

Perceptions of the Western Tropical Atlantic and Caribbean stakeholders regarding their role in achieving sustainable fisheries

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ABSTRACT

Marine fisheries and seafood provide important economic and social benefits for communities in the Western Tropical Atlantic Region, including food security, livelihoods, and tourist activities. However, these resources have experienced a global decline due to overfishing, pollution, and warming oceans. To help halt and reverse this decline, interventions should prioritize the threats that are identified as most severe. The UN Decade of Ocean Science for Sustainable Development (2021-2030) presents itself as an opportunity to enhance ocean sustainability with "A sustainably harvested and productive ocean ensuring the provision of food supply and ocean resources" as one of its seven major societal outcomes. This paper addresses the proposed research priorities identified during the workshop for the UN Decade Working Group V which agree with the findings from two previous workshops conducted during 2017 and 2019 by the Gulf and Caribbean Fisheries Institute (GCFI) and the Environmental Defense Fund (EDF). Over 300 scientists, policymakers, managers, government officials, representatives from tourism, maritime sector and communicators discussed regional priorities, and recognized the urgent need to expand stakeholder and partnership engagement. The respondents generally agreed on the major gaps within science and governance; however, managers and stakeholders view science as a critical source of information for the decision-making process. Respondents recommended that science should be inclusive of various knowledge types across sectors, including community and traditional knowledge. Furthermore, science quality assurance review processes that are impartial, reliable, and transparent. Ultimately, science-based management and policies require effective scientific input which must be achievable. There are good opportunities over the next decade to improve the sustainability and governance of the region's fisheries resources. However, ensuring that fishers, resource users, civil society, and scientists work together with national and regional government resource management agencies will be the key for the development of successful governance structures overseeing these resources.

Keywords: UN Decade of Ocean Science for Sustainable Development, Western Tropical Atlantic, Sustainably Harvested Ocean, Knowledge gaps and Research Priorities.

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INTRODUCTION

A healthy ocean ecosystem is a foundational requirement to achieve the United Nations Sustainable Development Goals for the sustainability of marine resources and the economic viability of coastal communities in the region. Using the ocean sustainably requires overcoming many daunting challenges such as: overfishing, climate change, ocean acidification, and pollution (Lubchenco et al. 2016, IPBES, 2019). Marine fisheries and seafood play an important role for communities in the Western Tropical Atlantic (WTA) region by contributing to food security, providing livelihoods, opportunities for tourism and other potential economic and social benefits. Most fisheries production in the WTA comes from marine fisheries. In 2016, Latin America and the Caribbean represented 4% of the global population engaged in the fisheries and aquaculture sectors (FAO 2018). On average, fisheries and aquaculture account for about 1% of the Gross Domestic Product (GDP) accounted in the Western Central Atlantic Fishery Commission (WECAFC) area. Despite the relatively low production, catch in the WECAFC area focuses on high value species or groups such as spiny lobster, Queen conch, snapper, groupers, and shrimp (FAO 2018).

In the Caribbean, many fisheries are under stress from the numerous causes mentioned above, and these have impacts to the coastal communities and countries that depend upon them. Whalley (2011) provided a summary of the key issues impacting reef, pelagic, and continental shelf fishery ecosystems. Overfishing and ecosystem degradation are the most demanding threats to many of the region's fisheries (Brown and Pomeroy 1999). This is particularly troublesome because small-scale fishers rely on these fisheries for their livelihoods. Coral reef ecosystems in the Caribbean are more recently threatened by *Sargassum* outbreaks, which were first recorded in the early 1990s (Bouchon et al. 1992) and now represent a growing concern in the region (Johnson et al. 2013, Louime et al. 2017, Langin 2018).

National fisheries laws and international treaties are often not linked to the local realities that fishermen face (Allison 2001). Although better fishery management could create and preserve sustainable fishing practices, ensuring compliance with regulations requires local acceptance and participation (Karnad et al. 2014).

Fishery managers must acknowledge that people's perceptions influence their resource extraction patterns and local fisheries management (Cook and Cox 2006). These perceptions are particularly important in developing countries and Small Island States (SIDs), where centralized governance and fisheries regulations are often poorly enforced. Fishing practice and the success of future management interventions are influenced by perceptions about the fishery (Hansen et al., 2011), but there have been few studies in WTA that have systematically documented these perceptions and practices.

Most recently the UN General Assembly proclaimed the UN Decade of Ocean Science for Sustainable Development (2021–2030), hereinafter referred to as the Ocean Decade. The Ocean Decade will span a 10-year period commencing 1 January 2021, to support “transformative ocean science solutions for sustainable development, connecting people and our ocean” (IOC, 2020a) and is coordinated by UNESCO's Intergovernmental Oceanographic Commission (IOC).

In the WTA, the discussion and co-design process for the Ocean Decade began in early 2020 with the later establishment of the Regional Planning Group (RPG) and the thematic Working Groups (WG). These working groups hosted a series of thematic virtual workshops between April 28–29, 2020, that created the baseline for the implementation plan and the strengthening of working groups. Over 300 scientists, policymakers, program managers, government officials, representatives from tourism, maritime sector and communicators discussed regional priorities, and emphasized the importance for expanding stakeholder partnerships. As with other events, the results fed into the Ocean Decade Implementation Plan. Regional challenges and actions were also identified. Over the course of 2021, the focus of the Decade has identified the importance for integrating thematic networks, organizations, experts and stakeholders and catalyzing communication.

Sustainable development will depend on the extent to which nations and other stakeholders can develop and implement the governance and management reforms necessary to effectively manage fisheries and conserve and protect the marine environment and its biodiversity. There are many challenges and gaps that must be taken into consideration in making fisheries sustainable in the region.

In recent years, we have collectively adopted and are implementing a number of cooperative policy instruments at the sub-regional and wider regional levels based on ecosystem-based management (EBM) approaches, and transparent and participatory processes. These instruments are aimed at strengthening fisheries management and promoting food security and sustainable livelihoods (Haughton 2017).

