in the last 12 months include: 1. Producing benchmark datasets for all three subgroups. Those for the ADV and ADCP subgroups are at testing stage and available on the wiki. The datasets from the shear probe subgroup were finalized and deposited to British Oceanographic Data Centre, which is also accessible from the wiki. 2. Publication of a best practices method paper and a data descriptor for the shear probe subgroup. 3. Brainstorming and

collating existing materials for teaching core principles of processing turbulence analysis to develop capacity in estimating mixing. 4. Improvement and updates on our wiki site.

Action: Consider one-year extension to complete the ToR.

2.2.4. WG# 161. Respiration in the Mesopelagic Ocean (ReMO): Reconciling ecological, biogeochemical and model estimates – Robinson/Gobin

The working group has held 6 online WG meetings between August 2023 and July 2024. The meetings in October 2023, November 2023 and February 2024 included seminars which were recorded and made available via the website and YouTube channel https://www.remo-scor-wg161.com/about-3. The mentoring scheme continues to thrive https://www.remo-scor-wg161.com/copy-of-home and discussions within the WG have contributed to 2 publications with early career first authors (Sulpis et al., 2023, and Guo et al., 2023). During the Ocean Sciences 2024 meeting in New Orleans, the working group organized a Town Hall meeting (TH33K) called ReMo: Respiration in the Mesopelagic. The meeting aimed to bring together a larger group of scientists to broaden the discussion of mesopelagic respiration measurements and share data and experiences across temporal and spatial scales. The Town Hall meeting was well visited and started exciting discussions that have so far resulted in direct collaborations between the SCOR WG ReMo and the SCOR WG PRIMO. Morten Iversen (ReMo) and Kai Ziervogel (PRIMO) have been granted funding to support Kai´s visit to Morten´s group in Germany to develop new protocols for microbial hydrolytic enzymic activities in combination with respiration measurements on sinking particles. Hence, combining the aims of the two SCOR Working Groups.

Action: Consider extension through to the 2026 Ocean Sciences Meeting (pending positive annual review in 2025).

2.2.5. WG# 162. Developing an Observing Air-Sea Interactions Strategy (OASIS) – Cronin/Peeken

In the last year of the WG162 OASIS, the working group finally had their first in-person meeting. This could not be realized since the start of the WG, due to the COVID pandemic. The working group combined this meeting with a community workshop with over 70 participants. This meeting was an overwhelming success and the participation was truly global, spanning a range of demographics. In addition, the working group published one paper and a commentary, and have several in preparation as follow-ups to the community workshop. During the reporting period, OASIS organized science sessions and town hall meetings at the Ocean Sciences Meeting (2024) and UN Ocean Decade Conference in Barcelona (co-organized with SOLAS). OASIS was invited for keynote talks, for example at Oceans 24 in Singapore and the NOAA NESDIS STAR OceanWatch Annual Conference. Two OASIS webinar series were highly attended: (1) Air-Sea Fluxes from Space, and (2) A Community of Practice for an Uncrewed Surface Vehicle network for GOOS. Both series are available on the OASIS YouTube channel. OASIS celebrated two major successes, namely that the air-sea interaction remote sensing project ODYSEA was selected for launch and that our emerging Uncrewed Surface Vehicle network for GOOS was selected for participation at the OCG meeting in May 2024. Finally, the working group accepted another application for an endorsed UN Ocean Decade Project under our OASIS UN Ocean Decade Program umbrella.

Action: Disband the working group after activities at the 2024 AGU meeting.

2.2.6. WG# 163. Coupling of ocean-ice-atmosphere processes: from sea-Ice biogeochemistry to aerosols and Clouds (CIce2Clouds) – Willis/Croot

A key goal of CIce2Clouds is to build conceptual models of biological and chemical systems that interact across the ocean - ice - atmosphere interface. A major focus of CIce2Clouds work in 2023 was on a set of synthesis papers that build and present these conceptual models. Work in our three CIce2Clouds subgroups (sulfur cycle, nitrogen cycle, primary aerosols) are developing coupled conceptual models, considering both poles and the seasonal cycle. Manuscripts that describe these conceptual models are in active writing, internal review and revision phases. Work has continued on their tutorial paper, which is in active internal review and revision. The tutorial material targets both early career researchers and senior scientists with expertise in only one of the domains, with a key goal of improving communication and understanding among ocean, sea ice and atmospheric scientists on exchange processes between interfaces and their impacts on polar regions.

Action: Consider fourth year extension for activities in 2025.

2.2.7. WG# 164. CoNCENSUS: Advancing standardisation of COastal and Nearshore demersal fish visual CENSUS techniques – Bernard (recording)/Gobin

The SCOR CoNCENSUS working group made significant strides in advancing underwater fish observation methodologies and standardization. A key achievement was the compilation of a preliminary global dataset comprising 371,448 samples from 93 countries, spanning temperate, tropical, and polar regions. This dataset, integrating various methodologies, will form the foundation for three planned manuscripts addressing global indicator robustness, MPA effectiveness evaluation, and the impact of methodological choices on biodiversity assessments. The group refined its approach to best practices, focusing on developing a decision-making roadmap for underwater fish observation methods, assessing the maturity of existing practices, and creating guidelines for managing methodological changes in long-term monitoring. Significant progress was made in data management, including the development of a schema for integrating fish observation data into OBIS and creating data schema cross-walks between global repositories. Capacity development remained a priority, with the group hosting a regional network meeting and developing a comprehensive training course for the Ocean Teacher Global Academy. An epistemic analysis of the research landscape was completed, identifying growth areas and capacity development needs. Additionally, an online questionnaire was launched to gather insights from the global research community. The group held a productive hybrid meeting in Margaret River, Australia, advancing multiple terms of reference. Plans are underway for the next in-person meeting in South Africa (7-11 October 2024) and a workshop at the International Marine Conservation Congress (14 October 2024). These activities collectively contribute to the group's goal of enhancing global marine biodiversity research through standardized methodologies and improved data interoperability.

