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INTERGOVERNMENTAL OCEANOGRAPHIC COMMISSION
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INFORMATION DOCUMENT

**CONCEPT PROPOSAL FOR AN
'IOC-COORDINATED STATE OF THE OCEAN REPORT (IOC STOR)'**

Summary

In the recent years, a renewed focus on the world ocean and appreciation of its crucial role for life on Earth, the global climate, food security, human health and wellbeing, as well as its role in the global economy, have led to an increased demand by decision-makers and society at large for relevant, strategic, current, and easily accessible information on the state of the ocean.

Various high-level assessments provide comprehensive peer-reviewed analysis of the state of the ocean and climate with varying periodicities, often once in several years. Their volume and process of preparation does not allow the actualization of information at shorter intervals. However, the state of the ocean changes rapidly while the interest of accessing more regularly updated information remains unmet.

By its mandate, IOC is the UN body responsible for ocean science and provides a first place for the world to look for ocean-related information. An annual State of the Ocean Report (StOR), to be coordinated by IOC, will update the community of stakeholders on the current state of the ocean and progress in expanding its management. This information can support actions by multiple stakeholders in the context of the UN Decade of Ocean Science for Sustainable Development and within various fora.

The multiple expert groups and networks supporting the IOC programmes and activities are in position to provide the bulk of information to describe the current state of the ocean. However, the IOC StOR should be organized to benefit from all relevant organizations willing to contribute to it. Quality assurance/control of the contents will be ensured through a peer-review process.

The IOC StOR will be a comprehensive but concise annual report, not surpassing the length of 30 pages. As such, the topics included in the Report should be presented in a manner that succinctly introduces the issue, stresses its importance, and outlines the current state of knowledge in that issue area.

This concept proposal has been prepared for the information of Member States on the occasion of the 53rd session of the IOC Executive Council (online, 3–9 February 2021).

Introduction

As stated in the preamble, in the recent years, a renewed focus on the world ocean and appreciation of its crucial role for life on Earth, the global climate, food security, human health and wellbeing, as well as its role in the global economy, have led to an increased demand by decision-makers and society at large for relevant and easily accessible and strategic information on the state of the ocean.

This increased demand for information on the state of the ocean can be illustrated, inter alia, by keen interest of many stakeholders in the Special Report of the Intergovernmental Panel on Climate Change (IPCC) on the Ocean and Cryosphere in a Changing Climate (SROCC). The report triggered very engaged discussions at the 25th Conference of Parties (COP) of the UN Framework Convention on Climate Change (UNFCCC) and contributed to the decision by Parties to convene a Dialogue on Ocean and Climate Change under the Convention's Subsidiary Body on Scientific and Technological Advice (SBSTA), which took place virtually on 1–2 December 2020.

As per the evidence presented in the IPCC Assessment and Special Reports, manifestations of climate change occur with further frequency and intensity, and have become a subject of continuous interest and concern. It can be noted that a fundamental IPCC report that is issued once-in-several-years is usefully complemented by an annual Statement on the State of the Global Climate, which is coordinated by WMO. The Statement accounts what has been happening with the climate in the past year and its near-ready version is usually announced before sessions of the UNFCCC COP that take place late in the year. The WMO-led Statement is therefore seen as a relevant additional source of more current information on climate. IOC leads the ocean sections in the WMO Statement. The proposed IOC State of the Ocean Report (StOR) would present several dimensions of the ocean climate problem.

The World Ocean Assessment (WOA) process represents the most comprehensive publication of the UN about the state of the ocean with a view to informing its sustainable management. The 2nd edition of WOA is expected to be concluded at the end of 2020. Plans for conducting the 3rd WOA Report are being discussed. The report, however, sees the light every four or five years and is voluminous in nature. A more frequent and concise update on the situation of the world ocean, also from the perspective of applications of the findings of scientific research and observations for ocean management, is therefore desirable. The IOC StOR can serve as a real-time update for some of the science-to-management issues dealt with by the WOA and will therefore support future WOA endeavours.

