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INTERGOVERNMENTAL OCEANOGRAPHIC COMMISSION
(of UNESCO)

INFORMATION DOCUMENT

REPORT OF THE AD HOC ADVISORY GROUP FOR THE IOC OCEAN SCIENCES POGRAMME

The Advisory Group expressed general satisfaction with the existing elements of the Ocean Sciences Programme (OSP) and Ocean Sciences Section (OSS) and recommended to build the OSP around four clusters or strategic themes to adapt OSS priorities to the new global challenges. In addition to the strategic priorities, the Advisory Group also discussed removal of certain constraints and the implementation pillars to deliver the strategy, including the overwhelming constraint caused by the lack of resources for IOC activities.

The Advisory Group recommends that IOC/OSS should focus its efforts and support on aspects where it can make a difference, through: (i) supporting global and local initiatives addressing key data, knowledge, and science capacity gaps; (ii) enhancing the capacity of IOC to provide leadership in global ocean science, for example, through formal associations with key global scientific projects and programmes; (iii) endeavouring to improve the inclusivity of global ocean science and to build a truly global scientific community in Ocean Sciences, by contributing to build and enhance scientific capabilities at the individual, institutional and national level in the developing world, especially in Africa, in line with UNESCO's priorities; and (iv) sustaining and further developing interdisciplinarity as the interdisciplinary nature of research supported and promoted by IOC is seen to be one of its greatest strengths.

The Advisory Group recommends that the OSP is built around the following four clusters or strategic themes: (i) Science in support of sustainability of ocean ecosystems in a changing environment, (ii) Assessing and predicting ocean health and variations in ocean goods and services, (iii) Responding to governments and (iv) Science for the unknown sea.

Introduction

1. In discussing the Intergovernmental Oceanographic Commission (IOC) ocean science priorities and programme actions, it is important to make a distinction between the Ocean Science Programme (OSP) of the IOC and the Ocean Science Section (OSS). The OSS aims to play a lead role in creating the conditions for doing good ocean science and building a network of scientific logistic facilities at regional and global scales. The functions of OSS include the promotion of science innovation, nurturing programmes, transferring, disseminating and sharing information, data and knowledge, best practices, assessment and scientific services related to ocean sciences. This is done in an inclusive and participatory way, synthesizing knowledge of the scientific community, academia, Member States, etc.; the OSS acts under the direction of the IOC Executive Secretary. The OSP represents the priority ocean science issues identified by Member States that require international cooperation and coordination, and which are carried out in a manner consistent with the procedures and practices of the Commission. There may be elements of the OSP for which there is little direct support from the OSS Secretariat, but which nevertheless represent critical elements of the Programme. For other elements, programme actions may be undertaken directly by the Secretariat, or taken in cooperation with Member States.

2. The Medium-Term Strategy for 2008-2013 (34 C/4) set out the strategic vision and programmatic framework for UNESCO's action over six years in all its domains of actions at the global, regional and country levels. This Medium-Term Strategy defines a common framework for all UNESCO Sectors and was followed by sectoral plans such as the IOC Medium-term Strategy 2008-2013 (IOC-XXIV/2), which identifies 4 High-level Objectives (HLO) in accordance with UNESCO strategy and within the IOC mission statement. The roadmap given in the 34 C/4 was developed into three consecutive programmes and budget documents, beginning with document 34 C/5 (2008-2009) and followed by 35 C/5 (2010-2011) and 36 C/5 (2012-2013). These documents were then prepared in work-plan format according with the UNESCO Result Based Management practice.

3. In addition to the above-mentioned framework, the IOC OSS work-plan adopted in 2009 (IOC/INF-1259) was organized around the IOC Mission, the high level objectives for the period 2008-2013 and the priority areas of research determined by the Ad hoc Advisory Group for the IOC OSS (IOC/INF-1235, i.e. climate change, ocean health and coastal research, assessment and management and modelling). The focus of the work-plan intended to make all science efforts to engage as broad range of experts as possible and to be as global as possible and in line with the functions of promoting science innovation and management, science synergy, scientific services, outreach and capacity building as defined in document IOC/INF-1259. The progress of the IOC Science Section work-plan were reviewed and presented during the 26th IOC Assembly (IOC/INF-1286).

4. Other requests of work to be taken up by the OSS come from the policy priorities of the Member States and within the list of items of major international global agendas and priorities (e.g. UNCED Agenda 21, JPoI, Millennium Development Goal 7), such as climate change and variability, biodiversity, ocean carbon, as well as other emerging issues that are part of the Agenda of the High Level Committee on Programmes (HLCP) of the Chief Executive's Board (CEB) of the United Nations (e.g. the seasonally recurring dead-zones in the coastal oceans, pollution by microplastics, etc.) where IOC may provide coordination and expertise.

