Food and Agriculture Organization of the United Nations

Report of the vulnerability and capacity assessments in coastal and fishing communities in Grenada

Cover photographs: Grenville workshop participants, Grenada (left). Community mapping in Gouyave, Grenada (top right). Participants in Windward, Carriacou workshop engaged in community mapping (bottom right).

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Report of the vulnerability and capacity assessments in coastal and fishing communities in Grenada

Prepared by the Caribbean Natural Resources Institute for the Food and Agriculture Organization of the United Nations

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This publication is an output of the ***Climate Change Adaptation in the Eastern Caribbean Fisheries Sector Project (CC4FISH)*** which is being implemented by the Food and Agriculture Organization of the United Nations (FAO) and the national fisheries authorities from the seven project countries, Antigua and Barbuda, Dominica, Grenada, Saint Kitts and Nevis, Saint Lucia, Saint Vincent and the Grenadines and Trinidad and Tobago, with funding from the Global Environment Facility (GEF). The Caribbean Natural Resources Institute (CANARI) has been contracted by FAO to undertake the regional implementation of VCAs under the CC4FISH project.

Abstract

This report presents the main findings and recommendations from a vulnerability and capacity assessment (VCA) of coastal and fishing communities in Grenada. The overall goal of the assessment was to improve understanding of local climate change impacts and vulnerabilities for effective adaptation in the fisheries sector. It utilised three tools: community mapping, surveys and impact and capacity matrix for data collection, and engaged a wide range of stakeholders to ensure a participatory process. Based on the assessment, a range of climate-related hazards have begun to impact the communities, including: coastal erosion and flooding due to sea level rise, storms and storm surges; rainfall variability and extremes leading to inland flooding; sargassum seaweed influxes; and rising sea surface temperatures that impact fisheries and marine ecosystems like coral reefs. Adaptation actions were also identified to address these hazards. These included: building the adaptive capacity of fisherfolk; improving access to insurance, services and infrastructure; strengthening key government agencies to better provide technical assistance and support; and protecting critical marine ecosystems that support fisheries and other economic sectors like tourism.

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Acronyms and abbreviations

CANARI	Caribbean Natural Resources Institute
CARIFICO	Caribbean Fisheries Co-Management Project
CC4FISH	Climate Change Adaptation in the Eastern Caribbean Fisheries Sector Project
CCA	climate change adaptation
CCCCC	Caribbean Community Climate Change Centre
CCCRA	CARIBSAVE Climate Change Risk Atlas
CDEMA	Caribbean Disaster Emergency Management Agency (formerly known as the Caribbean Disaster Emergency Response Agency (CDERA) from 1991 to 2009)
CERMES	Centre for Resource Management and Environmental Studies – University of the West Indies
CNFO	Caribbean Network of Fisherfolk Organisations
COAST	Caribbean Ocean and Aquaculture Sustainability Facility
COVID-19	novel coronavirus disease (SARS-CoV-2) of 2019
CRFM	Caribbean Regional Fisheries Mechanism
CSO	civil society organization
DRM	disaster risk management
EAF	ecosystem approach to fisheries
FAO	Food and Agriculture Organization of the United Nations
FFO	fisherfolk organization
GAMPA	Grand Anse Marine Protected Area
GCM	General Circulation Model
GDP	gross domestic product
GEF	Global Environment Facility
GIS	Geographic Information System
GIZ	German Development Cooperation
GoMPA	Gouyave Marine Protected Area
GRENCODA	Grenada Community Development Agency
ICCAS	Integrated Climate Change Adaptation Strategies Project
ICT	information and communications technology
ICZM	integrated coastal zone management
IFRC	International Federation of Red Cross and Red Crescent Societies
IMA	Institute of Marine Affairs
IPCC	Intergovernmental Panel on Climate Change
JICA	Japan International Cooperation Agency
MBMPA	Molinière-Beauséjour Marine Protected Area
MPA	marine protected area
NaDMA	National Disaster Management Authority
NAP	National Adaptation Plan

NFP	National Focal Point
NPC	National Project Coordinator
ODPM	Office of Disaster Preparedness
P-GIS	Participatory Geographic Information System
RCM	Regional Climate Model
SFC	Sugarcane Feed Centre
SIDS	Small Island Developing States
SIOBMPA	Sandy Island/Oyster Bed Marine Protected Area
SLR	sea level rise
SST	sea surface temperature
UNDESA	United Nations Department of Economic and Social Affairs
UNFCCC	United Nations Framework Convention on Climate Change
UWI	The University of the West Indies
VCA	vulnerability and capacity assessment
WECAFC	Western Central Atlantic Fishery Commission
XCD	Eastern Caribbean Dollar

Executive summary

The Caribbean Natural Resources Institute (CANARI) provided technical assistance to the Food and Agriculture Organization of the United Nations (FAO) to undertake the regional implementation of a vulnerability and capacity assessment (VCA) under the **Climate Change Adaptation in the Eastern Caribbean Fisheries Sector Project (CC4FISH)**. CC4FISH is being implemented from 2017-2021 by FAO and the national fisheries authorities from the seven project countries: Antigua and Barbuda, Dominica, Grenada, Saint Kitts and Nevis, Saint Lucia, Saint Vincent and the Grenadines and Trinidad and Tobago, with funding from the Global Environment Facility (GEF). CANARI's work under CC4FISH focused on implementing VCAs in coastal and fishing communities in the following target countries: Grenada, Saint Kitts and Nevis, and Trinidad and Tobago. It contributed directly to the achievement of the outcomes under CC4FISH Component 1: *Increased awareness and understanding of climate change impacts and vulnerability for effective climate change adaptation (CCA) in the fisheries and aquaculture sector,* as well as informed implementation of the other CC4FISH project components.

This report presents the main findings and recommendations from the VCAs in Grenada. CANARI and the Fisheries Division in the Ministry of Sports, Culture and the Arts, Cooperatives and Fisheries, Grenada conducted the VCAs in three coastal and fishing communities: Gouyave and Grenville in mainland Grenada, and Windward in the island of Carriacou.

The overall goal of the assessments was to engage target coastal and fishing community stakeholders to improve understanding of local climate change impacts and vulnerabilities for effective adaptation and resilience building in the fisheries sector. The specific objectives of the VCAs were to:

- share and integrate local knowledge and perspectives to assess the key impacts and vulnerabilities related to climate change in target communities, especially for the fisheries sector and related livelihoods;
- identify priorities for adaptation in the fisheries of target communities; and
- build local capacity to conduct a VCA and improve understanding of the local impacts, vulnerabilities and strategies to adapt to climate change.

The VCAs utilised three tools: community mapping, surveys and an impact and capacity matrix, for data collection and analysis. A wide range of stakeholders were actively engaged in the VCA tools within each target coastal and fishing community, including fisherfolk and their organizations, other community groups, national fisheries authorities and local government agencies, to ensure a participatory process in assessing key vulnerabilities and priorities for adaptation to climate change.

Key findings and recommendations

The VCAs highlighted a range of climate change and related hazards that have begun to trigger biophysical and socio-economic impacts in the target coastal and fishing communities in Grenada, including:

- Coastal erosion and flooding due to sea level rise (SLR), storms and associated storm surge, which poses a significant risk to low-lying settlements, fisheries and other coastal infrastructure and to the natural environment, particularly beaches.
- Sargassum seaweed influxes that inundate beaches and nearshore areas and damage fishing gear and boat engines, as well as having impacts on the health of fisherfolk and other coastal and marine resource users and residents.

- Rainfall variability and extremes, particularly flooding that affects settlements and infrastructure and increases sedimentation in the coastal zone.
- Rising sea surface temperatures (SSTs) which impact on fisheries and on coastal and marine ecosystems, including coral reefs.

These climate change-related hazards are compounded by existing pressures. These pressures include pollution due to improper solid waste disposal, poor access to services and infrastructure, overexploitation of certain fishery resources, and market competition with foreign commercial fishing enterprises.

The adaptation priorities identified across the target coastal and fishing communities include the following:

1. Build the adaptive capacity of fisherfolk through enhancing knowledge, skills and resources related to safety at sea, access to insurance, conflict resolution and financial management and use of climate-smart and sustainable fishing practices and technologies;
2. Strengthen key government agencies, in particular national fisheries authorities and local government agencies, to better provide technical assistance for climate change adaptation and local fisheries management and development;
3. Protect critical coastal and marine biodiversity and ecosystems that support fisheries and other key economic sectors like tourism;
4. Improve access to services and infrastructure in communities, particularly fuel, cold storage and safe storage for boats, engines and other fishing gear for the fisheries sector; and
5. Improve communications and engagement of local communities in adaptation and sustainable management of the fisheries sector, particularly underemployed/unemployed youth in rural areas with limited livelihood options.

Further policy recommendations based on the VCA for moving forward and ensuring mainstreaming of CCA into fisheries governance and management in Grenada include to:

- Ensure community priorities are linked into local development plans and sectoral and national policies and programmes to support adaptation and build local resilience via an inclusive and 'bottom up' approach. This will ensure that these plans and programmes have local buy-in and are realistic and appropriate to local-level situations.
- Mobilise strategic partnerships to enable coordinated action and pooling of resources to address climate change and related hazards across stakeholders, including government, civil society and private sector, and across community to national levels. This recognises that the work of specific agencies, groups or individuals is often constrained due to limited human, financial and technical resources. In particular, national fisheries authorities and local government could foster and strengthen partnerships with established stakeholders including local fisherfolk organizations and other community-based organizations, private sector enterprises and national non-governmental organizations and academic/research institutions operating in these communities to mobilise resources (e.g. financial support, human capacity and technical assistance to implement adaptation).
- Investments in early warning systems, safety at sea, climate-smart technologies, insurance and social protection schemes for fisherfolk and their assets.
- Promote an ecosystem approach to fisheries (EAF) and local stewardship as part of the overall approach to build resilience to climate change and other existing pressures within coastal and fishing communities and the wider fisheries sector. EAF recognises that fisheries are social-

ecological systems, and so an integrated approach is needed to fisheries management to ensure ecological integrity, human well-being and good governance. EAF also seeks to manage uncertainty and address hazards and their impacts at the appropriate scale. EAF needs to be integrated in sectoral policies and plans as well as in project implementation.

1. Introduction

Understanding vulnerabilities to climate change and variability is a critical first step towards successfully adapting and building resilience. Assessment studies indicate that the Caribbean region is one of the most vulnerable regions in the world to the impacts of climate change and variability, and highlight that the fisheries sector in Caribbean small island developing states (SIDS) is more vulnerable than in other SIDS and that the Eastern Caribbean fisheries sector is particularly vulnerable (Monnereau *et al*., 2015). However, there remains insufficient understanding and awareness of the current and potential impacts of climate change and how this drives vulnerabilities within the Eastern Caribbean fisheries sector at the local to regional levels to enable adaptation. The challenges related to this include:

- limited coverage of the fisheries sector in existing vulnerability assessments; and
- limited understanding of local level situations and variability by site within countries to assess vulnerability and allow design of appropriate, location-specific adaptation strategies.

Vulnerability and capacity assessments (VCAs) have been recognised as an important tool for supporting the diagnosis of the specific areas of vulnerability at the local level and determining what actions can be taken to address them. VCAs are an important means to establish who and what is vulnerable to the impacts of climate change and identify potential adaptation measures at the local level. VCAs are also acknowledged as an important entry point for informing efforts to mainstream CCA and disaster risk management (DRM) into the fisheries sector and wider development agenda nationally and regionally. Coastal communities and fisherfolk (men and women involved in all aspects of the sector) are particularly vulnerable to these climate change impacts as they are dependent on the fisheries sector for food security, livelihoods and household income. However, at present, there is a fairly ad hoc approach to assessing the vulnerability of coastal and fishing communities that limits understanding of how to effectively adapt to climate change at the local level.

The Caribbean Natural Resources Institute (CANARI) provided technical assistance to the Food and Agriculture Organization of the United Nations (FAO) to undertake the regional implementation of VCAs under the Climate Change Adaptation in the Eastern Caribbean Fisheries Sector Project (CC4FISH). CC4FISH aims to increase resilience and reduce vulnerability to climate change impacts in the Eastern Caribbean fisheries sector through introduction of adaptation measures in fisheries management and capacity building of fisherfolk and aquaculturists. It is being implemented by FAO and the national fisheries authorities from the seven project countries, Antigua and Barbuda, Dominica, Grenada, Saint Kitts and Nevis, Saint Lucia, Saint Vincent and the Grenadines and Trinidad and Tobago, with funding from the Global Environment Facility (GEF).

The VCA work focused coastal and fishing communities in the following target countries: Grenada, Saint Kitts and Nevis, and Trinidad and Tobago. It contributed directly to achievement of the outcomes under CC4FISH Component 1: *Increased awareness and understanding of climate change impacts and vulnerability for effective climate change adaptation in the fisheries and aquaculture sector* as well as inform implementation of the other CC4FISH project components.

Under the project, the VCAs were conducted by CANARI and the Fisheries Division, Ministry of Sports, Culture and the Arts, Fisheries and Cooperatives, Grenada from October to November 2020 in three coastal and fishing communities, Gouyave and Grenville in Grenada and Windward in Carriacou.

The overall goal of the assessments was to engage target coastal and fishing community stakeholders to improve understanding of local climate change impacts and vulnerabilities for effective adaptation and resilience building in the fisheries sector. The specific objectives of the VCAs were to:

- share and integrate local knowledge and perspectives to assess the key impacts and vulnerabilities related to climate change in target communities, especially for the fisheries sector and related livelihoods;
- identify priorities for adaptation in the fisheries of target communities; and
- build local capacity to conduct a VCA and improve understanding of the local impacts, vulnerabilities and strategies to adapt to climate change.

This report presents the main findings and recommendations from the VCAs in Grenada.

2. Country overview

2.1 Context

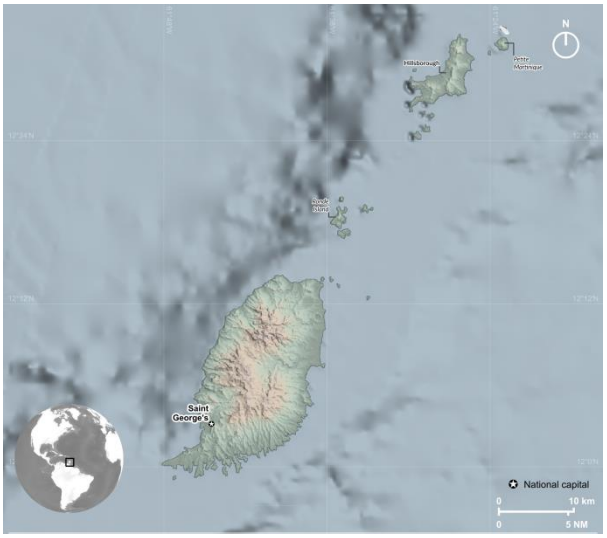
Grenada is the most southern of the Windward Islands, located between Saint Vincent to the north and Trinidad and Tobago to the south. The tri-island state comprises the islands of Grenada, Carriacou and Petite Martinique, and a number of islets, with an overall land area of about 350 km^2. Mainland Grenada has a land area of 312 km^2, Carriacou is 33.7 km^2 and Petite Martinique is under 5km^2 (Government of Grenada, 2019). The volcanic nature has led to the mountainous landscape of the islands. The highest point in Grenada is Mount St. Catherine which stands at 833 m above sea level. In Carriacou, the highest points are Mount Carre and High North at an elevation of 291 m above sea level (Government of Grenada, 2019).

In stark contrast to the country's small land area, Grenada has the second largest shelf area in the Eastern Caribbean, as well as substantial fishery resources (CCCCC, 2014). The east (windward) coast is lined by many fringing reefs and the shelf area is wider than that on the west coast (Mohammed and Rennie 2003). Grenada's climate is mostly humid and tropical, with the typical wet season (June to December) and dry season (January to May) (Government of Grenada, 2000).

Grenada's economy is largely service-based, with tourism serving as the leading source of revenue, employment and foreign exchange earnings. Services-based industries account for almost 80 percent of gross domestic product (GDP). Agriculture, including crops, livestock and fisheries, accounts for 6.5 percent of the GDP and is a significant source of export (CREWS Grenada, 2017). The country is the second largest producer of nutmeg in the world and exports other crops such as cocoa, citrus, bananas, cloves and cinnamon (FAO, 2015a). Fisheries are also an important contributor to employment and food for approximately 2 500 people involved in fishing or fishing-related activities in the country, with valuable commercial species like yellowfin tuna (FAO, 2015a).

The estimated population in 2018 was 112 207, with 89 percent of the population settling in mainland Grenada, 10 percent in Carriacou and 1 percent in Petite Martinique (FAO, 2015a). Population density is high at 306.8 per km^2 (Central Statistical Office, 2011). Approximately 25 percent of the workforce is unemployed, and 38 percent of the population is below the poverty line (CREWS Grenada 2017), earning less than XCD 16 (approximately USD 6) a day.

Figure 1. Map of Grenada



Prepared by FAO(RLC), based on layers from UN Map of the World [online].

