

Climate change and small-scale fisheries

A climate risk management perspective for the Caribbean

This factsheet outlines the main aspects from a global study and an underlying review on the management of climate change-induced losses and damages in small-scale fisheries in the Caribbean Community and Common Market (CARICOM) member states¹.

GLOBAL CONTEXT

Small-scale commercial and subsistence fisheries contribute significantly to income, livelihoods, and food security for hundreds of millions of people, particularly in Small Island Developing States (SIDS) and the coastal zones of Least Developed Countries

¹ The aim of both the study and the extended review was to focus on the climate change and fisheries nexus within the context of development cooperation. The study can be accessed [here](#).

(LDCs). More than two thirds of the partner countries supported by Germany's development cooperation are island or coastal nations. In these countries, 90 % of the people working in the fishing sector are subsistence fishers and small-scale aquaculture – including mariculture – farmers².

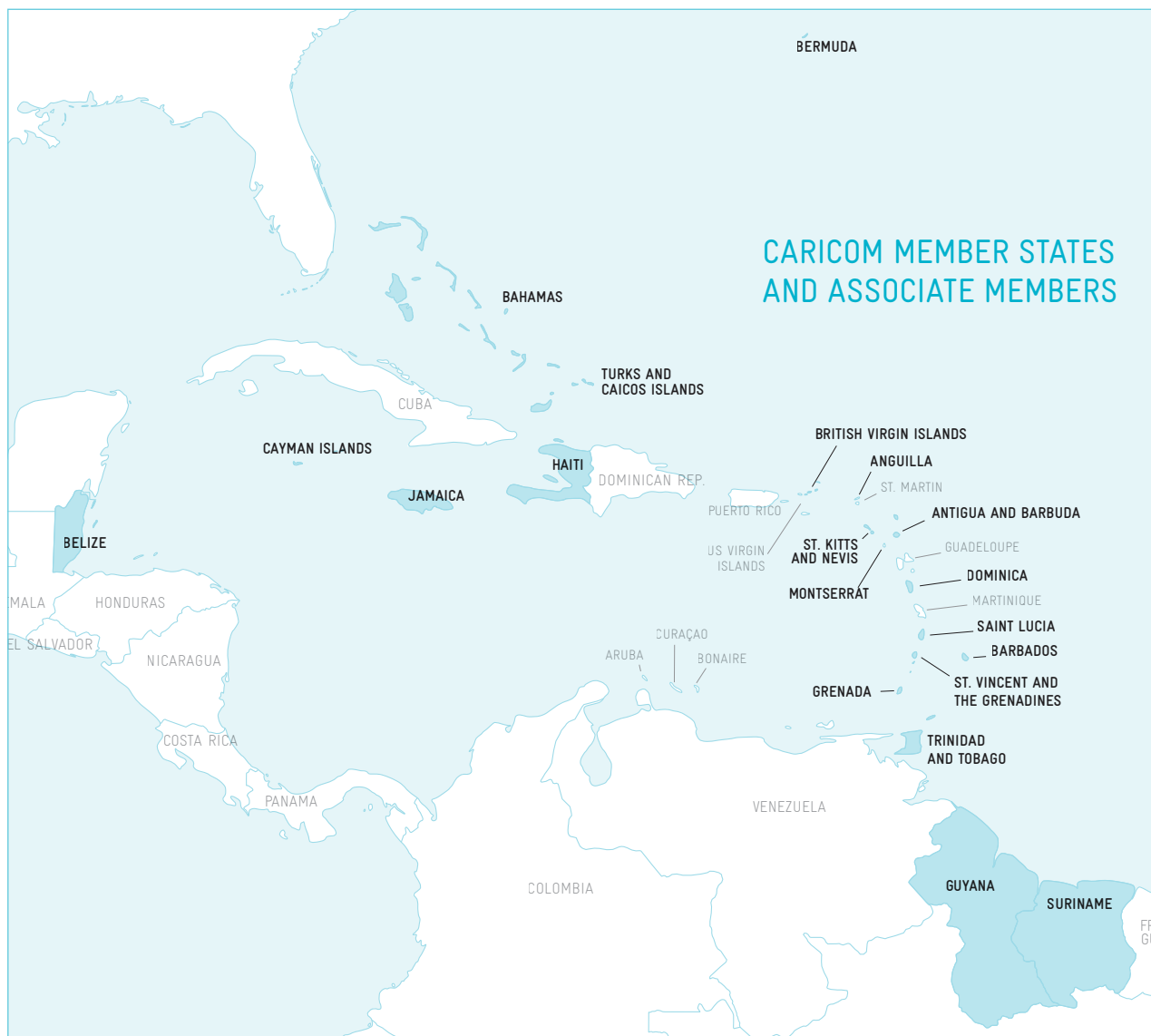
Climate change presents key challenges for small-scale fisheries and mariculture and is projected to have significant impacts on the lives of people dependent on these activities. Changes in ocean temperature and chemistry are already affecting the distribution and abundance of marine organisms. In addition, **recent climate projections suggest a significant increase in the frequency**