5. In addition to this internal context there is the external context and the societal need for coordinated, global and regional ocean science which is stronger than ever. The external context includes the field of agencies, IGOs, NGOs and foundations some of which are coming to function as IGOs always did, competing for leadership and resulting in science becoming more crowded and more competitive.

6. All IGOs, but in recent years especially IOC, require extra-budgetary funding to achieve their full potential. In turn, extra-budgetary funding requires brand recognition by donors. In the coming years major ocean science initiatives are going to need the strengths that have always characterized IOC initiatives, namely sound strategic and logistical planning, superb data management infrastructure, and global connections to governments and to experts. However, they will also need to have a clear presence of climate variation and change, take a full ecosystem approach, provide full coverage of biodiversity and habitats, and be "policy relevant without being policy prescriptive". These are also IOC strengths, but not areas where IOC is uniquely strong. There is no question that ocean science in the coming decade needs exactly the things that have made IOC ocean science initiatives globally significant. There is a real threat, however, that IOC may find itself increasingly challenged in its global leadership role by organizations with a lesser commitment to scientific implementation and excellence, but which are more organizationally nimble and willing to play science for the grandstand.

7. Within this challenging context, and in light of UNESCO's new Medium-term Strategy for 2014-2021[1], IOC is developing its own Medium-term Strategy for the same period (IOC/INF-1280). The OSS will need to adapt its work plan and priorities to these new strategies. Therefore, the 26th IOC Assembly adopted the Decision 8.1:

> *The Assembly requested the Executive Secretary to reconvene the Ad hoc Advisory Group for the IOC Ocean Sciences Section to help in the preparation of the next Medium-term Strategy and the prioritization of the OSS activities.*

Vision: Ocean Sciences at the IOC

8. The IOC Mission is established in Article 2.1 of the IOC Statutes:

> *The purpose of the Commission is to promote international cooperation and to coordinate programmes in research, services and capacity-building, in order to learn more about the nature and resources of the ocean and coastal areas and to apply that knowledge for the improvement of management, sustainable development, the protection of the marine environment, and the decision-making processes of its Member States.*
>
> *The Commission will collaborate with international organizations concerned with the work of the Commission, and especially with those organizations of the United Nations system which are willing and prepared to contribute to the purpose and functions of the Commission and/or to seek advice and cooperation in the field of ocean and coastal area scientific research, related services, and capacity-building.*

9. Thus, the IOC mission recognizes that scientific knowledge and research are vital to our understanding of the integrated ocean system, and this understanding depends on advances in science and technology. IOC must be a driver for such advances and must be seen to be contributing significantly to strengthening the scientific approach to understanding the integrated ocean system.

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[1] The General Conference of UNESCO at its 36th Session (Paris, 25 October–10 November 2011), through Resolution 105, decided to align programming cycles with the Quadrennial Comprehensive Policy Review (QCPR) of operational activities for development of the United Nations system and to extend the Medium-Term Strategy cycle from six to eight years in 2014. To align with the programming cycle of UNESCO, the IOC Medium-Term Strategy will therefore cover the period 2014–2021.

10. Therefore, the Ad hoc Advisory Group vision is that IOC should play a key role as a global knowledge broker on Ocean Sciences, involving the promotion of science, nurturing programmes, transferring, disseminating and sharing data, information and knowledge, promoting best practices, undertaking assessment and facilitating scientific services related to the Oceans. All of these must be done in an inclusive and participatory way respecting cultural diversity and taking into account the views of the scientific community, academia, Member States and industry from the North and the South.

Strategic priorities

i. The strategic context

11. It has been argued that the world has now entered a new geological epoch, the Anthropocene, where human actions are a strong, often dominant, influencing on global processes, from bio-geo-chemical to evolutionary. This reflects the reality that people are part of the ecosystems that they shape, and that ecological and societal systems are mutually dependent. These relationships and interdependencies need to be closely examined, as their understanding forms the basis for ecosystem approaches to the management of our oceans and their resources, including cultural and amenity services of marine ecosystems. Without high-quality science as a basis for sound, integrated ocean management, the sustainability of our marine ecosystems and socio-ecological systems will be unattainable.

12. Our planet is presently facing major challenges: our life support systems and our survival are being threatened by new consumption patterns, overexploitation of natural resources and increased waste production. These are further exacerbated by adverse climatic processes and episodic natural hazards some of which are becoming more and more frequent. As it becomes increasingly evident that climate is largely controlled by oceanic processes, the need for enhanced ocean observation grows. Collection of ocean data, including biological data, sharing of information, understanding oceanic processes and capacity building are of major importance for the sustainable development of the planet.

