Commonwealth Marine Economies Programme

Funded by UK Government

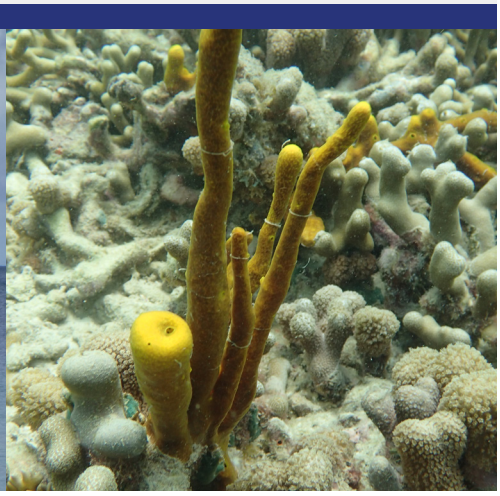
Grenada fisheries: Adapting to climate change

Changes in the abundance, size and distribution of fish are already being reported by fisherfolk and fisheries managers in Grenada, for both reef and pelagic fish species. Grenadian fisheries are considered to have a high climate vulnerability due to their exposure to climate hazards and high dependence on fisheries resources. However, there is a high potential to reduce this vulnerability in Grenada if appropriate action is taken.

There are common climate change risks across all types of Grenadian fisheries, relating to dangerous sea conditions and storm damage to vessels and infrastructure, degraded habitats and fewer fish resources, income and employment.

Many actions can be implemented relatively quickly at the local scale, by fisherfolk, or by managers or cooperatives. There are also longer-term actions which may take more planning, funding and research to implement. Reducing non-climate change pressures such as pollution, habitat damage, litter and ghost fishing gear is also important.

Action is already underway in Grenada, including building coastal resilience, mangrove and coral protection and planting, reducing beach erosion, safety at sea training, adding value to catches, aquaculture training and Fish Aggregating Device (FAD) fishing. By increasing the scale of this action, the future resilience of fisheries livelihoods and food security can be enhanced.



imc3 International Marine Climate Change Centre

CRFM

Caribbean Community Climate Change Centre

GRENADA FISHERIES DIVISION

Introduction

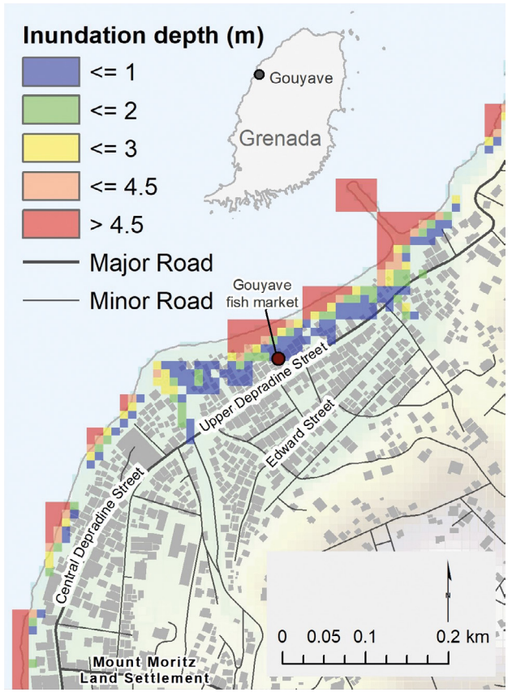
Grenada is in the southern Antilles in the Eastern Caribbean. Comprising the islands of Grenada, Carriacou and Petite Martinique, the fishing industry is hugely important for livelihoods, food, cultural value and tourism. Grenada is also home to important marine and coastal ecosystems including seagrass beds, corals and mangroves which support healthy fisheries.

A wide range of fish are caught around the islands using different fishing gears. Fisherfolk in Grenada catch offshore pelagic species such as tuna, billfish, dolphinfish, wahoo and king mackerel, using longlines, troll lines and Fish Aggregating Devices (FADs). Coral reef and deep slope fish such as groupers, hinds and snappers are caught using lines and pots. Spiny lobster, queen conch and turtles are also caught. Seamoss is a relatively new fishing sector, harvested using small vessels or cultured near shore. The fishing industry also supports fish vendors, boat builders and exporters.

Climate change and other pressures pose threats to fishing and to fishing livelihoods. In this card we explore what actions can be taken to adapt to climate change in Grenada and help ensure resilient ecosystems and fisheries into the future.

> “An empowered Grenadian population capable of managing the risks from climate change with an emphasis on pursuing a low carbon development pathway and building resilience at the individual, community and national level.”

