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IOCARIBE MEDIUM TERM STRATEGIC SCIENCE PLAN
(2017–2026)

The present IOCARIBE Medium Term Strategic Science Plan (2017-2026) has been developed to fulfil IOC Resolution XXVIII-2 “IOC Capacity Development Strategy 2015–2021” (IOC, 2015).

The Science Plan takes into consideration the IOCARIBE Medium Term Strategic Science Plan 2005-2015 (IOCARIBE 2006), IOC Medium-Term Strategy 2014-2021 (IOC, 2014), and the IOC Capacity Development Strategy 2015- 2021 (IOC, 2015).

The objectives of the IOCARIBE Medium Term Strategic Science Plan are to:

- Support strategic planning of IOCARIBE Member States in relation to the development of marine sciences, oceanic observations and associated services.
- Facilitate a coherent management of regional programmes related to the marine-coastal environment and its resources.
- Strengthen scientific basis supporting regional programmes

Lines of Action of the Plan are: i) Oceans and Climate ii) Ocean Science, technology and sustainable use of Coastal and Ocean Resources with special emphasis on Large Marine Ecosystems and Integrated Coastal Area Management; iv) and Extreme Natural Hazards.

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EXECUTIVE SUMMARY

The IOCARIBE Medium Term Strategic Science Plan (SSP) (2017-2026) has been developed as a response to IOC Resolution XXVIII-2 “IOC Capacity Development Strategy 2015–2021” (UNESCO, 2016), the IOC Medium-Term Strategy, 2014–2021, adopted by Resolution XXVII-2(B) of the IOC Assembly at its 27th Session (Paris, 26 June–5 July 2013), and UNESCO Medium-Term Strategy (37 C/4) when adopted at the 37th session of the General Conference and 194th Session of the Executive Board of UNESCO.

The IOC, established in 1960 as a body with functional autonomy within UNESCO, is the only competent organization for marine science within the UN system. In addition, IOC is recognized through the United Nations Convention on the Law of the Sea (UNCLOS) as the competent international organization in the fields of Marine Scientific Research (Part XIII) and Transfer of Marine Technology (Part XIV).

The IOC Medium-Term Strategy (MTS) 2014–2021 is derived from a vision guiding the high-level objectives, programmes, and also actions and activities to be detailed in each subsequent biennial programme and budget. The strategy including its objectives will also fulfil IOC’s role as a main line of action (MLA) of UNESCO and contribute to the relevant UNESCO Thematic areas of expected results, as reflected in the UNESCO Medium-Term Strategy (37 C/4)

The Science Plan takes into consideration the IOCARIBE Medium Term Strategic Science Plan 2005-2015 (IOCARIBE, IOCARIBE Medium Term Strategic Science Plan 2005-2015, 2016), IOC Medium-Term Strategy 2014-2021 (IOCARIBE, 2016), and the IOC Capacity Development Strategy 2015- 2021 (IOC, IOC Capacity Development Strategy 2015- 2021, 2016).

Lines of Action of the Plan are:

- Oceans and Climate
- Ocean Science, technology and sustainable use of Coastal and Ocean Resources with special emphasis on Large Marine Ecosystems, and Integrated Coastal Area Management
- Extreme and Natural Hazards

The objectives of the IOCARIBE Medium Term Strategic Science Plan are to:

- Support strategic planning of IOCARIBE Member States in relation to the development of marine sciences, oceanic observations and associated services.
- Facilitate a coherent management of regional programmes related to the marine-coastal environment and its resources.
- Strengthen scientific basis for supporting regional programmes.

The IOCARIBE SSP is directed to following users:

- Managers and decision makers working in marine sciences and technology of Member States.
- Regional scientific community and regional organizations
- Donor organizations.
- Other United Nations agencies, Intergovernmental Organizations and Non-Governmental Organizations.
- IOCARIBE Secretariat.

1. JUSTIFICATION OF A SCIENCE PLAN

1.1 INTRODUCTION

The Strategic Science Plan (SSP) for IOCARIBE must become a system which permits the application of strategic planning to its daily work plan, creates policies, strengthens cooperation, identifies needs, facilitates filling-in gaps and addresses national and regional needs related to the marine-coastal issues.

By following the SSP, IOCARIBE will assist Member States in achieving sustainable use of the coastal zone and its resources. It should assist the scientific community in reducing scientific uncertainties, including those due to climate change. At the same time the SSP should effectively encourage the adoption of pertinent measures for reducing human and material losses associated with the increased frequency of extreme ocean and meteorological hazards.

The IOCARIBE SSP must consider specifically the real and/or functional insular condition of the majority of the countries of the region which demands that the strengthening of the marine sciences be directed towards the improvement of its scientific basis. In another words, the final objective of the SSP as a whole, is to contribute to the sustainable use of resources and its interaction with the ocean, river basins and the atmosphere.

Another relevant aspect to be considered in the SSP is the existing synergy between science and technology. Science being considered as the knowledge acquired through observations

and experiments proved objectively, systematized and based on general principles; and, technology as the use of this knowledge for the production of goods and services with the main purpose of satisfying the needs of society. The advance of current technology is supported in science. Science on the other hand, benefits from the development of technology with its new experimental means and observational tools.

The development of any science branch requires two main elements, societal demands or needs for results of a particular type and, the financial resources invested in this science by the society for satisfying their needs.

On the other hand, when positioning the SSP within the IOCARIBE`s administrative levels (Strategic Planning, Implementation and Evaluation) (IOCARIBE, 1988), it is observed that at the Planning level (Table 3), the strategic formulation of projects must be complemented by the Action Plans (AP). The SSP implementation is acquired through programmes and projects, while the evaluation is effected in two levels: the Secretariat level, based on management indicators and results reporting, and, the project level based on success criteria and follow-up reporting.