² Food and Agriculture Organization. (2021). [Policy support and governance gateway](#).



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and/or magnitude of extreme weather events such as storms and floods³.

The precise magnitude of future impacts of climate change on fisheries – in particular small-scale fisheries – are still poorly understood, since they involve numerous interactions with fragile and complex ecosystems that are often already affected by other stressors such as overfishing or pollution. Assessing and managing risks to increase resilience and decrease poverty, inequality, and food insecurity are thus a priority of international cooperation.

IMPORTANCE OF SMALL-SCALE FISHERIES IN THE CARIBBEAN

The annual fish production of all member states of the Caribbean Community and Common Market (CARICOM) is currently worth approximately USD 420 million – point of first sale – of which **93 %** comes from **marine capture fisheries**, and **7 %** from **aquaculture – including mariculture**. The official contribution of fisheries and aquaculture to the gross domestic product (GDP) in CARICOM countries ranges from 4.47 % (Suriname) to 0.07 % (Trinidad and Tobago)⁴.

³ Intergovernmental Panel on Climate Change. (2014). *AR5 Climate Change 2014: Impacts, adaptation, and vulnerability. Part A: Global and sectoral aspects. Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change*. Intergovernmental Panel on Climate Change. (2019). *Special Report on the ocean and cryosphere in a changing climate*.

⁴ Caribbean Regional Fisheries Mechanism. (2020). *CRFM Statistics and Information Report – 2018*.

These GDP statistics, however, do not fully reflect the importance of fisheries in providing food and livelihoods for people in the Caribbean. The latest figures suggest fisheries and aquaculture – including mariculture – employ more than 280,000 people, or 3.3 % of the total CARICOM workforce . **Fish consumption is about 20 kg per person per annum**, equivalent to between 2 and 15 % of animal protein intake depending on the country⁵.

While the catch and production side of small-scale fisheries is still a male dominated industry mainly, women often hold the majority of jobs in post-harvest processing and marketing, as well as in the sale of fishing equipment and in the management of fishing cooperatives and civil society organisations. On some Caribbean islands, such as Jamaica, women typically are the owner of the fishing boats and in control of business related finances.

NATURAL AND HUMAN STRESSORS

According to the IPCC, the Caribbean region is one of the most vulnerable regions to impacts from climate change globally, with small-scale fisheries being particularly at risk. The sector's heightened vulnerability stems

⁵ Food and Agriculture Organization (2016). Summary of the Recommendations of the Regional Technical Commissions. In: FAO Regional Conference for Latin America and the Caribbean. Thirty-fourth Session.

