

The ocean in a changing climate: Rapidly growing risk of loss and damage?

Key insights from an expert dialogue



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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:
Nicola Hanke (lead author, GIZ), Ulf Schäfer (GIZ), Ann-Kathrin Petersen (GIZ)

With support by:
Dr. Owen Day (Clear Caribbean), Dr. Mechthild Kronen (GIZ),
Dr. Michael Siebert (GIZ)

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Islet near Île à Vache, Haiti.

Preface

The ocean plays a crucial role in the lives of billions of people around the world – ecologically, economically, and socially. It is a source of life, nutrition, and natural resources, and it is the largest carbon sink on the planet, having buffered the climate against accelerating CO₂ release since the start of the industrial age. The adverse effects of climate change, however, are now directly damaging entire marine ecosystems.

The economies of many Least Developed Countries (LDCs) and Small Island Developing States (SIDS) and the livelihood of their people are built on the ocean's resources and services, with tourism, fisheries, maritime transport, and trade being prominent examples. Fisheries and aquaculture contribute significantly to income and food security for more than 10% of the world population, directly or indirectly determining the livelihoods of millions of people (*Allison et al., 2013; HLPE, 2014*). Climate change is not only responsible for ecological alterations of fish stocks and fishing conditions, such as through patterns of fish reproduction and migration, but also exerts social, economic, and cultural stress on human populations as a result of the ocean's significance to people, their societies, and their identities.

To fulfil its distinct roles and to provide humanity with ecosystem services, the ocean needs to be healthy. Under the current conditions it is not, but the health of the ocean, and thus its multiple functions are increasingly threatened by climate change. Recent reports of the Intergovernmental Panel on Climate Change (IPCC) address a wide range of direct and indirect climate effects, from increasingly severe extreme weather events, such as more frequent and intense storms and flooding, to slow onset changes

such as warming and acidification of ocean waters. The scale of accompanying degradation of biodiversity, coastal erosion, salinisation of coastal soils, and loss of land due to rising sea levels, to name a few consequences, is severe. Rather than regarding these independently, research is more and more seeing their contribution to compound events and cascading impacts as a major threat to coastal communities.

The growing risk of losses and damages to island and coastal communities, marine and terrestrial ecosystems, and even beyond needs to be addressed urgently. Coastal communities in LDCs and SIDS are the most affected by the impacts of climate change on the ocean, with all its social, cultural, and identity-creating significance in addition to its ecological and economic importance. Here and everywhere, the management of climate risks is an important task for the future. German development cooperation is responding to this challenging task in its partner countries by fostering resilience to climate change impacts for coastal communities in the short and long term, inter alia by reducing knowledge and technology gaps and strengthening capacities. Science and research are strong partners that can make fundamental contributions: to enhance understanding of climate-related risks, to build technical capacities, and to develop and strengthen the integrated management approaches and solutions needed to effectively deal with risks.

The expert dialogue has been just a little drop of water in the ocean; however, many drops together make a difference. We hope that the dialogue will contribute to a better understanding of the challenges and induce action to address the nexus of climate and the ocean.

Dr. Bernd-Markus Liss

Head of Section Climate Change and Climate Policy

Dr. Michael Siebert

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

Nicola Hanke

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

Executive Summary

The nexus topic of ‘Climate and the Ocean’ is gaining increasing and reasonable attention. The ocean’s role for life on earth, the importance of its ecosystems and services globally, in particular for those living in coastal zones, is gradually being better understood. People have lived from and with the ocean for millennia, a fact that still applies today for over three billion people whose lives are still directly centred around the ocean¹.

However, climate change is having profound effects on the ocean and its ability to provide the ecosystem services humans – we all – rely on. Coastal zones are already and will continue to be the most affected regions by changing climatic conditions. Impacts include gradual changes within the system but also increasingly frequent and/or severe extreme events (*IPCC, 2019*). In highly vulnerable and affected coastal zones, the adverse effects of climate change are already having a direct impact on people and their livelihoods, a trend that is expected to intensify and accelerate in the coming years. Coastal ecosystems, such as coral reefs and mangroves, are being disproportionately affected by climate change and are gradually losing their ability to act as natural coastal defences or ‘buffers’ against storms, flooding and sea level rise. For international cooperation, understanding and factoring in future risks is paramount to designing and implementing effective measures to manage climate risk and to foster sustainable resilience.

Picking up the discussions held during the Ocean Dialogues at the UNFCCC Climate Change Dialogues in December 2020² and informed by the latest research, the GIZ Global Programme on Risk Assessment and Management for Adaptation to Climate Change (Loss and Damage) hosted an expert dialogue on the topic of ‘*The ocean in a changing climate: rapidly growing risks of loss and damage?*’ to discuss the topic of impacts of climate change on the ocean and coastal zones on an institutional

level and with a particular focus on the role of development cooperation. With key speakers including Ambassador Peter Thomson, UNSG’s Special Envoy on the Ocean and Dr. Heike Henn, Director and Commissioner for Climate Policy and Climate Financing at the BMZ, and participation from experts of the Blue Action Fund, the Food and Agriculture Organisation (FAO), Future Earth Coasts (FEC), World Bank, World Wide Fund for Nature (WWF) and Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) the dialogue was framed to emphasise the essential role of the ocean in the climate system as well as its paramount relevance for development.

During the discussion, the lack of data to improve forecasting and modelling of the impacts of climate change at a local scale was addressed as a major hurdle. The need for quick and effective action at institutional level and on the ground with participatory approaches and cooperation between stakeholders at all levels was highlighted. Nature-based solutions and the multiple benefits they can provide to local communities were discussed as opportunities, while also recognizing their natural limitations and the need for these to be investigated further.

The dialogue allowed these diverse aspects and considerations to be presented and discussed from a range of different perspectives informed by inputs from international experts. Among some of the key issues addressed were the particular vulnerability and importance of small-scale fisheries in the context of food security and livelihoods, especially in least developed countries (LDCs) and small island developing states (SIDS). Beyond that, solutions that are already being trialled and implemented were highlighted and discussed, as well as the need for community engagement and stronger cooperation between science, development cooperation and relevant stakeholders on the ground.

