



ISSN: 1995 – 1132

CRFM Technical & Advisory Document Series
Number 2020/02

**Climate Change Adaptation and Disaster
Risk Management in Fisheries and
Aquaculture in the CARICOM Region:
REGIONAL STRATEGY AND ACTION PLAN
2020-2030**

CRFM Secretariat
2020

CRFM Technical & Advisory Document - Number 2020 / 02

CLIMATE CHANGE ADAPTATION AND DISASTER RISK MANAGEMENT IN FISHERIES AND AQUACULTURE IN THE CARICOM REGION:

REGIONAL STRATEGY AND ACTION PLAN – 2020-2030

Prepared by

Jimena Eyzaguirre

Senior Climate Change Adaptation Specialist, ESSA Technologies Ltd., Ottawa, Ontario, Canada, K2A 3X9. Email: jeyzaguirre@essa.com

Natascia Tamburello

Marine Ecologist, ESSA Technologies Ltd., Vancouver, British Columbia, Canada, V6H 3H4. Email: ntamburello@essa.com

Colette Wabnitz

Senior Research Associate, Changing Ocean Research Unit at the University of British Columbia, Vancouver, British Columbia, Canada, V6T 1Z4. Email: c.wabnitz@oceans.ubc.ca

Susan Singh-Renton

Deputy Executive Director, Caribbean Regional Fisheries Mechanism Secretariat, Kingstown, St. Vincent and the Grenadines. Email: susan.singhrenton@crfm.int

The Fishery-Related Ecological and Socio-Economic Assessments of the Impacts of Climate Change and Variability consultancy has been conducted with support from the Regional Track of the Pilot Programme for Climate Resilience (PPCR) in the Caribbean, which is executed by the University of the West Indies, Mona (UWI), through its Mona Office of Research and Innovation (MORI); and co-implemented by the Caribbean Regional Fisheries Mechanism (CRFM) with resources provided by the Climate Investment Fund (CIF) through the Inter-American Development Bank (IDB)".

CRFM TECHNICAL & ADVISORY DOCUMENT – Number 2020 / 02

CLIMATE CHANGE ADAPTATION AND DISASTER RISK MANAGEMENT IN FISHERIES AND AQUACULTURE IN THE CARICOM REGION:

REGIONAL STRATEGY AND ACTION PLAN – 2020-2030

@ CRFM 2020

All rights reserved.

Reproduction, dissemination and use of material in this publication for educational or non-commercial purposes are authorized without prior written permission of the CRFM, provided the source is fully acknowledged. No part of this publication may be reproduced, disseminated or used for any commercial purposes or resold without the prior written permission of the CRFM.

Correct Citation:

CRFM, 2020. Climate Change Adaptation and Disaster Risk Management in Fisheries and Aquaculture in the CARICOM Region: Regional Strategy and Action Plan 2020-2030. *CRFM Technical & Advisory Document*, No. 2020 /02. 63pp.

ISSN: 1995-1132

ISBN: 978-976-8293-28-2

Published by the Caribbean Regional Fisheries Mechanism Secretariat,
Belize and St. Vincent and the Grenadines.

EXECUTIVE SUMMARY

The Caribbean Regional Fisheries Mechanism (CRFM) has developed an updated Regional Strategy and Action Plan for Climate Change Adaptation and Disaster Risk Management in Fisheries and Aquaculture (2020-2030). The original strategy and action plan was published in 2013, responding to the direction of CARICOM Heads of Government to use regional delivery frameworks as platforms to address climate change adaptation (CCA) and disaster risk management (DRM) in fisheries and aquaculture. Both the original strategy and action plan and this updated version benefited from consultation with CARICOM Member States. Both versions also built from the regional policy context contained in the Regional Framework for Achieving Development Resilient to Climate Change, which was designed to significantly increase the resilience of the region and ensure that the welfare of Caribbean residents is not adversely impacted by the multi-faceted impacts of climate change. This updated Strategy and Plan of Action for the sector takes into account progress made so far, and is composed of nine Strategic Elements and associated Goals that provide specific guidance on priority actions for advancing resilience to climate change and variability.

Caribbean Small Island Developing States (SIDS) are among the global regions most vulnerable to climate change and, within this region, the fisheries and aquaculture sector is among the most sensitive to climate-related threats. Changes in climate and ocean conditions will exacerbate ongoing challenges related to overfishing, habitat degradation and other cumulative stressors faced by the sector. Ocean habitats are projected to become increasingly unsuitable due to warming ocean temperatures, increasing ocean acidification, and shifting ocean currents, and species are predicted to shift in line with corresponding shifts of their preferred environmental ranges. As a consequence of changes in species distributions and abundances, potential fisheries catches across the Caribbean are projected to decline by mid-century from baseline levels by as much as 60% under high emissions scenarios (Cheung *et al.*, 2019a). The anticipated reduction in fish catches will have cascading effects on livelihoods and national economies among Member States in CARICOM, including a rise in domestic fish prices and associated decrease in consumer demand for fish and fish products (Eyzaguirre and Tamburello, 2019). Insufficient production and consumption of seafood by mid-century could spell national welfare losses on the order of hundreds of thousands to millions of US dollars (Boyd and Ryan, 2019). Expected losses in welfare are even more severe when considering the additional impacts of intensified storm activity on fisheries access and infrastructure. Growth in aquaculture production can help compensate for the declining availability of wild fish stocks in the Caribbean. However, aquaculture's expansion must carefully consider the species being cultured, the infrastructure required to culture it, and the resilience of both to future climate conditions when selecting culture sites.

The vision underlying this updated Strategy and Action Plan remains a *“regional society and economy that is resilient to a changing climate and enhanced through comprehensive disaster management and sustainable use of aquatic resources.”* A number of guiding principles provide CRFM / CARICOM Member States with direction for achieving this vision, including: an effective enabling environment, collaboration, integration, subsidiarity, precaution, transparency, participation and gender equality and equity. The framework underpinning the updated Strategy and Plan of Action draws on global, regional and sectoral agreements, frameworks and policies, including the Caribbean Community Common Fisheries Policy, that specifically account for ecosystem and participatory approaches to fisheries and aquaculture. The updated Strategy and Action Plan for the sector comprises nine Strategic Elements and associated Goals (Figure 1), and offers a tool to assist CARICOM Member States in creating sectoral adaptation plans and practices to bolster the sector's climate resilience.

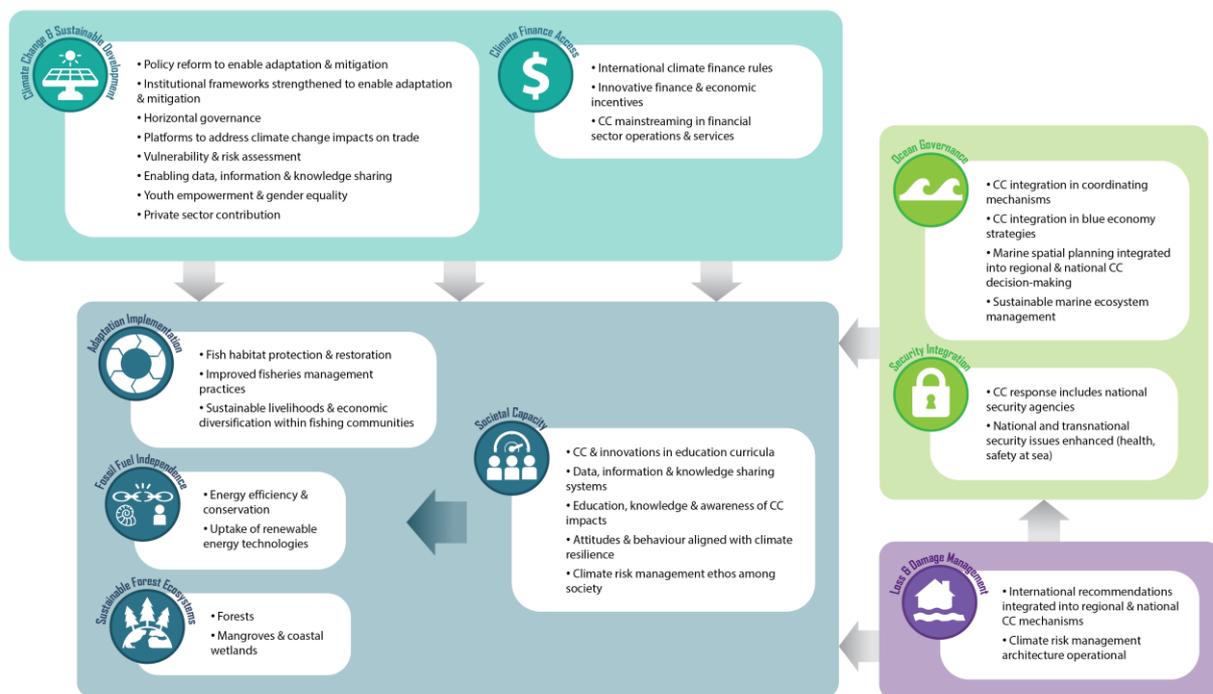


Figure 1: Strategic Elements and Goals supporting climate resilient development of the region's fisheries and aquaculture sector (2020-2030). Enabling actions such as policy and institutional reforms to integrate climate change and sustainable development, climate finance and economic incentives are shown in the turquoise box. Mechanisms to manage loss and damage, support delivery of adaptation, risk management and mitigation actions “on the ground” are shown in the blue and purple boxes. Emerging issues– ocean governance and climate security – are also important to begin managing as they also shape resilience of ecosystems and human communities; these are shown in the lime green box.

Effective and efficient implementation of the sectoral Strategy and Plan of Action requires clarity in roles, responsibilities and accountabilities across actors in the sector; good governance practices to overcome barriers to action; evidence and learning to inform continuous action on adaptation, disaster risk management and mitigation; resource mobilization and meaningful participation of the region's network of fisheries and aquaculture actors. The CRFM and Member States, in coordination with national, regional and international organisations, including the Caribbean Network of Fisherfolk Organizations (CNFO), will strive to apply interactive governance approaches in implementing this updated Strategy and Action Plan. CRFM will coordinate and facilitate regional data aggregation, analysis and reporting on the status and trends of climate change impacts on the Caribbean fisheries sector. This includes supporting assessment and management of transboundary stocks, which is expected to increase in complexity as climate change intensifies. As Member States roll out national adaptation plans and new blue / ocean economy strategies the opportunity exists to integrate and advance fisheries and aquaculture sector adaptation and climate risk management in line with priorities in this Strategy and Plan of Action. As delivery partners, fisheries organizations, civil society organizations and public education and extension officers play particularly important roles, including bolstering local capacity to participate in policy and planning processes. Raising broad-based awareness of the Strategy and Action Plan, catalyzing, tracking, learning from and resourcing its implementation are shared tasks among sectoral stakeholders in the region and critically important in translating the vision for climate resilience of the region's economy and its people into reality.

ACKNOWLEDGEMENTS

2013 marked the release of the Strategy and Action Plan on Climate Change Adaptation and Disaster Risk Management in the CARICOM Region. The 2013 Strategy and Action Plan has served as a guide for the development of resources and implementation of projects by the Caribbean Regional Fisheries Mechanism (CRFM) and Member States in support of climate-smart fisheries in the Caribbean. This draft document is an update to the Regional Strategy and Action Plan and is an output of the project “*Fishery-Related Ecological and Socio-Economic Assessments of the Impacts of Climate Change and Variability and Development of an Associated Monitoring System*”, funded by the Investment Plan for the Caribbean Regional Track of the Pilot Programme for Climate Resilience (PPCR). The document benefits from research studies during 2018-2019 on ecological and socio-economic impacts of climate change on key commercial fisheries in the region, climate change-related knowledge, attitudes and behaviour of fishers on three fishing communities (Montego Bay, Jamaica; Kingstown, Saint Vincent and the Grenadines; and Roseau, Dominica), as well as other technical outputs of the Project. Importantly, this document incorporates feedback from regional and national representatives of fisheries agencies on strengths and weaknesses of the 2013 Strategy and Action Plan and on perspectives on new priorities for action, compiled through a face-to-face workshop in November 2019 and from responses received through an online survey deployed in December 2019-January 2020. We gratefully acknowledge the time invested by fisheries officers in providing this feedback; special thanks go to staff of the CRFM Secretariat, for both facilitating access to stakeholders and for improving the technical quality of this document. Although the present draft has already been informed by consultations noted above, the CRFM will need to determine if any additional stakeholder consultations are necessary prior to formal endorsement and approval of this updated Regional Strategy and Action Plan. A more extensive consultation effort was beyond the scope of the Project.

ABBREVIATIONS AND ACRONYMS

CARICOM	Caribbean Community
CBO	Community-Based Organization
CCA	Climate Change Adaptation
CCCFP	Caribbean Community Common Fisheries Policy
CCCCC	Caribbean Community Climate Change Centre
CCRF	Code of Conduct for Responsible Fisheries
CCRIF-SPC	Caribbean Catastrophe Risk Insurance Facility Segregated Portfolio Company
CDEMA	Caribbean Disaster and Emergency Management Agency
CIMH	Caribbean Institute for Meteorology and Hydrology
CNFO	Caribbean Network of Fisherfolk Organizations
CRFM	Caribbean Regional Fisheries Mechanism
DRM	Disaster Risk Management
EAA	Ecosystem Approach to Aquaculture
EAF	Ecosystem Approach to Fisheries
EBM	Ecosystem-Based Management
EU	European Union
FAO	Food and Agriculture Organization of the United Nations
FEWER	Fisheries Early Warning and Emergency Response
GHGs	Greenhouse Gases
ICTs	Information and Communications Technologies
IUU	Illegal Unreported and Unregulated (Fishing)
IPCC	Intergovernmental Panel on Climate Change
OECS	Organisation of Eastern Caribbean States
PPCR	Pilot Programme for Climate Resilience
NGO	Non-governmental Organization
SIDS	Small Island Developing States
SPS	Sanitary and Phytosanitary
SSF	Small-Scale Fisheries
UNFCCC	United Nations Framework Convention on Climate Change
UWI	University of the West Indies
WECAFC	Western Central Atlantic Fishery Commission

TABLE OF CONTENTS

EXECUTIVE SUMMARY IV

ACKNOWLEDGEMENTS VI

ABBREVIATIONS AND ACRONYMS VII

1. INTRODUCTION..... 1

 1.1 ABOUT THIS DOCUMENT 1

 1.2 CLIMATE CHANGE VULNERABILITY AND CARBON FOOTPRINT..... 1

 1.3 REGIONAL CLIMATE CHANGE CONTEXT FOR THE SECTOR 4

2. VISION AND GUIDING PRINCIPLES 10

 2.1 VISION 10

 2.2 GUIDING PRINCIPLES 10

3. STRATEGIC ELEMENTS AND GOALS..... 11

 3.1 STRATEGIC ELEMENT 1: CLIMATE CHANGE & SUSTAINABLE DEVELOPMENT INTEGRATION 16

 3.2 STRATEGIC ELEMENT 2: ADAPTATION IMPLEMENTATION 21

 3.3 STRATEGIC ELEMENT 3: FOSSIL FUEL INDEPENDENCE 28

 3.4 STRATEGIC ELEMENT 4: SUSTAINABLE FOREST ECOSYSTEMS..... 29

 3.5 STRATEGIC ELEMENT 5: EDUCATION & KNOWLEDGE..... 30

 3.6 STRATEGIC ELEMENT 6: CLIMATE FINANCE ACCESS 37

 3.7 STRATEGIC ELEMENT 7: OCEAN GOVERNANCE 40

 3.8 STRATEGIC ELEMENT 8: SECURITY INTEGRATION 44

 3.9 STRATEGIC ELEMENT 9: LOSS AND DAMAGE MANAGEMENT 46

4. IMPLEMENTATION CONSIDERATIONS 49

 4.1 GOVERNANCE 49

 4.2 MONITORING, EVALUATION AND LEARNING 51

 4.3 COMMUNICATIONS & PARTICIPATION 52

 4.4 FINANCING IMPLEMENTATION 53

5. REFERENCES..... 54

1. INTRODUCTION

1.1 About this Document

This Strategy and Action Plan contributes to strengthening regional and national cooperation and building additional capacity in addressing climate change impacts and climate-related disaster risks in the Caribbean's marine fisheries and aquaculture sector. Since 2012 CARICOM Heads of Government agreed to use regional delivery frameworks as platforms to address climate change adaptation (CCA) and disaster risk management (DRM) in fisheries and aquaculture. The regional policy context for this updated Strategy and Action Plan for the sector is primarily the 2019 "*Climate Change and the Caribbean: A Regional Framework for Achieving Development Resilient to Climate Change (2019-2029)*" (the Regional Framework), which articulates CARICOM's refreshed strategy on climate change. Strategic direction and framing also come from the 2013 version of the sectoral Strategy and Action Plan (CRFM 2013), the Caribbean Community Common Fisheries Policy and other policy instruments that specifically account for ecosystem and participatory approaches to fisheries and aquaculture. Finally, contributions to this Strategy and Action Plan also include outputs from research and stakeholder engagement activities undertaken between 2018 and 2020, as part of a marine-focused project of the Investment Plan for the Caribbean Regional Track of the Pilot Programme for Climate Resilience (PPCR). The aim is for this Strategy and Action Plan to assist Member States in creating sectoral adaptation and climate risk management plans that meet or exceed the guidance included within the document.

The structure of this updated Sectoral Strategy and Plan of Action is as follows. The document starts with a concise overview of the sector's climate change vulnerability and carbon footprint. Section 2 then outlines the vision for adaptation and disaster risk management in the sector and direction for achieving this vision, by way of guiding principles. The substantive part of the document lies in Section 3, which outlines eight Strategic Elements to work toward, and related Goals and Actions. Strategic Elements and Goals provide a regional framework in which to nest specific actions relevant to fisheries and aquaculture. Finally, Section 4 presents general considerations for the CRFM, national departments and fisheries organizations to take into account in implementing this Strategy and Action Plan.

1.2 Climate change vulnerability and carbon footprint

Caribbean marine fish stocks, fisheries and land-based assets important to the marine fisheries and aquaculture sector are vulnerable to a range of climate change impacts and climate variability (Cheung *et al.*, 2019, Cheung *et al.*, 2019a, Oxenford and Monnereau, 2018). Regardless of the global climate model and emissions scenario used, climate and ocean conditions in the Caribbean Sea by mid-century are expected to be warmer, more acidic, with higher salinity, less oxygen and lower primary production, as compared to baseline levels (Cheung *et al.*, 2019). These and other shifts, such as sea-level rise, increased incidence of harmful algal blooms, increases in tropical cyclone winds and rainfall, as well as drier conditions on land, are likely to exacerbate ongoing challenges facing the sector in the near- and long-term (IPCC, 2019).

Regional climate and population modelling reveals that virtually no marine species, including commercially-important fishery species (see Box 1), are expected to be spared negative impacts under a future climate. Climate change places most exploited species at high conservation risk, as habitats become increasingly unsuitable due to warming ocean temperatures, increasing ocean acidification, and shifting ocean currents, and species shift to stay within their preferred environmental ranges. As a consequence of changes in species distributions and abundances, potential fisheries catches across the Caribbean are projected to decline by 5 to 30% in climate scenarios with strong global emissions mitigation and by 10 to 60% in 'business as usual' climate scenarios (Eyzaguirre and Tamburello, 2019; Cheung *et al.*, 2019a). Regionally, decreases in maximum catch potential are projected to occur across both pelagic and demersal reef species, especially in the southern part of the Caribbean Sea, with many commercially valuable species such as groupers, snappers and parrotfish among the most vulnerable.

Box 1: Anticipated Impacts of Climate Change for Key Fisheries Species

Recent climate change assessment of 110 important fisheries species revealed distinct patterns of vulnerability and impact that can help to inform strategic adaptation planning for the fisheries sector and advocate for strengthened global action to reduce emissions of greenhouse gases. Key changes in species distributions and availability to fisheries are highlighted for four key fisheries species below (Cheung *et al.*, 2019a). Although each of these species will experience range shifts, all four will continue to be found in the Caribbean Sea, whereas some other species are expected to shift away from the region entirely.



Dolphinfish: Habitat suitability is projected to experience modest declines throughout much of the wider Caribbean Sea, particularly in the lesser Antilles and even more so in the Gulf of Mexico. A small region of refuge from anticipated declines is found in the triangle between Cuba, Jamaica, and Haiti.



Yellowtail Snapper: Habitat suitability is projected to experience modest near-term increases in some coastal waters including Jamaica's Pedro Bank, off the south coast of Haiti, and in the coastal waters of the southerly Lesser Antilles. However, many of these gains are expected to disappear by mid-century as populations continue to move north and increase around the Bahamian bank and northern Gulf of Mexico.



Caribbean Spiny Lobster: Habitat suitability for this species is expected to decline in all shallow coastal waters, leading to a likely shift in the species' distribution towards deeper offshore bank waters that may be less accessible to traditional dive-based fishing methods.



Queen Conch: This species is expected to be less vulnerable to near-term changes in habitat suitability driven by climate change. In 'business as usual' climate change scenarios, however, this species is expected to follow a similar pattern to lobster where migration into deeper, offshore areas may limit their accessibility to fisheries.

The impacts of climate change on fish catches will have cascading effects on livelihoods and national economies among Member States in CARICOM. The anticipated reduction in the availability of fish has been translated through economic modelling into a roughly 5-10% increase in domestic fish prices and associated 5-6% decrease in consumer demand for fish and fish products by mid-century. These changes in supply and demand across the Caribbean region can add up to net annual welfare losses from national economies ranging from \$US 600,000 to nearly \$US 9 million (Boyd and Ryan, 2019). Because welfare is an economic metric closely linked to the concept of well-being, this implies that Caribbean nations are expected to experience a loss in economic well-being and greater food (as well as possible nutritional) insecurity due to insufficient production and consumption of seafood.

Expected losses in welfare are even more severe when considering the additional impacts of more intense storm activity on fisheries access and infrastructure. The average annual economic cost of tropical cyclones across the Caribbean between 1950 and 2014 has been estimated at equivalent to between 2 and 6% of a nation's gross domestic product (GDP) in constant 2010 US\$ (Acevedo, 2016). Analyses focused on loss and damage to the fisheries sector are less common, but national documentation of the economic consequences from tropical cyclones via damage and loss assessments shed light on the severity of the impact. For example, as noted in Boyd and Ryan (2019), in 2012, Hurricane Sandy caused extensive damage to the fisheries and aquaculture sectors in Jamaica, totaling more than J \$90 million (about US\$1 million in 2012 dollars). In 2017 the total estimated value of fishing boats, engines and gear damaged, destroyed or lost in Dominica as a result of Hurricane Maria amounted to XCD \$11,271,520 (about US\$ 4 million in 2017 dollars). Economic loss and damage to the fisheries sector from severe storms in the region is already large under present climate conditions, and the estimated economic impact of intensified storm activity under climate change will exacerbate the region's existing "adaptation deficit" (Boyd and Ryan, 2019).

Growth in aquaculture production has been hailed as one way to help compensate for the declining availability of wild fish stocks in the Caribbean due to climate change, overfishing, habitat loss, and other

cumulative stressors. Prior studies have shown a high potential for expanding aquaculture, including mariculture, in the Caribbean region (CRFM 2014, Thomas *et al.*, 2019). However, the aquaculture sector is also vulnerable to the effects of climate change and may experience favourable, unfavourable, or neutral effects depending on the species, location, and timeframes under consideration (Dabbadie *et al.*, 2018). Overall, for mariculture, favorable effects are much more likely for finfish aquaculture than for shellfish aquaculture, as ocean acidification is likely to adversely affect shell development and shellfish growth, and survival (Froehlich *et al.*, 2018; Dabbadie *et al.*, 2018; Reid *et al.*, 2019; Oyinlola *et al.*, 2018).

Global climate modelling studies have projected that climate-induced shifts in habitat suitability are expected to increase the potential for marine finfish aquaculture production by 5 to 20% in more northerly regions of the Caribbean including Jamaica, Haiti, Cuba and the Bahamas through mid-century, while the southern Caribbean is expected to experience neutral or negative effects on production (Froehlich *et al.*, 2018; Oyinola *et al.*, 2020). For those aquaculture species with broad temperature tolerances, much of these gains in productivity are expected to be driven by ocean warming and resulting improvements in feed conversion and faster growth rates (Dabbadie *et al.*, 2018). The situation may differ for land-based aquaculture operations, such as the cultivation of tilapia, which may suffer from reduced availability of freshwater due to drought as well as saltwater intrusion exacerbated by sea level rise (Dabbadie *et al.*, 2018). Lastly, the physical infrastructure required for either marine or land-based aquaculture is vulnerable to damage and loss due to extreme weather events (Reid *et al.*, 2019). Overall, any plans for the expansion of aquaculture activities in the Caribbean must carefully consider the species being cultured, the infrastructure required to culture it, and the resilience of both future climate conditions when selecting culture sites (Thomas *et al.*, 2019).

CARICOM countries contribute less than 1% of global heat-trapping gases that cause climate change, with emissions from energy use in agriculture (including emissions from fisheries and aquaculture) comprising a small fraction of that 1% of overall emissions. Estimates for the fraction of GHG emissions produced by energy use in the fisheries sector are not yet broadly available across Caribbean nations. However, comparing one available estimate of GHG emissions from the Bahamian fisheries sector (Greer, 2014) to data on total emissions (ClimateWatch, 2019) suggests that fisheries contributed about 6% of national GHG emissions from The Bahamas in 2010. Although most of these emissions were attributable to artisanal fishing, industrial fishing contributed one third of all fisheries-related emissions despite comprising only 3% of the fleet by number (Greer, 2014). This is reflective of an overall global trend of disproportionately higher contributions from industrial fishing fleets to GHG emissions from the fisheries sector (Greer *et al.*, 2019).

Although capture fisheries and aquaculture have small carbon footprints relative to other land-based food production systems, the sector is still highly dependent on fossil fuels and other inputs that generate greenhouse gases (FAO, 2019). Fuel is a major influence on the cost of fishing, comprising 20-50% of operational costs (Khan *et al.*, 2019) and so fishers are vulnerable to the volatility of fuel prices, although some examples exist where renewable energy is being exploited (e.g., sails in the artisanal fishery, solar in the industrial). Transportation to and from fishing grounds is the primary consumer of energy. Emissions related to energy use in the aquaculture sector can also be significant, but are expected to be minor relative to capture fisheries considering the small number and scale of aquaculture operations present in the region. Aquaculture's carbon footprint depends on the type and amount of fertilizer used, management of microbial processes in fish ponds and the energy demands of specific cultivars, with species of high-quality food value (e.g., shrimp, marine carnivores) often demanding more feed or energy (FAO, 2019). Post-harvest activities such as fish processing (e.g., washing and packaging), storage (e.g., freezers, refrigeration or ice while in transport) and transportation to final consumers also represent significant proportions of the sector's total energy consumption and emissions of greenhouse gases. Emissions from the aquaculture sector should be expected to increase if production capacity increases in the future, as is projected.

Advancing climate-smart approaches in fisheries and aquaculture is a priority in the region so it is critical to pursue policies and frameworks that can reduce climate change vulnerabilities, support risk management and encourage adaptation and mitigation practices that enhance food and nutritional security, promote

healthy fish stocks and ecosystems, as well as protect livelihood assets the well-being of dependent coastal communities. Similarly, the influence of climate change and climate-related disaster risks on aquaculture must also be considered when developing strategies for its use to offset losses in capture fisheries.