Action: Consider fourth year extension for activities in 2025.

2.2.8. WG# 165. Mixotrophy in the Oceans – Novel Experimental designs and Tools for a new trophic paradigm (MixONET) – Mitra, McManus/Peeken

The overarching aim of MixONET is to propose methods to determine contributions of mixoplankton to primary and secondary productions. MixONET entered the third year in January 2024. This year the WG has focussed primarily on consolidating ongoing works and delivering to the different ToRs (as reported in Sections 3 and 4). A fantastic achievement from this year has been the addition of, previously ignored, 81 protist species from the Mixoplankton Database (MDB) to the World Register of Marine Species (WoRMS). This task. overseen by Stephanie Dekeyzer (at WoRMS) in discussions with Mitra, included allocation of new AphiaIDs to these species new to WoRMS (e.g., Collozoum ellipsoides, Karlodinium azanzae, Mesodinium coatsi). Furthermore, the functional type descriptions of all species listed within the MDB were incorporated into WoRMS; these data can be found within the 'Attributes' tab for each species (e.g., *Karenia brevis*). These functional type classifications from the MDB have also been allocated to the mixoplankton species within the IOC-UNESCO Taxonomic Reference List of Harmful Microalgae; these data are available within 'Sources' and 'Attributes' tabs in the IOC-UNESCO database (e.g., *Karlodinium armiger*). Over the last MixONET year, various members have contributed to the research community and society through publications (details provided in Section #3), plenary lectures at international conferences (Mitra and Santoferrara), delivering in-person and online teaching modules to national and international audiences comprising UG-PG students as well as professionals (Ciotti and Reguera). The MixONET team has also started planning a legacy course on mixotrophy for the Ocean Teacher Global Academy to be finalised in 2025.

Action: Consider funding for ongoing activities in 2025.

2.2.9 WG# 166. Developing resources for the study of Methylated Sulfur compound cycling PROcesses in the ocean (DMS-PRO) – Galí, Hopkins/Peeken

During the last year, the DMS-PRO working group has undergone an internal reorganization. Former co-chair Daniela del Valle (INIDEP, Argentina) stepped down because of difficulties in her country, which is suffering major budget cuts and layoffs. Full members Steve Archer (Bigelow, USA) and Frances Hopkins (PML, UK) have taken over as new co-chairs. He working group incorporated Katherina Petrou (UTS, Australia) as new associate member, balancing the group's composition. Still regarding internal organization, this year the working group reduced the frequency of meetings to avoid overloading our members, and placed more emphasis on collaborative work using online documents. Regarding the first two important deliverables, the Standard Operating Procedures (SOP) and the database of MSC cycling rates, the working group has made significant progress towards their completion. However, after a first round of discussions and collaborative work, and a thorough literature review, the working group identified the need for improving the classification of MSC cycling processes and related measurement techniques. The systematization of these measurements is a major undertaking because of the many cycling processes and techniques involved (see the diagram, which is being updated, in our new website). In summary, the reformulation of these deliverables has not produced visible results yet, but is critical to maximize the impact of the new tools and their utility for the MSC research community. This year we have also placed emphasis on community building activities, including communication and

exchange with the wider community. The working group created a logo, published a new website, and organized an online webinar. An online workshop is planned for early fall 2024.

Action: Consider funding for ongoing activities in 2025.

2.2.10. WG# 167. Reducing Uncertainty in Soluble aerosol Trace Element Deposition (RUSTED) – Perron/Sicre

The second year of the SCOR WG 167 has focused on subgroups working to deliver each individual task. A quarterly WG newsletter was launched March 2024 to share news across RUSTED participants and build a sense of community between WG members. This year RUSTED held 2 all-hands meetings , 1 co-chair meeting, and 3 subgroup meetings. All meetings were virtual and scheduled to ensure maximum participation by varying the start times. An ad-hoc meeting with Oceania-based RUSTED members was organized to optimize their participation (10th April 2024). At AGU 2023 RUSTED modelers met to discuss future plans, including potential for collaboration with a SCOR WG FeMIP A hybrid annual meeting will be held in November 2024 in Goa, India alongside the SOLAS Open Science Conference event (to achieve minimum carbon footprint and maximum scientific outreach). Eight members will attend the meeting in person thanks to provision of travel funding from SCOR. RUSTED has several sessions planned for the SOLAS OSC: 1. The planned RUSTED Early Career Researcher workshop will be held at the National Institute of Oceanography, Goa, India, on the 9th and 10th November 2024 (Prior to the OSC). 2. The RUSTED annual meeting 2024 3. A 1 hr discussion session with the SOLAS community 4. A project planning meeting with FeMIP SCOR WG's chair, A. Tagliabue. Funds have been provisionally raised from NSF (Atmospheric Chemistry Program) to hold a workshop in the USA in Summer 2025. RUSTED inter-journal Special issue (Copernicus) is currently open and has to date received 6 publications. Preliminary data processing and interpretation and a manuscript plan were drafted by the Intercomparison sub-group. A meeting will be organized in Sept-Oct 2024 to discuss manuscript sections writing. 2 short articles were published in Eos (Shelley et al., 2024) and in the inter-journal RUSTED special issue (Perron et al., 2024), which acknowledged SCOR funding.

Action: Consider funding for ongoing activities in 2025.

2.2.11. WG# 168. Coordinating the Development of Gridded Four-Dimensional Data Products from Biogeochemical-Argo Observations (4D-BGC) – Sharp/Cheah

The 4D-BGC working group (WG 168) was established this year, bringing together 21 members from 14 different countries, who are experts in ocean biogeochemistry, from the perspective of both direct observations and numerical modeling. The stated purpose of WG 168 is to enhance access and utility of BioGeoChemical-Argo (BGC-Argo) observations through four-dimensional (4D) data products. These advanced data products aim to refine our understanding of ocean biogeochemistry, improve biogeochemical models and reanalysis products, and provide valuable insights for policy-making. In 2024, the WG made notable progress towards achieving these objectives. The WG hosted multiple group-wide meetings (one online and one in-person) and a conference session during Ocean Sciences Meeting in February 2024, bringing together interested researchers together to share ideas about

4DBGC products. These activities were instrumental in shaping a strategic plan to achieve the group's objectives and deliverables.