Most of Grenada's development and critical infrastructure is located along its shoreline, making sea level rise (SLR) and increasing storms and storm surge intensity significant threats to the island (Government of Grenada, 2019). Roads through coastal communities are close to sea level and below sea level in some cases. These roads may experience flooding, become impassable during high tides and experience severe damage during storm surges. Since 1955, hurricanes such as Hurricane Janet, Allen, Ivan and Emily have caused severe damage to infrastructure and the natural environment (Gill *et al*., 2007).

To promote the protection and sustainable use of its extensive coastal and marine ecosystems and related fishery resources, Grenada does have an active marine protected area (MPA) programme led by the Fisheries Division. Currently, there are four MPAs that have been designated across the country. These include: the Gouyave Marine Protected Area (GoMPA), Grand Anse Marine Protected Area (GAMPA) and Molinière-Beauséjour Marine Protected Area (MBMPA) in mainland Grenada, and the Sandy Island/Oyster Bed Marine Protected Area (SIOBMPA) in Carriacou (Government of Grenada, 2016).

2.2 Grenada fisheries profile

A fisheries sector profile for Grenada is provided below, including a brief overview of the fisheries sector, governance arrangements, key stakeholders, and opportunities and challenges for the sector of relevance to climate change.

Sector overview

The fisheries sector in Grenada is a major source of employment and income, a significant contributor to food supply and food security, and a foreign exchange earner (FAO, 2018). Fishing activities range from traditional subsistence practices based in rural areas to small but up-scale (technological) practices. No commercial freshwater fishery exists, but catching of riverine species of finfish and especially prawns (crayfish) is important for subsistence livelihoods and for recreational fishing.

Grenada has a considerable number of main (urban) and minor (rural) landing sites, reflecting the role that fishing has played in economy and livelihoods of local people, especially for rural population dispersed at most coastal areas. The main landing sites at the traditional urban areas include St. George's (Carenage, Melville Street, Grand Mal); Grenville, Gouyave, Victoria, Waltham, Sauteurs,

Carriacou (Hillsborough, Windward) and Petite Martinique (Sanchez). These sites often include fish storage facilities, market facilities for sales, vessel anchorage and storage. There are six main market centres where fish is sold on the island of Grenada and one on Carriacou.

There has been no reported commercial aquaculture production in Grenada for the last decade (FAO, 2018). Aquaculture has not developed significantly due to lack of terrestrial coastal sites (land being preferred for housing, tourism and other developments), whilst inland sites suffer topographical limitations. There are also limited suitable marine sites and competing marine, yachting and coastal development interests, as well as a limited market demand for farmed fish species. Attempts in the past to promote aquaculture included the introduction of tilapia and freshwater prawns in the 1980s to early 1990s, as well as a trial project on seamoss farming which did not lead to any commercial development. Currently, there is a small trial seamoss project underway at Grenville and a small experimental tilapia farm in the uplands nearby (SOFRECO, 2012; FAO, 2018).

Needs and priorities

- Grenada's National Climate Change Policy (2017-2021) identified improvements to building local human capacity to assess and respond to climate change, including through the access and use of appropriate technologies in the fisheries sector; however interventions are not sufficient to produce long lasting impact. There is a need for training in the fisheries sector, as well as other sectors for inter-sectoral linkages to take an integrated approach to engage all levels (government, community, civil society, private and others) (Government of Grenada, 2017).
- The need for on-island record of climate related data and its maintenance was identified.
- Vulnerability assessments of the fisheries sector need to be carried out; strong calls have been made for use of integrated approaches and layman-friendly methodologies that could be applicable in reaching the non-scientific stakeholders for their cooperation as partners for climate change adaptation responses. Participatory approaches and incorporation of local or traditional knowledge including from fisherfolk is encouraged. Assessment of sargassum impacts on the dolphinfish and flying fish populations have been identified as a specific area of interest.
- Need for improved collaboration between regional fisheries-related centres of excellence and fisheries authorities and general improved communication of climate change issues to a larger public.

Relevant governance and institutional arrangements

- National Fisheries Authority: Fisheries Division, Ministry of Sports, Culture and the Arts, Fisheries and Cooperatives, Grenada
- The country is actively promoting the application of the FAO Code of Conduct for Responsible Fisheries in its fisheries management and is interested in the application of the Ecosystem Approach to Fisheries (EAF) (FAO, 2018).
- Climate change is not addressed in the current fisheries legislation in Grenada Fisheries Act No. 15 of 1986 (Government of Grenada, 1986). The current proposed Grenada Fisheries Policy does refer to climate change in the guiding principles section in relation to the impacts that need to be considered and in the context of the Regional and International Priorities. The final draft Coastal Zone Policy for Grenada (2015) (Government of Grenada, 2015) however partly addresses the needs to address climate change in coastal communities. The National Climate Change Policy (2017-2021) (Government of Grenada, 2017) identifies the need to address linkages between climate change and biological diversity. A National Adaptation Plan (NAP) 2017-2021 (Government of Grenada, 2019) and sectoral adaptation plans for the agriculture, tourism and water sectors have been developed under the Integrated Climate Change Adaptation Strategies (ICCAS) Project.

- The NAP, which was approved in 2019, identifies fisheries as a priority category under its fourth programme of action (food security) and highlights undertaking technical vulnerability analyses to improve understanding of climate change impacts to fisheries stocks, improve policy, legal, regulatory and institutional framework to support climate smart practices in fisheries, and enhancing social protection for fishing communities (Government of Grenada 2019).
- Current policy regarding aquaculture or mariculture development is based on an emerging trend rather than any deliberate public policy. The selected policy option now being adopted by the Fisheries Division is that of co-management between Fisheries Division and local area communities on the one hand, versus private persons interested in access to / use of public resources (sea area/ sea use) for commercial enterprises.
- The Fisheries Division has a functional relationship with NaDMA in order to participate in coordinated response in the event of wide-scale disaster events.

Key stakeholders

-Government stakeholders include: The Fisheries Division, which coordinates with other government agencies responsible for physical planning, infrastructure, coastal zone management, forestry, agriculture, environment, tourism, foreign affairs, finance, health, community development, and marine law enforcement. These other key government agencies include: Customs; Coast Guard;
-National Disaster Management Agency (NaDMA); Meteorological unit; Grenada Port's Authority; and National Water and Sewerage Authority.
-Private sector stakeholders include: The Marine and Yachting association of Grenada; private fish processors; and markets owners/managers.
-Civil society stakeholders include: national fisherfolk and farmers' organizations; fisherfolk (men and women); aquaculture farmers; coastal community residents; and St. George's University.

Strengths/opportunities

- An active marine protected area (MPA) programme exists, which can be integrated with and support climate change adaptation and fisheries management as more areas are set aside for conservation.
- Strong technical capacity for fishers training on, and use of, information and communication technologies (ICTs).

Weaknesses/challenges

- Lack of mainstreaming EAF, CCA and DRM into fisheries policies. Need to build awareness of climate change impacts on the fisheries sector, and CCA activities.
- The fisheries sector has changed within the last 20-25 years. Private businesses have entered the sector once dominated by government and fisherfolk cooperatives. As a result, the fishers must compete for share of the market that is now driven by market prices for production/ supplies.

3. Climate change impacts and trends in Grenada

Grenada, like other Caribbean SIDS, is highly vulnerable to climate change and natural disaster risks. Climate change is projected to result in increased average annual air and sea surface temperatures, reduced average annual rainfall, SLR and the increased intensity of tropical storms and hurricanes (Monnereau and Oxford, 2017; Government of Grenada, 2019).

Negative impacts associated with climate change pose additional financial burdens affecting the country's economic and social development (Government of Grenada 2019). In 2004 and 2005 for example, the passage of Hurricanes Ivan and Emily resulted in destruction of most of the country's buildings and trees. The economy was devastated, with estimated damages from Ivan alone totalling approximately twice the country's annual GDP or Eastern Caribbean Dollars (XCD) 2.4 billion (Government of Grenada, 2019).

Major revenue generating sectors, such as tourism, also rely heavily on the attractiveness of the natural coastline which is vulnerable to climate change impacts such as coastal erosion due to SLR and storm surges. Agriculture and fisheries, which contribute to rural livelihoods, income and food security, are also highly vulnerable to the effects of extended periods of drought and extreme rainfall events including tropical storms and hurricanes (CARIBSAVE, 2012; Monnereau and Oxford, 2017).

Current climate change model projections for Grenada indicate:

1. Grenada is at significant risk of SLR, leaving coastal settlements, key infrastructure and ecosystems vulnerable to the impacts such as coastal erosion and flooding. A projected 1 m of SLR places 73 percent of the tourism industry's infrastructure at risk, increasing to 86 percent at 2 m SLR (CARIBSAVE, 2012). Other at-risk areas include sections of the coastline close to the Point Salines International Airport, the Eastern Main Road leading out of Grenville and passing through Soubise and Marquis, and the main streets in Hillsborough and Harvey Vale in Carriacou (Government of Grenada, 2019).
2. Increasing sea surface temperatures (SST), combined with the threat of SLR, are likely to impact Grenada's coastal ecosystems including coral reefs, lagoons, seagrass beds and mangroves which support the nation's tourism sector, protect coastal infrastructure, and serve as fish nurseries and habitat (CARIBSAVE, 2012). Increasing SST may also impact pelagic fisheries (Monnereau and Oxford, 2017). General Circulation Model (GCM) projections indicate increases in SST ranging from 0.9°C to 3.1°C by the 2080s (CARIBSAVE, 2012).
3. Increases in average annual temperature ranging from 2.4°C to 3.2°C by the 2080s in the high emissions scenario Regional Climate Model (RCM) projections. Over the last four decades, temperatures over Grenada have risen steadily at an average of 0.14°C per decade (Government of Grenada, 2019) and are projected to continue increasing, including the number of warmer days and nights expected.
4. Long term rainfall variability trends are difficult to identify for Grenada due to large variability in rainfall inter-annually. GCM projections span both overall increases and decreases, ranging from -40 to +7 mm per month by 2080 across the three emissions scenarios. Decreases in rainfall largely occur through decreased wet season rainfall. (CARIBSAVE, 2012, Government of Grenada, 2017).
5. Increased intensity of extreme weather events such as tropical storms and hurricanes are likely to result in significant damage and losses throughout the country and within the economy of Grenada lies on the southernmost region of the Atlantic Hurricane belt and does not experience hurricanes on a regular basis. However, when hurricanes have impacted the nation the resulting damages and losses have been significant, such as Hurricane Ivan that caused widespread devastation in 2004 (Government of Grenada, 2019).
6. Projected increases in ocean acidification as the oceans continue to absorb atmospheric carbon dioxide, reducing pH, carbonate ion concentration and the availability of biologically

important calcium carbonate minerals. This will likely affect plankton, algae, shellfish, coral reefs and related biodiversity (Monnereau and Oxford, 2017).

Key components of Grenada's socio-economic landscape including human settlements, agricultural production, food supply, water supply, health and tourism are all vulnerable to these hazards and changes in climate. Grenadians will be further exposed to related hazards including landslides, flooding, and the negative impacts associated with potentially more intense tropical storms and hurricanes (Government of Grenada, 2019).

The fisheries sector in Grenada is reliant on the health of coastal ecosystems such as coral reefs, seagrass beds and mangroves which are particularly important in sustaining nearshore fisheries and are also vital to various life stages of commercially and ecologically important fish species. Possible consequences of climate impacts on these ecosystems are a reduction in abundance and diversity of reef fish, with implications for livelihoods, food security and, less importantly, in the availability of seafood for the tourism sector (CARIBSAVE, 2012). Warmer temperatures and changes in weather patterns are also likely to impact the fisheries sector negatively. Grenada's Initial Communication to the UNFCCC noted preliminary analysis of data provided by the Fisheries Division showed a relationship between fish production and the El Niño phenomenon (Government of Grenada, 2000). In the year previous to El Niño, fish production was reduced by 25 percent to 60 percent of the decadal average (CARIBSAVE, 2012). Additionally, warmer sea temperatures may likely impact pelagic fisheries in Grenada. Species such as yellowfin tuna, blue marlin and sailfish, which comprise the major fisheries landings in Grenada, may be driven away from the tropics in search of cooler temperatures (Monnereau and Oxford, 2017).

Sargassum influxes into the Caribbean are one of the more recent symptoms of climate change, with mass movements of pelagic sargassum plaguing the region since 2011 (Oxenford *at al*., 2019). There are implications to both the fisheries and tourism sector in Grenada as a result of sargassum influx. The floating mats of vegetation impact fishers by entangling their nets and lines, while for both the fisheries and tourism sectors the beaching of sargassum is unsightly and poses a major expense and logistical challenge for governments who opt to collect and dispose of the sargassum. There are also implications for the general population in coastal communities, including possible health risks associated with the decomposition of sargassum in large quantities, which releases hydrogen sulfide gas and may cause effects such as nausea, tearing of the eyes, headaches and respiratory issues (Doyle and Franks, 2015).

Figure 2. Sargassum along the coastline at Levera National Park, Grenada

The potential impacts from climate change on the fisheries sector in Grenada requires focused attention to better understand and reduce local vulnerabilities.

Increasing frequency and intensity of storms may result in significant damage and loss for the sector, as was seen from the impacts of Hurricane Ivan. This resulted in an estimated XCD 5 732 500 in damages, and impacted some 2 200 fisherfolk with loss of fisheries equipment, housing and communication facilities. Projected increases in SSTs indicate a likely increase in hurricane intensity meaning increased likelihood that the level of devastation experienced for Hurricane Ivan may occur once more (CARIBSAVE, 2012).

4. Assessing vulnerability to climate change in coastal and fishing communities

Recognising that fisheries are linked social-ecological systems, understanding and assessing vulnerabilities should importantly consider ecological vulnerability alongside socio-economic vulnerability of fisheries in relation to climate change and their linkages (FAO, 2015b). Vulnerability to climate change is commonly defined as "*the degree to which a system is susceptible to, or unable to cope with, the adverse effects of climate change, including climate variability and extremes*" (IPCC, 2007, 2014). The Intergovernmental Panel on Climate Change (IPCC) identifies three components of vulnerability to climate change: exposure, sensitivity and adaptive capacity.[1] These components have become key in understanding and assessing vulnerability in different contexts. See Box 1 for definitions for the components of vulnerability.

Box 1 Key components of vulnerability

Box 1. Key components of vulnerability

Exposure refers to 'the nature and degree to which a system is exposed to significant climatic variations'. It is denoted by the presence of people, livelihoods, species or ecosystems, infrastructure or economic, social or cultural assets in places and settings that could be adversely affected.

Sensitivity refers 'to the degree to which a system is affected, either adversely or beneficially, by climate-related stimuli'. More specifically, it is the degree to which biophysical, social and economic conditions are likely to be influenced by stressors or hazards due to climate change including beneficial and harmful effects. The effect may be direct (e.g. a change in fisheries productivity in response to a change in the mean, range, or variability of sea temperature) or indirect (e.g. damages caused by an increase in the frequency of coastal flooding due to SLR).

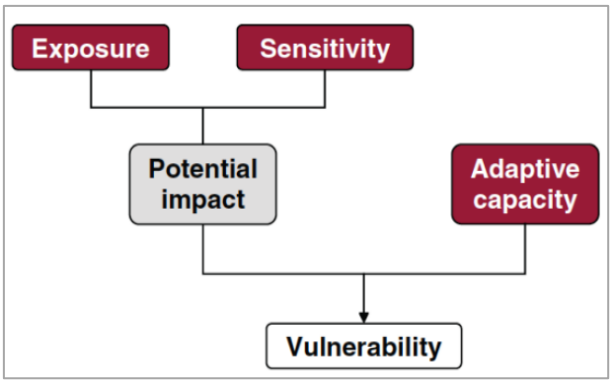
Adaptive capacity refers to 'the ability of a system to adjust to climate change – including climate variability and extremes – to moderate potential damages, to take advantage of opportunities, or to cope with the consequences'. It is context-specific as it is strongly influenced by culture, education, health, institutions and socio-economic factors.

Source: adapted from IPCC 2007, 2014

These components of vulnerability - exposure, sensitivity and adaptive capacity - are interdependent (Figure 3). Vulnerability is seen as a function of potential impacts due to exposure to climate hazards and sensitivity of the system to these hazards, and the adaptive capacity of the system to adapt and address the potential impacts of climate change. The drivers of vulnerability are therefore, not considered to be climate change alone, but interactions between wider contextual conditions and multiple processes of change (O'Brien *et al.,* 2007; Monnereau *et al*., 2015).

[1] In the Fifth IPCC Assessment Report (AR5) in 2014, the conceptualisation of vulnerability was altered from the framework outlined in the 2001 and 2007 assessment reports, with a greater focus on climate risk management. However, the original conceptual framework continues to be widely used and form the basis of vulnerability assessments in a range of sectors (e.g. Monnereau *et al*., 2015; FAO and CIFOR, 2019).

Figure 3. IPCC framework for conceptualising vulnerability to climate change



Adapted from IPCC (2007).

Understanding vulnerability is critical for adaptation and building resilience to climate change. Adaptation involves adjustments in natural or human systems in response to actual or potential climatic changes to moderate harm or to take advantage of new opportunities (IPCC, 2007, 2014). Whereas, resilience refers to the ability of a system to absorb, withstand and recover from disturbances and stressors while maintaining its structure and functions, and incorporates characteristics such as adaptability, learning and self-organization (Walker *et al*., 2004).