1.3 Regional climate change context for the sector

The regional policy context for this sectoral strategy and action plan is primarily the “Regional Framework for Achieving Development Resilient to Climate Change (2019-2029) (the Regional Framework)”, which articulates CARICOM’s updated strategy on climate change (CCCC, 2019). CARICOM Heads of State endorsed the original Regional Framework in 2009, issuing at that time the Liliendaal Declaration, which set out key climate change-related interests and aims of CARICOM Member States. Since 2009, the global and regional institutional landscape governing climate change and sustainable development has shifted significantly. Taking as a backdrop continued commitments under the United Nations Framework Convention on Climate Change (UNFCCC), the updated Regional Framework draws from global and regional agreements, frameworks, policies and plans as well as stated concerns of CARICOM Member States. Notable global and regional inputs to the updated Regional Framework appear in Figure 2:

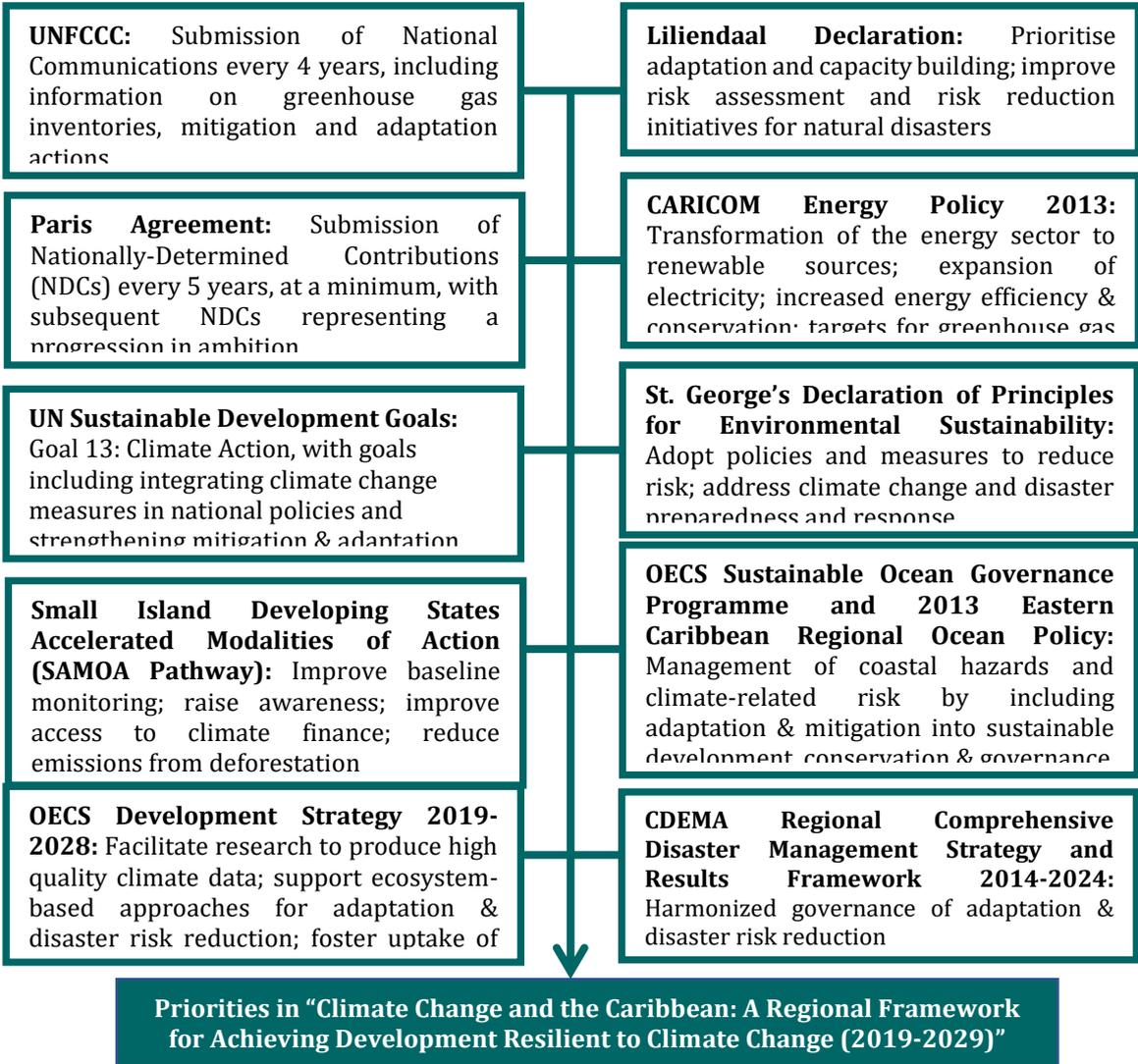


Figure 2: Global and regional frameworks that shaped priorities and strategic directions in the updated Regional Framework (Source: modified from CCCCC 2019).

Since releasing the 2013 Regional Strategy and Action Plan for Climate Change Adaptation and Disaster Risk Management in Fisheries and Aquaculture, the CRFM, Member States and their partners have implemented a range of projects in response to identified priorities. Table 1 highlights a few examples.

Table 1: Progress on the 2013 Regional Strategy and Action Plan on Climate Change Adaptation and Disaster Risk Management in Fisheries and Aquaculture in the CARICOM Region

2013 Strategic Elements	Indicative Projects and Achievements
<p>1: Mainstream climate change adaptation strategies into sustainable development / agendas of CARICOM Member States</p>	<ul style="list-style-type: none"> • The Council for Trade and Economic Development (COTED) authorized the implementation of the Caribbean Community Common Fisheries Policy (CCCFP) in 2014. The CCCFP fosters cooperation to conserve, manage and sustainably use the region's marine resources. It includes provisions for safeguarding fisheries and related ecosystems from climate-related threats. • The fisheries component of the EU-funded sanitary and phytosanitary (SPS) project produced model legislation, regulations, protocols and guidelines to promote harmonization of health and food safety in the fisheries and aquaculture sector. COTED has repeatedly urged CARICOM States to use these model instruments for strengthening the enabling framework for maximizing the benefits of trade and market opportunities throughout the value chain. Optimizing the value creation and value addition enterprise development is crucial for building resilience in the face of a decreased or weakened resource base. • The Caribbean & North Brazil Shelf Large Marine Ecosystems Project is a US\$12.5M, 5-year project (2015-2020) that facilitates ecosystem-based management approaches in support of sustainable and climate resilient provision of goods and services from shared living marine resources. Among other outputs this project has generated an updated flying fish Fisheries Management Plan (FMP) for the Eastern Caribbean. • The 2018 Protocol for Sustainable Small-Scale Fisheries for Caribbean Community Fisherfolk and Societies integrates considerations of disaster risks and climate change. • The Protocol on Climate Change Adaptation and Disaster Risk Management in Fisheries and Aquaculture under the CCCFP was released in 2018. It emphasizes a holistic approach to sector management that incorporates comprehensive risk management. • A marine-focused project under the Pilot Program for Climate Resilience (PPCR) - Caribbean Regional Track produced an ICT Fisheries Early Warning and Emergency Response (FEWER) Solution, which is now being mainstreamed, and also generated quantitative assessments of the ecological and economic impacts of climate change on regional fisheries, as well as tools to support climate-smart fisheries planning. • CRFM and FAO's Western Central Atlantic Fishery Commission (WECAFC) have developed a regional plan of action on Illegal Unreported Unregulated (IUU) fishing to enable more detailed action planning. Elimination of IUU fishing is crucial to minimize the adverse impacts of climate change.
<p>2. Promote the implementation of specific adaptation measures to address key vulnerabilities in the region</p>	<ul style="list-style-type: none"> • The Coral Reef Regional Plan of Action 2014-2019 provided a roadmap to address the challenges of sustainably managing coral reefs to protect biodiversity while sustaining the provision of goods and services that these ecosystems provide to Caribbean people. It included wide-ranging objectives and actions (e.g., enhancing marine protected areas, increasing livelihood options) and was developed under the Australia Caribbean Coral Reef Collaboration. • A Model Protocol for the Management of Extreme Accumulations of <i>Sargassum</i> on the Coasts of CRFM Member States was released in 2016.

2013 Strategic Elements	Indicative Projects and Achievements
	<ul style="list-style-type: none"> • CRFM has prepared a Model Disaster Preparedness and Risk Management Plan for the Fisheries and Aquaculture Sector of CRFM Member States, which has since been adapted for adoption and implementation by Belize and St. Vincent and the Grenadines. • The fisheries component of the EU-funded SPS project facilitated national and regional assessments of environmental monitoring programmes related to sanitary standards for the fisheries and aquaculture sectors. Assessment findings informed capacity building, including regional courses on value chain management, inspection and control procedures, as well as university fellowships on quality management of fish processing. • In collaboration with the UN University Fisheries Training Program, the CRFM conducted two regional workshops on the Value Chain Approach in Fisheries, which targeted both public and private actors, particularly entrepreneurs in fishing and aquaculture, to increase and optimize economic benefits from marine resources even with a limit on harvest levels. • As part of their work to support value chain management, the CRFM/CARICOM Fisheries and Aquaculture Priority Commodity Working Group (FISHCOM WG) is collaborating with CRFM's Working Group on Aquaculture to promote climate-resilient practices. The FISHCOM WG is also collaborating with FAO on value chain management initiatives on ways to optimize economic returns for less wastage of resources. • A marine-focused project under the PPCR - Caribbean Regional Track (2018-2020) produced an ICT Fisheries Early Warning and Emergency Response (FEWER) Solution that consisted of both web-based and mobile application components required to connect weather and climate data service providers with the users of such information, the primary stakeholders, and also supported the creation of several information and knowledge products that give key messages to fisherfolk, fisheries managers, vendors and consumers on the impacts of climate change on life below water, and ways to adapt. • The Climate Change Adaptation in the Eastern Caribbean Fisheries Sector Project (CC4FISH) (2017-2020) works to increase resilience and reduce vulnerability to climate change impacts by strengthening the adaptive capacity of fisherfolk, fisherfolk organizations and aquaculturists, examples of which include activities that strengthen the Information and Communications Technology (ICT) capacity of fisherfolk to improve safety at sea; improved capacity for full utilization of key commercial and under-utilized species, and improved value addition along the fish value chain; as well as improved understanding of the impacts of <i>Sargassum</i> on key fish commercial species and mainstreaming Climate Change Adaptation (CCA) and Disaster Risk Management (DRM) into fisheries policies, plans, and legislation.
3: Promote actions to reduce greenhouse gas emissions through fossil fuel reduction and conservation, and switching to renewable and cleaner energy sources	

2013 Strategic Elements	Indicative Projects and Achievements
4: Promote actions to reduce the vulnerability of natural and human systems in CARICOM Member States to the impacts of a changing climate	<ul style="list-style-type: none"> • The Fisheries Early Warning and Emergency Response (FEWER) ICT solution was launched in 2018, as a deliverable under the Investment Plan for the Caribbean Regional Track of the PPCR. The Caribbean Disaster Emergency Management Agency is responsible for ongoing maintenance, promotion of and delivery of training on the FEWER, and in this way, it is expected that FEWER will be incorporated into overall regional disaster emergency management frameworks. To support uptake of FEWER by fisherfolk, several regional partners, are working to build general ICT capacity among fisherfolk. • Launch of the Caribbean Ocean Assets Sustainability Facility (COAST), which has developed a parametric insurance product to cover fisheries-related losses due to unusually-bad weather conditions and / or high wind and storm surge caused by tropical cyclones. Policies have been issued to Grenada and Saint Lucia to date, as pilot countries. CRFM is currently working with the Caribbean Catastrophe Risk Insurance Facility Segregated Portfolio Company to undertake additional country assessments to extend fisheries insurance coverage to other CRFM States.
5: Promote actions to derive social, economic and environmental benefits from the prudent management of standing forests in CARICOM countries	<ul style="list-style-type: none"> • From 2014-2019, The Nature Conservancy's (TNC) Caribbean Division planted over 500,000 mangroves in Grenada, The Bahamas, Haiti, Saint Lucia and Saint Vincent & the Grenadines. Mangroves enhance biodiversity by providing habitat for marine species and support coastal resilience by substantially reducing flood risk to nearby coastal communities. • The Integrating Water, Land and Ecosystems Management in Caribbean Small Island Developing States (GEF-IWEco Project) (2016-2021) supports the preservation of globally-significant Caribbean ecosystems and the climate resilience of human communities via the application of proven technologies and approaches for sustainable land and integrated water resources management.

Developing the 2013 regional strategy and action plan required accounting for policy instruments with specific provisions for ecosystem approaches to fisheries and aquaculture. These included the Code of Conduct for Responsible Fisheries (FAO, 1995) and the Caribbean Community Common Fisheries Policy (CCCFP), the latter being formally adopted in 2014. Since then two significant protocols under the CCCFP have been endorsed by Caribbean Fisheries Ministers (see Table 2).

Recognizing that small-scale fisheries comprise over 95% of fisheries in CARICOM and are vital for food and nutrition security as well as employment, particularly in coastal communities, Ministers endorsed the *Protocol on Securing Sustainable Small-Scale Fisheries for Caribbean Community Fisherfolk and Societies* (hereinafter CCCFP-SSF Protocol) in 2018. The CCCFP-SSF protocol calls on Member States to incorporate the globally-endorsed Voluntary Guidelines for Securing Sustainable Small-Scale Fisheries in the Context of Food Security and Poverty Eradication (FAO, 2015) into policies, plans and projects, drawing special attention to the advancement of gender equality, equity and human-rights based approaches in addressing a range of subjects including disaster risk and climate change, value chains, post-harvest and trade.

While the region was still rebuilding from the devastating impacts of two catastrophic hurricanes, Irma and Maria, which struck in 2017, Fisheries Ministers approved a second protocol to the CCCFP in 2018: the *Protocol on Climate Change Adaptation and Disaster Risk Management in Fisheries and Aquaculture* (hereinafter CCCFP-CCA/DRM Protocol). The CCCFP-CCA/DRM Protocol supports Member States and their stakeholders to adapt to the impacts of climate change and ocean acidification and build resilience through regulatory reforms, adaptive planning and policy development, awareness and capacity building.

Table 2: Key provisions in two protocols to the Caribbean Community Common Fisheries Policy informing the 2020-2030 Regional Strategy and Action Plan

Summary of Content in the Protocol on Climate Change Adaptation & Disaster Risk Management
<i>Role of Member States</i>
<ul style="list-style-type: none"> • Research to strengthen the knowledge base on climate change impacts and responses • Climate change impact and vulnerability assessment • Mainstreaming of adaptation and disaster risk management into national budgeting and decision making, as well as in policies and management measures that affect the fisheries sector • Governance to strengthen the sustainability of fish stocks and their habitats • Policies and measures to support food security, resilient seafood supply chains, hygiene and sanitary and phytosanitary standards in the face of climate change • Public education & awareness about climate change and risk management in the fisheries sector • Implementation of climate-smart policies, plans and measures • Monitoring & evaluation to ensure effective selection of adaptation measures that meet environmental, cost, feasibility and equity criteria • Appointment of a national fisheries sector climate change focal point to champion and coordinate national efforts, share information regionally on climate change impacts & responses
<i>Role of Competent Agency (CRFM)</i>
<ul style="list-style-type: none"> • Cooperation with and assistance of Member States in discharging their protocol obligations • Coordination of activities with national, regional and international organizations to support protocol implementation • Outlines 15 functions CRFM could perform, which are wide-ranging and include such tasks as mobilizing finance and technical resources; building capacity for data collection, analysis and research; acting as a data and information repository on climate change impacts at the regional level
Summary of Provisions on Disaster Risks and Climate Change in the Voluntary Guidelines on Securing Sustainable Small-Scale Fisheries, which is expected to guide the implementation of this subject area listed in the CCCFP-SSF Protocol
<ul style="list-style-type: none"> • Develop policies and plans to address climate change in fisheries, fully consulting with fishing communities and paying particular attention to women, minorities, and other groups that are considered vulnerable or marginalized.

- Recognize the need for integrated and holistic approaches to address non-climate stressors like pollution and habitat degradation, which undermine adaptive capacity
- Introduce flexible and adaptive measures to address the impacts of climate change, such as shifts in species, quantities, qualities and shelf life, on post-harvest and marketing aspects of small-scale fisheries
- Consider long-term development objectives in disaster management for small-scale fisheries, including the concept of building back better
- Promote climate action in small-scale fisheries, including energy efficiency in fishing, post-harvest, marketing and distribution
- Increase small-scale fishing communities' access to finance and culturally-appropriate technologies for adaptation
- Ensure availability of information for sustainable small-scale fisheries, including disaster risks, climate change, livelihoods and food security

This Regional Strategy and Action Plan for the sector preserves CRFM's preference for matters of climate change adaptation and disaster risk management in fisheries and aquaculture to be closely linked to the Regional Framework (in this case the 2019-2029 version) and to retain priorities and actions identified in the 2013 Regional Strategy and Action Plan. The next three sections of this document lay out the vision and principles guiding the updated Regional Strategy and Action Plan (Section 2); introduce the strategic elements serving as its framework, taking into account contents of the two protocols to the CCCFP, as well as goals and actions for the region's fisheries and aquaculture sector per strategic element (Section 3); and outline considerations for implementation of the updated Regional Strategy and Action Plan (Section 4).

2. VISION AND GUIDING PRINCIPLES

2.1 Vision

The vision for the 2020-2030 Regional Strategy and Action Plan for Climate Change Adaptation and Disaster Risk Management in Fisheries and Aquaculture in the CARICOM Region is:

A regional society and economy that is resilient to a changing climate and enhanced through comprehensive disaster management and sustainable use of aquatic resources.

2.2 Guiding Principles

A number of principles guided the development of the Regional Framework. This Regional Strategy and Action Plan builds on them, incorporating provisions specific to the Sector. The resulting guiding principles below provide CRFM/CARICOM Member States with direction for achieving the vision of the Regional Strategy and Action Plan for Climate Change Adaptation and Disaster Risk Management in Fisheries and Aquaculture.

- An **enabling environment** for the adoption of appropriate technologies and practices is established to ensure progress on national, regional, and international commitments with respect to the causes and effects of climate change;
- **Collaboration** with regional and international state actors and organisations must be an integral part of resilience-building to climate change;
- An **integrated approach** is important to minimize the use and costs of limited technical, administrative, and financial resources, and linked to this, applying the principle of **subsidiarity**, whenever possible; to reduce any potential conflicts in policy development; and to promote coordination among all stakeholder groups in climate change risk reduction;
- A **precautionary approach**, based on the best available information, shall be used in adaptation, preparedness and resilient decision-making and planning. A lack of scientific certainty on the potential harm of climate change impacts and hazards shall not be used to delay action;
- **Access to information and transparency** are imperative to planning and implementation of resilience building projects and programmes;
- An **effective institutional, administrative, and legislative environment** is crucial for effective and timely resilience-building to the risks associated with climate change, and should ensure application of good governance practices;
- **Capacity building** is essential to ensure that countries, regional organizations, and civil society have the capacity to respond to climate change; and to improve the capacity of models/tools to project and predict climate impacts on various economies and sectors at scales relevant to the region;
- **Sustained engagement with, involvement and participation of everyone who has a stake in the fisheries and aquaculture sector** is critical, with due consideration given to their views, traditional rights and special needs;
- Actively **pursuing gender equality and equity**, increasing gender awareness and mainstreaming gender in the development and implementation of projects, programmes and policies as well as the data collection protocols and monitoring of activities is essential.

3. STRATEGIC ELEMENTS AND GOALS

This version of the Regional Strategy and Action Plan builds upon the Strategic Elements and Goals presented in the Regional Framework for Achieving Development Resilient to Climate Change (2019-2029), which was designed to significantly increase the resilience of the region and ensure that the welfare of Caribbean residents is not adversely impacted by the multi-faceted impacts of climate change. This report reinterprets the Regional Framework’s 11 Strategic Elements and associated Goals (Table 3) through the lens of fisheries and aquaculture to provide more specific guidance on priority actions for advancing resilience within this sector. Only Goals assigned high and medium priority levels for the sector in Table 3 are taken forward in Section 3. Priorities identified in the original 2013 Strategy and Action Plan for the sector, provisions in sectoral policy instruments and direct feedback from government representatives of CARICOM Member States informed the priority levels noted in Table 3. Feedback from regional and national representatives of fisheries agencies on strengths and weaknesses of the 2013 Strategy and Action Plan and perspectives on new priorities for action were compiled through a face-to-face workshop in November 2019 and from responses received through an online survey deployed in December 2019-January 2020.

In all, 9 of the 11 Strategic Elements of the Regional Framework comprise the updated Strategy and Plan of Action for fisheries and aquaculture. The resulting Strategy and Action Plan will assist Member States in creating sectoral adaptation plans that meet or exceed the guidance included within this document.

Table 3: Strategic elements and goals of the Regional Framework for Achieving Development Resilient to Climate Change (2019-2029) and their importance for climate change resilience within the fisheries and aquaculture context. Goals tagged as high priority and medium priority are taken forward in the Regional Strategy and Action Plan for Fisheries and Aquaculture for 2020-2030

Strategic Element	Goal	Priority for Fisheries and / or Aquaculture
1: Integration of climate change adaptation and mitigation strategies and actions into the development portfolios of Member States.	Vulnerabilities and risks associated with a changing climate at the regional, national and sub-national levels are incorporated into decision-making.	High priority – Included in the Protocol on CCA and DRM in Fisheries and Aquaculture under the CCCFP
	Policies, plans and legal instruments to enable and support adaptation and mitigation actions across all sectors are reformed.	High priority – Included in the Protocol on CCA and DRM in Fisheries and Aquaculture under the CCCFP
	The management of regional and international agreements for climate change, disaster risk reduction and sustainable development is harmonised.	Low priority – Harmonization efforts would advance regardless of participation of fisheries and aquaculture
	Regional and national institutional frameworks to enable and support adaptation and mitigation actions are strengthened.	High priority – Included in the Protocol on CCA and DRM in Fisheries and Aquaculture under the CCCFP
	Inter-governmental, inter-ministerial and inter-sectoral collaborative architecture are strengthened.	<i>Medium priority</i> – Depends on institutional strengthening and clarity within the sector first
	The enabling environment for the sharing of data, information and knowledge at national and regional levels is functional.	High priority – Included in the Protocol on CCA and DRM in Fisheries and Aquaculture under the CCCFP
	Legal, institutional and financial protocols and instruments for managing climate-induced migration and displacement are enacted.	<i>Medium priority</i> – Institutional strengthening should include the participation of fisheries and aquaculture stakeholders so the sector’s interests are reflected
	Investments in generational resilience through youth empowerment and development including gender equality to address the impacts of climate change are intensified.	High priority – Included in both protocols to the CCCFP, including references to marginal groups in SSF
	The contribution of the private sector to building the climate resilience of member States is intensified.	High priority – Awareness and resilience building of industry and entrepreneurs critical to climate-smart fisheries & aquaculture, as are private-public partnerships
	National and regional platforms for addressing the impacts of climate change on trade are instituted.	<i>Medium priority</i> – Many other factors come into play in ensuring resilient seafood supply chains

Strategic Element	Goal	Priority for Fisheries and / or Aquaculture
		and continued compliance with food safety standards
2: Successful implementation of specific adaptation measures to reduce vulnerabilities to CC	Regional and national management systems are established and capable of reducing climate-induced impacts on key sectors, ecosystems and critical infrastructure.	High priority - Marine and Fishery Resources has been identified as one of the key sectors for development of regional and national management systems to facilitate successful implementation of adaptation measures.
3: Reduction of the region's reliance on fossil fuels	Greenhouse gas emissions are reduced	Low priority – Given the other goals contributing to this Strategic Element.
	Energy efficiency and conservation standards and measures are adopted	<i>Medium priority</i> – Fossil fuel efficiency and conservation can offset impacts of rising energy costs of vessel operation, cold storage & processing
	Deployment of renewable energy technologies is intensified.	<i>Medium priority</i> - Transition to renewable energy sources can offset the impacts of rising energy costs across the fish value chain (operations, processing, storage delivery)
	Regional Carbon Market in support of decarbonising efforts of Member States is developed.	Low priority – Many other factors in play in developing market-based instruments targeting carbon emissions
	An appropriate model for sustainable energy resource management is adopted.	Low priority – Sustainable development of ocean energy technology could be covered under Strategic Element 7.
4: Sustainable management of forest ecosystems and associated landscapes	Best practices and best fit solutions for sustainable forest management that address climate change and include consideration for indigenous peoples, their cultures and traditions are adopted.	<i>Medium priority</i> -From an ecosystem approach that considers upland watershed impacts on habitat degradation
	Associated landscapes and seascapes are integrated into the sustainable management of forest ecosystems.	<i>Medium priority</i> – Mangroves and coastal wetlands provide ecosystem services that benefit the fisheries and aquaculture sector so these provisions should factor into sustainable forest management to complement ecosystem approaches to fisheries management
5: Society with the impetus and capacity for building resilience to the impacts of climate change	Programmes for enhancing knowledge, education and awareness of the impacts of climate change are intensified.	High priority - Included in the Protocol on CCA and DRM in Fisheries and Aquaculture under the CCCFP
	Science, Technology, Reading and writing, Engineering, Arts and Maths (STREAM) to support climate resilient innovation are integrated into the curricula at all education levels.	<i>Medium priority</i> – To have an influence on curricula development and research so these target the needs of the sector.
	Society is more proactive in reducing risks associated with climate change.	High priority – Proactive action is one of the guiding principles in the Protocol on CCA and DRM in Fisheries and Aquaculture under the CCCFP
	Comprehensive national and regional data collection, management, sharing and reporting systems are instituted.	High priority – Data and information management on climate change impacts and responses key to both protocols to the CCCFP
	Attitudes and behaviours towards enhancing national and regional climate resilience are positively transformed.	High priority – Public awareness, outreach and other stakeholder initiatives need to target behavioural change
6: Sustained access to and provision of national, regional and international climate finance	Frameworks for access to international climate financing including multilateral, regional and other bilateral arrangements are institutionalized.	<i>Medium priority</i> – Advocacy efforts are needed to ensure flows of climate finance to fisheries and aquaculture are proportionate to the region's development goals
	Innovative financing mechanisms and the deployment of economic incentives are adopted.	High priority - For both fisheries and aquaculture where insurance is scarce and capital costs are increasing. Also, economic incentives can come into play in livelihood diversification and post-harvest waste minimization and value creation
	Mechanisms to address financial de-risking are identified and institutionalized.	Low priority – Better addressed through insurance and other risk-sharing mechanisms
	Financial sector, insurance and credit unions integrate adaptation and mitigation imperatives into their operational portfolios.	Low priority – Mainstreaming efforts will advance and these are expected to include

Strategic Element	Goal	Priority for Fisheries and / or Aquaculture
		participation of fisheries and aquaculture from a holistic standpoint
	ODA classification restricting access to financing for some countries is addressed (while ensuring climate finance access above and beyond ODA).	Low priority – Negotiations on eligibility requirements and guidelines to receive official development assistance and additional climate finance are addressed holistically
	The enabling framework for facilitating ease of doing business in climate investments is instituted.	Low priority - Indirect link to fisheries and aquaculture matters, other goals are more directly relevant
7: Integration of ocean governance into regional and national decision making on climate change	Regional and national coordination mechanisms for ocean governance are strengthened by the inclusion of climate change considerations.	High priority – Management of transboundary fish stocks will become more complex with climate change and proactive action is needed
	Climate change considerations are incorporated into the blue economy.	<i>Medium priority</i> – Climate change influences the potential of fisheries and aquaculture to drive innovation and economic growth, but there are many other factors at play
	Marine spatial planning is integrated into national and regional climate change decision-making.	High priority – Marine capture fisheries and aquaculture can influence and be influenced by marine spatial planning.
	The sustainable management of marine ecosystems is integrated into Ocean Governance.	High priority – It encompasses habitat degradation, biodiversity conservation and sustainability of fish stocks, which the sector has a direct stake in and knowledge to contribute
8: Integration of regional and national security in managing the impacts of climate change	The roles of national and regional security agencies and systems in responding to climate change and its impacts are institutionalised.	<i>Medium priority</i> –Mechanisms to protect resources for legal fishing operations should be included in institutional strengthening
	The role of national security agencies, incl. customs, police, coast guard, defence force, immigration authorities & military, is integrated into the national response to climate change & its impacts.	<i>Medium priority</i> – National responses to climate change impacts should consider the role of security agencies in protecting resources for legal fishing operations
	National and transnational security issues for all other sectors, including health, tourism, and agriculture are enhanced.	High priority – Considering the links between climate change and disaster risk and several fisheries concerns (safety at sea, IUU fishing, value chain traceability, transmission of pathogens through seafood, food insecurity)
	Climate-induced migration is integrated into regional and national security management.	Low priority –At this time, link between climate change and human migration as applied to the fisheries and aquaculture is better addressed through other goals
9: Responsive reporting and effective governance frameworks for climate resilience building	Monitoring, evaluation and reporting frameworks are established and functioning.	Low priority – For sectoral-level action, better addressed through Strategic Element 5
	Governance at national and regional levels inculcates a climate-risk management ethos at all levels of decision-making.	Low priority – For sectoral-level action, better addressed through Strategic Element 5
10: Effective architecture for averting, minimising and addressing loss and damage from climate change	Recommendations arising out of the work of relevant international instruments such as the UNFCCC Warsaw International Mechanism for Loss and Damage, are incorporated into regional and national climate change response mechanisms.	High priority – Disaster risk reduction as related to climate hazards is reflected in the Protocol on CCA and DRM in Fisheries and Aquaculture under the CCCFP
	Architecture for comprehensive climate risk management is clearly defined and operational.	High priority – Disaster risk reduction as related to climate hazards is reflected in the Protocol on CCA and DRM in Fisheries and Aquaculture under the CCCFP
11: Functioning architecture for Extra-Regional Cooperation in building resilience to the impacts of climate change	Alliances with climate change negotiating blocs with issues similar to CARICOM SIDS (e.g. Pacific SIDS) are strengthened.	Low priority – SIDS coordination is managed by CCCCC at the regional level. For the fisheries and aquaculture sector strengthening regional cooperation is more of a priority at this time, as per provisions of the Protocol on CCA and DRM in Fisheries and Aquaculture under the CCCFP

Strategic Elements and Goals within them are interlinked and mutually reinforcing (see Figure 3). To achieve the transformational change needed to overcome vulnerabilities and risk associated with

intensified climate change and variability, building capacity and supporting action at both the systems level and among individuals, households and communities is necessary (Eakin *et al.*, 2014).