The pressures affecting marine ecosystems in the WTA are not unique. We have been transforming the global environment to support economic and social structures for a considerable time. In the WTA, as in other regions of the world, there is a recent trend to perceive Blue Economies as the way of the future; however, this potential is greatly dependent on healthy marine ecosystems (Clegg et al., 2021). The sustainability and productivity of the oceans depends highly on our knowledge and management of the sustainability of ocean resources at the global, regional, and national levels. Furthermore, we need to know what key factors and challenges are impacting the productivity of our oceans. Despite similar efforts in recent years, there are still serious knowledge gaps relevant to the sustainability of marine ecosystems and fisheries in the WTA.

The vision of a comprehensive regional ecosystem research agenda which strategically aligns and integrates regional assets, partnerships, and abilities to facilitate research served as the main premise for structuring this workshop. There is need for research which supports the sustainable use, protection, and restoration of coastal and marine ecosystems, as well as the ecosystem services they provide. This paper addresses the proposed research priorities identified during this workshop for Working Group V and complements the findings of two previous workshops conducted in the region during 2017 and 2019 by the Gulf Caribbean Fisheries Institute (GCFI) and the Environmental Defense Fund (EDF). At the 70th annual GCFI meeting in 2017, GCFI hosted a workshop to identify research priorities at the nexus of science and policy in the Caribbean and North Brazil Shelf Large Marine Ecosystems (CLME+ region). Subsequently, at the 72nd annual GCFI meeting in 2019, EDF and GCFI hosted a workshop entitled: Effective fisheries management: redefining fisheries policies in the Gulf of Mexico and the Caribbean region”.

The inputs from these previous workshops helped us to identify participants, gaps in areas of research, and to develop a framework that allowed the discussion of common themes across the region and identification of solutions and implementation pathways to identify gaps in science and governance. It also allowed us to define the set of questions and areas of interest to cover during the WTA workshop.

This document summarizes the outcomes of the UN Ocean Decade Working Group V Workshop on marine and coastal governance conflicts at the interface of multiple sectors and countries. Building from previous workshops, research, and new insights that emerge from this workshop synthesis, we hope researchers, practitioners, science policymakers, and funders of science will consider ways in which they can collectively contribute to the UN Ocean Decade to enhance the knowledge for more effective marine resources management in this region.

METHODS

The process of identifying gaps and research priorities is multi-dimensional and demand a diverse view of societal actors. The individuals surveyed for this study were comprised of practitioners with extensive experience and knowledge of the marine resource issues pertinent to the conservation and management of marine resources in the WTA. Potential participants were identified through the UNESCO/IOC membership, GCFI membership and registration list for the annual conference, the focal points for the various regional organizations and programs (i.e., UN Land Based Sources of Pollution Protocol and the Protocol for Specially Protected Areas and Wildlife), and FAO fisheries experts. We further refined the pool of experts through recommendations from CLME+ (PROCARIBE+) members and by asking the respondents to recommend other potential experts using a ‘snowball sampling procedure’. In all, the respondents represented researchers, managers, academics, students, resources users, civil society members, industry, decision makers and other relevant stakeholders. Although extremely knowledgeable and engaged at various stages of research and governance in the WTA, the information provided by these contributors reflects their perceptions of constraints and should not be interpreted as representing the views of all stakeholders engaged in fisheries in the WTA.

In our analysis, we identified two previous regional workshops that addressed and identified cross-sectoral issues that are impacting the marine resources of the WTA. We summarized the results of these workshops and focused on understanding what scientific, environmental, and societal factors lead to cross-sectoral conflicts and in identifying the key similarities and dissimilarities. Next, we discussed general insights generated by the workshops as well as the broader literature that relates to the participants and stakeholder collaboration in the following themes: governance, science, capacity building, communication, and implementation; and in the identification of emerging issues associated with intensifying anthropogenic pressure on ocean ecosystems. Finally, we summarized the main conclusions of the workshop and identified future research needs. Each workshop presented within this paper used a different approach, yet with unified similarities in the target goals and the audience.

WORKSHOP TO IDENTIFY RESEARCH PRIORITIES AT THE NEXUS OF SCIENCE AND POLICY IN THE CARIBBEAN AND NORTH BRAZIL SHELF LARGE MARINE ECOSYSTEMS (CLME+ REGION) GCFI (2017)

GCFI conducted a workshop at the 2017 annual conference which focused on cataloguing the fisheries research needs in the CLME+ region using a brainstorming format. The individuals surveyed for this study consisted of practitioners with extensive experience and knowledge of the marine resource issues, including the conservation and management of marine resources in the CLME+ region.

WORKSHOP ON EFFECTIVE FISHERIES MANAGEMENT: REDEFINING FISHERIES POLICIES IN THE GULF OF MEXICO AND THE CARIBBEAN REGION GCFI (2019) (ENVIRONMENTAL DEFENSE FUND AND GCFI)

Several countries in the Caribbean and the Gulf of Mexico region are successfully implementing innovative fisheries management strategies to address overarching challenges such as overfishing, illegal fishing and climate change. Countries such as Cuba and Belize are leveraging the lessons learned from these practices to drive new fisheries policies that facilitate and promote the continuity of these achievements (Miller 2020).

WESTERN TROPICAL ATLANTIC (WTA) REGIONAL WORKSHOP FOR THE UNITED NATIONS DECADE OF OCEAN SCIENCE FOR SUSTAINABLE DEVELOPMENT (2020).

The Western Tropical Atlantic held its regional workshop virtually on April 28-29, 2020. Over 300 scientists, policymakers, program managers, and government officials, representatives from tourism, maritime sector and communicators discussed and identified regional priorities, and recognized and engaged new and expanded stakeholders and partnerships. As with other events, the results fed into the Ocean Decade Implementation Plan. Regional and thematic challenges and actions were also identified.