1 UN Sustainable development goals. Goal 14: Conserve and sustainably use the oceans, seas and marine resources

2 UN Climate Change Dialogues 2020 (Climate Dialogues) | UNFCCC

Abbreviations and acronyms

BMZ	Federal Ministry for Economic Cooperation and Development
CC4Fish	Climate Change Adaptation in the Eastern Caribbean Fisheries Sector
CCCCC	Caribbean Community Climate Change Centre
COP	Conference of the Parties
CRM	Climate Risk Management
CRODT	Oceanographic Research Center of Dakar-Thiaroye
DIE	German Development Institute
EbA	Ecosystem-based Adaptation
FAO	Food and Agriculture Organization of the United Nations
FEC	Future Earth Coasts
GIZ	Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ)
ICZM	Integrated Coastal Zone Management
IPCC	Intergovernmental Panel on Climate Change
LDCs	Least Developed Countries
MPA	Marine Protected Area
NbS	Nature-based Solution
NDCs	Nationally Determined Contributions
NGO	Non-Governmental Organisation
SDGs	Sustainable Development Goals
SIDS	Small Island Developing States
TRIATLAS	South and Tropical Atlantic – climate-based marine ecosystem prediction for sustainable management
UN	United Nations
UNFCCC	United Nations Framework Convention on Climate Change
UNSG	United Nations Secretary-General
USC	University of the Sunshine Coast
WWF	World Wide Fund For Nature
ZMT	Leibniz Centre for Tropical Marine Research

State of departure

The nexus of climate and the ocean is complex. The critical importance of the ocean for the future of humanity was just recently highlighted by António Guterres, Secretary-General of the United Nations, with the simple words: “*The sea [...] keeps us alive*”. Dr. Michael Siebert, head of the GIZ Global Programme on Risk Assessment and Management for Adaptation to Climate Change (Loss and Damage) made use of this powerful quote to open the Expert Dialogue on *The ocean in a changing climate: rapidly growing risk of loss and damage?* that was held on January 14th, 2021. Coastal zones are home to the majority of the world’s population (IOC-UNESCO, 2017), and more than 650 million people live less than 10 m above sea level (IPCC, 2019). Over one-third of the world’s population, including more than half a billion of the poorest people, depend on marine and coastal resources for income and livelihoods (Mora et al., 2013).

The ocean is also home to the majority of life on earth and it is the world’s largest carbon sink. To date it has absorbed about 30 % of CO₂ emissions from human activity since

the industrial age (IPCC, 2013). It stores vast amounts of excess atmospheric heat, generates half of our biosphere’s oxygen, and acts as the great regulator of global climate. The UNSG’s Special Envoy for the Ocean Ambassador Peter Thomson recently stated: “*The ocean [...] is our*

greatest buffer against climate change. In a changing world, it will provide us with everything from food to energy, from medicine to employment”.

“The ocean
is our greatest
buffer against
climate-change”.

Ambassador Peter Thomson

While the importance of the ocean is clear, what is also becoming apparent is that the interaction between climate – respectively the atmosphere –, the ocean

and coastal communities is being profoundly affected by climate change. Direct and indirect effects of climate change range from increasingly frequent and severe storms and flooding events to the warming and acidification of ocean waters. These effects are causing a degradation of biodiversity, migrations of species into new habitats – in many cases towards the poles –, coastal erosion, loss of land and salinisation of coastal soils due to rising sea levels. The trend of more frequent and severe extreme weather events is projected to accelerate. Furthermore, the



Embankment Repair in Bangladesh.



Fishermen's Cooperative Building in Dominica after Hurricane Maria.

Intergovernmental Panel in Climate Change (IPCC) (*e.g.* *SROCC, 2019*) considers compound events and cascading effects as strong threats to coastal communities. Mutually reinforcing effects will challenge the adaptive capacity of communities and ecosystems on small islands and coastal zones in particular and present an increasing risk of significant losses and damages (also compare to figure 2).

In the domains of science and academia, the nexus of climate and the ocean is a topic that receives strong recognition. In its Special Reports on the Ocean and the Cryosphere in a Changing Climate (*SROCC, 2019*) and on Global Warming of 1.5 (*SR 1.5, 2018*), the IPCC underlines the consequences that distinct warming scenarios may have on the ocean and related systems including climate feedbacks, short-term to long-term changes – up to millennia – that cannot be avoided, thresholds, and irreversibility (*SROCC, 2019*). Several institutions, including those present during the workshop, have dedicated their latest work to this very topic.



Impacts from climate-induced changes in the ocean and cryosphere challenge the adaptive capacity of societies and ecosystems as well as their governance to address increasing and residual risks across local, regional, national, and international levels (high confidence).



Climate-related changes in the ocean have modified or degraded marine ecosystem services (high confidence) and led to observed impacts on fisheries (high confidence).

The United Nations Decade of Ocean Science for Sustainable Development³ launched this year and follows the objective of ensuring that science responds to the needs of society. Through stronger international cooperation, the decade will bolster scientific research and innovative technologies. **Ambassador Peter Thomson** underlined the need for reliable ocean science and ocean literacy, not least as a basis for negotiation processes in a world that is strongly linked to the ocean, but also built upon inter-linked systems. He cautioned that many past and continuing developments are exploiting the planet's resources in an unsustainable manner. Ambassador Thomson underlined that from his perspective as Special Envoy, the vital role of the ocean must be central to action on biodiversity loss and climate change. He emphasized that there can be “*No healthy planet without a healthy ocean*” and said the ocean's health is currently in decline.

3 The Decade of Ocean Science for Sustainable Development (oceandecade.org)

Although research in this field is advancing, modelling of the drivers, processes and impacts of climate change is oftentimes limited and involves medium to high degrees of uncertainty, especially at local scales. This makes the task of developing new opportunities for adaptation, or of selecting from existing solutions, challenging. From the **perspective of development cooperation**, an enhanced recognition and understanding of climate-related losses and damages is therefore essential to advance effective management solutions and their mainstreaming into existing and future projects that support adaptation measures on the ground. Climate risks will not only have serious implications globally, but especially on a regional and local level development achievements may be affected or even lost. In the case of German development cooperation, most of the partner countries are directly dependent on coastal and marine resources and ecosystem services. This underlines the crucial role that international cooperation plays in designing and implementing projects and measures to avert, minimise and address the adverse consequences of climate change on the ocean and coasts.