Through understanding and assessing vulnerability to climate change, ways to adapt and build resilience can be identified through reducing exposure and sensitivity to hazards (e.g., coastal defences or relocation away from coast) and building adaptive capacity to deal with hazards (e.g. livelihood diversification).

A number of vulnerability and adaptation assessments have been carried out on a country-level basis for Grenada targeting specific sectors (e.g. water, health) as well as those focused on a multi sectoral approach. In 2015, the German Development Cooperation (GIZ) conducted a vulnerability and adaptation assessment in Grenada exploring climate-related vulnerabilities of the health sector to raise awareness of the effects of climate change on health and identify priorities for action (Pochanka-Alff *et al.,* 2016). Under the European Union Global Climate Change Alliance Caribbean Support Project, the Caribbean Community Climate Change Centre (CCCCC) and the Government of Grenada carried out a VCA which fed into the creation of a national adaptation strategy and action plan to address climate change in the water sector in 2014 (CCCCC, 2014).

Additionally, the CARIBSAVE Climate Change Risk Atlas (CCCRA) Phase I, which was funded by the UK Department for International Development and the Australian Agency for International Development, successfully used evidence-based, intersectoral approaches to examine climate change risks, vulnerabilities and adaptive capacities and identify strategies to reduce vulnerabilities and enhance resilience on a national level with a focus on the tourism sector (CARIBSAVE, 2012).

However, these assessments generally do not cover specific community-level vulnerabilities related to climate change or the fisheries sector. Assessments are needed to meet the specific needs of the fisheries sector and enhance understanding of local-level situations to enable the design of appropriate, location-specific adaptation strategies. This includes the integration of ecological and socio-economic dimensions and priorities and consideration of fisheries-based livelihoods in a more comprehensive manner.

5. Approach and methodology

VCAs are one of the prominent and widely used approaches that allow for an integrated and participatory approach to assess vulnerability and capacity to adapt to climate change at the community level. Originally developed and promoted by the International Federation of Red Cross and Red Crescent Societies (IFRC), VCAs involve a process of participatory investigation designed to assess,

analyse and address the major risks affecting communities in a timely manner (IFRC, 2014). A participatory approach allows a deeper understanding of people's vulnerability and the issues that affect them and "empowers communities to identify their own needs, priorities and what they can do to address them" (IFRC, 2014: 9).

The VCAs aimed to be participatory and sought to actively engage community stakeholders to capture local knowledge and practices related to climate change vulnerabilities and priorities for adaptation, with a focus on the fisheries sector. Target community stakeholders included fisherfolk and other coastal and marine resource users, community groups including church, women and youth groups, local enterprises and local government representatives. The VCAs built on existing technical assessments of coastal vulnerability, climate change and disaster risks in Grenada.

5.1 Selecting the target communities

The VCAs targeted coastal and fishing communities in Grenada, which were selected in collaboration with the Fisheries Division and CC4FISH National Project Coordinator based on the following criteria:

- dependence on fisheries and marine resources for local economy and livelihoods (i.e. one of main sources of household income);
- high level of impact and frequency of past climate and disaster events (e.g. hurricanes, storms and storm surge, coastal erosion, coral bleaching and flooding);
- identified as priorities or hotspots to target for reducing coastal vulnerability to climate change and disasters in national assessments or reports;
- information available to facilitate VCA (e.g. desk studies and technical assessments);
- pre-existing relationships with CANARI, FAO or national fisheries authority that will facilitate fieldwork; and
- local community partners, such as fisherfolk organizations and other civil society organizations, have capacity to engage in and support VCA work.

The other factors considered in the selection process included:

- expressed need or interest from community in reducing its vulnerability to climate change and disasters, but no in-depth VCA has yet been undertaken;
- high unemployment and poverty levels (i.e. lack of alternatives for employment and income);
- remoteness (i.e. limits communications, transport and access to critical services); and
- coastal location and geomorphology which is highly exposed and sensitive to impacts from climate change and related disasters (e.g. erodible soil/rock base, proximity to estuary, located on cliffs or spits, etc.).

From this selection process, three coastal and fishing communities were selected: Gouyave and Grenville in Grenada, and Windward in Carriacou.

5.2 Scoping analysis

A scoping analysis of the selected communities was undertaken based on a comprehensive desk review of published and unpublished literature, technical reports and project documents related to coastal vulnerability, climate change and disaster risk management in Grenada and, particularly, the selected communities. Additional fisheries data and inputs from the Fisheries Division and CC4FISH National Project Coordinator in Grenada were also used to complement findings from the desk review. These findings were collated to better understand the local context for the selected coastal and fishing

communities and guide selection of the relevant VCA tools and engagement of key community stakeholders, such as fisherfolk and their organizations, local government and civil society partners engaged in fisheries and coastal and marine management. Findings from previous vulnerability assessments, and any existing or recent initiatives, were also summarised to provide a basis for the VCAs to build on and identify key information gaps to be filled.

5.3 Selected methods and tools

The following tools were utilised in conducting VCAs in the selected target coastal and fishing communities in Grenada, based on the approach outlined in the VCA Toolkit[2] developed under the CC4FISH project, to allow for a combination of spatial, socio-economic and institutional assessment of their vulnerabilities:

Community mapping – This tool can be used to assess biophysical and spatial vulnerability with the target communities. It brings together stakeholders in a participatory process to map their communities, including key resources and assets, and identify key hazards and impacts on the community including fisherfolk and fisheries related activities.

Impact and capacity matrix – This matrix is used as a participatory tool to highlight differences in the level of vulnerability and capacity to adapt to climatic and other hazards across different sectors and/or social groups in a coastal or fishing community. It helps determine the hazards that have the most serious impact on the community; determine which groups within the community, sectors, resources or livelihoods are most vulnerable; and identify coping and adaptation strategies to address hazards to identify and prioritise possible adaptation options. This is beneficial for local and national authorities that have limited resources to execute adaptation work.

Semi-structured interviews – This involved targeted interviews to gain insights from key community leaders and fisherfolk with specialised knowledge or needs within the fisheries sector. These focused on gathering information related to climate-related hazards and other issues affecting the community, stakeholder relationships and dynamics, local institutions and decision-making on management of fisheries and other resources.

These tools were selected based on the local context, key information gaps, existing capacities within the field team and the target communities, and the available resources and timeframe. The specific steps involved in applying these tools are outlined in the VCA Toolkit developed under CC4FISH. Table 1 provides a brief overview of each VCA tool, its advantages and challenges and the resources required.

[2] FAO and CANARI. forthcoming. Toolkit for Vulnerability and Capacity Assessment in Caribbean Coastal and Fishing Communities. Port of Spain, Trinidad.

Table 1. Overview of selected tools

Tool	Description	Advantages and Challenges	Resources/Skills Needed
Community mapping	Community mapping is used to gather and interpret spatial and/or biophysical information about vulnerability to climate change. This tool can be used to identify and document locations of key areas impacted by, or at risk from climate hazards, including settlements/populations, infrastructure, livelihood activities and natural resources in the community. It can also be used to identify key assets and services that enable adaptation to climate change. Community mapping can be a simple exercise where, for example, participants draw a rough map on a sheet of paper or it can be more detailed involving maps drawn to scale.	**Advantages:** • Useful to capture spatial information about who and what is vulnerable • Low cost and rapid (can be conducted in 2-3 hours) • Does not require special expertise • Maps can be displayed and serve as communications product • Flexible and can be integrated with other tools (e.g. photo-journaling, interviews etc.) **Challenges:** • Map's quality dependent on type of stakeholders involved in process, and their knowledge of the community • Difficult to document less tangible issues facing communities such as attitudes, conflicts and institutions	• Facilitation skills to guide mapping exercise • Spatial knowledge of area • Base maps and transparencies/tracing paper (if drawing to scale)
Impact and capacity matrix	The impact and capacity matrix is a participatory tool used to determine differences in the level of vulnerability and capacity to adapt to climatic and other hazards across different sectors and/or social groups within a community. It allows for identification of the hazards that have the most serious impact on the community; which groups within the community, sectors, resources or livelihoods are most vulnerable; and existing and potential coping/adaptation strategies to address hazards. This information is then used for prioritisation of needs and adaptation options.	**Advantages:** • Useful tool to systematically assess vulnerabilities to climate and other hazards and coping/adaptation strategies within the community • Low cost and rapid (can be conducted within one day) • Flexible and can be integrated with other tools (e.g. community mapping, P-GIS, semi-structured interviews etc.)	• Facilitation skills to guide exercise • Venue for workshop

Tool	Description	Advantages and Challenges	Resources/Skills Needed
	An impact and capacity matrix is developed by first identifying the climatic and other hazards affecting the community along the (top) horizontal axis of a grid. Community resources (e.g. natural resources, livelihoods and economic resources, physical infrastructure etc.) are listed on the (left) vertical axis. A ranking/scoring system is used to assess the degree to which these resources are impacted by the different hazards. Current and potential coping/adaptation strategies for the different hazards can then be identified and discussed.	**Challenges:** Matrix results dependent on type of stakeholders involved in process, and their knowledge of the various hazards, impacts and coping/adaptation strategies within community	
Semi-structured interviews	Semi-structured interviews are used to collect qualitative data and allow for more in-depth exploration and discussion of local perceptions and the economic, political and socio-cultural factors shaping vulnerability to climate change. They are best used to gain insights from key informants, such as fisherfolk and community leaders, with specialised knowledge or needs within a community or its fishery sector. Semi-structured interviews involve open-ended questions. The interviewer is encouraged to probe responses in order to get to the root causes of the vulnerabilities and to better understand priorities for adaptation.	**Advantages:** • Useful tool to capture cultural, socio-economic and political issues within community • Flexible and can integrate other VCA tools (e.g. mapping, participatory photo-journaling and livelihood analysis) **Challenges:** • Requires detailed stakeholder analysis to identify key informants • Requires trained and experienced persons to effectively design and conduct interviews • Takes 1-2 weeks to conduct interviews	• Training and skills in interviewing • Interview guide/questions

Source: CANARI, 2021.

5.4 Field teams and fieldwork activities

The VCAs in the three target communities were conducted from October to November 2020 by field teams of four to five persons trained as part of the VCA training workshop, held from 9 to 10 March 2020 in Grenada[3], and via virtual training sessions during the period October to November 2020. These field teams collectively encompassed a mix of competencies, including in climate change, fisheries and socio-economic and community development, to ensure a holistic approach and effective implementation. The field teams included:

- Fisheries officers and data collectors from the Fisheries Division, Ministry of Sports, Culture and the Arts, Fisheries and Cooperatives, Grenada that work in the target communities.
- Fisherfolk leaders and youth from active fisherfolk organizations in the target communities.
- Other civil society representatives, including from the Grenada Education and Development Programme (GRENED).
- The CC4FISH Project National Project Coordinator.

A listing of field teams can be found in Appendix 1.

The community mapping and impact and capacity matrix tools were applied in each community by field teams in half-day workshops (see Table 2 for details). Field teams also conducted 20-25 semi-structured interviews in each target community over two-four weeks. Interviews targeted fisherfolk, including fishers, fish processors and vendors, and selected households and individuals that are representative of various demographics, livelihood activities and sectors and vulnerable groups identified in the community mapping and impact and capacity matrix exercises. Semi-structured interview questions were tailored for fisherfolk, while other stakeholders were targeted with questions focused on the wider community (See Appendices 3 and 4).

Table 2. Community VCA workshops to conduct Community Mapping & Impact and Capacity Matrix VCA tools

Community	Workshop Venue	Workshop Dates	Total # of participants	
			Men	Women
Gouyave	Gouyave Fish Market Complex, Upper Depradine Street, Gouyave, Grenada	1 October 2020	7	4
Grenville	Hankey's Computer Service Conference Room, Grenville, St. Andrew's, Grenada	12 November 2020	2	4
Windward	Norman's Disco, Windward, Carriacou	24 November 2020	6	6

Source: CANARI, 2021.

[3] https://canari.org/wp-content/uploads/2018/02/CC4FISH-Grenada-VCA-Training-Workshop-Report-28.3.2020.pdf

Figure 4. VCA exercise workshop at Gouyave, Grenada: Stakeholders posing for a group photo at the VCA workshop including fishermen, fisheries division, government officials and residents (left); stakeholders working on the community mapping exercise (right)

Figure 5. Stakeholders in Grenville, Grenada use a web-based map of the area to orient themselves on the community landscape during the community mapping exercise (left), in order to create the community map and populate it with relevant climate change hazards and related impacts, as well as vulnerable areas to these identified impacts (centre and right)

Figure 6. Windward, Carriacou community workshop: Stakeholders working on the community mapping exercise to highlight relevant climate and other hazards in Windward, Carriacou affecting the fisheries sector in particular (left); group photo of all stakeholders who participated in the workshop including fishermen, fisheries division, fisherfolk organization representatives and residents community stakeholders (right).

5.5 Limitations

While the VCAs successfully engaged a wide range of stakeholders, including fisherfolk and their organizations women's and youth groups and residents in the three communities, there were limitations to the process. The COVID-19 pandemic led to delays in completion of in-person workshops and interviews in order to abide by restrictions on public gatherings and social distancing measures. Initially, VCA tools were to be executed within the timeframe May to July 2020. However, following the declaration of the COVID-19 pandemic in March 2020 by the World Health Organization, in-person workshops and other field activities were postponed until October to November 2020 when it was deemed safe given the low number of cases. All workshops and activities adhered to the COVID-19 protocols in Grenada.

6. Findings of the vulnerability and capacity assessments

This section presents the summary of results for VCAs implemented in the three target coastal and fishing communities: Gouyave and Grenville in Grenada and Windward in Carriacou. Results and findings from the three VCA tools are presented, detailing key climate change impacts and vulnerabilities and adaptation strategies and priorities identified by community stakeholders using a participatory process.

6.1 Gouyave

6.1.1 Overview of community

An overview of the Gouyave community is provided below, including the fisheries context, geography, demographic, socio-economic activities and findings from previous assessments in the area of relevance to climate change.

Box 2 Overview of Gouyave Community

Gouyave, Grenada

Fisheries sector highlights

- Gouyave is locally proclaimed as the "fishing capital" of Grenada, and has one of the country's main fish markets.
- There are approximately 300 fishers.
- The fish species of commercial importance that are landed in Gouyave include yellowfin and other tuna species, as well as other large pelagics (e.g. marlin, sailfish, swordfish, wahoo) (CANARI, 2019).
- There is a fish processing facility focused on exports, particularly of yellowfin tuna.

Geography

The town of Gouyave on the west coast of Grenada is 19 km to the north of the nation's capital, St. George's. Geographically, Gouyave town is the capital of St. John parish – one of the parishes of Grenada. Gouyave has an estimated population of 2 100 (Grant *et al.* 2007). The community is divided into three sections, Lower Depradine, Central Depradine and Upper Depradine. The fishing community's main population centre is the northern end of town – Upper Depradine (known locally as L'Anse). This area is often considered the poorer end of the town. It is home to six schools and nine churches. Recreational facilities include 32 bars, two nightclubs, one gym, and one sports complex. Social services include a health centre, police station, fire service, post office, courthouse, library, and a commercial bank. The town is relatively urbanised with over 441 residential buildings and 112 commercial buildings with 24

different types of commercial activities, and generally well serviced by electricity, piped water, roads, telecommunication, and transportation (Grant, 2007).

There is a protected area adjacent to the community called the Gouyave Marine Protected Area (GoMPA) comprised of five zones: a fish sanctuary, an anchoring zone, a beach seine fishing zone, a reef fishing zone and the rest of the area protected within the boundaries of the 5.4km^2 MPA (CANARI, 2019).

Socio-economic activities

- The community relies on employment from a number of economic sectors. Most residents' primary and secondary livelihood source is within the fisheries and agricultural sector (focused on small-scale production of nutmeg, fruit, vegetables and livestock (e.g. chickens, goats, pigs) in the surrounding upland areas). Other income source sectors include: government work and private sector enterprises.
- Principal and secondary income source for male residents were most often both within the fishing sector, while for female residents their sources of income were most often from fishing sector and small business enterprises (Grant, 2007).
- The fishing community has a clearly defined social and cultural context distinct from the rest of the Gouyave community (Grant, 2007). Gouyave fishers' households have on average three members. 37.1 percent of households had only one individual in 2007. Many fishers lived alone in a sparsely furnished small house, sometimes with no toilet or bathing facilities, while women lived with their children in well-furnished houses according to Grant (2007).
- Main landing sites of Grenada by percentage of landings rank Gouyave second only to Grenville; with 22 percent of landings coming in at Gouyave (FAO, 2018). This, along with the fish processing facility focused on exports, indicate the potential for significant income to be earned in the sector.
- Conflicts exist over the equitability of returns from the seine fishery versus longlining in terms of the level of investment and support provided by the national authorities and the local fisherfolk organization for these different types of fishing and the associated fisherfolk.