Workshop keynotes and panelists helped set the scene following which participants answered four questions which were targeted to “informing the future direction of marine science in the WTA and to ensure we can adequately conserve and manage our marine environments and resources”:

1. Do you agree that data collection and innovation can enhance the sustainability of marine resource?
2. Do you agree that policy measures needed for sustainable fisheries management are in place in the region, but the implementation has been inadequate?
3. Do you agree, that improving data collection and stakeholder participation will generate the information needed for good assessment of fisheries resources in the region?
4. Which topics of ocean sustainability most need policy innovation? (Rank top 3; 1 = highest priority)
 - a) Policies and strategies for fish in food security
 - b) Strategies and policies to eradicate poverty
 - c) Fisheries and the Blue Economy
 - d) Fisheries information systems and technologies (including data collection / monitoring)
 - e) Climate change and fisheries management
 - f) Stock assessment and management methods
 - g) Other

RESULTS AND DISCUSSION

Workshop participants were encouraged to provide input on how regional research initiatives could take an integrative and holistic approach to ecosystem research.

Participants were drawn from across the region (Table 1) including regional and national government agencies, academic institutions, NGOs, fishers, and other stakeholders (Figure 1). They represented the region's diverse stakeholders and geographic range with expertise ranging from socioeconomics and social sciences, fisheries, and marine biologists to climate scientists. Fifty-seven participants represented forty countries outside the region.

To develop the framework of this paper, participant's responses to the previously outlined workshop questions based on the five crosscutting themes (science, governance monitoring, economic and communication) were reviewed and summarized (Figure 2).

General insights generated from workshops and broader literature reviews related to achieving a sustainably harvested and productive ocean including stakeholder participation, data collection, research gaps, blue economy, climate change among other aspects were discussed. Finally, the main conclusions of common themes across the workshops were summarized with future research needs and implementation pathways identified.

The overarching goal of this working group was to identify the mechanisms needed to integrate scientific knowledge, governance, and local knowledge which are necessary for the monitoring, evaluation, and assessment of ocean resources.

Table 1. Geographic distribution of workshop participants (N = 368)

Colombia (59)	Perú (4)	Antigua and Barbuda (2)
México (49)	Nicaragua (4)	Dominican Republic (1)
United States (33)	Barbados (4)	Grenada (1)
Brazil (31)	Martinique (France) (4)	Saint Kitts And Nevis (1)
Trinidad and Tobago (13)	Ecuador (3)	Haiti (1)
France (12)	Venezuela (3)	El Salvador (1)
Jamaica (9)	Guadeloupe (France) (3)	Uruguay (1)
Panamá (9)	Guatemala (2)	Suriname (1)
Costa Rica (9)	Chile (2)	Cuba (1)
Puerto Rico (7)	Bahamas (2)	The Bahamas (1)
Canada (7)	Aruba (2)	Guyana (1)
Belize (5)	British Virgin Islands (2)	Countries Outside the region (57)
Argentina (5)	Saint Lucia (2)	
Netherlands (4)	Honduras (1)	

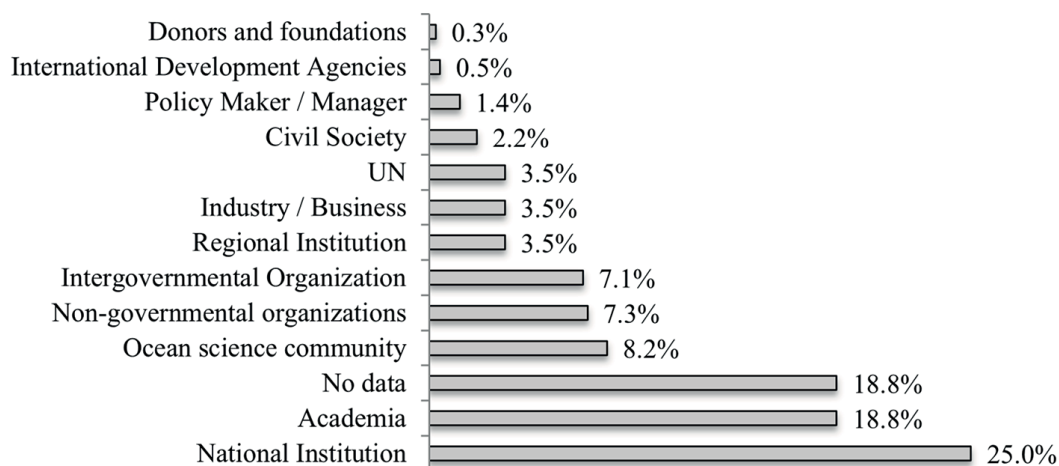


Figure 1. Stakeholder composition of workshop participants (N = 368)

This is especially integral since these mechanisms relate to fisheries, aquaculture, marine habitats (nearshore, oceanic, and deep-water habitats), climate change and land-based sources of pollution. Based on the results of the three workshops we identified five common themes of interest (governance, science, capacity building, communication, and implementation); and included recommendations and actions that fall under these five broad themes and sub-themes such as: minimizing habitat impacts, addressing climate change, Blue Economy, traditional knowledge, and scientific research stemming from social and ecological changes (Figure 2).

Traditionally, most research approaches have prioritized activities that have significant revenue generating economic value (such as commercial fishing) while disregarding other activities with less monetary less value (such as small-scale fisheries). There are regional and national initiatives that include natural and social elements of these relationships, but there are significant gaps amongst social, cultural, economic, political and institutional/governance elements (Acosta et al 2020a).

To incorporate these elements, research and government agencies must incorporate social and traditional knowledge into ecosystem research, from project design and implementation to translation of results. This approach must also include more research into how best to value ecosystem services, how to assess tradeoffs between services, and the importance that different sectors of society attach to various services.