The following sections of this chapter cover each Strategic Element in detail, describing its overall importance, listing goals and actions to be pursued by the sector on a priority basis and, for goals deemed “high priority”, providing a more detailed overview of 2 to 4 key actions per Strategic Element, for immediate attention over the next 2 to 4 years. Selection of these key actions accounted for perceived progress or lack thereof since 2013 as well as qualitative consideration of the following criteria:

- *Impact potential.* This means that the key action builds on past efforts and there is a degree of “readiness” in the region to convert outputs into desirable, ultimate outcomes.
- *Unlocking potential.* This means that the key action actively removes barriers to progress in other areas in a significant way.
- *Complementarity.* The key action was selected for its potential to complement other key priority actions selected under other strategic elements, for achieving an improved overall comprehensive approach.

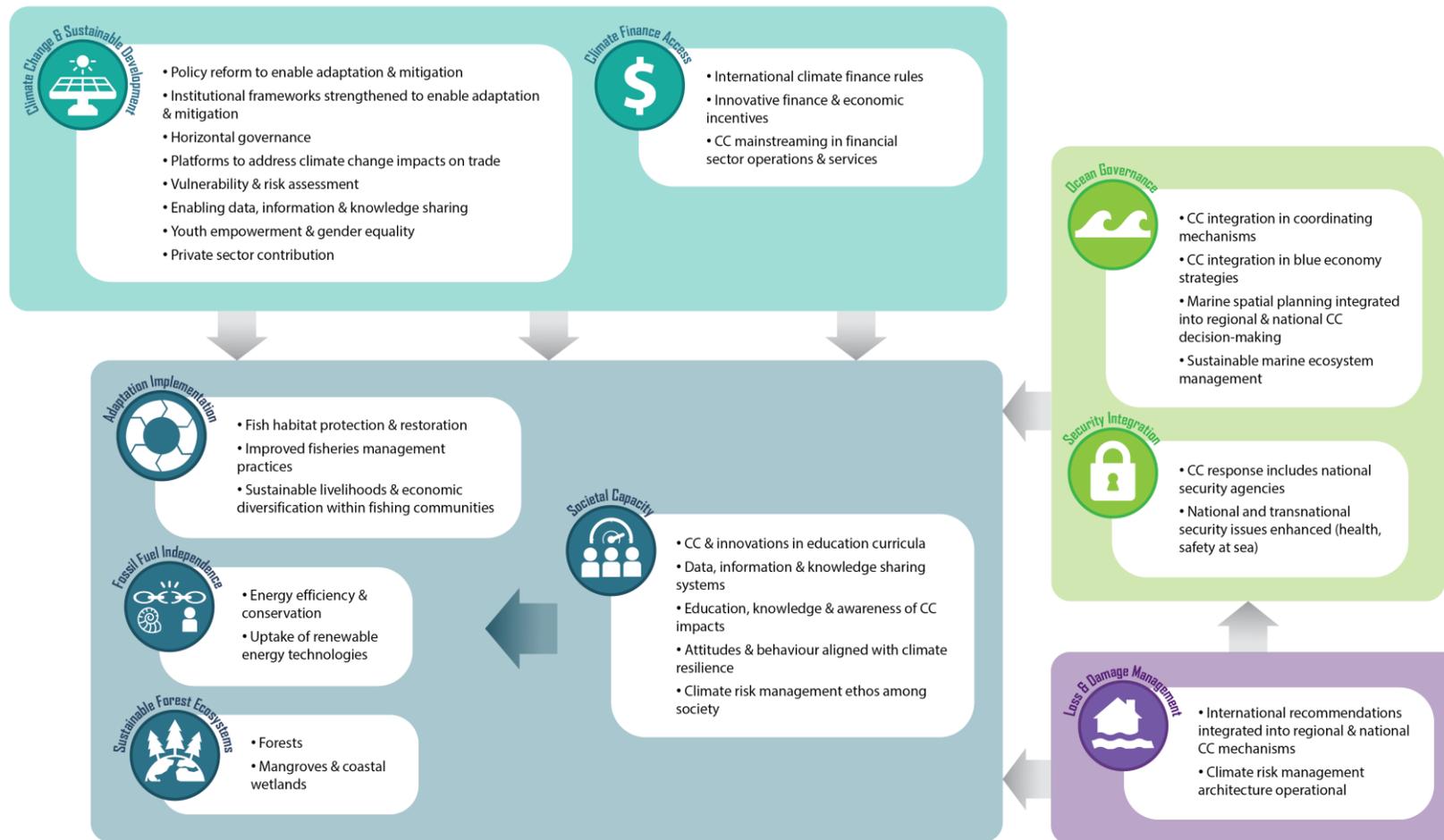


Figure 3: Strategic Elements and Goals supporting climate resilient development of the region’s fisheries and aquaculture sector (9 of 11 Strategic Elements of the broader Regional Framework). Enabling actions such as policy and institutional reforms to integrate climate change and sustainable development, climate finance and economic incentives are shown in the turquoise box. Mechanisms to manage loss and damage, support delivery of adaptation, risk management and mitigation actions “on the ground” are shown in blue and purple boxes. Emerging issues– ocean governance and climate security – are also important to begin managing as they also shape resilience of ecosystems and human communities; they are shown in the lime green box.

3.1 Strategic Element 1: Climate Change & Sustainable Development Integration



Overview

Regional experience with extreme weather events provides a compelling call for the transformation of national decision-making and planning processes into a paradigm that fully integrates climate change considerations and disaster risks. This is especially important for the fisheries and aquaculture sector, which relies on marine and coastal ecosystems as well as physical assets that have a high degree of exposure and sensitivity to potential climate change impacts and risks. The benefits of mainstreaming or integrating climate change adaptation and/ or mitigation considerations into development, policies, plans and legislation governing natural resources are increasingly obvious and opportunities to do so increasingly recognized (IPCC, 2014; Wentz, 2017; Runhaar *et al.*, 2018), including examples in Caribbean fisheries and coastal management (Hassanali, 2017; Oxenford and Monnereau, 2018). Integrative, institutional approaches to adaptation and resilience are multi-faceted and considered core in establishing an “enabling environment” for implementation of action at all scales (FAO, 2019; Poulain *et al.*, 2018). The goals associated with this strategic element emphasize adjusting policies, legal and institutional frameworks, strengthening mechanisms for cooperation and collaboration in order to manage climate-related risk (e.g., data sharing, inter-sectoral architecture) and ensuring climate-resilient development is inclusive.

Table 4: Goals and Actions related to Strategic Element 1, which focuses on climate change and sustainable development integration. Actions target particular stages of the fisheries value chain. Many actions have been carried over from the 2013 Strategy and Action Plan, while those marked with an asterisk (*) have been newly added in this edition of the Regional Strategy and Action Plan. [-] denotes actions that have seen least progress, as rated by stakeholders. [+] denotes actions that have seen most progress. These ratings are based on perspectives of regional and national fisheries officers gleaned through a workshop and an online survey.

Strategic Element 1: Integration of climate change adaptation and mitigation strategies and actions into the development portfolios of Member States.	Stage of Fisheries Value Chain
Goal 1.1: Vulnerabilities and risks associated with a changing climate at the regional, national and sub-national levels are incorporated into decision-making.	High Priority
Action 1.1.1: Conduct vulnerability and capacity assessment of the impacts of climate change on coastal and marine sectors (i.e., fisheries and aquaculture, tourism, shipping) for the years 2030s and 2050s in all CARICOM states and actively disseminate the results.	Enabling environment
Action 1.1.2: More closely link poverty reduction to multi-sector development, Ecosystem Approaches to Fisheries (EAF), Ecosystem Approaches to Aquaculture (EAA), climate change adaptation (CCA) and disaster risk management (DRM). [-]	Enabling environment
Goal 1.2: Policies, plans and legal instruments to enable and support adaptation and mitigation actions across all sectors are reformed.	High Priority
Action 1.2.1: Develop the legislative and regulatory framework to improve management of coastal and marine areas (includes climate change and DRM considerations).	Enabling environment
Action 1.2.2: Revise and upgrade regional and national fisheries and marine resource management policies, legislation and regulations to incorporate and address ecosystem approach to fisheries, climate change and DRM considerations. [-]	Enabling environment
Action 1.2.3: Enhance policy development and planning for coastal and marine areas (that includes EAF, EAA, climate change and DRM considerations). [+]	Enabling environment
Action 1.2.4: Adopt a livelihoods and rights-based approach to fisheries and aquaculture policies and plans within climate change adaptation (CCA), and the	Enabling environment

Strategic Element 1: Integration of climate change adaptation and mitigation strategies and actions into the development portfolios of Member States.	Stage of Fisheries Value Chain
design and implementation of disaster prevention, preparedness, response and recovery programmes.	
Action 1.2.5: *Support inclusion of adaptation priorities for fisheries and aquaculture in Nationally-Determined Contributions to the UNFCCC and National Adaptation Plans.	Enabling environment
Goal 1.3: Regional and national institutional frameworks to enable and support adaptation and mitigation actions are strengthened.	High Priority
Action 1.3.1: *Support the active implementation of the CCA and DRM Protocol of the CCCFP.	Enabling environment
Action 1.3.2: Keep under review and continue to strengthen the capacity of the CRFM, as a leading regional fisheries body, to advocate for the inclusion of fisheries and aquaculture into CCA and DRM through CARICOM's regional and national mechanisms.	Enabling environment
Action 1.3.3: Keep under review and continue to strengthen institutional capability of the CRFM and related institutions to coordinate, monitor and support the mainstreaming of climate change and DRM consideration in fisheries and marine resource management.	Enabling environment
Action 1.3.4: Improve and keep under review governance arrangements by identifying and facilitating the inclusive engagement empowerment and participation of the relevant interest groups, particularly taking into account gender equality and equity issues, and vulnerable groups in coastal areas.	Enabling environment
Action 1.3.5: Use network and institutional analysis as tools to establish and keep under review institutional arrangements that span from local to national to regional levels easily.	Enabling environment
Action 1.3.6: Keep under review and continue to increase the capacities of fishers and coastal communities to participate and engage in policy development and planning processes that utilize ecosystem-based management (EBM) and other integrated approaches, either as individuals or community-based groups.	Fishers, Vessels, and Gear Aquaculturists
Goal 1.4: Inter-governmental, inter-ministerial and inter-sectoral collaborative architecture are strengthened.	Medium Priority
Action 1.4.1: *Develop innovative instruments (e.g., guidelines) to enhance collaboration on the conservation and sustainable use of biodiversity in food systems, including fisheries and aquaculture.	Enabling environment
Action 1.4.2: *Contribute to the diversification of local, national and regional food systems and their resilience to climate change and disaster risks.	Enabling environment
Action 1.4.3: Contribute to development / enhancement of tourism-related policies, strategies and plans to incorporate sustainable tourism principles and mainstream climate change adaptation and mitigation and DRM issues and recommendations.	Enabling environment
Action 1.4.4: Contribute to the incorporation of climate change considerations and the principles of Sustainable Land Management (SLM) into coastal physical planning and development procedures. [-]	Enabling environment
Goal 1.5: The enabling environment for the sharing of data, information and knowledge at national and regional levels is functional.	High Priority
Action 1.5.1: Create channels through which local knowledge, traditional knowledge and culture can be included in policy and be used to inform implementation as part of any action plan in fisheries and aquaculture, including addressing information gaps in fisheries data (e.g., spatial and temporal distribution of fishing activities).	Enabling environment
Action 1.5.2: *Strengthen the capacity of the CRFM to function as a regional repository for data and information relating to climate change and climate-hazard impacts and vulnerabilities on fisheries and related livelihoods and assets.	Enabling environment
Action 1.5.3: *Develop / strengthen partnerships and instruments (e.g., protocols) at national levels in CRFM countries so as to generate, share and	Enabling environment

Strategic Element 1: Integration of climate change adaptation and mitigation strategies and actions into the development portfolios of Member States.	Stage of Fisheries Value Chain
manage local and traditional knowledge to complement the scientific understanding of the marine environment and its uses.	
<i>Goal 1.6: Investments in generational resilience through youth empowerment and development including gender equality to address the impacts of climate change are intensified.</i>	High Priority
Action 1.6.1: Mainstream gender equality and youth inclusion into fisheries and aquaculture CCA and DRM at all levels, drawing on civil society assistance.	Enabling environment
Action 1.6.2: *Expand extension and support services for fisherfolk and aquaculturists to facilitate holistic climate change adaptation planning and implementation, integrating gender equality and youth inclusion lenses in service design and implementation.	Fishers, Vessels, and Gear Aquaculturists Markets, Vendors, and Processors
Action 1.6.3: *Enhance the capacity of coastal communities to adopt and use ICTs in fisheries, climate change monitoring and disaster-prevention, tailoring strategies so they are equitable and inclusive.	Fishers, Vessels, and Gear
Action 1.6.4: *Analyze the effectiveness of social protection programs in reducing fisherfolk and aquaculturists' vulnerability to climate change and climate hazard impacts and strengthen programs accordingly.	Enabling environment
<i>Goal 1.7: The contribution of the private sector to building the climate resilience of member States is intensified.</i>	High Priority
Action 1.7.1: *Expand institutional support, capacity building and awareness raising to enable the widespread application of the value chain approach to fisheries and aquaculture harvesting, handling, processing, marketing and distribution.	Enabling environment
Action 1.7.2: *Improve access to environmentally-sustainable and climate-resilient solutions (e.g., technologies, equipment, processes) to existing challenges in the aquaculture sector.	Aquaculturists
Action 1.7.3: *Improve capacity to access to higher-value markets to promote greater benefits from fisheries and aquaculture production to compensate for reduced yields due to climate change, including by promoting certification and eco-labelling schemes as well as value-added products (see also Strategic Element 2, Objective 2.1.3).	Enabling environment
<i>Goal 1.8: National and regional platforms for addressing the impacts of climate change on trade are instituted.</i>	Medium Priority
Action 1.8.1: *Use network and institutional analysis, scenario and supply chain analysis as tools to understand the potential for climate change to create / enhance risks and opportunities for intra and extra-regional trade in fish and seafood products.	Enabling environment
Action 1.8.2: *Develop policies and procedures to minimize adverse impacts of international trade (e.g., unfair value of catch) and ensure the maintenance of food security, hygiene and sanitary and phytosanitary standards, and supply of fish and seafood products in the face of climate change and climate hazard impacts.	Enabling environment

Key Actions

Action 1.3.1: *Support the active implementation of the CCA and DRM Protocol of the CCCFP. This supports many other actions, including Action 1.5.2: *Strengthen the capacity of the CRFM to function as a regional repository for data and information relating to climate change and climate-hazard impacts and vulnerabilities on fisheries and related livelihoods and assets.

Justification: The CCA and DRM Protocol of the CCCFP is a concise regional policy document adopted by CRFM and its Member States in 2019, after validation by national governments, the Caribbean Network of Fisherfolk Organisations (CNFO) and regional and international organisations such as the Caribbean Community Climate Change Center (CCCCC) and the United Nations Food and Agriculture

Organisation (FAO). The Protocol clearly outlines roles and responsibilities for Member States and CRFM, and provides for priority measures to enable states and stakeholders to adapt to climate change and build resilience by working together and sharing experiences and best practices. Because of the importance of building on existing institutions and mechanisms, this updated Regional Strategy and Action Plan elaborates on many of the measures and roles noted in the Protocol. Therefore, implementation of the Protocol itself offers the possibility of moving forward on the main thrusts in this Regional Strategy and Action Plan for the sector.

Key Considerations for Implementation

Challenges:

- The Protocol is voluntary and subject to implementation as deemed appropriate by Member States and other named actors. As countries refine their national and sectoral responses to climate change and disaster risk as well as fisheries policies and plans, continuing to highlight the relevance of the commitments encoded in the Protocol may be necessary.
- Monitoring and evaluation of the Protocol's implementation is envisioned. However, this is also voluntary and is not a practice that is well-resourced or common among CARICOM countries or regional bodies. Gaps in accountability frameworks and reporting structures can create challenges for systematically assessing implementation progress and hinder sustaining the momentum of the Protocol's implementation.
- The Protocol is gender blind and priorities regarding gender equity and women's empowerment across the value chain are not yet developed. Robust information on the women's roles in the sector and gendered dynamics in Caribbean fisheries is sparse but at least one study suggests that women in the region account for 10% of participants in SSF (~305,000 women) and contribute approximately 19,000 tons of catch for a value between US\$46 and US\$67 million (2010 dollars) per year (Harper *et al.*, 2020).

Opportunities:

- The Protocol has already been used as a mechanism to broker major partnerships. In 2019, the CRFM and CCRIF SPC signed a Memorandum of Understanding to formalize collaboration around the Caribbean Oceans and Aquaculture Sustainability Facility (COAST) initiative. CCRIF SPC sees the activities stemming from this partnership as support to the CRFM in delivering on its mandate under the CCA and DRM Protocol.¹
- Gender analysis of Caribbean fisheries is being undertaken by the Gender In Fisheries Team at the University of West Indies-Cave Hill to support the region's implementation of the SSF Guidelines (GIFT 2018). Research outputs will include recommendations to integrate gender issues in fisheries management and support improved planning and policy formulation processes. The CRFM is also receiving technical support to advance the mainstreaming of gender equality, decent work and youth inclusion in Caribbean fisheries. Results of initiatives such as these can inform periodic reviews of the Protocol and form the basis for new or adjusted measures. In turn, new research and guidelines intended to improve gender analysis and mainstreaming of gender issues will also contribute toward Action 1.3.4 and 1.6.1.

Action 1.5.1: Create channels through which local knowledge, traditional knowledge and culture can be included in policy and be used to inform implementation as part of any action plan in fisheries and aquaculture, including addressing information gaps in fisheries data (e.g., spatial and temporal distribution of fishing activities).

Justification: Through long-term and inter-generational observations rooted in place and culture, local resource users, such as small-scale fishers, and indigenous peoples monitor and analyze the environment, making decisions based on these knowledge systems (UNESCO nd). Local and traditional knowledge systems are increasingly recognized as complementary to scientific research, conservation and resource management (Thornton and Scheer 2012), with global commitments and initiatives

¹ <https://www.ccrif.org/news/caribbean-countries-benefit-partnership-develop-climate-resilient-fisheries-and-aquaculture>

underway to strengthen capacities to use and share local and traditional knowledge in fulfillment of biodiversity and sustainable development goals and in support of climate action. In the fisheries sector, application of local and traditional knowledge is perhaps most advanced in addressing gaps in basic environmental data, conservation planning and protected areas management and in ecosystem approaches to fisheries (Thornton and Scheer, 2012; Fisher *et al.*, 2015). In the region, there is growing interest in mobilizing local and traditional knowledge to understand observations of environmental change and share information on livelihood, climate change adaptation and coping strategies and on the partnerships needed to support local and traditional knowledge integration in policy processes (UNESCO nd). Moreover, the region's local and traditional knowledge can play a vital role for enhanced understanding of situations that are data-limited. Still, few examples exist of truly collaborative and durable management mechanisms that embrace scientific and traditional and local ways of knowing. Experience from Latin America sheds light on important conditions for enabling the respectful use of fishers' knowledge in ecosystem approaches to fisheries (Medeiros *et al.*, 2015):

- Endorsement of the mobilization and integration of ways of knowing at high decision-making levels;
- An institutional environment that creates identity and helps build respect and trust among participants in decision making processes;
- Genuine interest and respect by scientists and managers in local and traditional knowledge, as opposed to seeing it as token input;
- Research that engages fishers from the outset in defining objectives and methods;
- Clarity of purpose and objectives of knowledge sharing;
- Practical and straightforward mechanisms for knowledge sharing;

Key Considerations for Implementation

Challenges:

- Experience in Latin America suggests that scientists and managers involved in fisheries management tend to lack skills that are critical to help integrate local and traditional knowledge into decision making (i.e., qualitative data collection, participatory methods, decision making through negotiations) and can underappreciate the socio-cultural context of local and traditional knowledge (Fisher *et al.*, 2015; ICSF, 2017). Sometimes fishers' knowledge can be contrary to scientific evidence and managers require skills to support co-construction of new knowledge.
- Establishing the trust and confidence needed among participants to effectively and safely share traditional and local knowledge takes time (ICSF, 2017) and this includes designing clear rules so knowledge holders retain control and ownership over their knowledge. Sporadic or one-off engagement may not be helpful.
- Local and traditional knowledge holders in the fisheries sector are not a homogenous group (Medeiros *et al.*, 2015). For example, Indigenous knowledge systems can be gendered, with women and men occupying different and complementary roles (UNESCO nd).

Opportunities:

- Interest in integrating local and traditional knowledge in natural resource and development decisions, including responsible fishing, is high on the policy and research agenda of many world regions. As a result, guidance, practical case studies and new collaborative modalities, among other resources, are available to learn from. For example, the Intergovernmental Platform for Biodiversity and Ecosystem Services (IPBES) has a task force on Indigenous and local knowledge systems and produces and compiles published research to support the task force. Similarly, the UNFCCC launched the Local Communities and Indigenous Peoples Platform (LCIPP) and a mechanism to strengthen knowledge sharing and support participation of Indigenous people and local communities in UNFCCC processes.
- Scholarship on ecosystem-based adaptation in SIDS also offers insights on existing approaches to integrating local and "external" knowledge for CCA and DRM. For example, Mercer *et al.* (2012) undertook a comparative analysis of participatory techniques, including scenario development, participatory planning, participatory GIS mapping and participatory risk and vulnerability

assessment, and their strengths and weaknesses in bringing local and traditional knowledge and scientific information closer together to support adaptation. Various regional initiatives have introduced or applied one or more of the participatory techniques for harnessing local and traditional knowledge, and these experiences provide an opportunity for identifying suitable options for achieving more formal and sustained practices.

3.2 Strategic Element 2: Adaptation Implementation



Overview

This section highlights actions associated with the key sector of Marine and Fishery Resources identified in the goal for this strategic element. Many of the potential climate change adaptation actions that have been identified for the fisheries sector are variants of more general coastal management, fisheries management, and sustainable development strategies that have been modified to account for the anticipated effects of climate change (West *et al.*, 2016; Parker *et al.*, 2017; Poulain *et al.*, 2018). Actions fall into three key areas, which have been represented as objectives beneath the main goal of this strategic element. These three key areas are (CRFM, 2019a):

- **Ecosystem Management Actions:** These adaptation actions help to reduce cumulative non-climate stressors on marine habitats which help to improve overall coastal ecosystem health, preserve the provision of coastal ecosystem services to the fisheries sector, and ultimately increase coastal ecosystem resilience to climate change.
- **Harvest Management Actions:** These adaptation actions help to modify fisheries practices to ensure ongoing yet sustainable levels of harvest in light of the anticipated effects of climate change to ensure the persistence of fisheries stocks and the benefits they provide into the future.
- **Sustainable Livelihoods and Economic Diversification Actions:** These adaptation actions focus on protecting the physical assets (e.g., landing sites, boats, fishing gear and cold storage) that fishing communities require to pursue their livelihoods and supporting fisherfolk throughout the value chain as they transition to new, climate-resilient practices and livelihoods.

Together, actions in these three areas contribute to the overall climate resilience of the fisheries sector (Table 5). Importantly, involving fishers and communities in the implementation of these actions can have far-reaching benefits beyond the immediate target of the action itself, including building understanding, raising awareness, and encouraging support for the broader adaptation enterprise.

Table 5: Goals and Actions related to Strategic Element 2 of the Regional Strategy, which is focused on adaptation implementation. Actions target particular stages of the fisheries value chain. Many actions have been carried over from the 2013 Strategy and Action Plan, while those marked with an asterisk () have been newly added in this edition of the Regional Strategy and Action Plan. [-] denotes actions that have seen least progress, as rated by stakeholders. [+] denotes actions that have seen most progress. These ratings are based on perspectives of regional and national fisheries officers gleaned through a workshop and an online survey.*

Strategic Element 2: Successful implementation of specific adaptation measures to reduce vulnerabilities to climate change	Stage of Fisheries Value Chain
<i>Goal 2.1: Regional and national management systems are established and capable of reducing climate-induced impacts on marine and fishery resources and related infrastructure</i>	High Priority
<i>Objective 2.1.1: Protect and restore productive fish habitats that contribute to the climate resilience of fish and shellfish populations that support fisheries.</i>	

Strategic Element 2: Successful implementation of specific adaptation measures to reduce vulnerabilities to climate change	Stage of Fisheries Value Chain
Action 2.1.1-1: Develop and implement programmes aimed at the protection and rehabilitation of degraded fisheries habitats and ecosystems, and the environment generally.	Ecosystem Mgmt.
Action 2.1.1-2:* Implement watershed and vegetation management programs to reduce nutrient, contaminant, and sediment runoff into coastal areas and ensure these efforts are robust to future climate conditions so that benefits are not lost.	Ecosystem Mgmt.
Action 2.1.1-3:* Identify and proactively protect areas expected to act as climate refugia for important fisheries species, including protecting those areas from non-climate stressors such as fishing and coastal development, seeking synergies with measures and actions under the Caribbean Challenge Initiative.	Ecosystem Mgmt.
Action 2.1.1-4:* Carry out systematic restoration of productive fish habitats including mangroves, seagrass beds, and coral reefs and ensure these efforts are robust to future climate conditions so that benefits are not lost.	Ecosystem Mgmt.
Objective 2.1-2: Improve fisheries management practices that will help to ensure sustainable levels of harvests under future climate scenarios.	
Action 2.1.2-1: Formulate, adopt, implement and revise conservation and management measures and, where appropriate, fisheries management and development plans on the basis of the best available information, including climate change, to achieve optimum sustainable use and long-term conservation of fisheries resources.	Ecosystem Mgmt. Fisheries Management
Action 2.1.2-2: * Enhance understanding of stock status for a greater number of fisheries, applying data-limited stock assessments to better understand current conditions, pressures and related tolerance levels and future prospects.	Fisheries Management
Action 2.1.2-3:* Adapt fisheries monitoring, assessment, and management strategies and actions to incorporate available information on the relative climate change vulnerability, risk, and anticipated impacts on fished species.	Fisheries Management
Action 2.1.2-4:* Promote the diversification of fisheries catches to relieve pressure on species and populations expected to be more vulnerable to the impacts of climate change.	Fisheries Management
Action 2.1.2-5:* Implement precautionary management of emerging fisheries to ensure they are not overfished before they can become established to support a sustainable fishery.	Fisheries Management
Action 2.1.2-6:* Adjust the boundaries of existing fisheries management areas to reflect changing species status and distributions, bearing in mind special considerations for transboundary stocks (see Strategic Element 7).	Fisheries Management
Objective 2.1.3: Promote sustainable livelihoods and economic diversification within fishing communities to increase resilience to climate impacts on the sector.	
Action 2.1.3-1: Develop stronger partnerships to mobilize resources for implementation of programmes and projects within the fisheries and aquaculture sectors via networked fisheries, aquaculture, CCA and DRM stakeholders.	Fishers, Vessels, and Gear Aquaculturists
Action 2.1.3-2: Design rehabilitation, reconstruction and recovery activities to rebuild livelihoods that are more sustainable and resilient than those existing before the disaster, while avoiding contributing to “poverty traps” by increasing dependence on aid (e.g., harmful fisheries subsidies).	Fishers, Vessels, and Gear
Action 2.1.3-3: Keep under review the capacity needs of fishers and coastal communities to confront more extreme rough sea events by improving safety at sea, early warning systems, and community-based or assisted rescue capabilities that leverage emerging technologies.	Fishers, Vessels, and Gear

Strategic Element 2: Successful implementation of specific adaptation measures to reduce vulnerabilities to climate change	Stage of Fisheries Value Chain
Action 2.1.3-4: Identify, and where possible develop and keep under review, sustainable alternative livelihood opportunities for fisherfolk and other vulnerable groups in the coastal zone.	Fishers, Vessels, and Gear Markets, Vendors, and Processors
Action 2.1.3-5: Work with a range of agencies, including civil society, to implement systematic approaches to livelihood diversification for fishing and aquaculture communities to build resilience and reduce vulnerability.	Fishers, Vessels, and Gear Aquaculturists Markets, Vendors, and Processors
Action 2.1.3-6:* Develop and institutionalize infrastructure and logistics to reduce product losses and support post-harvest handling, transportation, distribution, processing (including value-added products), and marketing of food within and amongst individual countries, based on needs and local conditions expected under a future climate.	Markets, Vendors, and Processors

Key Actions

Action 2.1.1-1: Develop and implement programmes aimed at the protection and rehabilitation of degraded fisheries habitats and ecosystems, and the environment generally. This is linked to Action 2.1.1.4, which is the responsibility of fisheries managers: to carry out systematic restoration of productive fish habitats including mangroves and seagrass beds, and coral reefs and ensure these efforts are robust to future climate conditions to that benefits are not lost.