13. Ocean science is in a transition period and credible and timely scientific knowledge is necessary for addressing global challenges. A more comprehensive, interdisciplinary and robust science that incorporates a better understanding of the marine ecosystems' role in climate change is required to forecast more accurately the magnitude and the intensity of change at multiple scales, as well as to evaluate options for mitigation and adaptation.

14. Within this strategic context, the IOC should continue to advocate, promote and coordinate international research in Ocean Sciences, maintain and nurture a strong link with the scientific community and support the work of this community at the intergovernmental level. This role spans from facilitating the development of new major international programmes, to facilitating the transitioning and new stages of recently completed programmes and projects such as the Census of Marine Life, GLOBEC, and GEOHAB and to cooperate with, or even adopt, projects like OBIS or IndiSeas.

ii. Defining strategic priorities

15. IOC OSS should focus its efforts and support on aspects where it can make a difference, through: (i) supporting global and local initiatives addressing key data, knowledge, and science capacity gaps; (ii) enhancing the capacity of IOC to provide leadership in global ocean science, for example, through formal associations with key global scientific projects and programmes; (iii) endeavouring to improve the inclusivity of global ocean science and to build a truly global scientific

community in Ocean Sciences, by contributing to build and enhance scientific capabilities at the individual, institutional and national level in the developing world, especially in Africa, in line with UNESCO's priorities; and (iv) sustaining and further developing interdisciplinarity; the interdisciplinary nature of research supported and promoted by IOC is seen to be one of its greatest strengths.

16. The Advisory Group recommends that the OSP is built around the following four clusters or strategic themes to adapt OSS priorities to the new global challenges:

17. Science in support of sustainability of ocean ecosystems in a changing environment: The risks posed to ocean ecosystems by global environmental change should be assessed at multiple scales, and the options for adaptation, mitigation, management and responses of ecological and social systems should be explored. This will require careful coordination of multidisciplinary and transdisciplinary studies, and synthesis of these results into forms suitable for communication and use by managers in their deliberations around balancing of conflicting objectives at regional and global scales. This increased understanding can form the basis for scientific guidance on options for adaptation of human social and economic systems to a changing ocean (as discussed at the UNCSD Rio+20), and for setting of regional and global objectives for conservation and sustainable use of a dynamic ocean. This priority addresses the interactions between the marine [eco]system and the overall Earth system.

18. Assessing and predicting ocean health and variations in ocean goods and services: Identifying robust indicators of ocean status, and locating their tipping points[2] relative to marine ecosystem functioning, are important in predicting or early detection of changes in ecosystem states, and in evaluating ecosystem resilience etc. Such knowledge and analytical tools can be very valuable in ocean management in general, and in placing management of single sectors, such as fishing, into an ecosystem-based approach. The knowledge and tools are also key for understanding how much an ecosystem can be stressed before it moves to other states from which recovery may be difficult. Current research on these topics is still piecemeal and needs coordination. Developing and testing robust approaches for locating positive feedback loops and tipping points poses hard scientific questions and requires comprehensive data sets, detailed analysis and advanced modelling skills, but is essential to address existing gaps in the ocean science-policy interface. The IOC, by virtue of its rich experience with various databases and multi-disciplinary research activities globally, could uniquely provide the desperately needed scientific leadership, focus and coordination required to move this scientific field forward in a coordinated, unified direction. This priority addresses as ecosystem based approach to observing and assessing the state of the marine eco[system].

19. Responding to governments: As demand for goods and services increases, competition will mount amongst different ocean users careful and managing human activities in a changing environment will be essential. However, there is little practical advice, few guidelines and few documented examples of how scientific information on our changing oceans (physical, chemical, biological) can be applied and incorporated into management of ocean usage, including fisheries, and conservation of marine resources. Local studies and experiences on how society has and could adapt to these ocean changes need to be assembled and synthesized to build greater understanding of human impacts on our changing oceans, and the impacts of our changing oceans on human society. This increased understanding can form the basis for scientific guidance on options for adaptation of human social and economic systems to a changing ocean, and for setting of regional and global objectives for conservation and sustainable use of a dynamic ocean. IOC has limited but high quality competence, relating to two activities that are essential to effective responses by governance bodies. With the Global Regular Assessments of the Marine Environment (GRAME) approved and progressing there is a real opportunity for IOC to play a

[2] A tipping point is understood as the point when a system changes from one stable state to another stable state. After a tipping point has been passed, a transition to a new state occurs. The tipping event may be irreversible.

prominent role in ensuring and coordinating the science foundations, to take the pulse of the ocean. The second is Marine Spatial Planning (MSP) which continues to expand as a major policy and planning tool for States and IGOs in both developed and less developed countries. The guidance documents on MSP developed by IOC in the 2000s remain the global benchmarks for best practice. IOC has recognized (and deserved) leadership in methods for MSP and will need to use its global network of collaborators to lead and consolidate experiences with MSP and update the guidance documents in light of the newer findings. This priority addresses the interactions between the marine [eco]system and human usage.