LESSONS LEARNED FROM THE WESTERN TROPICAL ATLANTIC (WTA) REGIONAL WORKSHOP

The keynote and panel workshop presentations highlighted several overarching themes based on research and their experiences from the field. Below we present and discuss the survey responses from 111 of the 188 participants registered to WTA sustainable harvested and productive ocean workshop. The number of participants responses varied among questions.

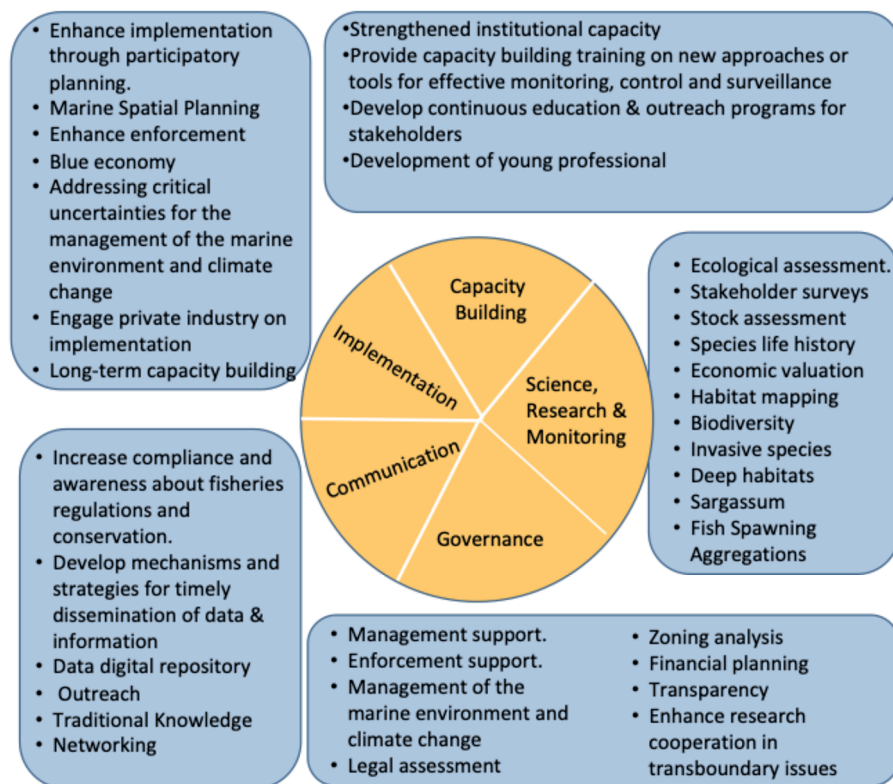


Figure 2. Regional priority research themes of interest (governance, science, capacity building, communication, and implementation) (yellow circle) including recommendations and actions (blue box) identified during previous workshops and used as a framework for the WTA workshop of 2020.

The respondents identified research gaps and highlighted that now is the time for action since there are many tools already in place. It was emphasized there is a strong need to build political will and strengthen partnerships to ensure we keep moving towards our goals of sustainable and productive ocean.

QUESTION 1: DO YOU AGREE THAT DATA COLLECTION AND INNOVATION CAN ENHANCE THE SUSTAINABILITY OF MARINE RESOURCE?

Most participants indicated that improvement in data collection and innovation were necessary within the region (Figure 3) and agreed with the complexities identified by the panelists. Data collection should ensure that all the information required for achieving the management and the sustainability of the ocean resources are obtained as cost-effectively as possible. Monitoring programs should balance data robustness, affordability, and implementation without sacrificing the quality of the information needed for management purposes. To promote cost-effective monitoring, we should encourage the use of more efficient sampling technologies, where appropriate.

The Caribbean region has a diverse assemblage of living marine resources shared across 42 geopolitical jurisdictions that provide significant socioeconomic benefits to its coastal communities. The priorities and knowledge gaps for managing these living marine resources include the need to improve monitoring programs, data collections, and assessments.

This can best be achieved with collaborative partnerships to establish the best practices in the application of emerging cost-effective science and technologies, including integrated sampling platforms (e.g., aboard vessels and unmanned systems), sensors (e.g., acoustic, optic, and omics) (Michaels et al, 2019), and processing efficiencies (e.g., data-limited analytics, machine learning) (Michaels et al, 2021). There is need for capacity building; however, this will be highly dependent on the level of training our next generation of professionals receive in the application of emerging science and technologies to improve the conservation and management of our living marine resources.

QUESTION 2: DO YOU AGREE THAT POLICY MEASURES NEEDED FOR SUSTAINABLE FISHERIES MANAGEMENT ARE IN PLACE IN THE REGION, BUT THE IMPLEMENTATION HAS BEEN INADEQUATE?

Most of the participants agreed that the policy measures needed for sustainable fisheries management are in place in the region, but the implementation has been inadequate (Figure 4). The promotion and implementation of a transboundary, ecosystem-based approach to the management of marine habitats and species are needed. Implementation of these actions should be strengthened and linked to existing strategic plans for the management of natural resources and existing framework in the region (e.g., climate change adaptation, fisheries management, biodiversity conservation, mining, oil and gas exploitation).

