Integrating digital technologies and participatory tools to support coastal community resilience in Trinidad & Tobago (Tech4CoastalResilience)

Castara Community Resilience Plan

April 30, 2025

Acknowledgements

CANARI would like to thank the Department of Marine Resources and Fisheries, Tobago House of Assembly for their support in conducting action planning in Castara, Tobago, as well as the community and other key stakeholders from the public and private sector for generously giving of their time and sharing their knowledge and perspectives, to develop this community resilience plan.

Citation: Granderson, A., Ramkissoon, C., Khan, K., and Thanoo, A. 2025. Castara Community Resilience Plan. Prepared under the Tech4CoastalResilience project. CANARI, Port of Spain.

Cover photo: View of Castara Beach, Tobago, Credit Ainka Granderson 2024

1. Overview

The Castara Community Resilience Plan aims to guide coastal planning and resilience actions and identify ways to reduce vulnerability and adapt to climate change and other coastal changes in Castara, Tobago. It is based on the key findings from the vulnerability and capacity assessment in Castara completed in May-August 2024 and the inputs from community residents and other key stakeholders from an action planning workshop in September 2024.

The Plan has been developed under the "Integrating digital technologies and participatory tools to support coastal community resilience in Trinidad and Tobago (Tech4CoastalResilience)" project, which is being implemented from 2023-2025 by the Caribbean Natural Resources Institute (CANARI) in partnership with the Fisheries Division, Ministry of Agriculture, Land and Fisheries and the Department of Marine Resources and Fisheries, Tobago House of Assembly (THA). The project aims to improve the resilience of vulnerable coastal communities to climate change impacts in Trinidad and Tobago. It is supported by the "Harnessing Innovative Technologies to Support Resilient Settlements on the Coastal Zones of the Caribbean (HIT RESET Caribbean)" programme. HIT RESET Caribbean is funded by the ACP Innovation Fund implemented by the Organization of African, Caribbean and Pacific States (OACPS) and European Union (EU).

2. Approach and methodology

The process to develop the Plan was facilitated by CANARI and the Department of Marine Resources and Fisheries, THA. It was designed to be interactive and participatory, engaging the community in practical exercises and discussions to support action planning for coastal resilience. See Appendix 1 for the agenda for the Castara Community Action Planning workshop.

The process engaged fisherfolk, other coastal resource users and community-based organisations (CBOs), including the Castara Fisherfolk Association, Castara Fisherfolk Association Reformed, All Tobago Fishing Association (ATFA) and Tobago Unified Fisherfolk Association (TUFA), as well as key government agencies including the Tobago Emergency Management Agency (TEMA) and Coastal Zone Management Unit, THA. See Appendix 2 for the participants list.

The Plan is based on findings from the vulnerability and capacity assessment in Castara completed in 2024. The assessment involved desk review and community scoping, participatory mapping and geographic information systems (GIS), household surveys and development of a historical timeline to collect data and better understand local impacts from climate change and other issues affecting the coast. The findings were further reviewed and validated as part of the action planning workshop in September 2024. See Appendix 3 for the vulnerability and capacity assessment findings.

3. Priorities for Action

A range of actions to adapt and build coastal resilience have been identified as part of the Plan (see section 5 and Appendix 4 for further details). In particular, key climate-related impacts from coastal erosion, land slippages, changing ocean conditions and extreme weather events (leading to increased run-off/siltation, water stress and impacted livelihoods) were highlighted by participants, affecting the fisheries and tourism sectors and key infrastructure, including access roads. The following priorities for action have therefore been identified for Castara for the short to medium term (1-6 years):

- Diversifying and developing alternative livelihoods for fisherfolk and other residents, particularly youth, such as mariculture (fish farming) and other options including business development training and affordable financing

- Installing communal fish aggregating devices (FADs) and providing training in the use of FADs to sustainably increase fish catch
- Organisational strengthening of local fisherfolk organisations to support increasing resiliency of fisherfolk in the face of climate extremes and related hazards
- Assessing the compounding impacts of seismic surveys on fish catch and identifying appropriate solutions
- Restoring coral reefs, and establishing artificial reefs where needed, based on best practices to address coral bleaching and increase fish stocks in nearshore areas
- Developing and marketing alternative tourism products e.g. cocoa and other agricultural tours (promoting climate-smart agriculture), recreational hunting (sustained through wildlife farming) and catch and release fishing
- Using eco-friendly chemicals in tourism-related businesses and households to reduce the impact of land-based runoff and pollution on coastal and marine habitats
- Increasing water storage (e.g. tanks) and use of alternative ways for distribution (e.g. gravity flow systems and solar-powered pumps) to improve water supply
- Raising awareness of and enforcing fire regulations, and building capacity for community fire management
- Constructing a helipad in/near to Castara for disaster response and medical emergencies when roadways are blocked

Prioritisation was based on the level of impact/risk to the community that the action can address, whether it benefits multiple sectors and community needs, and whether it can be implemented in the short to medium term.

One of these priorities was selected as a feasible option for further support under Tech4CoastalResilience and other current projects given the available timeframe and budget: installing communal FADs and providing training on use of FADs to sustainably increase fish catch. CANARI and the Department of Marine Resources and Fisheries will follow up to refine and implement this action.

4. Use of this Plan

This Plan serves as a guide for coastal planning and resilience actions in Castara. It should be used and further operationalised by key government agencies, including the Coastal Zone Management Unit, Department of Marine Resources and Fisheries, Department of Tourism and TEMA under THA, Environmental Management Authority and Institute of Marine Affairs, and CBOs and residents in Castara, and relevant civil society organisations and the private sector to inform efforts to address climate and other coastal changes. It is also aligned with, and contributes to, the National Adaptation Plan and Integrated Coastal Zone Management Policy for Trinidad and Tobago.

Figure 1: Stakeholders from Castara engaging in action planning activities *(Source CANARI 2024)*

5. Summary of Castara Community Resilience Plan

Note the table below includes only the key climate-related impacts and priorities for action identified and highlighted by participants. The full list of all the identified impacts and actions is in Appendix 4.

**= top priorities

Community impacts & risks	Actions to adapt/build resilience	Roles and responsibilities (Lead/supporting actors)	Required resources	Time frame	Indicators of Success
Fisheries					
<u>Extreme weather events (hurricanes/storms/heavy rainfall)</u> *Impacts* • Damage to boats, engines, nets/other fishing gear at sea due to storms and rough seas and damage to Castara fishing facility during storms • Safety at sea issues for fishers • Reduced fishing days and income due to weather conditions and equipment damage • Flooding and landslides leading to increased sedimentation of nearshore areas and fish habitat *Vulnerable groups* • Fisherfolk • Households dependent on fishing as income source	• Safety at sea training, access to required equipment (e.g. GPS, VHF radio) and improved early warning systems for fishers and boat owners • Provision of safe storage, and equipment for removal, of boats, engines and gear during heavy rainfall and storms • Access to insurance for boats, engines and gear and for fisherfolk • **Diversification and development of alternative livelihoods for fisherfolk, including business development training and affordable financing • **Organisational strengthening of local fisherfolk organisations to support the resiliency of fisherfolk to climate	• Tobago House of Assembly (THA) – Department of Marine Resources and Fisheries (DMRF) (co-lead) • Castara Fisherfolk Association and Castara Fisherfolk Association Reformed (co-lead) • Tobago Emergency Management Agency (TEMA) • Trinidad & Tobago Meteorological Service (TTMS) • All Tobago Fishing Association (ATFA) and Tobago Unified Fisherfolk Association (TUFA) • Fisherfolk • Environment Tobago, Future Fishers, CANARI and other NGOs • Caribbean Fisheries Training and Development Institute (CFTDI)	• Expertise (disaster response, business development, organisational strengthening, financial management) • Financing • Equipment (e.g. trailer/tractor to pull up vessels, VHF radios) • Materials and labour to construct safe storage facilities	Short to medium term (1-6 years)	• Reduced costs from damage or loss of fishing vessels, engines and gear • Reduced number of safety incidents reported by fisherfolk • Increased number of fisherfolk engaged in alternative livelihoods

	extremes and related hazards	• University of the West Indies (UWI) • UN Food and Agriculture Organization (FAO) • Finance and insurance providers • Telecommunication service providers			
<u>Changing ocean conditions – temperature, acidity, circulation</u> *Impacts* • Depletion in stocks and catch of certain fish species in nearshore areas due to coral bleaching with rising surface temperatures and change in fish distribution and migration, impacting on fisherfolk, coastal tourism and food security for residents • Impacts on fish stocks and catch compounded by seismic surveys for oil and gas exploration *Vulnerable groups* • Fisherfolk • Restaurant owners/tourism related businesses • Households dependent on fishing or tourism as income source	• **Set up communal fish aggregating devices (FADs), and provide training on their sustainable use, to improve efficiency and reduce fuel costs for fishers • Investment in larger fishing vessels to support fishing further offshore/exploring alternative fishing grounds and engaging in alternative fishing methods • **Coral reef restoration and artificial reef implementation • **Development of mariculture (fish farming) and other climate-smart agricultural practices to provide alternative livelihoods for fisherfolk and boost food security • **Assessment of the compounding impacts of	• DMRF (co-lead) • Institute of Marine Affairs (IMA) (co-lead) • Castara Fisherfolk Association and Castara Fisherfolk Association Reformed (co-lead) • Environmental Management Authority (EMA) • THA - Department of Agriculture • ATFA • TUFA • Fisherfolk • Dive/tour operators • Restaurant owners • Environment Tobago, Environmental Research Institute Charlotteville (ERIC), Future Fishers and CANARI • CFTDI • UWI	• Expertise (fisheries and marine science, ecosystem restoration, artificial reefs, SCUBA diving) • Materials (including for restoration and artificial reefs, FADs) • Financing • Equipment (fishing vessels, GPS, monitoring tools etc) and SCUBA gear • Training to support alternative fishing methods (e.g. safety equipment, use of marine GPS etc.), mariculture and use of FADs • Labour • Land for farming	Short to medium term (1-6 years)	• Increased use of FADs, and increase in catch and size of fish from FADs • Increased coral cover and health • Increased number of fisherfolk engaged in climate-smart agriculture or other alternative livelihoods

• Residents dependent on fish as food source	seismic surveys on fish stocks and catch	• FAO • Caribbean Agricultural Research & Development Institute (CARDI) • Inter-American Institute for Cooperation on Agriculture (IICA) • Oil and gas companies			
Tourism					
<u>Coastal erosion</u> *Impacts* • Decline in visitors and income from tourism due to degradation of tourism attractions (e.g. beaches, turtle nesting sites and other coastal areas); • Damage to guesthouses/hotel and other tourism-related infrastructure • Increase in land-based run-off due to coastal vegetation die-off, impacting beaches and coral reefs *Vulnerable groups* • Guesthouse and tour operators • Restaurant owners • Vendors at beaches and nearby areas	• **Development and marketing of alternative tourism products, including ○ Cocoa and other agricultural tours (promoting climate-smart agriculture) ○ Catch and release fishing ○ Recreational hunting (sustained through wildlife farming) • Improved access to insurance for tourism-related businesses and property • Development and enforcement of building codes for high-risk areas taking into account coastal erosion and sea level rise • **Use of eco-friendly chemicals in tourism-related businesses and households to reduce impact of land-	• Tobago Tourism Agency Limited/ THA - Division of Tourism, Culture, Antiquities, and Transportation (co-lead) • Castara Tourism Development Association (co-lead) • THA Division of Settlements, Public Utilities and Rural Development - Rural Development Unit (RDU) • Department of Agriculture • CZMU/Department of Environment, Climate Change and Energy • EMA • Town and Country Planning Division • ERIC, Environment Tobago, CANARI and other NGOs • Hunting Association of Trinidad and Tobago	• Expertise (tourism development, marketing, coastal planning, environmental health) • Financing • Training and certification for new tour guides • Equipment • Materials	Short to medium term (1-6 years)	• Reduced loss and damage of tourism-related property and infrastructure along coast • Increased diversity of tourism products offered and associated numbers of tourists for these products