Action: Consider funding for ongoing activities in 2025.

2.2.12. WG# 169. Global Library of Underwater Biological Sounds (GLUBS) – Parsons (recording)/Croot

Since being inducted as a working group in November 2023, the Global Library of Underwater Biological Sounds (GLUBS) has had a productive start toward achieving the proposed terms of reference. Within GLUBS, sub-working groups have continued to meet separately to work towards their respective assignments for the ToRs, in addition to several large group meetings. Two workshops were held on annotation standardization, consisting mostly of GLUBS members, but also included several outside experts in the field. The working group expects this effort to result in a peer-reviewed publication soon, adding to the three publications in the last year (Parsons et al. 2023, Looby et al. 2023, Jarriel et al. 2024). These have contributed to several of the ToRs, notably 1 and 7. They also expect to have a perspective piece on current AI practices in bioacoustics published in the coming months. As listed in the ToRs, GLUBS aims to inspire others to also investigate unknown sound detection and characterization. Our Frontier's research topic on this subject has currently received 8 submissions, with several more in preparation. On top of movement on the scientific front, GLUBS has taken large strides in outreach and establishing its presence in the bioacoustics community. The working group has presented GLUBS at several conferences, including ASA Australia, OSM USA, UNDOS, ASA Ottawa, and the World Ecoacoustics Congress, through talks, posters, small sessions, or satellite events. Finally, we have had tremendous success with the outreach surrounding our second World Oceans Passive Acoustic Monitoring (WOPAM) Day, with more than 400 planned recording sites from over 100 different contributors. In the lead up to this event, WOPAM and GLUBS were featured on numerous social media platforms (X and Facebook) and news channels (Channel 7 and ABC radio in Australia).

Action: Consider funding for ongoing activities in 2025.

2.2.13. WG# 170. Physiology and Rates in Microbial Oceanography (PRIMO) – Strzepek/Peeken

WG170 was informed of its selection for funding by SCOR on 8 Nov. 2023. This news was announced to the participants of the International BioGeoSCAPES science planning workshop (6-9 November 2023, Woods Hole Oceanographic Institute), which resulted in expressions of interest from several participants to contribute to the working group activities (via our extended network, PRIMOnet). A presentation was given by E. Bertrand at the Ocean Science Meeting 2024 Town Hall: Accelerating Toward an International BioGeoSCAPES Program on 20 February 2024 to disseminate information on the aims of the PRIMO working group and build community engagement. Following the guidance of the SCOR national committees review of our proposal, the group recruited two additional members to the working group from South America (Cecilia Alonso, Microbial Ecology of Aquatic Systems Research Group, Centro Universitario Regional del Este, Universidad de la República, Rocha, Uruguay, and Peter von Dassow, Departamento de Ecología, Facultad de Ciencias Biológicas, Pontificia Universidad Católica de Chile, Santiago, Chile). The PRIMO working group has met regularly since February 2024 (the leadership team has met regularly online since November 2023), including a one-day hybrid meeting of PRIMO and

PRIMOnet members (15 members online and 8 members in person) in Les Diablerets, Switzerland following the Marine Microbes Gordon Research Conference on 14 June 2024. A key outcome of these meetings was the assignment and division of tasks to achieve our first Term of Reference (ToR): the review, gap analysis, and ranking of current physiological metrics. In July 2024 the working group launched the PRIMO website (https://www.primoscorwg.org) and the mentorship program (https://www.primoscorwg.org/mentorship-program).

Action: Consider funding for ongoing activities in 2025.

Tab 3 – Large-Scale Ocean Research Projects reports

3.1. GEOTRACES – Marine Biogeochemical Cycles of Trace Elements and Isotopes – Tagliabue/Croot

The GEOTRACES field programme continues to progress successfully with 153 cruises completed, corresponding to 39 GEOTRACES sections (with 52 cruises), 44 process studies (with 71 cruises), 19 compliant datasets, as well as, 11 cruises completed as a GEOTRACES contribution to the International Polar Year (IPY). During the past year (May 1st, 2023 to April 30th, 2024), 2 new section cruises from Australia and USA and 4 process studies (1 from Australia, 1 from UK, 1 from Netherlands, and 1 from USA have been undertaken. In addition, 1 new compliant dataset has been endorsed.
Dataset submissions are now being received and processed for the next GEOTRACES IDP (IDP2025) which will be released in November 2025. The first deadline for dataset submissions was 15th May 2024 and the final deadline is 15th December 2024.
During the reporting period, 335 new peer-reviewed papers have been published (2,527 publications in total). This includes the publication of two special issues: *Oceanography*, Volume 37, Number 2 and *Chikyukagaku*, Volume 57, Issue 2.

Action: None. GEOTRACES funding is provided by specific funding from an NSF grant.

