The UN Decade of Ocean Science for Sustainable Development 2021-2030:
Tropical Americas and Caribbean Region

Regional Kick-off Conference
Concept Notes for the Consultation Process (D1)

Content

Breakout Sessions Concept Notes

This summary was a first guide for the participants to the Breakout Sessions of the Regional Kick-off Conference for the UN Decade of Ocean Science for Sustainable Development 2021–2030 for the Tropical Americas and the Caribbean Region. It aimed at providing a briefing of the actions, ensuring better use of the breakout sessions that took place on the first day of the Kick-off Conference.

The actions are based on the results gathered from the recent reports of international and regional entities and include a comprehensive review of available information from Regional Workshops.

Breakout Session 1: Knowledge and Solutions

1.1. Title: Developing a Tropical Americas and Caribbean Region Pollutants Observatory

Background: To achieve a clean ocean, where sources of pollution are identified, quantified, and reduced, and pollutants are removed from the ocean, the Decade aims to create a better understanding of the interactions and interdependencies while develop collaborative approaches across sectors (communities, industry, and government) to reduce marine pollution. Nonetheless, to achieve this, the harmonization of regional governance and overcoming geopolitical and economic diversity of the Western Tropical Atlantic Region is essential.

Description of Action: During the Working Group 1 (A Clean Ocean) workshop, key oceans-related research priorities were identified for a regional program in the Western Tropical Atlantic. These included a need for developing an inventory of contaminant sources along with a regional database of the baseline, and current values, to better understand and interpret cumulative impact of climate change on pollutants along with future changes and trends. Furthermore, there is a need to unify programs and efforts whilst enhancing technical capacities through institutional expertise across the region to develop integrated solutions. Thus, the development and implementation of a transboundary, multidisciplinary, and cross-sectoral research approach such as regional pollution observatory was warranted. This will help to coordinate, analyze and regularly publish information on marine pollution and produce data that will be curated, credible, and open access – to better guide and inform key stakeholders and decision makers.

Addressing gaps:
- Identify primary sources, pathways and fates/spreading of pollution and creation of a global pollutants database (including pesticides, hydrocarbons, metals, plastics) and improve understanding of emerging pollutants (including light, noise, and pharmaceutical pollutants
- Identify acceptable levels of pollution to set thresholds values and define ecological boundaries/maximal levels of pollutants as well as their half-life and rates of biodegradation for optimal functioning ecosystems and improve understanding of the tolerances of species and ecosystems to pollutants

- Improve understanding of the impacts of pollution and combined effects of climate change and other stressors on ecosystems/organisms and human health.
- Develop risk assessment methods to understand impacts on biota and human health under climate change and taking into account multiple stressors.

Considerations for co design / trans-disciplinary approaches
- Foster interdisciplinary work in support of positive change including facilitating collaboration with social sciences (e.g. to allow assessments of the socio-economic costs of degraded ecosystems or better understand the drivers of behaviour change). There is a recognized priority to capture and incorporate local and indigenous knowledge
- Develop a digital atlas of the ocean, which will include depth measurements, biological, physical, chemical and geological parameters, as well as ecosystems, cultural objects, resources and boundaries. This work can assess risks of current and future types of ocean pollution whilst generating ideas to reduce ocean pressures through the promotion of recycling, improved waste management, and strengthening governance regimes that encourage more sustainable production and consumption
- Encourage the transfer of knowledge and capacity building through the development of manuals and practical training with harmonized methods consistent with the needs of our region which can contribute to the dissemination of results that provide useful information to the population and interested parties, as well as to the strengthening of relevant databases for decision-making.

Identification of partners / agencies / funding mechanisms
- There is a need to move beyond traditional frameworks and move towards equal participation of all stakeholders in policy, governance, and the implementation of strategic decision-making frameworks that enable equity in ocean science, management, and conservation for the benefit of all.
- Decade should also work with end-users in institutions to increase the speed of uptake of science and thus facilitate more reactive decision-making

Questions:

1.1.1. What actions need to be taken to achieve a clean ocean?
1.1.2. What observations and data systems are needed?
1.1.3. What are the capacity building needs required to ensure that sources of pollution are identified, quantified and reduced?
1.1.4. What are the policy needs required?
1.1.5. How do we ensure broad and equal access to technology, training, information, and capacity building?
1.1.6. What important aspects have we missed?
1.1.7. Can you suggest possible partners and contributors?

Breakout Session Group Outcomes:
- To achieve a clean ocean there is a need for better governance and for national policies and regulatory frameworks to be updated with more forceful policies, penalties and mechanisms to facilitate better compliance and infrastructure to mitigate pollution.
- The sources of pollution are already established, however the challenge lies in establishing what should be done to eliminate these sources of contamination. There is a need for the

scientific community to develop protocols which can be used by citizen scientists in the field with the government supporting them through financial contributions.

- The characteristics of insular and continental territories should be recognized and differentiated with individual countries developing national regulation plans which would further support the development of regional actions and programs as well as a regional pollution observatory
- Policies and regulations are needed for single use plastics, pesticides, fertilizers, antibiotics, nano plastics, hydrocarbons, organic pollutants and emerging pollutants and should include standards to monitor their impact and effect on aquatic communities.
- There is a need for participatory policies and ocean knowledge programs targeted at all users, with mass dissemination efforts by various mechanisms. There is also a need to design a communication policy with the media as leading actors and communicators should be trained to communicate on a scientific basis.

1.2 Title: Increasing knowledge in order to respond to multiple stressors in a changing environment

Background: To achieve a healthy and resilient ocean, where marine ecosystems are mapped and protected, the Decade aims to create a better understanding of the interactions and interdependencies while developing collaborative approaches across sectors (communities, industry, and government). Nonetheless, to achieve this, the harmonization of regional governance and overcoming geopolitical and economic diversity of the Western Tropical Atlantic Region is essential.

Description of Action: During the WG2 workshop, key oceans-related research priorities were identified for a regional program in the Western Tropical Atlantic. These included a need to sustainably manage, protect or restore marine and coastal ecosystems, fill priority knowledge gaps of ecosystems, and their reactions to multiple stressors and develop tools to implement management frameworks that build resilience, recognize thresholds, and avoid ecological tipping points. Furthermore, there is a need to unify programs and efforts whilst enhancing technical capacities (lack of data, information, and research) through institutional expertise across the region to develop integrated. There is a pressing need to develop solutions to monitor, protect, manage, and restore ecosystems and their biodiversity under changing environmental, social, and climate conditions whilst addressing the lack of baseline scientific information on oceans and their biological diversity as well as the low investment in ocean science.