Justification: Climate change and ocean acidification are already affecting marine and coastal ecosystems and habitats, with cascading impacts on fisheries manifested through changes in the diversity, composition, abundance and quality of catch. A strategy to enhance the capacity of marine and coastal ecosystems to adapt to climate change impacts is to reduce environmental degradation and the cumulative stressors from fishing, coastal development, tourism and other human activities, including on land. This includes programs that target protection and rehabilitation of shallow marine and coastal habitats, including through the application of integrated environmental management approaches.

Coastal habitats provide important ecosystem services contributing to climate change resilience, including as habitat for economically-important fisheries species, as coastal defenses against extreme weather, and as “blue carbon” sinks. Given that many of these habitats have been significantly degraded or lost across the Caribbean region, coastal habitat restoration represents a key climate change adaptation strategy for the coastal fisheries sector (Guannel *et al.*, 2016; Wilson and Forsyth, 2018). Mangroves, seagrasses, and coral reefs are important fish habitats and are already facing climate impacts that render them more vulnerable to the negative consequences of harmful inputs from land-based activities, particularly sedimentation and excessive nutrient loads from upland watersheds. Reducing undesirable inputs to the marine environment through upland vegetation and forest management to improve erosion control and sediment trapping (e.g., planting for slope stabilization, riparian buffers) helps to reduce pressures on these productive fish habitats and improve their resilience to climate change (Bell *et al.*, 2018; Andersson *et al.*, 2019). These latter activities have the added benefit of mitigating increased hazards related to more frequent and severe rainfall, flooding, and landslides, anticipated under future climate scenarios.

Key Considerations for Implementation:

Challenges:

- Effective restoration requires information on past and present conditions (e.g., coastal habitat maps, land use maps, precipitation maps, and marine water quality monitoring data such as nutrient levels and pH) to identify and prioritize areas where action is needed or likely to succeed.

- Restoration of coastal habitats is generally time, labour, and cost-intensive, particularly for subtidal habitats requiring access to SCUBA diving training and equipment.
- Effective implementation of integrated approaches requires close collaboration between coastal and marine resource management agencies with forestry, agriculture, and land use planning.
- Stakeholder input and support, as well as political will, are required to counteract perceived drawbacks of potential restrictions on land and marine uses and activities (West *et al.*, 2016; Bell *et al.*, 2018).

Opportunities:

- Practical guidelines on site selection criteria and other aspects of restoration are available for several habitat types: mangroves (McLeod and Salm 2006), seagrasses (Björk *et al.*, 2008), and coral reefs (Grimsditch and Salm, 2006; Lirman and Schopmeyer, 2016; Frias-Torres *et al.*, 2018).
- Restoration costs can be offset by using volunteers or partnering with communities (Hernández-Delgado *et al.*, 2014; Bayraktarov *et al.*, 2016).
- Blue carbon project finance can be used to offset implementation costs (Hejnowics *et al.*, 2015).

Action 2.1.2-1: Formulate, adopt, implement and revise conservation and management measures and, where appropriate, fisheries management and development plans on the basis of the best available information, including climate change, to achieve optimum sustainable use and long-term conservation of fisheries resources.

Justification: A changing climate brings a new set of stressors to fish populations already under pressure from coastal pollution, habitat loss and fishing. One way to help mitigate the effects of climate change is to reduce other stressors, including fishing pressure, where populations are presently fully or over-exploited. In the wider Caribbean, illegal, unreported and unregulated (IUU) fishing is a significant problem, with available information suggesting that as much as 30% of total catches in the region are illegally caught (WECAFC, 2019). Improving regional capacity, rigor, and effectiveness in everyday fisheries management and conservation, including advancing current regional efforts to combat IUU fishing, will go a long way towards offsetting many of the anticipated negative effects of climate change on fisheries (Gaines *et al.*, 2018; Gourlie *et al.*, 2018). Where information on anticipated impacts to individual species distributions and abundances are available, as is now the case in the Caribbean (CRFM, 2019), management can begin to proactively manage fisheries to help offset their relative risks to climate change (Karp *et al.*, 2019) and account and plan for expected changes in species distributions. Existing harvest regulations such as size limits, catch limits, seasonal and spatial closures, and restrictions on types of gear to be used, are all tools to maintain or increase diversity of exploited fish populations that can be modified to better adapt to uncertainty about future climate. For high-value species where enough information exists to implement stock assessments and harvest management, explicitly incorporating the anticipated effects of climate change on growth and survival into harvest control rules can help to further improve the resilience of these economically important fisheries (Queirós *et al.*, 2017; Kritzer *et al.*, 2019).

The conservation benefits of some marine protected areas (including no-take and limited-take areas) may decline over time due to species range shifts under future climate scenarios (e.g., Davies *et al.*, 2016; Woodson *et al.*, 2019). Therefore, when establishing new management areas, or refining zones within existing management areas, it will be important to explicitly address climate resilience as part of the decision-making process (e.g., Keller *et al.*, 2009; Davies *et al.*, 2016).

Key Considerations for Implementation:

Challenges:

- Successful design and implementation of regulations and conservation measures require assessment data (e.g., distribution of species and habitats of conservation concern) and modelling capacity (e.g., to evaluate the performance of alternative measures) but access to these resources are often constrained.

- Implementation success is also contingent on effective consultation with fishing communities to ensure that, at a minimum, the measures are understood and broadly supported.
- Sufficient capacity to enforce the prescribed regulations and rules, either by governments or using self-policing fishers' cooperatives or other community-based organizations is necessary and often limited.

Opportunities:

- A number of tools and approaches designed for data-limited fisheries are available and are relevant to different phases of adaptation planning (e.g., Dowling *et al.*, 2016, [FishPath](#), the [Data Limited Toolkit](#)). Spatial analyses to inform climate-aware marine protected areas planning can use general indicators of reef resilience (e.g., depth, structural complexity, coral cover) as proxies for climate resilience (e.g., Davies *et al.*, 2016). Existing management area boundaries can instead be overlaid with high-resolution projections of species range shifts under future climate scenarios produced as part of the PPCR Caribbean Track project for a more direct assessment of anticipated conservation effectiveness in light of climate change.
- The simplest fishing regulations will also be the easiest to effectively enforce and so fisheries managers should strive for adequate enforcement of existing regulations before adding new harvest control rules.

Action 2.1.3-4: Identify, and where possible develop and keep under review, sustainable alternative livelihood opportunities for fisherfolk and other vulnerable groups in the coastal zone. This action is linked to Action 2.1.3-2: Design rehabilitation, reconstruction and recovery activities to rebuild livelihoods that are more sustainable and resilient than those existing before the disaster, while avoiding contributing to “poverty traps” by increasing dependence on aid (e.g., harmful fisheries subsidies), and Action 2.1.3-3: Keep under review the capacity needs of fishers and coastal communities to confront more extreme rough sea events by improving safety at sea, early warning systems, and community-based or assisted rescue capabilities that leverage emerging technologies.

Justification: Both the anticipated impacts of climate change on marine habitats and populations of fished species and many of the conservation-oriented adaptation strategies adopted in response, such as enhanced fishing regulations and ecosystem protective measures, have the potential to cause hardships to fishing communities unless they are mitigated through complementary socio-economic rehabilitation and adaptation strategies (Shaffril *et al.*, 2017; Savo, 2017; Cinner *et al.*, 2018). Along with these longer-term risks to sustained extraction of marine resources, increased frequency and severity of extreme weather conditions at sea carries significant implications for both catches and the safety of fishers while at sea, especially as fishers travel farther to pursue pelagic fish species in an effort to diversify their catch in the face of shifting fish populations (ILO, 2014; Monnereau and Oxenford, 2017). Bolstering the capacity of fishers and fishing communities to be more resilient to climate change through livelihood diversification and also enhancements in preparedness and response for managing adverse conditions such as rough seas and natural disaster events will reduce the likelihood of vulnerable community members pursuing unsustainable and unsafe livelihood practices (e.g., illegal fishing, see Ahmed *et al.*, 2019). CRFM (2019a) lists a number of related adaptation measures, including the following:

- Financial assistance, skills development training (including business skills), and mentorship to support diversification within the sector (fishing methods, target species, post-harvest processing and marketing) and across sectors (expanding participation in marine tourism, agriculture, or other market opportunities, such as seamount farming).
- Inspection programs to verify maintenance records and assess seaworthiness of vessels (including small-scale vessels) should be promoted which would improve the safety of fishers and aid in their accessibility to insurance schemes.
- Scaling up trainings in engine repair, vessel maintenance and the implementation of safety-at-sea practices, protocols, and equipment to prepare for maritime emergencies.
- Purchase and use of dedicated safety equipment including VHF radios, navigation lights, compass and charts or navigational global positioning systems (GPS), vessel monitoring systems, rain gear,

life vests, flares, and fire extinguishers to use during emergencies (Monnereau and Oxenford, 2017; C-FISH, 2016; Tietze and van Anrooy, 2018).

- Mainstreaming the use of the Fisheries Early Warning and Emergency Response (FEWER) ICT Solution as part of sectoral emergency management and rescue efforts at sea.

Key Considerations for Implementation

Challenges:

- The options described above to improve livelihood diversification, as well as climate change and disaster preparedness and response are context-specific. This is because the sensitivity to climate change and other threats and capacity to manage them is uneven across a given fishing fleet (Stoll *et al.* 2017). The benefits derived from these programs are contingent on careful design that takes into account pressures, drivers and motivations underlying unsustainable and unsafe behaviours, segmented by different target audiences (e.g., large-scale and small-scale fishers; men and women) and their needs. Livelihood diversification and rehabilitation strategies can be more successful by first conducting surveys to assess interest in a range of alternative livelihoods among those employed in the fisheries sector.
- Where resources are limited, training is the least resource-intensive adaptation option. Indeed, safety-at-sea and skills development training has been implemented as part of a number of alternative livelihoods and adaptation projects throughout the Caribbean, as has specialized training in the proper use of early warning systems (FEWER, in particular). However, adopting new behaviours and practices or getting to the necessarily skills levels to do things differently can rarely be effectively accomplished through a few short training sessions. Additional supports are often required, including the purchase of specific supplies and equipment, long-term mentorship and follow-up incentives, which can be resource-intensive to sustain.
- Even where supports are available, fisherfolk may be reluctant to change practices and activities for psychological and cultural reasons, particularly as regards pursuing alternative livelihoods. Fisherfolk can derive a sense of self in their fishing occupation, location, and lifestyle that may make it challenging to transition into alternative employment (Cinner *et al.*, 2018).

Opportunities:

- Several resources exist to help design interventions requiring social change (see, for example, Rare and the Behavioural Insights Team 2019).
- In recognition of these financial, social, cultural, and environmental challenges to the successes in livelihood diversification, many practitioners have published lessons learned and best practices for implementation of livelihood diversification initiatives in small-scale fisheries households and communities (Gillett *et al.*, 2008; APFIC, 2010). This includes implementing complementary strategies to improve access to credit (Bell *et al.*, 2018; Cinner *et al.*, 2018), fostering partnerships with existing businesses (Gillett *et al.*, 2008) and matching socio-economic interventions with management reforms to reverse the degradation of the fisheries resource base (APFIC, 2010).
- National implementation of the FAO's SSF Guidelines presents an opportunity for national fisherfolk unions and cooperatives to build internal organizational capacity and attend to issues of sustainable livelihoods and climate and disaster resilience (McConney *et al.*, 2017), and this has formal regional-level support in CRFM's Protocol on Securing Small-Scale Fisheries Guidelines under the CCCFP (CRFM, 2020).

Action 2.1.3-6:* Develop and institutionalize infrastructure and logistics to reduce product losses and support post-harvest handling, transportation, distribution, processing (including value-added products), and marketing of food within and amongst individual countries, based on needs and local conditions expected under a future climate.

Justification: Aside from affecting fish harvesting levels, climate change has the potential to impact the sector through post-harvest processing and marketing. Enhancing post-harvest handling, processing, and marketing can help to preserve and extend the benefits of harvest adaptation strategies. For example, enhancing post-harvest practices can help to significantly extend the shelf life of the catch and maintain

market access to fish during interruptions in supply. Training in food safety (e.g., HACCP) and in traditional methods of food preservation (e.g., smoking, salting, and drying) that do not rely on a power supply; investing in refrigeration systems (e.g., purchase of coolers, ice machines, and freezers to bank catches) and in decentralized power sources (e.g., solar power, wind power, generators) are among the types of adaptation measures included in this category (Bell *et al.*, 2018; CANARI, 2015; Dunstan *et al.*, 2018; Tietze and van Anrooy, 2018). These measures can help to stabilize the supply of fish, reduce the likelihood of food-borne disease or pathogens affecting fish consumers, and better meet food safety requirements for export markets (CANARI, 2015; Dunstan *et al.*, 2018). CRFM countries have also been working to improve legislation for sanitary standards and controls, and to build capacity in fish food safety monitoring and regulation (e.g., CRFM, 2017; 2017a, b), and to foster networking for value creation and value addition activities (e.g., CRFM, 2018; 2019c). Support for market promotion to encourage consumption of new, more sustainable fish species not commonly consumed in the past are another type of measure to build resilience to climate change (Bell *et al.*, 2018). Additionally, many assets within the fisheries sector are vulnerable to physical damage due to sea level rise and extreme weather, including fishing gear, vessels, piers, fish landing sites, processing facilities and markets, as well as transportation infrastructure. Countries are increasingly recognizing the need to apply a climate lens to coastal management and harden, retrofit or relocate fisheries and aquaculture infrastructure and assets to build resilience to climate impacts (e.g., Government of Saint Lucia, 2018; Mycoo, 2018).

The Caribbean has taken initial steps to implement value chain management approaches to optimize economic benefits from marine resources even in the face of a decreased or weakened resource base (e.g., CRFM 2017a, 2019c). However, significant work remains to ensure these approaches are holistic (not one offs), integrated into existing management and practice. Optimizing post-harvest management and marketing of fish and seafood products also requires connecting fishers to markets, understanding gendered differences across the value chain and embracing the rights-based approaches enshrined in the CCCFP-SSF Protocol.

Key Considerations for Implementation

Challenges:

- The range of options described above to enhance post-harvest handling, processing and marketing is vast and the potential benefit of implementing each will be context-specific. Understanding baseline conditions of post-harvest and marketing activities, to identify where along the chain to intervene to achieve most impact (however defined) and who to target will be necessary. Information on current supply-side inefficiencies or unmet needs, as perceived by consumers, can also help select the most promising intervention approaches.
- Community infrastructure projects built using funds from short-term development projects are likely to fail (“rust out”) if they do not adequately account for operating costs (e.g., electricity bills) and long-term maintenance needs (e.g., local availability of parts and expertise for repair in case of breakdowns).
- Setting priorities for asset hardening and protection requires an understanding of current and future vulnerability and risk, which can involve data-intensive methods.
- Strategies for protection of coastal infrastructure should ideally be implemented as part of a broader coastal zone management strategy, and are most effective when using several complementary approaches (Mycoo and Chadwick, 2012). Therefore, coordination between the fisheries sector and other sectors operating in marine and coastal environments will be necessary.

Opportunities:

- ICT solutions to secure sustainable SSF developed for and by fisherfolk are increasingly available. For example, Abalobi (<http://abalobi.info/>) is a mobile app suite that promotes “*traceable, storied seafood by empowered small-scale fishers from hook to cook, in a manner that is not only ecologically responsible, but also socially fair.*” The scope of the mobile app covers the full fish value chain, from fishery monitoring and maritime safety to local development and market opportunities. Abalobi began as a participatory research project and is now a registered social enterprise in South Africa.

- Certification, such as through the Marine Stewardship Council, is a key marketing mechanism that influences consumer choices and provides strong incentives toward sustainable seafood production. Among the CRFM membership, three major commercial fisheries are MSC-certified: The Bahamas spiny lobster fishery, and the Atlantic Seabob trawl fisheries of each of Suriname and Guyana. These fisheries have greatly improved their management systems to meet the MSC standard, that covers not only the target resource, but considers environmental stewardship and ensuring coordinated and well-supported industry responses.
- Projects aimed at increasing access to community infrastructure, such as ice production and cold storage infrastructure, are more likely succeed if local organizations (e.g., fishing cooperative, fish market, fisheries authorities) are engaged from the outset to oversee long term maintenance and funding for continued operations is secure.
- A range of guiding documents and protocols are available to enable accounting for climate change risk in the design of individual physical assets (e.g., Scott *et al.*, 2013), with lessons emerging from application of this guidance.
- CRFM’s collaborative work with CCRIF to develop appropriate insurance coverage for the fisheries sector is already improving risk awareness and informed risk management capabilities.
- Post-disaster damage and loss assessments, which reveal relative vulnerabilities to hazard events, could be leveraged to derive rankings of areas and assets in need of protection on a priority basis. These assessments can also be used to inform insurance payouts.

3.3 Strategic Element 3: Fossil Fuel Independence



Overview

The region remains disproportionately dependent on imported fossil fuels, increasing exposure to volatile and rising oil prices; limiting economic development; and failing to establish a precedent for global action to mitigate the long-term consequences of climate change. Transition to fuel efficient and renewable energy sources in the fisheries and aquaculture sector will help to offset the impacts of rising energy costs associated with vessel operation, cold storage, and processing of seafood products. The goals associated with this strategic element emphasize enhancing uptake of energy efficiency and conservation practices, as well as renewable energy technologies.

Table 6: Goals and Actions related to Strategic Element 3 of the Regional Strategy, which is focused on fossil fuel independence. Actions target particular stages of the fisheries value chain. Many actions have been carried over from the 2013 Strategy and Action Plan, while those marked with an asterisk () have been newly added in this edition of the Regional Strategy and Action Plan. [-] denotes actions that have seen least progress, as rated by stakeholders. [+] denotes actions that have seen most progress. These ratings are based on perspectives of regional and national fisheries officers gleaned through a workshop and an online survey.*

Strategic Element 3: Reduction of the region’s reliance on fossil fuels	Stage of Fisheries Value Chain
Goal 3.1: Energy efficiency and conservation standards and measures are adopted	Medium Priority
Action 3.1.1: Support sector-wide audits of the energy used by fishing vessels to systematically evaluate the potential cost and environmental benefits of fuel-saving practices.	Enabling Environment
Action 3.1.2: Accelerate the use of more fuel efficient and affordable outboard and inboard engines in fishing vessels.	Fishers, Vessels, and Gear

Strategic Element 3: Reduction of the region’s reliance on fossil fuels	Stage of Fisheries Value Chain
Action 3.1.3: Align aquaculture and onshore fish processing to take advantage of advances in energy conservation and fuel-efficient technologies (including implementing energy audits, selecting feedstuffs with lower associated emissions, etc.).	Fishers, Vessels, and Gear Aquaculturists Markets, Vendors, and Processors
Action 3.1.4: *Improve energy efficiency in cold storage and ice plants at landing sites and fisheries complexes.	Markets, Vendors, and Processors
Goal 3.2: Deployment of renewable energy technologies is intensified.	
Action 3.2.1: *Accelerate research into and commercialization of low emission intensity fuels use in fishing vessels, management of feed mills and processing plants.	Enabling Environment Fishers, Vessels, and Gear Aquaculturists Markets, Vendors, and Processors
Action 3.2.2: *Increase research, development and investment funding for green technology such as supplemental wind and solar power for fishing vessels and processing plants.	Enabling Environment Fishers, Vessels, and Gear Markets, Vendors, and Processors

3.4 Strategic Element 4: Sustainable Forest Ecosystems



Overview

Mangrove forests are vulnerable to the impacts of sea-level rise and extreme weather anticipated under future climate projections if they are not afforded the time and space to retreat inland (McLeon and Salm, 2006; Ward *et al.*, 2016; Feller *et al.*, 2017). Improving sustainable management of forest ecosystems within a climate change context will help to preserve these landscapes and the important ecosystem services they provide, including the livelihoods of dependent communities and indigenous peoples. Within a fisheries and aquaculture context, these ecosystem services include contributing to carbon sequestration (Duarte *et al.*, 2013; Serrano *et al.*, 2019), acting as nursery habitats for important fisheries species (Bell *et al.*, 2018), and offering protection from coastal storm surge, flooding, and erosion during extreme weather events (Chang, 2006; Spalding *et al.*, 2014; Menéndez *et al.*, 2020).

The goals associated with this strategic element emphasize sustainable management of forest resources and associated ecosystems within an integrated, ecosystem-based management framework. It is important to recognize that any efforts towards this strategic element depends on a clear understanding of land use and tenure arrangements as well as inclusive participation of both land users, land owners, and indigenous peoples to ensure successful implementation (Worthington and Spalding, 2018; Lovelock and Brown, 2019; Lee *et al.*, 2019; Pearson *et al.*, 2020).

Table 7: Goals and Actions related to Strategic Element 4 of the Regional Strategy, which is focused on sustainable forest management. Actions target particular stages of the fisheries value chain. Many actions have been carried over from the 2013 Strategy and Action Plan, while those marked with an asterisk (*) have been newly added in this edition of the Regional Strategy and Action Plan. [-] denotes actions that have seen least progress, as rated by stakeholders. [+] denotes actions that have seen most progress. These ratings are based on perspectives of regional and national fisheries officers gleaned through a workshop and an online survey.

Strategic Element 4: Sustainable management of forest ecosystems and associated landscapes	Stage of Fisheries Value Chain
Goal 4.1: Best practices and best fit solutions for sustainable forest management are adopted that address climate change and include consideration for indigenous peoples, their cultures, and traditions.	Medium Priority
Action 4.1.1: Economic valuation of both monetary (timber and non-timber products and services) and non-monetary (community livelihoods, food and nutritional security, coastal protection) forest resources and benefits in selected countries	Ecosystem Mgmt.
Action 4.1.2: Add to the cases of economic valuation of coastal forests such as mangroves for alternative uses including those related to fisheries and aquaculture; share lessons from the valuation studies in order to guide policy	Ecosystem Mgmt.
Action 4.1.3: Enact legislation to support implementation of management plans.	Ecosystem Mgmt.
Goal 4.2: Associated landscapes and seascapes are integrated into the sustainable management of forest ecosystems. (Associated Landscapes: Savannas, dry forests, littoral forests, mangroves and wetlands).	Medium Priority
Action 4.2.1: Protection, including reforestation, of mangrove swamps in selected coastal areas, and ensuring these initiatives are robust to a future climate so that benefits are not lost. [-]	Ecosystem Mgmt.
Action 4.2.2: Enhance the linkages between forest management in upland watersheds and coastal management, including aspects such as ensuring freshwater supplies and flows sufficient for both aquaculture and coastal ecosystem	Ecosystem Mgmt.

3.5 Strategic Element 5: Education & Knowledge



Overview

Building a foundation of understanding and knowledge about climate change vulnerability and impacts is the first step towards successful adaptation (USAID, 2019). Although scientific understanding of climate change risks to the Caribbean fisheries sector has improved in recent years (CRFM, 2019), many information gaps remain that can slow down progress on adaptation and climate risk management. In addition, prior studies have shown that understanding of climate change impacts and adaptation options among Caribbean fisherfolk sector needs improvement (e.g., Baptiste, 2018; Smith, 2018; CRFM, 2019b). Adaptation planning for the fisheries sector would benefit from additional research, outreach, education, training, and capacity-building initiatives. As our understanding of risks, impacts and adaptation options improves, it is imperative to communicate this information to fishing communities using current best practices for climate change communication and social behaviour change campaigns to ensure that knowledge is translated into action (Dupar *et al.*, 2019; USAID, 2019). The goals associated with this strategic element emphasize outreach, education and information and knowledge management efforts as foundations for shifts in attitudes and behaviours around climate action.

Table 8: Goals and Actions related to Strategic Element 5 of the Regional Strategy, which is focused on education and knowledge transfer. Actions target particular stages of the fisheries value chain. Many actions have been carried over from the 2013 Strategy and Action Plan, while those marked with an asterisk (*) have been newly added in this edition of the Regional Strategy and Action Plan. [-] denotes actions that have seen least progress, as rated by stakeholders. [+] denotes actions that have seen most progress. These ratings are based on perspectives of regional and national fisheries officers gleaned through a workshop and an online survey.

Strategic Element 5: Society with the impetus and capacity for building resilience to the impacts of climate change	Stage of Fisheries Value Chain
Goal 5.1: Programmes for enhancing knowledge, education and awareness of the impacts of climate change are intensified.	High Priority
Action 5.1.1: Expand partnerships within and outside the region to enhance Caribbean technical expertise and capacity to produce and make available climate modelling outputs data at higher spatial resolutions (e.g., 10 square kilometre grids) for direct use by the sector.	Ecosystem Management
Action 5.1.2: Strengthen the sea-level rise monitoring network and its permanence as an official monitoring and analysis program under the leadership of the Caribbean Institute for Meteorology and Hydrology (CIMH).	Ecosystem Management
Action 5.1.3: Continue to advance modelling to forecast changes in distribution, abundance and production of commercially important fisheries (e.g. lobsters, conch, shrimp, ground fish, tunas, flyingfish, groupers, snappers etc.) and the social and economic impacts (food security, employment, income etc.) based on different climate scenarios (temp, salinity, pH, etc.) to facilitate planning, decision-making and disaster risk management. [-][+]	Fisheries Management Fishers, Vessels, and Gear Markets, Vendors, and Processors
Action 5.1.4: CFRM to continue work in technical research priority areas and provide technical assistance to national governments.	Enabling Environment
5.2: Science, Technology, Reading and writing, Engineering, Arts and Maths (STREAM) to support climate-resilient innovation are integrated into the curricula at all education levels.	Medium Priority
Action 5.2.1: University of West Indies (UWI) as well as other tertiary research and education institutions to be provided with institutional support (building and equipment) to allow for expansion of teaching and research functions.	Enabling Environment
Action 5.2.2: Implement and institutionalize regional coastal and inshore ecosystems and social systems research programmes through formal regional partnership arrangements with the relevant competent agencies and institutions.	Ecosystem Management
Action 5.2.3: Develop and / or implement new research and teaching areas in alternative energy, waste management, resource economics and marine spatial analysis techniques.	Enabling Environment
Action 5.2.4: Develop education and training for the entire DRM cycle, especially for climate-related disaster mitigation in fisheries and aquaculture. [+]	Enabling Environment
5.3: Society is more proactive in reducing risks associated with climate change.	High Priority
Action 5.3.1: Develop the capacity of stakeholders in the fisheries sector to incorporate climate change considerations, including DRM, in fisheries development and management.	Fisheries Management
Action 5.3.2: Strengthen the capability of fisherfolk organisations at the regional, national and local levels to enhance community participation in planning and implementing programmes to increase resilience to climate change. [+]	Fishers, Vessels, and Gear
Action 5.3.3: Strengthen the capacity of stakeholders at regional, national and local levels for early warning and response delivered locally. [+]	Enabling Environment

Strategic Element 5: Society with the impetus and capacity for building resilience to the impacts of climate change	Stage of Fisheries Value Chain
Action 5.3.4: Encourage public and private sector tourism stakeholders and civil society to apply a mix of technology and behavioural change to address the issue of climate change.	Enabling Environment
5.4: Comprehensive national and regional data collection, management, sharing and reporting systems are instituted.	High Priority
Action 5.4.1: Institutionalize the network of Coral Reef Early Warning Systems (CREWS) and monitoring programs in all countries with coral reefs, through partnerships between UWI and national agencies.	Enabling Environment
Action 5.4.2: Undertake mapping and valuation of coastal ecosystems and habitats, including coral reefs, sea-grass beds, mangrove systems, to document location, state of health and benefits to people (e.g., economic, livelihoods, food security) [-]	Ecosystem Management
Action 5.4.3:* Undertake mapping of fish species distributions through fishery-dependent and fishery-independent monitoring programs to track range shifts expected under future climate change.	Ecosystem Management
Action 5.4.4:* Establish or strengthen systems to collect and compile data on fisheries catch and effort and aquaculture data, as well as collecting complementary biological, ecological, economic, social (including gender), and other relevant data needed to monitor and contextualize performance of key biological, social, and economic indicators of the status of the fisheries system.	Fisheries Management
Action 5.4.5: Monitor and evaluate the implementation of fisheries management plans in such a way as to be prepared to replace physical infrastructure, technology and practices with improvements should disaster recovery allow wholesale replacements. [-]	Fisheries Management
Action 5.4.6: Build local and national capacities to undertake hazard identification and analysis, undertake risk assessments and compile risk mapping down to the local level to facilitate empowerment and strengthen subsidiarity.	Enabling Environment
Action 5.4.7: Document, analyze and understand local knowledge, existing strengths, coping strategies and community measures in disaster-prone coastal communities so as to build on and share lessons about their resilience. [-]	Enabling Environment
Action 5.4.8:* Develop, populate, and curate a centralized repository for spatial information related to marine ecosystems and species, fishing locations, fisheries infrastructure, and future climate risk maps to inform national and regional marine spatial planning efforts.	Enabling Environment
5.5: Attitudes and behaviours towards enhancing national and regional climate resilience are positively transformed.	High Priority
Action 5.5.1:* Mainstream best practices in climate change communications and social behaviour change theory into gender-sensitive outreach programs to help convert knowledge to action.	Enabling Environment
Action 5.5.2: Develop and implement climate change and DRM awareness / education / information programme (including relevant fora, websites, databases publications, toolkits, guidelines) targeted to key tourism-sector sub-sectors and stakeholders (public / private sector organizations, civil society / NGO, communities).	Enabling Environment
Action 5.5.3: Sensitize stakeholders, including the general public and health professionals, to the role and threat of climate change in determining wellbeing and health.	Enabling Environment
Action 5.5.4:* Sensitize stakeholders, including the general public, fisherfolk, and health professionals to the specific impacts of climate change on marine ecosystems, fisheries species and value chains, and human health and wellbeing.	Enabling Environment
Action 5.5.5:* Design an evaluation framework for communication and behaviour change campaigns to measure outcomes of individual campaigns,	Enabling Environment

Strategic Element 5: Society with the impetus and capacity for building resilience to the impacts of climate change	Stage of Fisheries Value Chain
track trends in awareness and perceptions of climate change impacts, adaptation and DRM over time, and inform the design of future outreach initiatives.	