3.2. SOLAS – Surface Ocean – Lower Atmosphere Study – Li/Flossmann

The Surface Ocean-Lower Atmosphere Study (SOLAS) is dedicated to achieving quantitative understanding of the key biogeochemical-physical interactions and feedbacks between the ocean and atmosphere, and how this coupled system affects and is affected by climate and environmental changes. At the end of its second decade, SOLAS coordinated a special issue of *Elementa*, including 12 invited review papers to assess the state of air-sea interaction science, highlight critical future research directions, and identify emerging opportunities for new collaborations, technologies, and discoveries. A series of events have been organised to reboot SOLAS, including a scoping workshop in Xiamen, China (Sep. 2023) and side events at the World Climate Research Programme (WCRP) Open Science Conference in Kigali, Rwanda (Oct. 2023) and the United Nations (UN) Ocean Decade Conference in Barcelona, Spain (Apr. 2024). A community-led new decadal science plan is under development, which will further advance SOLAS' achievements and grapple with emerging issues. Several initiatives were launched under this framework. For example, SOLAS organised the FLARE workshop to formulate a roadmap for integrated wildfire research as climatic and environmental effects as wildfire frequency increases. A marine Carbon Dioxide Removal (mCDR) postdoc programme and a global network of mCDR nodes were

launched to advance understanding, model development, and to advance standards for mCDR initiatives, especially concerning Monitoring, Reporting, and Verification (MRV). The SOLAS modelling initiative team has been actively organising/co-organising discussions to prioritise SOLAS Earth System Model (ESM) strategy for the next 5 years, e.g., with WCRP Earth System Modelling and Observations (ESMO). SOLAS is committed to science communication and capacity building. The quarterly SOLAS seminars have continuously been organised to foster discussions on cutting-edge scientific questions, provide researchers at all career stages with the opportunity to interact, and build the SOLAS community across the globe. The seminars organised during the reporting period featured collaborations with other global research projects, such as the International Global Atmospheric Chemistry (IGAC) project, the Cryosphere and Atmospheric Chemistry (CATCH) and the Second International Indian Ocean Expedition (IIOE-2). SOLAS established its future committee, the Early Career Scientist Committee (ECSC), in 2023 to coordinate and champion the early career activities of the SOLAS community. The ECSC was tasked with new crucial roles in the past year, including co-leading SOLAS Implementation Teams and New Initiatives with SOLAS Scientific Steering Committee (SSC) members, co-organising major SOLAS events, and being part of writing the new science plan and designing SOLAS's future. New ECSC members from Kenya and India have been recruited to build the capacity in Africa and South Asia.

Action: None. SOLAS funding is provided by specific funding from an NSF grant. Noting that SCOR will review the new Science Plan.

3.3. IMBeR – Integrated Marine Biosphere Research – Liu/Aliani

The reporting period was the ninth year of the IMBeR (2016-2025). Science research teams were quite productive, and their science highlights were significant. Individual group submissions are available at https://imber.info/imber-annual-reports-2024/. IMBeR suffered collectively from the prolonged absence of the SSC Chair and the scheduled closure of IPO-Canada (March 2024). The new SSC Chair came to the office in June 2024. The remaining International Project Office in Shanghai will stay until the end of IMBeR in August 2025. The coming year is the final year of the IMBeR (2016-2025). IMBeR plans to hold two workshops for wrapping up the 10-year IMBeR and developing a 10-year-long science plan starting in 2026.

IMBeR Science, IMBeR 2016-2025: Science Plan and Implementation Strategy, endeavors to address three Grand Challenges (GC) focusing on climate variability, global change, drivers, and stressors. The qualitative and quantitative understanding of the past and present ocean variability and change (GC I) is the basis for future scenarios, projections, and predictions (GC II). These are linked in Grand Challenge III to understand how humans are causing the variability and changes and how they, in turn, are impacted by these changes, including feedback between the human and ocean systems. Regional Programmes, Working Groups, Symposia, and Summer Schools are advancing the IMBeR Science agenda with the assistance of endorsed projects, a network of more than 10018 scientists from about 115 countries, and other competent scientific organizations. IMBeR Science further strengthens itself by creating new working groups, regional activities, ongoing, and new partnerships and collaboration with international and national scientific projects.

Action: None. IMBeR funding is provided by specific funding from an NSF grant.

3.4. IQOE – International Quiet Ocean Experiment – Tyack (recording)/Cheah

The IQOE Science Committee (SC) held a Zoom call on 10 June 2024 to review the progress of IQOE activities. The SC decided to update the front page of the IQOE Website to focus on major ongoing activities. The site will still provide access to all content related to IQOE, but will highlight a few specific activities. Work continues on the IQOE Ocean Sound Observation Metadatabase, including entry of metadata for observations that occurred in 2023. The SC was updated about WOPAM Day 2024 and reviewed progress of GLUBS (see below). Updates about other ongoing IQOE activities that were discussed during the call are included below. The IQOE SC will meet in person on 20–22 November 2024 in Reykjavik, Iceland to review progress of all IQOE activities and to plan activities for the final year of the project.

Action: Consider supporting the 2025 activities as proposed in the budget.

3.5. IIOE-2 – Second International Indian Ocean Expedition – Hood/Sicre

The IIOE-2 Steering Committee (SC), during its sixth meeting, noted that the tenure of the IIOE-2 is until 2025. For the last 8 to 9 years, the IIOE-2 community has contributed significantly to the understanding of the Indian Ocean in terms of observation, research and capacity development. In addition, there has been many international collaborations resulting in the exchanges of scientific ideas but also in identifying gaps and regional requirements. In addition, the ECSN has gained momentum and the need for its sustainability has been emphasized. This has resulted in the recommendation that the efforts should be put to extend the tenure of IIOE-2 aligned with the UN Decade of Ocean Science for Sustainable Development. In this regard, the IIOE-2 Project Office hosted a brainstorming meeting, from 28th to 30th November 2023, of the distinguished researchers, and policymakers engaged in various fora of Indian Ocean research from across the globe such as the Indian Ocean Global Ocean Observing System (IOGOOS), the Indian Ocean Region Panel of CLIVAR/IOC-GOOS (IORP), the Indian Ocean Observing System Resources Forum of IOGOOS (IRF), Sustained Indian Ocean Biogeochemistry and Ecosystem Research of IMBeR/IOGOOS (SIBER), the IOC Regional sub-commission for the Central Indian Ocean (IOCINDIO) and the Scientific Committee on Oceanic Research (SCOR). The leads of these forums, after a comprehensive discussion, concluded to prepare an addendum to IIOE-2 science plan and revised implementation strategy for extension of IIOE-2 tenure till 2030. The addendum will focus primarily on Science Theme -1 (Human Benefits and impacts) along with the coastal observations and aligning it to the challenges and outcomes of the UN Decade of Ocean Science for Sustainable Development.