IPCC
SROCC
2019

All coastal ecosystems will experience high to very high risk under RCP8.5 by the end of the 21st century. The ecosystems expected to be at very high risk under the high emission scenario are coral reefs (transition from high to very high risk 0.6 – 1.2°C) (very high confidence), seagrasses meadows (2.2 – 3.0°C) (high confidence).

from the high exposure and sensitivity of both the marine ecosystems, such as coral reefs and mangrove forests, and its coastal communities to the current and projected changes. Climate-related hazards include increasingly frequent and severe **extreme weather events** (EWE), such as storms and flooding, but also gradual changes within the system, accordingly referred to as **slow onset processes** (SOP), such as warming and acidification of ocean waters. Among the severe accompanying impacts and consequences are degradation of biodiversity, coastal erosion, salinisation of coastal soils, and loss of land due to rising sea levels.

Coral reefs are particularly threatened by higher temperatures, with mass coral bleaching events reported with increasing frequency. More intense storms are also degrading fragile coastal reefs and exacerbating the threats they face from overfishing, pollution and sedimentation.



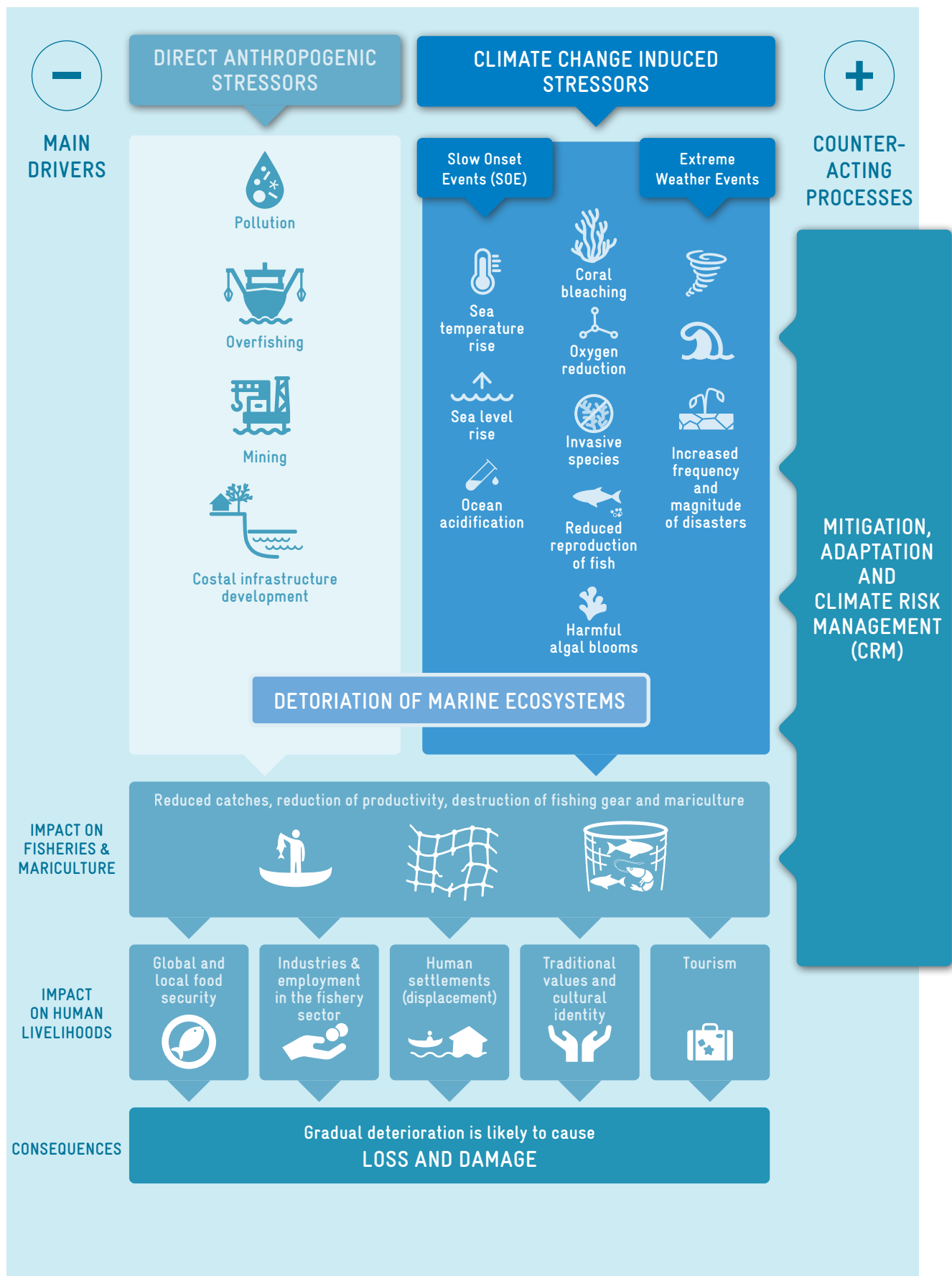


Figure 1: Impacts on fisheries and mariculture sector in the era of climate change

Source: © GIZ/Global Programme on Risk Assessment and Management for Adaptation to Climate Change (Loss and Damage)



More than 50 % of Caribbean coral reefs have already been lost, and more than 30 % of the remaining are classified in the high and very high threat categories⁶. Coral reef-associated harvested species (e.g. snapper, grouper, lobster, conch), which form a base of livelihoods in Caribbean fisheries, are projected to decline substantially in the coming decades.

The distribution of pelagic species such as tuna, dolphin-fish, billfish and flying fish will be affected by decreasing levels of oxygen content associated with warmer seas. Many fish species are expected to redistribute to cooler waters, and thus, tropical areas in particular will see a decline in species abundance and productivity.

Ocean acidification is becoming increasingly severe and has started affecting the Caribbean Sea. The decreasing pH value in the surface seawater will have extensive detrimental effects on coral reefs and many species of plankton and shellfish if the trend continues at the current rate.