Addressing gaps:
- Understand the impacts of human and other multi-stressor activities on ecosystems including new, synergistic, and cumulative impacts of climate change, the growing Blue Economy and associated economic opportunities including geoengineering.
- Improve understanding of monitoring ecological status response of ecosystems to multiple stressors through the collection of appropriate data, including environmental variables and the status of aquatic organisms, and analysis via suitable models and investigate other potential approaches such as the application of eDNA metabarcoding data for ecological monitoring
- Improve understanding of land-ocean interactions and drivers affecting ecosystem health including understanding the structure and function of the ecosystems, as well as interdependencies between ecosystems (particularly for the mesopelagic zone and other realms) to maintain or restore a healthy and resilient ocean.

- Improve understanding of global marine processes and the role of ecosystems and species, including in poorly studied areas, such as the deep ocean
- Improve marine biodiversity inventories through DNA barcode registrations and definition of indicators of dynamic ecosystems services
- Develop tools to evaluate ecosystem resilience to regime shifts and to better understand functional ecological connectivity to underpin marine protected area design and identification of critical ecosystems

Considerations for co-design / trans-disciplinary approaches
- Promote and discuss the drafting of sustainable ocean plans to respond to multiple stressors in the region, as it provides a credible basis for safeguarding the long-term health and resilience of the ocean, attracting investment, and creating jobs for the benefit of coastal communities and national economies.
- Promote ocean literacy and science-policy dialogue to respond to multiple stressors including expanding use of citizen and user-oriented (e.g. tourism operators, fishers) data collection, and use of local and traditional knowledge and practices. Improved understanding is seen as being driven by greater levels of outreach from scientists to the public and policy makers.

Identification of partners / agencies / funding mechanisms
- There is a need to move beyond traditional frameworks and move towards equal participation of all stakeholders in policy, governance, and the implementation of strategic decision-making frameworks that enable equity in ocean science, management, and conservation for the benefit of all.
- Decade should also work with end-users in institutions to increase the speed of uptake of science and thus facilitate more reactive decision-making.

Questions:
1.2.1. How can more interdisciplinary and trans-disciplinary interactions be created to respond to multiple stressors?
1.2.2. What are the policy needs required to be able to effectively respond to multiple stressors in a changing environment?
1.2.3. What do you believe are the capacity building needs required in the region?
1.2.4. How do we ensure broad and equal access to technology, training, information, and capacity building?
1.2.5. What are the ecological trade-offs associated with different policies and sustainable development pathways in the region?
1.2.6. How can we identify and agree on a definition of "restoration" that can be used in the region?
1.2.7. What important aspects have we missed?
1.2.8. Can you suggest possible partners and contributors?

Breakout Session Group Outcomes:
- Development of regional projects that facilitate sharing of information and transfer of knowledge, technologies and infrastructure can enhance the objectives focused on multiple stressors and their impact on biological communities.
- Fostering inter-sectoral and multinational efforts that facilitate collaboration amongst different disciplines and initiatives such as oceanographic and coastal observatories whilst encouraging the strengthening of decision-making is essential.

- Reanalyzing and promoting the commitments made in international agreements at the local government level is needed so that they are implemented effectively. It is also important to capitalize on existing agendas and efforts to organize and coordinate joint work to ensure better implementation.
- The establishment of cooperative mechanisms and exchange of capacities through offers to share training, equipment, co-design and joint projects is essential. The development and maintenance of regional training programs such as academic training programs can help maintain a constant group of trained professionals.
- There is a need for seminars or other events to regionally assess stressors and foster the standardization of protocols for the measurement of variables of common interest for decision-making in terms of management, conservation and restoration.
- The creation of databases of institutions, researchers and experts in the region can help facilitate cooperation between institutions both in research and training and access to technology.

1.3 Title: Increasing knowledge on impacts of the blue economy activities and climate variability change on fisheries and ecosystems health

Background: To achieve a sustainably harvested and productive ocean, which ensures the provision of food supply and alternative livelihoods, the Decade should create a better understanding of the interactions and interdependencies of the environmental conditions and processes as well as the use of resources and the economy. Nonetheless, to achieve this, the harmonization of regional governance and overcoming geopolitical and economic diversity of the Tropical Americas and Caribbean Region is essential. There is also a need for an increased understanding of the social and cultural factors impacting labor and poverty of women, men, youth in fisheries, and gender-responsive approaches to address these issues.

Description of Action: During the Working Group 5 workshop (A Sustainably Harvested and Productive Ocean), key oceans-related research priorities were identified for a regional. These included a need for focusing on environmental, health and biodiversity; climate change adaptation and mitigation, supporting blue economy initiatives, improving food security and nutrition and ensuring gender diversity and reducing social equalities. Thus, the development and implementation of a transboundary, multidisciplinary, and cross-sectoral research approach which connects science, technology, service providers, private sector, policy makers and society in general, for the sustainability of fisheries and marine ecosystem services for livelihoods, economic and social development was warranted. Better governance, policies, and regulations must be implemented at the global, regional, national, and local levels to protect our oceans, mobilize partnerships, and more importantly, all the developments in the blue economy must be data-driven and science and technology will be a key factor for a sustainable blue economy.

Addressing gaps:
- Improve the understanding of marine ecosystem functioning and how anthropogenic pressures and blue economy activities affect marine ecosystems especially when considering the future of food production from the ocean in a changing climate
- Improve the understanding of ecotoxicology and fish diseases, chemical and biological impacts of aquaculture and the effects of IUU fisheries on the health and state of fisheries and identify measures for climate change adaptation

- Improve the understanding of the role of coastal / small scale fisheries in underpinning wellbeing in the TAC region and how traditional and local knowledge can be incorporated into decision making
- Increase knowledge on ecosystem function and sustainability at the ecosystem level and strengthen research on trophic gaps to better understand the interrelationships between species and habitats and their connectivity.
- Identify ecosystem thresholds and develop indicators of sustainability

Considerations for co design / trans-disciplinary approaches
- Develop tools to allow an adaptive ecosystem approach to fisheries management in the face of a rapidly changing climate including integrated ecosystems assessments, fish catch and effort data collection and value chain analysis in the fisheries sector as well as the development of sustainable / low-impact marine technologies in the energy and minerals sector and other activities related to the blue economy
- Integration of social and natural sciences and traditional and local knowledge in the co-design and delivery of ocean science can be used as a tool to understand and resolve conflicts between different users, integrate different knowledge systems and more effectively communicate science to policy makers and communities and stakeholders involved in blue economy activities.