Action: Consider supporting the 2025 activities as proposed in the budget. SCOR will undertake a review of the Science Plan addendum following the annual meeting.

Tab 4 – Infrastructural Projects reports

4.1. SOOS – Southern Ocean Observing System – Hancock/Cheah

The highlight of 2023 was the inaugural SOOS Symposium held in August 2023 in Hobart, Australia. The Symposium brought together 300 people from 25 countries across all continents to discuss all parts of

the ocean observations pathway. In addition to the SOOS Symposium, SOOS co-convened the 4th International Ross Sea Symposium in July 2023 in Naples, Italy. Rejuvenated after the last Ross Sea Symposium was run in the early 2000s, the Symposium was attended by over 100 scientists from 11 nations who discussed recent advances in Ross Sea research. SOOS was also very active in policy forums during 2023. As an observer at the CCAMLR, SOOS presented information to the commission on how its tools can assist with conservation monitoring and ecosystem-based management. SOOS was also well represented at COP28 in Dubai, leading and contributing to multiple events in the Cryosphere Pavilion. These events highlighted the threat of climate change to Antarctic and Southern Ocean ecosystems and discussed what the 2023 record low levels of sea ice tell us about Antarctica's future. In 2023, SOOS continued to provide the Southern Ocean chapter to the BAMS State of the Climate Report and released a publication on the catastrophic breeding failure of emperor penguins. In 2022, irregularities were observed in sea surface temperature, salinity, heat transfer between the atmosphere and ocean as well as marine productivity and oxygen levels. Additionally, the early break up of sea ice in the Bellingshausen Sea region resulted in the total breeding failure of four out of five breeding sites in the region. Looking ahead to 2024, SOOS will continue its efforts in linking to policy, maintain a strong presence at the SCAR Open Science Conference, coordinate a special issue in *Elementa*, and be actively involved in the planning for the 2032-33 International Polar Year. An overarching priority for SOOS in 2024 will be securing funding to ensure a stable and sustainable future for SOOS.

Action: Consider supporting the 2025 activities as proposed in the budget.

4.2. IOCCP – International Ocean Carbon Coordination Project - Telszewski/Moran

In the past 12 months the IOCCP continued to support the development of a global network of ocean carbon and biogeochemistry observations, coordinate the development of globally acceptable strategies and provide technical coordination developing operating methodologies, practices and standards, homogenizing efforts of the research community and scientific advisory groups. IOCCP continues its work with and within GOOS structures and in partnership with our sponsors (SCOR, US NSF, US NOAA, IOC-GOOS, EU OceanICU), to implement specific actions of the Greenhouse Gas Watch Implementation Plan. In the past 12 months and into the future IOCCP strongly focuses on formalizing and strengthening SOCONET, developing coordination structure for regional and global observational efforts to integrate N2O measurements with existing GOOS observing networks, and transitioning SOCAT funding structure into one that's sustainable and resilient. All these activities stem from the IOCCP-coordinated, community-developed *Declaration on Operationalising the Surface Ocean Carbon Value Chain*, published in January 2024 as an outcome of a series of community workshops held at the Flanders Marine Institute (VLIZ) in Oostende, Belgium and online (6-9 November 2023). IOCCP initiated a community-wide effort to develop a Global Ocean Observing System Carbon Plan based on 3 high level mandates: the Global Greenhouse Gas Watch Implementation Plan, the 2022 Global Climate Observing System (GCOS) Implementation Plan and the Integrated Ocean Carbon Research (IOC-R) Report. IOCCP in close collaboration with Xiamen University (China) and Mercator Ocean International (EU), held an important and fruitful Scoping Workshop in May 2024, which was aimed at identifying the most urgent needs of both communities with regards to an efficient and fit-for purpose creation and use of relevant ocean biogeochemistry observations.

Action: None. IOCCP funding is provided by specific funding from an NSF grant.

4.3. COBS – Changing Ocean Biological Systems – Collins (recording)/Yoo

This year, COBS has focused mainly on first, establishing involvement with a recurring conference where ocean multiple driver biology researchers can network and exchange ideas regularly. We have identified the "Ocean in a High CO2 world symposium" as a possible option (see below), and established ties with the BioGeoScapes programme. Second, COBS has improved the interface and statistical support associated with MEDDLE, our suite of resources for designing multiple driver experiments, as well as improved the structure and support for our National Advocated network, a group of ECRs who disseminate MEDDLE resources globally. Finally, we continue to produce outputs aimed at researchers in the form of peer reviewed papers and conference presentations.

Action: None. COBS funding is provided by specific funding from an NSF grant.

4.4. GlobalHAB – Global Harmful Algal Blooms – Anderson/Yoo

The GlobalHAB SSC experienced a transition in leadership during the last year, with Chair Elisa Berdalet, who served for eight years, stepping down and passing the baton to Clarissa Anderson, SSC member since 2020. Given this momentous event, an in-person get together was held in October 2023 in Hiroshima, Japan for those SSC members and liaisons attending the International Conference on Harmful Algae (ICHA) to celebrate Elisa's dedication and service, and discuss plans for the year ahead. In lieu of monthly virtual meetings since October 2023, Clarissa has been working with Elisa, Henrik Enevoldsen, and Yun Sun during the transition and maintaining regular email communications with the SSC. A series of virtual Zoom meetings were held with all SSC members on the 17th and 18th of June 2024 to begin planning for our upcoming in-person meeting to be hosted by Chair Anderson at Scripps Institution of Oceanography, University of California, San Diego on 23-25 September 2024. Throughout the year, various members of the SSC were involved in publishing a white paper on *Fish-Killing Algal Blooms and Ichthyotoxins: Prevention, Mitigation and Control* based on a 2019 workshop, a session at the 2nd UN Ocean Decade Regional Conference and the 11th WESTPAC International Marine Science Conference on "Mitigation and Management of Harmful Algal Blooms (HABs)," the U.S. National HAB Observing Network webinar series and town hall, representation at the UN Informal Consultative Process on Oceans and the Law of the Sea, an ICES-IOC Working Group on Harmful Algal Bloom Dynamics, a qPCR workshop, and a workshop at the PICES 2023 meeting on "GlobalHAB International Workshop on Solutions to Control HABs in Marine and Estuarine Waters."

