

Climate change and small-scale fisheries

A climate risk management perspective for the South Pacific Island Countries

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 South Pacific Island Countries and Territories¹.

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 (LDCs). More than two thirds of the partner countries supported by Germany's development cooperation are island or coastal nations. In these countries, 90 %

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](#).

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

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

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](#).



Published by

giz Deutsche Gesellschaft
für Internationale
Zusammenarbeit (GIZ) GmbH

The projected redistribution of resources and abundance increases the risk of conflicts among fisheries, authorities or communities. Challenges to fisheries governance are widespread under RCP 8.5 with regional hotspots such as [...] the tropical Pacific Ocean (medium confidence).

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 SOUTH PACIFIC

The **South Pacific** encompasses a vast tropical and sub-tropical area where **14 independent Pacific Island Countries and Territories** (PICTs) (compare figure 1) have a combined Exclusive Economic Zone (EEZ) of approximately 19 million km².

Oceanic fisheries are the **driving force of economic development** in many PICTs. They are comprised of large-scale, industrialised national and foreign fleets that principally target tuna. Access fees and associated licenses often make up the majority of government revenues.

Small-scale fisheries occur on all islands and provide an important source of food and income to local communities. An average of 47 % of coastal households across 17 PICTs earn their first or second income from catching or selling fish and invertebrates⁴. This source of income is often based on catch surplus to subsistence needs and sold at local markets, but also includes targeted high-value species for export markets.

For the independent PICTs, where total fishery dependence tends to be greatest, the average contribution of all fishery types to the national gross domestic product (GDP) was estimated to be 6.87 %⁵. The contribution was highly variable among these countries ranging from 1 % for the Cook Islands to 29.5 % for the Marshall Islands.

Coastal fisheries are extremely important for food security throughout the Pacific, **with subsistence catches comprising approximately 67 % of all coastal fisheries catch** across the region. The reliance on coastal fisheries as a source of local food is variable among PICTs, as stated above. For example, the share of coastal fisheries production used for subsistence is as high as 80 % or greater in Papua New Guinea, the Federated States of Micronesia, Wallis and Futuna, Tuvalu, Niue and Tokelau, while only 29 % in French Polynesia and 37 % in Guam⁶.

Per capita fish consumption in many PICTs is three to five times the global average and in rural areas fish often supplies 50 to 90 % of dietary animal protein.⁷ Most of this fish is caught from coral reefs by subsistence fishing.

Land-based aquaculture is comparatively less developed in the Pacific region whereas mariculture is more frequent, like marine farming of black-lipped pearl oysters in French Polynesia, Cook Islands and Fiji or penaeid shrimps in New Caledonia. There are also farms producing seaweed, freshwater prawns, milkfish and tilapia.

It has been found that **women in the Pacific region account for 56 % of the small-scale fisheries catches**⁸. Traditionally, women have concentrated their harvesting activities on inshore areas and lagoons, where their methods require a profound knowledge of the ecosystem and species characteristics. The under-representation of women in decision-making contributes to poor fisheries management and contrasts with their important role in providing food and income⁹.

5 The official estimate of 5.16 % is likely to be an underestimate given that some PICT estimates exclude some offshore fishery components. It should also be noted that reliable estimates of the contribution of fishing to GDP are not available for all PICTs due to data limitations. See Gillett (2016).

6 Gillett. (2016). *Fisheries in the economies of Pacific Island Countries and Territories*.

7 Bell, Kronen, Vunisea, Nash, Keeble, Demmke, Pontifex, Andréfouët. (2009). *Planning the use of fish for food security in the Pacific*.

8 Harper, Zeller, Hauzer, Pauly, & Sumaila. (2013). *Women and fisheries: Contribution to food security and local economies*.

9 Rohe, Schlüter, & Ferse. (2018). *A gender lens on women's harvesting activities and interactions with local marine governance in a South Pacific fishing community*.

4 Pinca, Kronen, Friedman, Magron, Chapman, Tardy, Pakoa, Awira, Boblin & Lasi. (2010). *Regional Assessment Report: Profiles and Results from Survey Work at 63 Sites Across 17 Pacific Island Countries and Territories*.



Figure 1: Summary of key dependencies in PICTs that are expected to drive vulnerability and therefore losses and damages from climate change for the 14 independent PICTs. Based on Johnson et al. (2016); Gillett (2016); Bell et al. (2013).