Identification of partners / agencies / funding mechanisms
- There is a need to move beyond traditional frameworks and move towards equal participation of all stakeholders in policy, governance, and the implementation of strategic decision-making frameworks that enable equity in ocean science, management, and conservation for the benefit of all.
- Decade should also work with end-users in institutions to increase the speed of uptake of science and thus facilitate more reactive decision-making

Questions:
1.3.1. How can more interdisciplinary and trans-disciplinary interactions be created to achieve a sustainably harvested and productive ocean?
1.3.2. What are the policy needs required to effectively protect our oceans and mobilize partnerships?
1.3.3. How do we ensure broad and equal access to technology, training, information, and capacity building?
1.3.4. What do you believe are the capacity building needs required in the region to achieve a sustainably harvested and productive ocean?
1.3.5. How can communication of science to policy makers and communities and stakeholders involved in blue economy activities be improved?
1.3.6. What important aspects have we missed?
1.3.7. Can you suggest possible partners and contributors?

Breakout Session Group Outcomes:
- Strengthening and enhancing synergies between national and transnational stakeholders is an important way forward whilst ensuring that stakeholders understand their ocean role.
- Policies need to be more regularly updated in order to incorporate fundamental changes and legislation has to be in place to set the foundation for institutional arrangements.

- National policies need to be dynamic and adjust to environmental changes and strengthened so that when policy directions are given at the regional level (WECAFC, OSPESCA, CRFM), these regional policies are implemented/implementable.
- To ensure broad and equal access to technology, training, information and capacity building, there is a need to first identify what is happening regionally and then identify and facilitate the relevant training needs and the programs available and eventually scale up.
- Recognizing stakeholders and ensuring that traditional knowledge is incorporated is essential. Fisher populations are dwindling and thus there is need to develop and sustain training to attract younger fishers.
- The ocean needs some recovery before we can consider expanding capacity, thus we need to collectively give the ocean a chance to recover after all these major disturbances and then build harvest capacity etc.
- Simplifying scientific language and summarizing key information to engage policy makers and specific audiences is essential. Identifying and utilizing existing fora to communicate science and maximize the science-policy interface and engage the persons that drive policy decision makers to engender action is needed
- The pandemic has created opportunities through virtual approaches to improve broader and more equitable access for knowledge and sharing information for training and building capacity.

1.4 WAY FORWARD

Breakout Session 1 on Knowledge and Solutions recognized as a way forward that understanding data needs in the region is required before establishing best practices requiring to organize regional workshops that help understand the needs. It recognized that co-design is crucial, that the ocean does not observe human dictated boundaries. Therefore, data that is considered necessary for solid decision making should not have the same human boundaries either.

Breakout Session 2: Essential Infrastructure

2.1 Title: An Ocean Observing System for the TAC Region

Background: The desired outcome is a predicted ocean whereby society has the capacity to understand current and future ocean conditions, and the ability to forecast their change and impact on human well-being and livelihoods. This will require sustained, long-term, high-quality observations of TAC marine and coastal environments, including human interactions, to support delivery of forecast and decision-support tools that help fulfill the multiple sustainable development goals of The Decade.

For the purposes of this discussion, we will assume that Ocean and Coastal Observations will be one fully aligned component of an Integrated System including Groups 1-4 of Breakout 2, and that an overall Decade ACTION will be the full implementation and sustained operation of a TAC Regional GOOS

Description of Action

In order to support the GOOS in the TAC region (Challenge 7), we must put in place a sustainable region-wide network of ocean and coastal observations providing information for

1. Model support – validation, assimilation, formulation (e.g., bathymetry, boundary conditions)
2. Early warning systems (immediate hazards as well as longer-term climate and stressor 'tipping points')
3. Real time products for use by ocean and coastal interests and activities

We should use the GOOS 2030 Strategy - Value chain approach, connecting OBSERVATIONS through DATA MANAGEMENT for use in ANALYSES and MODELS to create APPLICATIONS.

It is critical to create a 'pull' from potential participants - regional agencies, governments, economic interests - to bring resources for ocean prediction into the region and implement them locally (rather than an external 'push').

This requires
● A highly inclusive governance model; representation from all states, NGOs, Intergovernmental agencies, researchers, industries, communities; numerous committees for interest groups, technologies, training, etc.). Engage widely with a 'useful bureaucracy'.
● A well-formulated initial demonstration system with significant initial deliverables, potential for wide inclusivity, and a robust system framework capable of expansion. Regionwide glider coverage (addressing climate, hazards, model support) for example, can promote data sharing and trans-boundary observational cooperation.
● Identification and initial inclusion of existing programs.
● A complete initial (and continuing) inventory of possible observations (operational and potentially operational systems, at all scales) that *could* be included in an Ocean Observing System.

Existing observing technologies are often inappropriate (complexity, training, expense) for widespread local use, particularly in coastal regions where dense measurements are required. Part of a mandatory observational needs assessment should include relevant available data collection methods and technologies assessment, and potential alternatives. Integrate new technologies into a network of Internet of Things where data is made available and processed in real-time.

Share and promote Best Practices to ensure efficiency, data and information standards, quality, ease of data sharing, standard knowledge and training.

Other aspects
● Given the Background and Description of the desired Action (or component of Action), what do the participants see as most important aspects and steps to take towards achievement?
● What important aspects have we missed in the summary?
● How do we ensure initial and ongoing co-design, participation, and trans-disciplinary approaches (so the Observing System can contribute to ALL TAC Decade Actions)

Questions

2.1.1. What are the keys to engaging the entire region to participate in collaborative ocean observing activities – including data and information sharing and transboundary ocean observing (noting that critical ocean features are transboundary).

2.1.2. What are the highest priority observations and products you would like to see?

2.1.3. What are some ongoing activities that could be utilized as an initial 'core' observing system. How might they be expanded?

2.1.4. How do we ensure broad and equal access to equipment, training, information, and capacity building?

2.1.5. What important aspects have we missed?

2.1.6. Can you suggest possible partners and contributors?

Breakout Session Group Outcomes:

- Need to identify the observational platforms in the region in order to know their spatial and temporal coverage and identify the gaps. Therefore, an extended collaborative platform is needed to map what is available in the region and diagnoses what ocean observations, information resources and other data from different institutions are available.

- Saving lives and mitigate the impacts of severe weather events must be the ultimate priority. It is also urgent to focus on what is needed to improve MHEWS, for example mesoscale models, hurricane dynamics understanding and of course marine forecasts for marine safety. It is thus a priority to establish observational platforms that can address the most pressing problems from extreme events with an ocean origin or feedback, gliders to assess and track the upper ocean heat content, buoys measuring marine meteorology and surface ocean essential variables temperature, salinity, oxygen concentrations, waves and currents, satellite imagery of essential variables and waves.