Action: Consider supporting the 2025 activities as proposed in the budget.

4.5. JCS – Joint Committee on Seawater (IAPWS/SCOR/IAPSO) – Pawlowicz/van Haren

No in-person meetings of JCS occurred over the past year. The Chemical Speciation Taskgroup has held 5 virtual meetings over the past year. An in-person meeting is being planned at the Busan IAMAS-IACS-IAPSO Joint Assembly in 2025. A draft JCS website, separate from http://www.teos-10.org/, was

completed in 2023, with plans to "go live" once arrangements for hosting and the provision of a suitable domain name have been finalized. JCS maintains a web site at www.teos-10.org. This site get around 1000 visitors per month. Annual downloads of most items are stable, with the GSW Matlab toolbox being the most downloaded item (between 1500-2000 times a year). GSW software is also available from a github repository (github.com/TEOS-10) for developers and those interested in contributing to the software. At present, however, the loss of our software subgroup member, who maintained these sites, means that continued upkeep is uncertain. A further website for the MarChemSpec software (marchemspec.org), allowing for users to perform calculations via a web interface, is also under development. However, both have been stalled by a lack of resources (time, money, and web expertise).

Action: Consider supporting the 2025 activities as proposed in the budget.

Tab 5 – Affiliated projects

Affiliated projects reports

5.1. IOCCG – International Ocean Colour Co-ordinating Group – Lovindeer (recording)/Yoo

The International Ocean Colour Coordinating Group (IOCCG) is an affiliated project of SCOR since 1997, and is an associate member of the Committee on Earth Observation Satellites (CEOS). The mandate of IOCCG is to promote the development and application of science and technology that underpin remote sensing of ocean colour across all aquatic environments (in-land, coastal, open ocean). This mandate is achieved through coordination, training, liaising between providers and users, advocacy, and provision of expert advice. Details can be found on the IOCCG website at http://ioccg.org. The 28th IOCCG Committee meeting was hosted in hybrid format in Cordoba, Argentina by Comisión Nacional de Actividades Espaciales (CONAE) at the Centro Espacial Teófilo Tabanera (CETT). The committee reviewed the progress and documents from existing IOCCG working groups and task forces; approved the development of a new protocol document on the use of HPLC measurements for satellite ocean colour validation; approved a new ad hoc working group of the development of multi-agency-blended long-term time series ocean colour products; received updates on the recently launched PACE mission, and discussed the upcoming SABIA-Mar mission; discussed capacity building initiatives; advanced the CEOS aquatic carbon roadmap and other CEOS initiatives under the Ocean Colour Radiometry-Virtual Constellation (OCR-VC), among other scientific discussions.

Action: Consider continuation of affiliation.

5.2. InterRidge – International RIDGE Studies – Lee/Cheah

A report was not provided in advance by InterRidge.

Action: Consider continuation of affiliation.

Affiliated organizations reports

5.4. IABO – International Association for Biological Oceanography – Gobin

During this performance cycle, IABO activities focused on the following activities:
1) Preliminary organizational steps to support the VII WCMB meeting to be held in Bruges, Belgium between November 17th to 20th of 2026;
2) Continuing implementation of the *PeerJ-IABO Hub*;
3) Preliminary selection of 2023 and 2024 Carlo Heip awardees
4) Transfer of hosting of IABO's website

Action: Identify future areas for SCOR cooperation with IABO.

5.5. IAPSO – International Association for the Physical Sciences of the Oceans – van Haren

IAPSO has the prime goal of 'promoting the study of scientific problems relating to the oceans and the interactions taking place at the sea floor, coastal, and atmospheric boundaries insofar as such research is conducted by the use of mathematics, physics, and chemistry.' IAPSO works mainly through 1) biennial scientific assemblies; 2) working groups; 3) commissions; 4) services; and 5) website information. Of special importance to IAPSO is the involvement of early career scientists as well as those from least developed countries. For 2024/2025 the following three BPSG proposals were awarded: (1) Calibrating Measurements of Total Dissolved Inorganic Carbon in Seawater, (2) Ship-based CTD/O2 operations, calibration, and processing procedures, and (3) Reconciling Cross-platform Observations of Ice-shelf Melt. The Joint Assembly of IAPSO, IAMAS, and IACS to be held in Busan, South Korea from 20-25 July 2025. About 100 scientific sessions have been proposed for this meeting, of which about three-quarters are joint sessions between two or all three associations. The association's SGs have been very busy in defining, collecting and ordering the session proposals.

Action: Identify future areas for SCOR cooperation with IAPSO.