Key Actions

Action 5.3.1: Develop the capacity of stakeholders in the fisheries sector to incorporate climate change considerations, including DRM, in fisheries development and management.

Justification: Several aspects of fisheries development and management are sensitive to climate change and variability, with approaches to integrate climate change considerations, including climate-related risks, into monitoring, vulnerability assessment, spatial management, stock assessment, harvest limits, among others, increasingly discussed (Pinsky and Mantua, 2014). As one among a few adaptation strategies (Mycoo and Donovan, 2017), “mainstreaming” climate change considerations alongside development and disaster risk planning tends to be associated with strengthening institutions, policies and plans (Donner and Webber, 2014; Uppanunчай *et al.*, 2017). Nevertheless, the strategy is also applicable to the distributed and community-based decisions across small-scale and industrial fishing sectors. Guidelines, tools and information on climate change impacts and adaptation options are available to support adaptation mainstreaming across the diverse contexts comprising Caribbean fisheries (Jones and Tamburello, 2019) but the uptake of these resources could be improved by building the capacities of government agencies and fisherfolk through awareness-raising, training and mobilization of resources to support changes in behaviour (CANARI, 2018).

Key Considerations for Implementation:

Challenges:

- Relative to immediate pressures facing government agencies and fisherfolk, adapting to projected impacts of climate change is not always a priority. Any attempts to raise awareness of the need to adapt and then proceed through the steps of assessing vulnerabilities, defining objectives, selecting, implementing and monitoring measures to build climate resilience need to adequately connect to priority outcomes of the actors involved (e.g., sustainable livelihoods). This is why baseline studies such as knowledge – attitudes – practice studies are critical to designing effective interventions that account for differences in aspirations, risk tolerance and assets to leverage.
- The absence of reliable information on future impacts of climate change and variability at temporal and spatial scales that are useful for decision making is a commonly-cited barrier to moving forward on adaptation (Moser and Ekstrom, 2010). At the same time there is an emerging scholarship and practice on approaches to make best use of seasonal climate forecasts and long-term climate projections to support climate-smart decisions across society (Buizer *et al.*, 2016; Dunstan *et al.*, 2018). The recent Memorandum of Understanding between the CRFM and CDEMA to sustain FEWER is one example of efforts afoot to increase access to weather information to fisherfolk, as a way to enhance risk management. Within the region CIMH has the institutional mandate to lead development of climate services, with agriculture as one priority sector for product development.

Opportunities:

- A first step in strengthening the ability to integrate climate change considerations in decisions across the sector is to understand who is vulnerable, to what and why (Murray, 2016). There is a proliferation of guidance and tools to support climate change vulnerability assessment at different scales and using a range of participatory, indicator-based or modelling based methods (e.g., see IFAD, 2014; FAO, 2015a). As well, national and regional climate change projects focused on the sector generally include climate change vulnerability assessment (or aspects of it) as part of their scope of work (e.g., CANARI, 2018; CC4FISH, CRFM, 2019). There are lessons emerging on how best to undertake these assessments so they serve the needs of fisheries managers, coastal communities and fisherfolk.

- Training resources are available to tailor to local, national and regional contexts. For example, the Caribbean track PPCR Project delivered from 2018-2020 generated numerous scientific (e.g., mapped outputs of future species distribution under climate change, a compendium of adaptation options), communications products and training modules that are publicly available through the CRFM data portal. Other promising sources include Reef Resilience Online Courses ([Adaptation Design Tool](#)), Blue Solutions Training (Climate change adaptation in coastal and marine areas - [Blue CCA](#)) and [AdaptationCommunity.net](#).

Action 5.4.4:* Establish or strengthen systems to collect and compile data on fisheries catch and effort and aquaculture data, as well as collecting complementary biological, ecological, economic, social (including gender), and other relevant data needed to monitor and contextualize performance of key biological, social, and economic indicators of the status of the fisheries system.

Justification: The importance of evidence-based decision-making in the Caribbean fisheries sector and the need to strengthen multi-level data collection, monitoring and reporting in support of stock assessment, fisheries management and sustainable development is increasingly recognized. Regional initiatives such as the Western Central Atlantic Fishery Commission’s Data Collection Reference Framework (FAO, 2019), CLME+ (e.g., State of the Marine Environment and Economies) and the proposed climate-smart fisheries monitoring framework as part of PPCR-Caribbean Track activities (CRFM, 2019a) all support the establishment of new mechanisms or strengthening of existing ones. The objectives and, therefore, indicator priorities differ across these multi-level initiatives but ensuring holistic and long-term coverage of the socio-ecological systems represented in Caribbean fisheries will be critical to building resilience to climate change and meeting other Sustainable Development Goals. For example, monitoring changes in essential fish habitats may provide an early warning of pending changes to fish distribution, enabling implementation of proactive management strategies as part of broader ecosystem-based management (Cogan *et al.*, 2009; Anderson *et al.*, 2015; Karp *et al.*, 2018). Early identification of climate-induced changes to fish stocks or key habitats can help build a case for enhanced habitat protection and more aggressive harvest limits for vulnerable species. Understanding the relationship between distribution, abundance, and productivity of fish stocks and climate-driven changes to the environment is necessary to predict and effectively manage those changes. Predicting the possible risk exposure of small-scale fishers and fishing communities to the impacts of climate change on target fish species can pave the way for social transitions that may be necessary to build climate resilience.

Key Considerations for Implementation:

Challenges:

- There is a degree of fragmentation across the multi-level data collection and monitoring mechanisms mentioned above. Therefore, there is a risk of duplication, consultation burnout and missed opportunities for joint action, unless coordination capacity is strengthened.
- As these mechanisms and frameworks move ahead, the region would benefit from a central repository where spatial and tabular information could be stored for easy reference during adaptation planning and marine spatial planning (linked to Action 1.5.2 and the information portal managed by CRFM <http://portal.crfm.int/>).
- This endeavor would strongly benefit from the development of greater regional and national capacity and technical expertise to design and uptake monitoring programs, undertake data collection, and analyze monitoring data to address management questions.
- Within national and regional systems, collection of socio-economic data beyond that required for catch and effort estimation is limited (CRFM, 2019a). Indicators that are specific to the achievement of gender equality, equity and the empowerment of women in fisheries are largely absent (GIFT, 2018).
- Sustaining results (capacity, tool and information use) from short-term projects in support of data collection and monitoring can be challenging due to issues such as turnover in trained staff, lack of long-term mentoring and the need for maintenance of bespoke software applications over time.

- Fisheries management practices in the region are often disconnected from the science, and so this linkage would need to be strengthened to ensure meaningful use of the systems for the purposes intended.

Opportunities:

- Public-private partnerships, especially with Environmental Non-Governmental Organizations (ENGOS), have helped to provide added capacity for mapping and other forms of environmental, fisheries and socio-economic data collection and data analysis.
- CRFM’s Continental Shelf Fisheries Working Group (CSWG) has been supporting both Guyana and Suriname to update their seabob fishery assessments and management systems to satisfy the MSC standard. The CSWG has identified the need to incorporate climate change effects, including the impact of Sargassum on fishery performance (CRFM, 2019d).
- All CRFM fisheries working groups were re-configured in 2014 to take into account the need to promote ecosystem-based approaches to fisheries monitoring and development of fisheries management advice. (CRFM 2015).
- Administered through the FAO, the initiative “Fisheries information technology innovations for resource management and climate change adaptation in the Caribbean (FIT4CC)” shows promise in supporting the set-up a comprehensive data and statistics “ecosystem” to move toward evidence-based decision making in fisheries and aquaculture.
- Open source toolkits and ICT applications to support field-based data collection are now widely available and tested, demonstrating their ability to work in the SIDS contexts. One such toolkit is Open ArtFish, which includes a generic database and mobile phone application to support routine small-scale fisheries data collection (see <http://www.fao.org/fishery/static/OpenArtfish/Toolkit.pdf>).

Action 5.5.1:* Mainstream best practices in climate change communications and social behaviour change theory into gender-responsive outreach programs to help convert knowledge to action.

Justification: Most climate change adaptation measures require people to change their behaviours or adopt new ones. Conveying information on climate change impacts and adaptation options is helpful, but must be done correctly, following climate change communication best practices, to resonate with the audience and create empowerment rather than hopelessness (Dupar *et al.*, 2019; CANARI, 2017). Even when these messages are well-crafted, many studies have shown that information alone is not sufficient to bring about behaviour change, but an emerging body of research on social behaviour change (SBC) provides a wider range of tools such as social marketing, incentives and disincentives, reducing barriers, and many others that are much more effective in achieving desired behaviour change outcomes (Rare and BIT, 2019; USAID, 2019). Education and outreach initiatives promoting adaptation strategies in the fisheries sector should incorporate these best practices into the design of outreach campaigns to achieve better outcomes. This includes attention to gender issues so men and women benefit equally from these outreach and communications efforts (CERMES, 2018).

Key Considerations for Implementation:

Challenges:

- Implementing best practices requires additional training of communications, education and outreach personnel on participatory approaches and behavioural change concepts.
- Strategies to motivate, socialize and ease the change toward more beneficial and adaptive practices (Rare and BIT, 2019; Battista *et al.*, 2018) require interpersonal communications, peer to peer exchange (Evans and Teer-Tomaselli, 2018) and training, which can be resource intensive. As well, closer collaboration with fisheries organizations and extension officers may be required to implement some behaviour-change strategies, such as incentives and disincentives or regulations. The most effective social behaviour change initiatives target individuals in different roles (e.g., fishers, vendors, processors, conservationists, regulators) at the same time (USAID, 2019).
- Sex-disaggregated data of actors throughout fish value chains and gender analysis are necessary to develop gender-responsive outreach and communication strategies. Training extension staff to

improve knowledge of issues around gender inequality and skills in gender analysis will be required (CERMES, 2018).

Opportunities:

- While social behaviour change initiatives usually require more time, effort, and resources than purely informational campaigns, they tend to be more effective.
- The PPCR-Caribbean Track project produced a number of climate change communications resources (posters, video documentary and discussion guide) and a climate change knowledge attitudes and practice study that can inform new initiatives.
- Social media (e.g., Facebook, WhatsApp) and ICTs can be harnessed for mass communications and to mobilize communities. Their use can boost the reach and extend participation rates of communications and outreach, particularly by women in the sector (CERMES, 2018).
- The Caribbean Network of Fisherfolk Organisations was a delivery partner on the Climate Change Adaptation in the Eastern Caribbean Fisheries Sector project (CC4Fish), building their capacity for knowledge-sharing on adaptation in SSF.
- As CARICOM Member States deploy these types of behaviour change efforts there is an opportunity to gather lessons and share them regionally. For example, Jamaica is launching a behaviour change and public education campaign as part of the Climate Data & Information Management Project (ICDIMP) project.

Action 5.5.5:* Design an evaluation framework for communication and behaviour change campaigns to measure outcomes of individual campaigns, track trends in awareness and perceptions of climate change impacts, adaptation and DRM over time, and inform the design of future outreach initiatives.

A number of communications, behaviour change and outreach campaigns have been implemented in the Caribbean to enable fisherfolk and coastal communities to gain knowledge to support shifts in attitudes and stimulate uptake of adaptive behaviors in the face of growing impacts from climate change and climate-related disasters. These campaigns tend to be informed by risk perception research and baseline studies on knowledge attitudes and practice (e.g., CRFM, 2019b; Smith, 2018; Baptiste, 2018; Severin and Small, 2016). Implementation of these campaigns can provide robust information on i) messages worth reinforcing through other channels, ii) adaptation behaviours that merit targeting and how and iii) interventions worth scaling up due to their cost-effectiveness and potential for creating lasting change. However, gathering reliable evidence as to their effectiveness requires monitoring and evaluation (M&E) of these individual campaigns. At the same time, a holistic approach to adaptation and DRM in the sector requires behaviour change at multiple scales (local to regional) and across all segments in the fish value chain. By identifying a limited number of broadly-applicable key performance indicators and promoting their use within individual campaigns national and regional organizations could have access to consistent data to track changes in behaviour over time, the evaluation of which could then inform research and outreach to address gaps.

Key Considerations for Implementation:

Challenges:

- Many actors have roles in designing and implementing communication and behaviour change campaigns targeting the fisheries sector so the coordination effort to agree on indicators to use and share data seamlessly would be significant.
- Communications and behaviour change campaigns in the region tend to rely on project funding and, therefore, too short in duration to achieve measurable changes in target behaviours.
- Systematic literature reviews and new research is likely needed to clarify target adaptive behaviours to promote at each segment of the fish value chain, in response to observed and expected climate vulnerabilities.

Opportunities:

- Working through the Caribbean node of the Global Socio-economic Monitoring Initiative for Coastal Management (SocMon) could be an efficient way to disseminate guidance and serve as a central repository for M&E data stemming from communications and behavioural change campaigns in the region.
- As behavioural insights research and implementation at local levels gains traction Caribbean nations can benefit from the growing evidence base and guidance available. For example, through the Fish Forever project, the Rare Center for Behavior and the Environment has identified four behaviors for responsible coastal fishing: 1) becoming a registered fisher; 2) recording fish catch; 3) respecting fishing regulations; and 4) participating in fisheries management and policy (see [here](#)).

3.6 Strategic Element 6: Climate Finance Access



Overview

Meeting the costs of adaptation and climate-risk management presents major challenges for states, communities and individuals. This is particularly true for many in the fisheries and aquaculture sector, who are often self-employed with little safety net in the event of a major weather event or climate-related disruption. Lack of access to funding is a commonly cited barrier to climate change adaptation at all scales and the flow of new and additional funding to develop projects and programs in the fisheries and aquaculture sector stands out as a key enabler for action (e.g., Government of Saint Lucia, 2018). Despite the importance of fisheries to the region relatively little climate finance has been directed into this sector within the Caribbean to date (Atteridge *et al.*, 2017). However, fisheries are increasingly moving up the policy agenda and a higher profile is expected to bring with it increased opportunities for financing (Blasiak and Wabnitz, 2018, 2019; Guggisberg, 2019; McManus *et al.*, 2019). Developing access to financing through international (multilateral, bilateral arrangements, dedicated climate finance) and domestic instruments will help to transform the landscape for financing of adaptation, mitigation and climate-risk management initiatives in fisheries and other sectors across the region. The goals associated with this strategic element emphasize both access to external finance and mobilization of domestic resources.

Table 9: Goals and Actions related to Strategic Element 6 of the Regional Strategy, which is focused on climate finance access. Actions target particular stages of the fisheries value chain. Many actions have been carried over from the 2013 Strategy and Action Plan, while those marked with an asterisk () have been newly added in this edition of the Regional Strategy and Action Plan. [-] denotes actions that have seen least progress, as rated by stakeholders. [+] denotes actions that have seen most progress. These ratings are based on perspectives of regional and national fisheries officers gleaned through a workshop and an online survey.*

Strategic Element 6: Sustained access to and provision of national, regional and international climate finance	Stage of Fisheries Value Chain
Goal 6.1: Frameworks for access to international climate financing including multilateral, regional and other bilateral arrangements are institutionalized.	Medium Priority
Action 6.1.1:* Track development assistance and international climate finance flows to regional and national fisheries and aquaculture adaptation efforts.	Enabling Environment
Action 6.1.2: * Advocate for alignment between allocations of ODA and additional international climate finance for fisheries and aquaculture under climate change with regional development goals and targets.	Enabling Environment
Goal 6.2: Innovative financing mechanisms and the deployment of economic incentives are adopted.	High Priority

Strategic Element 6: Sustained access to and provision of national, regional and international climate finance	Stage of Fisheries Value Chain
Action 6.2.1: *Develop and implement policies and other measures to promote investment in new business opportunities that arise in response to climate change.	Enabling Environment
Action 6.2.2: *Design and implement innovative fiscal instruments or modify existing ones to support investments by individuals (e.g., livelihood diversification, strengthened vessels) and fishing communities (e.g., sustainable construction in less vulnerable coastal zones) in anticipation of future climate change impacts.	Enabling Environment
Action 6.2.3: Develop and expand innovative insurance products, such as life and income insurance where applicable, that can be tied to existing implementation capacity.	Enabling Environment
Action 6.2.4: * Facilitate access to affordable financial products and services (loans, favourable interest rate and terms, compensation schemes) to help those in the fishing sector more quickly access new assets to assist with recovery following extreme events and participate in broader community-scale adaptation.	Enabling Environment

Key Actions

Action 6.2.2: *Design and implement innovative fiscal instruments or modify existing ones to support investments by individuals (e.g., livelihood diversification, strengthened vessels) and fishing communities (e.g., sustainable construction in less vulnerable coastal zones) in anticipation of future climate change impacts.

Justification: As climate change progresses, both gradual effects and extreme events will require spending across society. The fisheries sector will require access to new assets to help them adapt to gradual changes in sector operations, recover from acute losses following extreme weather events and undertake broader community-scale adaptation projects to prevent or lessen the consequences of future climate change impacts. Public-sector intervention is key in implementing adaptation and resilience-building measures (Forni *et al.*, 2019), including investing in climate-resilient infrastructure and deploying fiscal incentives to support private spending on adaptation. Policymakers have a range of fiscal instruments (taxation, subsidies and ecological fiscal transfers) and the need to meet adaptation finance needs is a compelling reason to optimize existing instruments and create new ones with the potential to yield positive outcomes cost-effectively (Mohammed *et al.*, 2018).

Recent analysis by the World Bank on fiscal policies for development and climate action highlight the benefits of environmental tax reforms. These are policy packages that raise taxes from polluting/unsustainable activities and reallocate the revenue to reduce taxes on non-polluting activities or increase public spending on broad-based priorities (e.g., education, critical infrastructure) (Forni *et al.*, 2019). This analysis highlights the flexibility of this approach and the potential for such tax reforms to reduce informality and yield co-benefits across society.

Subsidies are another tool to support the overall well-being of fishing communities. Access to some fishing opportunities under climate change may increase travel distances, and fuel consumption. Provision of incentives for use of more fuel-efficient engines from governments and/or fisheries associations can help to offset the costs of travelling farther to fish (CANARI, 2015; Young *et al.*, 2018). Subsidies require careful design, however, and should involve very clear goals linked to positive contributions to fisheries management, transparent implementation, monitoring and enforcement to prevent unintended and harmful consequences including illegal, unreported and unregulated fishing, maladaptation, dependence, and overcapacity which can lead to overexploitation of fisheries stocks (Khan *et al.*, 2006; Bell *et al.*, 2018; Mohammed *et al.*, 2018).

Key Considerations for Implementation

Challenges:

- Enhancing the use of fiscal instruments for fisheries adaptation can require strengthening of current institutional frameworks, including technical and institutional capacity for fiscal administration (e.g., tax collection), adequate compliance mechanisms and provisions to ensure transparency and accountability (Mohammed *et al.*, 2018).
- Defining use and access rights of marine and coastal resources is key in reforming and creating fiscal instruments. This needs to be done through an inclusive and equitable approach, including recognizing traditional or customary rights (Mohammed *et al.*, 2018). Codifying user rules is one of several actions involved in establishing fisheries co-management schemes as well (Tamura *et al.*, 2018).
- Because the importance of fish and fish-related products in Caribbean diets, careful assessment of the responsiveness of consumer demand to price changes is necessary so consumers do not end up unfairly absorbing taxes applied to producers (Mohammed *et al.*, 2018).

Opportunities:

- Loss and damage assessments and results of studies on the economic consequences for fisher welfare of lower catches and more intense storms due to climate change (e.g., Boyd and Ryan 2019, Murray and Romer-Joseph, in prep.) can help define the magnitude of financial assistance currently needed to recover from extreme weather and the magnitude of potential finance shortfalls in the future.
- Guidance and other supports are available to help governments undertake climate public expenditure reviews (Resch *et al.*, 2017). These reviews and tracking of expenditures over time provide information to enhance budgeting in pursuit of adaptation and resilience goals.
- Global, regional and national adaptation funds (e.g., the Community Disaster Risk Reduction Fund of the Caribbean Development Bank) are available to help public budgets go further. For example, co-financing through grants and loans from multilateral or bilateral funds can help communities to implement larger-scale adaptation projects, such as purchasing freezers to store fish, funding the installation and maintenance of FADs, or implementing coral reef restoration programs (Shaffril *et al.*, 2017). International climate funds have been used to finance adaptation projects in the fisheries sector, including some in the Caribbean, but the opportunity exists to increase the share of finance flowing to this sector overall (Guggisberg, 2018) and within the Caribbean specifically (Atteridge *et al.*, 2017).

6.2.4: * Facilitate access to affordable financial products and services (loans, favourable interest rate and terms, compensation schemes) to help those in the fishing sector more quickly access new assets to assist with recovery following extreme events and participate in broader community-scale adaptation. Linked to Action 6.2.3: Develop and expand innovative insurance products, such as life and income insurance where applicable, that can be tied to existing implementation capacity.

Justification: As the frequency, magnitude or intensity of climate-related hazards shifts under climate change, so too will the sector's risk exposure. Financial instruments have a role to play in boosting the sector's economic resilience through disaster preparedness, response, recovery and adaptation to long-term change (CARE International 2019). For example, broadening access to credits and loans can help fishers acquire new fishing gear and vessels to adapt to new fishing opportunities and to replace lost assets (Shaffril *et al.*, 2017). As well, access to affordable insurance and social assistance programs to replace vessels, equipment and income lost following extreme weather events which may prevent fish harvesters, processors, or sellers from earning income can also be effective (Shaffril *et al.*, 2017; Tietze and van Anrooy, 2018). However, financial instruments of these kinds are currently underutilized or inaccessible to the Caribbean fisheries sector, particularly small-scale fisheries (Monnereau and Oxenford, 2017). As well, credit unions, banks, insurers and regulatory agencies in the Caribbean financial services sector are yet unclear on their roles in providing solutions to address climate change risk (Andrew, 2015). Enhanced collaboration among public, private and philanthropic sectors as well as

international financial institutions is necessary to expand access to flexible financial instruments that meet the needs of actors across the fish value chain.

Key Considerations for Implementation

Challenges:

- Fisherfolk can face a number of “barriers to entry” as consumers of financial products and services. For example, fisherfolk have difficulties accessing credit through formal institutional arrangements because of literacy levels, high bureaucratic burden, lack of adequate collateral, inability to arrange a co-signer and inflexible repayment schedules (Haque *et al.*, 2015). Despite the availability of marine insurance only about 3% of fishing vessels and assets in the Caribbean fisheries sector are insured and less than 20% of fishers had health or life insurance policies, where the primary reason given by fishers for not obtaining insurance was because they could not afford it (Tietze and van Anrooy, 2018).
- A case study focused on Antigua and Barbuda on the financial services sector’s response to climate change revealed low levels of risk perception among financial institutions, minimal use of risk assessment and few cases of formal policies or procedures to address climate change risk (Andrew, 2015). Major hurricane events since then may have caused shifts in risk perception and climate risk management but systematic surveys of the sector are unavailable.

Opportunities:

- Efforts are afoot to link social-protection schemes to climate risk finance, such that the most vulnerable communities have the resources to recover quickly after a climate-related shock. For example, the World Food Program and the World Bank are supporting the Government of Belize in developing risk profiles, designing a risk finance strategy and determining implementation costs (WFP, 2019).
- Information on the potential interplay between institutional interventions, commercial offerings and informal social safety nets is also important to consider. Lessons on the application of micro-finance to reduce vulnerability to climate risk are starting to emerge and can guide the design of new interventions targeting the sector (CARE International, 2019; PPCR, 2018).
- The Inter-American Development Bank (IDB) recently launched a research program to examine the relationship between climate change and financial markets in Latin America and the Caribbean, and is actively supporting assessment and disclosure of financial risk related to climate change (Frisari *et al.*, 2019).
- CRFM is currently working with the Caribbean Catastrophe Risk Insurance Facility Segregated Portfolio Company to extend insurance coverage for fisheries-related losses due to unusually-bad weather conditions and / or high wind and storm surge caused by tropical cyclones beyond the two initial pilot countries.

3.7 Strategic Element 7: Ocean Governance



Overview

The ocean is under increasing pressure from overexploitation, poor management, and now climate change. The Blue Economy paradigm may offer an approach to sustainable development that explicitly integrates climate change considerations into ocean governance to ensure that economic development does not come at the expense of long-term marine ecosystem health and resilience, which is needed to support the fisheries and aquaculture sector (Rustomjee, 2016; Patil *et al.*, 2016, Golden *et al.*, 2017). Importantly, sustainable ocean governance must also address issues surrounding power structures, agency, gender and broader equity norms to facilitate inclusive, participatory decision-making and pave the way for better implementation outcomes (Keen *et al.*, 2018; Cisneros-Montemayor *et al.*, 2019).

Goals within this strategic element are related to mainstreaming of climate change considerations into ocean governance, spatial and economic planning, and sustainable natural resource management decisions.

Table 10: Goals and Actions related to Strategic Element 7 of the Regional Strategy, which is focused on integrative ocean governance. Actions target particular stages of the fisheries value chain. Many actions have been carried over from the 2013 Strategy and Action Plan, while those marked with an asterisk (*) have been newly added in this edition of the Regional Strategy and Action Plan. [-] denotes actions that have seen least progress, as rated by stakeholders. [+] denotes actions that have seen most progress. These ratings are based on perspectives of regional and national fisheries officers gleaned through a workshop and an online survey.

Strategic Element 7: Integration of ocean governance into regional and national decision making on climate change	Stage of Fisheries Value Chain
<i>Goal 7.1: Regional and national coordination mechanisms for ocean governance are strengthened by the inclusion of climate change considerations.</i>	High Priority
Action 7.1.1:* Track, and contribute to as required, the evolution of, international governance arrangements for transboundary stock management beyond fish already known to be highly migratory (e.g., tunas) to encompass species and stocks expected to move with climate change.	Fisheries Management
Action 7.1.2:* Ensure emerging blue economy policies, strategies, and roadmaps for the region incorporate considerations for climate-smart fisheries and aquaculture.	Enabling Environment
Action 7.1.3: Improve governance arrangements by identifying and facilitating the empowerment of vulnerable groups in coastal areas.	Enabling Environment
Action 7.1.4: Ensure that while strengthening coastal community-based organizations (CBOs) in DRM/CCA they are sensitised to fisheries and aquaculture, preferably by linking them to site-based fisherfolk organisations.	Enabling Environment
<i>Goal 7.2: Climate change considerations are incorporated into the blue economy.</i>	Medium Priority
Action 7.2.1: Ensure that small-scale fisheries and aquaculture do not contribute to land or coastal degradation and exacerbate issues of climate change and disasters.	Ecosystem Management
Action 7.2.2: Conduct research to develop methodologies and systems for culture of indigenous marine and brackish water and freshwater species to diversify industry, reduce pressures on the living marine resources and build coastal community resilience to climate change.	Fishers, Vessels, and Gear
Action 7.2.3: Ensure logistical and financial supports are in place to help transition commercial fish processing and storage facilities to future climate conditions.	Markets, Vendors, and Processors
<i>Goal 7.3: Marine spatial planning is integrated into national and regional climate change decision-making.</i>	High Priority
Action 7.3.1:* Use existing asset maps, climate projections, and species-specific risk maps to inform marine spatial planning and conduct additional studies to identify and address important knowledge gaps to inform future planning.	Ecosystem Management
Action 7.3.2:* Use information on changes in patterns of spatial fishing effort to reallocate resources for fisheries management and enforcement across the seascape.	Fisheries Management
Action 7.3.3:* Use climate projections of coastal storm surge and flood risk to inform development strategies for coastal fisheries sector infrastructure (e.g., protect, retreat, relocate, managed realignment, etc.)	Fishers, Vessels, and Gear
<i>Goal 7.4 The sustainable management of marine ecosystems is integrated into Ocean Governance.</i>	High Priority
Action 7.4.1: Increase the capacities of fishers and coastal communities to participate and engage in policy development processes that use ecosystem-based management (EBM), marine spatial planning (MSP), and other integrated approaches, either as individuals or community-based groups.	Ecosystem Management

Strategic Element 7: Integration of ocean governance into regional and national decision making on climate change	Stage of Fisheries Value Chain
Action 7.4.2: Ensure that tourism policies and plans, including tourism related to recreational fisheries and diving, conform to the principles of sustainable tourism.	Ecosystem Management

Key Actions

Action 7.1.2: *Ensure emerging blue economy policies, strategies, and roadmaps for the region incorporate considerations for climate-smart fisheries and aquaculture. Linked to: Action 7.1.3: Improve governance arrangements by identifying and facilitating the empowerment of vulnerable groups in coastal areas.