• Other tourism-related businesses • Households dependent on tourism as income source	based runoff on coastal and marine habitats	• Cocoa Development Company of Trinidad & Tobago Limited • Guesthouse and tour operators and other tourism-related businesses • Insurance providers			
Settlements and Infrastructure					
<u>Heat waves and droughts with hotter, drier spells</u> *Impacts* • Personal health and livelihoods of residents impacted by heat stress and water stress/shortages • Sanitation challenges during periods of water stress/shortages. This can impact commercial and residential areas. • Water shortages affect key services (e.g. health, education) within the community • Increased potential for forest fires to start and spread rapidly *Vulnerable groups:* • Residents with poorly ventilated houses and limited access to air conditioning or regular piped water supply	• **Increase in water storage (e.g. tanks) and use of alternative ways for distribution (e.g. gravity flow systems and solar-powered pumps) • Development of wells to increase access to ground water where feasible • Use of passive cooling, along with air conditioning systems, for residential and commercial buildings • Zoning and maintenance of dedicated green spaces that will not be cleared/developed to enable cooling and ground water recharge • **Awareness raising of and enforcing fire regulations, and building capacity for community fire management	• DIQUD (co-lead) • Water and Sewerage Authority (WASA) (co-lead) • Castara Village Council (co-lead) • THA - Division of Health, Wellness and Social Protection • Town and Country Planning Division • TEMA • Department of Environment, Climate Change and Energy • Trinidad and Tobago Fire Service • Chamber of Commerce • Castara Tourism Development Association • Tourism-related and agriculture-related businesses • Community groups and organisations (e.g. churches)	• Technical expertise (public health, water resource management, engineering and green building, fire management and disaster response) • Finance • Equipment • Materials • Labour	Short to medium term (1-6 years)	• Reduced incidence of heat stress and related health impacts • Reduced incidence of water stress/shortages • Reduced loss and damage from forest fires

• Elderly and young children • Tourism-related, agriculture-related and other small businesses • Vendors at the beach and along roadways		• Habitat for Humanity T&T • Global Water Partnership-Caribbean (GWP-C)			

Appendices

Appendix 1: Agenda

Integrating digital technologies and participatory tools to support coastal community resilience in Trinidad & Tobago (Tech4CoastalResilience)

Castara Community Action Planning Workshop
September 11, 2024

CONCEPT NOTE

Background

The project, "Integrating digital technologies and participatory tools to support coastal community resilience in Trinidad and Tobago (Tech4CoastalResilience)", is being implemented from 2023-2024 by the Caribbean Natural Resources Institute (CANARI) in partnership with the Fisheries Division, Ministry of Agriculture, Land and Fisheries and the Department of Marine Resources and Fisheries, Tobago House of Assembly. It aims to improve the resilience of vulnerable coastal communities to climate change impacts in Trinidad and Tobago (T&T). It is supported by the "Harnessing Innovative Technologies to Support Resilient Settlements on the Coastal Zones of the Caribbean (HIT RESET Caribbean)" programme. HIT RESET Caribbean is funded by the ACP Innovation Fund implemented by the Organization of African, Caribbean and Pacific States (OACPS) and European Union (EU).

CANARI, the Fisheries Division, Ministry of Agriculture, Land and Fisheries and Department of Marine Resources and Fisheries, Tobago House of Assembly conducted action planning workshops in ten coastal communities – Blanchisseuse, Carli Bay, Icacos, Mayaro, Matelot and Moruga in Trinidad and Castara, Roxborough, Speyside and Scarborough in Tobago – from June to September 2024 under the project. These workshops involved validating the findings from the vulnerability and capacity assessments conducted in these communities to better understand local impacts from climate change and other issues affecting the coast, and prioritised actions to build local resilience. This informed efforts to implement specific coastal resilience actions under the project and in the future.

Workshop goal and objectives

The goal of this workshop is to engage community residents in Castara and other key stakeholders to review and validate key impacts from climate change and other changes and related vulnerabilities and prioritised strategies to adapt and build coastal resilience.

The specific objectives of the workshop are to:

- review findings from the vulnerability and capacity assessment completed in 2024 in Castara in terms of key impacts and vulnerabilities related to climate change and other changes, including for the fisheries and tourism sectors and related livelihoods;
- conduct participatory action planning to improve understanding of and identify ways to reduce vulnerability and adapt to climate and other changes; and
- prioritise specific strategies to adapt and build coastal resilience in Scarborough.

Workshop venue
The workshop will be held September 11, 2024 from 9:30am – 3.15pm at the Castara Fishing Facility, Castara, Tobago.

Target group
The workshop will target 20-30 participants, including fisherfolk, hotel and tour operators, other coastal resource users and community-based organisations in Castara. The project partners and government and civil society organisations involved in fisheries, coastal and marine management, climate change and disaster risk management in Castara will also be engaged. This includes:

- key government agencies involved in adaptation, disaster risk management and coastal and marine resource management, including Department of Marine Resources and Fisheries, Coastal Zone Management Unit - Division of Infrastructure, Quarries and Urban Development, Institute of Marine Affairs and Tobago Emergency Management Agency;
- civil society organisations, including fisherfolk organisations, environmental non-governmental organisations (NGOs), women's, youth and other community groups; and
- private sector, including fisherfolk and hotel and tour operators.

Approach
The workshop will be facilitated by CANARI in collaboration with the Department of Marine Resources and Fisheries, Tobago House of Assembly. It is designed to be interactive, engaging the community in practical exercises and discussions to support coastal resilience action planning.

Outputs
A local action plan for building coastal resilience will be developed based on the key findings from the vulnerability and capacity assessment in Castara and the inputs from community residents and other key stakeholders. Specific strategies to adapt and build coastal resilience in Castara will also be identified to be further implemented under the project.

Travel and meals
CANARI will cover the costs of the venue and meals for all participants. Local travel to Castara will also be covered for civil society representatives where needed.

Provisional Agenda

September 11, 2024	
9:30 am	Registration of participants
10:00 am	Opening remarks, welcome and introductions Overview of the project and workshop objectives
10:30am	Presentation and Q&A – VCA findings for Castara community Group discussion – Validating the VCA findings
12:00 pm	**Lunch**
12:45 pm	Introduction to participatory scenario planning Interactive exercise – Participatory Scenario Planning for Castara community
2:35 pm	Group discussion – Prioritising strategies to adapt and build coastal resilience of Castara community
3:10 pm	Wrap up and next steps for project Closing remarks
3:15 pm	**End of workshop**

For more information, please contact CANARI via Ainka Granderson, Resilience Programme Manager at ainka@canari.org or Aditi Thanoo, Technical Officer at aditi@canari.org or call 638-6062

Appendix 2: List of Participants at Castara Action Planning Workshop

FULL NAME	ORGANISATION	TITLE	EMAIL
1. Howard Robin	Coastal Zone Management Unit, Tobago House of Assembly (THA)	Climate Change Specialist	howardrobin@gmail.com
2. Nalalie Knott-Robin	Department of Environment, THA	Environmental Officer 2	nknottrobin@gmail.com
3. Allison Thomas	Tobago Unified Fisherfolk Association	Secretatry	tufafisherfolkassociation@gmail.com
4. Marc Hamilton	Environment Tobago	Member	Marc.a.hamilton@gmail.com
5. Bhikarry Bertrand	Environment Tobago	Director	bertrand@environmenttobago.net
6. Shermain Stephens	Trinidad and Tobago Red Cross Society (Tobago Branch)	Member	ss.stephens90@gmail.com
7. Junior Quashie	Castara Fisherfolk Association	President	-
8. Anique Trotman	Division of Infrastructure, Quarries and Urban Development (DIQUE), THA	Intern (tourism)	Trotmananique5@gmail.com
9. Shelly Wilson-Quashie	Castara Fisherfolk Association	Member	Jush9104@gmail.com
10. Ian Daly	Bloody Bay Fisheries	Secretary	Iandaly314681@gmail.com
11. Kristan Douglas	Tobago Emergency Management Agency (TEMA)	Intern	Kristandouglas13@gmail.com
12. Jayson Santia	TEMA	Intern	Jayson.santia.229@gmail.com
13. Shaunte Greene	TEMA	Planning Assistant	Shaunte.greene@gov.tt

14. Dominic Waldron	Department of Marine Resources and Fisheries, THA	Trawler Captain 1	Dominicwalds36@gmail.com
15. Carisse Thompson	TEMA	DPS Clerk	Carisse.thompson@tha.gov.tt
16. Errol Roach	Castara Fisherfolk Associated Reformed	President	Roachestourstaxiservice@yahoo.com
17. Ainka Granderson	Caribbean Natural Resources Institute (CANARI)	Resilience Programme Manager	ainka@canari.org
18. Aditi Thanoo	CANARI	Technical Officer	aditi@canari.org

Appendix 3. Castara Vulnerability and Capacity Assessment

Overview of community

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

Castara, Tobago

Geography

Castara is located on the northern coast of Tobago on the leeward side of the island (Tobago Guide, 2023). Castara Bay is 308m long and is surrounded by vegetated headlands (Darsan *et al.,* 2013). The Castara River flows overland to the centre of the bay. The beach is wide and gently sloping and Castara's coastal profile is described as a sandy bay with slightly gravelly sand (Darsan et al., 2012; Ganase, 2020). Castara Bay experiences winds from the southeast and waves from the northwest (Darsan *et al.,* 2013). The shoreline stability for the period 2004-2008 in Castara Bay indicated that it is in a state of dynamic equilibrium (i.e. between net accretion and net erosion) (Darsan *et al.,* 2013).

Its coral reefs are comprised of octocoral and hard coral and have high biodiversity. The 2010 bleaching event and more recent events have impacted the area (Ganase, 2020). The reefs are also part of the monitoring sites under the IMA's coral reef monitoring programme (Ganase, 2020).

Castara's coastal area is part of the proposed North East Tobago Marine Protected Area (NETMPA) (FAO/UN, 2019). There is a tree planting initiative in Castara, Roxborough, Speyside and Lambeau which aims to plant 2,500 native trees to increase coastal resilience and prevent erosion and damage to housing from rising sea levels and increasing wave action. Part of the initiative includes educating community stakeholders on climate change and coastal erosion (THA, 2019). The initiative is spearheaded by the Environment Research Institute Charlotteville (ERIC) and Environment Tobago, together with the North East Tobago Climate Change Champions Network and the Tobago House of Assembly (THA) (THA, 2019). ERIC has also supported coral replanting in Castara Bay in collaboration with the Castara Tourism Development Association (CTDA) (Roach, 2023, pers. comm.).

Socio-economic activities

- Castara is considered one of the most popular fishing and tourism-based villages in Tobago, and fishing is the main economic activity.
- Fisherfolk engage in seine fishing due to the deep inshore waters, which is also known as 'pulling seine' and is a tradition practiced by older generations (Historical Tobago, 2014). Catch can include round-robin, balahoo, sprat, herine, sardine, flaunders, squids, bonito, jacks and needlefish (Tobago Guide, 2023). Currently there is no jetty or landing site in Castara and a fisheries slipway still needs to be developed.
- Fisherfolk in the area are represented by the Castara Fisherfolk Association and Castara Fisherfolk Association Reformed (for the northern part of the village) and supporting facilities include the Castara Fishing Facility (THA, 2022).
- Castara is also known for tourism-related activities rooted in traditional village heritage, including bonfires by the beach, waterfall hikes, fish roasts, and observing the tradition of pulling seines (Nicholas, 2022; THA, 2023). Castara hosts the annual Tobago Heritage Festival which is a cultural celebration of Tobago's African and Indigenous heritage (Tobago Guide, 2023).