5.6. IAMAS – International Association of Meteorology and Atmospheric Sciences – Penner/Flossmann

IAMAS promotes research in all atmospheric sciences, especially programs requiring international co-operation. IAMAS leads the Alliance for Capacity Transfer (ACT) – a joint activity of IUGG, the World Meteorological Organisation (WMO), and the U.S. University Corporation for Atmospheric Research (UCAR). IAMAS is made up of ten international commissions and one committee which together play a major role in implementing IAMAS's activities. The ten commissions cover Atmospheric Chemistry and Global Pollution (ICACGP), Atmospheric Electricity (ICAE), Climate (ICCL), Clouds and Precipitation (ICCP), Dynamical Meteorology (ICDM), the Middle Atmosphere (ICMA), stratospheric Ozone (IOC), Planetary Atmospheres and their Evolution (ICPAE), Polar Meteorology (ICPM), and atmospheric Radiation (IRC). The Committee on Nucleation and Atmospheric Aerosols (CNAA) under ICCP brings together scientists covering the areas of Nucleation Theory and Experiment, Tropospheric and stratospheric aerosols, Cloud Drop and Ice Nucleation and Aerosol-Climate Interactions. Currently, IAMAS is hoping to add another commission on Tropical Meteorology (ICTM) under the founding president Thara Prabhakaran from the Indian Institute of Tropical Meteorology in Pune. The proposal will be submitted for approval by the

IAMAS EC next year in Busan (South Korea). Many of these commissions play international leadership roles in their specialist areas [see https://www.iamas.org]. The commissions provide an important supplement and extension to the leadership and research role of the World Meteorological Organization (WMO), which is the governmental body with a scientific scope that is comparable to that of IAMAS. From 20-25th July 2025, a joint Assembly of IAMAS-IACS-IAPSO will be organized in Busan, Republic of Korea (BACO-25, initially planned in 2021 and postponed due to COVID-19) http://www.baco-25.org/new/ .

Action: Identify future areas for SCOR cooperation with IAMAS.

Tab 6 – Intergovernmental and partner Organizations

Intergovernmental organizations reports

6.1. IOC – Intergovernmental Oceanographic Commission – Isensee/Sicre

SCOR and IOC currently co-sponsor IIOE-2, GlobalHAB, and IOCCP.

Action: None

6.2. PICES – North Pacific Marine Science Organization – Chiba/Moran

The North Pacific Marine Science Organization (PICES) is an intergovernmental scientific organization established by an international convention in 1992, to promote and coordinate marine scientific research in the North Pacific and adjacent seas. PICES 2023 Annual Meeting was held in Seattle, USA, October 20-27. This was the largest Annual Meeting ever with a total of 672 attendees, including 76 virtual participants, with 244 Early Career Ocean Professionals (ECOP) and observers from 20 international and regional organizations and programs. SCOR's GlobalHAB project supported US$ 10,000 for a session and workshop which were organized by a PICES expert group and regional GlobalHAB component, Section on Ecology of Harmful Algae Blooms in the North Pacific. PICES 2024 Annual Meeting will be held from October 26 – November 1, 2024, in Honolulu, USA with the scope of "The FUTURE of PICES: Science for Sustainability in 2030." PICES has approved the establishment of several new expert groups with multi-disciplinary structures to address cross-cutting topics and emergent socio-ecological-environmental issues, aiming to meet the challenges of the UN Ocean Decade: Working Group on Data Management (WG52), Advisory Panel on the Arctic Ocean and the Pacific Gateways (AP-ARC), and Joint PICES/ICES Working Group on Sustainable Pelagic Forage Communities (WG53).
PICES contributes scientific expertise to SCOR-sponsored international large-scale ocean research projects e.g., Harmful Algal Blooms (GlobalHAB), IMBeR, SOLAS, GACS (Global Alliance of Continuous Plankton Recorder Surveys), and to SCOR-supported projects e.g. IOCCP [International Ocean Carbon Coordination Project, and co-sponsors their activities such as summer schools. PICES also has supported several SCOR Working Groups (Table 1) by sending experts to WGs (WG 155, WG 163, WG 165). SCOR and PICES have regularly exchanged observers at each other's annual/executive meetings. The current PICES Deputy Executive Secretary, Sanae Chiba has served as PICES liaison to the SCOR Capacity

Development Committee since 2021. In 2024, SCOR funded US$ 6000 for travel support of eligible participants in the 7th Zooplankton Production Symposium (ZPS7) held in Hobart, Australia in March, and also US$ 6000 for Marine Socio-Ecological System Symposium (MSEAS) in Yokohama, Japan in June. PICES also regularly supports capacity development events organized by the SCOR partner organizations including SOLAS and IMBeR. From Oct 2023 to Oct 2024, PICES approved to fund the SOLAS Open Science Conference and IMBeR IMBIZO 7 to support the travel of ECOP participants from PICES countries (note: IMBeR IMBIZO 7 was cancelled).

Action: None

6.3. GESAMP WG 38– The atmospheric input of chemicals to the oceans – Jickells/Aliani

During the past year GESAMP WG 38 has focused its attention on four areas: (1) Completed a GESAMP Reports and Studies document entitled "The Atmospheric Transport of Microplastics to and from the Ocean: Proceedings of a GESAMP International Workshop" as well as a "Summary for Policymakers" from the same workshop. (2) Began development of a paper from a workshop in South Africa on the ocean management and policy implications of the air/sea exchange of nutrients in the southwest Indian Ocean. (3) Organized a session on air/sea chemical exchange at the 2024 European Geosciences Union General Assembly in Vienna, Austria in April 2024. (4) Developed plans for a new initiative entitled "Research priorities for improving global flux estimates of atmospheric deposition to the ocean". Working Group 38 has the following plans for the period 2024-2025: (1) Final publication by WMO of the GESAMP Reports and Studies document "The Atmospheric Transport of Microplastics to and from the Ocean: Proceedings of a GESAMP International Workshop". (2) Completion of the peer-reviewed paper presenting the results of the 2022 workshop in South Africa on the ocean management and policy implications of the air/sea exchange of nutrients in the southwest Indian Ocean and developing a report for GESAMP on that workshop. (3) Carrying out the new workshop "Research priorities for improving global flux estimates of atmospheric deposition to the ocean" in Heraklion, Crete, Greece in April, 2025 and begin developing relevant papers and reports from that workshop. (4) Development of a session on air/sea exchange of chemicals at the 2025 European Geosciences Union General Assembly in Vienna in April 2025.

