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INFORMATION REPORT OF THE INTERGOVERNMENTAL OCEANOGRAPHIC COMMISSION (IOC) of UNESCO TO THE ANNUAL MEETING 2021 OF SCOR

I. Introduction :

This information report aims at providing information to the SCOR 2021 Annual Meeting on substantive activities of the Intergovernmental Oceanographic Commission (IOC) of UNESCO that align with SCOR's on-going or planned activities.

Reference is also made to relevant activities in the context of the United Nations Decade of Ocean Science for Sustainable Development.

The report does not include consideration of an institutional nature in relation to cooperation between IOC and SCOR. Report on the joint Second International Indian Ocean Expedition is covered by relevant documentation of the 2021 SCOR Annual Meeting.

II. Activities involving close cooperation and coordination between IOC and SCOR

Harmful Algal Blooms

The IOC is coordinating and developing its work on HAB through the IOC Intergovernmental Panel on HABs (IPHAB). A number of Task Teams, working groups and activities are operating and reporting to the IPHAB. A core activity is the development of a 'Global HAB Status Report' which is compiling an overview of HAB events and their societal impacts; providing a worldwide appraisal of the occurrence of toxin-producing microalgae; and assessing the status and probability of change in HAB frequencies, intensities, and range resulting from environmental changes at the local and global scale. The development of this report is intimately linked with the systematic compilation of HAB data in OBIS and the IOC Harmful Algal Event Data base HAEDAT and is funded by Flanders and cosponsored by the IAEA. The first Global HAB Status Report was launched June 2021.

The long-term focus of the IOC Harmful Algal Bloom (HAB) programme is on improved understanding of the factors controlling HAB events and thereby improving management and mitigation options. The scientific key questions have for more than a decade been addressed jointly with SCOR through research programmes. The current decadal IOC-SCOR research programme to meet societal needs in a changing world, entitled GlobalHAB, launched its science and implementation plan in 2017 (www.globalhab.info). GlobalHAB is reported on in detail directly by the GlobalHAB SSC.

Time Series

As from 2016, an expert group has worked specifically to investigate Climate Change and Global Trends of Phytoplankton in the ocean, in particular the coastal ocean (TrendsPO). The Group continues the comparative analysis and synthesis of long time series data sets compiled by SCOR WG137, and expands the focus not only to the continental shelf and open oceans, but also to estuarine and upstream freshwater ecosystems where perturbations from terrestrial, atmospheric, oceanic sources and human activities converge to cause changes that ramify across local and global scales. TrendsPO has a special issue of the Journal of Plankton Research in preparation for expected release late 2021/early 2022.

Index of Coastal Eutrophication, SDG 14.1.1

IOC-UNESCO supports the development of the indicators for SDG 14.1.1, for which UNEP is the custodian agency. A task force, which includes experts from the IOC-UNESCO Nutrients and Coastal Impacts Research Programme (N-CIRP), the UN Joint Group of Experts on the Scientific Aspects of Marine Environmental Protection, supported by the Group on Earth Observation (GEO) Blue Planet, has been established to provide the technical expertise during the course of the development of the methodology for the indicator. The core focus of IOC-UNESCO is to contribute to the development of the Index of Coastal Eutrophication (ICEP). ICEP is expected to be fully developed for validation by end 2022.

Microplastics

Plastics form a large proportion of marine litter, and the widespread occurrence of macroscopic plastic debris and the direct impact this can have both on marine fauna and legitimate uses of the environment, sometimes remote from industrial or urban sources, has grown rapidly. Lately the existence of micro-plastics and their potential impact has received increasing attention. The extent of the impact of plastic litter in the oceans is uncertain, despite the considerable scientific effort that has been expended in recent years. GESAMP Working Group 40 on 'Sources, Fate and Effects of plastics and micro-plastics in the marine environment', led by IOC and UNEP, was initiated in 2012. The Working Group has recently published guidelines on how to monitor plastics in the ocean (read more [here](#)). The focus in 2019–2021 is on an overview of risks associated with marine plastic litter; environmental risk from nano- and microplastics; and human health risks associated with nano- and microplastics.