The combined effects of gradual changes including ocean acidification, sea level rise (SLR) and extreme weather events such as storm surges and their related impacts and degraded coastal defenses will likely cause significant economic impacts on Caribbean SIDS. Much of the region's key infrastructure, including airports, seaports, hospitals and roads is protected by natural coastal barriers that will be eroded under current projections. Fisheries infrastructure and landing sites for small crafts are already being impacted in many locations.

Figure 1 summarises the main climate change induced and direct anthropogenic stressors that have the potential of seriously impacting fisheries and dependent human livelihoods leading to losses and damages. In the Caribbean, climate change will cause a rise in average temperature, resulting in a warmer, dryer region with more intense hurricanes and possibly more climate variability, affecting the entire marine ecology, and thus, the small-scale fisheries sector. Mitigation and adaptation measures, as well as a climate risk management strategy and instruments are tools to counteract resulting losses and damages.

Climate change, not least through the stressors of ocean acidification and harmful algal blooms, **means new pressures to Caribbean marine ecosystems, and is compounding existing challenges** from further anthropogenic stressors such as pollution, habitat destruction, coastal erosion, fisheries overexploitation and illegal, unreported and unregulated (IUU) fishing.

For a comprehensive and effective management of small-scale fisheries, capacities for enforcement, availability of reliable fisheries data and stakeholder participation in policy and decision-making are essential. According to available data **54 % of commercially harvested fish stocks in the region are already overexploited or depleted** and some 40 % of the stocks are fully exploited⁷.

A high level of exposure to climate change impacts combined with socio-economic aspects such as limited options to diversify livelihoods and a lack of capacities leads to a high vulnerability of the sector in the Caribbean.



In the last decade large accumulations of SARGASSUM SEAWEED have been drifting through the Caribbean impeding certain fishing operations and fouling fishing gear. These Sargassum blooms are thought to be associated with elevated sea surface temperatures (SSTs), increased nutrient input from Saharan dust and South American rivers and higher levels of dissolved CO₂. These blooms accumulate and decompose in shallow coastal areas often causing hypoxia and eutrophication, which can damage important nursery habitats (corals, seagrass) for juvenile fish.