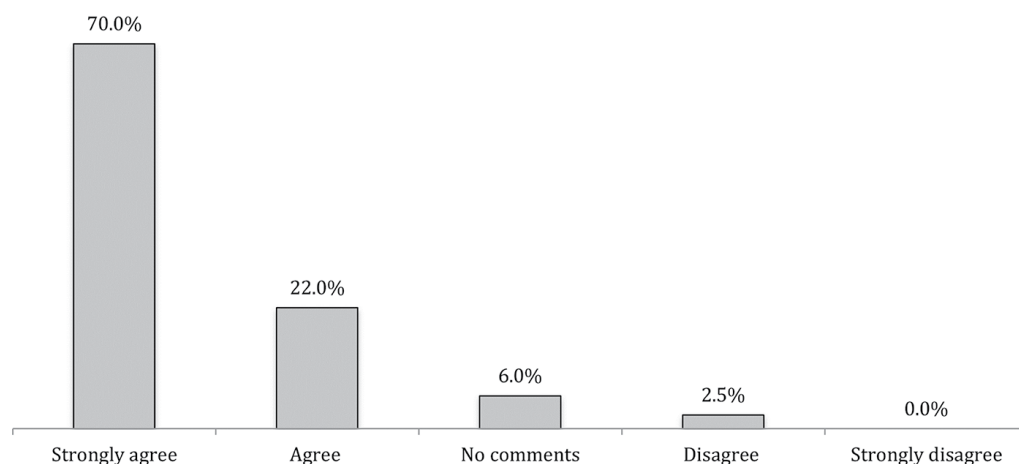


Figure 3. Workshop participants' responses to Question 1 on whether data collection and innovation can enhance the sustainability of marine resources (N = 120).

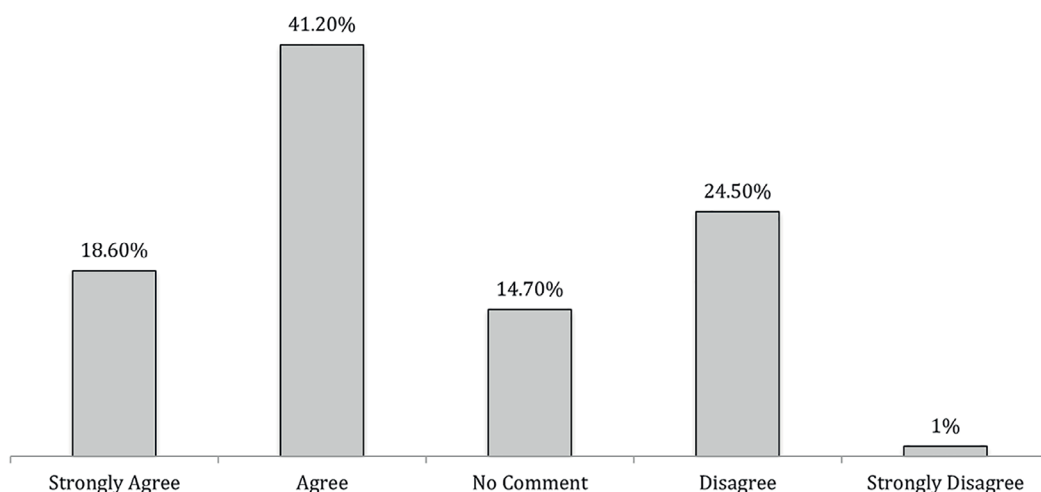


Figure 4. Workshop participants' responses to Question 2 on whether policy measures needed for sustainable fisheries management are in place in the region, but the implementation has been inadequate (N = 102).

Failure to adequately regulate small-scale fisheries (SSF) by managing access and capacity is the primary reason for inadequacies in the implementation of policy measures. It is often suggested that the nature of these fisheries makes this impossible to manage and that since SSF is the safety net for the unemployed, access cannot be restricted.

Although policy measures needed for sustainable fisheries management are in place in the region, there are many gaps. With regards to Ecosystem Based Management (EBM) and Ecosystem Approach to Fisheries (EAF), the inter-sectoral integration at both national and regional levels is weak mostly because the policy mandate is absent or unclear. Similarly, the engagement with civil society and private sector is weak for the same reason whilst the connectivity between science and policy is also weak (Science-Policy interfaces) as well as the mechanisms required for this to occur. There is need for deliberate restructuring so functions can be achieved as intended rather than being left to chance. Pathways to decision makers at the regional level are often absent because linkages between institutions that get policy recommendations from technical forums to the highest political levels (e.g. Association of Caribbean States (ACS), Central America Integration System (SICA), Caribbean Community (CARICOM)) are weak. Indeed, marine ecosystem issues are often low priority in these forums.

There is need to strengthen linkages and pathways between technical (science providers) and technical advisors (science consumers), by strengthening advisory mechanisms where science is regularly and rigorously used to address policy questions and even policy formulation. The development of a cadre of intermediaries or brokers who can 'translate and promote' science for policy advisors as described by Mahon and Fanning (2021) is required to ensure up-take of science in management decisions.

QUESTION 3: DO YOU AGREE, THAT IMPROVING DATA COLLECTION AND STAKEHOLDER PARTICIPATION WILL GENERATE THE INFORMATION NEEDED FOR GOOD ASSESSMENT OF FISHERIES RESOURCES IN THE REGION?

The participants overwhelmingly supported improving data collection and stakeholder participation (Figure 5). Gaps in knowledge and data about the state of our oceans, seabed resources, marine life and risks to habitats and ecosystems, in conjunction with the dispersed monitoring and research efforts in marine and maritime science are among the factors that slows the progress in the development and implementation of effective management and sustainability of marine ecosystems.

The panelists strongly agreed that improving fisheries statistical and biological data collection will generate the needed information for good assessment and management of fisheries resources in the region.