De-oxygenation

De-oxygenation is a global problem in coastal and open regions of the ocean, which has led to expanding areas of oxygen minimum zones and coastal hypoxia. In the coastal ocean, the number of reported dead zones has increased exponentially since the 1960s, with more than 600 systems catalogued now. The recent expansion of hypoxia in coastal ecosystems has been primarily attributed to global warming and enhanced nutrient input from land and atmosphere. In order to improve the data availability and data quality of ocean oxygen data the members of the IOC Working Group the Global Ocean Oxygen Network (GO2NE) contributed to planning of an ocean oxygen data portal and a corresponding white paper, which was submitted in June 2021. Further the working group published a scientific paper comparing low oxygen areas around the world. Since November 2020 IOC organizes together with the members of GO2NE monthly webinars featuring young and senior scientists presenting the latest science on ocean and coastal deoxygenation. This webinar series continues to be a huge success with on average more than 100 participants. Over the time of 11 months scientists and other stakeholders from 95 countries joined. In addition, the IOC WG GO2NE successfully submitted a proposal for an

Ocean Decade Programme – Global Ocean Oxygen Decade. GO2NE further collaborated with IUCN on improving ocean oxygen science communication to policymakers and will continue the cooperation within the framework of GOOD. In addition, GO2NE contributed to a new OceanOPS report card focused on ocean oxygen, which was published 15 July 2021. The IOC was invited to submit a contribution on ocean deoxygenation to the WMO annual Statement on the State of the Global Climate in 2019 and 2020. The full statement for 2019 was published in March 2020 and new information for 2020 was published in the final statement in March 2021.

Multiple Stressors

The IOC working group, with leading contributions by members of the SCOR WG149, which now is a SCOR project, focusing on multiple stressors, established in 2018 met for the first time in March 2020 (online, due to the COVID-19 pandemic). The policy brief introducing the issue of multiple stressors on marine ecosystems – working title: ‘Ocean under Stress: A changing ocean at all locations’ is currently under preparation and will be published in late 2021. However, this process is delayed due the current restrictions.

Open Science Conference on Eastern Boundary Upwelling Systems (EBUS): Past, Present and Future

IOC is actively engaged with the SCOR WG155, and a number of partners, in the organization of the “Open Science Conference on EBUS: Past, Present and Future Open Science Conference on EBUS” and the “Second International Conference on the Humboldt Current System”, to be held in Lima (Peru) 19-23 September 2022.

III. Other activities of actual or potential interest to SCOR

Ocean acidification

In view of the growing urgency and recognition of ocean acidification as one of the major stressors for the marine environment, improved observation and research are needed to help scientists and governments in implementing related mitigation and adaptation measures.

IOC-UNESCO actively provided technical support to Member States to report towards the Sustainable Development Goal indicator 14.3.1, focusing on ocean acidification in the framework of sustainable development. The Commission provides the methodology guiding scientists and countries in terms of how to carry out measurements following the best practices established by the ocean acidification community. In this way, IOC and its networks, including the Global Ocean Acidification Observing Network (GOA-ON), directly contribute to the achievement of SDG Target 14.3. Dedicated trainings were developed and a first workshop was held in November 2020.

The IOC Secretariat launched the SDG 14.3.1 data portal in December 2019 and invited Member States and experts to contribute to the annual reporting of the 14.3.1 indicator (2020 collection: 8 Member States of which 1 SIDS; 2021 collection: 30 Member States of which 5 from Africa and 1 SIDS).

In order to further facilitate and advance SDG 14.3.1 related measurements and data reporting IOC together with experts are working on an improved methodology, and data collection, representatives of global ocean carbon data products and databases, e.g. EMODNET, ICOS, GLODAP, NCEI, SOCAT agreed on the establishment of a federated system to facilitate data submission and collation. This system is currently under development.

GOA-ON has now more than 865 members, from 101 countries (2015: 150 scientists, 31 countries) and is constantly growing; currently 19 SIDS and 23 African countries are represented in the Network. This is also thanks to IOC engagement and involvement in Ocean Acidification projects in the Pacific Islands, Caribbean, the Middle East and East Africa.

IOC is further strongly supporting the coordination and implementation of the recently endorsed GOA-ON Ocean Decade Programme – Ocean Acidification Research for Sustainability. IOC is the focal point for this global collaboration programme and activities and outreach are started in September 2021.

The IOC was invited to submit a contribution on ocean acidification to the WMO Statement on the State of the Global Climate in 2019 and 2020. The full statement for 2019 was published in March 2020 and for 2020 in March 2021.