- A comprehensive mapping of observing systems, data sources, portals, project, and initiatives with the support of multi stakeholders, partners need to be conducted. In this sense, it is needed a joint effort to connect current observational platforms active in the region, to identify the gaps and address the need for observations of the modeling community. A sustained effort should be taken to maintain the current observing systems in the region following the example set by the WMO structure and operation.

- A specific Implementation Plan needs to be agreed with a clear connection to the societal benefits and the contribution to the global agenda: CC agenda post-COP 26; Sendai, Samoa Pathway and the Sustainable Development Agenda. This will allow to identify the financial resources.

- Broad and equal access to equipment, training, information, and capacity building must worked out from many directions from the communities' level to the local governments, industry and stakeholders, and national government and back. In the case of equipment there is an investment on resources that national governments and industry must provide, the training can be provided on different levels by the school system and academia.

- Broad and equal access to information is a necessary compromise of all the observing and operational modeling groups associated with the decade and enforced by the funding agencies and trusts, efforts should be made to make the products widely available especially through electronic media and widely extended use of smartphones, and this broadcasting of information should be happening both ways to engage the communities as sources of information on the coastal ocean conditions and events. Capacity building has to provide extensive and equal access to educational institutions with the knowledge and experience in the setup, operate and maintain of the observational platforms and modeling efforts.

- We need a multi-agency and multi-partners agreement: IOC, WMO, UNDRR, UNEP and cooperation development agencies to look for more coherent coordination- also to bring in private sector and NGOs that have ocean observations systems, the generators of information.
- We further need the active participation and funding from local to national governments, private foundations, stakeholders and industry to achieve these goals, which further involves public policies regulating the marine environment, the welfare and health of their communities.

2.2 Title: Implementation of TAC Regional Modelling and Forecasting Systems

Background: The desired outcome is a predicted ocean whereby society has the capacity to understand current and future ocean conditions, and the ability to forecast their change and impact on human well-being and livelihoods. This will require an ensemble of regional interdisciplinary models providing forecast and decision-support tools that help fulfill the multiple sustainable development goals of The Decade.

For the purposes of this discussion, we will assume that Modeling and Forecast System will be one fully aligned component of an Integrated System including Groups 1-4 of Breakout 2, and that an overall Decade ACTION will be the full implementation and sustained operation of a TAC Regional GOOS.

Description of Action

- To support the Global Ocean Observing System and Services in the TAC region (Challenge 7), we must put in place an ensemble of regional interdisciplinary models that:
    - Are accessible to all, with publicly available model viewer(s) devoted to TAC Region.
    - Include various global models cropped to regional area

- Models should be nested to provide high resolution products for coastal states and regions
    - Choose one or more high resolution coastal models to implement in all states (or small groups of collaborating states)
    - Ideally provide many outputs – hydrodynamics (waves, currents, inundation, etc.), transports (sediments, pollutants, larvae, etc.), biogeochemical characteristics (T, S, nutrients, carbon, oxygen)
    - Desirable to engage states in development and operation
    - Will require selection of [model, operator, training], creation of local parameters [grids, forcing, observations, output fields, etc.]
    - Include accessibility as above

- They will utilize all available data, including that from a regional Ocean and Coastal Observing System, and support regional early warning systems (immediate hazards as well as longer-term climate and stressor 'tipping points') and real time products for use by ocean and coastal interests and activities.

- We should use the GOOS 2030 Strategy and Other Ocean Observation Agreements (e.g WMO-IOC; IOC-IHO) - Value chain approach, connecting OBSERVATIONS through DATA MANAGEMENT for use in ANALYSES and MODELS to create APPLICATIONS.

- Models/products/forecasts should be multipurpose and support local interests.

Other aspects
- Given the Background and Description of the desired Action (or component of Action), what do the participants see as most important aspects and steps to take towards achievement?
- What important aspects have we missed in the summary?
- How do we insure initial and ongoing co-design, participation, and trans-disciplinary approaches (so the Modeling and Forecast System can contribute to ALL TAC Decade Actions)

Questions:
2.2.1. What are the priority products and forecasts you would like to see and use?
2.2.2. How do we ensure broad and equal access to technology, training, information, and capacity building?
2.2.3. What are the keys to engaging the entire region to participate in collaborative use of ocean observations – including data and information sharing and transboundary ocean observing (noting that critical ocean features are transboundary) – and resulting forecasts and products?
2.2.4. What are some ongoing activities that could be utilized as an initial 'core' system? How might they be expanded?
2.2.5. What important aspects have we missed?
2.2.6. Can you suggest possible partners and contributors?

Breakout Session Group Outcomes:
- There is a need to implement dispersion models, such as Sargasso, in the regional level.
- It is a regional priority to standardizing scientific knowledge. Therefore, one must provide Virtual training for the region, capacity building, video tutorials for users with a virtual platform. Access to technology allows end users to have access to training and information, which is why it should be sought to increase access to technology in the TAC Region.
- To foster regional agreements to make available and share data, establishing observation networks. Empower ODINCARSA. The more ocean information is available to end users, the more they will add to the use of observations and data, and the data generators should provide free access to data.
- Repower ODINCARSA, identify other platforms to download / share / disseminate data. It is necessary to establish platform with models and products for different users.

2.3 Title: Early Warning Systems and Services for the TAC Region

Background: The desired outcome risk-informed sustainable development through an evidence and impact-based Multi-Hazard Early Warning System (MHEWS) which includes the four key elements of: risk knowledge, monitoring and warning service, dissemination and communication, and response capability.

Regional Ocean and Coastal Hazards included in a TAC regional MHEWS should address, at least: Sea level rise, Sargassum, Tsunami, COVID-19, Wastewater, Tropical Cyclones and their impacts, and Oil Spills.

In consideration of its critical and immediate importance to the security of life and society, the System must address TAC cultural, political, economic, social diversity, social capital needs and human and environmental sustainability requirements, and engage and address the most vulnerable.

Description of Action: Addresses all MHEWS components: Monitoring and Warning Services (highest), Risk Knowledge and Understanding (complexities and cascading impacts), Dissemination and Communication of information and warnings (from regional thru national and local levels), and Response Capabilities.

Maximizes and strengthens linkages to existing efforts: UNDRR, Sendai Framework, Tsunami

and Other Coastal Hazard Early Warning System (ICG CARIBE EWS), Hurricanes (WMO RAIV), GOOS (IOC), Sargassum Hub, Regional Emergency Management Organizations (CDEMA, CEPREDENAC, EMIZA), Decade Actions (Programmes, Projects and Contributions), PAHO, REWS (Caribbean Regional Early Warning System), CREWS (Climate Risk Early Warning System)

Builds capacity development (e.g. coding, numerical modelling, communication technology,) including at local level to provide better inclusion of local knowledge and trusted voices in the System.