⁶ Jackson, Donovan, Cramer, Lam (editors) (2014). *Status and Trends of Caribbean Coral Reefs: 1970–2012*.

⁷ Food and Agriculture Organization (2014). *The Sustainable Intensification of Caribbean Fisheries and Aquaculture*.

OPTIONS OF CLIMATE RISK MANAGEMENT (CRM)

The magnitude and interrelatedness of the risks described above highlight the need for an integrated climate risk management framework (CRM) to identify solutions for small-scale commercial and subsistence fisheries in the Caribbean. Over the past two decades, a wide range of initiatives has focused on strengthening the resilience of the sector using scientific research to develop improved policies and management, and through the implementation of specific adaptation options at the regional, national and community level.



CLIMATE RISK MANAGEMENT (CRM)

is a strategy to manage risk and potential impacts related to natural and climate-induced hazards. GIZ's Global Programme

Risk Assessment and Management for Adaptation to Climate Change (Loss and Damage) (GP L&D) developed a risk-based, iterative framework to manage climate-related risks considering biophysical, social, economic, non-economic, and environmental aspects. It considers the entire spectrum of climate-related hazards and triggered risks from short-term extreme weather events (EWE) to long-term slow onset processes (SOP). To minimise losses and damages, CRM combines a smart mix of approaches from climate change adaptation (CCA) and disaster risk reduction (DRR). To address residual losses and damages, these are complemented by more innovative adaptation tools such as risk finance and insurance, and transformational approaches such as livelihood diversification. Tried and tested measures are linked with innovative instruments and transformational approaches in a comprehensive and integrated way⁸. Ultimately, CRM implies that all sectors factor risks into plans, including considering how risks may affect action across sectors.

⁸ GIZ Global Programme on Risk Assessment and Management for Adaptation to Climate Change (2021). *Climate Risk Management. Promising pathways to avert, minimise, and address losses and damages.*

Efforts to strengthen the resilience of marine ecosystems include support for networks of Marine Protected Areas (MPA) and innovative financing mechanisms from the Caribbean Challenge initiative and the Caribbean Biodiversity Fund. The **Caribbean Aqua-Terrestrial Solutions** programme (CATS) is one example of a programme that supports a wide range of adaptation measures.

Since 2013, GIZ, commissioned by the Federal Ministry for Economic Cooperation and Development (BMZ) has been implementing the **CATS PROGRAMME** in selected countries of CARICOM⁹. The programme aims to improve the management of marine and coastal protected areas, including terrestrial resources in their immediate hinterlands (watersheds). To achieve this, an integrated Ridge-to-Reef approach for strengthening the resilience of natural ecosystems to climate variability and change induced risks and other anthropogenic stressors is applied and carried out through interventions, which promote good maritime, agricultural and forestry practices among programme partners and stakeholders. The programme encourages participation of and outreach to women and youth; the action areas include: promotion of sustainable ecosystem management (training/capacity building), restoration of coral reefs, generation of employment options and support of sustainable financial management practices by the partners operating in the targeted protected areas and their hinterlands.

⁹ [Caribbean Aqua-Terrestrial Solutions \(CATS\) project website](#)

Programmes are underway to engage communities and governments in Ecosystem-based Adaptation (EbA), including restoration programmes for key habitats, such as coral reefs and mangroves. Measures are also being taken to protect key species important for the resilience of coral reefs such as parrotfish and to remove harmful invasive species like lionfish.

Coral restoration programmes in several locations are demonstrating that they can successfully assist natural adaptation processes by propagating and planting resilient genotypes. These programmes are also an effective mechanism for actively engaging and educating local stakeholders in natural resource management with a community- and ecosystem-based approach.