Demographic information

The community of Gouyave has over 2 000 residents (CANARI, 2019). L'Anse is the population centre for the fishing community and accounts for 51.6 percent of the town's dwellings. The fishing culture is a way of life, attitudes and socialization and involves individuals whose economic and social lives are influenced in some way by fishing (McConney, 2003). While most fishers are male, there are three or four female fishers who do longlining occasionally. Division of labour is otherwise mostly clear; with women working "behind the net" in processing, sales and marketing (McConney, 2003; CANARI, 2019).

Past assessments

- *Status of Hazard Maps, Vulnerability Assessments and Digital Maps: Grenada Country Report* (CDERA, 2003).
  - The Caribbean Disaster Emergency Management Agency (CDEMA) (formerly the Caribbean Disaster Emergency Response Agency [CDERA]) identified a multiple hazard map of Grenada including Gouyave from 1988, which had mapped areas prone to natural hazards and recommended mitigation measures (CDERA, 2003).
- *Grenada Case Study: Legalisation of beach seine traditional rules at Gouyave* (McConney, 2003).
  - Research methods used included: questionnaire surveys, semi-structured interview, focus groups, informants.
- *Public Knowledge and Attitudes towards Climate Change and Its Impacts on Ecosystems in Grenada* (Glasgow *et al*., 2018).
  - Focus group interviews conducted. Perception from fishermen that reef fish stocks have declined considerably, with little healthy coral reef left.

6.1.2 Key climate change impacts and vulnerabilities for Gouyave

The specific findings from the applications of the three VCA tools are detailed further below.

Community mapping findings

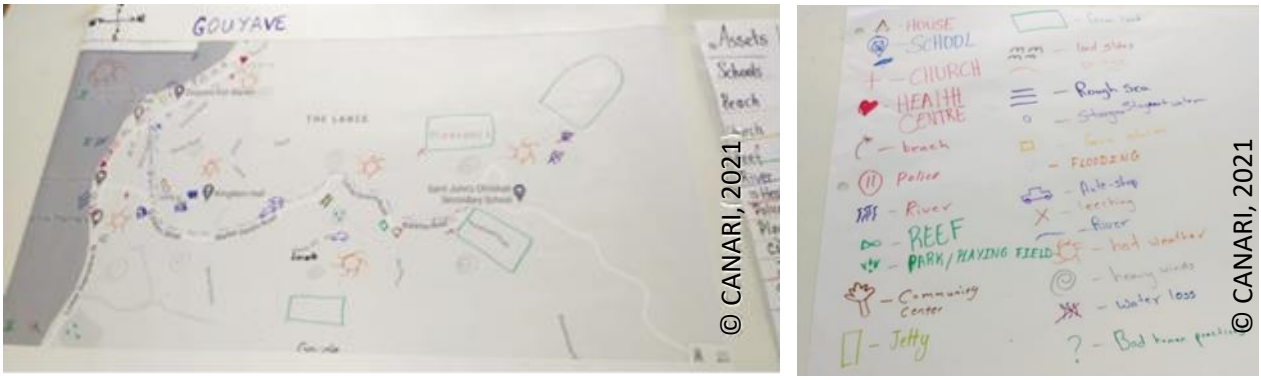
Stakeholders identified and mapped a range of climate-related hazards that they had experienced or which will pose a significant risk to the community of Gouyave, and the areas and groups vulnerable to these hazards during the community mapping exercise. These hazards included:

- Hotter temperatures and stronger winds experienced in the community of Gouyave both along the coast near residential houses and the fish market, as well as further inland where there is small-scale agriculture, and at the Saint John's Christian secondary school.
- Water shortages in inland agricultural lands, particularly in close proximity to areas noted as experiencing hotter temperatures.
- Storms, storm surges and rough seas, which impact and threaten key community infrastructure along the coastline including the fish market, jetty, residential buildings, the Gouyave Nutmeg Processing Cooperative's building and other important community infrastructure such as the police station and health centre.
- Flooding along Middle river in the community, particularly at bridges and most prominently at the river's mouth closer to the coastline.
- Coral bleaching and sedimentation from increased flooding impacting the coral reef ecosystems located within the GoMPA.

Fisherfolk and other community stakeholders noted the decline in fish stocks. As stakeholders highlighted, coral bleaching and reef sedimentation were significant impacts to the ecosystems within the GoMPA, and so it is likely that the decline in coral reef health has led to a decline in observed fish stock in the area. However, there are other potential threats that may have contributed to a decline such as overfishing of certain reef fish and land-based and marine pollution.

Additionally, stakeholders noted other hazards, namely land-based pollution from several automotive shops in the community and an area close to a park/playing field where landslides have been observed. Figure 7 shows the stakeholders community maps and accompanying legends highlighting key community assets and climate related hazards and impacts of concern.

Figure 7. Community map and legend of Gouyave, Grenada highlighting key community assets, climate hazards and vulnerable areas



Impact and capacity matrix findings

Stakeholders ranked the impact of identified climate-related hazards on community assets, including related to the fisheries sectors, and natural assets, including the GoMPA, during the impact and

capacity matrix exercise. Additionally, current and potential coping and adaptation strategies were identified for the hazards.

Hotter temperatures were ranked the top hazard impacting the Gouyave community, in particular activities within the health centre, schools, the church and community centre as well as residential homes. The ranking of hotter temperatures as a higher risk to Gouyave may be related to the time of year interviews occurred (November) when hotter temperatures are expected for the island and humidity is relatively high at about 80 percent (Government of Grenada, 2019). In terms of natural assets, the marine biodiversity in GoMPA was noted by stakeholders as being particularly vulnerable to the impacts of coral bleaching due to rising SST as well as reef sedimentation.

Flash flooding, rough seas, storm surge and strong winds also pose significant risk to the community of Gouyave. Vulnerable areas to these impacts include the Nutmeg Processing Cooperative's building/facility (as nutmeg production is one of key agricultural activities) the police station (as the main local emergency response unit) and the fishing jetty, which may incur high impact as a result of rough seas, storm surge and associated coastal erosion and flooding. Residential houses along the coast are also vulnerable to these impacts. Other hazards identified include pollution having high impact on natural assets such as coral reefs and the river.

Stakeholders identified both current and potential coping and adaptation strategies to address the impacts of these hazards, including the planting of trees to address the impact of hot weather and improving infrastructural standards of buildings to withstand harsh weather conditions such as strong winds and heatwaves. Additional strategies include; improved and additional drainage to address the impacts of flooding along rivers; additional sea defences such as sea walls and planting of trees along the coastline to buffer against the impacts of storm surge; and education and awareness on hazards like pollution and their impacts.

See Table 3 for the detailed results of the impact and capacity matrix exercise in Gouyave.

Table 3. Impact and capacity matrix for Gouyave, Grenada

Key:	3 – High Impact	2 – Medium Impact	1 – Low impact	0 – No impact

Assets	Hazards									
	flooding	landslides	rough seas	strong winds	hot weather	pollution	coral bleaching	reef sedimentation	drain blockage	storm surge
Community assets										
schools	2.5	1	0	2	3	2	0	0	2	1
church	2	1	1	2	3	2	-	-	-	-
health centre	1	1	2	2	3	2	0	0	1	2
police station	1	0	2	2	3	2	0	0	1	3
playing field	2	0	2	1	1	2	-	-	-	-
community centre	0	0	0	2	3	2	-	-	-	-
bridge	1.5	1	1	0	2	1	0	0	2	1
gas station	0	0	0	1	2	2	-	-	-	-
houses	2	2	3	3	3	2	-	-	-	-
jetty	0	0	3	0	1	1	0	0	0	3
vendor market	1	0	-	-	-	-	0	0	2	1
farmland	-	3	-	-	-	-	0	0	3	0
sea defences	0	0	-	-	-	-	0	0	1	3
nutmeg processing cooperative	3	0	-	-	-	-	0	0	1	3
Natural assets										
beach	3	0	3	2	1	2	-	-	-	-
reef	1	0	3	0	2	3	-	-	-	-
river	3	2	2	2	2	3	-	-	-	-
GoMPA	2	1	-	-	-	-	3	3	1	3
TOTAL RANKING	**25**	**12**	**22**	**19**	**29**	**26**	**3**	**3**	**14**	**20**
Current coping/adaptation strategies?	- proper drainage in some areas	- mesh fencing/ containment for rocks along the		- trees to act as buffers	- fans, A/C, trees	- campaign on reducing pollution - bins, posters and	- coral gardens			- sea defences

Assets	Hazards									
	flooding	landslides	rough seas	strong winds	hot weather	pollution	coral bleaching	reef sedimentation	drain blockage	storm surge
		coastline to prevent rock falls due to coastal erosion				signs used along with campaign to reduce pollution				
Potential coping/adaptation strategies?	**Key overall strategies:** - Better enforcement - Provide education - Proper drainage - Additional sea defences (wall, trees) - Increased water storage **Targeted strategies:** **Floods**: improve drainage system in community **Landslides**: tree planting to stabilise land/prevent erosion **Rough seas**: additional/improved sea defence and/or planting of trees along the coastline **Strong winds**: build stronger buildings **Hot weather**: burn less fossil fuels, utilise bioenergy **Pollution**: Educate people, use biodegradable items, have more bins present in areas, enforcement of laws/regulations The above will require drive and motivation, better communication tools, adequate funding, materials and skills and human resources. Key stakeholders to involve include Police, Ministry of Works and National Water and Sewerage Authority.									

Source: CANARI, 2021.

Interview findings

A total of 21 semi-structured interviews were administered in Gouyave. Only 5 percent of respondents were female. Persons aged 30-59 represented 71 percent of the respondents while persons over 60 represented 24 percent and those under 30 represented 5 percent.

A total of 75 percent of respondents were involved in the fisheries sector as fishers, vendors or members of fisherfolk organizations, 10 percent of respondents were business owners within the Gouyave community, 5 percent were employed in the public sector and 5 percent involved in non-governmental organizations. 5 percent of respondents gave no indication of any affiliated title or organization.

Changing fishing habits: Of the 75 percent of respondents involved in the fisheries sector, the majority indicated they were involved in longline fishing, targeting commercially important pelagic species such as marlin, sailfish and tuna. Other respondents were engaged in beach seine fishing and bottom line fishing. The majority of these respondents indicated that they have been fishing for twenty or more years.

Fishers indicated their fishing habits have changed since their involvement in the sector with respect to fish species caught, gear used, effort required, fishing seasons and landing sites used. They indicated changes in type of species caught and less and/or smaller fish being caught, particularly parrot fish and flying fish. Fishers also indicated changes to fishing seasons where months they used to target fish species have shifted and they now go further into the open ocean to target species.

In terms of changes in type of gear used, they noted that fishing technologies had improved for longline fishing in particular, where the use of smaller mesh is now a best practice standard for net gear. Fishers highlighted that their fishing effort is directly tied to the availability of bait and often the number of lines used are dependent on the amount of bait available. They also highlighted that new fishing techniques require less fishing effort than previously used methods. Fishers and vendors further indicated changes to their landing sites and facilities, with improvements to facilities to offer better fish storage, ice boxes on boats and relocation of chosen facilities from Gouyave to Grand Mal.

The majority of fisherfolk respondents highlighted climate change as a key factor contributing to changes in fishing habits in Gouyave. For example, changes in fishing seasons were linked to warmer waters and changes in ocean conditions. Changes in types of species and amount and size of catch were also linked to changes, such as warmer water, sargassum influxes and declining health of coral reefs. This indicated awareness of the impacts of climate change on fisheries and related livelihoods. Other factors driving changes in fishing habits included improved infrastructure, increased number of fishing boats and improved fishing technologies and techniques as well as unsustainable fishing practices and changes in fishing dynamics and fishing grounds over time. Observed shifts in fishing season and population dynamics by fishers in the community have resulted in increased fishing effort and fuel costs as boats have to venture further out at sea.

Key climate-related hazards and impacts: Mass sargassum influxes were highlighted as the main problem affecting fisherfolk and the fisheries sector, resulting in damage to boat engines and equipment used for longlining, beach seine fishing and net fishing. Fisherfolk have also noted an increase in the amount of sargassum impacting Gouyave over the past few years. Sargassum presence also negatively impacts the availability of fish species used for bait, which longline fishers are reliant on in order to catch commercially valuable pelagics (e.g. marlin, sailfish and tuna). Resulting impacts

from sargassum influxes included less fish catch, degradation of beaches and nearshore reefs and decrease in the viability of fishing as a reliable source of income.

Fisherfolk indicated other impacts from climate-related hazards, including:

- **Higher and changing tides** affecting their ability to venture out at sea and fish.
- **Storms and rougher seas** impacting fisheries in Gouyave leading to coastal erosion and damage to key fisheries ecosystems such as coral reefs. Flooding and stronger winds as a result of storms and rougher seas, particularly during hurricane season, also impact the ability to venture out at sea and lead to loss of income.
- **Hotter temperatures** resulting in changes to the type fish species being caught.
- **Rainfall variability**, particularly increased rainfall leading to flooding along rivers and disruptions to livelihood activities, including fishing and vending.

Wider community stakeholders identified water shortages, flooding along river banks, coastal erosion and landslides as well as degradation of coral reefs as the main problems impacting Gouyave. For example, they noted extreme dryness leading to water shortages, which is then followed by heavy rainfall causing landslides, flooding along rivers and soil erosion in coastal and upland farming areas that lead to loss of trees, infrastructure damage and siltation, impacting coral reefs and other nearshore marine ecosystems. The tourism and transport sectors are particularly impacted by landslides which block access routes and hinder transportation services. Rougher seas and higher tides leading to increased coastal erosion were also highlighted. Stakeholders noted areas in Gouyave where there were once coconut trees along the coastline, but are now underwater.

Additionally, an interesting problem identified by community stakeholders relates to access to education and skills building in the community. They noted that people who are not academically inclined often turn to fishing and so fisherfolk therefore lack literacy and numeracy skills and other knowledge to create viable business operations from their fishing activities. The need for education and training to address this gap was highlighted, and echoed by fisherfolk as one of the most useful measures to help the community address identified impacts and build resilience.

Coping/adaptation strategies and relevant supporting organizations: While the majority of fisherfolk indicated no measurable response beyond coping with the situation and accepting the change, a few respondents noted relocation of activities, development of new survival skills for safety at sea and improved access to financing as strategies to manage impacts from the identified hazards. They also identified the Grenada Community Development Agency (GRENCODA), the government and the Gouyave Fishermen's Cooperative as organizations that have been providing technical and financial support to address impacts. In particular, fisherfolk noted the work of the fishermen's cooperative in educating and training fisherfolk and lobbying for financial assistance for members of the cooperative, and saw a role for the cooperative in climate change adaptation in the community.

As noted above, community stakeholders highlighted education and training for fisherfolk as a useful adaptation strategy to enhance knowledge and skills to create viable business operations and livelihoods based on fishing activities. They also noted improved early warning and preparedness for extreme climate events as important strategies. Community stakeholders highlighted the Lion's Club as one organization that works within the Gouyave community which contributes to disaster response in the Saint John parish area during disasters, and also supports and assists the vulnerable (e.g. elderly and persons with disabilities) on an everyday basis in collaboration with NaDMA and other

organizations. They also noted the work of GRENCODA and the Grenada Coral Reef Foundation in addressing climate change and environmental threats in the community. However, existing conflicts between the fishermen's cooperative and other non-governmental organizations, such as the Grenada Coral Reef Foundation and GRENCODA, and the government managed GoMPA need to be addressed and collaboration improved to ensure an integrated, multi-stakeholder approach.

Priorities for adaptation: Fisherfolk respondents identified education and awareness raising about climate change and specific training to enhance knowledge and skills for small business development as priorities for adaptation. Additional training on use of new, climate-smart technologies and safety at sea was noted. Fisherfolk also noted the need for improvements to fishing facilities, including cold storage facilities, fish market facilities and equipment maintenance, and improved lighting for the jetty and beach in Gouyave used by fisherfolk. Financial assistance was also highlighted as a priority, particularly access to credit and insurance and social protection programmes for the more vulnerable.

Community stakeholders also echoed the priority measures highlighted by fisherfolk, with particular focus on education, awareness and training geared towards underemployed/unemployed youth in the community and engaging them in fisheries sector. Additionally, community stakeholders highlighted the following:

- sea defence walls to address the impacts of SLR and coastal erosion
- improved management of coastal development to reduce environmental degradation
- enhancement of green spaces
- promotion of sustainable and climate-smart agricultural practices
- improved management of flows during heavy rainfall events in flood-prone areas
- reforestation to buffer against the impacts of flooding and reduce likelihood of landslides
- establishment of a coral nursery to facilitate coral rehabilitation efforts to address coral bleaching and improve coral reef health
- provision of equipment and tools for clean-up of sargassum influxes by local organizations
- financing to support adaptation measures e.g. via grant facilities

In terms of roles for organizations in supporting the Gouyave community to adapt, stakeholders identified:

- Government stakeholders, such as the Fisheries Division and NadMA, providing education, awareness raising and training via improving extension services and presence in the community and lending technical assistance to address various hazards and their impacts.
- national NGOs to enable access to grants and other funding for practical adaptation actions, particularly for access to and training on climate-smart technologies and practices for fisherfolk and farmers.
- business/private sector stakeholders that may offer funding to implement activities, sponsor events in the community (e.g. coastal clean-up campaigns) and invest in the fisheries industry. Other assistance suggested included offering reduced cost options for purchasing fishing equipment and promoting the consumption of local fish and use of local products.