“No healthy planet
without a
healthy ocean”.

stated by
Ambassador Peter Thomson
during the dialogue.

At the **international policy level**, the nexus topic is receiving growing attention. A respectable if not large number of conventions, conferences and information events under the United Nations Framework Convention on Climate Change (UNFCCC) targeted the topic in 2020 and will continue to do so in 2021.

UNFCCC’s Nairobi Work Programme⁵, the oceans and coastal ecosystems is one of the priority areas. Urgent actions to enhance adaptation and resilience building in ocean and coastal zones, as well as their ecosystems based on a compilation of identified knowledge gaps were collected and discussed through various formats. Following decision 1/CP.25 paragraph 31 (COP25), at the Blue COP, the Subsidiary

Body for Scientific and Technological Advice (SBSTA) was mandated to initiate an *Ocean and Climate Change Dialogue* to consider how to strengthen adaptation and mitigation actions. In accordance with an expert dialogue on technologies for averting, minimising and addressing loss and damage in coastal zones that was held in 2019, UNFCCC’s Technology Executive Committee and Executive Committee of the Warsaw International Mechanism for Loss and Damage addressed climate risk management in coastal zones, along with relevant tools and methodologies, in a joint policy brief (*UNFCCC, 2020*).

Building on this momentum, and looking ahead to a decade dedicated to ocean science for sustainable development, **this expert dialogue’s primary objective** was to provide a platform for exchange among institutional stakeholders to share and discuss research and latest findings as well as recent experiences with the aim of guiding current and future international cooperation strategies and actions. Specific emphasis was put on the opportunities and potential synergies for greater cooperation between science and international development cooperation.

In her opening speech, **Dr. Heike Henn**, Director and Commissioner for Climate Policy and Climate Financing at the BMZ, not only emphasised the essential role of the ocean in the climate system, but also its paramount

EXAMPLES OF THE OBJECTIVES OF THE TEN-POINT PLAN OF ACTION FOR MARINE CONSERVATION AND FISHERIES⁴, BMZ, an agenda for action that was launched in 2016:

1. Create more, better managed marine protected areas
2. Encourage sustainable artisanal fishing and aquaculture
7. Develop strategies for dealing with potentially irreversible damage to marine ecosystems
8. Support coastal regions in adapting to climate change
10. Support cooperation initiatives covering multiple countries and sectors

Source: BMZ (2016)

⁴ Ten-point Plan of Action for marine conservation and fisheries (BMZ, 2016)

⁵ For further information see: [Oceans, Coastal Areas and Ecosystems \(unfccc.int\)](https://unfccc.int)

relevance for development. Dr. Henn accentuated the need to jointly approach the various interlinked and complex challenges by involving all relevant actors, also with a view to the upcoming climate negotiations in Glasgow in 2021 and beyond. In her speech, Dr. Henn referred to the important role of international development cooperation, as she pointed out various measures and concepts from BMZ's portfolio of programmes that already implement the management of climate risks in coastal zones. Among the measures are insurance schemes, early warning systems and nature-based solutions (Nbs), which she described as *"options to mitigate and adapt to climate change provided by the ocean itself"*.

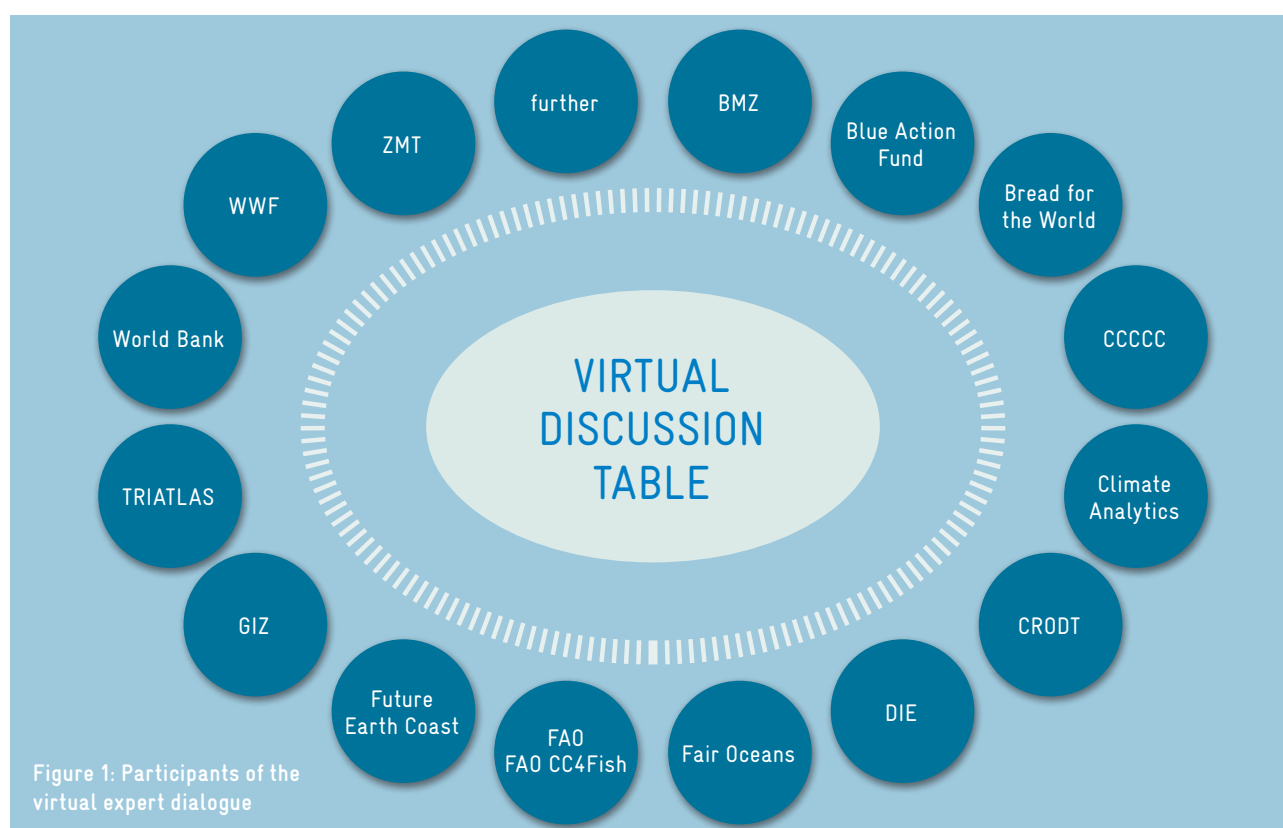
Discussions on the opportunities and challenges to advance towards more effective management, whilst strengthening and safeguarding livelihoods, biodiversity and cultural values on the distinct spatial and temporal scales, centred around the questions of:

i) **what impacts climatic change may have on coastal and marine ecosystems as well as coastal communities under different scenarios;**

ii) **how existing and future risks and the threats of losses and damages can be countered through various measures, such as ecosystem-based approaches, and the development of capacities development that is needed locally.**