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




NATURAL AND HUMAN STRESSORS

Climate change will have **profound impacts on fisheries and mariculture** throughout the South Pacific, with significant **declines in productivity and forced changes in fishing practices**. It will not only result in the loss of certain fish species and changes in the migration patterns of commercially important tuna-like species, but also aggravate the influence of regional climate cycles such as El Niño.

Sea level rise presents the greatest risk to low-lying atoll nations, such as Kiribati, the Marshall Islands and Tuvalu. Other slow onset changes, such as ocean acidification, increasing sea surface temperatures and coral bleaching will impact all Pacific Island Countries and Territories (PICTs), with subsequent changes to marine habitats, fisheries and aquaculture.

The main climate change and anthropogenic-induced stressors that have the potential of seriously impacting fisheries and dependent human livelihoods leading to losses and damages by affecting both individual species and whole ecosystems are summarised in figure 2.

Coastal and oceanic ecosystems in the South Pacific are already heavily influenced by regional climate cycles and the projected changes will affect them in different ways, depending on their location and geomorphology. Mitigation and adaptation measures, as well as further climate risk management are tools to counteract resulting losses and damages.



OCEAN ACIDIFICATION is a particularly serious threat, as tropical Pacific pH is projected to decrease by 0.15 units into the 2040–2060 period under the RCP 8.5 ‘business-as-usual’ scenario. This will dramatically change the levels of aragonite saturation in seawater which are critically important for many marine organisms, including corals. Saturation levels greater than 4 are considered optimal for corals while levels of less than 3.5 are considered very low for a healthy reef system to continue reef-building.¹⁰

¹⁰ Source: BOM (Australian Bureau of Meteorology) and CSIRO (2014): [Climate Variability, Extremes and Change in the Western Tropical Pacific](#). In: New Science and Updated Country Reports.

Due to combined effects, further risks arise. An example is the **increased risk of inundation and salinisation of freshwater resources** due to saltwater intrusions and the increased intensity and frequency of storm surges. The combined effects of increased **coral bleaching and ocean acidification** are expected to reduce live coral cover by 50% by 2050, if managed in a sustainable manner, and by 75% under poor management. The **projections for 2100 are more dramatic**; even with good management, live coral cover is projected to decrease by >90% relative to 2010.

For aqua- and mariculture, the main climate change risks are reduced growth of marine ornamentals, shrimp, seaweeds, pearl oysters and to a lesser extent, freshwater prawns.