Vision from the National Climate Change Policy for Grenada, Carriacou and Petite Martinique (2017 2021)



MODELLED STORM SURGE INUNDATION FOLLOWING A HURRICANE IVAN TYPE EVENT, COMBINED WITH FUTURE SEA LEVEL RISE TO 2065 UNDER A HIGH EMISSIONS SCENARIO. SOURCE: CMEP, 2019[4]

Grenada climate change impacts

Sea temperature rise

Sea surface temperatures in the Antilles have risen by around 1.3 ˚C over the last century. They are projected to increase further, and by the 2080s sea temperatures may rise by another 2.5 °C compared with the end of the 20th Century[1].

pH decline (ocean acidification)

There has been a decrease in surface water pH in the Caribbean of approximately 10% from 1992 to 2015. pH levels may reduce by a further 20% by 2050[2].

Hurricane frequency and intensity

Hurricanes in the region have been more destructive since the 1970s, typically lasting longer and being of greater intensity. It is likely there will be even more of the strongest hurricanes in the future[3]. In Grenada, the east coast of the islands are most exposed to hurricanes.

Sea level rise

Sea levels in the Caribbean have risen by around 20cm since the 1900s. They are projected to increase by between 26 and 82cm by the end of this century, relative to 1986-2005[3].

The map above left shows the potential scale of inundation at Gouyave, Grenada from the combined effects of sea level rise and a major hurricane event (of similar magnitude to Hurricane Ivan in 2004).

Other stressors affecting the coastal and marine environment

Across the Caribbean, the marine environment is already experiencing impacts from other human activities. Land-based and agricultural sources of pollution, sedimentation, habitat damage, marine litter and lost fishing gear collectively cause stress to marine and coastal habitats, with resulting impacts to fisheries. This impacts their ability to maintain resilience to the impacts of climate change.

Climate risk and vulnerability for Grenada fisheries

The impacts described will affect Grenada fisheries by changing fish distributions and abundance, degrading marine habitats and their ability to support healthy fish stocks, and increasing safety risks to fisherfolk, their equipment and the communities they support.

In an assessment of climate risk and vulnerability for Caribbean fisheries, Grenada emerged as one of the most vulnerable to climate change[5]. Grenada's position in the Eastern Caribbean means it has a very high exposure to climate hazards, including hurricanes. It is highly reliant on marine resources, and so the fisheries sensitivity is also very high. Overall, this means Grenada fisheries have a high climate vulnerability, with potential for country-wide damages and a long recovery time. However, Grenada is regarded as having a higher adaptive capacity than some neighbouring countries, a positive sign for implementing adaptation actions.

Within the Caribbean, it has been estimated that climate change impacts in Grenada could have some of the highest economic costs. If no action were taken, it has been estimated that climate change could cost Grenada as much as 46.2% of its GDP each year by 2050, and 111.5% each year by 2100[6].

What are climate-smart fisheries?

Climate smart fisheries and aquaculture protect the safety of fisherfolk and their assets[7] while preserving natural resources. They are sustainably managed, environmentally friendly and cost-effective. They improve food security, are efficient, reduce vulnerability and increase resilience of the environment and fisherfolk to climate change. They also reduce greenhouse gases. Climate-smart fisheries are a win-win for both fisheries and the environment.

Changes being seen in Grenada

Changes in the abundance, size and distribution of fish are already being widely observed off Grenada. Here are some examples of changes that fisherfolk and fisheries managers have seen in the fish they catch.

- Changes in species composition of catches
- Increased scarcity of pelagic fish
- An overall decline in fish species caught
- A change in the seasonality of fish catch
- Changes in fish size
- Longer distances to travel to catch some species
- Smaller catches
- Effects on spawning
- Effects on reef and reef fish
- More Sargassum seaweed
- Shortage of bait
- More drastic changes in weather patterns
- Changes in yellowfin tuna distribution
- Fewer jacks and kingfish (wahoo and king mackerel)
- Reduced catches of redhind and snapper
- Increase in sharks being caught
- Fewer mahi mahi (dolphinfish) when they are usually abundant
- Fewer flyingfish
- Fewer round robin

Adaptation Overview

Everyone can be involved in climate change adaptation. There are short term actions that can be implemented relatively quickly at the local scale, by fisherfolk, or by managers or cooperatives. There are also longer-term actions which may take more planning, funding and research to implement. These are summarised in this card, but a full list of options can be found in the Climate Change Adaptation for Caribbean Fisheries report card and supporting paper[7].

Local scale climate-smart actions

To ensure secure incomes for the future, fisherfolk can be more climate-smart. Adaptation actions such as improving safety at sea, adding value to their catches, stopping destructive practices and removing lost gear can help fisherfolk while also improving marine habitats and fish stocks. Many actions can be taken at the local-scale, without being reliant on government or large grants to make a change. This can include repeating success stories from other individuals, communities or neighbouring countries. As well as having benefits in terms of climate change, these actions can also save money, improve safety and increase incomes.