- Castara is known for its sandy beaches and the two main beaches, Big Bay and Heavenly Bay, provide calm conditions for snorkelling (Clarke *et al.,* 2019; Tobago Guide, 2023). The surrounding rainforest provides opportunities for hiking and birdwatching (Tobago Guide, 2023).
- In 2021, Castara was selected for the United Nations (UN) World Tourism Organization's Best Tourism Village upgrade programme due to the potential of Castara as a community-based tourism destination and its cultural and natural assets (Nicholas, 2022). Notably, Castara also has a growing guesthouse industry (FAO/UN, 2019). The community has adopted the model of community-based tourism development and aims to preserve their environment, heritage and culture through community participation and engagement of younger generations.
- The CTDA, a network of small business owners, engages and supports businesses in promoting stewardship through recycling and a plastic bag/Styrofoam ban in the community (Mohan, 2022).

Demographic information

Total population in Castara was recorded as 580 persons in the 2011 census with 52% males and 48% females (CSO, 2011).

Past assessments

- In a national vulnerability assessment for T&T, Castara was identified as an area with specific vulnerabilities from storm surge and rough seas, which can cause damage to access roads and transportation links, sea defences, residential infrastructure, and sewage plants (Clarke *et al.,* 2019).
- A coastal erosion assessment was conducted by the Caribbean Development Bank for Tobago and provided estimates for a coastal protection and restoration programme of TT$1.2 billion (THA, 2023a)
- A Design and Feasibility Study for a Risk-Resilient ICZM Programme was conducted in 2016 by the Inter-American Development Bank (IDB), which focused on increasing the level of Trinidad and Tobago's resilience to coastal management issues (GoRTT, 2021)
- Beharry-Borg and Scarpa (2010) conducted an economic valuation of coastal water quality in Tobago targeting residents and tourists visiting a wide cross-section of beaches in Tobago, including Castara Bay.

Methodology

The vulnerability and capacity assessment (VCA) in Castara was conducted from May-August 2024 by the Caribbean Natural Resources Institute (CANARI) and a team of two field assistants.

Participatory geographic information systems (P-GIS) and historical timeline tools were applied in Castara in a one-day workshop on May 9, 2024. Production of maps based on information gathered in the workshops was supported by a GIS expert who digitised and input maps into GIS. The field team then conducted 77 surveys over a period of four weeks from July to August 2024. Surveys targeted fisherfolk, including fishers, processors and vendors, business owners, and selected households and individuals that are representative of various demographics, livelihood activities and sectors and vulnerable groups.

The field team included a fisherfolk leader from the Tobago Unified Fisherfolk Association and a representative from a community-based organisation (CBO). The team encompassed a mix of

competencies, including fisheries and socio-economic/community development, to ensure a holistic approach and effective implementation. They received specific virtual training on conducting household surveys as part of the VCA in June 2024.

Figure 1: Photos of the vulnerability and capacity assessment workshop in Castara, Tobago on May 9, 2024 (Photo on left shows the community-developed historical timeline. Photo on the right shows participatory GIS mapping activity). *Source: CANARI (2024)*

Key climate change impacts and vulnerabilities for Castara

The specific findings from the applications of the three VCA tools in Castara in 2024 are detailed below.

Participatory mapping and GIS findings

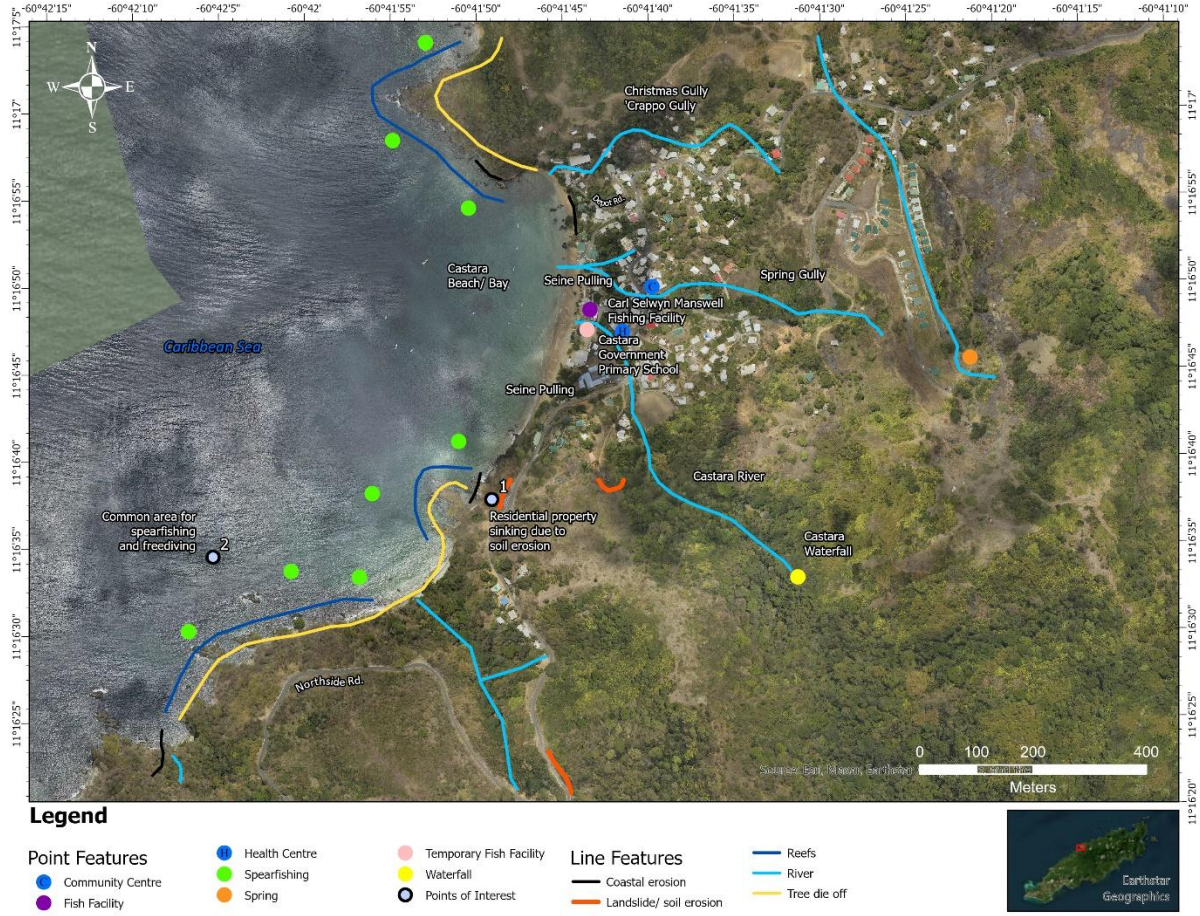
During the mapping exercise, community stakeholders identified and mapped climate-related hazards and impacts that they had experienced or which will pose a significant risk to the community of Castara, as well as specific vulnerable areas and groups. These hazards included:

- Coastal erosion which affects coastal and marine habitats and infrastructure and results in the following:
  - vegetation die-off along coastline and erosion along beaches, which has decreased shade and reduced the occurrence of certain fish species along the coastlines; and
  - landslides along the coastline leading to damage of residential and commercial property.
- Increase in sea surface temperatures has also impacted the health of the reefs and availability of certain species of fish e.g. changes in catch have been observed in jacks and anchovies.
- Landslides further in-land, along steep slopes, which impact road infrastructure. These landslides were caused by building along steep slopes and removal of hillside vegetation, which exposed the soil and increased erosion and slippage during heavy rainfall.

Stakeholders noted that the decrease in vegetation along hills, as well as the coastline, was linked partly to bushfires and clearing of trees, which is practiced by residents to maintain a view of Castara Bay. Loss of trees has been linked to further landslides along steeper terrain and also to reduced local wildlife.

During the mapping activity, stakeholders also noted the importance of the reef to local livelihoods, including spearfishing. Whilst, at the time, stakeholders noted that reefs were in relatively good health with only mild bleaching noted in deeper waters, they expressed concerns about the impact of runoff and siltation on reefs.

Figure 2: Digitised participatory GIS map of Castara.

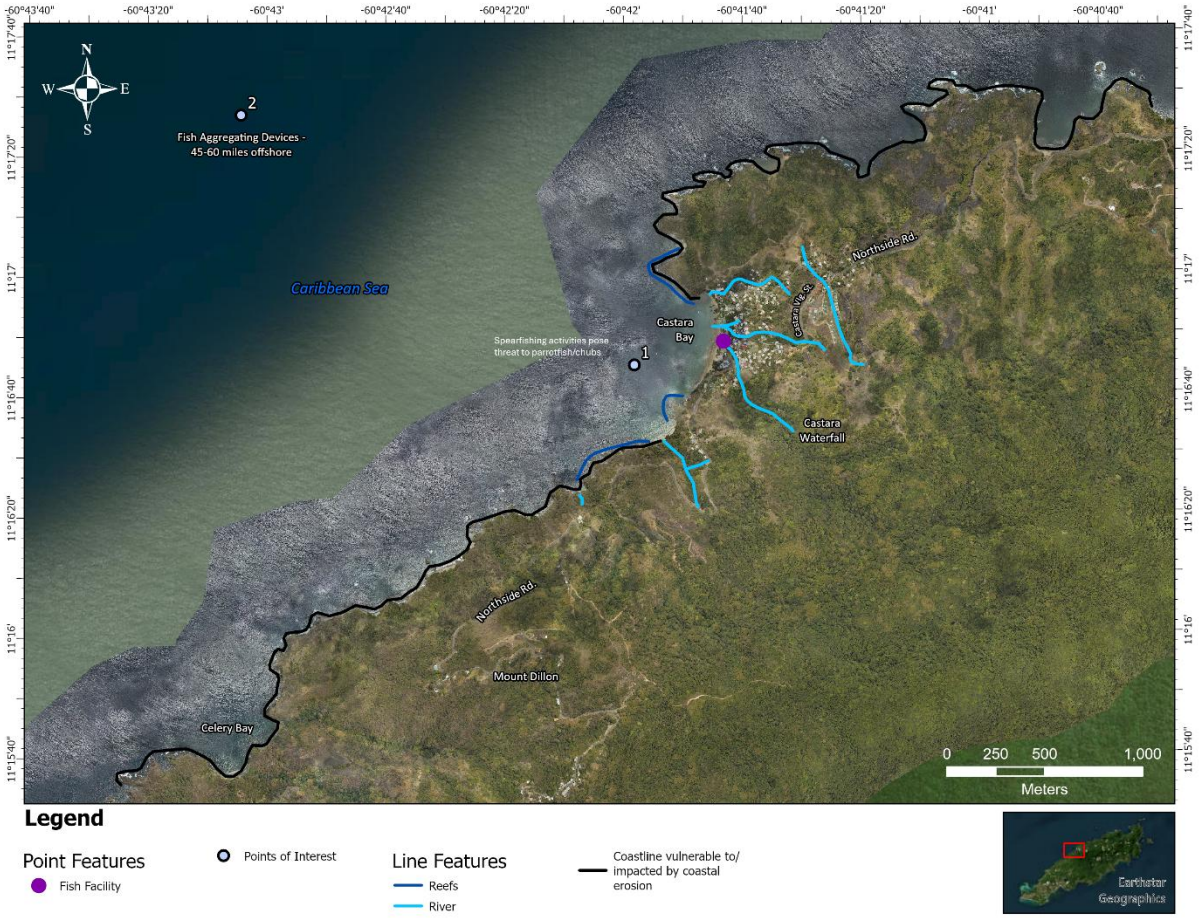


Local knowledge data for map provided by stakeholders in Castara, Tobago, during the *Workshop for the Vulnerability and Capacity Assessment of Castara* (May 9, 2024). Map created using: EPSG:4271 coordinate system, Surveys and Mapping Division, Ministry of Agriculture, Land and Fisheries (2014 Aerial Orthomosaic) and Esri World Imagery, ArcGIS Online (available at: https://services.arcgisonline.com/arcgis/rest/services/World_Imagery/MapServer, accessed February 25, 2025).