The IOC Mid Term strategy (United Nations Educational, 2014) stresses the “realization that building regional know how is essential for facilitating the solving of economic and social problems” facing people living in the coastal zone depending on the oceans for their wellbeing, and at risk to ocean related disasters. IOC Capacity Development Strategy (UNESCO, 2016) also stresses on the leadership of the regions. Thus, IOCARIBE as the IOC Subcommittee for the Caribbean will implement this effort by assisting Member States in achieving sustainable use of the coastal zone and its resources (United Nations Sustainable Development Goal 14) (United Nations, 2017). It will facilitate the scientific community in providing the science base for sound management and policy decisions, and being a catalyst for reducing scientific uncertainties, including those due to climate change. At the same time IOCARIBE will effectively encourage the adoption of pertinent measures for reducing human and material losses associated with the increased frequency of extreme ocean and meteorological hazards. The approach will be to stress a regional approach in collaboration with other organizations and entities. This document presents a strategic plan for IOCARIBE`s work for 2018-2028.

1.2 IOC AND IOCARIBE ROLE

The Intergovernmental Oceanographic Commission (IOC) of UNESCO was established in December 1960. In Article 2 of its Status, states:

1. 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.

2. 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.

IOC aspires to help its Member States to collectively achieve the following high-level objectives (HLOs), with particular attention to ensuring that all Member States have the capacity to meet them:

- Healthy ocean ecosystems and sustained ecosystem services
- Effective early warning systems and preparedness for tsunamis and other ocean-related hazards
- Increased resiliency to climate change and variability and enhanced safety, efficiency and effectiveness of all ocean-based activities through scientifically-founded services, adaptation and mitigation strategies
- Enhanced knowledge of emerging ocean science issues.

When working towards the high-level objectives, IOC will focus on the broad areas of:

- strengthening scientific knowledge of the ocean and human impact on it,
- applying that knowledge for societal benefit, and
- building institutional capacities for sound management and governance

The strategy is organized in a conceptual framework of functions required to advance towards the IOC Vision:

- A. Foster ocean research to strengthen knowledge of ocean and coastal processes and human impacts upon them [Ocean research]
- B. Maintain, strengthen and integrate global ocean observing, data and information systems [Observing system / data management]
- C. Develop early warning systems and preparedness to mitigate the risks of tsunamis and ocean-related hazards [Early warning and services]
- D. Support assessment and information to improve the science-policy interface [Assessment and Information for policy]
- E. Enhance ocean governance through a shared knowledge base and improved regional cooperation [Sustainable management and governance]
- F. Develop the institutional capacity in all of the functions above, as a cross-cutting function [Capacity Development]

The IOC Mid Term Strategy's vision identifies capacity development as the primary catalyst through which IOC will achieve its four High Level Objectives (HLOs) in the current 2014–2021. IOCARIBE will provide the leadership for this effort to empower capacity in the IOCARIBE Region.

In 2014, the UN General Assembly adopted the Oceans and the law of the sea Resolution (A/RES/69/245) which reiterated the essential need for cooperation, including through capacity building and transfer of marine technology, “to ensure that States, especially developing countries, in particular the least developed countries and small island developing States, as well as coastal African States, are able both to implement the Convention and to benefit from the sustainable development of the oceans and seas, as well as to participate fully in global and regional forums and processes dealing with oceans and law of the sea issues”.

On September 25th 2015, countries adopted a set of goals to end poverty, protect the planet, and ensure prosperity for all as part of a new sustainable development agenda. Each goal has specific targets to be achieved over the next 15 years with Goal 14 being: Conserve and sustainably use the oceans, seas and marine resources. (www.un.org/sustainabledevelopment/sustainable-development-goals/development).

IOCARIBE is a Regional Sub-Commission of IOC (UNESCO). The IOC Terms of References for Regional Sub-commissions determine the basic functions of IOCARIBE:

Regional Sub-commissions are Intergovernmental Subsidiary Bodies of the Commission, responsible for the promotion, development and co-ordination of the marine scientific research programmes, the ocean services, and related activities, including capacity development in their respective regions. In establishing their programmes, it should take into account the specific interests and needs of the Member States in the region. In carrying out the above work, it is mandatory that the regional sub-commissions collaborate together with IOC's subsidiary bodies concerned with global activities, within their fields of competence.

IOCARIBE will work to achieve the high level goals of the IOC Mid Term Strategy within its region by implementing the following efforts:

- Foster the generation of knowledge, sharing of information, expertise and experiences on the IOCARIBE Region and its coastlines.
- Assist Member States to develop their capacity to formulate national and regional policies and plans to meet their needs in marine science and technology.
- Reinforce and broaden scientific cooperation, regionally and internationally through networking and institutional arrangements with organizations operating within and without the region, for example, UN bodies, IGOs, NGOs and the scientific community.
- Provide the regional input to global ocean sciences and observation programmes.

- Promote and facilitate implementation of IOC global science programmes and ocean services at the regional level.

Finally, IOCARIBE will implement the IOC support for attaining the United Nation's Sustainable Development Goals (SDGs) adopted in 2015, specifically emphasizing Goal 14, "Conserve and sustainably use the oceans, seas and marine resources for sustainable development" (Affairs, 2017).

1.3 STRATEGIC VISION, PRINCIPLES, OBJECTIVES AND USERS OF THE STRATEGIC SCIENCE PLAN

Vision of the IOCARIBE SSP - Strong scientific understanding and systematic observations of the changing world ocean climate and ecosystems shall underpin sustainable development and global governance for a healthy ocean, and global, regional and national management of risks and opportunities from the ocean.

The strategic objectives of the IOCARIBE SSP, based on IOC's strategic principles include:

Increase scientific knowledge and better understanding of coastal and oceanic processes in the region to help Member States in the formulation and application of ocean and coastal zone policy for sustainable development contributing to global strategies and regional IOC programmes; support the permanent enhancement of capacity building and empowerment in marine sciences and oceanic observations of developing Member States, for enabling management of resources and coastal ecosystems in their own exclusive economic zones and in the region.

The design of the IOCARIBE SSP is based on main guidelines of the IOC Ocean Science Section (IOC, 2005):

- The activities and products of the IOC Ocean Science Section reflect Member States' needs, UN Agreements and decisions of the UN General Conference.
- The activities and products of the Ocean Science Section are designed to:
 - Catalyze research to focus on issues important to the Member States and UN.
 - Agreements.
 - Coordinate national and regional efforts to produce global results and advice.
 - Communicate the results of these activities to the UN Conventions, Member States, and the general public.