20. Science for the unknown sea: Oceans are the Earth's final frontier with an enormous unexplored biodiversity and rarely accessed deep-sea habitats. The application of molecular biological and genomic techniques like DNA sequencing has revolutionized the study of marine biodiversity and enabling the molecular identification of marine biomass. Pilot projects are applying these techniques and opening new avenues for research. IOC has been requested by CBD to contribute to planning of the marine biodiversity component of IPBES, and the secretariat is actively pursuing this. Physical oceanographic research and the support of global numerical modelling also requires attention in broader contexts than just climate change (e.g. understanding processes that influence marine biodiversity patters), as does the continuation of decadal monitoring of the geochemistry of the different deep ocean basins organized in the past by IOC.

Delivering the strategy

i. Removing barriers

21. Sustained long-term monitoring and observing programmes: Of the ICSU five Grand Challenges[3], Forecasting and Observing are already established strengths of IOC. One of the barriers to more effective and efficient global ocean monitoring/observing is the complexity in activities, programmes, funding sources, and different objectives of observing/monitoring (scientific, metocean, management etc.). Observations of many different parameters (chemical, physical, biological) are recorded in many different ways, by different groups for different purposes, resulting in simultaneous duplication and fragmentation of efforts. Mapping exercises or inventories of observing activities and data collection at regional seas level can help to provide a first step towards developing a strategic approach to guide future investments and programme development. IOC is in a position to promote the development of such mapping of - at least the scientific - observing effort to assist in better use of member state resources. The development of coastal applications from C-GOOS will be hampered if relevant research issues pertaining to this complex environment are not addressed rigorously and in a timely manner.

22. Ensure environmental data exchange across nations and the international community: IOC has a leading role in ensuring that the oceanographic data and information goes to open access digital databases (e.g. the Ocean Biogeographic Information System, OBIS). It has both access to the databases and the technical knowledge to lead this initiative, for the benefit of science initiatives at local, national and global scales.

23. Capacity gap between developed and developing countries: IOC can enhance its impact in ocean science by moving beyond the blue water arena where only countries with more advanced oceanographic research capabilities can launch expensive expeditions and observing systems, to facilitate and lead coordinated activities at coastal laboratories. These "windows to the sea" span developed and developing countries and can assess impacts of eutrophication (dead zones, changes in diversity), HABs, climate variability, etc., and be linked for global synthesis through existing reporting processes (e.g. IPBES and GRAME) or throughout existing networks and

[3] ICSU (2010). Earth System Science for Global Sustainability: The Grand Challenges. International Council for Science, Paris. 24pp

communities of practice (e.g. LME, Regional Councils, Associations of Marine Stations). Such initiatives have potential for buy-in from countries not otherwise engaged in IOC, thus building more capacity and support.

ii. Implementation pillars

24. Some additional practical mechanisms to enhance the capacity of IOC to provide leadership in global ocean science are:

25. Scientific agenda and resources: A key word used in the comments above is “Leadership”. To make this a reality it is necessary to ensure future support for IOC work (membership, funding, commitment of resources etc). IOC occupies a unique position as the foremost intergovernmental global organization coordinating and promoting ocean science and informing ocean management. Notwithstanding obvious budget limitations, IOC has the potential to influence and drive ocean research agendas from global scale to local scale even more than it currently does. While the high quality of the science programmes in which IOC participates and/or coordinates is widely acknowledged, such “goodwill” is not sufficiently leveraged to influence political support for national/international scientific agendas (i.e. science policy decisions and actions which support ocean science development beyond the scope of IOC).

26. Ocean Science Foresight and Strategy: develop IOC as a provider of global ocean science strategy and foresight. IOC currently does this through producing *ad hoc* strategic reports (e.g. by working groups), but this should be done on a more consistent and organized level, possibly published as a high quality series. IOC should develop a capacity to be a global leader in developing and promoting global ocean science strategy, in addition to research coordination and capacity development. This could be carried out in cooperation with other organizations within the UN system and also with other IGOs and appropriate academic NGOs.