Summary of findings

A summary of the key climate change impacts, vulnerabilities and adaptation priorities is outlined in Table 4.

Table 4. Key climate change impacts and vulnerabilities identified by Gouyave stakeholders

Climate-related hazards	Key impacts	Vulnerable groups and areas	Priorities for adaptation
Coastal and marine biodiversity and ecosystems			
• storms and storm surge • higher and changing tides • rough seas • sargassum influx • warmer air and sea temperatures • stronger winds • rainfall	• coastal erosion and flooding • sargassum strandings impacting beaches and nearshore areas • coral bleaching • reef sedimentation due to heavy rainfall, flooding and increased soil erosion • periods of reduced rainfall/drier conditions • decline in fish stock due to loss of habitat, nurseries and breeding grounds	• beaches susceptible to coastal erosion and flooding due to storm surge, higher tides and rough seas • coral reefs, seagrass beds and mangroves, including in the gompa • reef-dependent fish species (e.g. parrot fish) and other biodiversity	• planting of trees along the coastline to buffer against the impacts of storm surge, higher tides and rough seas • improving coastal defences such as sea walls • improving management of the gompa and coastal development to sustainably manage natural resources • promoting sustainable agricultural practices to reduce erosion and siltation in nearshore areas • establishing a coral nursery towards coral rehabilitation efforts to improve coral reef ecosystem health
Livelihoods and socio-economic practices			
• storms and storm surge • higher and changing tides • rough seas • sargassum influx • warmer air and sea temperatures • stronger winds • rainfall variability and extremes	• loss and damage of coastal property (e.g. hotels, restaurants) and fisheries infrastructure (e.g. jetty) due to coastal erosion and flooding • reduced fishing hours and income as storms and rough sea conditions prevent venturing out to sea • damage to boat engines and equipment used for longlining, beach sein fishing and net fishing due to sargassum influxes	• fisherfolk, including fishers, vendors and boat owners) and their dependents experiencing decline in viability of livelihoods and income • tourism-related enterprises and their workers who depend on fisheries and marine resources (e.g. tour guides, hotels and restaurants selling local fish) • community residents reliant on key community infrastructure,	• improving coastal defences such as sea walls • education, awareness raising and training for fisherfolk, particularly youth, to improve viability of fisheries-based enterprises • using new fishing techniques which require less fishing effort from fisherfolk than previously used methods • planting of trees to address the impact of higher

Climate-related hazards	Key impacts	Vulnerable groups and areas	Priorities for adaptation
	as well as impacts on availability of bait • health impacts when sargassum seaweed decomposes and releases hydrogen sulphide, including burning/itchy eyes and difficulties breathing • disruptions to indoor and outdoor activities (e.g. schooling, sports etc.) due to high temperatures • shifts in fishing seasons and population dynamics resulting in increased fishing effort and costs as boats have to venture further out at sea • coral bleaching • reef sedimentation due to heavy rainfall, flooding and increased soil erosion • landslides • periods of reduced rainfall/drier conditions impacting water availability	including schools, health clinics, police station, affected by higher temperatures and coastal flooding • tourism and transport operators impacted by landslides which block access routes • rain-fed agricultural lands and farmers	temperatures in the community • provision of equipment and tools for clean-up of beaches affected by sargassum influxes • improving access to financial assistance for fisherfolk and other vulnerable groups • promoting sustainable agricultural practices, including agroforestry, to reduce erosion and siltation in nearshore areas • improved management of river flows during heavy rainfall events in flood-prone areas
Settlements and infrastructure			
• storms and storm surge • higher and changing tides • rough seas • stronger winds • sargassum influx • rainfall variability and extremes	• loss and damage of coastal property and infrastructure due to coastal erosion and flooding from storms and surge, higher tides and rough seas • damage to buildings (e.g. exterior) and public health concerns due to hydrogen sulphide gas released as	• coastal property (e.g. residential buildings, hotels, restaurants) and infrastructure (e.g. jetty, roads) • community residents reliant on key community infrastructure, including schools, health clinics, police station, affected by	• improving coastal defences such as sea walls • planting of trees along the coastline to buffer against the impacts of storms and surge, higher tides and rough seas • improving infrastructural standards of buildings and roads

Climate-related hazards	Key impacts	Vulnerable groups and areas	Priorities for adaptation
	sargassum seaweed decomposes • landslides due to increased instability and erosion due to periods of reduced rainfall followed by heavy rainfall	higher temperatures and coastal flooding • tourism and transport operators impacted by landslides which block access routes	to withstand harsh weather conditions • improving and adding drainage to address the impacts of flooding • reforesting upland areas, including agroforestry, to reduce landslides, erosion and flooding in low-lying areas

Source: CANARI, 2021

6.2 Grenville

6.2.1 Overview of community

An overview of the Grenville community is provided below, including the fisheries context of the community, geography, demographics, socio-economic activities, and previous assessments in the area of relevance to climate change.

Box 3 Overview of Grenville Community

Grenville, Grenada

Fisheries sector highlights

- Grenville is the major fish landing site on the east coast of Grenada.
- Over 100 fishers operate from Grenville (VanAnrooy *et al.,* 2018).
- Fishing off Grenville is primarily offshore for pelagic species.
- Grenada's 80 active Fish Aggregating Device (FAD) fishing vessels mostly fish from Grenville (VanAnrooy *et al.,* 2018).

Geography

Grenville, which is the capital of St. Andrews Parish, is located on the eastern coast of Grenada and borders the Grenville Bay. It is the second largest town on the island, with the Grenville Fish Market and a branch of the Fisheries Division (Nayar, 2009). The east coast is fringed by coral reefs, seagrass beds, and patches of wetlands. A narrow channel between coral reefs allows access from Grenville to the offshore fishing grounds for large pelagic and some demersal shelf fish species (Parsram, 2008).

Socio-economic activities

- Grenville's main livelihood activities include fishing, farming, crabbing and charcoal making. The town is a commercial centre and consequently some activities are not associated with coastal livelihoods (Isaac, 2010). However, opportunities for livelihood development are limited to an extent due to the community's remote location on the east coast and restricted access to certain public services and markets.
- Grenville Port is located on the east coast of the island and is the second largest port on mainland Grenada. It functions as the main landing site for fishermen on the eastern side of the island and as a shipping facility for agricultural goods and services to and from Trinidad.

- Although Grenville is the most remote fish landing site on Grenada (VanAnrooy *et al*., 2018), the Fisheries Division has provided infrastructure for the fisheries sector (e.g. Grenville Market), financial support through a fishing industry fund up to XCD 20 000 and gas rebates. Grenville's fish landing site has a mini-gas station where fishers purchase their fuel. Fishers may also access loans through financial institutions such as the Grenada Development Bank (Parsram, 2008).

Demographic information

Grenville has a population of approximately 2 400 people (Commonwealth Secretariat, 2019). Specific demographic information is only available at the parish level for the most recent 2011 census. Grenville is located in the Parish of Saint Andrew, with a population of 26 436 (13 414 men and 13 022 women) which is largely of African descent (76.9 percent) (Central Statistical Office, 2011). The majority of the parish reported the highest education level as pre-primary or primary in the last census (Central Statistical Office, 2011).

Past assessments

- Under the *At the Water's Edge (AWE): Enhancing Coastal Resilience in Grenada* project, a vulnerability analysis of Grenada was conducted in 2013; results provided the rationale for focus in the Grenville Bay Area (Reef Resilience Network, 2016).
  - A participatory 3D mapping exercise (P3DM) was conducted with the communities. Members constructed a model of the surrounding villages and the Bay of Grenville, highlighting existing natural and cultural resources (Reef Resilience Network, 2016).
- In 2010, the Government of Grenada commissioned a project that sought to investigate the current flood problems in Grenville as part of the "*Greater Grenville*" project, and highlighted that rooftop rainwater harvesting by households in the town can mitigate the severity of flooding by lowering the peak flow by 25 percent (UNDESA, 2012a).

6.2.2 Key climate change impacts and vulnerabilities for Grenville

The specific findings from the applications of the three VCA tools are detailed further below.

Community mapping findings

During the community mapping exercise, stakeholders identified and mapped a range of climate-related hazards that they had experienced or which will pose a significant risk to the community of Grenville, particularly the fisheries sector, as well as specific vulnerable areas and groups. These hazards included:

- SLR, storms and storm surge contributing to flooding along the coastal community area, particularly Victoria and Ben Jones Streets and their associated secondary roads. Key fisheries-related and community infrastructure is impacted as a result including the fish market, police station, bus terminal, stores and food outlets.
- Coastal erosion as a result of SLR and higher high tides, contributing to intensified impacts during flooding events.

Other key hazards identified include:

- Pollution, particularly from improper solid waste and sewage disposal, which impacts key community infrastructure, livelihoods and the natural resources of the Grenville community.

Impact and capacity matrix findings

Building on the identified climate and other hazards, stakeholders ranked the impacts of these hazards on community infrastructure and assets in the impact and capacity matrix exercise in order to determine hazards of greatest priority in the Grenville community. Additionally, current and potential coping and adaptation strategies were identified for the hazards.

Flooding and SLR were the top ranked hazards based on impacts. SLR will compound the impacts of floods on key community assets, including infrastructure, natural resources such as beaches and the fisheries sector (e.g. fishing facilities). Other key livelihoods are also negatively impacted such as seamoss farmers by the effects of flooding, SLR and more intense storms and storm surge. The impacts of non-climate hazards, including pollution from solid waste and theft/crime, were also of concern for Grenville stakeholders.

Stakeholders identified potential coping and adaptation strategies to address the impacts of top-ranked hazards, including improving drainage infrastructure and its maintenance and addressing the flow of flood water away from flood-prone areas in order to minimize impact. See Table 5 for the detailed results from the impact and capacity matrix exercise.

Table 5. Impact and capacity matrix for Grenville, Grenada

Key:	3 – High Impact	2 – Medium Impact	1 – Low impact	0 – No impact

Community assets	**Hazards**					
	Flooding	Drought	Fires	Sea Level Rise	Theft	Solid Waste
schools	2	2	1	1	2	2
police station	3	1	1	3	2	2
church	1	0	0	0	-	-
business	3	1	1.5	3	2	2
restaurants/bars	3	0	1	2	-	-
fish market	2	1	1	3	2	3
vendors market	3	0	0	3	-	-
nutmeg processing station	3	0	0	3	-	-
mariculture	1	0	0	2	2	2
bus terminal	3	1	0	3	1	2
supermarkets	2	1	1	2	2	2
banks	2	1	1	2	1	1
TOTAL	**31**	**8**	**7.5**	**29**	**14**	**16**
Potential coping/adaptation strategies?	- unblock drains		- smoking signage			
	- big drain (newly built) is currently directed towards Grenville. This should be addressed to divert flow in a way to minimize flooding of the community - storm surge which impacts seamoss farmers requires addressing - community dam					

Source: CANARI, 2021

Interview findings

A total of 23 semi-structured interviews were administered in Grenville, with 26 percent of the respondents being female. 74 percent of respondents were aged 30-59, while persons over 60 represented 17 percent and those under 30 represented 4 percent. 5 percent of respondents did not indicate their age.

A total of 88 percent of respondents were involved in the fisheries sector as fishers, divers, vendors or members of fisherfolk organizations. 4 percent of respondents each were involved in politics and the business sector and 4 percent were community leaders.

Changing fishing habits: Of the 88 percent of respondents involved in the fisheries sector, the majority were involved in trawling, towing[4] and diving/spearfishing. A few respondents were involved in fish vending. The majority of the respondents have been involved in fishing or vending for 10 or more years, although a few younger respondents had only been involved for 1-9 years.

Fishers indicated their fishing habits have changed since their involvement in the sector. Changes in type of species being caught were noted, including decreased fish catch for species such as the common dolphinfish, while marlin and tuna catch has increased with the implementation of FADs. Other species targeted include snapper, cavalli or crevalle jack, kingfish, marlin, barracuda, bonito as well as Queen conch (known locally as lambi). Most of the fishers interviewed fish year-round and go out to sea between three and seven days per week, weather-permitting. They did not note significant changes in fishing seasons. This is likely due to the active FAD fishing vessels operating from Grenville. In terms of fishing grounds, some of the fishers interviewed noted no changes while others indicated that they have to go further out to sea to catch fish.

In addition to the use of FADs, which attract larger and commercially important pelagic species such as marlin and tuna, and make catching these species easier and faster, fishers also highlighted new techniques and lessons from training through the Japan International Cooperation Agency (JICA). JICA and the Caribbean Fisheries Regional Mechanism (CRFM) collaborated on the Caribbean Fisheries Co-Management Project (CARIFICO) which supported training in various fishing techniques including the design, construction, deployment and management of FADs in a collaborative manner among fishers and government officials. Other reasons given for changing fish habits include depleted fish stocks, competition from foreign trawling vessels leading to overfishing, greater awareness of the importance of sustainability to their livelihoods and climatic changes such as shifts in weather patterns and tides.

Key climate-related hazards and impacts: Half of the fisherfolk interviewed noted changes in weather and climate patterns and impacts in areas where they live and fish, including:

- **Sargassum influxes impacting fishers and the community** via health and air quality issues and damage to boat engines and fishing equipment/gear. Respondents indicated breathing difficulties due to the gas (i.e. hydrogen sulphide) released from the decomposing sargassum, and irritation to their skin as a result of contact with sargassum seaweed. Sargassum seaweed also tangled fishing lines, and boat engines have been damaged as a result of seaweed preventing propellers

[4] Towing is a variety of bottom-set line fisheries

from operating properly. Interestingly, a positive impact is highlighted by fisherfolk respondents where sargassum has led to an increase in fish catch for specific species (e.g. dolphinfish and kingfish), as well as smaller fish species that hide among the floating mats.

- **Changes in high tides and sea levels** causing coastal erosion and impacting access to fish landing sites and nearshore fishing grounds. Fishers also note higher tides and changes in sea levels decrease the availability of suitable time periods to fish.
- **Storms and rougher seas** which impact fishers' ability to go out at sea due to rougher sea conditions and also increases fishing effort required as lines drift away faster during storms or rough seas.
- **Changes in ocean temperature or currents** where stronger and changing currents impact the ability to catch fish, and rising temperatures lead to coral bleaching events and affect the reef-based fishery.
- **Heavy rainfall** leading to soil erosion and damage to agricultural areas and increasing run off into nearshore areas and sedimentation on coral reef ecosystems. This leads to murky waters which fishers highlighted as not attractive for lobster, and so they did not observe this high value target species in surrounding coral reef habitats in as much frequency. Heavy rainfall also restricts fishers' ability to go out to sea.

Similarly to fisherfolk, other respondents from the wider community highlighted sargassum as a key hazard impacting Grenville and other coastal communities further south of Grenville such as Marquise and Soubise, where people are affected by the foul odour and respiratory problems from the decomposing sargassum on the nearby beach. SLR and associated coastal erosion and flooding were also identified as major issues, impacting in particular Telescope beach in Grenville, and resulting in loss of coastal property, community infrastructure such as roads closer to the coast, mangroves and coconut palms. Respondents highlighted that mangrove loss impacts fishers as they have to find alternative locations for seine fishing and suffer from loss of breeding grounds for fish species.

Wider community respondents also noted hotter temperatures and rainfall variability and extremes, including heavier rainfall and periods of drought. Rainfall is now observed more within the month of November, rather than in September as was common in the past, resulting in extended dry periods that impact the agricultural sector. Other non-climate hazards and issues highlighted were unemployment, sand mining and inland erosion.

Coping/adaptation strategies and relevant supporting organizations: Fisherfolk respondents identified the following coping and adaptation strategies for the identified hazards: not fishing when sargassum influxes are prevalent or not going out far to sea (e.g. for bottom line fishing) during strong currents and rough sea conditions. FADs were also highlighted as a coping measure, largely because they reduce fishing efforts and costs and increase the possibility of a good catch. Alternative livelihoods are also sought during periods when fishing is not feasible. Alternatives include farming, selling of agricultural products, developing trade skills by enrolling in craft programmes or working on projects such as coral gardening which serve to rehabilitate the environment. However, fisherfolk lamented that the government-led coral rehabilitation project is currently inactive.

Other respondents from the wider community highlighted coping and adaptation strategies including community-led clean-up of sargassum influxes and replanting mangroves and other trees along the coastline to address the impacts of SLR and rough sea conditions.

Neither fisherfolk nor other community respondents indicated any significant presence or actions by local groups or organizations in Grenville, although there are active groups including the Soubise Fishermen Cooperative and the Grenville FAD Fishers Organization Inc. A few respondents highlighted support from the national and local government to address sargassum influxes and promote coastal protection and coral reef rehabilitation (e.g. the coral gardening project).

Priorities for adaptation: The majority of respondents, including fisherfolk, highlighted the need to improve clean up measures to avoid large sargassum seaweed deposits building up on beaches and along shorelines, find ways to address sargassum's negative impacts on fishers while at sea and exploring avenues towards harvesting and using sargassum commercially.