At the same time the IOCARIBE SSP incorporates as well following principles:

- Prioritize regional social, scientific and economic impacts in project formulation.
- Reflect adequately in the plan projects and programmes executed by IOCARIBE and by other UN Agencies.
- Coordinate jointly with UN Agencies priorities of specific action plans.
- Bear in mind synergic relation existing between science and technology becoming a unique entity.
- Strengthen cooperation among countries and organizations of the region.
- Reinforce institutional strengthening of the Sub-commission and national coordinating networks.
- Perform periodic evaluations of the SSP progress and its priorities every two years.

Objectives envisioned with the present IOCARIBE are described below:

- Strengthen scientific basis for supporting regional programmes
- Support strategic planning of IOCARIBE Member States in relation to the development of regional marine sciences, oceanic observations and associated services.
- Facilitate a coherent management of regional programmes related to the marine-coastal environment and its resources.

The IOCARIBE SSP is directed to a wide group of users, among them following users:

- Administrators and decision-makers working in the marine sciences and technology areas of Member States and regional bodies.
- Regional scientific community.
- Donor organizations.
- Other United Nations agencies, Regional, Intergovernmental Organizations and Non-Governmental Organizations.
- IOCARIBE Secretariat.

The IOCARIBE SSP has been structured as a selection of themes which allow the implementation of IOC intended goals and objectives in the region and proposed solutions to regional and national problems.

2. REGIONAL CONTEXT

2.1 BACKGROUND

The IOCARIBE region (Caribbean Sea, Gulf of Mexico and Adjacent Areas) consists of 31 independent states and 15 depending territories. The territories and depending departments are represented by 4 independent states, three of which have their capital located outside the region in Europe.

All thirty-one (31) states of the region are members of IOCARIBE Annex 1). Taking into account geographical characteristics, size, language and socioeconomic development, member states have been grouped by IOCARIBE as follows:

1. Small Island Developing States (SIDS) Antilles includes 16 independent states; Antigua & Barbuda, Aruba, Bahamas, Barbados, Curacao, Dominica, Grenada, Haiti, Jamaica, St. Kitts & Nevis, St. Lucia, St. Vincent & Grenadines, Trinidad & Tobago,.. Belize, Guyana and Suriname are included because of size and language likeness.
2. Central America Developing States of: includes 6 independent states of Central America and Dominican Republic is also included because of language and size similitude.
3. Latin America Medium-LargeSize: includes Brazil, Colombia, Cuba, Mexico, and Venezuela five independent States considered among the most active countries in IOCARIBE.
4. Europe and USA: includes the 15 territories and departments represented by France, Netherlands, and the USA and its two territories in the region.

There are great differences in size, wealth, ethnic make up, language and political situation among countries in the region, but there are also many common issues such as the cultural background, its geographical location, its natural resources and their associated environmental problems.

Continental Coastal Latin-American countries and the Caribbean SIDS are two distinct regions with regards to the ocean sciences capacity and economic development point of view. Nevertheless, both are greatly depending on the ocean and coastal resources.

Caribbean Island countries are classified as middle income countries and most are Small Island Developing States (SIDS). This situation is indeed unique and brings a different set of dimension and challenges in-terms of ocean sciences. The principal features of these countries are smallness in geographical size and population; insularity; low resilience and high vulnerability to natural and human-made disasters and the impact of the global climate

change— as seen in the annual passages of hurricanes, and sea level rise; and high dependence on tourism.

Although tourism is Important for all IOCARIBE countries, it is most critical in the Caribbean where tourism income is equivalent to 16.6% of its GDP. In February 2016 the Tourism Organization for the Caribbean published that for the first time in history the growth of tourism in the Caribbean in 2015 surpassed all the major tourism regions in the world, reaching 28.7 million visits and contributing Approximately US \$ 30 billion to the Caribbean economies.

Maritime transport is a key component of world trade and it considered one of major sources of pollution in this region. The presence of the recently expanded Panama Canal plays a major role in the world maritime transport, since it serves more than 144 sea routes, connecting 160 countries and reaching some 1,700 ports in the world. In 2015 more than 340.8 million tons of cargo passed through the Canal and the tolls generated amounted to 1.9 billion dollars.

2.2 ENVIRONMENTAL SITUATION

2.2.1 The Environmental Situation in the IOCARIBE Region

The IOCARIBE Medium Term Strategic Science Plan 2005-2015 (IOCARIBE, 2006) detailed regional environmental concerns. Since then both the Caribbean and Gulf of Mexico Global Environmental Facility (GEF) Large Marine Ecosystem (LME) Projects have produced major documents identifying marine and coastal environmental concerns in the Gulf of Mexico, Caribbean Sea and North Brazil Shelf LMEs (Heileman, 2001). In addition, both the Caribbean Environmental Programme (CEP) of the UN Environmental Programme (UNEP) (UNEP, 2017) and the Western Central Atlantic Fisheries Commission (WECAFC) (WECAFC, 2017) of the UN Food and Agricultural Organization (FAO) have produced numerous reports on environmental issues especially land based sources of pollution (the former) and fisheries resource status (the latter). IOC has had the UN lead for Tsunami warning system coordination (IOC, 2017) and the Wider Caribbean Region was included from the start as a result of the efforts of IOCARIBE (CARIBE-EWS – Tsunami and Other Coastal Hazards Early Warning System for the Caribbean and Adjacent Regions).

There are many major stressors that can be drawn from these studies and the deliberations of IOCARIBE. Priority transboundary problems that affect the CLME: unsustainable exploitation and non- optimal harvesting of fish and other living resources, habitat degradation and pollution both point and non-point, land and ocean based. Each one of these can be broken down in to specific examples such as the degradation of the extensive coral reef habitat and the major oil spills that have occurred including the most recent Deepwater Horizon, where by the time the well was capped on July 15, 2010 (87 days later), an estimated 3.19 million barrels of oil had leaked into the Gulf of Mexico, as evident in the references mentioned above.