Following the objective of initiating exchanges mostly at the institutional level, different actors from international institutions and non-governmental organisations involved in science, research and development cooperation (compare figure 1) were brought together to jointly:

- › Foster a common understanding of current and future nexus' related challenges, particularly with regards to needs of the most vulnerable countries, e.g. small islands developing states and countries with low-lying coastal zones,
- › Exchange experiences and good practices including tried-and-tested approaches for adaptation and effective management of climate related risks,
- › Discuss solutions and options for advanced multi-stakeholder collaboration towards enhanced ocean and coastal resilience.



Deep dive: Impacts on the ocean, coasts and people

IPCC
SROCC
2019

Coastal ecosystems are under stress from ocean warming, intensified marine heat waves, ocean acidification, loss of oxygen, and sea level rise, in combination with adverse effects from human activities on ocean and land (high confidence). Impacts are already observed on species, biodiversity, ecosystem functioning as well as services (high confidence).

In physical terms, impacts of climate change on the ocean are manifold. The most common and known processes include slow onset processes such as rising sea levels,

increasing water temperature and ocean acidification, as well as changes in the frequency and magnitude of extreme weather events. The direct consequences of these impacts are multi-faceted and often interactive with each other. The consequences for island and coastal communities arising from climate change are highly complex and often linked to existing practices and industries. In many instances, unsustainable use, exploitation and pollution are exacerbating the negative impacts of climate change. Population growth and the expansion of industrial zones as well as urbanisation processes for instance, contribute to habitat loss and environmental degradation often affecting already vulnerable coastal zones (compare figure 2) (*Mycoo and Donovan, 2017*).



Fisher near a densely-populated island in South Sulawesi, Indonesia.

According to the IPCC (2019), physical and chemical changes within the ocean, such as warming of surface waters or decreases in pH and oxygen levels, will lead to changes in marine ecosystems and biodiversity worldwide (SROCC, 2019). Examples of this are already visible in the shifting distribution and migration of fish, and changes in the biology of ecosystems like corals. These changes will in turn alter the function and dynamics of many marine and coastal ecosystems and will eventually lead to the extinction of many species.

Coral reefs are one example of a marine ecosystem for which the possible consequences of climate change are becoming increasingly obvious. Coral reefs are very effective coastal defences, protecting shorelines against storms and flooding. Intact – or healthy – coral reefs play a major role in reducing wave energy and height, thus contributing to a reduction of annual losses from storms and flooding by half, or by an estimated value of over 4 billion dollars annually (Ferrario *et al.*, 2014; Beck *et al.*, 2018). In addition, coral reefs contribute to food security, livelihoods and income. While the IPCC SR1.5 (2018) estimates that coral reefs generate about 11.5 billion dollars

in tourism revenue annually, the value has been ranked at almost 36 billion dollars by other studies (Spalding *et al.*, 2017). Hence, ecosystem services provided by intact coral reefs are numerous and of significant importance. About 500 million people globally benefit from marine ecosystem services provided by coral reefs, often depending

20TH CENTURY MANGROVE LOSSES

Mangrove forests have repeatedly and drastically been reduced with 20 to 35 % of global mangrove extent lost over the last 50 years (Polidoro *et al.*, 2010). Twentieth-century mangrove losses are predominantly accounted for by forest clearing, exploitation for timber production and raw materials, aquaculture development, the construction of grey infrastructure, and urban expansion (Thomas *et al.*, 2017) linked to rapid coastal population growth (Hughes *et al.*, 2017).



Mangroves in Fiji, South Pacific.

directly on them for their livelihoods, food and coastal protection (*Wilkinson, 2008*). Despite these benefits, the value of intact coastal and marine ecosystems is not always completely understood, and often only recognised once lost.

It has been estimated that with only 1.5°C of global warming, as many as 70 to 90 % of reef-building corals could be lost; under a 2°C scenario this might reach 99 % (*Hughes et al., 2017*). As stated during the expert dialogue by Dr. Sebastian Ferse, Executive Director, Future Earth Coasts and senior scientist at the Leibniz Centre for Tropical Marine Research (ZMT), intact coral reefs are enormously important as habitat of one third of all marine species, and – together with mangroves – as natural coastal protection. For some species, adaptation processes to changing conditions are already being observed. Migration is one adaptive strategy used by many species; in the case of corals and other sessile organisms it is a rather slow processes, and a strategy that is naturally limited.

The behaviour of this fragile but fundamental ecosystem in a changing climate remains to be understood better as are the nature and extent of the projected changes, and the implications for reef-dependent coastal communities. Ongoing efforts to protect corals include coral reef conservation and restoration measures.

The majority of the world's population lives in close proximity to the ocean and is economically, socially, in some cases even culturally, bound to it. This is particularly true for coastal zone communities of LDCs and SIDS. Their high dependency on the ocean's resources and services render these economies and populations extremely vulnerable to the risks posed by climate change. Moreover, the low adaptive capacity and often limited opportunities of these countries and communities further aggravate the situation. Earlier development achievements may experience setbacks due to insufficient or unsuitable adaptation strategies.



Seawall in Kiribati.

The case of small-scale fisheries

In 2017, fish accounted for 17 % of global animal protein intake (FAO, 2020). This proportion was significantly higher in some LDCs and SIDS. In many coastal regions, the small-scale fishing sector is the main source of income alongside tourism. Over 97 % of all people who are dependent on capture fisheries (120 million) work in developing countries and most of these – over 90 % – are involved in small-scale fisheries (FAO, 2020; World Bank, 2012).