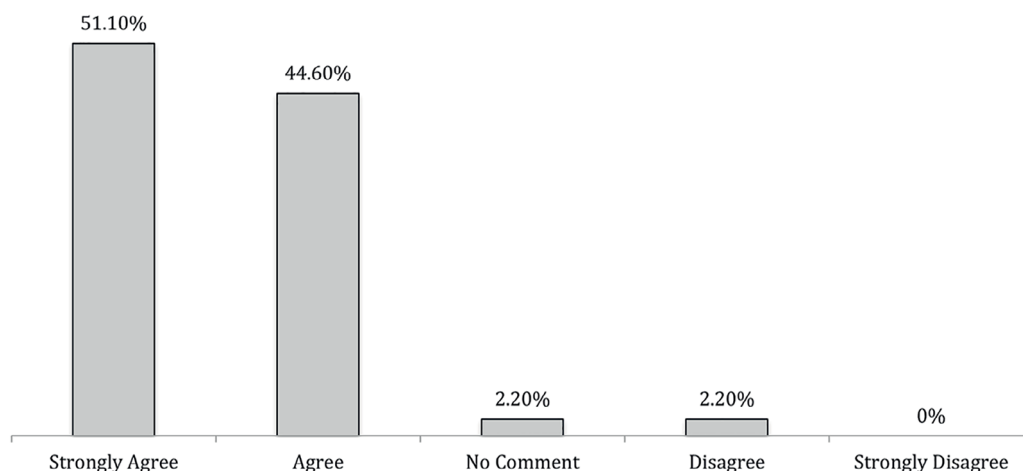


Figure 5. Workshop participants' responses to Question 3 on whether improving data collection and stakeholder participation will generate the information needed for the assessment of fisheries resources in the region (N = 92).

In the context of the WTA region, this improvement would entail:

- Developing robust fisheries statistical and biological data collection frameworks, as well as collection and analysis of relevant social and economic data.
- Developing technical and institutional capacity to collect and exchange data and information, analyze state and trends of fishery resources, and provide timely advice to fisheries managers.
- The need to collect ecosystem relevant information and develop robust indicators of ecosystem well-being, particularly for essential habitats in coastal environments.

Stakeholder participation is essential. Given the characteristics of most fisheries in the region, the gaps in statistics and fisheries biological data, as well as social and economic information in the region can only be addressed with a well-coordinated, multi-disciplinary and transdisciplinary collaboration among relevant stakeholders and institutions. This goes beyond the enumerators/data collectors and processors and must specifically involve the fishers in the data collection process, as well as feeding back to them in a timely manner the results of the data analyzed and the stock assessment findings. As primary users of resources they can provide data on catch and effort, they have traditional knowledge on fisheries habitats, an understanding of critical life stages and status of the resources based on their experience.

Involving them is also critical to build ownership of and compliance with subsequent management and conservation measures. At the 17th Session of WECAFC in July 2019, member states endorsed a standardized mechanism setting a framework for data collection and information sharing systems to support scientific and decision-making processes in the region. The implementation of this framework is a necessary step to ensure adequate national and international capacity to collect relevant information for sustainable management of fisheries resources in the WTA.

QUESTION 4: WHICH TOPICS OF OCEAN SUSTAINABILITY MOST NEED POLICY INNOVATION?

Two emerging and current issues: the Blue Economy and climate change were identified by respondents as the issues most in need of policy innovation (Figure 6). There is great interest within the region regarding developing Blue Economy initiatives, which can contribute to competitiveness, resource efficiency, job creation and offer new sources of growth while safeguarding biodiversity and protecting the marine environment. There is also the need to fill knowledge gaps in climate change impacts, and to increase the capacity of coastal and marine managers and communities to anticipate climatic impacts.

MECHANISMS FOR ACHIEVING A SUSTAINABLY HARVESTED AND PRODUCTIVE OCEAN

Eight priorities were identified as mechanisms to facilitate policy change towards more sustainable and resilient fisheries in the Western Atlantic region:

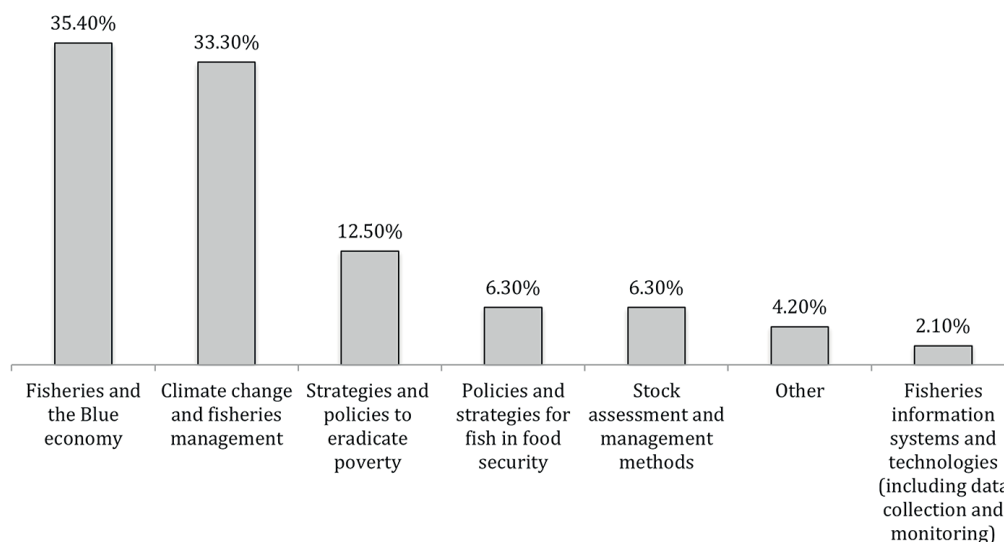


Figure 6. Workshop participants' responses to Question 4 which identifies the topics of ocean sustainability most in need of policy innovation (N=48).

1) IMPROVING DATA QUALITY TO ENSURE SUSTAINABLE INDUSTRIAL AND ARTISANAL (SMALL-SCALE FISHERIES) FISHERIES

There is need to invest and improve fisheries programs dedicated to the collection of data at the scientific, socio-economic, and governance levels since strong data collection and scientific evidence will enhance and incentivize the design of strong policies and promote policy change. The absence of definitive scientific evidence in fisheries is particularly challenging for policy makers as it weakens the evidence that could support the need for policy change but calls for more preventive action before robust evidence is produced, especially in countries where the capacity to produce such evidence is scarce (Delpeuch et al 2019).