While the above stressors are primarily human driven, in the last twenty years the population increased from 386 million to 554 million (PRB, 2017), (Commerce, 2017). The region is also vulnerable to natural disasters that are intimately tied to the ocean, specifically hurricanes and tsunamis. The former is very much a product of ocean-atmospheric relationships. The latter of tectonic forces and the ocean.

Recently, Hurricane Matthew was one of the fourteenth hurricane of the Atlantic hurricane season of 2016. It became a powerful Category 5 hurricane and is considered to be the strongest hurricane that has affected the Caribbean area since Hurricane Felix in 2007. In October 2016, hurricane Matthew's passage through Haiti caused \$ 2.7 billion in damages, 32 percent of the gross domestic product (GDP).

Finally, all of this is taking place under the overall condition of rapid human magnified climate change. The warming temperatures themselves have an impact such as increasing coral bleaching and deoxygenation. The rising temperatures result in sea level rise are extremely critical for low lying areas especially those on small island states. Ocean acidification over time is a direct threat to shell forming organism and thus an ecosystem changer. In addition, the weather patterns will change and there is some indication the stronger storms may occur.

The IOCARIBE Region with its island states and significant and important coastal areas in the continental states is a region very depended on the ocean for its well-being from food security to energy and from being a major ocean shipping region to one of the world's great tourism areas. Its position in an area of extreme events like hurricanes and tsunamis, and is ground zero for climate change impacts requiring the strongest science possible to form the basis upon which societal decisions relevant to the coasts and oceans are made.

2.3 RESEARCH CAPACITY / INFRASTRUCTURE

The IOCARIBE region has been increasing its capabilities in the marine sciences in recent years. Governmental structures have also strengthened. Looking at the its Member States, the IOCARIBE Secretariat identified 147 academic higher education institutions that offer 796 Ocean Sciences programmes including 313 B.Sc. 298 M.Sc. 185 Ph.D. programmes. From that in the United States are 30 institutions with 69 Ph.D., 65 M.Sc. and 63 B.Sc. As well, students and scientists have other opportunities in Canada that has 14 Ph.D., 19 M.Sc. and 18 B.Sc.; Argentina with 13 Ph.D., 11 M.Sc. and 17 B.Sc.; Chile with 10 Ph.D., 20 M.Sc. and 24 B.Sc.; Peru with 2 Ph.D., 8 M.Sc. and 5 B.Sc. (C. Toro *et al.*, 2017). However, 66% of that capacity is concentrated in only five Latin American countries and USA. The study concluded that the major challenge in the marine sciences was the asymmetrical development and capacity of member states.

To follow and analyze different variables and generate marine and meteorological forecasts, tsunami waves, trajectory and oil dispersion at sea, among other events, the IOCARIBE Member States use about 48 numerical models most of them operationally. Also, for the development of marine research in the region there are 35 oceanographic vessels in Latin America, 44 oceanographic vessels in USA including 16 of the National Oceanic and

Atmospheric Administration – NOAA; 14 of University National System of Oceanographic Laboratories – UNOLS; and 14 belonging to US Navy (6 managed by UNOLS).

The ocean and marine institutions in the Island States of this region represent a minor percentage of the entire region. However, despite their small land area, they have jurisdiction over, often hundreds times larger marine areas, they need to manage.

The IOCARIBE Member States have implemented some 60 legal instruments related to ocean and coastal issues management as national policies, strategies, laws, plans, decrees, resolutions and diagnostic analyses and assessments for the management and sustainable development of the ocean, addressing coastal management, risk management and climate change (C. Toro *et al.*, 2017). There are few regional and subregional policy instruments developed for the ocean and in force in the region, with the Cartagena Convention as one of the most comprehensive instruments available. The Organization of Eastern Caribbean States, developed Eastern Caribbean Regional Ocean Policy, an example of a sub-regional policy. CARICOM fisheries has worked with the regional fisheries management organization for Central America (OSPESCA) on management actions. The CLME is working on developing regional management linkages.

It must be recognized that outstanding individual marine scientists occur throughout the region and the products of the CARIBE-EWS Tsunami and Other Coastal Hazards Early Warning System for the Caribbean and Adjacent Regions and GEF Caribbean Large Marine Ecosystem Project clearly demonstrate the power of a regional approach (CLME, 2016). Thus, this science plan will have a regional focus and will address strengthening regional science efforts and strengthening countries' participation. The needs of both coastal states and small island states need to be addressed.

3. IOCARIBE STRATEGIC SCIENCE PLAN

3.1 BACKGROUND

The social and economic vulnerability as well as the limitations of environmental, organizational and human capacity in the Small Island Developing States (SIDS) and Coastal American States, points to challenges to be considered in the IOCARIBE SSP.

The SSP must become a system which permits the application of strategic planning to the daily work plan, create policies, strengthen cooperation, identify needs, fill-in gaps and address national and regional needs related to the marine-coastal issues.

The SSP is a tool to IOCARIBE Member States for achieving a sustainable use of the coastal zone and its resources. It should allow the scientific community to reduce scientific uncertainties, particularly referring to climate change. At the same time the SSP should permit adoption of pertinent measures for reducing human and material losses associated with the increased frequency of extreme hydro-meteorological events.

The IOCARIBE SSP must consider specifically the real and/or functional insular condition of the majority of the countries of the region which demands that the strengthening of the marine sciences be directed towards the improvement of its scientific basis. On another words, the final objective of the SSP as a whole, is to contribute to the sustainable use of resources and its interaction with the ocean, river basins and the atmosphere.

Another relevant aspect to be considered in the SSP is the existing synergy between science and technology. Science being considered as the knowledge acquired through observations and experiments proved objectively, systematized and based on general principles; and, technology as the use of this knowledge for the production of goods and services with the main purpose of satisfying the needs of society. The advance of current technology is supported in science. Science on the other hand, benefits from the development of technology with its new experimental means and observational tools.

On the other hand, when positioning the SSP within the IOCARIBE`s administrative levels (Strategic Planning, Implementation and Evaluation) [10], it is observed that at the Planning level (Table 3), the strategic formulation of projects must be complemented by the Action Plans (AP). The SSP implementation is accomplished through programmes and projects, while the evaluation is effected in two levels: the Secretariat level, based on management indicators and results reporting, and, the project level based on success criteria and follow-up reporting.