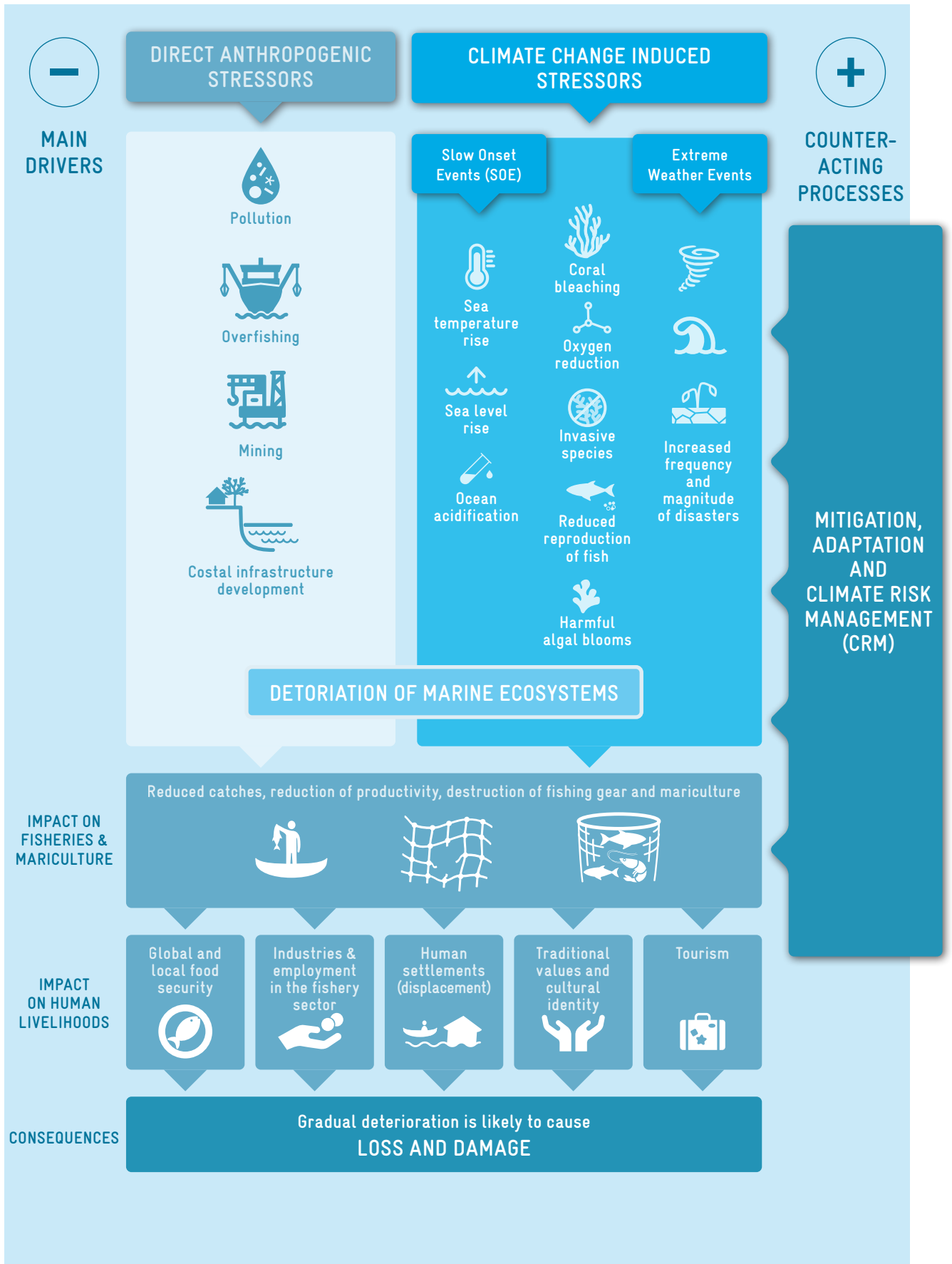


Figure 2: Impacts on fisheries and mariculture sector in the era of climate change

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



FOOD (IN-)SECURITY: Decreasing fish resources are likely to contribute to increasing poverty, further marginalisation of socially disadvantaged groups, and local if not regional, food insecurity. Losses and damages in fisheries and coastal habitats may impose social and economic constraints and potentially increase the likelihood of climate-induced migration.¹¹

11 Barange, Bahri, Beveridge, Cochrane, Funge-Smith & Poulain (eds.) 2018. [Impacts of climate change on fisheries and aquaculture: synthesis of current knowledge, adaptation and mitigation options.](#)

Importantly, **climate change in the tropical Pacific region will be spatially variable**, particularly between the western and eastern Pacific. **Climate change related losses and damages**, especially in small-scale coastal fisheries but also in oceanic fisheries, threaten food security and the economic livelihoods in all PICTs. Communities in Melanesia are particularly vulnerable as they are highly dependent on coastal fisheries and vulnerable mariculture species, leading to food insecurity – see figure 1. These risks will be exacerbated by population growth, particularly in Papua New Guinea and Solomon Islands.

Marine ecosystems and fish populations are already threatened by degradation due to over-exploitation, pollution and destructive activities. Climate change will exacerbate the pressures on these ecosystems. Maintaining fish populations within sustainable levels, particularly herbivorous fish, is essential for the resilience of coral reefs and their ability to recover following bleaching events.

Any efforts to minimise future impacts on coastal resources and adapt to residual risks must be underpinned by robust and effective fisheries management. There is an **imperative for increased awareness and capacity building** to effectively achieve this.

OPTIONS OF CLIMATE RISK MANAGEMENT (CRM)

Regional organisations and national governments have recognised the threat that climate change poses to PICTs, and have partnered with many international organisations to assess the risks and identify potential management measures. Most of the programmes are focused on developing national adaptation plans and policies that concentrate on agriculture, energy, water, tourism, education, and health. The inclusion of small-



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 way¹². Ultimately, CRM implies that all sectors factor risks into plans, including considering how risks may affect action across sectors.

12 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.](#)

scale fisheries and aquaculture – including mariculture – in these strategic documents is yet rather limited.