Points of Interest

#	Description
1	Residential property sinking due to soil erosion
2	Common area for spearfishing and freediving

Figure 3: Digitised participatory GIS map of Castara and environs



Local knowledge data for map provided by stakeholders in Castara, Tobago, during the *Workshop for the Vulnerability and Capacity Assessment of Castara* (May 9, 2024). Map created using: EPSG:4271 coordinate system, Surveys and Mapping Division, Ministry of Agriculture, Land and Fisheries (2014 Aerial Orthomosaic) and Esri World Imagery, ArcGIS Online (available at: https://services.arcgisonline.com/arcgis/rest/services/World_Imagery/MapServer, accessed February 25, 2025).

Points of Interest

#	Description
1	Spearfishing activities pose threat to parrotfish/chubs
2	Fish aggregating devices - 45-60 miles offshore

Historical timeline findings

Using the historical timeline, stakeholders identified and documented the key problems or threats affecting various sectors and livelihoods in Castara over a 60-year period. This included how these sectors and livelihoods have changed over time (including in environment, social and economic dimensions) and the resulting impacts. The timeline results were also used to analyse the different ways that the community has dealt with key changes.

Table 1 provides an overview of key hazards and other major events highlighted by stakeholders, which have impacted the Castara community over a 60 year-period. Key climate-related events

included extreme weather events such as hurricanes, tropical storms and heavy rainfall resulting in landslides along roadways and hillsides and blocking or damaging roadways. Stakeholders also highlighted an increase in the fishing effort required and changes in fish catch over the years (change in quantity and species caught). It was noted that decline in catch of key species - wahoo and blackfin tuna - has impacted livelihoods. While increasing sea surface temperatures is a contributing factor, stakeholders also linked changes in fish catch to seismic testing/surveys for oil and gas exploration. Additionally, stakeholders noted a decline in the market for flying fish, given the decline in agro-processing companies. Any decline of reef health noted over the last few decades was attributed largely to coastal development. Stakeholders also expressed concern about the potential island-wide impacts of the 2024 oil spill and its indirect impacts on Castara, including impacts on fish spawning sites as well as turtle nesting sites.

In terms of coping strategies for both climate and non-climate related hazards, stakeholders highlighted increased awareness amongst fisherfolk on safety as sea practices, seeking alternative livelihoods during the COVID-19 pandemic, the importance of traditional and local fisheries knowledge passed on through generations e.g. on how to deal with emergencies and return to landing sites (utilising an understanding of flight patterns of birds and seaweed mats), and the use of fish aggregating devices (FADs). While FADs were considered a useful coping mechanism, stakeholders noted that the ways FADs are managed does need to be reconsidered in order to better support nearshore fisheries. Stakeholders also noted the need for increased efforts by the authorities and Coast Guard to support fisherfolk safety at sea. Currently, there are no Coast Guard boats in Tobago to rescue fisherfolk or other persons, and all reports of issues regarding fisherfolk safety are relayed to and handled from Trinidad. Stakeholders recommended that authorities have vessels that are based in Tobago to support search and rescue efforts. Also, they suggested that the reporting system be redesigned to ensure efficiency and reduce reliance on Trinidad's systems.

Although there were efforts to improve fisherfolk livelihoods, stakeholders further noted that newly constructed fishing facilities in Castara and other communities were not up to Hazard Analysis and Critical Control Points (HACCP) standards and this limited their ability to access export markets.

In terms of the tourism sector, stakeholders noted that there was a need to raise awareness to prevent anchoring on reefs and spearfishing on reefs (e.g. by the installation of signage).

Table 1: General historical timeline for Castara community over 60-year period

Decade	Key Events
1960s	• 1963 – Hurricane Flora • 1960 – 1970 – Black Power Movement (residents from Castara participated)
1970s	• 1978 – Landslips occurred within the community leading to rock falls which obstructed roadways; community-led efforts particularly by women assisted in clearing roadways • 1978 – Castara's main road was eroded in the vicinity of Mt. Dillon due to heavy rainfalls • 1970 – 1980 – Livelihoods were mainly focused on fishing and farming (persons were part-time fishers and farmers, engaging in cocoa estates during Christmas period/ during off fishing periods.
1980s	• 1980s – Fires occurred on 300 acres of agricultural estates due to an uprising of residents against foreign estate owners

	• 1980s – Fisherman Fete started within the community • 1980s – Extreme rainfall caused landslides and blocked roadways
1990s	• 1990 – national coup impacted morale of community given that then Prime Minister, ANR Robison, was a former resident of Castara. • 1993 – Tropical Storm Brett • 1990s – Farming activities (related to provisions, plantains and livestock farming) decreased and there was a shift to backyard gardening of culturally important crops e.g. corn and peas • 1990s – Decrease in catch of wahoo and blackfin tuna impacting livelihood • 1990s – Increase in small scale tourism; the first guesthouse was built in the community by a Guyanese national. Following that, a Castara resident started a restaurant/guesthouse and the popularity of bed and breakfasts increased with improved marketing, and attracted more foreigners to the community, increasing local business. • 1990s – Fishing facility built • 1990s – Health centre and community centre built • 1990s – Decline in reef health attributed to coastline development
2000s	• Early 2000s – Seismic testing/surveys conducted in north east Tobago and impacted fish catch within the community (stakeholders noted change in species and quantity) • 2004 – Hurricane Ivan • 2003 – Foreign-owned restaurants and guesthouses increased within the community • 2005-2010 – Increase in population due to both natural population growth as well as local and regional tourists and returning villagers settling in Castara (e.g. retirees returned from Trinidad and Scarborough with families). • 2007-2008 – Internet access increased in the area
2010s	• 2010-2019 – Tourism boom and increase in room capacity; Local and international recognition received for tourism product • 2011 – Recession affected the community and livelihoods • 2012 – ATM installed within community • 2014 – Increase in safety awareness amongst fisherfolk e.g. more fisherfolk began utilising life jackets
2020s	• 2020 – New fishing facility developed. However, a temporary facility (which was built when old facility was demolished) was still in use to store gas as persons were not allowed to store gas in the new facility. • 2020-2022 – COVID-19 impacted tourism due to decline in arrivals and tourist numbers have not recovered since. Stakeholders noted a decline in health due to COVID-19 as well as decline in income post pandemic. Post COVID-19, there was a shift in perspectives related to certain livelihoods e.g. persons began to engage more in fish vending to support livelihoods during and post pandemic. • 2020-2024 – Increased in fishing effort required to catch the same volume • 2020-2024 – Change in fish catch e.g. smaller size recorded in dolphinfish that is now also caught further out at sea, and increase catch in amber, cavalli, snapper and silver fish • 2022 – Extreme weather events caused massive landslides blocking roadways, particularly along the Northside Road coming into Castara and Parlatuvier.

Survey findings

Overview

A total of 77 surveys were administered in Castara as part of the VCA, with 36 percent of respondents being female and 56 percent male (other respondents did not provide a response). 9 percent of respondents were 18-29 years, 22 percent were aged 30-39, 22 percent were 40-49 years, 21 percent fell within the 50-59 age range and 22 percent were over 60 years. Survey responses disaggregated by age and gender revealed no significant differences in responses among groups.

Castara respondents noted 'other' as their main source of income (28.6 percent), followed by the tourism sector (27.3 percent) and the public sector (24.7 percent). Of the respondents who indicated 'other' as their main source of income, 31.8 percent were self-employed/operated their own businesses and 36.3 percent relied on pensions/national insurance (Table 5). In terms of secondary sources of income, 20.2 percent of respondents indicated 'other', while 13.1 percent indicated fisheries.

The majority of persons working within the tourism sector were female (47.6%) and persons mainly fell within three age categories: 30-39, 40-49 and 50-59. The fisheries sector and the public sector were male dominated, and persons were mainly within the 40-49 and 50-59 age range. Respondents who chose their main source of income as 'other' were evenly spread between male and female mainly over the age of 60.

Of those that responded, 62 percent indicated ownership/partial ownership of house and 54 percent indicated ownership/partial ownership of land.

96 percent of respondents were aware of climate change.

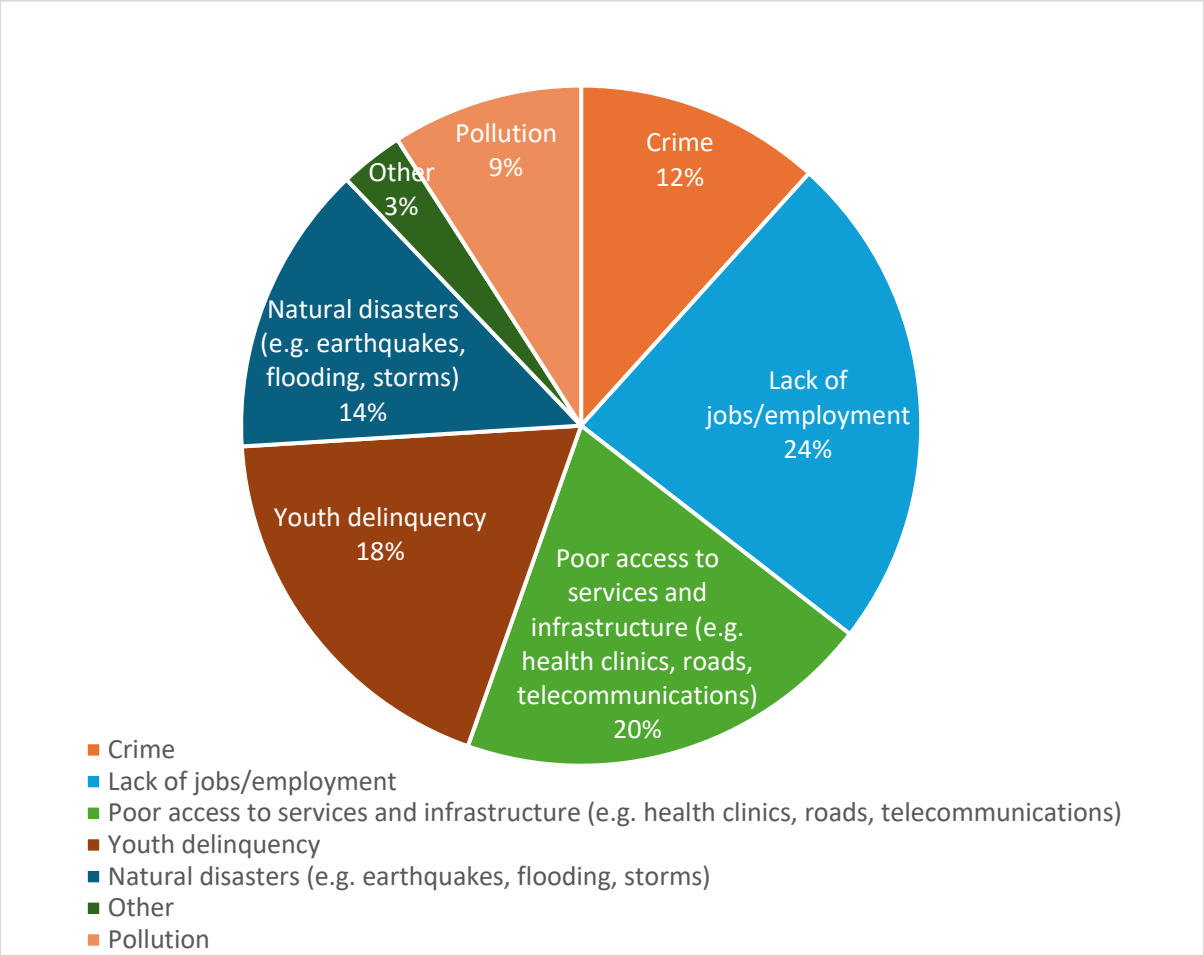
Table 2: Sources of income for Castara survey respondents

Source of income	Agriculture (crops and livestock)	Fisheries	Public Sector	Tourism	Other	No Answer
Primary Source	1.3%	13.0%	24.7%	27.3%	28.6%	5.2%
Secondary Source	2.4%	13.1%	3.6%	6.0%	20.2%	54.8%

Source: CANARI (2024).