Actions for managers and cooperatives

These are actions that can be implemented by managers or cooperatives, supporting groups of fisherfolk or aquaculturists. These actions can reduce the impacts from hurricanes, build strong fish populations, improve the health of the marine environment and empower individuals to act. Fishing cooperatives can make a big difference in coordinating, supporting, and providing training to fisherfolk.

Longer term goals

There are actions that would have a large impact on the fisheries sector, but will take time because they need more funding, further research, or policy change before they can be implemented. Grenada is implementing policies to support these actions, which will result in secure incomes, sustainable fisheries and food security. The Draft National Ocean Policy aims for a future in which:

> “Our coastal and marine resources are sustainably managed to maximise the potential of the blue economy, ensure resilience to climate impacts, protect and restore marine ecosystems and nurture our natural and cultural heritage for the benefit of current and future generations”
>
> Draft National Ocean Policy (2019)

Reducing non-climatic human pressures

Reducing non-climatic human pressures can also be considered climate adaptation[8]. There are pressures on the marine environment which affect the health of fish habitats and fish stocks. These include agricultural and land-based pollution, practices that cause erosion and sedimentation, habitat damage, litter and ghost fishing gear. These place additional stress on marine ecosystems, making them less resilient to the effects of climate change. By reducing these pressures, ecosystems become more resilient to the impacts of climate change, and better able to support healthy fisheries.

Adaptation Workshop

A workshop was held with fisherfolk, Fisheries Division staff, the Caribbean Regional Fisheries Mechanism (CRFM), the Caribbean Community Climate Change Centre (CCCCC) and the Food and Agriculture Organization of the United Nations (FAO) to discuss what actions were available to Grenada fisheries to adapt to climate change.

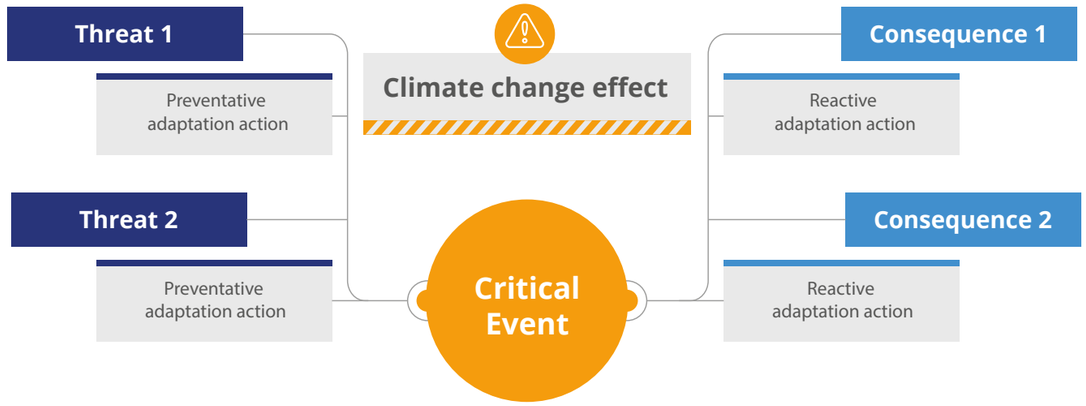
During the workshop, fisherfolk said they were already changing how they work because of climate change, including:

1. Listening to weather warnings
2. Using more safety measures
3. Changing where they go fishing
4. Changing the species they target or the equipment they use

Participants at the workshop identified adaptation actions that could be used to reduce climate change impacts on pelagic, deep slope and reef fisheries, and seamoss farming in Grenada. These included actions that were already underway, and some additional actions that could be undertaken in the future.

The actions were identified using a causal chain analysis, or bow-tie, tool (shown below), where 1. preventative adaptation actions are identified which can limit the climate change threats to fisheries, and 2. reactive actions are identified which can reduce the consequences to society. The adaptation actions described here are based on workshop outputs as well as best practice elsewhere. This type of analysis has been applied to fisheries in many other parts of the world.

This bow-tie tool shown here can be adopted by fisherfolk or co-operatives in Grenada to identify adaptation actions which may be suitable for their own fishery or community. It can also help identify successful actions that are already underway, which could be repeated elsewhere, and to facilitate discussions around how climate change may impact specific fisheries.



Adaptation Actions

During the workshop, actions which could be implemented in Grenada were identified which address a range of threats and consequences. These are described here, along with examples from best practice elsewhere.