Franck Hollander's vision for progress on the topic of growing risk of losses and damages:

“It is urgent to help fisheries in adapting towards climate change, change is happening now; in developed countries, we need to reconsider fish as a delicacy”.

THE IMPORTANCE OF SMALL-SCALE FISHERIES AT A GLANCE

- › More than 90 % of all fishery workers globally are employed in small-scale fisheries;
- › 60 % of the global catch by volume comes from developing countries;
- › 5.8 million fishers earn less than 1 USD per day;
- › Roughly 35 % of fish stocks globally are fished exceeding sustainable levels.

Sources: FAO 2020, World Bank 2012

Despite the importance of small-scale fisheries globally, they are particularly vulnerable to the current and projected impacts of climate change. Changing migration patterns of some pelagic fish (e.g. tuna), the degradation of coral reefs, and the destruction of fishing equipment and infrastructure in storms and floods are only some examples of how the sector is being seriously affected. Many anthropogenic stressors, including overfishing and pollution, are exacerbating the problem. Figure 2 summarizes the main direct anthropogenic and climate induced stressors that have the potential to seriously impact fisheries, livelihoods, individual species and entire ecosystems. Mitigation and adaptation measures, as part of a comprehensive climate risk management strategy, will be increasingly necessary to address risks and avert resulting losses and damages.



Fishing stores damaged by beach erosion in the Caribbean.



Fisherwomen on Lau, Fiji.

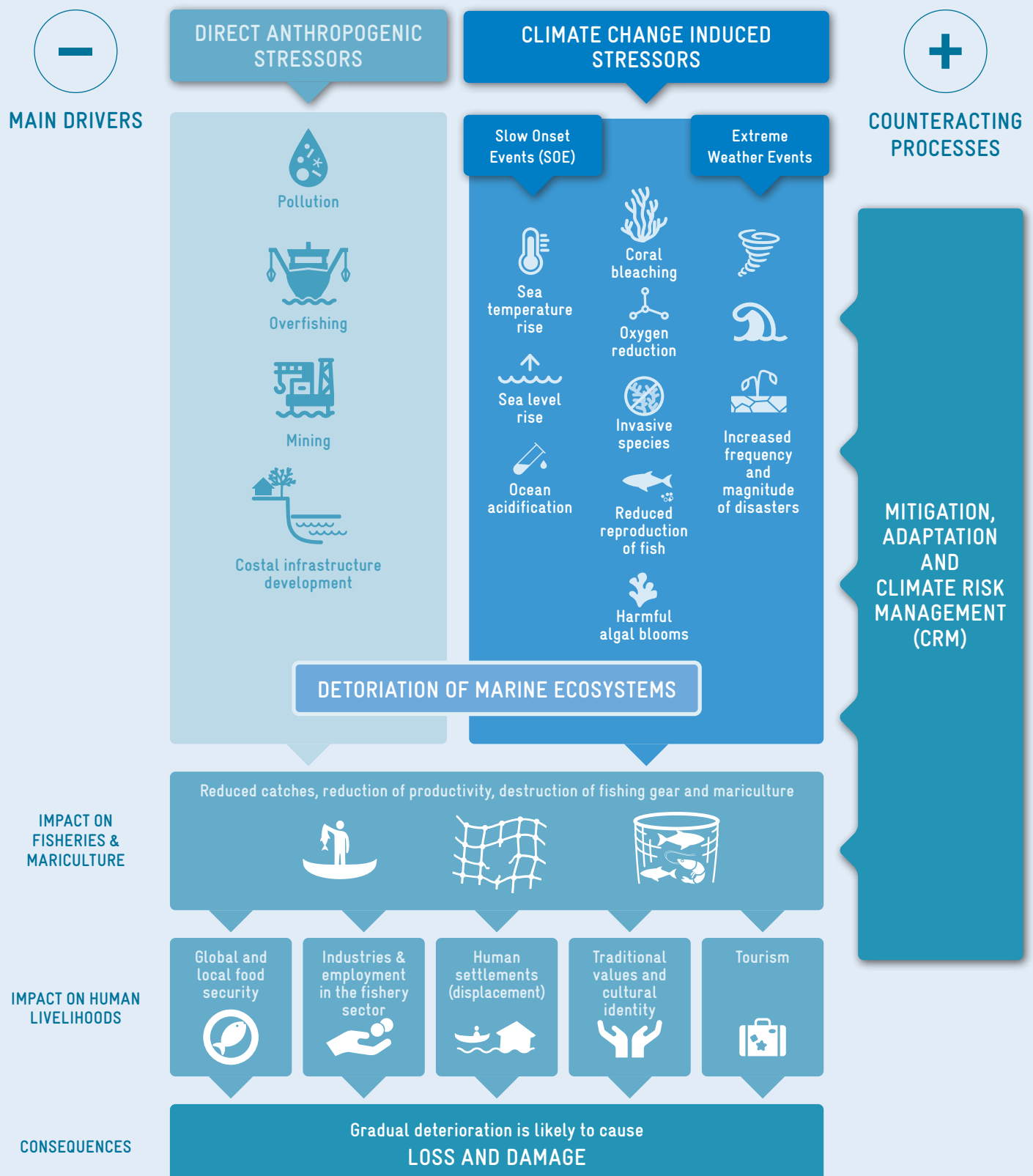


Figure 2: Impacts on fisheries and mariculture sector in the area of climate change

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



Destruction at coast of Futuna, Vanuatu after landfall of cyclone Tomas in 2010.

Small-scale fisheries in the South Pacific, the Caribbean and West Africa

Dr. Mechthild Kronen, senior expert planner at GIZ, presented findings from the recent study *Climate change and small-scale fisheries – A case for a comprehensive climate risk management*, which was prepared by the GIZ Global Programme on Risk Assessment and Management for Adaptation to Climate Change (Loss and Damage). The study identifies some of the economic and non-economic losses and damages associated with climate change, including increasing extreme weather and slow onset processes. The study's main objective is to contribute to a better understanding of the impacts of climate change on small-scale fisheries in order to identify suitable risk-management-solutions and to highlight entry points for climate risk management (CRM)⁶. The involvement of local fishermen and stakeholders constituted an integral part of the whole process. The major findings derived from this work include:

- Globally and within the target regions, climate change induced impacts to small scale fisheries may cause severe losses and damages. The extent and nature of these losses will differ between regions and to some extent, and despite past and ongoing efforts for mitigation and adaptation, residual risks of adverse impacts of climate change might remain;
- Addressing climate change impacts in the management of sustainable small-scale fisheries and aquaculture is of paramount importance and needs to be considered at all levels;
- As a component of climate risk management, ecosystem-based adaptation (EbA) is the best way forward to increase resilience (GIZ, 2019).