Reinforces the many synergies with other Decade outcomes – Predicted Ocean (models. Forecasts, data), Clean Ocean (wastewater, oil spills), Productive Ocean (similar stakeholders), Inspiring and Engaging (Education and Outreach)

Develops a tightly connected structure of Regional to National to Local Governance and Forecasting and Warning Networks

Considers within the TAC MHEWS a wide range of ocean related hazards including Sea level rise, Sargassum, Tsunami, COVID-19, Wastewater, Tropical Cyclones and their impacts, and Oil Spills (result of survey in May 2021). While each of these hazards may have unique warnings and responses, many of the impacts are crosscutting and the underlying infrastructure elements – observations, data management, and models and forecasts – should share common features of the integrated regional observing system.

Integrates infrastructure within the GOOS 2030 Strategy which considers value chain approach, connecting OBSERVATIONS through DATA MANAGEMENT for use in ANALYSES and MODELS to create APPLICATIONS. For the Impact Based MHEWS, the APPLICATIONS can be the critical forecasts and risk analysis products.

Other aspects to consider
- Given the Background and Description of the desired Action (or component of Action), what do the participants see as most important aspects and steps to take towards achievement?
- What important aspects have we missed in the summary?
- How do we insure initial and ongoing co-design, participation, and trans-disciplinary approaches so the resultant Multi Hazard Early Warning System can both utilize and contribute to other TAC Decade actions?

- Are we missing key partners / agencies / programmes we should be considering?
- What would be the sources of funding?

Questions:
2.3.1. What level of UN Decade Action (Programme, Project, Activities) should be to bring together various existing regional disaster reduction activities into an efficient integrated Multi Hazard Early Warning System for the TAC?
2.3.2. Should the Safe Ocean TAC Decade Action be a UN led effort or should it be a "coalition" let action. If a coalition led effort, who could lead the effort?
2.3.3. How do we ensure broad and equal access to technology, training, information, and capacity building?
2.3.4. How do we ensure the system considers the cultural, political, economic, social diversity, social capital needs and human and environmental sustainability requirements; engage and address the most vulnerable.
2.3.5. What are the keys to engaging the entire region to participate in collaborative data, information, and product management and access – including data and information sharing and transboundary ocean data and products (noting that hazards are transboundary).
2.3.6. What important aspects have we missed?
2.3.7. Identify possible contributors
2.3.8. Identify possible name for the action

Breakout Session Group Outcomes:
- It should be established a programme that includes the regional thru local and focus on multi hazard. The programme could be drafted as a coalition/consortium to enhance partnerships, collaborations, empowerment of local, national and regional efforts, under the leadership of universities, CDEMA /CEPREDENAC/EMIZA. It could also be an UN led effort, UNDRR, CARIBE-EWS (with CTIC), considering that CARIBE EWS already includes other coastal hazards.
- There is a need for capacity building in decision support tools for warning, communication technology and social communication. Another aspect is Capacity Development in native languages.
- The programme should include Pre-during-after, consistent, commonly understood, avoid science jargon and consider need for products in local languages. Moreover, it needs to integrate local stakeholders from the onset.
- Wide and sustained awareness and sensitivity campaigns are the keys to engaging the entire region to participate in collaborative data, information, and product management and access. It is also worth mentioning the value of invest in the subject (productivity, tourism, etc.) and its Social/Economic/Political Outcomes/Impacts. One should refer to recommendations of the Regional Platform for UNDRR (Jamaica).
- Coral Bleaching and Droughts should be added to the list of hazards. One should also be more specific about Tropical Cyclones and use text "Hurricanes/Tropical Cyclones (storm surge and winds).
- Possible contributors: UNDRR (Americas), Sendai Framework, Tsunami and Other Coastal Hazard Early Warning System (UNESCO/IOC ICG CARIBE EWS), Hurricanes (WMO RAIV), GOOS (IOC), Sargassum Hub, Regional Emergency Management Organizations (CDEMA, CEPREDENAC, EMIZA), Decade Actions (Programmes: Ocean Teachers Global Academy and Ocean Decade Tsunami Programme, Projects and Contributions), PAHO, REWS (Caribbean Regional Early Warning System), CREWS (Climate Risk Early Warning System),

Caribbean Institute for Meteorology and Hydrology, National HYDROMET offices, Red Cross, Central America Tsunami Advisory Center (CATAC at INETER, Nicaragua), National Hurricane Center, CCCCC (Caribbean Community Center for Climate Change). Caribbean Meteorological Organization, University of the West Indies, Barbados, Jamaica and Trinidad and Tobago, particularly the Seismic Research Centre [SRC], Trinidad and Tobago), University of Puerto Rico at Mayaguez (Seismic Network, Coastal Resilienced Center), National University Costa Rica (SINAMOT-UNA), French West Indies University (Guadeloupe), National Science Academies, National Disaster Management Organizations, Regional organization of Municipal/Local officials (maybe it does not exist, only National level), CARICOOS.

2.4 Title: Supporting Data and Information Management, Access and Delivery Systems for TAC

Background: The desired outcome is a truly integrated ocean information and data management, integration, exchange, and public delivery system for the TAC region. The system would provide open access to data, information, and products. As part of the region's Essential Infrastructure, the System would be designed to support multiple Decade Challenges.

Development of a Digital Twin Ocean focused on the TAC region would provide a valuable tool for integrating observations and models to provide best possible ocean nowcasts and forecasts. Additionally, DTO can be used for scenario modeling for extreme events and climate change impacts and development of decision support tools. A fully developed integrated information and data management is a critical building block for the DTO.

For the purposes of this discussion, we will assume that the Data and Information Management, Access and Delivery Systems will be a fully aligned component of an Integrated System including Groups 1-4 of Breakout 2, and that an overall Decade ACTION will be the full implementation and sustained operation of a TAC Regional GOOS.

Description of Action:

- To support the Global Ocean Observing System (GOOS) in the TAC region (Challenge 7), as well as provide support for most other regional Challenges, we must put in place an integrated ocean information and data management, exchange, and public delivery system for the TAC region.

- The Data and Information Management System:

  - Should Serve multiple functions: Data intake, Quality Assurance and Quality Control, Distribution – all in a transparent and accessible way

  - Should fill the DATA MANAGEMENT role in1 the GOOS 2030 Strategy - Value chain approach, connecting OBSERVATIONS through DATA MANAGEMENT for use in ANALYSES and MODELS to create APPLICATIONS.