Comprehensive vulnerability assessments of Pacific Island communities, including fisheries and mariculture, coordinated by the Secretariat of the Pacific Community (SPC), have identified targeted adaptation options and supporting policies for all PICTs¹³. Critically, the study provided sector-specific and PICT-specific options for adaptation actions to minimise climate change induced losses and damages. **Implementation of these PICT-specific adaptation options has been limited** by the considerable challenge for managing small-scale fisheries and aquaculture in this vast region with limited financial resources and limited institutional capacity.

13 Bell, Johnson, Hobday (eds.). (2011). [Vulnerability of Tropical Pacific Fisheries and Aquaculture to Climate Change.](#)



Pacific Island countries and territories have a long tradition of community-based approaches to fishery management and strengthening this approach is broadly seen as offering the best solution for securing coastal fisheries resources for the future. In large parts of Melanesia, community-based approaches to fisheries management are also favoured by long-standing customary marine tenure, which helps to ensure that benefits accrue directly to communities.

A community-based ecosystem approach to fisheries management (CEAFM) is being developed for the region as a practical way of managing coastal fisheries in the face of the many challenges affecting it. CEAFM merges the well-recognised need for an ecosystem approach with fisheries management based on co-management through strong community involvement¹⁴. **Strengthening CEAFM in all PICTs as an adaptation priority can be an opportunity.**

A landmark regional meeting in March 2015 aimed at developing innovative approaches for the management of coastal fisheries resulted in a manifesto entitled ‘**A New Song for Coastal Fisheries – Pathways to Change – the Noumea Strategy**’. The overarching vision of this manifesto is “*Sustainable well-managed inshore fisheries, underpinned by community-based approaches that provide food security, and long-term economic, social and ecological*

benefits to our communities”. Interdisciplinary gaps can be closed through cooperation (e.g. FishAdapt)¹⁵.

An adaptation option to improve food security and reduce pressure on reefs is to diversify catches and transfer fishing effort offshore to tuna and small pelagic species. This would require better local access to tuna fishing and tuna processing operations to supply local markets. The use of Fish Aggregating Devices (FADs), together with real-time weather information to ensure safety at sea¹⁶, would facilitate this adaptation option. Improving simple post-harvest methods to extend the shelf life of fish, such as traditional smoking, salting and drying, would secure the food supply in local communities.

The development of hatchery and grow-out systems for semi-intensive and intensive freshwater pond aquaculture (e.g. tilapia) has potential to provide livelihoods and high-quality protein. Climate-resilient (e.g. temperature-tolerant) strains may be needed, and coastal aquaculture operations should be located to mitigate impacts from extreme events and sea-level rise. In addition, incentives and training for aquaculture enterprises to assess and minimise risks are required.

¹⁵ Johnson, De Young, Bahri, Soto, Virapat, (eds.). (2019). *Proceedings of FishAdapt: the Global Conference on Climate Change Adaptation for Fisheries and Aquaculture, Bangkok, 8–10 August, 2016*.

¹⁶ 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.

The **COPING WITH CLIMATE CHANGE IN THE PACIFIC ISLANDS REGION (CCCPIR) PROGRAMME**¹⁷, implemented by Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH on behalf of the Federal Ministry for Economic Cooperation and Development (BMZ) between 2009 and 2021, aimed at advancing adaptation to climate change in various sectors in 15 countries of the Pacific Community (SPC). To achieve this, CCCPIR advised island state governments on developing policies and strategies to prepare key sectors of the economy for anticipated climate-related events. Focusing on terrestrial and marine resources, and on the education, energy and tourism sectors, the existing development plans and policy guidelines were reviewed for their climate resilience and adjusted accordingly. Selected communities of Samoa and the Federal States of Micronesia worked in projects on the sustainable management of their coastal resources, f.e. using FADs to prevent over-fishing, while being trained in continuing the projects by themselves. Further, climate adaptation activities were carried out at community level to support the capacity development in all participating countries.

¹⁷ <https://www.giz.de/en/worldwide/14200.html>

Coastal ecosystems and important habitats need to be protected and restored. Integrated Coastal Zone Management (ICZM) can help achieve this, by improving the management of watersheds and reducing sedimentation and land-based sources of pollution.