⁶ Climate Risk Management Framework developed by GIZ Global Programme on Risk Assessment and Management for Adaptation to Climate Change (Loss and Damage) (2019)



Dominica after Maria Caribbean; Dominica.

The study concludes **four major recommendations** that apply globally:

- i) Capacity Development at all levels;
- ii) Closing data gaps implementing CRM;
- iii) Developing instruments and tools;
- iv) Promoting scientific cooperation.

For the cases of the Caribbean, West Africa and the South Pacific, recommendations tailored to the regional context are presented illustrating the region's specific challenges, and opportunities.

Findings from this study, which concurred with those of similar recent studies that cover additional regions, were discussed during the dialogue in 2021. A panel of experts from the field featuring **Bérengère Prince**, Lead Natural Resources Management Specialist at World Bank Group, **Florence Poulain**, Fisheries and Aquaculture Officer at FAO, **Dr. Iris Monnereau**, Fisheries Officer and Regional Project Coordinator of CC4FISH⁷, and **Franck Hollander**, Seafood Expert, and **Dr. Philipp Kanstinger**, Program Officer Seafood Certifications at the International WWF-Centre for Marine Conservation **discussed the following points**: i) the risks that the small-scale fisheries sector faces in light of a changing climate, especially existing knowledge gaps that need to be filled to improve

understanding of the challenges and potential solutions, and ii) existing and proven solutions for tackling these challenges that are in place already.

From FAO's perspective, local scale modelling and forecasting of extreme events – in particular understanding the atmosphere-ocean interactions and resulting biological changes – remain a challenge. Globally, small-scale fisheries are experiencing more risks than previously, including multiple climate risks as well as non-climate risks. Risk-taking is tolerated because of poverty frequently; greater awareness and action are needed to address this. In her vision for progress on the topic of growing risk of losses and damages, Florence Poulain, FAO, made it clear that *“Loss and damage on the fisheries and aquaculture sector will largely be determined by the sector's ability to develop and implement adaptation strategies. Adaptation strategies must build on a suite of interventions that include institutional and management adaptations, measures to strengthen livelihoods and measures intended to manage and mitigate risks. Early adaptation frameworks, and in particular low and no regret adaptation strategies, offer opportunities to strengthen the resilience of small-scale actors in LDCs and SIDS in the face of early climate change impacts and limited financial resources.”* She also underlined that structural poverty needs to be addressed.

The short- and long-term challenges, as well as the need for quick and effective action, were stressed during the entire discussion and mirror international discussions. Florence Poulain further highlighted that uncertainties of climate projections over the medium to long term (i.e. from decadal to multidecadal) could have been reduced for projections using climate modelling; nevertheless, local-scale modelling and forecasting of extreme events remains challenging and needed.

In the Caribbean context, the lack of data poses hurdles to establishing a needed baseline for understanding and modelling climate risks and impacts to fisheries. Poor governance and the need to mainstream climate change adaptation and disaster risk management throughout the region, as well as limited capacity at the regional, national and local level, further complicate the situation. Potential avenues for adapting include diversification of livelihoods, improving seafood processing and value-added products, targeting underutilised species, climate smart fishing techniques and resilient infrastructure, improved knowledge

⁷ Climate Change Adaptation in the Eastern Caribbean Fisheries Sector Project. FAO

and awareness, and development of the aquaculture sector. Beyond that, the integration of the vulnerability of the fisheries into nationally determined contributions (NDCs) to ensure future climate financing, addressing early warning systems, and improving fisheries management, including the need to address conflicts between small-scale and industrial fishers in some areas were highlighted as necessary steps forward. Additional priorities that were covered during the discussions include the gaps in monitoring, control and surveillance, e.g. of illegal, unregulated and unreported fishing (IUU). Electronic traceability is increasingly being used in fisheries management to improve compliance with marine protected areas, and this has been particularly successful in Belize's lobster fishery. Caribbean fishery managers are now looking to expand the use of this technology throughout the region (Foley, 2019).

An aspect that was emphasized repeatedly by all panellists is the need to anchor the participation of those affected – small-scale fishermen and -women themselves – into the discussions and especially the management of fisheries. Participatory approaches not only capture the extensive knowledge of local communities, but also enable the identification of needs, raise awareness and build capacity of key stakeholders. WWF recently published a study informed by local actors and experiences in small scale fisheries (WWF, 2020) that highlights the value of comprehensive and participatory management approaches. Franck Hollander and Dr. Philipp Kanstinger, co-authors of the report, also emphasised the enabling aspects of new technologies for enhanced knowledge-transfer as well as for increased control and effective monitoring.

The lack of recognition and representation of small scale fisheries and their interests in political processes was underlined by Bérengère Prince as a key challenge in many African countries: *“There is often a tension between revenue provided by industrial fleets and the need for adequate and safe maritime space for small-scale fishers.”* With the disproportionate impact of climate change on many fisheries in Africa, governments need to adopt more cautious management measures. Through modelling it could be shown that West African fisheries are indeed strongly impacted. Models show that as early as 2050 the Maximum Catch Potential (MCP) will likely decrease by 30 % or more in many tropical West and Central African countries, including the Democratic Republic of Congo, Côte d'Ivoire, Equatorial Guinea, Gabon, Liberia, and São Tomé and Príncipe. In 2019, at COP25 in Madrid, the World Bank released a *study* on the economic impacts that declining fisheries will have on African countries.

Despite progress and advancements in climate modelling and research, despite recognitions and the amount of available tried-and-tested tools and instruments, adaptation actions at the local level have the potential for further improvement. Effective action at the different levels, provided through capacity development and knowledge sharing, through the implementation and mainstreaming of climate change adaptation measures, are presented in the next chapter of this report. Overall consensus on the potential of nature-based solutions (NbS) as an effective strategy to mitigate some of the projected impacts on small-scale fisheries existed among all panellists.