Action: None

Partner organizations reports

6.4. POGO – Partnership for Observation of the Global Oceans – Krug/Aliani

POGO was established in 1999 by a group of directors of marine research institutions who met to discuss ways in which they could work together more effectively in support of global oceanography, and in particular ocean observations. Joint activities between POGO and SCOR in 2024 include the POGO-SCOR Fellowship Programme and IQOE. The fellowship programme is now in its 24th year, and a total of 200 fellowships have been awarded to date. POGO funded a Working Group to support the IQOE, which was instrumental in getting an Acoustic Essential Ocean Variable (EOV) accepted by GOOS, and the Ocean Sound EOV Implementation Plan can be found at https://zenodo.org/records/10067187. This year, POGO

has approved funding for a working group on Development of a low-cost hydrophone for research, education and community science.

Action: None

6.5. ISC – International Science Council – McBride/Sicre

The year 2023 has been transformative for the Council, marked by a notable increase in the ISC's profile, reflected in its enhanced global impact through collaborations with Members and partners. In parallel, the Council has enhanced its governance through extensive consultations with Members, resulting in revised statutes and significant development and reorganization of the Secretariat. Led by the Working Group on Constitutional Revision, Members played a vital role in the constitutional reform process, demonstrating their vision and the ISC's ability to adapt to evolving scientific and societal landscapes. The ISC has strengthened its role and reach by establishing liaison mechanisms within the United Nations system through our New York presence and the launch of the UN Group of Friends on Science for Action. We've expanded partnerships with UN agencies such as UNESCO, UNEP and UNDP, enabling the mobilization of experts from our membership to support specific science-driven UN processes, strengthening the voice of science on the international stage. ISC has also broadened its member to encompass early and mid-career scientists. ISC's scientific capacities were strengthened by the launch of the Centre for Science Futures and the appointment of Dr. Vanessa McBride as the new Science Director.

Action: None

6.6. SCAR – Scientific Committee on Antarctic Research – Nath (recording)/Peeken

SCOR and SCAR currently co-sponsor the Southern Ocean Observing System (SOOS).

Action: None

6.7. Future Earth and the Ocean Knowledge Action Network - Pendleton (recording) /Twigg

The Ocean Knowledge Action Network (Ocean KAN) is adding members weekly, now up to 120 members from over 30 countries. This includes members from indigenous communities. The Ocean KAN utilizes regional hubs. The Ocean KAN Western Indian Ocean hub was formed this year, based in the Seychelles. Meetings of opportunity are held at other ocean science conferences, such as the UN Ocean Decade conference in Barcelona. Members support and learn from each other in the meetings. Members of the community can sponsor a Learning Circle. SCOR is an international science network partner to Ocean KAN. The focus on relationship building has led to international and regional meetings, collaborative research proposals, and a UN Ocean Decade Endorsed Action, side events, and the creation of gender equality charters. Ocean KAN works with the UN Ocean Decade projects CoP of Marine Life 2030, Empowering Women – High Level Advisory Board, and the ECOP network. The network has received two Future Earth grants: (1) to network across indigenous communities and (2) on earth observations. Future Activities will include coordination around indigenous science, supporting traditional leaders, holding

listening sessions at the UN Ocean Conference 2025, and remain involved in UN Ocean Decade projects. Anyone interested in being involved with the Ocean KAN can contact Pendleton.
Future Earth is a global network composed of 9 Secretariat hubs, 19 local and regional networks, and 27 Global Research Networks. These networks include the SCOR and Future Earth cosponsored activities, IMBeR and SOLAS, as well as the Ocean KAN. In the next year, Future Earth will focus on the UN Ocean Conference, a sustainability in research conference, and a general assembly. Publications and activities will continue through Ocean KAN, IMBeR, and SOLAS. A "Pathways Forum" on the intersection of Western and Indigenous science will be conducted with the Ocean KAN.

Action: None

6.8. WCRP – World Climate Research Programme / CLIVAR – Santoso/Flossmann

Currently, WCRP is in the process of implementing its new research strategy (WCRP Strategic Plan 2019-2028). Major elements of the Science and Implementation Plan are to strengthen support for core research, ensure engagement of the next generation of scientists and improve the diversity of WCRP leaders (across nations, regions, and disciplines), deepen our interaction with partners at national and international levels, and ensure that society has the climate knowledge that it needs for decision-making. WCRP has reoriented itself to ensure that there is the science, knowledge and understanding needed to target frontier problems, such as disaster risk reduction, climate adaptation, mitigation, and intervention strategies, that need to be solved together with partners for which WCRP's core research continues to be essential for developing answers. These efforts culminated in the WCRP Open Science Conference (OSC; https://www.wcrp-climate.org/wcrp-osc23), 23-27 October 2023 in Kigali, Rwanda, which brought together nearly 1500 participants both virtually and on-site from diverse research communities, programmes and partners to discuss the latest developments in climate science, with an emphasis on science-based information for decision making.

CLIVAR aims to understand the dynamics, the interaction, and the predictability of the climate system with emphasis on ocean-atmosphere interactions. Many scientific activities carried out by CLIVAR panels and Research Foci groups are of strong relevance to other WCRP core projects, Lighthouse Activities, and other emerging initiatives (e.g., a joint activity on Cycle and Budgets, jointly with GCOS). CLIVAR has also helped identify ocean hubs for My Climate Risk Lighthouse Activity. CLIVAR Research Foci on Marine Heatwaves in the Global Ocean which was launched in Feb. 2023, aims to achieve a better understanding of MHWs globally, including detection, surface and subsurface characteristics, mechanisms, connection with climate change and biogeochemical extremes.

Action: None

Tab 7 – Capacity-Development Activities

Capacity development activities are described in the presentations by Rebecca Zitoun, Chair, SCOR Capacity Development Committee and Lica Krug, POGO. Additionally, a report on the 2023 POGO-SCOR Fellowship program can be found at the following link: https://scor-int.org/wp-content/uploads/2024/09/POGO-SCOR-Fellowships_2023_Report.pdf.