Fisheries monitoring and assessment programs should ensure that all the information required to achieve the management and the sustainability of the fishery objectives are obtained as cost-effectively as possible. These programs should be implemented by balancing data robustness and affordability without sacrificing the quality of the information needed for management. For successful implementation of a fisheries monitoring and assessment program, a monitoring work plan that outlines priority actions and associated timelines must be developed at both national and regional levels. These work plans need to be updated regularly as new priorities arise (e.g., climate change, invasive species, adaptation, or other emerging issues).

They must also contain the input from all stakeholders involved in the fishery including the incorporation of traditional knowledge.

2) SETTING PRIORITIES FOR RESEARCH AND INVESTMENT TO ENCOURAGE THE PROMOTION OF THE BLUE ECONOMY

Blue Economy is gaining traction in the WTA region, especially in Small Island Developing States (SIDs) as a major innovation on governance and integration. However, its potential has not been maximized, primarily because the Blue Economy has not been formally recognized as an important economic driver (Caribbean Development Bank 2018; UNEP-CEP 2020). At the same time, their potential is greatly dependent on healthy marine ecosystems (Clegg et al., 2021).

The WTA region's opportunities for sustainable blue growth are increasingly being jeopardized by habitat degradation, unsustainable fisheries practices, and pollution (Acosta et al 2020b). The lack of capacity related to effective management is a critical bottleneck that impedes both the growth of a sustainable Blue Economy and the development of policies that are both achievable and effective. At present, the Blue Economy, as a new development concept and the "blue engine," is becoming an important driving force for achieving global sustainable development (Wenhai, et al 2019). However, increased knowledge on impacts of the Blue Economy including the need for better understanding of the socio-economic value of ocean products and services are needed in the region.

Having a thorough understanding of the multiple interrelated dimensions occurring in oceans as well as how these translate to human well-being including economies is essential to making informed decisions to achieve a sustainable Blue Economy. Increasing focus on supporting a sustainable Blue Economy could facilitate future processes of policy change in fisheries by creating new opportunities across the region.

3) INCREASE PARTICIPATION OF STAKEHOLDERS TO FACILITATE THE DELIVERY OF SCIENCE, TO ENHANCE THE DECISION-MAKING PROCESS

Stakeholder involvement is crucial for the assessment of fisheries resources in the WTA region. The traditional conceptualization of fisheries management in the developed world established a division of knowledge between scientific expertise and policy making on one side of the system and fisher's knowledge perspectives on the other side (Linke et al. 2011). However, we have seen a change from the top-down management approaches towards more inclusive forms of 'participatory governance.' These new models are particularly prominent in ecosystem-based management approaches, where all interest groups are accepted as stakeholders, and invited to participate. Under this approach stakeholders, experts, and scientists across disciplines and sectors combine different knowledge bases, assumptions, and goals.

The scientific findings and the perspectives of people need to be integrated in decision-making if the desired outcome is to utilize the best scientific information available and to harmonize it with the public's beliefs about how the world works to improve the management of resources (Mackinson et al. 2011). The same principle should apply for the management of fisheries. As a general principle, the greater the participation from resource users, the greater the likelihood the approach will be accepted and used. Whatever form it takes, the approach informed by the best available science, sets the stage for clarifying which people and institutions are needed to negotiate management rules (Andrew et al 2007).

The UN Decade Partnership process is currently being developed as a mechanism to engage the full range of stakeholders and to include them in the development and implementation of ocean governance in the WTA. The process is being designed to pay specific attention to promoting the production and uptake of science in decision-making.

4) IDENTIFY APPROACHES THAT INCREASE THE INTEGRATION OF POLICY ACROSS GOVERNMENT AND NON-GOVERNMENT SECTORS

The overarching goal of the decade should be the development of mechanisms to integrate scientific knowledge, governance and local knowledge which is necessary for the monitoring, evaluation and assessment of fisheries and oceans resources, marine habitats, and land-based sources of pollution. The key recommendations should address issues such as minimizing habitat impacts, climate change, Blue Economy, traditional knowledge, adaptability, capacity for responding to natural events, and scientific research changes coming from social and ecological changes.

Decade activities should be conducted on all scales; regional, sub-regional, national and local levels. It should present the scientific objectives of the actions and designate principles to guide data management, capacity development and discuss how stakeholders and private sector can be engaged in decision-making. There are several regional and government agencies working directly or indirectly on biodiversity, fisheries, and socio-economic issues in the WTA. Research projects should be linked to the priorities of these agencies which should strive to work together in synergistic partnerships. Similarly, it may be more resource-efficient to strengthen and support current initiatives rather than develop new ones. In this regard, the Decade will provide opportunities for identifying potential strategic alliances among initiatives of different stakeholders including those representing civil society.

5) CAPACITY BUILDING (HUMAN RESOURCES AND INFRASTRUCTURE): NEEDS TO BE ENHANCED TO ENSURE THAT ALL COASTAL STATES CAN PLAN AND CONTRIBUTE TO SUSTAINING A VIABLE OCEAN

Well-crafted capacity building programs that focus on technical and governance-based skills are critical to ensure that policy makers are confident that the policies they develop have a high probability of success. The information provided to them must be based on the best available science in forms that are understandable, relevant, and timely. To achieve this objective, new and focused skills must become priorities in the region's universities and training programs to ensure a degree of self-sufficiency. Furthermore, initiatives need to attract and target the development of young professionals.

There is also a need to acknowledge that marine research must be viewed as multi-disciplinary and thus an additional focus must be placed on addressing this. This is extremely critical as the need increases for new approaches that address policy-relevant goals spanning science and governance.

Capacity-building programs are needed to ensure that a critical mass of the available workforce has the adequate skills and competence to face the new and emerging needs of multiple sectors and the resources to create relevant policies that address the complexity of diverse tropical marine ecosystems. In the WTA, learning exchanges have a long history in fisheries development, and are becoming increasingly appreciated as effective tools for developing individual and organizational adaptive capacity in fisheries conservation and development (Cox and McConney, 2021).