Regional institutions, such as the Caribbean Community Climate Change Centre (CCCCC) and the Caribbean Regional Fisheries Mechanism (CRFM) are promoting the **Caribbean Community Common Fisheries Policy (CCCFP) to mainstream climate change into fisheries policy and legislation and shift the focus towards an ecosystem-based approach to fisheries management (EAF)**. CCCFP also encourages CARICOM countries to include fisheries into their existing national climate



change adaptation and disaster risk management (DRM) plans.

The Food and Agriculture Organization of the United Nations (FAO) has been supporting the CCCFP together with regional partners by implementing the “Strategy and action plan for disaster risk management and climate change adaptation in fisheries and aquaculture in the CARICOM and wider Caribbean region.”

Part of this action plan involves the **Climate Change Adaptation in the Eastern Caribbean Fisheries Sector Project (CC4FISH)** that is introducing adaptation measures in fisheries management and building the capacity of organisations involved in fisheries.

In an effort to reduce fishing pressure on reefs and increase the income of small-scale fishers, many Caribbean countries **are building capacity for offshore fishing**. This has involved the use of **Fish Aggregating Devices (FADs)**, drifting or anchored buoys or rafts that attract pelagic fish, making them easier to find and catch.

To ensure that the benefits of FADs are sustainable and do not lead to the harvesting of undersized fish, they must form part of effective fisheries management plans. Moving small-scale fishing further offshore may also require better access to ice for preserving fish, and improved weather forecasting and early warning systems (EWS) as well as investment into ocean-going vessels, safety equipment on board, and the development of a functional search and rescue service.

The Caribbean region is highly exposed to natural hazards, in particular hurricanes, tropical storms and storm surges. The loss of life as well as boats and equipment are therefore major risks for small-scale fishers. **The Sendai Framework for Disaster Risk Reduction**

2015–2030 refers to EWS as a critical element for disaster risk reduction, and they form an important part of the region’s 2014–2024 Comprehensive Disaster Management Strategy.

The Climate Risk and Early Warning Systems (CREWS) Caribbean initiative – supported by the WMO – World Bank/GFDRR, UNDRR, and regional Caribbean authorities with Germany as a contributing member is helping to strengthen capacity and streamline systems related to weather forecasting and multi-hazard impact-based warnings.

Reducing the vulnerability of fisheries infrastructure to the combined effects of storms and sea level rise by building climate-proof ports, landing sites, storage and processing facilities is also an important component of CRM.

When significant losses and damages occur, the existence of suitable insurance schemes is often essential for the recovery not only of individual fishers but for the wellbeing of entire fishing communities. **The Caribbean Ocean and Aquaculture Sustainability Facility (COAST)** has been developed as an innovative parametric insurance product by the **Caribbean Catastrophe Risk Insurance Facility (CCRIF)** at a scale relevant to vulnerable fishing communities.

COAST provides coverage for losses caused by adverse weather on fisheries and for direct damages caused by tropical storms to fishing vessels, equipment and infrastructure. A country’s COAST policy can be triggered under the Livelihood Protection component and the Tropical Cyclone component. To benefit from this facility, countries must be implementing CCCFP. In 2019/20 COAST was available in two pilot countries, Grenada and Saint Lucia.

RECOMMENDATIONS

While population growth and poor management of the resources may have been responsible for much of the declines in the productivity of small-scale fisheries in recent decades, it is clear that climate change and ocean acidification already have and potentially lead to more devastating impacts on Caribbean communities and the marine ecosystems on which they depend. The latest science outlined in the *IPCC Special Report on the Ocean and Cryosphere in a Changing Climate* (2019) provides striking projections on the magnitude of the risks, unless urgent action is taken. Caribbean countries will require substantial support from international partners to help them implement the necessary management measures and to strengthen scientific cooperation during the *United Nations Decade of Ocean Science for Sustainable Development* (2021–2030).