Motivation for the IOC State of the Ocean Report

The IOC StOR will present, on an annual basis, the current status of the ocean drawn upon the analysis of scientific data—essential physical, biogeochemical and ecological variables—gathered through the IOC science activities and those of its partners, as well as implementation progress of science-based ocean management arrangements. This will inform Member States, other stakeholders and the general public about the changes and challenges which the world ocean is facing and will seek to report on adequate science-based solutions to those challenges that are emerging. This Report could thus trigger informed policy action, facilitate decisions on research focus areas that ought to be strengthened or developed, and allow the implementation of stronger science-based governance frameworks at national and global levels by strengthening the science-policy interface.

The interest in the ocean, in using it and keeping it healthy also manifests itself in the growing engagement in the United Nations Decade of Ocean Science for Sustainable Development (2021–2030), which aims to generate actionable knowledge in support of ocean sustainability. The IOC StOR can therefore play a useful and positive role in providing information based on ocean research and observations that will be required to guide actions by and stimulate synergies between multiple stakeholders in the context of the Ocean Decade. It can usefully contribute to the Decade monitoring and evaluation process and help the adaptive management of the Decade's implementation.

The bulk of the report can be constituted by the findings by all relevant IOC expert groups and programmes. State of the ocean can be represented by reviewing such thematic or crosscutting issues as ocean carbon, the effects of climate change on the ocean, ocean acidification, nutrients and eutrophication, ocean de-oxygenation, harmful algal blooms, synergies among multiple ocean stressors, and the results of ocean modelling and predictions. While the findings of the work of expert groups of IOC or co-sponsored by the Commission are already presented on a regular basis in the form of scientific and technical publications and brochures, the IOC StOR will allow for these findings to be compiled, to identify convergences and

divergences between them, and, importantly, to be digested through appropriate communication techniques in a language that is accessible to non-specialized stakeholders.

The IOC StOR will be a new endeavour, a platform to assess the state of our knowledge on ocean sustainability in a manner that is innovative, value-adding and in line with the objectives of the Ocean Decade. It will be the first assessment on ocean science benefiting from application of the notions and approaches of co-design, co-production and co-delivery of knowledge: in addition to relevant expert groups, multiple stakeholder groups other than the scientific community will be invited to contribute to its scoping and the formulation of the questions to be addressed together with experts in those areas (ocean health, ocean resources, ocean and climate, ocean weather forecast, ocean and values and behaviours) (co-design). The report will mobilize transdisciplinary knowledge over academia, the private sector and indigenous and local communities (co-production); it will illustrate successful applications of the knowledge presented for multiple purposes, at multiple scales (co-delivery of solutions).

The IOC StOR will constitute an integrated contribution of IOC to the Ocean Decade as it will provide, on an annual basis, an assessment of knowledge (and gaps therein) to develop and steer the programmes, projects and other activities populating the Decade against the organizing framework provided by the Challenges delineated in the [Implementation Plan of the Ocean Decade](#). The report will complement and be complemented by the [IOC Global Ocean Science Report](#), which assesses the status and trends in ocean science capacity, focusing on the global ocean science infrastructure, investments and capacities, both human and technical, and allow to redirect efforts in ocean sciences towards the identified science and societal priorities.

The development of an IOC StOR will respond to the [Draft IOC Medium-Term Strategy for 2022–2020](#), revised in accordance with [Resolution XXX-3](#) of the IOC Assembly. In particular, High Level Objective 5 (HLO5) of the Medium-Term Strategy calls for ‘facilitating research, technical analyses, and syntheses of scientific data to address emerging ocean environmental issues’, which will be served by the IOC StOR.

Complementarity of and synergies with relevant assessments, and the value added to them by the IOC StOR

There are already a number of publications which focus on the ocean or contain dedicated sections describing ocean-related issues. Several of these publications take into account the findings of ocean science. These publications, reports and assessments have played a critical role in informing policy decisions related to, inter alia, biodiversity, climate change and food security. Importantly, they have also contributed to raising awareness on the importance of the ocean for the general public, policy-makers and other marine stakeholders. Below is a non-exhaustive list of such publications.