Although the blue economy paradigm offers promise for a sustainable ocean future, it will be important to scale the economic development of the fisheries sector to the level of fisheries productivity anticipated under future climate projections to ensure that development is in fact sustainable (Golden *et al.*, 2017). Given that all fished species within the Caribbean are expected to experience some level of impact due to climate change (CRFM, 2019), and that some of the most commercially important species in the region will be among the most impacted, emerging blue economy policies, strategies, and roadmaps for the region must not rely on the expansion of “business-as-usual” fisheries, but seek innovative approaches to sustainable development in the sector that can help offset some of the anticipated declines in wild harvests and possible loss and damage across the value chain due to climate-related hazards. Blue economy strategies must also consider the cumulative effects of other aspects of economic development in the marine environment on the fisheries sector in addition to climate change.

Further, reforms in ocean governance in pursuit of blue economy pathways need to account for the social and equity dimensions of fisheries such that the role of small-scale fisheries in supplying food and income to those whose financial needs are greatest is recognized and protected (Cohen *et al.*, 2019). Otherwise, blue economy responses risk undermining key commitments in the CCCFP, SSF Guidelines and achievements toward Sustainable Development Goals. New governance regimes created or adjusted for the purpose of pursuing blue economy strategies present an opportunity to address past inequities in access to marine / coastal resources and invisibility in decision-making (Österblom *et al.*, 2020).

Key Considerations for Implementation:

Challenges:

Important considerations for ensuring that the blue economy is green and socially equitable are related to governance, finance, and value chains (Golden *et al.*, 2017).

- As blue economy initiatives unfold, governance frameworks need to keep pace with development so that it is effectively able to monitor and manage an increasing number of overlapping marine activities.
- Care needs to be taken so financing arrangements for the development of the blue economy incorporate social and environmental considerations (Weber and Acheta, 2016).
- Investments to support the fisheries industries’ and supply chains’ transition towards more sustainable products and practices may be necessary. As the availability of harvested species changes, value chains will need to transition toward alternatives. These might include investment in aquaculture operations, innovation in value-added processing, expansion of access to novel and higher-value markets through food safety and sustainable fisheries certifications (Bell *et al.*, 2018; CANARI, 2015; Dunstan *et al.*, 2018).
- Enhanced collaboration across sectors will be important. For example, given that tourists represent one of the largest seafood consumer groups in the region mainstreaming sustainable seafood supply chains in the Caribbean tourism sector will be helpful (Wabnitz, 2019).

- Equity and social inclusion are important cross-cutting concern pertaining to all of the above. Enforcing principles such as these will require concerted effort, including tapping into local, national and regional capacity in social science.

Opportunities:

- A number of environmental and social safeguards systems exist to ensure new finance does no harm (at a minimum), including the International Finance Corporation (IFC)'s Equator Principles and related performance standards.
- Several of the actions highlighted in this Strategy and Action Plan that aim to improve practices in inclusive engagement in policy development and planning processes (e.g., Action 1.3.4, 1.5.1, 1.6.1, 8.2.5) will also improve the outcomes of reforms to ocean governance.
- Assembling baseline ecological, fisheries and socio-economic data, including pre-existing rights, livelihoods and socio-economic status of coastal communities, as well as projected vulnerabilities to climate change impacts and disaster risks (Action 5.4.4) can go a long way in positioning the region to pursue a climate-smart blue economy.

Action 7.3.1:* Use existing asset maps, climate projections, and species-specific risk maps to inform marine spatial planning and conduct additional studies to identify and address important knowledge gaps to inform future planning. Linked to Action 7.4.1: Increase the capacities of fishers and coastal communities to participate and engage in policy development processes that use ecosystem-based management (EBM), marine spatial planning (MSP), and other integrated approaches, either as individuals or community-based groups.

Justification: Marine Spatial Planning (MSP) is one tool in the toolkit of integrated approaches to coastal and marine area management. It involves allocating coastal or ocean space to specific uses and activities. Outputs of MSP can inform ecosystem approaches to fisheries (EAF) and several examples of this exist in the Caribbean (see Pomeroy *et al.*, 2014 for examples from St. Kitts and Nevis, transboundary Grenadine Islands and Antigua and Barbuda). As marine spatial planning efforts continue throughout the region adopting a climate lens will become increasingly important. The effects of climate change on Caribbean fisheries are expected to vary across regions and, as a result, much of the information produced during climate change vulnerability and impact assessments is necessarily spatial in nature. This valuable information can be used to incorporate climate change considerations directly into marine spatial planning, which can help managers identify management opportunities and allocated limited adaptation resources to those areas that need it most (Mills *et al.*, 2015; Jones *et al.*, 2016). Explicitly spatial approaches to climate change adaptation in the fisheries sector will also help to address shifting resource distributions (e.g., Maina *et al.*, 2015; Pinsky *et al.*, 2018; Jones *et al.*, 2018; Selden and Pinsky, 2019), consider cumulative effects (e.g., Wedding *et al.*, 2018), and has the potential to improve knowledge transfer and participatory planning within and outside of institutions (e.g., Le Cornu *et al.*, 2017; Pomeroy *et al.*, 2014).

Key Considerations for Implementation:

Challenges:

In order to access the many benefits of spatial adaptation planning, national and regional entities may first need to overcome a number of challenges to the successful implementation of marine spatial planning approaches (Mills *et al.*, 2015):

- Access to and proficiency with using GIS software is generally low.
- Outside of project settings, availability of marine geospatial information is relatively limited (though growing) in the Caribbean.
- Institutional capacity and political will are necessary to carry out effective participatory and inclusive planning, implementation, and enforcement of spatial plans, with vulnerable groups often still marginalized from decision making processes that will impact them (Flannery *et al.*, 2018).

Opportunities:

- When the vision is shared and enforcement is strong, MSP and zoning serves to clarify accountabilities for activities and resource uses in the marine environment, encouraging investment in and stewardship over ecosystems and the benefits flowing from them (Pomeroy *et al.*, 2014).
- Open source and low-cost technologies, such as QGIS and SeaSketch, can be used to support marine spatial planning. As well, participatory documentation of local and traditional knowledge can also support these endeavors. Over 60% of data used to develop the MSP for Grenadine Islands, for example, derived from the local knowledge of resource users (Pomeroy *et al.*, 2014).
- Training programs and other efforts to strengthen capacities across scales can build on the successes of experiences in marine spatial planning in the Caribbean and other SID regions.

3.8 Strategic Element 8: Security Integration



Overview

The growing impacts of climate change are expected to contribute to increasing scarcity, instability, and conflict in the region that will place added pressure on national and regional security agencies and systems which must be considered as part of systematic adaptation planning. In the fisheries and aquaculture sector, security concerns may arise from a shortage of fish leading to food and nutrition insecurity; increasing reliance on unsustainable or unsafe fishing practices; conflict over fishing areas; and turning to illegal activities in the absence of sustainable alternative livelihoods (CRFM, 2010; McConney *et al.*, 2020). Goals within this strategic element are related to integrating security considerations in managing climate change impacts and enhancing sectoral security efforts.

Table 11: Goals and Actions related to Strategic Element 8 of the Regional Strategy, which is focused on security integration. Actions target particular stages of the fisheries value chain. Some actions have been carried over from the 2013 Strategy and Action Plan, while those marked with an asterisk () have been newly added in this edition of the Regional Strategy and Action Plan.*

Strategic Element 8: Integration of regional and national security in managing the impacts of climate change	Stage of Fisheries Value Chain
Goal 8.1: The role of national security agencies, incl. customs, police, coast guard, defence force, immigration authorities & military, is integrated into the national response to climate change & its impacts.	Medium Priority
Action 8.1.1: * More closely link issues of maritime security (illegal fishing, illicit trafficking, trans-national organized crime and labor abuses at sea) to national climate change efforts that enhance the sustainability of fish stocks and protection of habitats and legal fishing operations.	Enabling Environment
Action 8.1.2: * Keep under review and continue to strengthen the capacity of the CRFM, as a leading regional fisheries body, to advocate for the inclusion of fisheries concerns in regional and national security agendas.	Enabling Environment
Action 8.1.3: * Enhance regional understanding of the potential for climate change to exacerbate fishery-related resource conflict.	Enabling Environment
Goal 8.2: National and transnational security issues for all other sectors, including health, tourism, and agriculture are enhanced.	High Priority
Action 8.2.1: * Increase agency support for monitoring, control and enforcement of fishing regulations to reduce the occurrence of illegal and unreported fishing.	Enabling Environment
Action 8.2.2: * Implement early warning systems to alert fishers of maritime emergencies in time to take countermeasures.	Enabling Environment

Strategic Element 8: Integration of regional and national security in managing the impacts of climate change	Stage of Fisheries Value Chain
Action 8.2.3: Provide training in vessel maintenance, best practices for safety at sea, and the use of specialized safety equipment in the event of maritime emergencies.	Fishers, Vessels, and Gear
Action 8.2.4: Conduct inspections to verify the seaworthiness of vessels and create incentives for correct maintenance of vessels and safety equipment.	Fishers, Vessels, and Gear
Action 8.2.5: *Facilitate equitable access to fishery resources for small-scale fishing communities to enhance the sector’s contribution to regional and national food and nutrition security.	Fishers, Vessels, and Gear
Action 8.2.6: Conduct research on linkages between climate change, fisheries, aquaculture and health, with emphasis on diseases and impacts.	Enabling Environment

Key Action

Action 8.2.1:* Increase agency support for monitoring, control and enforcement of fishing regulations to reduce the occurrence of illegal and unreported fishing.

Justification: The negative consequences of illegal, unregulated and unreported fishing (IUU) are increasingly recognized in the Caribbean and beyond. IUU fishing is associated with unsustainable resource use, health and sanitary issues, foregone government revenue, labour trafficking and, in severe cases, military conflict over scarce resources (Moreto *et al.*, 2019; Van As *et al.*, 2019). IUU fishing and climate change interact in various ways. IUU fishing contributes to the depletion of fisheries resources, which are at risk from climate change. Climate change is expected to shift the distribution and abundance of fished species and fish catches in the Caribbean are projected to decline (Cheung *et al.*, 2019). Shifts in fishing activities, including target species, fishing methods, migration due to dwindling resources, in response to climate change impacts can also increase the incidence of IUU. Therefore, elimination of IUU fishing is crucial to minimize the adverse impacts of climate change to the sector. Main drivers of IUU fishing include economic incentives, governance incapable of regulating fisheries and barriers to enforcement of fisheries regulation (Van As *et al.*, 2019). Combatting illegal, unregulated and unreported (IUU) fishing is among the commitments under Sustainable Development Goal 14 and efforts are underway in the region to contain and reverse IUU fishing. A Regional Plan of Action to Prevent, Deter and Eliminate Illegal, Unreported and Unregulated (IUU) fishing has been developed under WECAFC and is under review by member countries.² Developing a strong system for monitoring, control, surveillance and enforcement to identify IUU operators, take action against them and support regulatory compliance is a priority measure of this Plan.

Key Considerations for Implementation

Challenges:

- The WECAFC Regional Plan of Action recognizes the need for enhanced information and cooperation across agencies as well as the need to build capacity in several areas including: port state inspections, vessel tracking, investigation and prosecution of IUU fishing offences, at-sea observer programs and interoperable databases.
- The CRFM recently acknowledged capacity challenges that stand in the way of developing and implementing corresponding National Plans of Action (NPOAs IUU), and noted the need for external assistance to help address the issue (CRFM, 2019e).

Opportunities:

- In their blue paper on IUU fishing and associated drivers, the High-Level Panel for a Sustainable Ocean Economy (HLP) outlines a number of opportunities for reversing the economic incentives for IUU fishing, strengthening governance, monitoring and compliance (Van As *et al.*, 2019). For

² <http://www.fao.org/fi/static-media/MeetingDocuments/WECAFC/SAG2019/3.pdf>

example, the paper highlights success of the FishFORCE Academy (South Africa), which delivers educational programs to law enforcement officers and other players in the criminal justice system so they gain the knowledge and skills to manage the complexities of IUU fishing. Another example is the creation of “fusion centres”, which bring together military and civilian data together in one platform to support monitoring of maritime issues.

- CRFM has adopted instruments to address IUU fishing, the implementation of which should be advanced with the implementation of the RPOA IUU that was developed in collaboration with WECAFC.
- CRFM currently collaborates with the Regional Security System to provide training to active law and enforcement officers in surveillance and enforcement procedures, and expansion of collaborative activities can be explored.

3.9 Strategic Element 9: Loss and Damage Management



Overview

The increasing intensity and frequency of extreme weather events as well as gradual changes such as sea level rise, coastal erosion and freshwater salinization will result in increased loss and damage-impacts of climate change that occur despite mitigation and adaptation. It will be important to have frameworks in place for assessing loss and damage, providing support for recovery, and managing the resulting displacement and migration. For the fisheries and aquaculture sector the increasing frequency and / or intensity of extreme events and related loss and damage to marine habitats, harvest operations and coastal infrastructure has highlighted the cascading effects of disruptions to one link of the seafood value chain and the need for integrated climate risk management (Khan *et al.*, 2019). Increasing sea surface temperatures and ocean acidification within marine ecosystems are affecting fish productivity; dependence on fish commodity for food and export earnings heightens the region’s sensitivity to ecosystem changes. Similarly, loss and damage of fishing infrastructure and other assets such as wharves and fishing vessels have implications toward viability and disruption of supply chains, which in turn disrupt marketing and distribution networks. Goals within this strategic element relate to integrating loss and damage recommendations in regional and national climate change responses and clarifying the structures to enable this.

Table 12: Goals and Actions related to Strategic Element 10 of the Regional Strategy, which is focused on loss and damage management. Actions target particular stages of the fisheries value chain. Many actions have been carried over from the 2013 Strategy and Action Plan, while those marked with an asterisk (*) have been newly added in this edition of the Regional Strategy and Action Plan. [-] denotes actions that have seen least progress, as rated by stakeholders. [+] denotes actions that have seen most progress. These ratings are based on perspectives of regional and national fisheries officers gleaned through a workshop and an online survey.

Strategic Element 10: Effective architecture for averting, minimising and addressing loss and damage from climate change	Stage of Fisheries Value Chain
Goal 10.1: Recommendations arising out of the work of relevant international instruments, such as the UNFCCC Warsaw International Mechanism for Loss and Damage, are incorporated into regional and national climate change response mechanisms.	High Priority
Action 10.1.1: *Highlight trends in loss and damage to regional fisheries and their implications in negotiations of the UNFCCC Warsaw International Mechanism for Loss and Damage and in implementing long-term climate finance.	Enabling Environment

Strategic Element 10: Effective architecture for averting, minimising and addressing loss and damage from climate change	Stage of Fisheries Value Chain
Action 10.1.2: Plan strategically in disaster response for long-term rehabilitation, recovery and “building back better”, bearing in mind the sustainability of livelihoods, equitable access to resources and changes to ecosystems that occurred as a result of the disaster. [-]	Enabling Environment
Action 10.1.3: Introduce the Sendai Framework of Action within the fisheries and aquaculture sectors, and facilitate implementation of multilevel action via closer networking among fisheries, aquaculture, CCA and DRM practitioners.	Enabling Environment Fishers, Vessels, and Gear Aquaculturists
Action 10.1.4:* Conduct and keep current inventories of national fisheries and aquaculture physical (e.g., vessels, engines, ponds and infrastructure) and natural (e.g., spawning habitat) assets to help improve accuracy and efficiency of damage and loss assessments after extreme weather events and facilitate recovery.	Enabling Environment
Action 10.1.5: Strengthen the ability of coastal and rural communities to properly assess damage and loss following the impacts of an extreme weather event or slow-onset events.	Fishers, Vessels, and Gear Aquaculturists
Goal 10.2: Architecture for comprehensive climate risk management is clearly defined and operational.	High Priority
Action 10.2.1: Support the development of crisis prevention and climate-risk management policies in the fisheries and aquaculture sectors at multiple levels by involving networks of national and local CCA and DRM experts with aquatic skills.	Enabling Environment
Action 10.2.2: Improve the systems for expedient rehabilitation and resilience-building of the aquaculture, but especially fisheries sector, in the aftermath of climate-related disasters, as key contributors to food and nutrition security at local and national levels. [-]	Enabling Environment
Action 10.2.3: Improve integration of regional and national emergency preparedness institutions as integral to climate change adaptation response strategies. [+]	Enabling Environment

Key Actions

Action 10.1.4:* Conduct and keep current inventories of national fisheries assets (vessels, engines, infrastructure) to help improve accuracy and efficiency of damage and loss assessments after extreme weather events that would facilitate applications for rebuilding assistance.

Justification: One key outcome under the Caribbean Comprehensive Disaster Risk Management Strategy (2014-2024) is to establish integrated systems for fact-based policy and decision-making (RO2.2 in CDEMA 2014). For fisheries and aquaculture this includes a robust understanding of assets (e.g., vessels, engines and infrastructure) that are core to the effective and efficient functioning of the sector, as well as their exposure to climate-related hazards. National disaster risk management information systems in the region are under development but gaps remain in the collection and integration of sectoral baseline data, including for fisheries and aquaculture (Bello *et al.*, 2017). Government agencies and researchers alike could use baseline data in the way of asset inventories as inputs into climate change and disaster risk assessments to inform preventative measures. As well, access to such data can accelerate post-disaster damage and loss assessments and inform priorities for disaster response and recovery, based on evidence of the quantity, quality and location of affected assets. Regional efforts to enhance holistic monitoring of the sector in support of responsible fisheries, such as

through CRFM and WECAFC, can also contribute to strengthening national disaster risk management information systems. For example, WECAFC's Data Collection Reference Framework proposes to keep track of registered vessels across the region, fed by national vessel records (FAO, 2019), and the CRFM's CCCFP is also supportive of this. The case for investing in building technical and human resource capacity to keep these inventories current is, therefore, all the clearer.

Key Considerations for Implementation

Challenges:

- Collection of sectoral baseline data and sustained monitoring efforts are resource intensive and when privately-held assets or private information are involved issues such as confidentiality and statistical aggregation come to bear.
- Focusing on assets that serve a productive function for fisheries and can be monetized is an incomplete account of loss and damage since aspects such as losses in biodiversity, ecosystem services, culture and human wellness are evidently important but harder to count and monetize. As a result, investments in recovery and recovery may not be adequately channelled to restoring or preserving these other non-economic values.

Opportunities:

- Working from a common set of indicators for the sector allows for efficiencies in data collection as existing mechanisms such as the fisheries census and surveys of living standards (as part of country poverty assessments) can be employed to feed into national and regional reporting on DRM, climate change adaptation and sustainable development.

Action 10.2.2: Improve the systems for expedient rehabilitation and resilience-building of the aquaculture, but especially fisheries sector, in the aftermath of climate-related disasters, as key contributors to food and nutrition security at local and national levels. Linked to Action 8.2.5: *Facilitate equitable access to fishery resources for small-scale fishing communities to enhance the sector's contribution to regional and national food and nutrition security.

Justification: The impacts of climate change, such as ocean warming, and the increased frequency, intensity or magnitude of climate-related hazards are threats to the integrity of local, national and regional food systems in the Caribbean. Although the population facing food inadequacy in the Caribbean has decreased since the nineties (FAO, 2017), nutrition levels can deteriorate during emergencies.³ Sudden or prolonged shocks to food production and distributions systems have a number of cascading socio-economic impacts and even short-lived shortages in foods containing essential nutrients can cause negative health outcomes among pregnant women, children and people with ill health (Gephart *et al.*, 2017). As fisheries provide about 10 percent of the region's protein intake (Nurse, 2011) ensuring fisheries livelihoods, post-harvest activities and marketing form part of resilient food systems is important (FAO, 2015). However, the sector's⁴ ability to respond or recover from emergencies without rebuilding existing risks or generating new risks is suboptimal (FAO, 2017). Potential improvements to the sector's capacity for rehabilitation and resilience-building include the following:

- Boosting the capabilities of coordination mechanisms at national and sub-national levels to identify and address nutrition-related vulnerabilities and capacity gaps, identifying where fisheries and seafood products offer opportunities for improvement.⁵
- Strengthening links between the fisheries sector and planning and social development and health sectors.

³ <https://www.enonline.net/fex/62/emergencynutritionlatinamericacaribbean>

⁴ FAO (2017) provides guidelines to implement the Sendai Framework for Disaster Risk Reduction in the Agriculture and Food Security and Nutrition Sector and defines agriculture as inclusive of fisheries and aquaculture "sub-sectors".

⁵ <https://www.enonline.net/fex/62/emergencynutritionlatinamericacaribbean>

- Supporting the development of livelihood rehabilitation and restoration plans, with active engagement of civil society organizations and community groups and a view to “building back better”.
- Providing DRM training and sensitization of extension workers, field technicians and fisheries officers working directly with producers.
- Enhancing use of vulnerability mapping, examining the intersection of climate change vulnerability and disaster risk, poverty and food and nutrition insecurity.

Key Considerations for Implementation

Challenges:

- Compared to agriculture, fisheries and aquaculture receive less policy attention; the sector’s contributions to disaster resilience and food and nutrition security are less visible in comparison.
- The improvements outlined above require investments in staffing, skills development and coordination.
- Policy actions to improve the overall role of the fisheries sector in food and nutrition security outlined in 2013 remain relevant today (CRFM, 2013a). For example, gains in consumer education to shift purchasing choices of fish and seafood to minimize the consumption of contaminated fish are not clear.

Opportunities:

- Developing policies and measures to maintain food security is one of the roles the CCA and DRM Protocol of the CCCFP outlines for CARICOM Member Countries (CRFM, 2020a).
- Shocks are common in fish and seafood production systems; they occur most frequently in Central America and the Caribbean than in other world regions (Gephart *et al.*, 2017). Therefore, there are opportunities to learn from past failures and successes in navigating food shocks, as well as strengths and weaknesses at each link in the fish value chain. Global analysis indicates that shocks are more frequent in aquaculture than in wild capture fisheries (Gephart *et al.*, 2017).
- Several organizations, including the International Food Policy Research Institute, are tracking the impacts of the COVID-19 pandemic on national and global food and nutrition security and poverty, and development, with lessons likely to emerge and guide future DRM efforts.⁶ There are also Caribbean regional-scale activities that are tracking the COVID-19 impacts and responses being undertaken by CARICOM, CRFM and others, which should yield key information about vulnerabilities, lessons and best practices.

4. IMPLEMENTATION CONSIDERATIONS

This Strategy and Action Plan strives to translate the comprehensive approach to building resilience to climate change and variability outlined in the Regional Framework for operational use by fisheries and aquaculture stakeholders in the Caribbean, in cooperation with international and regional development partners. Effective and efficient implementation of the sectoral Strategy and Plan of Action requires that i) actors at local, national, regional, and international levels have a clear appreciation of their respective roles and responsibilities and collaborate to overcome barriers to action; ii) priorities and progress build on knowledge of climate change vulnerabilities and risks and successes in adaptation, mitigation, and disaster risk management; iii) actors mobilize financial resources to ensure shortfalls in funding do not prevent early and transformative action; and iv) the region’s network of fisheries and aquaculture actors come to “own” the Plan.

4.1 Governance

This Strategy and Action Plan is a sectoral expression of the Regional Framework. As such, governance integral to implementation of the Regional Framework in addition to existing sectoral governance

⁶ <https://www.ifpri.org/landing/covid-19-blog-landing-page>

mechanisms apply in clarifying how decisions are made, how account is rendered and who is responsible for what.

Overall responsibility to drive action under the Regional Framework lies within the **Regional Coordinating Committee on Climate Change (RCCCC)**. The RCCCC includes representatives of CARICOM specialised agencies, academic institutions and regional financial institutions with a mandate in areas related to climate change mitigation and adaptation. This Committee also assesses relative progress in delivering on Strategic Elements and Goals. **The Caribbean Community Climate Change Centre (CCCCC)** is responsible for providing technical support and guidance to the RCCCC, implementing agencies and Member States to fully implement the Regional Framework. This includes helping to maximize benefits to the region from developments under the UNFCCC, providing technical guidance so Member States fulfill their responsibilities under the UNFCCC, supporting South-South knowledge exchange and assuming its role as a Regional Implementing Entity of the Green Climate Fund. The Regional Framework (CCCCC,2019) also outlines roles for regional organizations (including the CRFM), national governments, the private sector, civil society organizations, citizens and the international development community. In this way, successful implementation of the Regional Framework is a shared responsibility across levels of decision making.

Under the Regional Framework, the **CRFM** is the regional organization responsible for coordination, information-sharing, capacity-building and advocacy in support of the fisheries and aquaculture sector's engagement in climate change risk management. In addition, by issuing this updated Strategy and Action Plan the CRFM is contributing to developing common regional policy platforms, an expectation for regional organizations outlined in the Regional Framework. In this context, the CRFM and national governments, in particular, provide critical links to ensure coherence and synergies across the broad-based strategies and actions of the Regional Framework and the sector-specific priorities outlined in this document.

The Protocol on Climate Change Adaptation and Disaster Risk Management in Fisheries and Aquaculture (CRFM, 2019) emphasizes interactive governance as a guiding principle for implementation, a concept readily applied in managing small-scale fisheries (Jentoft and Chuenpagdee, 2015; McConney *et al.*, 2017). Interactive governance represents *“an integrative, inclusive, nested, multi-level, regional governance system for fisheries livelihoods assets that is built on linkages between the global, regional, sub-regional and national levels. It embraces complete policy cycles and supports processes for continually improving policies and practices, through coordinated and structured learning from the outcomes of previously employed policies and practices”* (CRFM, 2019). In implementing this updated Strategy and Action Plan, the CRFM and Member States, in coordination with national, regional and international organisations, including the Caribbean Network of Fisherfolk Organizations (CNFO), will strive to apply interactive governance approaches. In so doing, strengthening capacities to fulfill the following roles will be helpful:

CRFM

Assessment is a key phase in planning for iterative adaptation and climate risk management. The CRFM is well suited to convene analytical panels of regional experts to analyze data on climate-driven changes in marine ecosystems and fisheries they support from a regional perspective and produce a periodic report of the status and trends of climate change impacts on the Caribbean fisheries sector. An assessment report of this type would highlight areas (thematic and spatial) of greatest risk and should include recommendations for improving current policies and practices, including conditions to facilitate uptake.

For periodic assessments to be effective they need to integrate new information in a systematic way. Therefore, the CRFM will contemplate assuming the role of a central collector for annual climate change fisheries monitoring data reported by member states, based on guidance on monitoring to support climate-smart fisheries in CRFM member states (2019b). Regional data aggregation will help not only to track impacts of climate change on the sector, but also to track the effectiveness of project and

program implementation through the slowing or reversal of negative trends (e.g., shift to increase in regional-scale mangrove area with restoration).

The CRFM also plays a unique role in supporting sustainable assessment and management of transboundary stocks, activities that will increase in complexity as climate change intensifies (Pinsky *et al.*, 2018; Oremus *et al.*, 2020). There is a role for the CRFM to elevate discussions on future climate risks to the sector in regional meetings and draw lessons from its regional management of existing transboundary stocks (e.g., Gentner, 2016) to inform discussions on how range shifts might affect future transboundary fisheries governance and support negotiation of arrangements to maximise equitable sharing of resources and minimise conflict.

Aside from strengthening the scientific basis for managing marine resources, fisheries and aquaculture, integrative, inclusive and nested decision making requires competencies in stakeholder engagement, participatory approaches, gender and human-rights based analysis, negotiations, communications, conflict management and a number of other so-called “soft skills”. The CRFM should therefore be supported by regional NGOs and research institutions (including those with strengths in social sciences and humanities) to access additional capacity to support improvements in interactive governance in the sector.