- Will require a skilled and trusted governance structure –developed and managed with an emphasis on co-design to encourage participation, define standards and 'ground rules', establish trust and transparent processes.

- Utilize Best Practices as established in similar systems worldwide, and accessibility through freely available open-source software and services.

- Should be tailored towards product development, creation, delivery, display based on standards, user and market driven (with rules insuring inclusivity), at least one open regional clearinghouse for products and applications

- Should include real-time operational and archived content.

- May be distributed and/or mirrored but should set and utilize standards for interoperability.

All these characteristics are critical to ensuring that the system can support open development of products, forecasts, and warnings for the region.

The System will provide the infrastructural basis for the creation and operation of a TAC regional Digital Twin Ocean. An operational DTO provide a valuable tool for integrating observations and models to provide best possible ocean nowcasts and forecasts. Additionally, DTO can be used for scenario modeling for extreme events and climate change impacts and development of decision support tools.

Other aspects to consider
- Given the Background and Description of the desired Action (or component of Action), what do the participants see as most important aspects and steps to take towards achievement?
- What important aspects have we missed in the summary?
- How do we insure initial and ongoing co-design, participation, and trans-disciplinary approaches (so the resultant Data and Information Management System can contribute to ALL TAC Decade Actions)?

Questions:
2.4.1. What are the priority products and forecasts you would like to see and use?
2.4.2. How do we ensure broad and equal access to technology, training, information, and capacity building?
2.4.3. What are the keys to engaging the entire region to participate in collaborative data, information, and product management and access – including data and information sharing and transboundary ocean data and products (noting that critical ocean features are transboundary).
2.4.4. What are some ongoing activities that could be utilized as an initial 'core' system? How might they be expanded?
2.4.5. What important aspects have we missed?
2.4.6. Can you suggest possible partners and contributors?

Breakout Session Group Outcomes:
- It is critical to adopt best practices in the TAC region. It is also important to create a DOI capacity, so that data is properly filed in its respective data set, group and collection.

- Establishment of a common space/forum/clearing house where countries, scientists, researchers, policy makers and other relevant stakeholders could access common strategies. This would facilitate comparability, partnerships and foster joint solutions.
- One should consider creating a recognition for the efforts of researchers/ groups/ institutions for sharing data system/prize/award.
- There is a need to foster open data initiatives. Furthermore, there is a need to create communities that promote information and technology sharing. These communities help provide motivation for long-term participation. In that sense, a combination of top-down (grant requirements, international agreements) as well as bottom-up (social engineering) is necessary to create a culture of data sharing.

2.5. WAY FORWARD

Breakout Session 2 on Essential infrastructure recognized data – inventory, best practices, complexities, value in data sharing, access to technology regional – local and local –regional. There are many ocean processes that could be modelled, will have to prioritize according to interest – MHEWS need to work with the data and info.

Breakout Session 3: Foundation

3.1. Title: Best practices: achieving equal access to data by standardizing local, national, and international data

Background: According to the Decade's Implementation Plan, capacity development needs to include a focus on mechanisms to accelerate the use of knowledge for societal wellbeing. The Plan acknowledges that no single data system will be able to support the Decade's ambitions, being, thus, relevant to focus on c-design a transdisciplinary and multicomponent digital network capable of representing the entire ocean system. While understanding the regional needs and challenges, during the Workshop Series (April 2020) and Working Groups Webinars (2021), IOCARIBE identified as regional desired outcomes data sharing, open access to data and information and ensuring that the data collected can be distributed and interpreted nationally. It was concurrently noted that lack of data and the fact that data collection and management are taking place in a non-harmonized manner in the Region are relevant barriers to achieving the desired outcomes for the Decade in the Tropical Americas and Caribbean Region. Therefore, there is a regional need to establish/promote best practices in data collection and data management to promote a transformative change in capacity development.

Description of Action: During the Working Groups Webinars capacity building was identified as a cross-cutting subject, being thus the need to establish best practices in the Region highlighted in WG1, 2, 4 and 6 workshops. The limited availability of accessible and high-quality data, the need for open access data and ensuring that the data collected can be distributed and interpreted nationally were identified as common challenges to be overcome. In the region, there are several databases available. However, considering that those databases usually do not use the same

collection and organization methods, it is impossible to import and export data from one to another (lack of interaction). Therefore, establishing best practices is a critical need in the region to make data available to all, improving cooperation, management, decision-making, and governance. Finally, because best practices can lead to the establishment of efficient data sharing mechanisms, establishing best practices can also be helpful to develop ocean research policies in the region.

Addressing gaps:
- Limited coordination within the region, especially related to laboratory work and data comparability
- Lack of data, information, and research (understanding the effects of multiple stressors on ocean ecosystems)
- Lack of baseline scientific information on oceans and their biological diversity
- Impending ocean literacy and capacity development needs
- Lack of standards in data and practices
- Limited availability of accessible and high-quality data
- Ensure the development of data and information management plans in existing and new national ocean science, observation and related programmes and activities
- Low engagement with or approach and knowledge exchange with local communities and traditional knowledge holders
- Overcoming impediments to data sharing (e.g., language, and hidden or underexploited datasets)
- Lack of technology needed to generate, interpret, and use data

Considerations for co-design / transdisciplinary approaches:
- Understand all stakeholders needs
- Identify gaps in knowledge that could lead to a best practice guideline that is not understood by the end-users
- Avoid including terms and definitions that could lead to a diplomatic issue

Identification of partners / agencies / funding mechanisms
- **The International Hydrographic Organization (IHO)** is responsible for the distribution of Maritime safety Information. IHO also makes available nautical charts to support safe navigation, as well as develops and sets standards and issues guidance that ensures that hydrographic information is available and can be delivered to users through appropriate harmonized and interoperable products and services. Therefore, IHO can be a potential partner of IOCCARIBE regarding the improvement of data sharing and capacity development.
- **The IHO-IMO-WMO arrangement on Maritime Safety Provision:** In 2015, the World Meteorological Organization (WMO) has signed an agreement with IHO and IMO to strengthen cooperation and coordination in the provision of maritime safety information to protect lives at sea. The organizations should coordinate activities related to the Global Maritime Distress and Safety System. It is relevant to note that IHO, IMO and WMO work close to ensure the safety in the sea. In this regard, one must note that in 2016, the organizations joint drafted the Manual on Maritime Safety Information and, in 2019, IMO and WMO published the Revised IMO/WMO Worldwide Met-Ocean Information and Warning Service Guidance. IHO and WMO are also working together regarding the provision of

accurate early warning information to coastal communities and to identify and enact opportunities to develop and build capacity amongst the developing coastal states and small island developing states ([Joint Capacity Building Coordination effort](#)). Therefore, all organizations should be considered as possible partners due to their experience in establishing best practices and capacity building.