Blue Carbon

IOC assisted in the organization of annual International Blue Carbon Initiative (BCI) annual meeting, which was supposed to take place in October 2020 in Mexico. Unfortunately, the current situation forced us to postpone the meeting. In June 2020, IOC together with the other co-organizers of the BCI (CI and IUCN), started a series Blue Carbon online workshops, which continued in August and October 2020. The meeting in 2021 was also hold online in June 2021. During this meeting the experts agreed to develop a BCI OTGA course, which will be published by the end of 2021. IOC together with IUCN prepared the Marrakesh Partnership Ocean and coastal zones pathway and action table, which were published in December 2020 and a new updated version taking into account broader stakeholder review as well as recent process was published in May 2021. This work, together with related blue carbon activities, are key in preparation of the UNFCCC COP26 in engaging non-party stakeholder in the UNFCCC process and assisting Member States in how to improve the use of coastal wetlands in their Nationally Determined Contributions in the upcoming years.

Invasive alien species and other ocean stressors: Furthering the scientific knowledge and capacity basis in the Canary Current Large Marine Ecosystem (CCLME)

Since 2013, the IOC has worked in the implementation of the project *Enhancing oceanography capacities in the CCLME Western Africa countries*. The overall goal of its third phase (2018-2020) was to improve the existing knowledge on the possible effects of climate change on the Canary Current Eastern Boundary Upwelling System (EBUS) and to continue building regional science capacity in such knowledge. The inherent variability of EBUS poses indeed large challenges in projecting their responses to climate change and other ocean stressors. This has a direct impact on food security, livelihood systems of local populations, and economies.

Human-induced impacts add a layer of complexity to the systems. A new project has been recently approved, being funded by the Spanish Agency for International Cooperation development (AECID). The project aims at furthering the scientific knowledge and capacity basis in the CCLME by adding a focus on the effects of multiple ocean stressors to the knowledge base of the Canary Current system. This new focus will include a collaborative approach to the question of invasive alien species (IAS), its connection with other ocean stressors, and assessment of and implications of IAS and other ocean stressors in the region. The project will facilitate the creation of an IAS group of experts and will provide improved access to scientific data, information and knowledge produced. Further, the project will contribute to science-based management of the CCLME by facilitating the co-design of a collaborative action in the context of the Ocean .

Integrated Ocean Carbon Research

IOC has pursued a very active coordinating work aimed at federating the ocean carbon research community. The many gaps in knowledge on ocean and climate we still face, and the high degree of uncertainty related to our current knowledge, combined with the great sense of urgency to act, have prompted IOC Member States to convene the current main players in ocean carbon research and systematic observations under the umbrella of an expert Integrated Ocean Carbon Research (IOC-R) initiative. The IOC Working Group on Integrated Ocean Carbon Research federates: the IOC; the International Ocean Carbon Coordinating Project (IOCCP, which also operates as the Biogeochemistry Panel of the Global Ocean Observing System); the Surface Ocean-Lower Atmosphere Study (SOLAS); the Integrated Marine Biosphere Research Project (IMBeR); the Climate and Ocean Variability, Predictability and Change (CLIVAR) core project of the World Climate Research Programme (WCRP/CLIVAR); and the Global Carbon Project (GCP). The goal of this initiative is to design an integrated research and observation agenda in the next decade in support of relevant efforts by the UNFCCC and its SBSTA.

A first meeting of the IOC-R group took place on 28–30 October 2019 at the IOC premises in Paris. The group worked since towards the production of *Integrated Ocean Carbon Research: A Summary of Ocean Carbon Research, and Vision of Coordinated Ocean Carbon Research and Observations for the Next Decade*, published as IOC Technical Series No. 158 (<https://doi.org/10.25607/h0gj-pg41>).

IV. Potential future IOC and SCOR cooperation

The IOC and SCOR have long successfully cooperated and thereby strengthened research and scientific programmes.

The 2021 SCOR Working Group Proposals represent a wide-ranging array of relevant research projects, and the IOC Secretariat would like to share with SCOR its views on those proposals that more closely reflect the current priorities of IOC in the area of ocean science (see Annex to this document).