Fishing boat in Senegal.

Opportunities and practice perspectives

IPCC
SROCC
2019

Key enablers for implementing effective responses to changes in the ocean and cryosphere include intensifying cooperation and coordination among actors across scales, boundaries, and planning horizons (high confidence). Education and climate literacy, monitoring and forecasting, funding, and institutional support are also essential and enable social learning and participation in context-specific adaptation and the negotiation of trade-offs and co-benefits between reducing immediate risks and building resilience (high confidence).

The discussions stressed the importance of cooperation among all actors and the opportunities to work together on developing, testing and implementing measures to address the growing risks, and to effectively avert or minimise losses and damages. Cooperation between actors is particularly important during the planning phase and found beneficial to improve the effectiveness of chosen approaches. During the dialogue, comprehensive approaches as well as specific measures were discussed, and experiences shared.

The dialogue's participants and experts underlined the usefulness of increased cooperation between stakeholders at

all levels and participatory approaches to enable i) knowledge exchange, ii) consideration and integration of local knowledge and experiences, and iii) capacity development. **Nature-based solutions (NbS)** were frequently quoted as an emerging concept. Corresponding measures that are being implemented in distinct contexts are regarded as potential key components of climate risk management strategies. Lastly, the aspect of financial resources must be considered as financial resources for implementing projects can often pose a hurdle that slows down action.

One concrete approach mentioned to address risks from a changing climate more comprehensively is the climate risk management (CRM) framework developed by GIZ mentioned during Dr. Mechthild Kronen's presentation in the context of small-scale fisheries. This framework considers risks along the entire risk spectrum, by looking at hazards from short-term extreme weather events such as storms and floods to long-term slow-onset processes such as sea level rise and ocean acidification. To minimise and address losses and damages of coastal livelihoods and ecosystems, CRM combines a smart mix of tried and tested measures from climate change adaptation and disaster risk reduction, such as NbS or early warning systems. These measures are complemented by innovative and transformational adaptation approaches.



Diver observes a brain coral and a shoal of silversides in the Caribbean.

STORY 1

BETTER PROTECTED COASTS IN THE PHILIPPINES, SOUTHEAST ASIA

Building upon existing instruments, approaches and good practices, GIZ is currently implementing 43 Projects in over 70 countries. The regional focus is on Latin America and the Caribbean (42 %), followed by Asia and the Pacific (32 %), Africa (16 %) and Global projects (10 %). During the dialogue, Franca Sprong-Wijnreder, Cluster Coordinator on Biodiversity and Marine Protection in the Philippines, shared insights on the work of the *GIZ ProCoast* Project, a project that follows the objective of better protected coastal areas and its inhabitants against the effects of

climate change. Key challenges on the ground include poor or limited coastal management and coastal development (strategies), insufficient recognition of climate change impacts, inadequate implementation of policies at the local level and limited monitoring and evaluations systems. The **promotion of mangrove forests as important natural systems** that protect coastal communities against climate-related losses and damages and the creation and management of “Greenbelts” is one solution put forward by the project.

NATURE-BASED SOLUTIONS (NBS)...

... are defined as “actions to protect, sustainably manage and restore natural or modified ecosystems, which address societal challenges effectively and adaptively, while simultaneously providing human well-being and biodiversity benefits” (IUCN, 2016). Among other concepts, the umbrella term NbS includes Ecosystem-based Adaptation (EbA) (CBD, 2009). In the marine and coastal context, common measures include mangrove restoration, coral reef rehabilitation and the preservation of marshes and wetlands. Co-benefits of NbS comprise carbon sequestration, biodiversity conservation and habitat provision, protection of natural resources, water quality improvement and also an increased recreational value (EESI, 2019). For fishing communities NbS can provide supplementary livelihoods opportunities, such as eco-tourism. NbS projects thus have the potential to not only strengthen adaptive capacities but also to enhance coastal protection, food security and livelihoods of coastal communities.



Fishermen in a mangrove forest in the Philippines.

STORY 2

INTEGRATED COASTAL ZONE MANAGEMENT FOR SOC TRANG, VIETNAM

The Integrated Coastal Zone Management (ICZM) project in Soc Trang Province that was implemented by GIZ between 2012 and 2013 was introduced by **Prof. Dr. Tim Smith**, Co-Chair of Future Earth Coasts (FEC) and Professor at the University of Sunshine Coast (USC), to illustrate a participatory and holistic approach. The project itself followed the objective of strengthening the coastal zone of the Mekong Delta to enable better coping with a changing environment, thereby establishing a basis for resilient coastal communities. GIZ and the team from USC conducted workshops with local stakeholders and communities to take social, economic and institutional criteria such as policy frameworks – in addition to climate change drivers – into account. Prof. Dr. Smith underlined the key operative principles that were applied in the project and which are consistent with current FEC projects: inclusivity, the development of shared understandings, and co-design and co-production. In the case of the Soc Trang Province project, these principles were used to jointly build a comprehensive and realistic concept

for dealing with future changes, while also taking into account the existing local capacities required for implementation. Recommendations on how to enhance capacity (e.g. by building further social and human capital) could be drawn.

**Dr. Sebastian Ferse's vision
for progress on the topic of growing risk
of losses and damages:**

“Holistic, transdisciplinary approaches that overcome silos in research, assessment and management. Harnessing the potential of coastal ecosystems for nature-based solutions. Partnerships at eye-level that develop capacities of coastal communities and recognize their views and priorities”.



Systems mapping during a stakeholder workshop in Soc Trang, Vietnam.