As stated above, the [World Ocean Assessment \(WOA\)](#), the first edition of which was published in 2016, is the product of the first cycle of the Regular Process for Global Reporting and Assessment of the State of the Marine Environment, including Socioeconomic Aspects, established at the 2002 World Summit on Sustainable Development. WOA-I was compiled by over 600 scientists, nominated by UN Member States. The second edition of WOA is expected to be published in late 2020. **The scope of StOR would be less ambitious than WOA, concentrating on a selected number of topics and measurable variables through ocean science, and related science-based measures to address the issues described.**

The [IPCC Special Report on the Ocean and Cryosphere in a Changing Climate](#), also referred to above, is a most impactful report on the role of the ocean for the global climate, and on the effect of the changing climate on the ocean. The scale of this IPCC Special Report, including the considerable number of scientific publications reviewed and included, as well as the number of expert editors and reviewers involved, has significantly contributed to the awareness of the importance of the ocean to the global climate and the threats the ocean is facing. The IPCC SROCC has a strong focus on predicting future changes and their effects on the ocean. **The IOC StOR would focus on the current state of the ocean and document changes induced by climate change over time.**

The [European Union’s Earth Observation Programme ‘Copernicus’](#) has published [four Ocean State Reports](#) since 2016. The Copernicus Ocean State Reports include overviews of trends and highlight anomalies in a suite of ocean parameters, providing a detailed picture of certain ocean issues in specific regions of the European Seas. They introduce and develop Ocean Monitoring Indicators (OMI), similar to the Essential Ocean Variables (EOVs) introduced by the Global Ocean Observing System (GOOS) and its expert

panels. **The IOC StOR would have global coverage and rely on Copernicus Ocean State Reports to verify key findings related to the European Seas.**

The [Ocean Observing System Reporting Card](#) provides information on the status of GOOS yearly and, therefore, information on the conduct of ocean observations, the advances in observing measurements and initiatives, and the connection with vital services resulting from the observations. **This information is an important complement to knowledge resulting from research and other efforts other than ocean observations and can easily be integrated into IOC StOR.**

Since 1993, The World Meteorological Organization publishes annual [Statements on the State of the Global Climate](#), using seven 'State of the Climate Indicators', which are based on Essential Ocean Variables (EOVs) identified with the Global Climate Observing System (GCOS) and GOOS. Two of these State of the Climate Indicators relate to the ocean: ocean acidification and sea level. Moreover, information on the status of blue carbon ecosystems and on the impacts of warming on ocean de-oxygenation is also provided. IOC is responsible for the sections on ocean acidification, de-oxygenation and blue carbon contained in the WMO Statement and contributes significantly to the section on sea level. **This information would now be presented in the IOC StOR in the first place, while continuing to contribute to the WMO Statement.**

Furthermore, the reports of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services ([IPBES](#)) and the [CBD Global Biodiversity Outlook](#) also contain relevant information on the state of the ocean and its resources. **Through the IOC StOR, IOC will strengthen its contribution to the scoping and review of IPBES (and IPCC) reports.**

Some reports deal with thematic or crosscutting issues related to the oceans, such as the [State of the World Fisheries and Aquaculture](#) (SOFIA), which is produced by the Food and Agricultural Organization of the UN (FAO), assessments of Large Marine Ecosystem (LMEs) under the umbrella of the Global Environment Facility (GEF) or regional assessments such as those coordinated by the [Arctic Council](#), etc. **The IOC StOR would rely on relevant information contained in these reports, as appropriate.**

The contribution of the IOC StOR to the UN Ocean Decade

In light of the Ocean Decade and building on the momentum provided by previous publications on the state of the ocean, there may be a need to produce on a regular basis a concise and comprehensive report around the Challenges and Objectives of the Ocean Decade to address the following questions:

What is the status of our knowledge underpinning actions to tackle the Decade's Challenges and realize the desired characteristics of the world ocean at the end of the Decade?