Member States - National Fisheries Departments

As member states develop national adaptation and sectoral plans, update their nationally-determined contributions as part of the UNFCCC process and create new blue / ocean economy strategies the opportunity exists to update or strengthen national fisheries policies and other instruments based on anticipated climate change impacts reported in CRFM (2019) and other recent studies, to support adaptation and climate risk management in the fisheries sector. Activating existing inter-sectoral mechanisms to advance dialogue and practice toward climate-smart fisheries and aquaculture, is one way to ensure countries adopt a systemic and holistic approach to the sustainable use of marine ecosystems and seafood resources. In particular, countries’ experiences and successes using inter-ministerial / inter-sectoral task forces and committees to address single (e.g., fish trade sanctions and value chain development) and systemic (e.g., ecosystem approach to fisheries management) issues offer scalable lessons and justification for making these arrangements more permanent within national decision-making frameworks. In addition, translating policy and planning provisions into outcomes for ecosystems, fisheries and livelihoods will require strengthening capacity and resources for fisheries monitoring and enforcement, among other priorities.

CNFO, CSOs and Extension Officers

Fisherfolk organizations, CSOs and public education and extension officers play important roles in connecting the needs and capacities of fishers and other actors across the seafood value chain with management and enabling instruments created at regional and national levels. Their role in partnered delivery on many of the priorities outlined in this Strategy and Action Plan is key, particularly when it comes to i) increasing local capacity to meaningfully participate in policy development, CCA planning and DRM, ii) increasing capacity for fisheries monitoring, iii) implementing targeted projects and programs, such as training on safety at sea and in best practices for adaptation across the value chain, and iv) enabling a two-way flow of information to bring together scientific information on climate change and its impacts and local and traditional knowledge. These actors play a critical role in cultivating mutual understanding and trust between policy / management levels and small-scale fishers and their families. The Caribbean Network of Fisherfolk Organizations (CNFO), in particular, is becoming a civil society leader, regionally and internationally, in fisheries climate change adaptation initiatives within the implementation of an ecosystem approach to fisheries management and the Voluntary Guidelines for Securing Sustainable Small-Scale Fisheries in the Context of Food Security and Poverty Eradication.

4.2 Monitoring, Evaluation and Learning

The CRFM and Member States can employ existing governance mechanisms to review the Strategy and Action Plan and its implementation. The chief objectives of the review process will be to i) identify gaps

and in climate change adaptation and climate risk management within the fisheries and aquaculture sector and ii) identify possible adjustments to the Strategy and Action plan and / or additional guidance that Member States and their stakeholders may require to deepen efforts to adapt to climate change and manage climate-related risks.

To support this review process and the continuous improvement of the regional Strategy and Action Plan, detailed tracking of the number and character of national and regional programs and projects addressing each of the Strategic Elements and actions will be necessary. Only by explicitly associating projects / programs to these Strategic Elements and tracking coverage across the Strategic Elements and actions over space and time will it be possible to identify systematic gaps in climate change adaptation within the sector that require further attention.

Communicating progress against each Strategic Element and action on a regular basis (e.g., every year, or every 5 years) will help raise the visibility of the sector's adaptation and climate risk management efforts as well as the visibility of unmet needs. Linking monitoring and reporting against the Strategy and Action Plan to parallel reporting efforts (e.g., through the Regional Framework, or reporting against Sustainable Development Goals as in Carneiro *et al.*, 2019) can yield efficiencies.

Understanding the levels of activity across the region and identifying new areas for action is important but not sufficient to ensuring continuous improvement. It's equally important for the CRFM and Member States to reflect on what was learned through the implementation process and share these lessons broadly. A number of capacity-development mechanisms linked to national adaptation planning under the UNFCCC centre on learning (e.g., peer to peer learning activities of the National Adaptation Planning Global Network) and their modalities could be useful to emulate or tap into. The CRFM will endeavour to adopt learning-centred approaches to reviewing implementation on the Strategy and Action Plan.

4.3 Communications & Participation

The fisheries and aquaculture sectors are already experiencing impacts due to climate change and weather-related disasters that require immediate and sustained action. In response, routine fisheries management and climate change adaptation will become increasingly intertwined and this must be reflected in the way the CRFM disseminates and communicates this regional Strategy and Action Plan among its member states and partner organizations. In other words, the guidance outlined in the Regional Strategy and Action Plan should be positioned as a critical roadmap for helping to achieve the broader goals of the CCCFP and its protocols and reference to this document should be interwoven throughout the CRFM's meetings, electronic communications, and procurement processes moving forward.

Key strategies for **raising awareness** about this Regional Strategy and Action Plan include:

- Raising awareness across all CRFM member states and partners through regularly scheduled CRFM events, including the Annual Meeting of the Caribbean Fisheries Forum and Regional Data Workshops, and via distribution of updates through the CRFM's Mailing Lists.
- Mainstreaming linkages to the Regional Strategy and Action Plan into the CRFM's procurement process. This will require highlighting the Strategic Elements and Actions to be addressed in projects outlined in CRFM-issued RFPs, proposals, and final project reports, and make recommendations for requiring this linkage in procurement processes and projects pursued by partner organizations.
- Raising awareness among fishing communities and individuals across the region by developing public-facing outreach materials that summarize the content of this Strategy and Action Plan and indicate how individuals and communities can contribute to advancing progress on Strategic Elements and Actions.
- Raising awareness among fishing communities and individuals by broadly disseminating the results of monitoring and evaluation assessments for progress towards Strategic Elements and Actions and clearly identifying gaps in regional and national implementation that can help nations, communities, and organizations to better target future adaptation.

Importantly, there is also a need to nudge the Caribbean fisheries and aquaculture community beyond awareness and into active engagement and implementation of the strategy. Many lessons on “activating” strategy and action plans can be drawn from the United Nations, which has developed guidance [toolkits](#) to help catalyze integrative national contributions towards their Sustainable Development Goals (SDGs). Much of the guidance provided in these toolkits is designed to boost participatory decision-making through structured activities and workshops and is directly transferrable to this Strategy and Action Plan.

Key strategies for **catalyzing implementation** of this Strategy and Action Plan include (UN SDG Lab 2019):

- Fostering connections to and among key stakeholders and sectors to support more integrative, multi-sectoral adaptation;
- Amplifying key outcomes and accomplishments to ensure that new initiatives are always building upon the wealth of prior work in the region in order to carry forward successful strategies and avoid repeating mistakes;
- Creating forums for asking questions to identify potential obstacles or opportunities and uncover new ways of thinking;
- Supporting innovation through inclusive brainstorming sessions, national challenges, and incubator programs to encourage the development of new approaches, formats, and processes for implementing adaptation.

4.4 Financing Implementation

Implementing this Strategy and Plan of Action will require mobilizing financial and technical resources. Meeting the objectives of some of the CCA and DRM strategies and actions could be met by improved planning and use of information from climate change vulnerability and impact assessments as guides to decision making. The Regional Framework (CCCC, 2019) emphasizes the importance of treating financing of climate change resilience initiatives as a development priority in national budgeting. There is a role here for fisheries-sector representatives within government agencies to advocate for allocating resources from the fiscal framework in support of adaptation and climate-risk management.

The CRFM, working in close collaboration with the CCCCC, other regional organizations and governments, will need to access the financial and technical resources required to implement the Strategy and Action Plan. Relative to other sectors, fisheries and aquaculture has not been a significant beneficiary of financial support for adaptation through international cooperation or dedicated international funds (Blasiak and Wabnitz, 2018; Blasiak *et al.*, 2019; Guggisberg, 2019). It will be important for CRFM and Member States to ensure the sector is positioned to gain access to climate finance and benefit from accreditation by regional bodies and, increasingly, national bodies as implementing agencies under the Green Climate Fund and the Adaptation Fund.

Further, the CRFM and Member States should explore the use or development of innovative financing mechanisms to fund critical activities (e.g., monitoring, ongoing enforcement) that are not usually eligible under typical climate change adaptation funding programs. This includes tapping into financial mechanisms for conservation and ecosystem-based adaptation (e.g., Caribbean Biodiversity Fund-Blue Finance), as part of blue economy initiatives, and by continuing to pursue insurance solutions tailored to the needs of small-scale fishers and other actors in the value chain. Mobilizing technical resources and delivery capacity will require strengthening partnerships with environmental non-governmental organizations, academia, the private sector (e.g., tourism operators) and civil society (e.g., citizen science).

5. REFERENCES

- Acevedo, S. (2016). *Gone with the Wind: Estimating Hurricane Climate Change Costs on the Caribbean*. IMF Working Paper WP/16/199, IMF, Washington, DC.
- Ahmed, K., Campbell, D., Singh-Renton, S., Murray, A. and Eyzaguirre, J. (2019). *Toward Climate-Smart Value Chains in Caribbean Fisheries*. In CRFM Research Paper Collection volume 9.
- Anderson, J. L., Anderson, C. M., Chu, J., Meredith, J., Asche, F., Sylvia, G., ... Valderrama, D. (2015). *The Fishery Performance Indicators: A Management Tool for Triple Bottom Line Outcomes*. PLOS ONE, 10(5), e0122809. <https://doi.org/10.1371/journal.pone.0122809>
- Andersson, A.J., Venn, A.A., Pendleton, L., Brathwaite, A., Camp, E., Cooley, S., Gedhill, D., Koch, M., Maliki, S. and Manfrino, C. (2019). *Ecological and socioeconomic strategies to sustain Caribbean coral reefs in a high-CO2 world*. *Regional Studies in Marine Science*, p.100677. [LINK](#)
- Andrew, D.C. (2015). *Analyzing the Responses of the Financial Services Sector to Climate Change Risks in the Caribbean: A Case Study of Antigua and Barbuda*. Thesis Submitted to the University of Exeter.
- Asia-Pacific Fishery Commission [APFIC]. (2010). *Best practices to support and improve livelihoods of small-scale fisheries and aquaculture households*. FAO Regional Office for Asia and the Pacific, Bangkok, Thailand. RAP Publication 2010/21, 140 pp.
- Atteridge, A., Canales, N., & Savvidou, G. (2017). *Climate finance in the Caribbean Region's small island developing states*. Stockholm Environment Institute. <https://mediamanager.sei.org/documents/Publications/SEI-WP-2017-climate-finance-caribbean.pdf>
- Baldwin, K., Oxenford, H.A., Purkis, S., and Knowles, L. (2019). *Developing a benthic habitat classification scheme and island-wide map for Barbados based on remote sensing and comprehensive ground-truthing*. CERMES Technical Report No. 94. 53 pp. Available from: https://www.cavehill.uwi.edu/cermes/docs/technical_reports/baldwin_et_al_2019_benthic_habitat_classification_.aspx
- Baptiste, A. K. (2018). *Climate change knowledge, concerns, and behaviors among Caribbean fishers*. *Journal of Environmental Studies and Sciences*, 8(1), 51-62.
- Barbier, E.B. (2018). *Seascape Economics: Valuing Ecosystem Services across the Seascape*. In: Pittman, S.J., ed. *Seascape Ecology*. Wiley-Blackwell. 526 pp.
- Bates, A.E., Pecl, G.T., Frusher, S., Hobday, A.J., Wernberg, T., Smale, D.A., Sunday, J.M., Hill, N.A., Dulvy, N.K., Colwell, R.K. and Holbrook, N.J. (2014). *Defining and observing stages of climate-mediated range shifts in marine systems*. *Global Environmental Change*, 26, pp.27-38.
- Bayraktarov, E., Saunders, M.I., Abdullah, S., Mills, M., Beher, J., Possingham, H.P., Mumby, P.J. and Lovelock, C.E. (2016). *The cost and feasibility of marine coastal restoration*. *Ecological Applications*, 26(4), pp.1055-1074.
- Bell, J.D., Cisneros-Montemayor, A., Hanich, Q., Johnson, J.E., Lehodey, P., Moore, B.R., Pratchett, M.S., Reygondeau, G., Senina, I., Virdin, J. and Wabnitz, C.C., (2018). *Adaptations to maintain the contributions of small-scale fisheries to food security in the Pacific Islands*. *Marine Policy*, 88, pp.303-314.
- Bello, O., Khamis, M., Osorio, C., & Peralta, L. (2017). *Mainstreaming disaster risk management strategies in development instruments: Policy briefs for selected member countries of the Caribbean Development and Cooperation Committee*.
- Björk M., Short F., Mcleod, E. and Beer, S. (2008). *Managing Seagrasses for Resilience to Climate Change*. IUCN, Gland, Switzerland. 56pp.
- Blasiak, R. and Wabnitz, C. C. 2018. *Aligning fisheries aid with international development targets and goals*. *Marine Policy*, 88, 86-92.
- Blasiak, R., Wabnitz, C. C., Daw, T., et al. (2019). *Towards greater transparency and coherence in funding for sustainable marine fisheries and healthy oceans*. *Marine Policy*, 107, 103508.
- Boyd, R. and Ryan, J. (2019). *Economic Consequences of Climate Change for the Fisheries Sector in Six Caribbean Countries*. Research Paper C. CRFM Research Paper Collection, No. 9.
- Buizer, J., Jacobs, K., & Cash, D. (2016). *Making short-term climate forecasts useful: Linking science and action*. *Proceedings of the National Academy of Sciences*, 113(17), 4597-4602.
- CARE International. (2019). *Insuring for a changing climate: A review and reflection on CARE's experience with microinsurance*. [LINK](#)

- Caribbean Community Climate Change Center [CCCCC]. (2012). Delivering transformational change 2011 - 2021: Implementing the CARICOM `Regional Framework for Achieving Development Resilient to Climate Change. Caribbean Community Climate Change Centre, Belmopan, Belize.
- CCCCC (2019). Regional Framework for Achieving Development Resilient to Climate Change 2019-2029. Caribbean Disaster Emergency Management Agency [CDEMA] (2014). Regional Comprehensive Disaster Management (CDM): Strategy and Results Framework 2014-2024. https://www.cdema.org/CDM_Strategy_2014-2024.pdf
- Caribbean Fish Sanctuaries Partnership (C-FISH) Initiative. Final Technical Report (2016). The CARIBSAVE-INTASAVE Partnership. 194 pp + Appendices.
- Caribbean Natural Resources Institute [CANARI]. (2015). Research on social protection to foster sustainable management of natural resources and reduce poverty in fisheries and forestry dependent communities in the Caribbean. Contributed paper in: FAO. 2017. Social protection to foster sustainable management of natural resources and reduce poverty in fisheries-dependent communities. Report of the FAO Technical Workshop. 17–18. November 2015, Rome. FAO Fisheries and Aquaculture Department. Rome, Italy
- CANARI. (2017). Implementing climate change action: A toolkit for Caribbean civil society organisations. Laventille: CANARI.
- CANARI (2018). Report on the assessment of vulnerability to climate change in the Anguilla and Montserrat fisheries sector: Anguilla country report. Prepared by Granderson, A., Ramkissoon, C., Jehu, A. and Phillips, T. August 30, 2018. Barataria, Trinidad: CANARI.
- Caribbean Regional Fisheries Mechanism [CRFM] (2010). Castries (St. Lucia) Declaration on Illegal, Unreported and Unregulated Fishing. [LINK](#)
- CRFM (2013). Climate Change Adaptation and Disaster Risk Management in Fisheries and Aquaculture in the CARICOM Region. Volume 2 — Regional Strategy and Action Plan. CRFM Technical & Advisory Document Series, Number 2013 / 8, Volume 2.
- CRFM (2013a). The role of fish and seafood in the food and nutrition security in the Caribbean. Policy Brief No. 3, October 2013.
- CRFM (2014). Study on the Potential of Fish Farming in the Caribbean. CRFM Technical & Advisory Document No 2014 / 2. P78.
- CRFM (2015). CRFM Working Groups: Terms of Reference. CRFM Special Publication No. 3. 41p.
- CRFM (2017). Model Legislation for Health and Food Safety in Fisheries and Aquaculture. Annex C of Final Technical Report: Technical support to promote the adoption of comprehensive model legislation, protocols, guidelines for health and food safety related to fisheries and aquaculture in CARIFORUM States. CRFM Special Publication, No. 19. 143p.
- CRFM (2017a). Report of a Training Course on Sanitary and Phyto-Sanitary Measures in Fisheries and Aquaculture for CARIFORUM Member States, United Nations University - Fisheries Training Programme, Iceland, 18-29 April 2016. CRFM Technical & Advisory Document, No. 2017 / 01. 66pp.
- CRFM (2017b). Final Technical Report: Capacity building of regulatory and industry stakeholders in Aquaculture and Fisheries Health and Food Safety to meet the SPS requirements of international trade. CRFM Technical & Advisory Document, No. 2017 / 02. 16p + annexes.
- CRFM (2018). Report of the Second Meeting of the CRFM/CARICOM Fisheries and Aquaculture Priority Commodity Working Group (FISHCOM WG). CRFM Technical & Advisory Document, No. 2018/05. 48p.
- CRFM (2019). Research Paper Collection Volume 9. 285 pp.
- CRFM (2019a). Analytical Tools and Monitoring Guidance for Measuring Climate Change Impacts. CRFM Technical & Advisory Document, No. 2019/12. 121pp.
- CRFM (2019b). Research Paper Collection Volume 8. 104 pp.
- CRFM (2019c). Report of the Fourth Meeting of the CRFM/CARICOM Fisheries and Aquaculture Priority Commodity Working Group (FISHCOM WG). CRFM Technical & Advisory Document, No. 2019/02. 12p.
- CRFM (2019d). Report of Meeting of CRFM Continental Shelf Fisheries Working Group (CRFM-CSWG) on Atlantic Seabob, *Xiphopenaeus kroyeri*, fisheries of Guyana and Suriname. CRFM Fishery Report ± 2019/1. 67p.

- CRFM (2019e). Report and Proceedings of the Ninth Special Meeting of the Ministerial Council of the Caribbean Regional Fisheries Mechanism, Best Western Plus Belize Biltmore Plaza, Belize City, Belize, 1 October 2019. Volume 2. CRFM Management Report – PY 2019 / 20. 63p.
- CRFM (2020). Protocol on Securing Sustainable Small-scale Fisheries for Caribbean Community Fisherfolk and Societies. In Caribbean Community Common Fisheries Policy, CRFM Special Publication No. 26, p 17-19.
- CRFM (2020a). Protocol on Climate Change Adaptation and Disaster Risk Management in Fisheries and Aquaculture. In Caribbean Community Common Fisheries Policy, CRFM Special Publication No. 26, p 20-27.
- Carneiro, G., R. Bisiaux, M.F. Davidson, T. Tómasson, J. Björnstedt. (2019). Fishing Aid: Mapping and Synthesising Evidence in Support of SDG 14 Fisheries Targets, EBA Report 2019:08, the Expert Group for Aid Studies (EBA), Sweden.
- Centre for Resource Management and Environmental Studies (CERMES) (2018). Gender scoping preliminary report: Caribbean fisheries in the context of the small-scale fisheries guidelines. CERMES Technical Report No. 86.
- Chang, S.E., Adams, B.J., Alder, J., Berke, P.R., Chuenpagdee, R., Ghosh, S. and Wabnitz, C., (2006). Coastal ecosystems and tsunami protection after the December 2004 Indian Ocean tsunami. *Earthquake Spectra*, 22(S3), pp.863-887. [LINK](#)
- Cheung, W. L., Reygondeau, G., Wabnitz, C.C.C., Tamburello, N. and Singh-Renton, S. (2019). Climate Change Effects On Caribbean Marine Ecosystems and Fisheries: Regional Projections. Research Paper A. CRFM Research Paper Collection, No. 9.
- Cheung, W. L., Reygondeau, G., Wabnitz, C.C.C., Tamburello, N., Singh-Renton, S. and Joseph, A. (2019a). Climate Change Effects on Caribbean Marine Ecosystems and Fisheries: National Projections for 6 Pilot Countries: Jamaica, Haiti, Dominica, St. Lucia, St. Vincent and The Grenadines, and Grenada. Research Paper B. CRFM Research Paper Collection, No. 9.
- Cinner, J.E., Adger, W.N., Allison, E.H., Barnes, M.L., Brown, K., Cohen, P.J., Gelcich, S., Hicks, C.C., Hughes, T.P., Lau, J. and Marshall, N.A. (2018). Building adaptive capacity to climate change in tropical coastal communities. *Nature Climate Change*, 8(2), p.117.
- Cisneros-Montemayor, A.M., Moreno-Báez, M., Voyer, M., Allison, E.H., Cheung, W.W., Helsing-Lewis, M., Oyinlola, M.A., Singh, G.G., Swartz, W. and Ota, Y., 2019. Social equity and benefits as the nexus of a transformative Blue Economy: A sectoral review of implications. *Marine Policy*, 109, 103702-1-103702-9.
- Climate and Development Knowledge Network [CDKN] (2015). The IPCC's Fifth Assessment Report: What's in it for Small Island Developing States? Available from: https://cdkn.org/wp-content/uploads/2014/08/IPCC-AR5-Whats-in-it-for-SIDS_WEB.pdf
- Climate Watch. 2019. Washington, D.C.: World Resources Institute.
- Cogan, C.B., Todd, B.J., Lawton, P. and Noji, T.T. (2009). The role of marine habitat mapping in ecosystem-based management. *ICES Journal of Marine Science*, 66(9), p. 2033-2042.
- Cohen, P., Allison, E. H., Andrew, N. L., Cinner, J. E., Evans, L. S., Fabinyi, M., ... & Jentoft, S. (2019). Securing a just space for small-scale fisheries in the blue economy. *Frontiers in Marine Science*, 6, 171.
- Dabbadie, L., Aguilar-Manjarrez, J., Beveridge, M.C., Bueno, P.B., Ross, L.G. and Soto, D., (2018). Effects of climate change on aquaculture: drivers, impacts and policies. Chapter 20 in: Barange, M. et al., eds. 2018. Impacts of climate change on fisheries and aquaculture: synthesis of current knowledge, adaptation and mitigation options. FAO Fisheries and Aquaculture Technical Paper No. 627. Rome, FAO. 628 pp.
- Davies, H.N., Beckley, L.E., Kobryn, H.T., Lombard, A.T., Radford B., Heyward, A. (2016). Integrating Climate Change Resilience Features into the Incremental Refinement of an Existing Marine Park. *PLoS ONE* 11(8)
- Donner, S.D., and Webber, S. (2014). Obstacles to climate change adaptation decisions: a case study of sea-level rise and coastal protection measures in Kiribati, in *Sustainability Science Journal* 9:331-345
- Dowling, N.A., J.R. Wilson, M.B. Rudd, E.A. Babcock, M. Caillaux, J. Cope, D. Dougherty, R. Fujita, T. Gedamke, M. Gleason, N. Gutierrez, A. Hordyk, G.W. Maina, P.J. Mous, D. Ovando, A.M. Parma, J. Prince, C. Revenga, J. Rude, C. Szuwalski, S. Valencia, and S. Victor. (2016). FishPath: A Decision Support System for Assessing and Managing Data- and Capacity- Limited Fisheries. In: T.J. Quinn II,

- J.L. Armstrong, M.R. Baker, J. Heifetz, and D. Witherell (eds.), *Assessing and Managing Data-Limited Fish Stocks*. Alaska Sea Grant, University of Alaska Fairbanks. <http://doi.org/10.4027/amdlfs.2016.03>
- Duarte, C.M., Losada, I.J., Hendriks, I.E., Mazarrasa, I. and Marbà, N. (2013). The role of coastal plant communities for climate change mitigation and adaptation. *Nature Climate Change*, 3(11), p.961.
- Dunstan, P.K., Moore, B.R., Bell, J.D., Holbrook, N.J., Oliver, E.C., Risbey, J., Foster, S.D., Hanich, Q., Hobday, A.J. and Bennett, N.J., 2018. How can climate predictions improve sustainability of coastal fisheries in Pacific Small-Island Developing States?. *Marine Policy*, 88, pp.295-302.
- Dupar, M., with McNamara, L. and Pacha, M. (2019). *Communicating climate change: A practitioner's guide*. Cape Town: Climate and Development Knowledge Network (CDKN). 88 pp.
- Eakin, H. C., Lemos, M. C., & Nelson, D. R. (2014). Differentiating capacities as a means to sustainable climate change adaptation. *Global Environmental Change*, 27, 1-8.
- Evans, H. C., Dyll, L., & Teer-Tomaselli, R. (2018). Communicating climate change: Theories and perspectives. In *Handbook of Climate Change Communication: Vol. 1* (pp. 107-122). Springer, Cham.
- Eyzaguirre, J. and Tamburello, N. (2019). Synthesis. CRFM Research Paper Collection, No. 9.
- Food and Agriculture Organization of the United Nations [FAO] (1995). *Code of Conduct for Responsible Fisheries*. <http://www.fao.org/3/v9878e/V9878E.pdf>
- FAO (2015). *Voluntary guidelines for securing sustainable small-scale fisheries in the context of food security and poverty eradication*.
- FAO (2015a). *Assessing climate change vulnerability in fisheries and aquaculture: Available methodologies and their relevance for the sector*, by Cecile Brugère and Cassandra De Young. FAO Fisheries and Aquaculture Technical Paper No. 597. Rome, Italy.
- FAO (2017). *Guidelines and recommendations for the implementation of the Sendai Framework for Disaster Risk Reduction in the Agriculture and Food Security and Nutrition Sector. Latin America and the Caribbean*. https://www.preventionweb.net/files/54350_54350guidelinessendaiframeworkagric.pdf
- FAO (2019). *WECAFC Data Collection Reference (DCRF) Framework. Version 2019-03*.
- FAO (2019a). *FAO's Work on Climate Change – Fisheries & Aquaculture*. Rome.
- Feller, I. C., Friess, D. A., Krauss, K. W., & Lewis, R. R. (2017). The state of the world's mangroves in the 21st century under climate change. *Hydrobiologia*, 803(1), 1-12.
- Fisher, J., Jorgensen, J., Josupeit, H., Kalikoski, D., & Lucas, C. (2015). *Fishers' knowledge and the ecosystem approach to fisheries*. FAO Fisheries and Aquaculture Technical Paper: Rome.
- Flannery, W., N. Healy and M. Luna. (2018). "Exclusion and Nonparticipation in Marine Spatial Planning." *Marine Policy* 88: 32–40.
- Forni, L., Catalano, M., & Pezzolla, E. (2018). *Increasing Resilience: Fiscal Policy for Climate Adaptation*. *Fiscal Policies for Development and Climate Action*, 115.
- Frias-Torres, S., P.H. Montoya-Maya, N. Shah (Eds). (2018). *Coral Reef Restoration Toolkit: A Field-Oriented Guide Developed in the Seychelles Islands*. Nature Seychelles, Mahe, Republic of Seychelles. 76 pp.
- Frisari, G., Gallardo, M., Nakano, C., Cárdenas, V., & Monnin, P. (2019). *Climate Risk and Financial Systems of Latin America: Regulatory, Supervisory and Industry Practices in the Region and Beyond*.
- Froehlich, H.E., Gentry, R.R. and Halpern, B.S. (2018). Global change in marine aquaculture production potential under climate change. *Nature ecology & evolution*, 2(11), pp.1745-1750.
- Gaines, S.D., Costello, C., Owashi, B., Mangin, T., Bone, J., Molinos, J.G., Burden, M., Dennis, H., Halpern, B.S., Kappel, C.V. and Kleisner, K.M. (2018). Improved fisheries management could offset many negative effects of climate change. *Science advances*, 4(8), p.eaao1378.
- Gender in Fisheries Team [GIFT]. (2018). *Gender Scoping Preliminary Report: Caribbean Fisheries in the Context of the Small-scale fisheries guidelines*. Gender in Fisheries Team (GIFT), Centre for Resource Management and Environmental Studies (CERMES), The University of the West Indies, Cave Hill Campus, Barbados. CERMES Technical Report No. 86:60pp.
- Gentner, B. (2016). *The Use and Design Of Rights And Tenure Based Management Systems For Transboundary Stocks In The Caribbean*. FAO Fisheries and Aquaculture Circular No. 1126.
- Gephart, J. A., Deutsch, L., Pace, M. L., Troell, M., & Seekell, D. A. (2017). Shocks to fish production: Identification, trends, and consequences. *Global Environmental Change*, 42, 24-32.
- Gillett, R., Preston, G., Nash, W., Govan, H., Adams, T. and Lam, M. (2008). *Livelihood diversification as a marine resource management tool in the Pacific Islands: Lessons learned*. SPC Fisheries Newsletter, 125, pp.32-39.