TABLE 3: IOCARIBE management levels

STRATEGIC PLANNING		
Level	Means	Responsible
POLICIES (Long-term objectives)	UNESCO-IOC Policies Decisions, Budget	UNESCO General Conference IOC General Assembly
STRATEGY (Medium term objectives)	Medium Term Strategic Planning	Intergovernmental IOCARIBE Session
PROGRAMMES (Specific planning)	Formulation of Short-term Plans	IOCARIBE Board of Officers
IMPLEMENTATION		
PROMOTION COORDINATION	Strategic Programmes Regional Coordination Networks	Regional Secretariat

CAPACITY BUILDING	Projects in Sciences and associated Services Regional implementation networks	Project Coordinators Implementation networks
EVALUATION		
FOLLOW-UP	Regional output indicators Success Criteria for Projects	Board of Officers, Secretariat Project Coordinators
FEED-BACK	Reports and results National Reports	Board of Officers, Secretariat Project Coordinators

The APs should allow the preparation of a correspondence analysis between lines of action, objectives and defined strategies of the SSP. At the same time the AP will permit the identification of required regional research activities, technology transfer services, use and dissemination of knowledge to fill existing gaps on regional programmes as well as study the possibility of establishing strategic alliances for implementing projects to meet IOC objectives in the region. Throughout this strategic plan it will be essential to involve regional projects e.g. LMEs and bodies including the fisheries and economic entities.

3.2 LINES OF ACTION

Introduction

The lines of actions consider each major scientific area. After the description of these specific lines there are sections which address the cross cutting areas of technology transfer, education and outreach and capacity development. Furthermore, it should be understood that when the word science is used it includes the social and economic disciplines.

Priorities for the next decade fall within the following Lines of Action and cross cutting themes. The work conducted among these categories will enhance scientific understanding of the ecosystems within the region and provide information to policy and management decision makers to benefit societies within the region

3.2.1 Oceans and Climate

3.2.1.1 Objective

Facilitate an improved assessment of the impact of global climate change in the region.

3.2.1.2 Strategies

Identify knowledge gaps and facilitate the design of concerted plans on the impact of climate change in all of its aspects, in consultation and collaboration between IOCARIBE States and regional organizations with IOCARIBE-GOOS, IODE, GLOSS, MSP, ICAM, HAB, CARIBE-EWS, LMEs, and the pertinent UN, regional and nongovernmental agencies, for further data gathering, analysis and interpretation.

Serve as a catalyst for analyzing and interpreting time series data currently available and under development including: in situ (sea level, temperature, salinity, nutrients, chlorophyll) and remote sensing data (temperature, ocean color, and altimetry).

Document networks of moored and drifting instrumented profiling buoys to identify missing major passages of high priority needed to characterize seasonal and inter-annual variability of energy and material fluxes in the region and advocate for filling these gaps.

Serve as a catalyst to quantify and parameterize external climate forcing through atmospheric and oceanic interaction to better understand the teleconnections of the region with large-scale phenomena including the El Niño-Southern Oscillation, the North Atlantic Oscillation and the Tropical Dipole.

Advocate the evaluation the consequences of global change upon meso-scale phenomena such as oceanic gyres, river plumes, coastal upwelling and ventilation of sub-sill basin through downscaling of global climate models to the regional level.

Facilitate the evaluation of the vulnerability of living marine resources to climate change including acidification, to provide a basis for managers and policy makers to develop plans of action.

3.2.2 Ocean Science, technology and sustainable use of Coastal and Ocean Resources with special emphasis on Large Marine Ecosystems, and Integrated Coastal Area Management

3.2.2.1 Objective

Facilitate the improvement of the scientific basis for rehabilitation and recovery of impacted, ocean and coastal ecosystems and the maintenance of healthy ones, including sustainable mariculture and extractive use of resources with appropriate concern for biodiversity and the

potential economic importance of marine organisms for uses such as pharmaceuticals. This work will also inform development of integrated coastal zone management plans.

3.2.2.2 Strategies

Promote and facilitate design and implementation of research and monitoring projects including in situ and remote sensing data collection, and the analysis of regional oceanic circulation patterns.

Promote and facilitate a regional effort to identify and evaluate appropriate indicators of ecosystem health in the IOCARIBE region through assisting in designing a process for setting objectives, and determining indices.

Facilitate programs to investigate the transport and impact of pathogenic and other detrimental agents through large river plumes and other meso-scale events such as the influx of sargassum blooms impacting the tourism economy.

Advocate for the valuation of the importance to the region of introduction of exotic species through ballast-waters, aquaculture and other means.

Facilitate the interactions between ongoing initiatives such as CARICOMP and LME of the Gulf of Mexico and the Caribbean.

Advocate scientific basis for assessing the socio-economic value of near-shore ecosystems.

Promote and support utilization of IOCARIBE-GOOS and monitoring systems and operational data products

Encourage the involvement of primary stakeholders such as cruise and cargo lines and the oil-gas, fishing industries and coastal communities in collecting and disseminating data products useful for Integrated Coastal Area Management (ICAM)

Facilitate the provision of data and information exchange mechanisms to promote harmonization of conflicting uses of the ocean and coastal zone such as tourism, fisheries, industry and coastal settlements to ensure sustainability of resources.

Promote the implementation and development of standardized GIS tools for ICAM and Marine Spatial planning (MSP).

3.2.3 Extreme and Natural Hazards

3.2.3.1 Objectives

Facilitate the improvement of regional capabilities for prediction and mitigation of extreme events such as hurricanes, storm surges, extra-tropical low pressure systems and tsunamis

that create socio-economic consequences across a broad spectrum in order to save lives and protect property.

Facilitate the furthering of our understanding of extreme events impact on ocean ecosystems and natural resources including benthic (coral reefs, mangroves and sea-grasses in particular), pelagic and planktonic communities and to predict short and long-term ecological consequences of such events.