- **International Maritime Organization (IMO)**: The SOLAS Convention is often presented as the main instrument of IMO, since it aims to mitigate risks and manages to be effective, at the same time generic and short. It is precisely the importance of this convention for the development of data related to hydrographic surveys and nautical charting, as well as the possibility of different uses of the data and information collected (e.g. sustainable fisheries activities and other sectoral uses of the marine environment, the delimitation of maritime boundaries and environmental protection) that is praised in Resolution 72/73. Therefore, IMO already has experience in establishing standards and best practices for data collection.
- **International Seabed Authority (ISA)**: Aiming to fulfil its obligation to protect the marine environment, ISA has a relevant role in data collection and database management regarding the deep seabed. ISA's experience in establishing best practices and standards regarding data collection could be of great help to IOCARIBE.

Questions:

3.1.1. What is the perception of the state of the art?
3.1.2. What is needed according to participants to the breakout group?
3.1.3. What is missing to achieve the challenge?
3.1.4. How will these action change the trajectory of the oceans?
3.1.5. What important aspects have we missed?
3.1.6. Can you suggest possible partners and contributors?

Breakout Session Group Outcomes:

- International standards must address the region's biggest data needs. Workshops could be held aiming to understand the region's needs and to reach an agreement on the creation of repositories of publicly available data. However, identifying funding opportunities to promote these workshops, maintaining these repositories, and developing regional standards is still a challenge to the region.
- Before drafting best practices, one must confirm that there is no international protocol that already addresses the regional issue. It is critical to understand if the problem of interoperability in the region exists because end users do not have access or understand existing international data collection and data management protocols or if there is a true need for developing new protocols.
- Language and translations of databases must be considered for achieving more publicly accessible data in the region.
- Sharing knowledge is a key element for achieving the ocean we want by 2030. Therefore, establishing efficient data sharing mechanisms will be crucial for the Ocean Decade. It can allow for better decision making. Understanding the biggest data needs should also spark a discussion about equitability in the region with different countries having access to greater resolution of information and thus having a greater voice at the decision-making table.

3.2 Title: Ocean literacy: changing local communities' relationship with the ocean by promoting the democratization of access to knowledge in the TAC Region

Background: At the end of the Decade, the world aims to achieve an inspiring and engaging ocean where society understands and values the ocean concerning human wellbeing and sustainable development. However, information is unequally distributed across the world, across generations, and genders (Implementation Plan). Therefore, to achieve the ocean we want, we need to address ocean inequality and create solutions to make information available to all. According to UNESCO's Ocean Literacy Portal, ocean literacy is relevant to creating a society able to make informed and responsible decisions on ocean resources and ocean sustainability. It is relevant to understand that ocean literacy is more than educating and informing the public about the ocean. It is a relevant tool to overcome inequality and promote emotional engagement/empathy towards the ocean.

Description of Action: During the Webinar Series on Capacity Development, it was identified that the lack of knowledge is a relevant barrier to the sustainable development of the ocean and that it is crucial to recognize an efficient method to engage with or approach and exchange knowledge with local communities and traditional knowledge holders. Considering that ocean literacy is also about adopting tools and approaches that can transform ocean knowledge into actions that promote ocean sustainability, it is relevant for the Region to promote ocean literacy.

Addressing gaps:
- Lack of access to communities of practice
- Lack of regional and local policies to raise awareness, ocean literacy and public outreach
- Lack of information and content tailored to effectively impact all stakeholders
- Lack of students and early career professionals in the ocean decade
- Low engagement with or approach and knowledge exchange with local communities and traditional knowledge holders
- Lack of access to technologies and essential equipment
- Lack of ocean-related subjects in formal education

Considerations for co-design / transdisciplinary approaches:
- The Decade is not only about promoting and developing ocean science. The end-users should be also included. Therefore, it is relevant to promote ocean literacy content to all ages.
- Considering that the Region must adopt creative solutions to engage with local communities and traditional knowledge holders, it is relevant to use an anthropologic, social, and humanistic approach when designing the actions.

Identification of partners / agencies / funding mechanisms
- The Ocean Conservation Trust
- UNESCO's Ocean Literacy Portal
- EuroGOOS "Scientists for Ocean Literacy"
- National Marine Educators Association (USA)
- The EU4Ocean Coalition for Ocean Literacy

- Eurofleets+
- Cultura Oceánica – UNAM
- UN CC: Learn Project in the Dominican Republic
- OceanTeacher Global Academy
- The Ocean Panel
- ISA's Women in Deep-Sea Research Project
- The Endowment Fund for Marine Scientific Research in the Area
- WMU Empowering Women for the United Nations Decade of Ocean Science for Sustainable Development
- Local universities
- Local schools/colleges

Questions:
3.2.1. What is the perception of the state of the art?
3.2.2. What is needed according to participants to the breakout group?
3.2.3. What is missing to achieve the challenge?
3.2.4. How will these action change the trajectory of the oceans?
3.2.5. What important aspects have we missed?
3.2.6. Can you suggest possible partners and contributors?

Breakout Session Group Outcomes:
- There is no holistic understanding of Ocean Literacy by decision makers. The articulation and implementation process are difficult to carry on. Moreover, there is a lack of understanding of the ocean as a part of social Identity in the TAC Region and people from no-coastal regions are less likely to engage in ocean issues.
- Aiming to overcome those issues, one must identify efficient methods to provide scientific information to society in a manner that end users can truly and clearly understand the information, making information available and accessible to everyone.
- Traditional knowledge can be a useful tool to raise awareness and ease the "conversation" of ocean related issues in the TAC region. It is urgent to adopt innovative strategies and means in this regard.
- There is a need to adopt or implement regional mechanisms to foster Ocean Literacy Actions. The TAC region must seek to lend visibility to those actions and to foster the adoption of local policies based on continuous and dynamic processes that help to formalize marine education in curriculums

3.3 Title: The blue economy: enhancing comprehensive capacity development across all aspects of ocean science and for all stakeholders in the region in the TAC Region

Background: Developing an inspiring and engaging ocean demands access to high-quality research. Aiming to achieve that goal, scientists must be prepared and have access to the available technology. However, the Region is facing a lack of equipment, research vessels, funding, and trained researchers. Moreover, it was also identified an exodus of talents due to a lack of opportunities. According to the Implementation Plan, capacity development is an essential tenet of the Decade and, therefore, implementing capacity development programmes can help the Region to achieve the ocean we want.