27. Partnerships: It is important that the recent growth in international collaboration in Ocean Science needs maintains its momentum and continues. This growth has only become possible because barriers that prevent collaboration (e.g. in data sharing and exchange) are being removed, and appreciation for the global connectedness of the oceans increases. However, there is scope for more collaboration. IOC should continue to lead in even greater efforts at facilitating a global view of ocean science and mobilize existing global networks. IOC co-sponsors several global research programmes or joint working groups with other organizations, which are included in the descriptions of the new programme structure of the section. IOC also works in close partnership with a number of international programmes on a regular basis to meet research and observation objectives (e.g. LME). IOC should help to strengthen existing platforms complimentary to itself, and facilitate that they serve also as a dialogue space for science, policy, business and society to interact in active and productive ways.

28. IOC Global Ocean Science Conferences: develop a strategy to support the organization of regular global ocean science conferences (every 2-3 years), which would bring together leading scientists and policy makers from around the world to discuss high-level global ocean issues and future perspectives, and research needs and priorities to support them, as well as provide a forum for reporting on recent research development, successes and challenges. This would assist in the general aim to improve the IOC “brand” and IOC Leadership Role.

29. Knowledge management: Over the next 10 years the global scientific community must take on the challenge of delivering to society the knowledge necessary to accurately assess the risks from global environmental change and the options for sustainability. A part of this challenge is acquiring the necessary knowledge, as described in other parts of this report. However, the challenge also requires consolidating the knowledge in the context of informing the decisions

society must make as our socio ecological systems are transformed to provide food, water, energy, health and well-being in a sustainable manner: economically, ecologically and socially. The history of IOC in "expedition science" provided the foundations on which its current strengths in data management, planning of coordinated science, and integrating information across scientific disciplines were built. Now IOC has to focus on managing that knowledge base in ways that allow wise choices to be made in the socio-ecological transformations needed to meet the needs of society today and in future generations. Building on the adage that "if you can't measure it, you can't manage it", existing IOC strengths can guide the selection of ocean properties that are both measurable and meaningful, ecologically and in informing policy choices. Adding the growing experience that efforts at management are best informed when science-based benchmarks and reference points are available, IOC's strengths can give it a leadership role in providing guidance for setting management benchmarks using all the knowledge gained from the era of "expedition science" to the present.

30. Communication and outreach: The important role of IOC in communicating ocean science should be highlighted and strengthened in the coming years to ensure that scientific results are synthesized into usable forms for policy development, for guiding project development, for use in management and to inform the public on the implications of healthy marine ecosystems for humankind. Also considering the extensive scientific investigations that have been conducted in the world's oceans in recent years, the level of public awareness and perception of environmental changes and ocean well-being can and should improve. There are many audiences for these messages, including governments, academia, industries, conservation advocacy groups, and civil society, with multiple communication products possibly necessary to reach each audience most effectively. Education and out-reach are essential if we are to continue scientific investigations in the ocean, since this work needs the support of the public at large. A clear mandate of the IOC to collaborate with educational institutes (e.g. Universities) would stimulate and inspire ocean sciences in the near future, while providing the tools to build the next generation of ocean scientists and policy makers.

ANNEX 1

Members of the Ad hoc Advisory Group for Ocean Sciences

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Annex 2

List of Acronyms

CBD	Convention on Biological Diversity
CEB	Chief Executive's Board (of the United Nations System)
C-GOOS	Coastal Panel of the Global Ocean Observing System
DNA	Deoxyribonucleic acid
GEOHAB	Global Ecology and Oceanography of harmful Algal Blooms
GLOBEC	Global Ocean Ecosystem Dynamics
GRAME	Global Regular Assessments of the Marine Environment
HAB	Harmful Algal Blooms
HLO	High-level Objectives
HLPC	High Level Committee on Programmes
ICSU	International Council for Science
IGO	Intergovernmental Organization
IndiSeas	Indicators for the Seas
IOC	Intergovernmental Oceanographic Commission
IPBES	Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services
JPoL	Johannesburg Plan of Implementation
LME	Large Marine Ecosystems
MSP	Marine Spatial Planning
NGO	Non-governmental Organization
OBIS	Ocean Biogeographic Information System
OSP	Ocean Sciences Program
OSS	Ocean Sciences Section
QCPR	Quadrennial Comprehensive Policy Review
UNCED	United Nations Conference on Environment and Development
UNCSD	United Nations Conference on Sustainable Development
UNESCO	United Nations Educational Scientific and Cultural Organization

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