Facilitate improvement of knowledge about coastal protection systems provided by coral reefs, sea grass and mangroves and the impact on them caused by the occurrence of extreme events. Promote research on ecosystem restoration using ecosystem based adaptations and marine spatial planning.

3.2.3.2 Strategies

Advocate for, and assist the provision of mechanisms for the establishments of coastal zone early warning systems.

Enhance the Tsunami and other coastal hazards early warning system for the Caribbean and Adjacent Regions.

Establish cooperation mechanisms with the WMO's Hurricane Working Group.

Establish mechanisms for joint action with IOC's and WMO's relevant Working Groups and regional meteorological services and emergency management authorities, especially within the JCOMM framework.

Advocate for the evaluation of short term effects of hurricane passage on upper water column structure to provide insight into biogeochemical and climatic changes.

Advocate for additional research and the coordination of on-going studies on extreme events impact on ocean ecosystems and natural resources with the goal of prediction of short and long-term ecological consequences of such events.

Promote the development of projects dealing with economic values and ecological restoration of coastal ecosystems using ecological engineering approaches.

4. CROSS CUTTING ELEMENTS

4.1 Technology Transfer

IOC has been involved in technology transfer since its inception but its role was codified in the XXII Session of the Assembly of the Intergovernmental Oceanographic Commission (2003) adopted the "IOC Criteria and Guidelines on Transfer of Marine Technology"

(CGTMT) drawn up by the Advisory Body of Experts on the Law of the Sea following the mandate established in Article 271 of UNCLOS.

The guiding principle of the CGTMT is that the Transfer of Marine Technology must always be conducted on fair and reasonable terms and conditions and should enable all parties concerned to benefit on an equitable basis from developments in marine science related activities, particularly those aiming at stimulating the social and economic contexts in developing countries.

More recently IOC has described its plans and goals for transfer of technology in:

Transfer of Marine Technology – Knowledge Sharing and Capacity Development for Sustainable Ocean and Coastal Management. 2015; IOC Brochure 2014-3 (IOC/BRO/2014/3). This document emphasizes the importance of the IOC Regional bodies in this transfer process.

IOCARIBE will prioritize and advocate for regional needs within the IOC programme and involves itself in the efforts to work to ensure that transfer efforts result in the ability to sustain technology transfers and thus truly empower the region.

4.2 Education and Outreach

Countries in the IOCARIBE region realize that without an informed and involved public (an all-encompassing term that includes young people, direct user, the civil sector both profit and non-profit and the general citizenry) that efforts to sustainably manage the marine environment and mitigate disasters will be sub-optimal at best, and a failure at worst. Therefore, IOCARIBE will integrate an education and outreach effort into all of its activities and encourage all relevant entities to do likewise using cooperative efforts whenever possible.

4.3 Building and Sustaining Capacity

Capacity Building has been a core element of IOC since its inception in the 1960s. It was developed under the acronym TEMA which stood for Training, Education and Mutual Assistance. Over the years numerous activities have been carried out and plans written. IOCARIBE has struggled to be effective with capacity development, which has been a significant issue during IOCARIBE Statutory Meetings.

Recently IOC has adopted an IOC Capacity Development Strategy 2015-2021 (IOC, 2015). This plan is a major step beyond previous efforts and sets the regional bodies as the major focal point for moving forward in this area. Although the financial outlook for all of UNESCO is challenging, the prioritizing of capacity building and the recognition of the regional bodies which contain the areas where capacity building is a central issue should be supported as drivers in the process is a game changer both now and when the financial situation improves (Figure. 1) from the IOC (2015) capacity building plan demonstrates the

centrality of capacity building in the current and future efforts of IOC and its subsidiary bodies. The areas identified as priority by IOC following UNESCO priorities are Africa, small island states and gender. Furthermore, its ultimate goal was stated as “Sustained (long-term) resource mobilization reinforced” that is capacity needs not just to be “built” but empowered to be able to impact sustained use of the oceans in all regions and the mitigation of ocean related disasters.

The IOC Medium term Strategy is to ensure that all Member States have the capacity to achieve the High Level Objectives of:

- Healthy ocean ecosystems and sustained ecosystem services.
- Effective early warning systems and preparedness for tsunamis and other ocean related hazards.
- Increased resiliency to climate change impacts and variability, and enhanced safety, efficiency and effectiveness of all ocean-based activities through scientifically-founded services, adaptation and mitigation strategies.
- Enhanced knowledge of emerging ocean science issues.

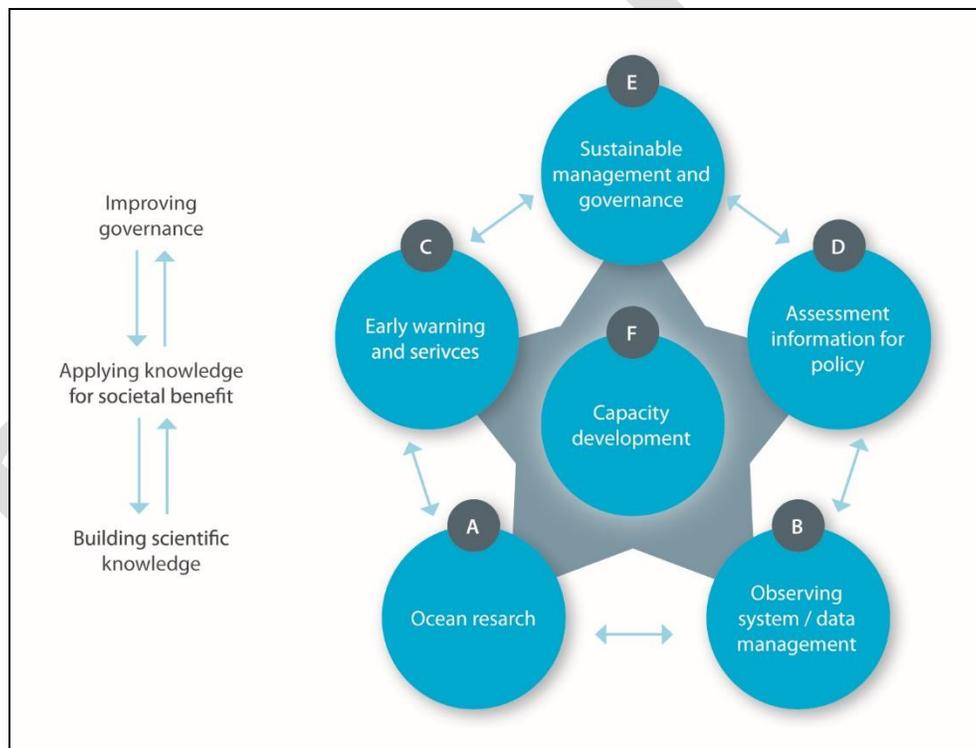


Figure 1. Conceptual framework of IOC Functions

Its Capacity Building Vision is as follows: “Through international cooperation, IOC assists its Member States to collectively achieve the IOC’S high-level objectives (HLOs) with particular attention to ensuring that all Member States have the capacity to meet them”