Is such knowledge reflective of the multi-stakeholder nature of 'the new ocean science' enterprise that the Ocean Decade is pursuing?

And finally: Which are the priority areas for action to which such knowledge of the state of the ocean points and what are the main current gaps in actionable knowledge hampering the full realization of the Decade's mission?

All questions are related to the monitoring and evaluation process of the [Implementation Plan of the Decade](#), to which the IOC StOR could contribute.

Guided by the above-mentioned main lead questions, the IOC StOR would serve as an annual scorecard for the Decade, providing a yearly report on the state of the knowledge of the world ocean in a salient, timely easily communicable, yet scientifically authoritative manner, thus contributing substantively to fulfilling the function to track and communicate progress in the implementation of the UN Ocean Decade.

The 10 Ocean Decade Challenges provide a unique opportunity to move from science for knowledge generation to actionable knowledge generated through co-design of the research and observation agendas by the scientific community together with concerned stakeholders; to capture the knowledge that exists and is generated outside of academia, for example, within the private sector and engage with relevant indigenous and traditional knowledge holders, through knowledge co-production; and to ensure that the Challenges guide the knowledge gathered towards the needed directions for action.

The issues at the core of the Ocean Decade Challenges align with several of the topics of the IOC activities, projects and expert working groups, on the scientific work of which the IOC StOR will rely for gathering the most up-to-date scientific findings (see the list of Ocean Decade Challenges in annex and the relevant IOC activities and projects that match with the Challenges).

Among the IOC programmes and activities covering issues identified under the Ocean Decade Challenge 1, which deals with pollutants and contaminants and their potential impacts on human health and ocean ecosystems, are: the [Nutrients and Coastal Impacts Research Programme \(N-CIRP\)](#), supported by IOC and UNEP; and the [GESAMP Working Group 40](#) on Plastics and Microplastics in the Ocean, under the lead of IOC-UNESCO and UNEP (SDG 14.1.1b) (cf. [IOC/EC-XLIX/2 Annex 4](#)).

Topics identified under the Ocean Decade Challenge 2, which is set out to understanding the effects of multiple stressors and to develop solutions to protect, monitor, manage and restore ecosystems and their biodiversity, include the IOC work on ocean acidification, especially IOC's role as the custodian agency for the [Sustainable Development Goal 14.3.1 Indicator](#) ([Decisions XXIX/9.1](#) and [EC-LI/4.4](#)), which calls on Member States to report the annual average marine acidity (pH), permitting the calculation of the rate of change of ocean acidification over time, and its partnership in the Global Ocean Acidification Observing Network (GOA-ON); the IOC Working Group on Multiple Ocean Stressors as outlined in [IOC/EC-LI/2 Annex 5](#) and its terms of reference, which elucidates the effects of more than one concurrent stressor on marine organisms and ecosystems; the [IOC Working Group of the Global Ocean Oxygen Network \(GO2NE\)](#), which monitors decreased oxygen concentration in the ocean and their impacts; the [IOC International Group for Marine Ecological Time Series \(IGMETS\)](#), which promotes the use of ecological time series to improve model projections and forecasts needed to separate human induced and natural variability in the open ocean and coastal areas; the [IOC Working Group on Climate Change and Global Trends of Phytoplankton in the Ocean \(TrendsPO\)](#), which coordinates investigations on the effects of climate change on phytoplankton dynamics in the open ocean and coastal seas. The IOC Working Groups GO2NE, IGMETS and TrendsPO are outlined in [IOC/EC-XLIX/2 Annex 6](#) and were established in 2016 ([Decision EC-XLIX/4.1.3](#)). The IOC-coordinated International Waters Learning Exchange and Resource Network ([IW-LEARN](#) Programme) can also contribute substantially to informing management responses to the multiple stressors facing the ocean and coastal areas of the world.