Description of Action: During the Capacity Development Webinar (2021), IOCARIBE identified that developing local expertise with lasting benefits can lead to transformative change in capacity development. According to the Blue Economy Development Framework, issued by the World Bank Group, diversifying countries' economies beyond land-based activities and along their coasts is critical to achieving the SDGs and delivering smart, sustainable, and inclusive growth globally. Therefore, it is critical to enhance knowledge about the blue economy (targeting scientists, governments, and policymakers). In addition to its notorious importance for local culture and livelihood, the ocean should also be understood as an economic asset, as it is estimated that the ocean economy directly contributes more than 1.5 trillion dollars a year to the global economy. The blue economy encompasses several sectors, such as fishing, carbon sequestration, offshore energy. In order to achieve a healthy and productive ocean by 2030, capacity building actions targeted to the local community must be carried out, being also important to align economic outcomes with the need for conservation. In this context, it is relevant to use the lessons learned to empower the region on the blue economy, so that sustainable development reaches all branches of the ocean sciences, and all stakeholders have equal access to knowledge.

Addressing gaps:
- Lack of students and early career professionals in the ocean decade
- Lack of funding and investment in ocean-related issues
- Lack of equipment, research vessels, funding, and trained researchers
- The exodus of talents due to lack of opportunities in the region
- Low engagement with or approach and knowledge exchange with local communities and traditional knowledge holders
- Lack of understanding of the deep ocean ecosystem
- Lack of understanding of the impacts of marine biodiversity loss

Considerations for co-design / transdisciplinary approaches:
- All stakeholders must be included. Co-design implies all the diversity of potential stakeholders.
- The adoption of approaches to co-design and co-produce solutions-oriented science, knowledge, and innovation for achieving the ocean we want should consider that the science and knowledge also refer to social science, humanities, traditional knowledge holders.
- A transdisciplinary approach requires the implementation of methods to promote social transformation, to analyze and evaluate local social issues, as well as to identify sociocultural, economic, institutional, and political barriers that discourage regional development.

Identification of partners / agencies / funding mechanisms
- Mining industry
- World Bank
- The Ocean Panel
- OECD
- Member States

Questions:

3.3.1. What is the perception of the state of the art?
3.3.2. What is needed according to participants to the breakout group?
3.3.3. What is missing to achieve the challenge?
3.3.4. How will these action change the trajectory of the oceans?
3.3.5. What important aspects have we missed?
3.3.6. Can you suggest possible partners and contributors?

Breakout Session Group Outcomes:
- There is a need to improve data sharing methods in the TAC region. Sharing data is crucial to co-design. Moreover, knowledge and information exchange is key for partnership development. It is important to note that the challenge is not sharing the information, but transition from information sharing to taking action. Therefore, there is a need to develop local initiatives in this regard, especially for small island nations.
- Engagement in pilots to ready-test emerging initiatives is critical. Capacity needs must transition into local jobs. Moreover, there is a need to integrate existing economies (e.g., agriculture) into emerging science and technology initiatives.
- Blue economy is a cross-cutting theme and must be addressed in a multi and interdisciplinary way. Therefore, sectors must be working together in order to take new tech and know how into actual action and job growth. Best practices for data standardization is critical for cross-sectoral collaboration.
- A regional need for more mainstreaming of sustainable economic operations was identified. Enterprises should be encouraged to incorporate best practices to ensure sustainability.
- A lack of regional financial capacity to invest in new economies was identified. In that sense, stepping into new sectors (e.g., biotechnologies, marine energy) without local expertise is a regional challenge that could be overcome through increasing knowledge and data sharing in the TAC Region. There is also a need for diversifying skill sets and partnerships. Finally, one must promote diversity in blue economy initiatives.

3.4. Title: Partnership and cooperation: overcoming barriers to reach optimal efficiencies, effectiveness, and impact of capacity development initiatives in the TAC Region

Background: According to the Implementation Plan, partnership and cooperation are essential pillars of all capacity development during the Decade. The Ocean Decade aims to revolutionize ocean science, changing humanity's relationship with the world. Therefore, it encourages stakeholders to develop scientific knowledge and it creates an enabling environment for partnerships and cooperation agreements. The ocean should be understood as a unit, and the Decade was designed to be inclusive, i.e., anyone can participate and take action. Therefore, all stakeholders should cooperate and act together to achieve the ocean we want. Partnerships are thus a helpful mechanism to facilitate stakeholders' engagement and to establish a multi-stakeholder environment.

Description of Action: During the Webinar Series (2021) lack of funding was indicated as a critical barrier to achieving the ocean we want. Moreover, ocean issues such as plastic pollution are transboundary by nature and, just as oil spills, it must be addressed through the establishment of partnerships at the national and international levels. There is a regional need for all

stakeholders to cooperate to attain a sustainable ocean. Therefore, building bridges between scientists, society, industry, and sectors can be a way to mitigate the adverse impact of lack of funding or adequate equipment in the region. Moreover, including a tab on the IOCARIBE website with an inventory of programs and initiatives related to the Decade could be helpful to face regional challenges.

Addressing gaps:
- Lack of information and content tailored to effectively impact all stakeholders
- Lack of access to technologies and essential equipment
- Strengthen collaboration and networking.
- Lack of funding
- Lack of sustainable operations
- Lack of human and technical resources
- Limited technical capabilities
- Lack of low-cost observing technologies
- Limited financial resources

Considerations for co-design / transdisciplinary approaches:
- One should consider creating bridges between research projects to promote the exchange of information and data in the region

Identification of partners / agencies / funding mechanisms
- UN specialized agencies
- NGOs
- Member States
- The private sector
- ISA
- The World Bank
- OECD
- The Ocean Panel
- The World Maritime University
- Local universities

Questions:
3.4.1. What examples do people know of good collaborative efforts that have been successful in the region? Do participants think partnership is needed?
3.4.2. What type of partnership do participants think is required now to achieve sustainable development goals and achieve the Decade outputs for the next 10 years?
3.4.3. Let us start with the scenario that there is no fund: what actions would trigger funding of CD?
3.4.4. What type of alliances are needed and with whom?
3.4.5. In a second scenario: we have unlimited funds, what is needed first?
3.4.6. What important aspects have we missed?
3.4.7. Can you suggest possible partners and contributors?

Breakout Session Group Outcomes:

There was no group discussion on partnerships and cooperation

3.5. WAY FORWARD

Breakout Session 3 on Foundational Challenges recognized that co-design processes are critical, especially for capacity development. To overcome the foundational challenges we need to think out of the box and inspire people with innovative strategies and means.