Given these lofty goals and the lead role for IOCARIBE, it is essential that IOCARIBE muster its networks of regional experts to provide guidance to IOC in these efforts to ensure that not only are people trained but they are empowered to effectively use that capacity to address issues in the Wider Caribbean.

IOCARIBE will create a standing committee to continually work on the issue of effectively using IOCARIBE as a catalyst for effective regional capacity building. Since historically IOC has carried out capacity building through its on-going programs e.g. harmful algae blooms, and since the IOC plan is to use those resources for capacity building, small working groups of IOCARIBE experts will liaise with these offices to help develop efforts in the Wider Caribbean region.

The IOC plan stresses the opportunities for collaboration between IOC Regional Subsidiary Bodies. Among the IOC Subcommissions, WESTPAC has one of the most well developed regional capacity programmes with a strong country support, IOCAFRICA has the largest region of high priority focus. Therefore, the IOCARIBE Secretariat will explore areas of cooperation and the Officers will appoint liaisons as appropriate.

IOCARIBE will promote gender balance in ocean science in the Region and will show leadership in its activities in this area.

IOCARIBE will position itself to be the conduit for developing and implementing IOC capacity building efforts to assist member states in developing marine science management procedures and national policies.

IOCARIBE will examine the UNESCO University Chairs Programme relevant to Ocean Sciences in the Wider Caribbean to determine how it may be an effective capacity building effort.

IOCARIBE will network with regional (including subregional) entities e.g. LME projects, other UN regional bodies, University consortia, and intergovernmental organizations as a catalyst to develop a regional approach for ensuring that capacity development efforts result in empowering that capacity to be effective in the Wider Caribbean Region.

IOCARIBE, recognizing the efforts in marine technology transfer and assistance and the increasing importance of utilizing state of the art technology to monitor and understand the marine environment will pay particular attention to the need for ocean engineering capacity in the region.

IOCARIBE will position itself to be the focus for the IOC regional approaches to capacity building in the Wider Caribbean.

5. IMPLEMENTATION

5.1 BACKGROUND

The IOCARIBE SSP will be implemented via regional efforts coordinated through the Secretariat and following the actions adopted by the statutory meeting and the guidance of the officers. The SSP will be briefed to leaders in member states and regional organizations as way forwarded to a comprehensive regional ocean and coastal science effort. These efforts are supportive of Sustainable Development Goal 14 as can be seen in Figure 2.



Figure 2. Sustainable Development Goal 14

5.2 EXECUTION

IOCARIBE will implement the following mechanisms for a coherent execution of regional programmes and projects related to the environmental marine-coastal issues and their resources:

- Promotion of the regional development and coordination of scientific research, oceanic observations and services.

- Promotion, development and coordination of study groups convened for specific issues, panels or small ad hoc working groups for implementing research studies or elaborating products about main scientific and/or organizational aspects.
- Promotion, development and coordination of conferences, workshops and scientific meetings.
- Execute a monitoring and accountability systems for project execution.
- Support Regional programmes which represent an excellent opportunity to increase transfer of technology and science among Member States.

IOCARIBE will track and monitor programmes and projects where it is involved including their impacts on the region, and establish a platform to make the information readily available utilizing regional experts.

5.3 MANAGEMENT AND USE OF KNOWLEDGE

The scientific base for enhancing national and regional marine science and applied ocean science becomes valuable when it is used by managers and policy makers in their decision making processes to provide sustainable benefits for society.

IOCARIBE has a prominent and visible role to promote, coordinate, sponsor, support and encourage the creation and dissemination of knowledge for an adequate decision making process. The creditability of IOCARIBE through its utilization of regional scientific networks will enable it to be a significant factor in increasing science- based decision making relying on the regional endogenous capacity for coastal and marine sciences and their knowledge of the local conditions of member states. Capacity building efforts will have a focus on this component.

The knowledge progression is from data to information to operational products to manuals, proceedings, inventories and methodological guides and finally teaching materials. All levels are valuable when disseminated to appropriately targeted audiences.

The various targeted users include: scientific institutions and regional experts, national agencies and donor countries, governments of Member States, regional organizations (governmental and non-governmental), private industry and the general public (schools, mass media, social media, communities, etc.).

Fundamental ways for disseminating knowledge are: reports and publications on ocean and coastal sciences, symposia, workshops, websites, e-mail lists, social media and newsletters both printed and on website. In addition to the scientific, management, and policy audiences there needs to be extensive teaching programs aimed at public awareness.

IOCARIBE will have Information Centers as focal points for dissemination of ocean science information in each of the Member States which will draw on existing capacities such as Ocean Portal and Environmental Portal.

As important as individual country efforts are at reaching the public, the greatest impact on science based decision making will be at the regional level. Regional Capacity Building Centers (Regional Resources Centers / Excellency Centers / Science and Communication Centers), at different levels of Science and Marine Sciences are needed and can utilize the experience of the Scientific and Communication Centres of Harmful Algal Blooms of the IOC and the Ocean Teacher Global Academy Centers

Fundamental uses of knowledge are critical input for strategic planning of national and regional policies. To provide the basis for decision making (models and methods for facilitating the analysis of economic and environmental policy) are needed.