Annex: IOC comments on the new SCOR WG proposals

2.1.1. Coupling of ocean-ice-atmosphere processes: from sea-ice biogeochemistry to aerosols and Clouds (Cice2Clouds)

Timeliness	Yes, very timely. IPCC and the special Report on the Ocean and Cryosphere in a changing climate (SROCC) have again highlighted of the interconnectedness of ocean and sea-ice and the effect of changes to this physical and chemical ocean - sea-ice - snow - atmosphere (O-SI-S-A) system for climate change.
High priority for ocean science and for SCOR?	Yes, for both – topic ties in with WG#152. Measuring Essential Climate Variables in Sea Ice (ECV-Ice).
Is a SCOR Working Group a good mechanism here?	Yes – due to the scale in terms of multi-disciplinary and international work proposed here there would be few if any other avenues for support and funding.
Are the terms of reference appropriate?	Yes – ambitious and clear.
Are the membership suggestions appropriate?	As far as we can tell the membership is entirely appropriate; the associate members also include a larger number of early career scientists and the WG plans to enhance connections with countries with emerging polar and sea-ice related programs, as there is very little polar research within developing countries.
Any other comments or suggestions for improvement of proposal	
Rating: <i>must fund, may fund, do not fund. Among any “must funds”, please list the rank: 1, 2, or 3</i>	Should fund

2.1.2. Harnessing global pELagic FISH biochemical data to address Sustainability challenges under climate change scenarios (ELFISH)

Timeliness	Unclear
High priority for ocean science and for SCOR?	
Is a SCOR Working Group a good mechanism here?	
Are the terms of reference appropriate?	
Are the membership suggestions appropriate?	
Any other comments or suggestions for improvement of proposal	
Rating: <i>must fund, may fund, do not fund. Among any “must funds”, please list the rank: 1, 2, or 3</i>	

2.1.3. Advancing standardisation of COastal and Nearshore demersal fish visual CENSUS techniques (CoNCENSUS)

Timeliness	
High priority for ocean science and for SCOR?	
Is a SCOR Working Group a good mechanism here?	
Are the terms of reference appropriate?	
Are the membership suggestions appropriate?	
Any other comments or suggestions for improvement of proposal	
Rating: <i>must fund, may fund, do not fund. Among any "must funds", please list the rank: 1, 2, or 3</i>	

2.1.4. Mixotrophy in the Oceans – Novel Experimental designs and Tools for a new trophic paradigm (MixONET)

Timeliness	Yes, there is a paradigm shift in trophic studies, science needs to attack complexity with novel approaches otherwise our capability to model pelagic ecosystems will not advance sufficiently to deliver what is needed and expected relatively to ecosystem predictability in a changing world.
High priority for ocean science and for SCOR?	For ocean science yes. science needs to attach complexity otherwise our capability to model pelagic ecosystems will not advance
Is a SCOR Working Group a good mechanism here?	Yes, there are few, if any, other mechanisms left for leading researchers to work on a pro bono basis to work on complex issues that are hard or impossible to fund for any individual.
Are the terms of reference appropriate?	Yes, very ambitious.
Are the membership suggestions appropriate?	To our best judgement, yes.
Any other comments or suggestions for improvement of proposal	
Rating: <i>must fund, may fund, do not fund. Among any "must funds", please list the rank: 1, 2, or 3</i>	Cannot rank as cannot evaluate the rest of the proposals. This proposal is concrete and focused and addresses a complex issue key to our capability to model pelagic ecosystems. This WG would complement SCOR-IOC GlobalHAB/deliver on GlobalHAB priorities. The proposal also describes how it responds to Ocean Decade objectives.

2.1.5. From the Ocean to the Lab to the Ocean: best practices for ecologically sound inferences in fluctuating habitats (OLO)

Timeliness	Yes. Multiple Ocean Stressors are affecting marine ecosystems the variation over short time scales is most probably also affecting the cumulative effect. However current laboratory experiments addressing this, able to identify the net impact and potential main source are limited or not existent. However, in order to improve future predictions and projections of ocean health this type of information is of immediate need.
High priority for ocean science and for SCOR?	Yes, see SCOR WG 149, SCOR WG COBS, however there might be a risk of duplication between those.
Is a SCOR Working Group a good mechanism here?	Yes, but as mentioned maybe the risk of duplication.
Are the terms of reference appropriate?	Appropriate, though very ambitious in particular regarding the development of the indicators and the multitude of guidelines they want to prepare, however if they distinguish more clearly what they will do to complement the SCOR WG 149- further development of the Meddle tool, not investing in new tools, rather improving, strengthening exiting instruments.
Are the membership suggestions appropriate?	
Any other comments or suggestions for improvement of proposal	
Rating: <i>must fund, may fund, do not fund. Among any "must funds", please list the rank: 1, 2, or 3</i>	Might be funded.