STORY 3

SUPPORT FOR OCEAN AND COASTAL CONSERVATION AND SUSTAINABLE LIVELIHOODS – THE BLUE ACTION FUND

Cecilia Torres, Programme Coordinator at the Blue Action Fund, gave an overview of the objective, funding opportunities and project portfolio supported by the Blue Action Fund. Financed by Germany, Sweden and France, the Blue Action Fund is now one of the world's largest public funds that promotes marine conservation and sustainable livelihoods in coastal communities. The Blue Action Fund provides 1–4 million Euro grants to NGOs working in consortium with local partners to establish and expand Marine Protected Areas (MPAs) and to support sustainable livelihoods in the surrounding communi-

ties. In addition, through financing from the Green Climate Fund and the German Federal Ministry for Economic Cooperation and Development (BMZ), the Blue Action Fund is currently supporting projects focused on ecosystem-based adaptation to climate change in the Western Indian Ocean. Several grants are already in the pipeline and a second funding call on this topic is expected in late 2021.⁸

8 For more information please visit blueactionfund.org



Sail canoe fishers, Maskelynes, Vanuatu.

Key take-aways and the way forward

The expert dialogue on *‘The ocean in a changing climate: rapidly growing risk of loss and damage?’* brought together a distinguished group of experts around a virtual table where insights on the latest studies, experiences implementation and collaborations with local stakeholders were shared. These informed discussions revolved around the following underlying questions:

1. What does climate change, its impacts and future trends mean for the ocean, coasts, ecosystems and communities?
2. What is needed at both the international development and the community level to safeguard and strengthen livelihoods, biodiversity and cultural values in the long-term?

What became very clear during the dialogue is the fact that the nature and magnitude of the impacts of climate change on the ocean, coasts, ecosystems, and not least communities are not yet fully revealed. While the IPCC’s Special Report on the Ocean and Cryosphere in a Changing Climate (*SROCC*, 2019) presents some of the trends with high confidence, the full scale and nature of the consequences remains unclear. In addition, there is growing **consensus** among actors of both the global international policy sphere and of international cooperation – as also seen at the international events mentioned earlier in this report – that **better understanding and upscaled action** are needed to achieve progress towards resilient oceans and coastal communities.

“Prevent the degradation of corals as much as possible to help coral reefs survive as safest and most cost-effective solution”.

Dr. Sebastian Ferse

Discussion insights

The discussion on the potential of NbS unpacked uncertainties about the behaviour of marine ecosystems in changing conditions and their potential to adapt, especially in the second half of the current century. Moreover, reliable data on projected economic losses are still scarce, as are reliable assessments of the consequences for specific economic sectors. Despite the availability of research findings, trends and scenarios for the next 80 years, recognition and awareness of the threats remain rather low. Among ocean and coastal communities, current changes in the environment are generally recognised as being associated with climate change, but there is limited understanding of the likely longer-term threats and consequences. Awareness among most stakeholders of the benefits of long-term and sustainable planning and the importance of mitigation and adaptation strategies is – in many cases – not yet sufficient. In some regions, the challenges and consequences of climate change are already being felt, and projections have been modelled with medium to high confidence levels. Nevertheless, local contexts vary significantly and the detailed understanding of each component of a system are equally important for designing and implementing locally effective solutions as are participatory elements and the involvement of local stakeholders. Coastal communities and small-scale fisheries, for instance, often lack the basic resources to deal effectively with the current and impending risks. Strong collaborations between science, development cooperation, and regional and local actors through participatory and holistic approaches are fundamental when addressing these multifaceted challenges.

The jointly followed objective is to secure livelihoods and to prevent economic as well as non-economic losses and damages. The contribution of actors in the field of development cooperation can be crucial. Building and developing technical capacities and jointly developing effective solutions for dealing with climate-related risks can strengthen resilience effectively and sustainably.

The policy sphere

Experts jointly stressed that dealing with climate change impacts must be more strongly anchored at the policy level and integrated into planning. Further, the need for an even stronger link between international agendas and local policies, while at the same time taking into account the individual nature of situations on the ground, was stressed. Discussions clearly emphasised local empowerment and inclusive approaches in decision-making as fundamental when dealing with climate change-related risks and developing effective management solutions. Last but not least, the importance of acknowledging scientific knowledge as the basis for political negotiations and decision-making and the integration of (political) decisions into local policies were underlined by all.

KEY TAKE-AWAYS

- ✓ Strengthened exchanges between science and stakeholders at the planning and implementation levels to systemically identify and fill data and knowledge gaps is strongly recommended;
- ✓ Holistic frameworks that integrate approaches, measures and tools are required for addressing climate risks comprehensively;
- ✓ These approaches should include participatory elements, and in addition shall include transformative elements such as the diversification of livelihoods as a key objective;
- ✓ The use of technologies for better governance and co-management e.g. in the case of small-scale fisheries;
- ✓ Nature-based solutions (NbS) are determined suitable for integration into holistic frameworks such as CRM; still, there is a need to better understand co-benefits and incentives that NbS can provide for enhanced and sustainable climate risk management in the future.

The way forward

Important initiatives and projects targeting the topic of climate change impacts on the ocean exist as does cooperation schemes between the relevant institutional actors, regional and local stakeholders. With Prof. Dr. Tim Smith and Dr. Sebastian Ferse, two members of the Executive Committee of the Future Earth Coasts (FEC) project engaged in the dialogue. Prof. Dr. Smith, co-chair of the project, describes the project's vision as follows: *“Our vision is to support transformation to a sustainable and resilient future for society and nature on the coast by facilitating innovative, integrated, collaborative and impactful research and knowledge mobilization”*. Summarising the dialogue's discussions and key take-aways, this vision can be extended by Ambassador Thomson's mantra of *“No healthy planet without a healthy ocean”* and put forward as principles of the 'action plan' that lies ahead.

Ideas, approaches and potential collaborations that were addressed in this expert dialogue have been earmarked as potential contributions for further anchoring the nexus topic more strongly internationally, and into events and political processes, such as COP26 in Glasgow. The Decade of Ocean Science for Sustainable Development represents an ideal window of opportunity to move forward together with this undoubtedly important agenda.



Small-scale fisher Mauretania.

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Deutsche Gesellschaft für
Internationale Zusammenarbeit (GIZ) GmbH

Registered offices
Bonn and Eschborn

Friedrich-Ebert-Allee 32 + 36
53113 Bonn, Germany
T +49 228 44 60-0
F +49 228 44 60-17 66

Dag-Hammarskjöld-Weg 1-5
65760 Eschborn, Germany
T +49 61 96 79-0
F +49 61 96 79-11 15

E info@giz.de
I www.giz.de

On behalf of



Federal Ministry
for Economic Cooperation
and Development