IOCARIBE will strive to be a catalyst for stimulating production of products that meet the satisfaction of regional and national needs. It will do this by promoting the enhancing of national and regional marine science and technology capacity building to strengthen the science base needed for decision making.

5.4 FUNDING

Funding is critical to progress in this science plan. Even though the UNESCO funding situation is not encouraging, the increased level of priority for its regional bodies fits well for the progress of IOCARIBE. Nevertheless, it will be necessary for IOCARIBE to re-double its efforts for creative extra-budgetary funding. These should include member countries, the private for profit and non-profit sectors and other entities with an interest in the IOCARIBE region especially for capacity building efforts and those with business concerns. Cooperative efforts with other UN Agencies, intergovernmental bodies and the regional projects e.g. LMEs will be pursued.

Recognizing society's demands, it is necessary to establish a priority order to be addressed by the Sub-commission's regional programmes and projects under generally limited funding resources.

The identification of priorities and requirements for the projects will be based on two main elements: on one side- by the policies that is the lines of action, objectives and strategies contained in this SSP, and on the other side- the needs which should be understood as the main national problems associated with marine-coastal issues identified by IOCARIBE Member States.

A third criteria for the establishment of priorities could be given by the possibility, that include the availability of human, technical and material resources needed for executing projects aimed to address priority issues mentioned above.

The sustainability of the SSP depends on the results of the projects reaching the required visibility, and satisfying the needs of different users groups, which would guarantee funding, and that an adequate enhancement of the capacity building strategy be implemented including human, material and institutional resources from the region and from IOCARIBE Member States.

The competition for funding requires engaging donors in a coordinated manner. Therefore, it is convenient to involve representatives from UN Agencies (UNEP, FAO, and other), NGOs and private industry through appropriate legal frameworks for particular initiatives. Using this method would likely reduce duplication of efforts, maximize the use of resources and contribute to the financial support of the plan.

The IOCARIBE Secretariat will establish an ad hoc group of experts for developing a sustainable business plan. The Group would be responsible for preparing proposals to be submitted to potential funding sources.

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Annex 1 **TABLE 1: Countries and territories in the IOCARIBE region**

Nr	Country	Dependent Territories	UNESCO	IOC
1	Antigua & Barbuda		Y	N
2	Aruba	(Autonomous Country within the Kingdom of the Netherlands)	Associate Member	N
3	Bahamas		Y	Y
4	Barbados		Y	Y
5	Belize		Y	Y
6	Brazil		Y	Y
7	Colombia		Y	Y
8	Costa Rica		Y	Y
9	Cuba		Y	Y
10	Curacao	(Autonomous Country within the Kingdom of the Netherlands)	Associate Member	N
11	Dominica		Y	Y
12	Dominican Republic		Y	Y
13	France	(1) French Guiana, (2) Guadeloupe; (3) Martinique; (4) Saint-Martin; (5) Saint Barthelemy	Y	Y
14	Grenada		Y	Y
15	Guatemala		Y	Y
16	Guyana		Y	Y
17	Haiti		Y	Y
18	Honduras		Y	Y
19	Jamaica		Y	Y
20	Mexico		Y	Y
21	Netherlands	Special Municipalities: (6) Bonaire, (7) Saint Eustatius (8)Saba.	Y	Y
22	Nicaragua		Y	Y
23	Panama		Y	Y
24	St. Kitts & Nevis		Y	Y
25	St. Lucia		Y	Y
26	St. Vincent & Grenadines		Y	Y
27	Suriname		Y	Y

28	Trinidad & Tobago		Y	Y
29	United Kingdom	British Overseas Territories: (9)Anguilla, (10)British Virgin Islands, (11) Cayman Islands, (12) Montserrat; (13) Turks and Caicos.	Y	Y
30	United States	(14) US Virgin Islands, (15) Puerto Rico	Y	Y
31	Venezuela		Y	Y

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LIST OF ACRONYMS AND ABBREVIATIONS

AP	Action Plan
CARIBE-EWS	Tsunami and Other Coastal Hazards Early Warning System for the Caribbean and Adjacent Regions
CARICOM	Caribbean Community
CARICOMP	Caribbean Coastal Marine Productivity Project
CEP	Caribbean Environmental Programme (UNEP)
CGTMT	Committee on Guidelines on Transfer of Marine Technology
CLME	Caribbean Large Marine Ecosystem Project
FAO	UN Food and Agricultural Organization
GDP	Gross Domestic Product
GEF	Global Environmental Facility
GLOSS	Global Sea Level Observing System
GOOS	Global Ocean Observing System
HAB	Harmful Algal Blooms
HAB-ANCA	Harmful Algal Blooms for the Caribbean
HLOs	High Level Objectives
ICAM	Integrated Coastal Area Management
IOC	Intergovernmental Oceanographic Commission
IOCAFRICA	IOC Sub-Commission for France
IOCARIBE	IOC Sub-Commission for the Caribbean and Adjacent Regions
IOCARIBE-GOOS	Global Ocean Observing System for the Caribbean and Adjacent Regions
IODE	International Oceanographic Data Exchange
JCOMM	Joint WMO-IOC Technical Comisión for Oceanography and Marine Meteorology.

LAC	Latin America & the Caribbean
LME	Large Marine Ecosystems
MLA	Main Line of Action
MSP	Marine Spatial Planning
MTS	IOC Medium-Term Strategy
NGOs	Non-Governmental Organizations
NOAA	National Oceanic and Atmospheric Administration (USA)
OSPESCA	Regional Fisheries Management Organization for Central America
PC	Project Coordinators
SIDS	Small Isthmus Developing States (SIDS)
SIDS	Small Island Developing States
SIG	Geographic Information System
SSP	Strategic Science Plan
TEMA	Training, Education and Mutual Assistance on Marine Sciences
TWS	Tsunami Warning System
UN	United Nations
UNCLOS	United Nations Convention on the Law of the Sea
UNEP	United Nations Environment Programme
UNESCO	United Nations Educational, Scientific and Cultural Organization
WECAFC	Western Central Atlantic Fisheries Commission
WESTPAC	IOC Sub-Commission for the Western Pacific
WMO	World Meteorological Organization

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