Lack of employment and poor access to services and infrastructure were the main problems identified by respondents (24 percent and 20 percent respectively). Youth delinquency (18 percent), natural disasters (14 percent), crime (12 percent), and pollution (9 percent) were also highlighted as issues affecting respondents' households or livelihoods (Figure 4).

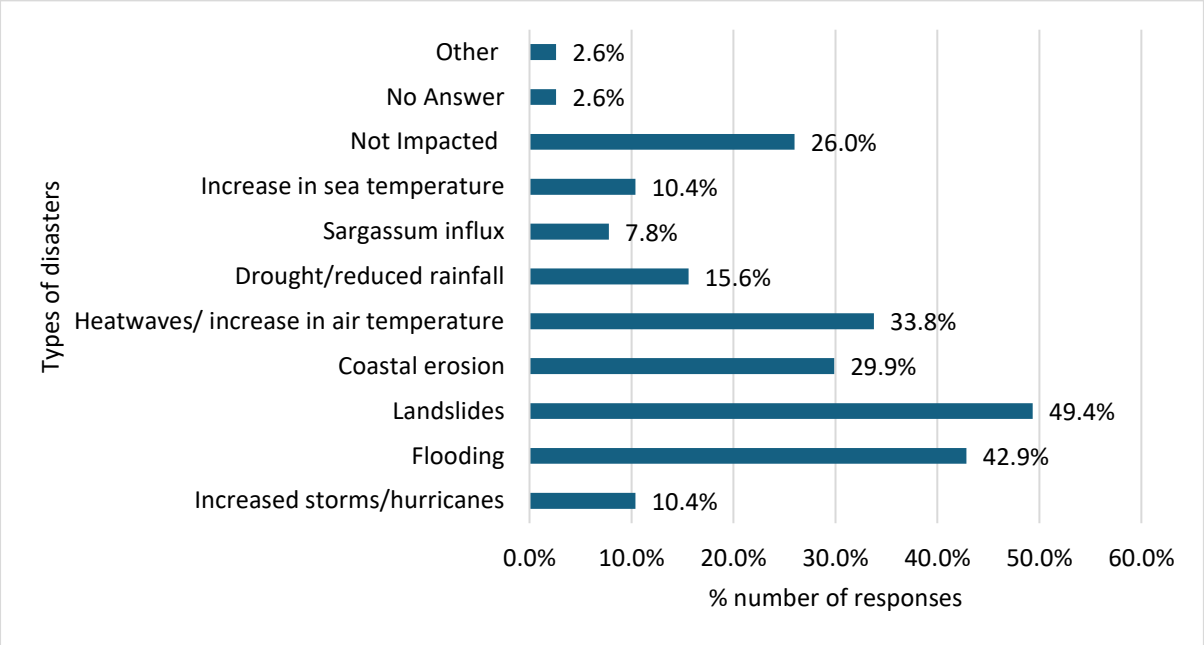
Figure 4: Main problems impacting Castara respondents' households and livelihoods



Climate and other hazards affecting the Castara community

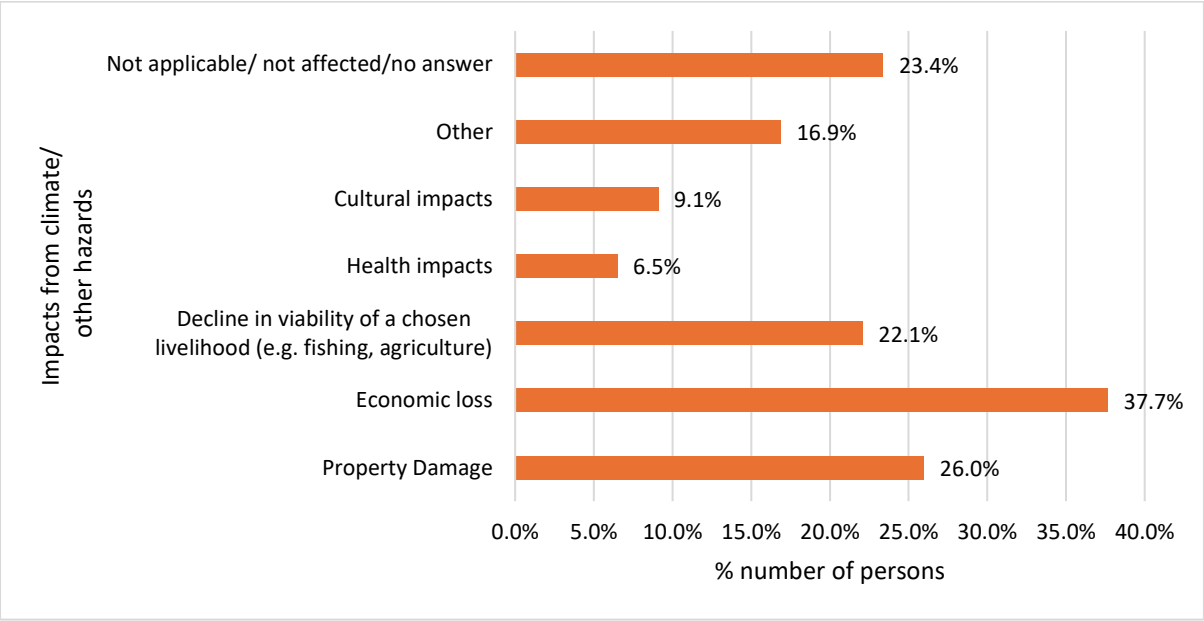
Landslides were identified with the most frequency by respondents (49.4 percent), followed by flooding (42.9 percent), heatwaves/increase in air temperature (33.8 percent) and then coastal erosion (29.9 percent) (see Figure 5).

Figure 5: Climate and other hazards affecting households and livelihoods in Castara (CANARI, 2024).



In terms of resulting impacts from these hazards, decline in economic loss, property damage and decline in viability of chosen livelihood were indicated at 37.7 percent, 26 percent, 22.1 percent respectively by survey respondents (Figure 6).

Figure 6: Impacts from climate-related and other hazards in Castara, Tobago

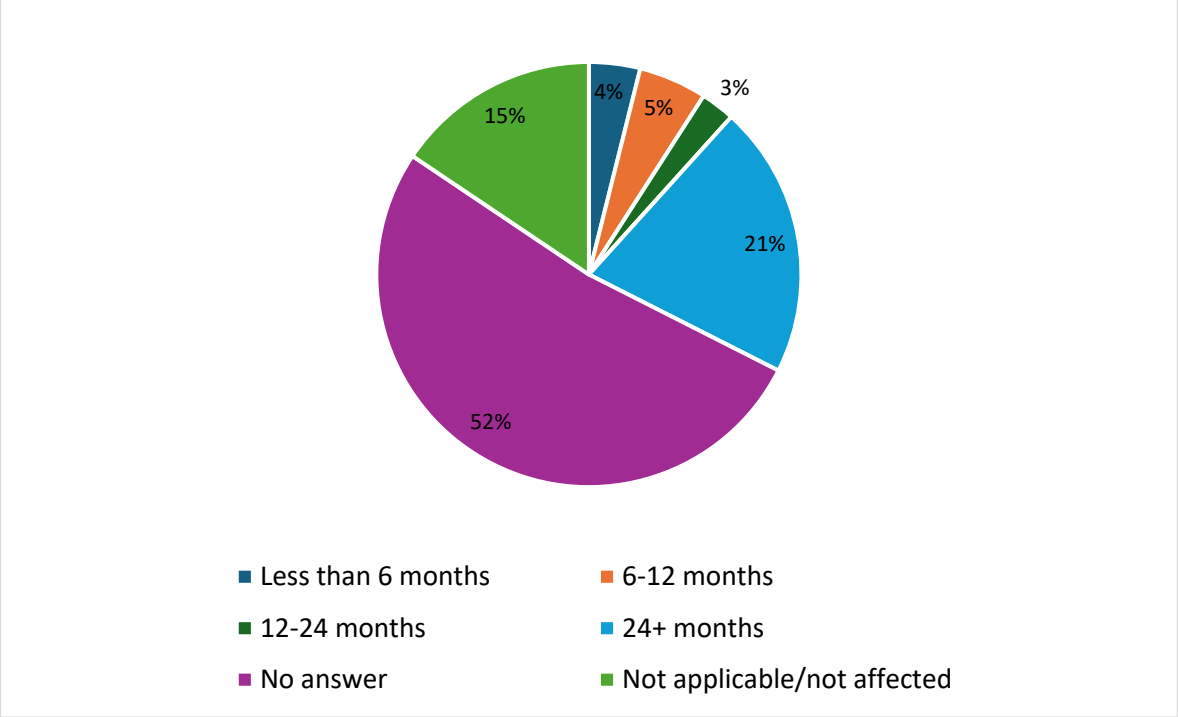


Recovery methods and coping and adaptation strategies

Of those surveyed, 21 percent indicated they were recovered from the identified hazards and their impacts in 24+ months, 4 percent had taken less than 6 months to recover and 5 percent took 6-12

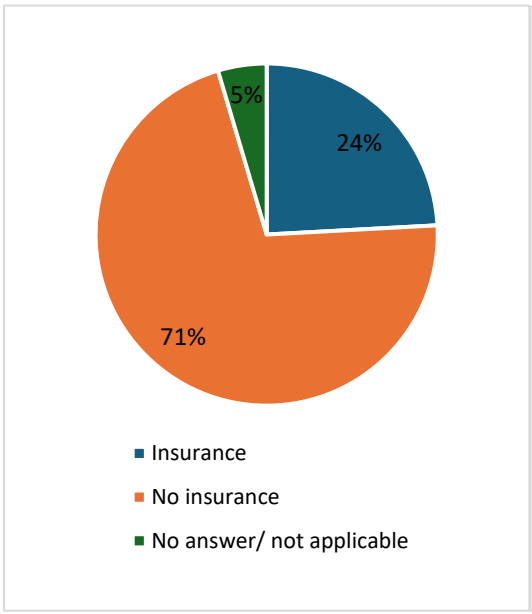
months. Notably, 19 percent indicated they had never recovered from identified hazards and their impacts. 56.9 percent of respondents indicated that no assistance was received/needed during the recovery period, while 15 percent indicated receiving assistance (from government agencies, civil society/community groups, private sector agencies and other sources).