- Golden, J.S., Viridin, J., Nowacek, D., Halpin, P., Benneer, L. and Patil, P.G. (2017). Making sure the blue economy is green. *Nature ecology & evolution*, 1(2), pp.1-3.
- Gourlie, D., Davis, R., Govan, H., Marshman, J. and Hanich, Q. (2018). Performing “A New Song”: suggested considerations for drafting effective coastal fisheries legislation under climate change. *Marine Policy*, 88, pp.342-349.
- Government of Saint Lucia. (2018). Saint Lucia’s Sectoral Adaptation Strategy and Action Plan for the Fisheries Sector (Fisheries SASAP) 2018-2028, under the National Adaptation Planning Process. Department of Sustainable Development, Ministry of Education, Innovation, Gender Relations and Sustainable Development and Department of Agriculture, Fisheries, Natural Resources and Cooperatives, Ministry of Agriculture, Fisheries, Physical Planning, Natural Resources and Cooperatives.
- Greer, K. (2014). Considering The ‘Effort Factor’ In Fisheries: A Methodology for Reconstructing Global Fishing Effort And Co2 Emissions, 1950 – 2010. M.Sc. Thesis University of British Columbia. [LINK](#)
- Greer, K., Zeller, D., Woroniak, J., Coulter, A., Winchester, M., Palomares, M.D. and Pauly, D., (2019). Global trends in carbon dioxide (CO₂) emissions from fuel combustion in marine fisheries from 1950 to 2016. *Marine Policy*, 107.
- Grimsditch, G.D. and Salm, R.V. (2006). Coral Reef Resilience and Resistance to Bleaching. IUCN, Gland, Switzerland. 52pp
- Guannel, G., Arkema, K., Ruggiero, P. and Verutes, G. (2016). The power of three: coral reefs, seagrasses and mangroves protect coastal regions and increase their resilience. *PloS one*, 11(7), p.e0158094.
- Guggisberg, S. (2019). Funding coastal and marine fisheries projects under the climate change regime. *Marine Policy*, 107, 103352.
- Haque, C.E., Idrobo, C.J., Berkes, F. and Giesbrecht, D. (2015). Small-scale fishers’ adaptations to change: The role of formal and informal credit in Paraty, Brazil. *Marine Policy*, 51, pp.401-407.
- Harper S, Adshade M, Lam VWY, Pauly D, Sumaila UR (2020) Valuing invisible catches: Estimating the global contribution by women to small-scale marine capture fisheries production. *PLoS ONE* 15(3): e0228912. <https://doi.org/10.1371/journal.pone.0228912>
- Hassanali, K. (2017). Challenges in mainstreaming climate change into productive coastal sectors in a Small Island State–The case of Trinidad and Tobago. *Ocean & coastal management*, 142, 136-142.
- Hejnowicz, A.P., Kennedy, H., Rudd, M.A. and Huxham, M.R. (2015.) Harnessing the climate mitigation, conservation and poverty alleviation potential of seagrasses: prospects for developing blue carbon initiatives and payment for ecosystem service programmes. *Frontiers in Marine Science*, 2, p.32. [LINK](#)
- Hernández-Delgado, E.A., Mercado-Molina, A.E., Alejandro-Camis, P.J., Candelas-Sánchez, F., Fonseca-Miranda, J.S., González-Ramos, C.M., Guzmán-Rodríguez, R., Mège, P., Montañez-Acuña, A.A., Maldonado, I.O. and Otaño-Cruz, A. (2014). Community-based coral reef rehabilitation in a changing climate: lessons learned from hurricanes, extreme rainfall, and changing land use impacts. *Open Journal of Ecology*, 4(14), p.918. [LINK](#)
- Intergovernmental Panel on Climate Change [IPCC] (2014). *Climate Change 2014: Impacts, Adaptation and Vulnerability*. Chapter 29.
- IPCC (2019). Summary for Policymakers. *In: IPCC Special Report on the Ocean and Cryosphere in a Changing Climate* [H.-O. Pörtner, D.C. Roberts, V. Masson-Delmotte, P. Zhai, M. Tignor, E. Poloczanska, K. Mintenbeck, A. Alegría, M. Nicolai, A. Okem, J. Petzold, B. Rama, N.M. Weyer (eds.)].
- International Collective in Support of Fishworkers [ICSF] (2017). *Traditional knowledge Use for the Sustainable*
- International Fund for Agricultural Development [IFAD] (2014). *Guidelines for Integrating Climate Change Adaptation into Fisheries and Aquaculture Projects*.
- International Labour Organization (ILO). (2014). *Climate Change and Employment: Challenges and Opportunities in the Caribbean*. Background document for the Tripartite meeting for consultations on “Decent Work, Climate Change and Sustainable Development”. 29 pp.
- Jentoft, S., & Chuenpagdee, R. (2015). Assessing governability of small-scale fisheries. In *Interactive Governance for Small-Scale Fisheries* (pp. 17-35). Springer, Cham.
- Jones, M. and Tamburello, N. (2019). F. Selecting Adaptation Options and Creating An Action Plan: From The Possible To The Practical. In *CRFM (2019) Reports on Analytical Tools and Monitoring Guidance: Sequel to the CRFM Research Paper Collection Volume 9*.

- Jones, K.R., Watson, J.E.M., Possingham, H.P., Klein, C.J. (2016). Incorporating climate change into spatial conservation prioritisation: A review. *Biological Conservation*, 194 (121–130).
- Karp, M. A., J. Peterson, P. D. Lynch, and R. Griffiths (editors). *Accounting for Shifting Distributions and Changing Productivity in the Fishery Management Process: From Detection to Management Action*. (2018). U.S. Dept. of Commerce, NOAA. NOAA Technical Memorandum NMFS-F/SPO-188, 37 p.
- Karp, M.A., Peterson, J.O., Lynch, P.D., Griffiths, R.B., Adams, C.F., Arnold, W.S., Barnett, L.A., deReynier, Y., DiCosimo, J., Fenske, K.H. and Gaichas, S.K. (2019). Accounting for shifting distributions and changing productivity in the development of scientific advice for fishery management. *ICES Journal of Marine Science*, 76(5), pp.1305-1315.
- Keen, M.R., Schwarz, A.M. and Wini-Simeon, L. (2018). Towards defining the Blue Economy: Practical lessons from pacific ocean governance. *Marine Policy*, 88, pp.333-341.
- Keller, B.D., Gleason, D.F., McLeod, E., Woodley, C.M., Airamé, S., Causey, B.D., Friedlander, A.M., Grober-Dunsmore, R., Johnson, J.E., Miller, S.L. and Steneck, R.S. (2009). Climate change, coral reef ecosystems, and management options for marine protected areas. *Environmental management*, 44(6), pp.1069-1088. [LINK](#)
- Khan, A.S., Sumaila, U.R., Watson, R., Munro, G. & Pauly, D. (2006). The nature and magnitude of global non-fuel fisheries subsidies. In: *Catching more bait: A bottom-up re-estimation of global fisheries subsidies*. Eds: Sumaila, U.R. and Pauly, D. Fisheries Centre Research Reports 2006 14:6. The Fisheries Centre, University of British Columbia.
- Khan, A., Campbell, D., Singh-Renton, S., Murray, A. and Eyzaguirre, J. (2019). *Toward Climate-Smart Value Chains in Caribbean Fisheries*. Research Paper D. CRFM Research Paper Collection, No. 9.
- Kritzer, J.P., Costello, C., Mangin, T. and Smith, S.L. (2019). Responsive harvest control rules provide inherent resilience to adverse effects of climate change and scientific uncertainty. *ICES Journal of Marine Science*.
- Le Cornu, E., Doerr, A.N., Finkbeiner, E.M., Gourlie, D., Crowder, L.B. (2017). Spatial management in small-scale fisheries: A potential approach for climate change adaptation in Pacific Islands. *Spatial Policy*, 10.1016/j.marpol.2017.09.030.
- Lee, S. Y., Hamilton, S., Barbier, E. B., Primavera, J., & Lewis, R. R. (2019). Better restoration policies are needed to conserve mangrove ecosystems. *Nature Ecology & Evolution*, 3(6), 870-872.
- Liquete, C., Cid, N., Lanzanova, D., Grizzetti, B. and Reynaud, A. (2016). Perspectives on the link between ecosystem services and biodiversity: The assessment of the nursery function. *Ecological indicators*, 63, pp.249-257. [LINK](#)
- Lirman, D. and Schopmeyer, S. (2016). Ecological solutions to reef degradation: optimizing coral reef restoration in the Caribbean and Western Atlantic. *Peer J*, 4, p.e2597.
- Lovelock, C. E., & Brown, B. M. (2019). Land tenure considerations are key to successful mangrove restoration. *Nature Ecology & Evolution*, 3(8), 1135-1135.
- Maharaj, R.R., Lam, V.W., Pauly, D. and Cheung, W.W. (2018). Regional variability in the sensitivity of Caribbean reef fish assemblages to ocean warming. *Marine Ecology Progress Series*, 590, pp.201-209.
- Maina, J., Jones, K., Hicks, C., McClanahan, T., Watson, J., Tuda, A. and Andréfouët, S. (2015). Designing climate-resilient marine protected area networks by combining remotely sensed coral reef habitat with coastal multi-use maps. *Remote Sensing*, 7(12), pp.16571-16587.
- Management of Marine and Fishing Resources. http://aquaticcommons.org/21176/1/Traditional%20knowledge%20Use_%20COSTA_RICA.pdf
- McConney, P., Cox, S.A. and Parsram, K. (2020). Fisheries Governance and Food Security in the Eastern Caribbean. In *Food Security in Small Island States* (pp. 199-218). Springer, Singapore.
- McConney, P., Phillips, T., Nembhard, N., & Lay, M. (2017). Caribbean fisherfolk engage the small-scale fisheries guidelines. In *The Small-Scale Fisheries Guidelines* (pp. 451-472). Springer, Cham.
- McConney, P., Simmons, B., Nicholls, V., & Medeiros, R. P. (2017). Building the Barbados National Union of Fisherfolk Organisations. *Maritime Studies*, 16(1), 19.
- McLeod, Elizabeth and Salm, Rodney V. (2006). *Managing Mangroves for Resilience to Climate Change*. IUCN, Gland, Switzerland. 64pp.
- McManus, E., Collins, M., Yates, O., Sanders, M., Townhill, B., Mangi, S., & Tyllianakis, E. (2019). Commonwealth SIDS and UK Overseas Territories sustainable fisheries programmes: An overview of projects and benefits of official development assistance funding. *Marine Policy*, 107, 103437.

- Medeiros, R. P., McConney, P., Foppa, C. C., & Faraco, L. F. (2015). Fishers and their knowledge in Brazil: from extractive uses to collaborative exchanges. *Fishers' Knowledge and the Ecosystem Approach to Fisheries: Applications, Experiences and Lessons in Latin America*. (Eds J. Fischer, J. Jorgensen, H. Josupeit, D. Kalikoski, and CM Lucas.) pp, 191-208.
- Menéndez, P., Losada, I. J., Torres-Ortega, S., Narayan, S., & Beck, M. W. (2020). The Global flood protection Benefits of Mangroves. *Scientific Reports*, 10(1), 1-11.
- Mercer, J., Kelman, I., Altham, B., & Kurvits, T. (2012). Ecosystem-based adaptation to climate change in Caribbean small island developing states: integrating local and external knowledge. *Sustainability*, 4(8), 1908-1932.
- Mills, M., Weeks, R., Pressey, R.L., Gleason, M.G., Eisma-Osorio, R., Lombard, A.T., Harris, J.M., Killmer, A.B., White, A., Morrison, T.H. (2015). Real-world progress in overcoming the challenges of adaptive spatial planning in marine protected areas. *Biological Conservation*, 181 (2015) 54–63
- Monnereau, I. and H.A., Oxenford (2017). Impacts of Climate Change on Fisheries in the Coastal and Marine Environments of Caribbean Small Island Developing States (SIDS). Caribbean Marine Climate Change Report Card: Science Review 2017. Commonwealth marine Economies Programme.
- Moreto, W.D., R.W. Charlton, S.E. DeWitt and C.M. Burton. (2019). “The Convergence of Captured Fish and People: Examining the Symbiotic Nature of Labor Trafficking and Illegal, Unreported and Unregulated Fishing.” *Deviant Behavior* 0: 1–17.
- Moser, S. C., & Ekstrom, J. A. (2010). A framework to diagnose barriers to climate change adaptation. *Proceedings of the national academy of sciences*, 107(51), 22026-22031.
- Murray, L. (2016). Enhancing Information on Climate Change Impacts and Adaptation for Caribbean Smallscale Fisheries. Belize: Caribbean Community Climate Change Centre.
- Murray and Romer-Joseph (in prep). Post Hurricane Dorian Damage and Loss Assessment (DaLA) of the fisheries sector of the Bahamas. CCRIF Publication, in prep.
- Mycoo, M.A. (2018). Beyond 1.5 C: vulnerabilities and adaptation strategies for Caribbean Small Island developing states. *Regional environmental change*, 18(8), pp.2341-2353.
- Mycoo, M. and Chadwick, A. (2012). December. Adaptation to climate change: the coastal zone of Barbados. In *Proceedings of the Institution of Civil Engineers-Maritime Engineering* (Vol. 165, No. 4, pp. 159-168). Thomas Telford Ltd.
- Mycoo, M. and Donovan, M. G. (2017). A blue urban agenda: adapting to climate change in the coastal cities of Caribbean and Pacific Small Island Developing States.
- Nurse, L. and J.L. Charlery (2014). Projected SST trends across the Caribbean Sea based on PRECIS downscaling of ECHAM4, under the SRES A2 and B2 scenarios. *Theoretical and Applied Climatology*. doi:10.1007/s00704-014-1346-1
- Nurse, L.A. (2011). The implications of global climate change for fisheries management in the Caribbean. *Climate and Development* 3: 228-241.
- Oremus, K. L., Bone, J., Costello, C., Molinos, J. G., Lee, A., Mangin, T., & Salzman, J. (2020). Governance challenges for tropical nations losing fish species due to climate change. *Nature Sustainability*, 1-4.
- Österblom, H., C.C.C. Wabnitz, D. Tladi et al. (2020). *Towards Ocean Equity*. Washington, DC: World Resources Institute. <http://www.oceanpanel.org/how-distribute-benefits-ocean-equitably>
- Oxenford, H., and I., Monnereau (2017). Impacts of Climate Change on Fish and Shellfish in the Coastal and Marine Environments of Caribbean Small Island Developing States (SIDS). Pages 83-114 Caribbean marine climate change report card: Science review 2017. pp 83-114. Commonwealth marine Economies Programme.
- Oxenford, H.A. and Monnereau, I. (2018). Climate change impacts, vulnerabilities and adaptations: Western Central Atlantic marine fisheries. Chapter 9 in: Barange, M. et al., eds. 2018. *Impacts of climate change on fisheries and aquaculture: synthesis of current knowledge, adaptation and mitigation options*. FAO Fisheries and Aquaculture Technical Paper No. 627. Rome, FAO. 628 pp.
- Oyinlola, M.A., Reygondeau, G., Wabnitz, C.C., Troell, M. and Cheung, W.W. (2018). Global estimation of areas with suitable environmental conditions for mariculture species. *PloS one*, 13(1).
- Parker, B.A., J.M. West, A.T. Hamilton, C.A. Courtney, P. MacGowan, K.H. Koltes, D.A. Gibbs, and P. Bradley. 2017. *Adaptation Design Tool: Corals and Climate Adaptation Planning*. Silver Spring, MD: NOAA Coral Reef Conservation Program. NOAA Technical Memorandum CRCP 27, 58 pp. DOI: 10.7289/V51N7Z5F

- Patil, P.G., Viridin, J., Diez, S.M., Roberts, J., Singh, A. (2016). *Toward A Blue Economy: A Promise for Sustainable Growth in the Caribbean; An Overview*. The World Bank, Washington D.C. 92 pp.
- Pearson, J., McNamara, K. E., & Nunn, P. D. (2020). *iTaukei Ways of Knowing and Managing Mangroves for Ecosystem-Based Adaptation*. In: *Managing Climate Change Adaptation in the Pacific Region* (pp. 105-127). Springer, Cham.
- Pigato, M.A. Editor. (2019). *Fiscal Policies for Development and Climate Action*. International Development in Focus. Washington, DC: World Bank. doi:10.1596/978-1-4648-1358-0 License: Creative Commons Attribution CC BY 3.0 IGO
- Pilot Programme on Climate Resilience. [PPCR] (2018). *Microfinance for Climate Adaptation: From Readiness to Resilience*. Climate Investment Funds. February 2018. [LINK](#)
- Pinsky, M.L., Reygondeau, G., Caddell, R., Palacios-Abrantes, J., Spijkers, J. and Cheung, W.W. (2018). *Preparing ocean governance for species on the move*. *Science*, 360(6394), pp.1189-1191.
- Pinsky, M.L., and N.J. Mantua. (2014). *Emerging adaptation approaches for climate ready fisheries management*. *Oceanography* 27(4):146–159, <http://dx.doi.org/10.5670/oceanog.2014.93>.
- Pomeroy, R. S., Baldwin, K., & McConney, P. (2014). *Marine Spatial Planning in Asia and the Caribbean: application and implications for fisheries and marine resource management*. *Desenvolvimento e Meio Ambiente*, 32, 151-164.
- Poulain, F., Himes-Cornell, A. and Shelton, C. (2018). *Methods and tools for climate change adaptation in fisheries and aquaculture*. Chapter 25 in: Barange, M., Bahri, T., Beveridge, M.C., et al., eds., 2018. *Impacts of Climate Change on Fisheries and Aquaculture. Synthesis of Current Knowledge, Adaptation and Mitigation Options*. Rome: Food and Agriculture Organization (FAO) of the United Nations. 654 pp.
- Queirós, A.M., Fernandes, J., Genevier, L. and Lynam, C.P. (2018). *Climate change alters fish community size & structure, requiring adaptive policy targets*. *Fish and Fisheries*, 19(4), pp.613-621.
- Rare and The Behavioural Insights Team. (2019). *Behavior Change For Nature: A Behavioral Science Toolkit for Practitioners*. Arlington, VA: Rare.
- Reid, G.K., Gurney-Smith, H.J., Marcogliese, D.J., Knowler, D., Benfey, T., Garber, A.F., Forster, I., Chopin, T., Brewer-Dalton, K., Moccia, R.D. and Flaherty, M. (2019). *Climate change and aquaculture: considering biological response and resources*. *Aquaculture Environment Interactions*, 11, pp.569-602.
- Resch, E., Allan, S. Alvarez, L. G. and Bisht, H. (2017). *Mainstreaming, accessing and institutionalising finance for climate change adaptation*. *Action on Climate Today – Learning Paper*.
- Runhaar, H., Wilk, B., Persson, Å., Uittenbroek, C., & Wamsler, C. (2018). *Mainstreaming climate adaptation: taking stock about “what works” from empirical research worldwide*. *Regional Environmental Change*, 18(4), 1201-1210.
- Rustomjee, C., 2016. *Developing the blue economy in Caribbean and other small states*. CIGI Policy Brief, No. 75, 8 pp.
- Savo, V., Morton, C. and Lepofsky, D. (2017). *Impacts of climate change for coastal fishers and implications for fisheries*. *Fish and fisheries*, 18(5), pp.877-889.
- Schill et al. (2014). *US Virgin Islands Climate Change Ecosystem-Based Adaptation Promoting Resilient Coastal and Marine Communities*. GUIDANCE DOCUMENT. 68 pp [LINK](#)
- Schill, S.R., Knowles, J.E., Rowlands, G., Margles, S., Agostini, V. and Blyther, R. (2011). *Coastal benthic habitat mapping to support marine resource planning and management in St. Kitts and Nevis*. *Geography Compass*, 5(12), pp.898-917.
- Schuler, P., Oliviera, L. E., Mele, G., & Antonio, M. (2018). *Managing the Fiscal Risks Associated with Natural Disasters*.
- Scott, H, McEvoy, D, Chhetri, P, Basic, F & Mullett, J. (2013). *Climate change adaptation guidelines for ports. Enhancing the resilience of seaports to a changing climate report series*, National Climate Change Adaptation Research Facility, Gold Coast, 28 pp.
- SDG Lab (2019). *Activating the 2030 Agenda*. SDG Toolkit. [LINK](#)
- Selden, R. and Pinsky, M. (2019). *Climate change adaptation and spatial fisheries management*. In: Cheung, W., Ota, Y. and Cisneros-Montemayor, A. eds., 2019. *Predicting Future Oceans: Sustainability of Ocean and Human Systems Amidst Global Environmental Change*. Elsevier. 539 pp.
- Serrano, O., Kelleway, J.J., Lovelock, C. and Lavery, P.S. (2019). *Conservation of Blue Carbon Ecosystems for Climate Change Mitigation and Adaptation*. In *Coastal Wetlands* (pp. 965-996).

- Severin, P. and Small, B. J. (2016). Knowledge, Attitudes, Practices / Behaviour (KAP/B) Study on Climate Change. Saint Lucia Baseline Study 2016.
- Shaffril, H.A.M., Samah, A.A. and D'Silva, J.L. (2017). Climate change: Social adaptation strategies for fishermen. *Marine Policy*, 81, pp.256-261.
- Smith, R. A. (2018). Risk perception and adaptive responses to climate change and climatic variability in northeastern St. Vincent. *Journal of Environmental Studies and Sciences*, 8(1), 73-85.
- Smith, R.A. (2018). Risk perception and adaptive responses to climate change and climatic variability in northeastern St. Vincent. *Journal of Environmental Studies and Sciences*, 8(1), pp.73-85.
- Spalding, M.D., Ruffo, S., Lacambra, C., Meliane, I., Hale, L.Z., Shepard, C.C. and Beck, M.W., (2014). The role of ecosystems in coastal protection: Adapting to climate change and coastal hazards. *Ocean & Coastal Management*, 90, pp.50-57.
- Stoll JS, Fuller E, Crona BI (2017) Uneven adaptive capacity among fishers in a sea of change. *PLoS ONE* 12(6): e0178266. <https://doi.org/10.1371/journal.pone.0178266>
- Tamura, M., Ishida, M., Sidman, C., Montes, N. and Lorenzen, K. (2018). Facilitating Co-managed Fisheries in the Caribbean Region: Good Practices and Guidance from the CARIFICO Experience. Japan International Cooperation Agency and Florida Sea Grant, University of Florida. https://www.flseagrant.org/wp-content/uploads/TP_234_web.pdf
- The Nature Conservancy [TNC]. (2016). Summary Report of Satellite Mapping Of Benthic Habitats And Bathymetry For Antigua, Dominica And Saint Lucia, Caribbean. 25 pp. Available from: https://marineplanning.org/wp-content/uploads/2018/02/OECS-Antigua-Dominica-and-St-Lucia-Report-3Dec2016_benthic_habitat_mapping.pdf
- Thomas, L.R., Clavelle, T., Klinger, D.H. and Lester, S.E. (2019). The ecological and economic potential for offshore mariculture in the Caribbean. *Nature Sustainability*, 2(1), pp.62-70.
- Thornton, T. F., & Scheer, A. M. (2012). Collaborative engagement of local and traditional knowledge and science in marine environments: a review. *Ecology and Society*, 17(3).
- Tietze, U. and van Anrooy, R. (2018). Assessment of insurance needs and opportunities in the Caribbean fisheries sector. *FAO Fisheries and Aquaculture Circular*, (C1175), pp.I-56.
- UNESCO (nd). Mobilizing Indigenous and Local Knowledge Solutions: Addressing Climate Impacts and Vulnerabilities. <https://en.unesco.org/enhancing-resilience-face-global-change-mobilizing-local-and-indigenous-knowledge/concept-note>
- United Nations Framework Convention on Climate Change [UNFCCC]. (2016). Report of the Conference of the Parties on its twenty-first session, held in Paris from 30 November to 13 December 2015. *FCCC/CP/2015/10/Add.1*
- Unsworth, R.K., Nordlund, L.M. and Cullen and Unsworth, L.C. (2019). Seagrass meadows support global fisheries production. *Conservation Letters*, 12(1), p.e12566. [LINK](#)
- Uppanunчай, A., Chitmanat, C., & Lebel, L. (2018). Mainstreaming climate change adaptation into inland aquaculture policies in Thailand. *Climate Policy*, 18(1), 86-98.
- U.S. Agency for International Development [USAID] (2019). Integrating Social and Behavior Change in Climate Change Adaptation: An Introductory Guide. 21 pp.
- Van As, H., Bergh, P. E., Brett, A., Copeland, D., Fernandez, M., Gusman, A., ... & Wilcox, C. (2019). Illegal, Unreported and Unregulated Fishing and Associated Drivers. DC: World Resources Institute. Available online at www.oceanpanel.org/iuu-fishing-and-associated-drivers.
- Wabnitz, C. C. and Blasiak, R. (2019). The rapidly changing world of ocean finance. *Marine Policy*, 107, 103526.
- Wabnitz, C.C. (2019). Adapting tourist seafood consumption practices in Pacific Islands to climate change. In: Cheung, W., Ota, Y. and Cisneros-Montemayor, A. eds., 2019. *Predicting Future Oceans: Sustainability of Ocean and Human Systems Amidst Global Environmental Change*. Elsevier. 539 pp.
- Wabnitz, C.C., Andréfouët, S., Torres-Pulliza, D., Müller-Karger, F.E. and Kramer, P.A., (2008). Regional-scale seagrass habitat mapping in the Wider Caribbean region using Landsat sensors: Applications to conservation and ecology. *Remote Sensing of Environment*, 112(8), pp.3455-3467.
- Ward, R. D., Friess, D. A., Day, R. H., & MacKenzie, R. A. (2016). Impacts of climate change on mangrove ecosystems: a region by region overview. *Ecosystem Health and Sustainability*, 2(4), e01211.
- Weber, O. and Acheta, E. (2016). The Equator Principles: Do They Make Banks More Sustainable. *Inquiry Working Paper*, 16(05).

- WECAFC (2019). Report of the Tenth Session of the Scientific Advisory Group (SAG). WECAFC/SAG/X/2019/3, 30 p.
- Wedding, L.M., Lecky J., Gove J.M., Walecka H.R., Donovan M.K., Williams G.J. (2018). Advancing the integration of spatial data to map human and natural drivers on coral reefs. *PLoS ONE* 13(3): e0189792.
- Wentz, J. (2017). Planning for the effects of climate change on natural resources. *Envtl. L. Rep. News & Analysis*, 47, 10220.
- West, J.M., Courtney, C.A., Hamilton, A.T., Parker, B.A., Julius, S.H., Hoffman, J., Koltas, K.H. and MacGowan, P. (2017). Climate-smart design for ecosystem management: a test application for coral reefs. *Environmental management*, 59(1), pp.102-117.
- Wilson, A.M.W. and Forsyth, C. (2018). Restoring near-shore marine ecosystems to enhance climate security for island ocean states: aligning international processes and local practices. *Marine Policy*, 93, pp.284-294.
- Woodson, C.B., Micheli, F., Boch, C., Al-Najjar, M., Espinoza, A., Hernandez, A., Vázquez-Vera, L., Saenz-Arroyo, A., Monismith, S.G. and Torre, J. (2019). Harnessing marine microclimates for climate change adaptation and marine conservation. *Conservation Letters*, 12(2), p.e12609.
- World Food Program [WFP] (2019). Strengthening Climate Risk Finance in the Caribbean for Rapid Assistance in Emergencies. <https://reliefweb.int/sites/reliefweb.int/files/resources/WFP-0000109034.pdf>
- Worthington, T., & Spalding, M. (2018). Mangrove Restoration Potential: A global map highlighting a critical opportunity. Report prepared by the IUCN, University of Cambridge, and The Nature Conservancy. <https://doi.org/10.17863/CAM.39153>.
- Young, T., Fuller, E.C., Provost, M.M., Coleman, K.E., St. Martin, K., McCay, B.J., Pinsky, M.L. and Handling editor: Mitsutaku Makino. (2018). Adaptation strategies of coastal fishing communities as species shift poleward. *ICES Journal of Marine Science*, 76(1), pp.93-103.

The CRFM is an inter-governmental organization whose mission is to “Promote and facilitate the responsible utilization of the region’s fisheries and other aquatic resources for the economic and social benefits of the current and future population of the region”. The CRFM consists of three bodies – the Ministerial Council, the Caribbean Fisheries Forum and the CRFM Secretariat.

CRFM members are Anguilla, Antigua and Barbuda, The Bahamas, Barbados, Belize, Dominica, Grenada, Guyana, Haiti, Jamaica, Montserrat, St. Kitts and Nevis, St. Lucia, St. Vincent and the Grenadines, Suriname, Trinidad and Tobago and the Turks and Caicos Islands.

CRFM Headquarters

secretariat@crfm.int

Tel: (501) 223-4443 - Fax: (501) 223-4446
Belize City - Belize

Eastern Caribbean Office

crfmsvg@crfm.int

Tel: (784) 457-3474 - Fax: (784) 457-3475
Kingstown - St. Vincent & the Grenadines

www.crfm.int

www.youtube.com/TheCRFM

www.facebook.com/CarFisheries

www.twitter.com/CaribFisheries



www.crfm.int