6) PROMOTE COMMUNICATION: KNOWLEDGE MOBILIZATION AND EDUCATION ACROSS ALL STAKEHOLDERS INVOLVED IN DECISION-MAKING (INCLUDING FISHERS AND INDIGENOUS COMMUNITIES)

Effective communication of scientific knowledge is a prerequisite for generating commitments among governments and other stakeholders, and for creating a new level of awareness in the public about the current and potential future state of the oceans. This conveyance of information may also trigger and guide substantial technological developments and related transfer of marine technology, including modelling tools, new forecasting capabilities through sustained cooperation, and new partnerships. Ultimately, this can stimulate capacity building. Mass communication is likely to continue to be a major driver of change in human behavior that affects marine ecosystems in the form of social media or mass communication that are being developed and can serve as powerful catalysts of change (Friedman et al. 2020). Among the processes that lead to policy change, participants suggested that consultation and communication are necessary to facilitate implementation. Interactions with sector stakeholders, and their lobbying efforts, are also seen as important determinants of policy change.

How scientists and citizens best communicate with policy makers and managers is crucial for the management of marine resources. Marine scientists must find innovative and concise ways to communicate their science to decision makers, fishers and other

stakeholders who are often overloaded with information from competing stakeholders. Without effective communication it can be hard for people in charge of fisheries management to translate the outcomes of consultation into actual policy change or to grant co-decision roles to advisory or inter-governmental groups. Improving communication, although important, is only part of the process of getting science into policy making. There is the need for well set up arrangements or institutional mechanisms (science-policy interfaces) that facilitate this flow. There is also the need to develop capacity for brokering/boundary spanning activities in the WTA (Goodridge et al. 2020, Mahon and Fanning 2021). These are researchable topics that should be as much a part of an ocean science decade as biophysical and management research (Acosta et al. 2020b, McConney et al. 2016).

7) CLIMATE CHANGE: ENHANCING CLIMATE CHANGE AND ECOSYSTEM IMPACTS AND MITIGATION FOR EFFECTIVE IMPLEMENTATION

Climate change will have an enormous impact on future activities and the economic stability of society, especially coastal communities. SIDS are often extremely vulnerable to climate change because they are typically geographically small with limited resources and limited capacity for resilience. Their high dependence on tourism increases their vulnerability and the coastal communities of SIDS are particularly vulnerable to sea level rise as well as other stochastic disturbances (Hernández-Delgado 2015). Addressing the synergies between mitigating biodiversity loss and adaptation to climate change, and considering their social impacts, should offer the opportunity to maximize the benefits from these activities.

The increasing frequency, severity and unpredictability of extreme climatological events, driven by global warming, is leading to increased impacts on vulnerable people in a wide range of States and communities (IFRC, 2021). Within the Wider Caribbean Region, as a result of amplified incidence and magnitude of storms and hurricanes, many fisheries have already experienced changes in species diversity, abundance and distribution along with an overall loss of fishing effort. The impacts on fisheries are further amplified by the increased influx of *Sargassum* which not only directly affects fishery resources, but also leads to a loss of productivity due to reduced fishing activity or damage to boats and other equipment (McConney and Oxenford 2020).

The Decade should incorporate climate change impacts into adaptation planning strategies and decision-making. In the short-term, it should encourage the monitoring and reporting of the ongoing and likely effects of climate change in the WTA region. The goal would be to fill knowledge gaps in climate change impacts as well as increase the capacity of coastal and marine managers and communities to anticipate climatic impact and to mitigated risk. This requires early warning strategies and management plans informed by scientific knowledge.

8) GENERATE POLITICAL WILL AND BUILD PARTNERSHIPS: TO IMPROVE IMPLEMENTATION OF EXISTING POLICY FRAMEWORKS, AND SUPPORT INNOVATION FOR EMERGING CHALLENGES

Most WTA stakeholders, especially members of SIDS see the ocean as natural investment and a source of livelihoods for coastal communities involved in traditional sectors such as small-scale fisheries and tourism. Promoting climate change adaptation and mitigation with financial support from the government along with the development of novel strategies for the development of local sustainable livelihoods will ensure economic viability and incentives for the Blue Economy. Careful planning is needed to ensure sufficient critical mass of workforce with adequate skills and competence to face the new needs of sectors and policy to deal with the complexity of marine systems. Strong collaboration and partnerships with stakeholders involved in marine conservation and management are needed for the successful implementation of this research strategy including UNDP/GEF PROCARIBE+ project and partner organizations (UNEP-CEP, CRFM, OSPESCA, WECAFC, IOCARIBE, OECS, CARICOM, CANARI, GCFI, and UWI (CERMES)).

CONCLUSION

The key to delivering a sustainably harvested ocean is the development and implementation of a transboundary multidisciplinary and cross-sectoral research approach involving science, technology, service providers, private sector, policy makers and society for the sustainability of fisheries and marine ecosystem services for livelihoods, economic and social development. Governments and civil society are increasingly aware of the need for further

improvement of management frameworks to achieve greater sustainability and resilience, of marine resources. A key issue to deliver a sustainably harvested and productive ocean will be to allow all stakeholders to take ownership of/and responsibility for the importance of science in a changing world.

The Decade must provide opportunities for governance alternatives that will assist in evaluating trade-offs and conflict management. Projects that engage scientists and stakeholders at the national and transnational levels are also needed. These opportunities need to be transparent and focused on solutions and positive vision. The Decade also needs to encourage the political will needed to support data collection, policy development, management programs and enforcement, so, fisheries management can be highly effective and innovative actions can be undertaken. Ultimately the authors hope that addressing the priority research topics in this report will form the basis for new governance structures, approaches for creating employment opportunities, appropriate and enforceable regulations, and ways for increasing conservation awareness of stakeholders and the sustainability of marine resources in the WTA region.

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