The management of risk in Caribbean fisheries will require a multi-faceted approach, with interventions focusing on improving the resilience of ecosystems, while also addressing the adaptive capacity of fishing communities. Recommendations have been identified by regional experts in a workshop and these can be broadly categorised into the following four fields of action:

→ Capacity-building at all levels to improve fisheries management and reduce risk

It is essential to support the adoption and transfer of the CCCFP into national fisheries management plans, which are aligned with national DRM plans, climate change adaptation plans, and co-management agreements with local communities. These plans will require location-

specific climate projections and vulnerability assessments. The participation of fishing communities in fisheries management must be actively strengthened to improve compliance with and enforcement of laws and regulations. This will require better communication and awareness, as well as policies for rights-based fisheries to create greater ownership of the resource.

More effective protection and restoration of key coral reefs, mangroves and seagrass beds will also be essential to improve their resilience. This should include networks of MPAs and EbA initiatives led by local communities and supported by governments, private sector, science and international partners.

Diversifying livelihoods and shifting fishing efforts to pelagic species will be required to reduce pressures on already degraded reefs. This should be encouraged with well-managed Fish Aggregative Devices (FADs), improved measures for safety-at-sea¹⁰, and more affordable and accessible ice and post-harvest processing facilities. Mariculture – while still modest – has potential to grow and provide jobs as well as contribute to food security, especially using low-input freshwater systems (e.g. earth ponds) or with coastal farms sheltered locations (e.g. seamounts).

→ Close data gaps

More data is required on the status of fish stocks and ecosystems to increase the understanding and building the evidence base for an ecosystem-based fisheries manage-

¹⁰ Improved safety at sea has for decades been of major concern to various institutions who recognize that a functional legal framework is the prerequisite for concerted actions for improved safety.



ment. Information on fish biomass as an indicator of reef health is particularly important and best obtained with the participation of local stakeholders and fishers. Overall, strengthening existing mechanisms and institutions in their capacities to collect and share data is crucial.

Data on the cultural, social, nutritional and health values of fisheries are needed to increase recognition from governments of the importance of small-scale fisheries.

Social and economic data, including gender specific considerations, are needed for a better understanding of the factors associated with social resilience and opportunities for livelihood diversification.

Advances in weather forecasting and early warning systems that meet the demands of small-scale fisheries will be essential to reduce risks and increase profitability. Higher resolution biophysical models for national and local climate projections are also required for locally specific vulnerability assessments and adaptation plans.

→ Instruments and tools

National fisheries management plans need to adopt an ecosystem-based approach to fisheries management (EAF) and use tools for Integrated Coastal Zone Management (ICZM) and Marine Spatial Planning (MSP). This will contribute to reducing local stressors on marine habitats, such as sedimentation and pollution.

Fisheries policies need to move towards a rights-based system (not open access) and use participatory processes for greater stakeholder engagement in decision-making.

Pioneering insurance schemes designed for small-scale fisheries that are currently being piloted in two countries (e.g. Caribbean Ocean and Aquaculture Sustainability Facility (COAST)) need to be evaluated, refined and then expanded to the wider region.

→ Scientific cooperation

Collaborative research is needed to facilitate the development of new information and communication technologies to improve cost-effectiveness of data acquisition, analysis and dissemination. These will also help with stakeholder participation in fisheries management and decision-making.

Inter and trans-disciplinary research is required to better understand the vulnerability of small-scale commercial and subsistence fisheries, in particular the complex interactions between socio-economic and ecological systems.

Risks associated with increasing sea surface temperature and ocean acidification on certain marine species and ecosystems present potentially devastating threats to the region's small-scale commercial and subsistence fisheries and require international scientific cooperation.

Scientific cooperation is needed to develop ecosystem-based adaptation options, such as large-scale reef and mangrove restoration, to strengthen coastal defences adjacent to critical infrastructure and reduce vulnerability from combined threats of sea level rise and bigger storm surges. These programmes could also provide alternative and supplementary livelihoods.

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