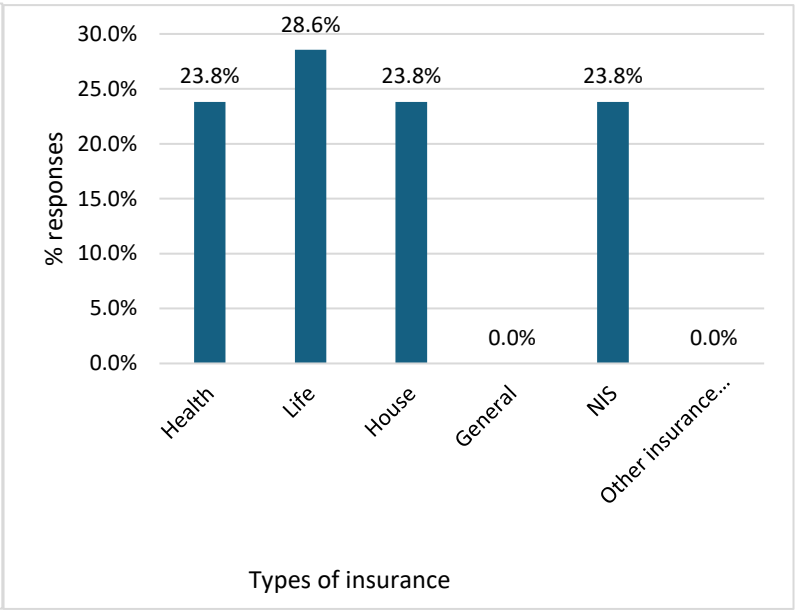
Figure 7: Number of months Castara respondents took to recover from identified hazards and their impacts



71 percent of survey respondents had no insurance to reduce risks and support recovery when needed. Out of the respondents who indicated they had insurance, 28.6 percent had life insurance, and health insurance, house insurance and NIS accounted for 23.8% percent each.

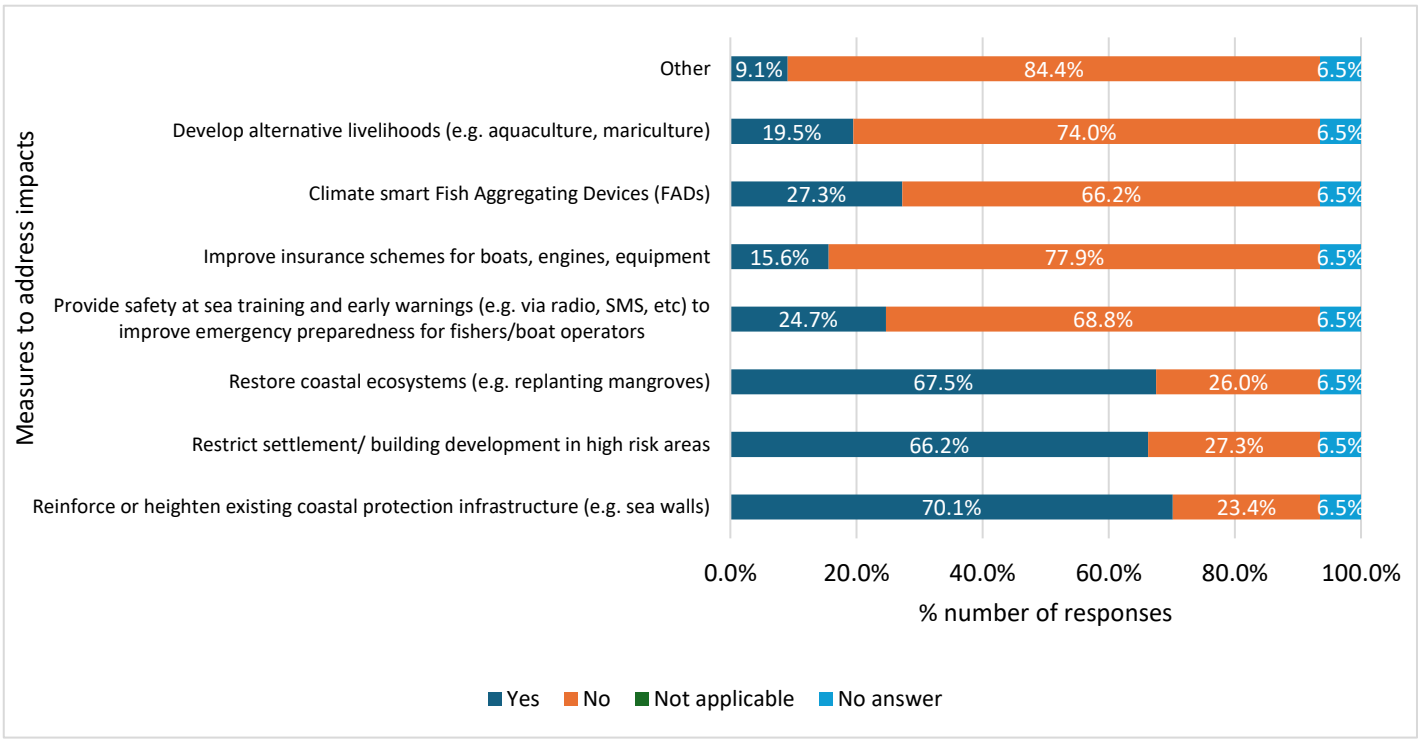
Figure 8: Survey respondents insurance status and type of insurance for Castara, Tobago (CANARI, 2024)





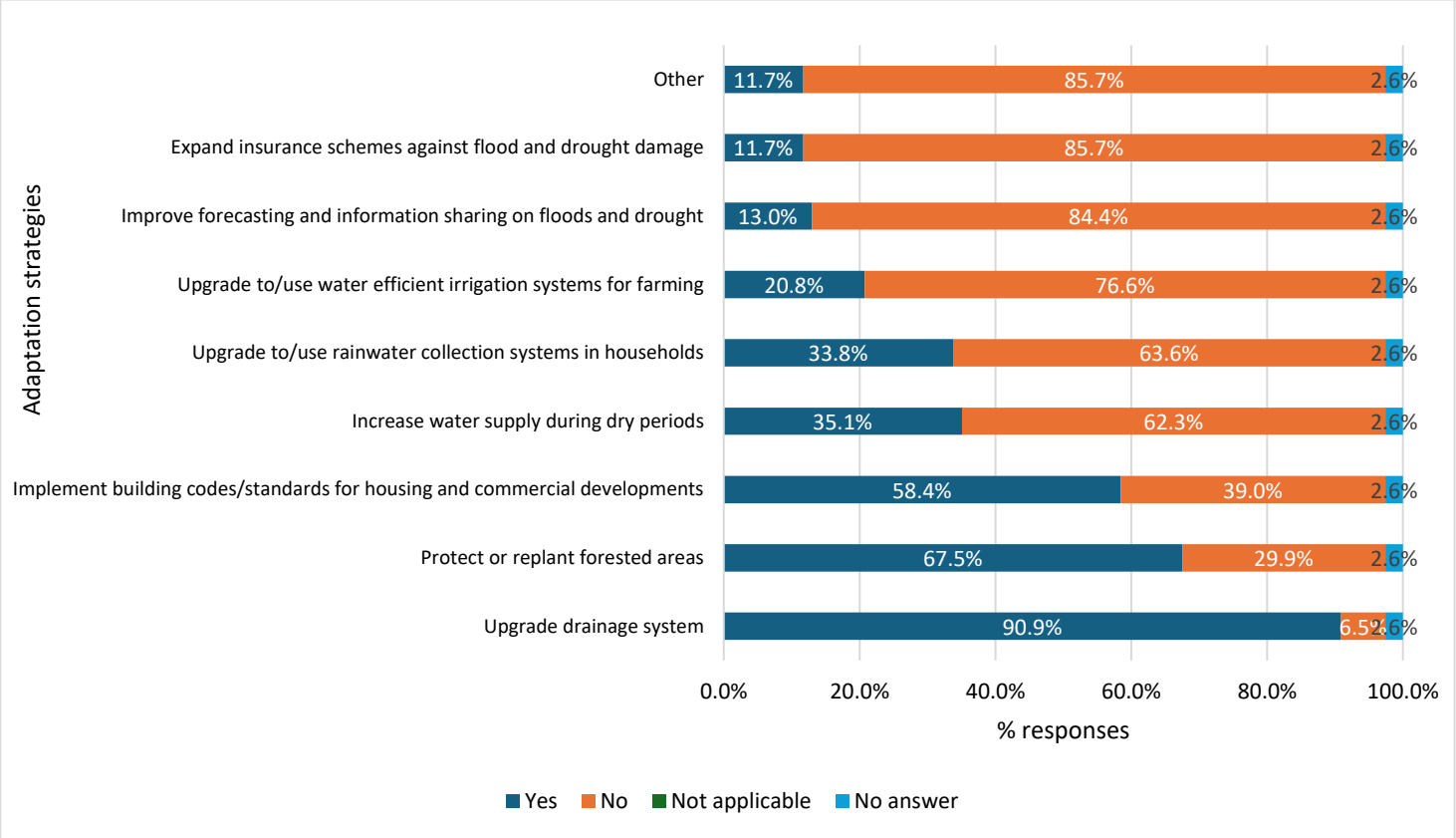
In terms of adaptation measures needed to address impacts from the eroding or changing coast on households and livelihoods, respondents highlighted the need for reinforcement of coastal protection infrastructure (70.1 percent), restoring coastal ecosystems (67.5 percent), restricting settlement/building development in high risk areas (66.2 percent), climate smart FADs (27.3 percent) and safety at sea training and early warnings to improve emergency preparedness for fishers/boat operators (24.7 percent) (Figure 9).

Figure 9: Coastal and marine zone adaptation measures for Castara, Tobago



In terms adaptation measures needed to address impacts in the wider community related to floods, drought and other hazards, survey respondents highlighted the need for upgrading the drainage system (90.9 percent), protecting/replanting forested areas (67.5 percent), implementing building codes/standards for housing/commercial developments (58.4 percent), and increasing water supply during dry periods (35.1 percent) (Figure 10).

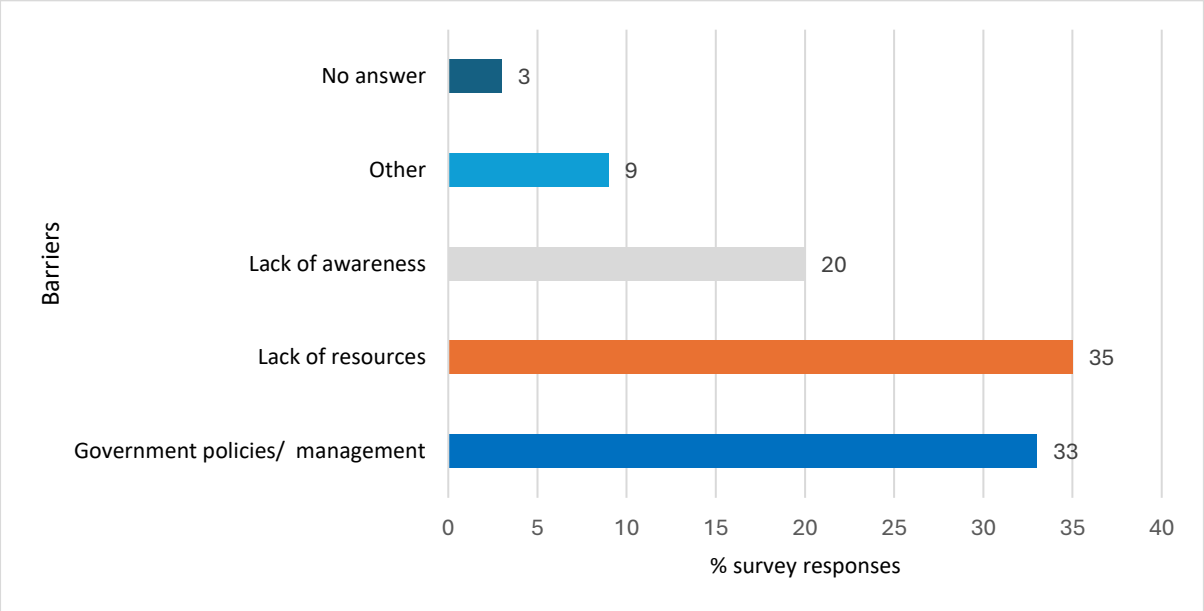
Figure 10: Adaptation measures for floods, droughts and other hazards in Castara, Tobago.