Fisherfolk respondents also highlighted the need for improved fishing facilities and infrastructure and improved marketing of fish and fish products to increase sales and profits, including a focus on quality assurance and pricing to access markets. In terms of infrastructure, the need to address impacts of higher tides and SLR on use of the jetty was specifically noted. Fisherfolk also highlighted the need for government assistance to purchase or repair equipment/tools, improved cold storage, improved fisherfolk cooperation and rehabilitation measures for critical coastal and marine ecosystems including coral reefs and mangroves that protect the coastline and support fisheries.

Other community respondents highlighted the need for improvements to building codes for residential homes, businesses and public buildings to better withstand extreme weather, including storms and floods, and building a sea wall to cope with the impacts of SLR and coastal erosion.

Fisherfolk and other community respondents highlighted the importance of education and awareness on identified hazards, particularly emerging issues like mass sargassum influxes, and their impacts in order to promote adaptation solutions that address these impacts as well as the need for funding to implement solutions. They also noted the need for improved coordination and communication between responsible government agencies, fisherfolk and other community groups to effectively address impacts from identified hazards using a multi-stakeholder approach. Community stakeholders further identified the need for improved spatial planning by responsible government agencies to address climate change in Grenville, particularly in low-lying, flood-prone areas.

In terms of roles for organizations in supporting the Grenville community to adapt, respondents identified:

- Government agencies supporting education and awareness to sensitize community on climate related hazards and their associated impacts, and enabling meaningful stakeholder participation in planning and implementing adaptation strategies for SLR, coastal erosion and flooding and sargassum influxes.
- National CSOs supporting coastal ecosystem rehabilitation with inclusion of community stakeholders, and building the local capacity to implement adaptation strategies.

- Business/private sector stakeholders serving a supporting role alongside both government and CSO-led initiatives in the community via financial support e.g. sponsorship of community sensitization billboards or clean up initiatives.

Summary of findings

A summary of the key climate change impacts, vulnerabilities and adaptation priorities is outlined in Table 6.

Table 6. Key climate change impacts, vulnerabilities and priorities for adaptation identified by Grenville stakeholders

Climate-related hazards	Key impacts	Vulnerable groups and areas	Priorities for adaptation
Coastal and marine biodiversity and ecosystems			
• SLR and higher tides • storms and storm surge • rough seas • sargassum influx • warmer air and sea temperatures • changes in currents • rainfall variability and extremes	• coastal erosion and flooding as a result of SLR and higher tides, storms and storm surge • blockage of beaches and other coastal ecosystems due to sargassum influx • coral bleaching • siltation of coastal ecosystems due to heavy rains and increased run off	• beaches, particularly telescope beach, and associated vegetation like coconut trees • coral reef and mangrove ecosystems and associated fisheries and marine biodiversity	• rehabilitation of coral reefs and mangroves to improve ecosystem health and buffer impacts of slr, storms and storm surge
Livelihoods and socio-economic practices			
• SLR • storms and storm surge • rough seas • sargassum influx • warmer air and sea temperatures • changes in ocean currents • rainfall variability and extremes	• damage to/loss of fisheries assets and infrastructure due to coastal erosion and flooding from SLR, storms and surge • disruptions to fisheries operations and damage to equipment, gear and boat engines due to sargassum influxes • health impacts to fisherfolk and wider community from release of hydrogen sulphide from decomposing sargassum (e.g. burning eyes, coughing and shortness of breath/respiratory problems) and skin	• jetty, fish market and other fishing facilities • fisherfolk (fishers, divers, vendors) and their dependents whose operations are disrupted • seamoss famers impacted by SLR, intensified flooding events and sargassum influxes • seine fishers that have to find alternative locations to fish due to mangrove loss • lobster and other reef-based fisheries	• upgrading landing sites and jetty • improving drainage infrastructure and its maintenance to divert floodwater away from the community • improving clean up measures to avoid large sargassum seaweed deposits on beaches and along shorelines • exploring ways to address negative impacts of sargassum on fishers while at sea and exploring avenues for harvesting and

Climate-related hazards	Key impacts	Vulnerable groups and areas	Priorities for adaptation
	irritation from contact with sargassum • increased catch of dolphinfish and kingfish attracted to floating sargassum mats • decreased time for fishing due to storms, rough seas, strong currents and heavy rainfall. Reduced catch and income for fisherfolk depend on nearshore fisheries due to mangrove loss, coral bleaching and siltation from increased runoff • extended dry periods	• Rain-fed agricultural lands and farmers	using sargassum commercially • rehabilitation of coral reefs and mangroves to improve ecosystem health and buffer impacts of SLR, storms and storm surge • improved community-level education and awareness, and active stakeholder participation in solutions • funding for projects to implement solutions
Settlements and infrastructure			
• SLR • storms and storm surge • rough seas • sargassum influx • warmer air and sea temperatures • rainfall variability and extremes	• damage to/loss of community infrastructure due to coastal erosion and flooding from SLR, storms and surge, heavy rainfall Health impacts to community from release of hydrogen sulphide from decomposing sargassum (e.g. burning eyes, coughing and shortness of breath/respiratory problems) • loss/degradation of mangroves and coral reefs that act as natural defences due to SLR, storms and storm surge, coral bleaching and siltation of nearshore areas	• fisheries-related and community infrastructure in low-lying areas, including Ben and Jones Streets and their associated secondary roads, police station, bus terminal • business owners and employees working in shops and food outlets in low-lying areas • Marquise and Soubise residents affected by the foul sargassum odour and respiratory problems	• improving drainage infrastructure and its maintenance to divert floodwater away from the community • improving building codes to lessen the impact of extreme weather • building a sea wall to address impacts of SLR and storm surge • rehabilitation of coral reefs and mangroves to improve ecosystem health and buffer impacts of SLR, storms and storm surge

Source: CANARI, 2021.

6.3 Windward

6.3.1 Overview of community

An overview of the Windward community is provided below, including the fisheries context of the community, geography, demographics, socio-economic activities, and previous assessments in the area of relevance to climate change.

Box 4 Overview of Windward Community

Windward, Carriacou

Fisheries sector highlights

- Windward is one of five major fishing villages in Carriacou located on the north eastern side of the island with a traditional boat building culture that is still observed today.
- Approximately 75 fishers and over 52 fishing vessels operate from Windward (JICA, 2014).
- Fishers mainly target demersal species via handling and trap fishing off of the expansive shallow shelf surrounding the island, and also do longlining.
- There is a wooden jetty, as well as private moorings and lockers for fishers' gear at the Windward Fishery Centre (VanAnrooy *et al.,* 2018).

Geography

Windward is located on the north eastern side of Carriacou. Carriacou is a dependency of Grenada and is the largest island in the Grenadine Islands (Vincentian and Grenadian Islands). The island is 33.7 km^2 and is known for its coral reefs, having been named 'the land of reefs' by its earliest Amerindian inhabitants (Staskiewicz and Mahon, 2007). European settlers from Scotland and Ireland began the traditional boat building culture upon settling in Windward, and the tradition is still observed today with many of Carriacou's people of Scottish and Irish ancestry still concentrated in the Windward community (Staskiewicz and Mahon, 2007). A proposed bird sanctuary is also located nearby the area in the mangrove wetland of Petite Carenage, which is part of the High North National Park on Carriacou.

Demographics

Windward is a small village with a population of about 500 people (JICA, 2009). It is estimated that there have been significant levels of out-migration from Carriacou, including Windward, with about 50 percent of the population migrating since 2000 due to limited economic opportunities and high levels of unemployment (Central Statistical Office, 2011; UNDESA, 2012b).

Socio-economic activities

- Fishing is a major livelihood and income source for the area.
- Other livelihood activities include tourism and working in the public sector. Tourism in Windward and wider Carriacou is less well developed than on the mainland of Grenada, with a limited number of hotels and guesthouses. The majority of visitors are short-stay visitors from the mainland as well as from yachts and occasional cruise ship stopovers.

There is a high level of dependence on remittances from the extended family that have migrated to North America and the United Kingdom of Great Britain and Northern Ireland (UNDESA, 2012b). In 2012, it was estimated that remittances account for over 30 percent of Carriacou's GDP (UNDESA, 2012b), and it is believed that this trend continues to date.

Past assessments
Windward was part of larger national assessments in 2009, including baseline field surveys exploring five main components: pelagic fisheries development and management, aquaculture development, participatory approaches to management, a regional database and education and training towards sustainable resource management of small-scale fisheries (JICA, 2009).

- A livelihood analysis of fishers in the Grenadine islands was done in 2006 including livelihood surveys and field visits on Carriacou and included the community of Windward. Key findings from this assessment show over 60 percent of fishers interviewed are solely dependent on fishing as their source of income and livelihood. Fishers who are involved in alternative livelihoods indicated that fishing alone would not support their families. Key concerns also expressed by fishers in this analysis include declining fish abundance, lack of government support and the need for fisherfolk cooperatives.

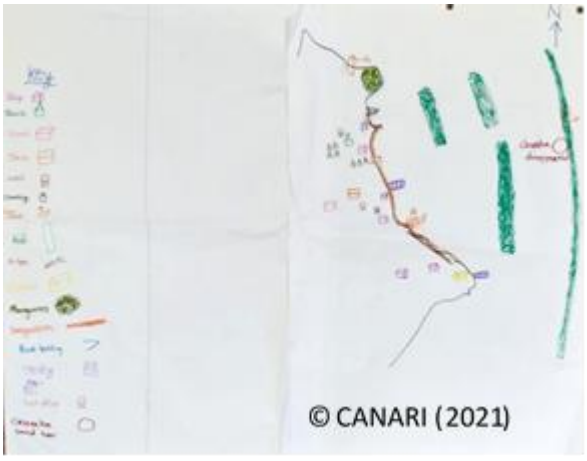
6.3.2 Key climate change and related impacts and vulnerabilities for Windward

The specific findings from the applications of the three VCA tools are detailed further below.

Community mapping findings
Stakeholders identified and mapped during the community mapping exercise a range of climate-related hazards and impacts that they had experienced, or which will pose a significant risk to the, and vulnerable areas and groups (See Figure 8). These hazards included:

- Sargassum influx that impacts beaches and affects fisheries sector operations and community infrastructure along the coastline in Windward.
- Coastal erosion due to SLR, storms and storm surge, which impacts physical infrastructure relevant to the fisheries sector (e.g. fisheries facility, boat building yard) and wider community (e.g. the church, post office, clinic, and local businesses) that are within close proximity to the coastline. Coastal erosion also leads to mangrove loss and degradation. This loss of mangrove poses a further threat of loss of biodiversity from the proposed bird sanctuary in Windward.

Figure 8. Community map of Windward developed through discussions with community stakeholders on key climate change hazards and related impacts and vulnerabilities



Impact and capacity matrix findings

Stakeholders ranked the impacts of the identified hazards on fisheries-related assets, community assets and natural assets in Windward as part of the impact and capacity matrix exercise to help determine hazards of greatest priority (Table 7). Additionally, current and potential coping and adaptation strategies were identified for the hazards.

SLR was ranked the top hazard, followed by coastal erosion, sargassum influx and storm surge. Coastal erosion was of particular concern for fisheries-related assets, including the jetty, community assets such as businesses, schools and the post office and natural assets such as the beach. Storm surge impacts were similar to those to coastal erosion. Sargassum was ranked as a significant hazard impacting fisheries-related assets, including fishing grounds and access to infrastructure such as jetty/landing sites, and natural assets including the beach.

Stakeholders identified both current and potential coping and adaptation strategies to address the impacts of the identified hazards, including building sea defences such as a sea wall, replanting of mangroves to buffer against the impacts of coastal erosion and storm surge, and efficient clean-up of sargassum stranded on beaches.

Table 7. Impact and capacity matrix for Windward, Carriacou

Key:	3 – High Impact	2 – Medium Impact	1 – Low impact	0 – No impact

Assets	**Hazards**					
	sargassum	coastal erosion	storm surge	reduced rainfall	sea level rise	mangrove removal
Fisheries assets						
jetty	3	3	3	2	3	0
fisheries	2	3	3	2	3	0
Community assets						
clinic	3	3	2	2	3	0
churches	3	2	2	2	3	0
post office	3	3	2	2	3	0
school	3	3	2	2	3	0
shops/supermarkets	2	0	0	2	1	1
bars/restaurant	3	3	2	2	3	0
disco	3	3	3	2	3	3
bridge/sea wall	0	3	3	0	3	0
well	0	2	1	3	2	0
Natural assets						
beaches	3	3	3	0	3	3
TOTAL	**28**	**31**	**26**	**21**	**33**	**7**
Potential coping/adaptation strategies?	- clean-up of sargassum along coastal areas	- replanting of mangrove trees	- sea defence/wall	- building more water catchments (e.g. wells, etc.)	- sea defence/wall	- replanting of mangroves

Source: CANARI, 2021.

Interview findings

A total of 25 semi-structured interviews were administered in Windward, with 80 percent of respondents being male, 8 percent female and 12 percent unspecified. Persons aged 20-34 represented 64 percent of the respondents while persons aged 35-49 represented 28 percent and those over 60 represented 8 percent.

80 percent of respondents were involved in the fisheries sector as fishers, while 16 percent were employed by the government in the fisheries sector and protected area management and 8 percent were wider community members.

Changing fishing habits: Of the 80 percent of respondents involved in the fisheries sector, the vast majority practiced longline fishing as well as spearfishing/diving. A few of the respondents practiced bottom lining (droplining or towing methods). The majority of respondents indicated they have been involved in fishing between one to nine years, which suggests that a significant proportion of fishers in Windward are youth/young adults.

Most of the fishers interviewed indicated both shifts in fishing effort as well as location of fishing grounds, noting the increased time required to secure catch and having to go further out at sea in order to reach fishing grounds. A number of fishers also highlighted shifts in fishing seasons as well as changes to type of gear used.

Changes in their fishing habits were attributed to changing weather and climate, mass sargassum influxes, and changes in movement/migratory patterns of fish and in fishing grounds with reduced cost and accessibility of fishing gear and depletion of stocks in traditional fisheries.

Key climate-related hazards and impacts: Of the vast majority of fishers interviewed identified higher tides and SLR as the most significant hazard, resulting in coastal erosion and murky waters due to siltation that affect their ability to venture out to sea and earn an income. In addition, fishers noted the following hazards:

- **Sargassum influx** which results in decreased visibility in the water which is particularly important for diving or spearfishing, damage to boat engines and fishing lines, and foul odour due to decomposing sargassum stranded on beaches. Damage to fishing lines further increases the amount of time and effort required to secure a catch.
- **Storms and rough seas** which results in damage to coral reefs and prevents fishers from venturing out to sea and earning an income.
- **Changes in ocean temperature or currents** that impact on movement/migratory patterns of fish and lead to increased fishing effort and higher risk to fishers' safety as they have to go further out to sea to catch fish. Changes in ocean currents can also result in fishing lines becoming tied up.
- **Rainfall variability** where fishers highlighted that rainfall is more unpredictable, with very little rainfall last year and more, heavier rainfall this year leading to flooding. Water security is a significant problem in Windward and Carriacou as a whole where most households rely on rainwater collection and storage systems.

Other respondents from the wider community identified similar issues to fishers. They noted the negative impacts of rainfall variability on agriculture in Windward in addition to the above hazards. Further, they noted the significant implications from adverse impacts on the fisheries sector on the wider community, given the small population, its reliance on the fisheries sector as a source of income,

food security and livelihood and the cultural importance to the village as a traditional boat building area in Carriacou.

Coping/adaptation strategies and relevant supporting organizations: Approximately half of fishers interviewed note coping/adaptation strategies for the identified hazards, including use of GPS and weather tracking applications to monitor weather, clean-up of sargassum influxes and placing in banks, improving drainage infrastructure to buffer against the impacts of flooding, seeking alternative sources of income when fishing may not be viable, and increasing fishing effort through extending their time at sea. Fishers also highlighted measures to address coastal erosion such as use of tyres, stones or conch shells along the coastline to lessen the effects of rough seas, storm surge and SLR.

Innovation/adaptability in fishing habits were also mentioned including changes in bait and trying line fishing for different types of fish species than those traditionally targeted. An interesting measure highlighted by one fisher was termed 'strategic unity' where fishers go out to sea and separate in the hopes of finding the location of good fishing grounds (rather than grouping their vessels in one area) and inform each other so that they may all benefit once grounds located. This strategy therefore decreases the time and effort to locate good fishing grounds individually.

In terms of local organizations working in the community, fishers and other community respondents did not indicate any except for the local fisherfolk cooperative. However, only a few fishers were members of the fisherfolk cooperative and there appear to be issues of conflict and mismanagement affecting the cooperative's operations.

Priorities for adaptation: Fishers interviewed indicated the need for improvements to fisheries infrastructure, particularly upgrading/strengthening the jetty to address risks from coastal erosion due to SLR, storm surge and rough seas. Further improvements to infrastructure include improved lighting via port starboard lights to avoid boats running a ground during nightfall or when conditions are hazy and visibility is limited.

They also noted the need for continued training for fishers and boat captains, including in the use of ICT such as advanced monitoring equipment for currents and tides. Additionally, fishers noted their desire to reinvigorate the fishing cooperative or create another community-based organization to enable organised and collective action to address climate-related and other hazards.