Clear delineation of roles and procedures is lacking for disaster response in PICTs. Strategic plans to guide the national response are required, particularly to address food shortages and ensuring the interest of all sectors is recognised, including humanitarian needs and longer-term fisheries sustainability.

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 recognised that climate change and ocean acidification already have and potentially lead to more devastating impacts on PICTs 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. PICTs will require substantial investments 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).

To maintain the important contributions of fisheries, aqua- and mariculture to the region, support by PICTs and their international development partners is required at several levels. In particular, support is needed to:

→ Implement PICT-specific adaptation options

Adaptation options should be identified and prioritised using PICT-specific climate change vulnerability assessments conducted for coastal fisheries and mariculture following the results of the vulnerability assessments conducted by SPC10. This framework uses down-scaled projections and a semi-quantitative approach to identify locally relevant and context-specific adaptation options for commercial and subsistence fisheries and aquaculture – including mariculture.

These locally based assessments should guide national policy, legal instruments and local action plans specific to commercial and subsistence fisheries. However, the implementation of these processes and the implementation of these instruments will still not overcome the major constraint of poor acknowledgement of the small-scale fisheries sector. This will require a dedicated strategy with significant international support.

Adaptation options should be implemented using a **community-based ecosystem approach to fisheries management** (CEAFM) and should focus on building capacities for fisheries co-management, leadership skills, rights-based fisheries, equitable access to benefits and decision making, community engagement and public awareness.

The implementation of specific adaptation options should be conducted through pilot projects to test and demonstrate effective adaptation actions and to serve as blue prints for expanding and replicating in other PICTs.

→ Close data gaps

Hydrographic and weather data to be applied in higher resolution climate and biogeochemical models and socio-economic data for an enhanced understanding of the human dimension are required to improve the overall understanding of vulnerability of PICT communities. Therefore the collection of real-time atmospheric and ocean data (e.g. collected through new weather stations) and the development of tools to facilitate access and dissemination of relevant data to stakeholders (e.g. early warning systems) are necessary.

→ Monitoring

Investments in a variety of monitoring programmes are required to improve understanding of the status of natural resources, assess whether the projected effects

of climate change on these resources are occurring, and to measure the effectiveness of adaptation actions. In general, programmes should include the acquisition of socio-economic data to also measure the effectiveness of adaptation actions to maintain contributions of fisheries and mariculture to food security and livelihoods.

→ Strengthen partnerships and management capacities

Scientific cooperation is needed to develop inter- and trans-disciplinary teams required to assist PICTs in the implementation of key adaptation projects, improve their understanding of the vulnerability of fisheries, and to fill gaps in knowledge and skills. Capacity development is needed at all levels for a better management of climate risks.

Partnerships can also facilitate an enhanced development of ownership structures and leadership skills in government and communities. For sustainable and locally-driven solutions such skills are critical to build management and initiate successful adaptation. Although “hard infrastructure” adaptation options (e.g. aquaculture ponds, FADs) are often within the focus of partnerships because they are tangible, the partially significant lack of capacity in many PICTs requires a greater focus on “soft infrastructure” (e.g. ownership, leadership and skills).

Finally, new perspectives for climate risk informed transformational approaches for fishing communities need to be developed.

Published by:
Deutsche Gesellschaft für
Internationale Zusammenarbeit (GIZ) GmbH

Registered offices
Bonn and Eschborn, Germany

Global Programme on Risk Assessment and Management for
Adaptation to Climate Change (Loss and Damage)
Friedrich-Ebert-Allee 32
53113 Bonn, Germany
T +49 228 44 60-0
F +49 228 44 60-17 66
E info@giz.de
I www.giz.de/en

Responsible:
Dr. Michael Siebert

Author:
Global Programme on Risk Assessment and Management for
Adaptation to Climate Change (Loss and Damage)

Co-authors:
Dr. Owen Day (Lead Author, Clear Caribbean), Solveig Schindler,
Ulf Schäfer, Ann-Kathrin Petersen, Nicola Hanke, Dr. Michael Siebert (GIZ).
With scientific support by: Dr. Jörn Schmidt (ICES)

Photo credits:
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Design and layout:
Katrin Straßburger/W4 Büro für Gestaltung, Frankfurt

On behalf of
German Federal Ministry for Economic Cooperation and Development (BMZ)

As at:
Bonn, November 2021

On behalf of



Federal Ministry
for Economic Cooperation
and Development