In terms of broader measures needed at the national level to address the impacts of climate change, respondents indicated the need to provide economic incentives (77.9 percent), implement awareness raising or education campaigns (61 percent), and establish and mobilise community committees/groups on climate change and disasters (31.2 percent).

In terms of the main barriers to implementation of adaptation measures in Castara, 35 percent of respondents indicated lack of resources and 33 percent indicated weak government policies/management (Figure 11).

Figure 11: Main barriers to putting in place measures to address the impacts identified in Castara



Summary of findings

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

Table 3: Key climate change impacts, vulnerabilities and adaptation priorities identified by Castara stakeholders using the vulnerability and capacity assessment tools

Climate-related hazards	Key impacts	Vulnerable groups and areas	Priorities for adaptation
Coastal and marine biodiversity and ecosystems			
• Sea level rise/higher tides • Heavy/intense rainfall and extreme weather events • Rising sea surface temperatures	• Coastal erosion due to sea level rise, extreme weather and landslides, and coastal development, leading to sand loss on beaches and coastal vegetation die-off (which has decreased shade and reduced occurrence of certain fish species along coastlines); vegetation die-off also due to fires and development. • Increase in sea surface temperatures which impacts the	Vulnerable areas: • Offshore marine areas and the coastline of Castara, including beaches, coastal vegetation and associated biodiversity. Vulnerable groups: • Fisherfolk • Community members dependent on coastal/marine resources • Recreational users of coastal/marine habitats • Tourism-based businesses	• Reinforce or heighten existing coastal protection infrastructure to reduce erosion • Restrict settlement/building development in high-risk areas • Restore coastal ecosystems (e.g. replanting mangroves)

Climate-related hazards	Key impacts	Vulnerable groups and areas	Priorities for adaptation
	availability of certain fish species (e.g. changes in catch have been observed in jacks and anchovies) and leads to coral bleaching including in deeper waters; reefs further impacted by runoff/siltation from coastal development.		
Livelihoods and socio-economic practices			
• Sea level rise/higher tides • Heavy/intense rainfall and extreme weather events • Rising sea surface temperatures • Heatwaves and rising air temperatures	• Degradation of reefs due to coral bleaching and land-based runoff/siltation which impacts spearfishing and other nearshore fisheries • Increase in fishing effort required e.g. fishers may be required to go further out to sea and incur greater costs • Change in quantity and species of fish caught (e.g. decline in catch of wahoo and blackfin tuna); stakeholders also linked impacts of seismic testing/surveys to changes in fish catch • Increased risk of heat stress and water shortages with rising air temperatures	• Fisherfolk (e.g. fishers, boat owners, vendors) • Households dependent on the fisheries sector for their livelihoods and income • Tour operators • Small businesses owners and employees in coastal areas in Castara	• Utilise FADs to allow fishers to be more efficient and improve catch • Increase practices and training in safety at sea, and improve early warnings and emergency preparedness, for fishers/boat operators given increase in fishing effort required • Improve early warnings and emergency preparedness for hot, dry spells/heatwaves for tour operators and other tourism-related businesses • Address issues non-climate related issues to reduce cumulative impacts of climate related hazards on fisheries livelihoods e.g. improve Hazard Analysis and Critical Control Points (HACCP) standards at fish facility, prevent anchoring on reefs and promote transfer of local knowledge to the next generation
Settlements and infrastructure			

Climate-related hazards	Key impacts	Vulnerable groups and areas	Priorities for adaptation
• Sea level rise/higher tides • Heavy/intense rainfall and extreme weather events • Heatwaves and rising air temperatures	• Coastal erosion which affects key infrastructure and household property • Landslides/land slippage along hillsides leading to blocked and damaged roadways (e.g. Northside Road); degradation of hillsides also due to development and removal of vegetation linked to bushfires • Flooding • Increased risk of heat stress and water shortages with rising air temperatures	• Community infrastructure (e.g. schools, roads along the coast. • Home or business owners impacted by flooding and land slippages.	• Reinforce or heighten existing coastal protection infrastructure • Restrict settlement/building development in high-risk areas • Upgrading the drainage system • implementing building codes/standards for housing/commercial developments • Protect or replant forested areas to reduce landslides.

Source: CANARI (2024).

Stakeholder Validation

A validation exercise was conducted in Castara as part of the action planning workshop on September 11, 2024 to review and verify the key climate change impacts and vulnerabilities identified in the VCA in May-August 2024, and note if there was any further information to add.

Below is a summary of updates shared by fisherfolk and other community residents:

- Mangroves were replanted along riverside, but these were degraded and washed away during periods of heavy rainfall and rough seas.
- Livelihoods within the community are heavily dependent on the coastal areas and related resources, and stakeholders perceived that there were limited options for alternative livelihoods and relocation.
- Impacts on the fisheries sector identified in the VCA have been compounded by the increase in cost of living post-COVID-19.

Based on the above, they also recommended additional actions to adapt and build resilience:

- Replanting appropriate coastal vegetation to reduce the impacts of coastal erosion (aligning with best practices and seeking technical expertise)
- Regulating/restricting coastal settlement and other infrastructure development to reduce pressure on the coast and potential for erosion
- Monitoring coastal erosion by engaging technical expertise and utilising existing data on beach profiles (from Coastal Zone Management Unit, THA and Institute of Marine Affairs [IMA]).

- When installing FADs, encourage use of communal FADs managed by the local fisherfolk organisations and provide training on the effective and sustainable use of FADs
- Supporting training of fisherfolk in business development and managing funds and strengthening of the local fisherfolk organisations
- Educating/training youth in the community to address local issues e.g. hillside fire management
- Increasing sustainable practices to address black/grey water runoff and reduce impacts on coastal and marine habitats e.g. increased awareness and uptake of environmentally friendly products by households and tourism-related businesses
- Designating emergency shelters for vulnerable groups e.g. fisherfolk
- Conducting further research on the impacts of seismic surveys on fisheries; need to advocate for ESIAs when conducting seismic surveys

Appendix 4. Castara Community Resilience Plan

Bold = priority impacts and actions; ** = top priorities

Community impacts & risks	Actions to adapt/build resilience	Roles and responsibilities (Lead/supporting actors)	Required resources	Time frame	Indicators of Success
Fisheries					
<u>Extreme weather events (hurricanes/storms/heavy rainfall)</u> ***Impacts*** • **Damage to boats, engines, nets/other fishing gear at sea due to storms and rough seas and damage to Castara fishing facility during storms** • **Safety at sea issues for fishers** • **Reduced fishing days and income due to weather conditions and equipment damage** • **Flooding and landslides leading to increased sedimentation of nearshore areas and fish habitat** ***Vulnerable groups*** • **Fisherfolk** • **Households dependent on fishing as income source**	• **Safety at sea training, access to required equipment (e.g. GPS, VHF radio) and improved early warning systems for fishers and boat owners** • **Provision of safe storage, and equipment for removal, of boats, engines and gear during heavy rainfall and storms** • **Access to insurance for boats, engines and gear and for fisherfolk** • ****Diversification and development of alternative livelihoods for fisherfolk, including business development training and affordable financing** • ****Organisational strengthening of local fisherfolk organisations to support the resiliency of fisherfolk to climate**	• **Tobago House of Assembly (THA) – Department of Marine Resources and Fisheries (DMRF) (co-lead)** • **Castara Fisherfolk Association and Castara Fisherfolk Association Reformed (co-lead)** • **Tobago Emergency Management Agency (TEMA)** • **Trinidad & Tobago Meteorological Service (TTMS)** • **All Tobago Fishing Association (ATFA) and Tobago Unified Fisherfolk Association (TUFA)** • **Fisherfolk** • **Environment Tobago, Future Fishers, CANARI and other NGOs** • **Caribbean Fisheries Training and**	• **Expertise (disaster response, business development, organisational strengthening, financial management)** • **Financing** • **Equipment (e.g. trailer/tractor to pull up vessels, VHF radios)** • **Materials and labour to construct safe storage facilities**	**Short to medium term (1-6 years)**	• **Reduced costs from damage or loss of fishing vessels, engines and gear** • **Reduced number of safety incidents reported by fisherfolk** • **Increased number of fisherfolk engaged in alternative livelihoods**

	extremes and related hazards	**Development Institute (CFTDI)** • **University of the West Indies (UWI)** • **UN Food and Agriculture Organization (FAO)** • **Finance and insurance providers** • **Telecommunication service providers**			
<u>Changing ocean conditions – temperature, acidity, circulation</u> ***Impacts*** • **Depletion in stocks and catch of certain fish species in nearshore areas due to coral bleaching with rising surface temperatures and change in fish distribution and migration, impacting on fisherfolk, coastal tourism and food security for residents** • **Impacts on fish stocks and catch compounded by seismic surveys for oil and gas exploration** ***Vulnerable groups*** • **Fisherfolk** • **Restaurant owners/tourism related businesses**	• ****Set up communal fish aggregating devices (FADs), and provide training on their sustainable use, to improve efficiency and reduce fuel costs for fishers** • **Investment in larger fishing vessels to support fishing further offshore/exploring alternative fishing grounds and engaging in alternative fishing methods** • ****Coral reef restoration and artificial reef implementation** • ****Development of mariculture (fish farming) and other climate-smart agricultural practices to provide alternative livelihoods for fisherfolk and boost food security**	• **DMRF (co-lead)** • **Institute of Marine Affairs (IMA) (co-lead)** • **Castara Fisherfolk Association and Castara Fisherfolk Association Reformed (co-lead)** • **Environmental Management Authority (EMA)** • **THA - Department of Agriculture** • **ATFA** • **TUFA** • **Fisherfolk** • **Dive/tour operators** • **Restaurant owners** • **Environment Tobago, Environmental Research Institute Charlotteville (ERIC), Future Fishers and CANARI**	• **Expertise (fisheries and marine science, ecosystem restoration, artificial reefs, SCUBA diving)** • **Materials (including for restoration and artificial reefs, FADs)** • **Financing** • **Equipment (fishing vessels, GPS, monitoring tools etc) and SCUBA gear** • **Training to support alternative fishing methods (e.g. safety equipment, use of marine GPS etc.), mariculture and use of FADs** • **Labour** • **Land for farming**	**Short to medium term (1-6 years)**	• **Increased use of FADs, and increase in catch and size of fish from FADs** • **Increased coral cover and health** • **Increased number of fisherfolk engaged in climate-smart agriculture or other alternative livelihoods**