Other respondents from the wider community indicated coral reef rehabilitation, coastal defence to buffer against erosion and SLR and improved response to sargassum influxes as their priorities for adaptation.

In terms of roles for organizations in supporting the Windward community to adapt, respondents identified:

- Government agencies to provide funding, materials and equipment to implement actions, including the continued construction of the bridge and retaining wall in the community to address coastal erosion, with active stakeholder participation. They can also support training and access to ICTs.
- National CSOs to support education and sensitization of community stakeholders to climate hazards and related impacts, improve community capacity, engagement, mobilization for practical actions and provide funding for actions.

- Business/private sector stakeholders to provide funding and technical assistance to implement actions (e.g. sponsor clean up campaigns and other events) and invest in the fisheries sector.

Summary of findings

A summary of the key climate change impacts, vulnerabilities and adaptation priorities is outlined in Table 8.

Table 8. Key climate change impacts, vulnerabilities and priorities for adaptation identified by Windward stakeholders

Climate-related hazards	Key impacts	Vulnerable groups and areas	Priorities for adaptation
Coastal and marine biodiversity and ecosystems			
• sargassum influx • SLR • storms, storm surge and rough seas • changes in ocean currents • warmer ocean temperatures • rainfall variability	• coastal erosion and flooding due to SLR, storms and storm surge and rough seas • degradation of coastal ecosystems including beaches, mangroves and coral reefs from sargassum influxes • change in movement/migratory patterns of fish and changes in fishing grounds	• exposed beaches and associated vegetation • coral reef and mangrove ecosystems • damage to/loss of bird sanctuary and associated biodiversity • reef-based fisheries	• building a sea wall or replanting of mangroves to buffer against the impacts of coastal erosion • coral reef rehabilitation • efficient clean-up of sargassum influxes to minimize the effects on beaches
Livelihoods and socio-economic practices			
• sargassum influx • SLR • storms, storm surge and rough seas • changes in ocean currents • warmer sea temperatures • rainfall variability	• damage to/loss of fisheries-related and community infrastructure from coastal erosion and flooding due to SLR, storms and storm surge, and rough seas • disruptions in fishing operations and income generation due to decreased visibility in water, damage to boat engines and fishing gear from sargassum influxes • health impacts, including respiratory problems, and foul odour from release of hydrogen sulphide gas from decomposed sargassum	• jetty • boat building yard • fishers and boat captains, and their dependents, affected by damage/loss of infrastructure, boat engines, equipment/gear, disruptions to operations and safety at sea issues Community residents relying on infrastructure impacted by coastal erosion and flooding • community residents and businesses relying on rainwater harvesting to access freshwater • rain-fed agriculture and farmers	• upgrading jetty and other fisheries-related infrastructure • building a sea wall or replanting of mangroves to buffer against the impacts of coastal erosion and flooding • efficient clean-up of sargassum influxes to minimize the effects on beaches • enhancing use of ICTs (e.g. GPS, weather tracking applications and monitoring equipment for changing tides and ocean currents) • applying 'strategic unity' by fisherfolk to

Climate-related hazards	Key impacts	Vulnerable groups and areas	Priorities for adaptation
	• water shortages during unpredictable rainfall and extended dry spells		find fishing grounds and reduce individual fishing vessel time/effort • reviving the fishing cooperative or forming a community-based organization to enable organised and collective action • expanding the rainwater harvesting system to address water shortages
settlements and infrastructure			
• sargassum influx • SLR • storms, storm surge and rough seas • warmer ocean temperatures • rainfall variability	• damage to/loss of fisheries-related and community infrastructure from coastal erosion and flooding due to slr, storms and storm surge, rough seas and heavy rainfall • health impacts, including respiratory problems, and foul odour from release of hydrogen sulphide gas from decomposed sargassum • degradation of coastal ecosystems including mangroves and coral reefs that serve as natural coastal defences	• jetty • community infrastructure such as the church, post office, clinic, and in coastal and flood-prone areas • community residents relying on infrastructure impacted by coastal erosion and flooding	• building a sea wall or replanting of mangroves to buffer against the impacts of coastal erosion • coral reef rehabilitation • efficient clean-up of sargassum influxes to minimize the effects on beaches • improving drainage infrastructure to buffer against the impacts of flooding

CANARI, 2021.

7. Key vulnerabilities and priorities for adaptation

The VCAs highlighted a range of climate change and related hazards that have begun to trigger biophysical and socio-economic impacts in the target coastal and fishing communities in Grenada, including:

- Coastal erosion and flooding due to SLR, storms and associated storm surge which poses a significant risk to low-lying settlements, fisheries and other coastal infrastructure and the natural environment, particularly beaches.

- Sargassum seaweed influxes that inundate beaches and nearshore areas and damage fishing gear and boat engines as well as impacts on the health of fisherfolk and other coastal and marine resource users and residents.
- Rainfall variability and extremes, particularly flooding that affects settlements and infrastructure and increases sedimentation in the coastal zone.
- Rising SSTs which impact on fisheries and other coastal and marine ecosystems, including coral reefs.

These climate change hazards are compounded by existing pressures. These pressures include pollution due to improper solid waste and sewage disposal, poor access to services and infrastructure, overexploitation of certain fishery resources, and market competition with foreign commercial fishing enterprises.

In addition to existing pressures on fisheries and coastal and marine resources, socio-economic pressures are also critical to understand vulnerabilities and capacity to adapt, including poor access to services and infrastructure and employment opportunities within the target coastal and fishing communities in Grenada and the need for improved education, awareness and communication on identified climate hazards, their impacts and potential adaptation strategies.

Key priorities for adaptation identified for the target communities and the wider fisheries sector are as follows:

- **Build the adaptive capacity of fisherfolk and coastal communities** through:
    - Further training on safety at sea and use of climate-smart and sustainable fishing practices and technologies, and improved access to ICTs for early warnings related to extreme weather and changes in ocean conditions (e.g. currents, tides, etc.) that affect fish populations and their movements.
    - Training and support for fisherfolk to improve their business operations, including financial management. This training and other capacity building measure could be tied to government policies/management to encourage fisherfolk via economic incentives (e.g. tax breaks/one-off assistance grants) to strengthen access to financing for their small businesses.
    - Improving access to insurance, including adequate information on criteria required for insurance schemes (e.g. income statements, proof of address), benefits and transfer of risk principles that insurance schemes provide to cover costs of damage and loss of boats, gear and other equipment. This could build on current efforts to pilot the Caribbean Ocean and Aquaculture Sustainability Facility (COAST) insurance for the fisheries sector in Grenada under the Caribbean Catastrophe Risk Insurance Facility. Incentives could also be explored to have the fishers registered with the National Insurance Scheme as self-employed so that they have social protection in the event of on-the-job injuries and post-retirement benefits.
    - Improving infrastructure for fisheries sector, including cold storage facilities as fishers highlighted warmer temperatures may impact fish catch quality and decrease likelihood of sale. Given fishing efforts are changing in terms of amount of time as well as time of day fisherfolk have to go out to sea, improved lighting at landing sites may also be beneficial as fishers may have to return at late hours.
- **Strengthen fisherfolk organizations to enable collective voice and action** to address the impacts of climate change and other hazards impacting on fisherfolk and their livelihoods.

- **Strengthen community engagement and involvement with key government agencies**, in particular the Fisheries Division in Grenada and local government responsible for upkeep and maintenance of public infrastructure towards:
    - improving access to services and infrastructure in communities, which was identified as a significant problem impacting all target communities. Stakeholders highlighted coastal erosion and flooding leading to inaccessible jetties, damage to fish markets and other facilities and community infrastructure including roads and public buildings.
    - providing adequate resources, including manpower, towards efficient and timely clean-up of mass sargassum influxes to address ecological, health and socio-economic impacts.
    - engaging underemployed/unemployed youth in these often remote communities that have limited livelihood options.
- **Strengthen key government agencies, in particular the Fisheries Division and local government authorities**, to better provide technical assistance for climate change adaptation and local fisheries management and development; and
- **Protect critical coastal and marine biodiversity and ecosystems**, including coral reefs and mangroves, that support fisheries and other key economic sectors like tourism.

8. Conclusions and recommendations

Climate change poses a significant threat to coastal and fishing communities in Grenada, including Gouyave and Grenville on mainland Grenada and Windward on the island of Carriacou. Assessing vulnerability to the impacts of climate change is vital to guide decision-making and ensure that efforts to mainstream CCA into fisheries governance and management are appropriate to the community level where fishers and local residents live and work.

Using VCA tools, key climate change impacts and vulnerabilities within the three target coastal and fishing communities and adaptation priorities were identified using a participatory, multi-stakeholder process. This process ensured active participation from fisherfolk and other resource users, community residents and other CSOs that may not typically be engaged in decision-making, and enabled local and scientific knowledge to be incorporated into the assessment to identify key vulnerabilities and priorities for adaptation.

Further policy recommendations based on the VCA for moving forward and ensuring mainstreaming of CCA into fisheries governance and management in Grenada include to:

- **Ensure community stakeholder engagement and inclusion in local development plans and sectoral and national policies and programmes to support adaptation and build local resilience via a 'bottom up' approach**. This will ensure that these plans and programmes have local buy-in and are realistic and appropriate to local-level situations.
- **Mobilise strategic partnerships to enable coordinated action and pooling of resources to address climate change and related hazards across stakeholders, including government, civil society and private sector, and across community to national levels**. This recognises that the work of specific agencies, groups or individuals is often constrained due to limited human, financial and technical resources. In particular, national fisheries authorities and local government could foster and strengthen partnerships with established stakeholders including local fisherfolk organizations and other community-based organizations, private sector enterprises and national non-governmental organizations and academic/research institutions

operating in these communities to mobilise resources. (e.g. financial support, human capacity and technical assistance to implement adaptation).

- **Invest in and further expand early warning systems, safety at sea initiatives, climate-smart technologies, and insurance and social protection schemes for fisherfolk and their assets**.
- **Promote an ecosystem approach to fisheries (EAF) and local stewardship as part of the overall approach to build resilience to climate change and other existing pressures** within coastal and fishing communities and the wider fisheries sector. EAF recognises that fisheries are social-ecological systems, and so an integrated approach is needed to fisheries management to ensure ecological integrity, human well-being and good governance. EAF also seeks to manage uncertainty and address hazards and their impacts at the appropriate scale. EAF needs to be integrated in sectoral policies and plans as well as in project implementation.

References

CANARI. 2019. *Gouyave Fishermen Cooperative Society Limited: Fisherfolk taking the lead-Co-management of the Gouyave Marine Protected Area*, *Grenada*.

CARIBSAVE. 2012. *CARIBSAVE Climate Change Risk Profile for Grenada*.

CCCCC. 2014. Caribbean Planning for Adaptation to Global Climate Change Project. C6: Component 6: Coastal Vulnerability and Risk Assessment (Barbados, Grenada, Guyana. Grenada's Coastal Vulnerability and Risk Assessment, January 2002. *Technical Report 5C/CPACC-02-01-3*. Belmopan, CCCCC.

CDERA. 2003. *Status of hazard maps vulnerability assessments and digital maps:* Grenada country report. (also available at http://nadma.gd/wp-content/uploads/2017/10/Hazards_maps_Vulnerability_maps_Grenada.pdf).

Central Statistical Office. 2011. *Census, Census Population Density – Census Submission Final*. St. George's, Ministry of Finance, Planning, Economic Development and Physical Development. (also available at: https://www.finance.gd/index.php/central-statistics-office)

Commonwealth Secretariat. 2019. *Grenada* [online]. [Cited November 11, 2019] https://thecommonwealth.org/our-member-countries/grenada

Doyle, E. & Franks, J. 2015. *Sargassum Fact Sheet*. Gulf and Caribbean Fisheries Institute. (also available at https://tamug-ir.tdl.org/bitstream/handle/1969.3/28843/GCFISargassumFactSheet[1].pdf?sequence=1).

Environmental Solutions Limited. 2015. Vulnerability and Capacity Assessment and a National Adaptation Strategy and Action Plan to address Climate Change in the Water Sector for Grenada (also available at: http://extwprlegs1.fao.org/docs/pdf/grn171438.pdf)

FAO. 2015a. *AQUASTAT Country Profile- Grenada.* Rome, FAO.

FAO. 2015b. Community-level socio-ecological vulnerability assessments in the Benguela Current Large Marine Ecosystem. Prepared by S. Raemaekers and M. Sowman, University of Cape Town, South Africa. *FAO Fisheries and Aquaculture Circular No. 1110*. Rome, FAO.

FAO. 2018. *Fishery and Aquaculture Country Profiles – Grenada* [online]. [Cited January 10, 2021] http://www.fao.org/fishery/facp/GRD/en

Gill, D., McConney, P. & Mahon, R. 2007. Socio-economic profile of fisheries in the Grenadines Islands. *CERMES Technical Report No. 11*. Bridgetown, Centre for Resource Management and Environmental Studies (CERMES), University of the West Indies, Cave Hill Campus.

Glasgow, L., Langaigne, B., Thomas, C., Harvey, O. & Campbell, E.A. 2018. Public Knowledge and Attitudes towards Climate Change and its impacts on Ecosystems in Grenada. *American Journal of Climate Change*, Vol. 7, pp. 600-610 (also available at http://www.scirp.org/journal/ajcc).

Government of Grenada. 1986. *Grenada Fisheries. Act. No. 15 of 1986*. (also available at http://extwprlegs1.fao.org/docs/pdf/grn129300original.pdf).

Government of Grenada. 2000. *Grenada's Initial Communication to the United Nations Framework Convention on Climate Change* (also available at: https://unfccc.int/resource/docs/natc/grnnc1.pdf)

Government of Grenada. 2001. *National Report. Integrating Management of Watersheds and Coastal Areas. Grenada.* Department of Economic Affairs, Ministry of Finance, Financial Complex, Carenage, St. George's. [online]. [Cited January 10, 2021] http://www.oas.org/reia/iwcam/iwcam_documents.htm

Government of Grenada. 2015. *Integrated Coastal Zone Management Policy for Grenada, Carriacou and Petite Martinique*.

Government of Grenada. 2016. *National Biodiversity Strategy and Action Plan (NBSAP) for Grenada, Carriacou and Petite Martinique* (also available at: https://climatefinance.gov.gd/embedded-pdf/national-biodiversity-strategy-and-action-plan2016-2020/).

Government of Grenada. 2017. *National Climate Change Policy for Grenada, Carriacou and Petite Martinique 2017-2021.* Ministry of Climate Resilience, the Environment, Forestry, Fisheries, Disaster Management and Information

Government of Grenada. 2019. *National Climate Change Adaptation Plan (NAP) for Grenada, Carriacou and Petite Martinique 2017-2021.* Ministry of Climate Resilience, the Environment, Forestry, Fisheries, Disaster Management and Information.

Grant, S., Berkes, F. & St. Louis, J. 2007. A history of Change and Reorganization: The Pelagic Longline Fishery in Gouyave, Grenada. *Gulf and Caribbean Research,* Volume 19, Issue 2 (also available at: https://core.ac.uk/download/pdf/301286583.pdf).

Grant, S.C. 2007. *Description of the Pelagic Longline Fishery System in Gouyave, Grenada and Punta Cana, Dominican Republic*. Gulf and Caribbean Fisheries Institute (also available at: http://aquaticcommons.org/15405/1/gcfi_60-15.pdf).

Harvey, O. 2013. Socio-economic trends of adjacent communities of the Sandy Island Oyster Bed Marine Protected Area. Socio-economic monitoring by Caribbean Challenge MPA Managers. Report No. 10. Sandy Island Oyster Bed MPA, Hillaborough, Carriacou. Centre for Resource Management and Environment Studies (CERMES), University of the West Indies, Faculty of Pure and Applied Sciences, Cave Hill Campus Barbados

IFRC. 2014. *Integrating climate change and urban risks into the VCA: Ensure effective participatory analysis and enhanced community action.* Geneva, IFRC.

International Bank for Reconstruction and Development/The World Bank. 2016. *Blue Growth Coastal Master Plan for Grenada.* Report No: AUS20778, October 13, 2016 (also available at: http://documents.worldbank.org/curated/en/358651480931239134/pdf/AUS20778-WP-P156854-ABSTRACT-MAILED-grenada-PUBLIC.pdf)

IPCC. 2007. *Climate Change 2007: Synthesis Report*. Contribution of Working Groups I, II and III to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change [Core Writing Team, R.K. Pachauri and A. Reisenger (eds.)]. Geneva, IPCC, 104 pp.

IPCC. 2014. *Climate Change 2014: Synthesis Report. In: Contribution of Working Groups I, II and III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change*. [Core Writing Team, R.K. Pachauri and A. Reisenger (eds.)]. Geneva, IPCC, 104 pp. (also available at: https://www.ipcc.ch/report/ar5/syr/).

Isaac, J.C. 2010. *An evaluation of socio-economic conditions and environmental interactions on a section of the east coast of Grenada*. Centre for Resource Management and Environmental Studies (CERMES), University of the West Indies, Cave Hill Campus, Barbados.