The IOC Marine Spatial Planning (MSP) Programme, established in 2006 and lately reconfirmed through Decision [IOC-XXX/10.2](#), assists Member States with ecosystem-based management (EBM) in the marine realms and aligns with Ocean Decade Challenge 4, which focuses on developing solutions to contribute to equitable and sustainable development of the ocean economy. The IOC StOR could feature how MSP and ecosystem-based management (EBM) support SDG Indicator 14.2.1, specifically in relation to assessing the proportion of exclusive economic zones managed using ecosystem-based approaches.

To enhance the understanding of the ocean-climate nexus, as outlined in Ocean Decade Challenge 5, IOC supports the Integrated Ocean Carbon Research Group (IOC-R) for observations and research into ocean carbon ([IOC/EC-LI/2 Annex 5](#) and terms of Reference); the [GESAMP Working Group 41 on Ocean Interventions for Climate Change Mitigation](#), which investigates measures for carbon removal from the ocean; the [Blue Carbon Initiative \(BCI\)](#) and the [International Blue Carbon Partnership \(IBCP\)](#) for their work on conservation and restoration of coastal and marine ocean ecosystems for climate change mitigation; and the [IOC-WMO-ISC World Climate Research Programme \(WCRP\)](#), which facilitates the analysis and prediction of climate and the effect of human activities on climate ([Decision IOC-XXX/6.2](#)).

The Ocean Decade Challenge 6 with its focus on multi-hazard warning systems will be supported by the [IOC Harmful Algal Blooms](#) portfolio and emerging work on ocean and human health, as well as the [IOC Tsunami Programme](#), which covers warning and mitigation systems and educational and public awareness activities on tsunamis and other ocean hazards. The Harmful Algal Blooms portfolio, established in 1991 through [Resolution XVI-4](#), fosters research on and effective management of harmful algal blooms in order to understand their causes, predict their occurrences and mitigate their effects on animals, ecosystems and human health. The IOC StOR would include the latest findings from this field, highlighting changes in the frequency and extent of, and trends in harmful algal bloom events under changing ocean conditions. The IOC Tsunami Programme, with over 50 years of experience, is leading a global effort to develop and establish ocean-based tsunami warning systems as part of an overall multi-hazard disaster reduction strategy, organizing tsunami readiness exercises and providing tsunami warning and protection at local, regional, and global scales. The IOC StOR would capitalize on the wealth of experience of this programme in detecting changes in the ocean from a multi-hazard perspective, and related implications for society. An account of tsunamis that have occurred during the year of report and a list of recognized Tsunami Ready communities

would be of interest to nations and would help to maintain the level of alertness through the Tsunami Ready programme.

The [IOC-WMO-UNEP-ISC Global Ocean Observing System \(GOOS\)](#) (see its [2030 Strategy](#)) and the newly established Joint IOC-WMO Collaborative Board ([Decision IOC-XXX/5.1](#)) work towards a global and sustainable ocean observing system that delivers timely data and information, as described in the Ocean Decade Challenge 7. The IOC StOR will also be reflective of findings emerging from sustained observations of EOVs, which can act as proxies and early warning indicators for changes in the ocean.

The [IOC International Oceanographic Data and Information Exchange Programme \(IODE\)](#) facilitates the exchange of oceanographic data and information between Member States and meets the needs of data users. The importance of continuing this work and of tailoring it towards the outcomes and objectives of the Decade, as called for in Ocean Decade Challenge 9, was reconfirmed by IODE ([IOC/IODE-XXV/3s](#)) and the IOC Assembly ([Decision IOC-XXX/7.2.1](#)) in 2019. The IOC StOR will therefore also rely on IODE metrics to point to critical trends in ocean data, from gathering to analysis and access. Ideally, the IOC StOR could point to various important datasets, such as the Ocean Biodiversity Information System (OBIS) and its current findings and updates and reanalyses by the Copernicus Marine Environment Monitoring Service (CMEMS).