• **Households dependent on fishing or tourism as income source** • **Residents dependent on fish as food source**	• ****Assessment of the compounding impacts of seismic surveys on fish stocks and catch**	• **CFTDI** • **UWI** • **FAO** • **Caribbean Agricultural Research & Development Institute (CARDI)** • **Inter-American Institute for Cooperation on Agriculture (IICA)** • **Oil and gas companies**			
<u>Coastal erosion</u> *Impacts* • Erosion of beaches and cliffs, and deterioration of fish landing sites and the Castara fishing facility *Vulnerable groups* • Fisherfolk • Households dependent on fishing as income source	• Assessment of high-risk areas and construction of a breakwater or other coastal protection infrastructure (e.g. utilising tires) • Restoration of coastal vegetation, seagrass beds and coral reefs to protect shoreline • Upgrade and maintenance of the Castara fishing facility to ensure resiliency to coastal erosion and other hazards and to meet Hazard Analysis and Critical Control Points (HACCP) standards for fish exports	• THA – Coastal Zone Management Unit (CZMU)/ Department of Environment, Climate Change and Energy • (co-lead) • DMRF (co-lead) • Castara Fisherfolk Association and Castara Fisherfolk Association Reformed (co-lead) • Division of Infrastructure, Quarries and Urban Development (DIQUD) • IMA • EMA • Town and Country Planning Division – Ministry of Planning and Development • TEMA	• Expertise (coastal engineering, fisheries and marine science, ecosystem restoration) • Financing (significant amount for breakwater and fishing facility upgrade) • Materials (including seedlings and coral polyps/spawn for restoration) • Equipment (vessels, SCUBA gear etc) • Labour • Policy development/ planning approvals/	Medium to long term (4-10 years)	Reduced costs for loss and damage to fish landing sites and fishing facility

		• ATFA • TUFA • Fisherfolk and local community groups • ERIC, Environment Tobago, Future Fishers, CANARI and other NGOs			
<u>Heat waves/rising air temperatures</u> *Impacts* • Heat stress in fisherfolk • Shorter fishing periods (limited to when air temperatures not very high) • Sanitation challenges and income loss for fishers due to lack of cold storage and increase in rate of spoilage of fish *Vulnerable groups* • Fisherfolk • Households dependent on fishing as income source	• Upgrade of the Castara fishing facility with water storage tanks and rainwater harvesting, ice machine and walk-in freezer • Altering fishing times to avoid hottest times of the day (e.g. fishing at night)	• DMRF (co-lead) • Castara Fisherfolk Association and Castara Fisherfolk Association Reformed (co-lead) • TEMA • THA - Division of Health, Wellness and Social Protection • ATFA • TUFA • Fisherfolk • Future Fishers, CANARI and other NGOs • FAO	• Expertise (construction, heat management) • Financing • Equipment (inc. for fishing facility and night fishing operations) • Materials • Labour	Short term (1-3 years)	• Reduced incidence of heat stress in fisherfolk • Increase in access to ice/cold storage facilities • Reduced rate of spoilage of fish
Tourism					
<u>Coastal erosion</u> ***Impacts*** • **Decline in visitors and income from tourism due to degradation of tourism attractions (e.g. beaches,**	• ****Development and marketing of alternative tourism products, including** ○ **Cocoa and other agricultural tours (promoting climate-smart agriculture)**	• **Tobago Tourism Agency Limited/ THA - Division of Tourism, Culture, Antiquities, and Transportation (co-lead)**	• **Expertise (tourism development, marketing, coastal planning, environmental health)** • **Financing**	**Short to medium term (1-6 years)**	• **Reduced loss and damage of tourism-related property and infrastructure along coast** • **Increased diversity of tourism products**

turtle nesting sites and other coastal areas); **• Damage to guesthouses/hotel and other tourism-related infrastructure** **• Increase in land-based run-off due to coastal vegetation die-off, impacting beaches and coral reefs** ***Vulnerable groups*** **• Guesthouse and tour operators** **• Restaurant owners** **• Vendors at beaches and nearby areas** **• Other tourism-related businesses** **• Households dependent on tourism as income source**	**○ Catch and release fishing** **○ Recreational hunting (sustained through wildlife farming)** **• Improved access to insurance for tourism-related businesses and property** **• Development and enforcement of building codes for high-risk areas taking into account coastal erosion and sea level rise** **• **Use of eco-friendly chemicals in tourism-related businesses and households to reduce impact of land-based runoff on coastal and marine habitats**	**• Castara Tourism Development Association (co-lead)** **• THA Division of Settlements, Public Utilities and Rural Development - Rural Development Unit (RDU)** **• Department of Agriculture** **• CZMU/ Department of Environment, Climate Change and Energy** **• EMA** **• Town and Country Planning Division** **• ERIC, Environment Tobago, CANARI and other NGOs** **• Hunting Association of Trinidad and Tobago** **• Cocoa Development Company of Trinidad & Tobago Limited** **• Guesthouse and tour operators and other tourism-related businesses** **• Insurance providers**	**• Training and certification for new tour guides** **• Equipment** **• Materials**		**offered and associated numbers of tourists for these products**

Coral bleaching due to increase in sea surface temperatures
 	
Impacts
• Decline in visitors and income from tourism due to degradation of tourism attractions (e.g. coral reefs and nearshore fisheries)
 	
Vulnerable groups
• Guesthouse and dive/tour operators
• Restaurant owners
• Vendors at beaches and nearby areas
• Households dependent on tourism as income source
	• Coral reef restoration
	• Artificial reef implementation
	• Development and marketing of alternative tourism products, including
	  ○ Cocoa and other agricultural tours (promoting climate-smart agriculture)
	  ○ Catch and release fishing
	  ○ Recreational hunting (sustained through wildlife farming)
		• IMA (co-lead)
		• Tobago Tourism Agency Limited/ THA - Division of Tourism, Culture, Antiquities, and Transportation (co-lead)
		• Castara Tourism Development Association (co-lead)
		• CZMU/ Department of Environment, Climate Change and Energy
		• DMRF
		• EMA
		• RDU
		• Department of Agriculture
		• Hunting Association of Trinidad and Tobago
		• ERIC, CANARI and other NGOs
		• Guesthouse and dive/tour operators and other tourism-related businesses
			• Expertise (coastal and marine science, ecosystem restoration, tourism development and marketing)
			• Financing
			• Training and certification for new tour guides
			• Equipment (including vessels, SCUBA gear etc)
			• Materials (including coral polyps/spawn for restoration)
			• Labour
				Short to medium term (1-6 years)	• Improved cover and health of coral reefs
					• Increase in diversity of tourism products offered and associated numbers of tourists for these products

Settlements and Infrastructure					
Heat waves and droughts with hotter, drier spells ***Impacts*** • **Personal health and livelihoods of residents impacted by heat stress and water stress/shortages**	• ****Increase in water storage (e.g. tanks) and use of alternative ways for distribution (e.g. gravity flow systems and solar-powered pumps)** • **Development of wells to increase access to ground water where feasible**	• **DIQUD (co-lead)** • **Water and Sewerage Authority (WASA) (co-lead)** • **Castara Village Council (co-lead)**	• **Technical expertise (public health, water resource management, engineering and green building, fire management and disaster response)** • **Finance**	**Short to medium term (1-6 years)**	• **Reduced incidence of heat stress and related health impacts** • **Reduced incidence of water stress/shortages**

• **Sanitation challenges during periods of water stress/shortages. This can impact commercial and residential areas.** • **Water shortages affect key services (e.g. health, education) within the community** • **Increased potential for forest fires to start and spread rapidly** ***Vulnerable groups:*** • **Residents with poorly ventilated houses and limited access to air conditioning or regular piped water supply** • **Elderly and young children** • **Tourism-related, agriculture-related and other small businesses** • **Vendors at the beach and along roadways**	• **Use of passive cooling, along with air conditioning systems, for residential and commercial buildings** • **Zoning and maintenance of dedicated green spaces that will not be cleared/developed to enable cooling and ground water recharge** • ****Awareness raising of and enforcing fire regulations, and building capacity for community fire management**	• **THA - Division of Health, Wellness and Social Protection** • **Town and Country Planning Division** • **TEMA** • **Department of Environment, Climate Change and Energy** • **EMA** • **Trinidad and Tobago Fire Service** • **Chamber of Commerce** • **Castara Tourism Development Association** • **Tourism-related and agriculture-related businesses** • **Community groups and organisations (e.g. churches)** • **Habitat for Humanity T&T** • **Global Water Partnership-Caribbean (GWP-C)**	• **Equipment** • **Materials** • **Labour**		• **Reduced loss and damage from forest fires**

<u>Extreme weather events (hurricanes/storms/heavy rainfall)</u> *Impacts* • Damage to households and infrastructure e.g. damaged/blocked roadways resulting from landslides and rockslides • Compromised telecommunications, power lines and other utilities during periods of heavy rainfall and landslides • Loss of lives and disruptions to livelihoods *Vulnerable groups* • Residents • Business owners • Property owners along coast • Elderly, persons with disabilities and young children that are not very mobile	• Upgrade and maintenance of roads, bridges and drainage to enhance resilience • **Construction of a helipad in/near to Castara for disaster response/medical emergencies when roadways are blocked • Reforestation and increase in vegetative cover along hillsides to prevent landslides and rockslides • Further training and provision of equipment/tools for community disaster response • Upgrade and/or designate emergency shelters for vulnerable and exposed groups e.g. elderly, persons with disabilities, young children • Installation of solar powered streetlights and promotion of renewable energy sources (e.g. solar PV and micro hydro) for reliable local power supply	• DIQUD (co-lead) • Tobago Reforestation and Watershed Rehabilitation Programme (TRWRP) (co-lead) • Castara Village Council (co-lead) • TEMA • Department of Environment, Climate Change and Energy • EMA • RDU • Ministry of Public Utilities • Ministry of Energy and Energy Industries • Trinidad and Tobago Civil Aviation Authority • Town and Country Planning Division • Chamber of Commerce • Local businesses • Local community groups • Property owners • ERIC, Environment Tobago and other NGOs • Trinidad and Tobago Red Cross Society (TTRCS) • Telecommunication providers • Renewable energy suppliers	• Expertise (renewable energy, engineering and construction, disaster response) • Finance (significant amount for infrastructure upgrades/ helipad) • Equipment (e.g. solar powered lights, PV etc.) • Materials • Labour • Planning approvals	Short to medium term (1-6 years)	• Reduced loss and damage to households and infrastructure • Reduced number of incidents reported of loss of access to transport, tele-communications or electricity in community

<u>Coastal erosion</u> *Impacts* • Compromised buildings, roads and other infrastructure along coastline impacting households and livelihoods • Loss and damage of local heritage sites and land areas with rising tides and sea levels *Vulnerable groups* • Residents • Business owners • Property owners along coast	• Assessment of high-risk areas and construction of a breakwater or other coastal protection infrastructure • Improved access to insurance for households and property owners • Possible relocation of the community, including households and relevant infrastructure, further inland	• CZMU/ Department of Environment, Climate Change and Energy (co-lead) • DIQUD (co-lead) • Castara Village Council (co-lead) • IMA • EMA • Town and Country Planning Division • TEMA • RDU • State Lands • Chamber of Commerce • Local businesses • Property owners • Community groups and residents • Insurance providers	• Expertise (coastal engineering, construction, urban planning, disaster response) • Finance (significant amount for breakwater/other infrastructure and relocation) • Equipment • Materials • Labour • Land for relocating • Policy development/ planning approvals/	Medium to long term (4-10 years)	Reduced loss and damage to coastal property and infrastructure