JICA. 2009*. Final Country Report for Grenada – Formulation of a Master Plan on Sustainable Use of Fisheries Resources for Coastal Community Development* (also available at: https://openjicareport.jica.go.jp/pdf/12058533_02.pdf).

JICA. 2014. *Data Collection Survey on Fisheries in the Caribbean Region - Final Report.* March 2014 (also available at: https://openjicareport.jica.go.jp/pdf/12148664.pdf).

McConney, P. 2003. *Grenada case study: legalisation of beach seine traditional rules at Gouyave.* Caribbean Coastal Co-management Guidelines Project. Bridgetown, Caribbean Conservation Association.

Mohammed, E. & Rennie, J. 2003. Grenada and the Grenadines: Reconstructed Fisheries Catches and Fishing effort, 1942 – 2001. *Fisheries Centre Research Reports,* Vol. II (6).

Monnereau, I., & Oxenford, H. A. 2017. Impacts of climate change on fisheries in the coastal and marine environments of Caribbean Small Island Developing States (SIDS). *Caribbean marine climate change report card: science review*, 2017, 124-154.

Monnereau, I., Mahon, R., McConney, P., Nurse, L., Turner, R., & Vallès, H. 2015. Vulnerability of the fisheries sector to climate change impacts in small island developing states and the wider Caribbean. *CERMES Technical Report No. 77*. Cavehill, Barbados, Centre for Resource Management and Environmental Studies (CERMES) – University of the West Indies.

Nayar, R. 2009. The Sea Urchin Fishery in Grenada: A Case Study of Socio-ecological Networks. Natural Resources Institute. Clayton H. Riddell Faculty of Environment Earth and Resources, University of Manitoba, Winnipeg, MB, Canada.

O'Brien, K., Eriksen, S., Nygaard, L., & Schjolden, A. 2007. Why different interpretations of vulnerability matter in climate change discourses. 'Climate Policy' 7, pp 73-88. 10.3763/cpol.2007.0706.

Organisation of Eastern Caribbean States (OECS). 2004. *Grenada: Macro-Socio-Economic Assessment of the damages caused by Hurricane Ivan, September 7th 2000*. (also available at: https://www.eird.org/isdr-biblio/PDF/Grenadapercent20Macro-socio-economicpercent20Ivan.pdf).

Oxenford, H.A., Johnson, D., Cox, S-A. & Franks, J. 2019. *Report on the Relationships between Sargassum Events, Oceanic variables and Dolphinfish and Flyingfish Fisheries.* Bridgetown, Centre for Resource Management and Environmental Studies, University of the West Indies, Cave Hill Campus. 32 pp.

Parsram, K. 2008. Socio-ecological system interactions in small-scale fisheries: case studies of the large pelagic and shallow reef fisheries of Grenada and Saint Lucia under construction. *Proceedings of the 61st Gulf and Caribbean Fisheries Institute*, November 10-14, 2008, Gosier, Guadeloupe, French West Indies.

Pochanka-Alff, A., Meincke, M., Scheske, L., & Wuttge, E. 2016. *Grenada climate change and health vulnerability and adaptation assessment*. Berlin, GIZ. (also available at http://www.iccas.gd/sites/default/files/resources/VApercent20Grenada_Formatted_GIZ_FinalApril.pdf).

Project for a Climate Resilient Water Sector in Grenada (CREWS). 2017. *Environmental and Social Assessment, Environmental and Social Management Plan (ESMP)*. Version 3, October 20th 2017.

Reef Resilience Network. 2016. *Grenada – Coastal Resilience.* At the Water's Edge (AWE): Enhancing Coastal Resilience in Grenada [online]. [Cited November 11, 2019] https://reefresilience.org/case-studies/grenada-coastal-resilience/

Renaud-Byrne, G. 2017. *Social-Ecological Resilience to Climate Change: A Case Study of the Sandy Island Oyster Bed Marine Protected Area*.

SOFRECO. 2012. *Fisheries Policy for Grenada. Working document n◦1. Support to formulate a fisheries and aquaculture policy for the Commonwealth of Dominica, Grenada and St. Vincent and the Grenadines*. ACP Fish II – Strengthening fisheries management in ACP states. 9 ACP RPF 128 Accounting No. RPR/006/07 – EDF IX. Reference: CAR/1.2/B2b. (also available at http://acpfish2-eu.org/uploads/projects/id140/I1544percent20-percent20ACPFISHpercent20IIpercent20-percent20CARpercent20-percent201.2percent20-percent20B2bpercent20-percent20Policypercent20Grenadapercent20percent20-01.pdf).

Spencer, L., Peters, E., Smith, T. Alexis, R., Mason, M., Thompson, T. & Purcell, F. 2002. Grenada's Coastal Vulnerability and Risk Assessment. *Technical Report 5C/CPACC-02-01-3,* January 2014. Belmopan, CCCCC.

Staskiewicz, T. & Mahon, R. 2007. A livelihood analysis of fishers in the Grenadine Islands. *CERMES Technical Report No. 12*. Bridgetown, CERMES, University of the West Indies, Cave Hill Campus.

UN Map of the World. (2021). [online]. [Cited 30 August2021]. un.org/geospatial/file/3420/download?token=bZe9T8I9

UNDESA. 2012a. *Climate Change Adaptation: Grenada: Water Resources, Coastal Ecosystems and Renewable Energy*. (also available at: https://sustainabledevelopment.un.org/index.php?page=view&type=400&nr=635&menu=35).

UNDESA. 2012b. *Road Map on Building a Green Economy for Sustainable Development in Carriacou and Petite Martinique, Grenada*. Division of Sustainable Development of UNDESA in cooperation with the Ministry of Carriacou and Petite Martinique Affairs and the Ministry of Environment, Foreign Trade and Export Development of Grenada. (also available at: https://sustainabledevelopment.un.org/content/documents/523421Finalpercent20Pubpercent20Roadpercent20Mappercent20Carriacoupercent20&percent20Petitepercent20Martiniquepercent20Grenadapercent20percent20June2012.pdf).

UNFCCC. 2005. *Climate change and Small Island Developing States* [online]. [Cited November 12, 2019] https://unfccc.int/resource/docs/publications/cc_sids.pdf

VanAnrooy, R., Josupeit, H., Williams, C., Johnson, F. A. & Pereira, G. 2018. *Techno-economic performance of fish landing sites and fishing ports in Grenada: Assessment of the current situation and opportunities for responsible investments* [online]. FAO. [Cited November 12, 2019] https://www.marfisheco.com/wp-content/uploads/2019/04/Techno-economic-performance-report-Grenada.pdf

Walker, B., Holling, C.S., Carpenter, S.R. & Kinzig, A. 2004. Resilience, adaptability and transformability in social-ecological systems. *Ecology and Society*, 9(2): 5.

Appendix 1: List of field teams for target coastal and fishing communities in Grenada

#	First and Last Name	Organization	Position/Title
Gouyave Field Team			
1.	Krisma McDonald-Moore	FAO/CC4FISH	National CC4FISH Project Coordinator/Workshop Facilitator
2.	Tylon Joseph	Gouyave Fishermen Cooperative Society Ltd.	Vice President, Gouyave Fishermen Cooperative Society Ltd./ Workshop Facilitator/Survey Enumerator
3.	Rena Noel	-	Survey Enumerator
4.	Thorn Joseph	-	Survey Enumerator
Grenville Field Team			
5.	Krisma McDonald-Moore	FAO/CC4FISH	National CC4FISH Project Coordinator/Workshop Facilitator
6.	Jenelle Francique	Fisheries Grenville	Market Clerk/Workshop Facilitator
7.	Cosil Garcia	-	Survey Enumerator
8.	Hermione Elcock	-	Survey Enumerator
9.	Avonelle Patrick	-	Survey Enumerator
Windward Field Team			
10.	Krisma McDonald-Moore	FAO/CC4FISH	National CC4FISH Project Coordinator/Workshop Facilitator
11.	Alpha Marryshow	-	Survey Enumerator
12.	Chantel Bethel	-	Survey Enumerator
13.	Deborah Charles	-	Survey Enumerator

CANARI, 2021.

Appendix 2: List of participants for target coastal and fishing community VCA workshops in Grenada

Vulnerability and Capacity Assessment Workshop
Gouyave, Grenada
1 October 2020

#	First and Last Name	Organization	Position/Title
1.	Jadine Bernadine	-	Community resident
2.	Devon Britton	-	Community resident
3.	Ashiba Williams	Gouyave Fishermen Cooperative Society Ltd.	Director
4.	Cecil Joseph	Gouyave Fishermen Cooperative Society Ltd.	Member
5.	Shemia Superville	Gouyave SDA Church	Assistant Church Clerk/A.Y. Leader
6.	Sean Walker	Gouyave Fishermen Cooperative Society Ltd.	Fisherman
7.	Clauvia Mitchell	RGPF	Police Officer
8.	Omari Ferguson	-	Community resident
9.	Leighton Taylor	-	Community resident (Loretto)
10.	Nydan Joseph	GFMC	Manager
11.	Denzel Adams	Grenada Coral Reef Foundation	Coral Restoration Specialist
12.	Krisma McDonald-Moore	FAO/CC4FISH	CC4FISH National Project Coordinator/Workshop facilitator
13.	Tylon Joseph	Gouyave Fishermen Cooperative Society Ltd.	Vice President, Gouyave Fishermen Cooperative Society Ltd./ Workshop Facilitator/Survey Enumerator

CANARI (2021).

Vulnerability and Capacity Assessment Workshop
Grenville, Grenada
12 November 2020

#	First and Last Name	Organization	Position/Title
1.	Gloria Thomas	GRENED	Programme Officer
2.	Shania David	GRENED	Alumni Board
3.	Teiesha Fortune	BE-CD	President
4.	Luis Acosta	GNEXTT	Technologist
5.	Shikkira Charles	BE-CD	Treasurer

#	First and Last Name	Organization	Position/Title
6.	William Andrews	Seamoss farming	President
7.	Krisma McDonald-Moore	FAO/CC4FISH	CC4FISH National Project Coordinator/Workshop Facilitator
8.	Jenelle Francique	Fisheries Grenville	Market Clerk/Workshop Facilitator

CANARI (2021)

Vulnerability and Capacity Assessment Workshop
Windward, Carriacou
24 November 2020

#	First and Last Name	Organization	Position/Title
1.	Nariba Samuel	TAMCC	College graduate
2.	Rhonda Mehaomm	NDAC	Councillor (retired)
3.	Winsley Vlelrea	-	-
4.	Stacy Medeau	NDAC	Member
5.	Patricia Peters	Dover Government School	Teacher
6.	Frank Patol	-	Community resident (Dover)
7.	Romould Compton	-	Community resident (Windward)/Fisher
8.	Terrence M	NDAC	President
9.	Benson Patrice	Ministry of Carriacou and Petite Martinique Affairs	Senior Agriculture Officer
10.	Krisma McDonald-Moore	FAO/CC4FISH	CC4FISH National Project Coordinator/Workshop facilitator
11.	Montez McLawrence	High School	Student
12.	Patrice Charles	-	-
13.	Lene Mitchel	-	-
14.	Alpha Marryshow	-	-

CANARI, 2021.

Appendix 3: Interview sheet used for general interviews in three target coastal and fishing communities in Grenada

Regional Implementation of the Vulnerability and Capacity Assessment for the Climate Change Adaptation in the Eastern Caribbean Fisheries Sector Project (CC4FISH)

Interview Questions – General

Intro: We are doing an assessment of vulnerability in coastal and fishing communities as part of a regional project on building resilience in the Eastern Caribbean fisheries sector. The assessment is being implemented by the Caribbean Natural Resources Institute (CANARI) in collaboration with the Food and Agriculture Organization of the United Nations (FAO) and The Fisheries Division - Ministry of Sports, Culture and the Arts, Fisheries and Cooperatives in Grenada.

Name of interviewer: **Date:**

Name of participant:

Organization/Title:

Age Range:

[ ] <20
[ ] 20-24
[ ] 25-29
[ ] 30-34
[ ] 35-39
[ ] 40-44
[ ] 45-49
[ ] 50-54
[ ] 55-59
[ ] 60-64
[ ] 65+

Gender:

1. What do you see as the main problems affecting this community?

2. Are you aware of any impacts from climate change (or changing weather patterns) in this community? If so, can you describe these impacts and how you are affected?
   Prompts:
   - Are livelihoods been impacted by any changes in weather and climate (e.g. fishing, farming, tourism)?
   - Have you noticed any changes and impacts on the coastline (e.g. from higher tides or sea levels, stronger storms and storm surge, rougher seas)?
   - Have you noticed any changes and impacts on fisheries and marine areas (e.g. fish catch, type of species bought and sold, fishing practices, coral reefs and seagrass beds)?

3. What are the different ways in which you and other people in the community deal/have dealt with these impacts (e.g. coastal erosion, flooding of rivers, stronger storms and hurricanes, rough seas or coral bleaching)?

4. Are there any local community groups or other groups working to address these impacts of climate change (or changing weather patterns)? If so, how?
   Prompts:

- What about the village council?
- Is there local Red cross group or disaster management committee active in the community?
- Is there any cooperation among the different groups being impacted by climate change or organizations working on climate change?

5. What do you see as priorities for taking action to address the impacts of climate change (or changing weather patterns)?

6. a) What resources does your community currently have to plan and implement these actions?
   b) What other resources would they need?

7. What barriers are there to effective community cooperation and action to address climate change (or changing weather patterns)?

8. What role do you see for these groups in supporting your community to address climate change (or changing weather patterns):
   a) Government (national and local)?
   b) National non-governmental organizations (NGOs), like National Trust?
   c) Businesses/Private sector?

Appendix 4: Interview sheet used for fisherfolk interviews in three target coastal and fishing communities in Grenada

Regional Implementation of the Vulnerability and Capacity Assessment for the Climate Change Adaptation in the Eastern Caribbean Fisheries Sector Project (CC4FISH)

Interview Questions – Fisherfolk

Intro: We are doing an assessment of vulnerability in coastal and fishing communities as part of a regional project on building resilience in the Eastern Caribbean fisheries sector. The assessment is being implemented by the Caribbean Natural Resources Institute (CANARI) in collaboration with the Food and Agriculture Organization of the United Nations (FAO) and The Fisheries Division - Ministry of Sports, Culture and the Arts, Fisheries and Cooperatives in Grenada.

Name of interviewer: **Date:**

Name of participant:

Organization/Title (if any):

Age Range:

[ ] <20
[ ] 20-24
[ ] 25-29
[ ] 30-34
[ ] 35-39
[ ] 40-44
[ ] 45-49
[ ] 50-54
[ ] 55-59
[ ] 60-64
[ ] 65+

Gender:

1. How long have you been involved in fishing? What type of fishing do you do?

2. Have your fishing habits changed since you started fishing? If so, how?
   Probe to see if changes in following:
   - Type/species of fish caught
   - Type of gear
   - Fishing effort (e.g. how often go out, how many pots/lines used, use of FADs)
   - Location of fishing grounds
   - Fishing seasons
   - Landing sites and facilities

3. What are the reasons for these changes in fishing habits?

4. Have you noticed any changes in weather and climate patterns in areas where you live or fish? If so, can you describe the impacts on you/your livelihood?
   Probe for the following:
   - Changes in high tides or sea levels? What have been the impacts?
   - Changes in storms or rougher seas? What have been the impacts?
   - Changes in ocean temperature or currents? What have been the impacts?
   - Changes in sargassum seaweed? What have been the impacts?
   - Changes in rainfall? What have been the impacts?

5. How have you and other fisherfolk in your community been dealing with these impacts from changes in weather and climate?

6. Are there any local groups or other organizations working to address these problems in your community? If so, how?

7. Are you a member of the fisherfolk co-op or association in your community? Do you see a role for it in helping you and other fisherfolk address the problems you mentioned?
   Probe for any conflicts:
   - Have there been any issues between the co-op and independent fishers?
   - Have there been any issues between co-op and other community groups?

8. A national plan and various projects for addressing climate change (changes in weather and climate) and related impacts on the fisheries sector are being developed.
   a) What are the main problems/impacts that you would like to see addressed?
   b) What do you think would be most useful in helping the community, especially fisherfolk, to address these impacts?

This report presents the main findings and recommendations from a vulnerability and capacity assessment (VCA) of three coastal and fishing communities in Grenada: Gouyave, Windward and Grenville. The overall goal of the assessment was to improve understanding of local climate change impacts and vulnerabilities for effective adaptation in the fisheries sector, with the focus on using local ecological knowledge. Three tools were utilised: community mapping, surveys, and impact and capacity matrix for data collection. A wide range of stakeholders, including fisherfolk and other community members, were engaged to ensure a participatory process. The input from the local communities was that a range of climate-related hazards have begun to impact them, including: coastal erosion and flooding due to sea level rise, storms and storm surges; rainfall variability and extremes; sargassum seaweed influxes; and rising sea surface temperatures that impact fisheries and marine ecosystems, like coral reefs. The participatory process also allowed identifying adaptation actions to address these hazards. These included: building the adaptive capacity of fisherfolk; improving access to insurance, services and infrastructure; strengthening key government agencies to better provide technical assistance and support; and protecting critical marine ecosystems that support fisheries and other economic sectors like tourism.

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