Should the IOC StOR provide a scorecard of the Decade progress, it must address all Decade Challenges through relevant scientific activities, relying on strategic partnerships with other UN and non-UN organizations and with multiple other stakeholders when necessary. This would include reporting on such issues as sustainable food security and nutrition (Ocean Decade Challenge 3); a digital ocean (Ocean Decade Challenge 8); and changes in perception of and behaviour towards the ocean (Ocean Decade Challenge 10). These are the three Ocean Decade Challenges in which the IOC would partner closely with FAO (Challenge 2), IHO and GEBCO (Challenge 8), and the International Science Council (Challenge 10).

The above demonstrates IOC's assets and capability to produce the proposed State of the Ocean Report. The expertise provided by the numerous IOC expert groups and through partnerships provide a solid ground for developing annual reporting on ocean science issues the Commission has been actively working on over 60 years of existence, an endeavour that align well with the Ocean Decade Challenges.

However, the Ocean Decade is no conventional science endeavour. Its Implementation Plan specifies clearly the direction of ocean science in the next 10 years, by stimulating the production of the knowledge needed to ensure sustainable development (Objective 1), building a new form of ocean science capacity that is more integrated and helpful to understand the interactions between humans and the ocean (Objective 2), and by being applicable and solution-oriented (Objective 3). Assessing where one stands with this 'new knowledge' requires a tailored process to measure the availability of integrated, multi- and trans-disciplinary knowledge needed to address the most pressing challenges to preserve ocean sustainability.

The need for a dedicated process for scoping and outlining the IOC State of the Ocean Report

The IOC Secretariat will designate a dedicated group of representatives from relevant IOC expert groups and programmes as well as members of the IOC Secretariat to form the scoping group of the first edition of the IOC StOR.

Furthermore, the Decade Coordinating Unit will identify representatives of stakeholder groups outside the scientific community working in academic circles who will be invited to the scoping process of the IOC StOR. A multistakeholder editorial board for the report will be established under the coordination of the Executive Secretary of IOC (function delegated to the Ocean Science Section of IOC).

The core content of the Report will be based on the latest findings of the IOC expert groups and other relevant IOC programmes and projects populating the Ocean Decade following through the Calls for Actions of the Ocean Decade.

A selection of topics by the scoping group will be shared with the broader expert community on an annual basis, according to the process outlined in Table 1. The process should seek and mobilize knowledge from the private sector, and relevant fora specialized in documenting indigenous and local knowledge for instance.

The knowledge co-produced through the process will undertake a rigorous peer-review process, whereby all comments received by relevant experts and practitioners will be addressed individually as per the IPCC peer-review model.

The IOC StOR will be a comprehensive but concise annual report not exceeding 30 pages. The topics selected by the scoping group will be presented in a manner that succinctly introduces the issue, stresses its importance and outlines the current state of knowledge relevant to the issue. Graphic design will be an important feature of the Report to illustrate issues and visualize development over time and geographical scales.

The process for scoping the Report would follow the timeline proposed in Table 1, culminating in the publication of a pilot IOC State of the Ocean Report in the first half of 2022, for consideration by the IOC Executive Council at its 55th session mid-2022.

Table 1 – Provisional timeline for the preparation of the pilot IOC State of the Ocean Report

Timeline	Action
Month 1	<ul style="list-style-type: none"> • General scoping by the IOC Secretariat re. selection of contents, format and types of inputs • Constitution of the IOC StOR Scoping Group and 1st virtual meeting of the group • Invitation letters to IOC experts, including provision of guidance for their inputs
Month 2	<ul style="list-style-type: none"> • Gathering a compilation of the inputs received
Months 3-5	<ul style="list-style-type: none"> • Organized compilation of inputs received by the IOC Secretariat • Drafting of the text of the IOC StOR by the Scoping Group (now evolved into the IOC StOR Editorial Board) and by the IOC Secretariat • V.0 of draft of the IOC StOR and scorecards • Development of graphs and other iconography
Months 6-7	<ul style="list-style-type: none"> • First round of peer-review and development of V.1 by IOC Secretariat and the IOC StOR Editorial Board
Month 8	<ul style="list-style-type: none"> • Virtual meeting of Editorial Board • Finalization of the narrative • Peer-review by external experts
Months 9-10	<ul style="list-style-type: none"> • Second round of peer-review and development of final manuscript by IOC Secretariat and the IOC StOR Editorial Board
Month 11	<ul style="list-style-type: none"> • Editing and graphic layout
Month 12	<ul style="list-style-type: none"> • Quality control by IOC Secretariat and publication of the Report

**Annex 1 – Building blocks for the proposed IOC StOR:
Ocean Decade Challenges and relevant IOC expert activities**

Ocean Decade Challenge	IOC expert group or project
<p>Ocean Decade Challenge 1: Understand and map land and sea-based sources of pollutants and contaminants and their potential impacts on human health and ocean ecosystems and develop solutions to mitigate or remove them.</p>	<ul style="list-style-type: none"> • IOC-UNEP Nutrients and Coastal Impacts Research Programme (N-CIRP), (SDG 14.1.1a) • GESAMP WG 40 on Plastics and Micro-plastics in the Ocean: Marine Plastics (SDG 14.1.1b)
<p>Ocean Decade Challenge 2: Understand the effects of multiple stressors on ocean ecosystems, and develop solutions to protect, monitor, manage and restore ecosystems and their biodiversity under changing environmental conditions, including climate.</p>	<ul style="list-style-type: none"> • IOC WG on Multiple Ocean Stressors: Multiple Stressors • GOA-ON and IOC work on ocean acidification: Ocean Acidification ((SDG 14.3.1) • IOC WG Global Ocean Oxygen Network (GO2NE): Ocean Deoxygenation • IOC International Group for Marine Ecological Time Series (IGMETS): Ecological Time Series • IOC WG on Climate Change and Global Trends of Phytoplankton in the Ocean (TrendsPO): Effects of Climate Change
<p>Ocean Decade Challenge 4: Generate knowledge, support innovation, and develop solutions to contribute to equitable and sustainable development of the ocean economy under changing environmental and social conditions.</p>	<ul style="list-style-type: none"> • IOC Marine Spatial Planning initiative and Ecosystem Based Management-related work
<p>Ocean Decade Challenge 5: Enhance understanding of the ocean-climate nexus and use this understanding to generate solutions to mitigate, adapt and build resilience to the effects of climate change, and to improve services including improved predictions and forecasts for weather, climate, and the ocean.</p>	<ul style="list-style-type: none"> • Integrated Ocean Carbon Research Group (IOC-R): Ocean Carbon Research and Observations • GESAMP WG 41 on Ocean Interventions for Climate Change Mitigation: Carbon Dioxide Removal • Blue Carbon Initiative (BCI) and International Blue Carbon Partnership (IBCP): Blue Carbon • IOC-WMO-ISC World Climate Research Programme (WCRP): Research on Climate Variability and Change
<p>Ocean Decade Challenge 6: Expand multi-hazard warning systems for all biological, geophysical, and weather and climate related ocean hazards, and mainstream community preparedness and resilience.</p>	<ul style="list-style-type: none"> • The Harmful Algal Blooms portfolio of activities and emerging work on ocean and human health: Ocean Health and Ocean and Human Health • IOC Tsunami Programme: Tsunami and other Sea-level related Hazards
<p>Ocean Decade Challenge 7: Ensure a sustainable ocean observing system that delivers timely data and information accessible to all users on the state of the ocean across all ocean basins.</p>	<ul style="list-style-type: none"> • IOC-WMO-UNEP-ISC Global Ocean Observing System (GOOS): Ocean Observations • Joint IOC-WMO Collaborative Board
<p>Ocean Decade Challenge 9: Ensure comprehensive capacity development and equitable access to data, information, knowledge and technology across all aspects of ocean science and for all stakeholders regardless of geography, gender, culture, or age.</p>	<ul style="list-style-type: none"> • IOC Intergovernmental Oceanographic Data and Information Exchange Programme (IODE): Ocean Data and Information