THREAT

Dangerous sea conditions and storm damage to vessels and infrastructure

ADAPTATION ACTIONS

- Develop pre- and post-disaster plans
- Check weather forecasts more often
- Weather warning (FEWER) app
- Early warning systems
- Safety at sea training
- Insurance
- Improved communications (e.g. radio technologies)
- Breakwaters to protect vessels
- Docking areas to secure vessels prior to a storm
- Changes in vessel design to improve safety
- Temporary translocation of seamoss and equipment prior to storms
- Potential to use protected bays for sea moss farming

THREAT

Reduced fish abundance or distribution shifts

ADAPTATION ACTIONS

- Follow the fish to new areas
- Diversify catch to underutilised species e.g. squid
- Flexibility in fisheries, to change target species depending on seasons and availability
- Catch non-native species e.g. lionfish
- Better ice system if travelling further for catch
- Fish Aggregating Devices (FADs) to concentrate the fish
- Protected areas to enhance fisheries
- Reduce other pressures such as illegal, unregulated and unreported (IUU) fishing
- Fish the most sustainable species

THREAT

Degraded habitats

ADAPTATION ACTIONS

- Protected areas, to rebuild habitats
- Habitat enhancement e.g. coral planting and artificial reefs
- Prevent further habitat degradation
- Preventing and removing litter and ghost gear
- Discourage damaging gears and practices
- Use waste facilities for damaged fishing gear and litter
- Reducing non-climatic pressures on the environment e.g. pollution

CONSEQUENCES

Reduced income and employment, reduced supply to traders and exports, and reduced food supply

ADAPTATION ACTIONS

- Marketing for new species being landed
- Value addition e.g. salting, drying, smoking, packaging, adding spices, ensuring high standards
- Value addition for seamoss e.g. marketing, packaging, recipes
- Accessing higher value markets e.g. exports
- Develop multi-species aquaculture
- Diversify incomes
- Training in business skills and personal finance
- Improve fuel efficiency of vessels
- Involving fishers in tourism use of coral reefs and recreational fishing

To improve the health and climate resilience of the marine environment, and support healthy fish stocks, the Government of Grenada is implementing policies to protect and restore marine ecosystems. The Draft National Ocean Policy (2019) includes goals to reduce land-based pollution, implement spatial planning, and use ecosystem based adaptation to restore and conserve coastal ecosystems. The National Biodiversity Strategic Action Plan, National Adaptation Plan, the Maritime Economy Plan[9] and the Marine Protected Area management plans all have actions to build the health and biodiversity of marine ecosystems.

Adaptation already underway in Grenada

There are already many adaptation projects underway in Grenada, and habitat improvement projects which also have climate adaptation benefits. Some examples are provided here, including pilot projects which could be replicated elsewhere in Grenada.

Coastal resilience

The Nature Conservancy's 'At the Water's Edge' project has used artificial reefs to reduce wave energy and coastal erosion and support coral growth. Coastal vegetation was also restored by training locals to plant and care for mangroves. The completed breakwater is designed to reduce 80-90% of wave energy over a 30 year timeframe. Under the Commonwealth Marine Economies Programme, habitat maps and flood models have been produced for Grenada, increasing understanding of the coastal and marine environment and the role it plays in coastal protection.

Coral planting

There are coral planting projects in a number of locations around Grenada. For example, the Grenada Coral Reef Foundation works with local communities to establish and maintain coral nurseries such as in Gouyave and Carriacou. Coral planting can restore degraded reefs, helping provide coastal protection as well as habitat for healthy fisheries.

FAD fishing

There have been various projects deploying small, moored Fish Aggregating Devices (FADs) in Grenada, and training fisherfolk in sustainable management using FADs. Using sustainably managed FADs can divert fishing pressure from coral reef species to pelagic fish, which are considered more resilient to climate change impacts.

Climate resilient agriculture

A project funded by the Global Environment Facility (GEF) aims to improve agricultural and land management in Grenada. This would reduce the land-based sources of pollution entering the seas, and reduce erosion and sedimentation, ultimately improving the health of the marine environment.

Adding value to catches

The FAO has been providing training in adding value to catches. This includes salting, drying, smoking and adding spice blends to fish to create unique brands for businesses.

Safety at sea training

The FAO Climate Change Adaptation in the Eastern Caribbean Fisheries Sector (CC4Fish) project has provided training to more than 300 captains in Grenada, aimed at significantly improving the safety of fishers in the country. VHF radios were also provided and a manual produced to improve safety awareness of fisherfolk and how to respond in the case of accidents.

Aquaculture training

Implemented by the FAO, free courses have been provided in aquaculture, to increase its contribution to food security, nutrition, and livelihoods in Grenada. Support is provided through the provision of equipment and materials and training on best production practices, marketing and access to finance. As part of CC4Fish, aquaculturists from Grenada received training in aquaponics, a type of aquaculture which combines fish rearing with hydroponics production of vegetables.

Beach erosion

Beach erosion can be caused by climate change or sand mining. A study was carried out by the UK Commonwealth Marine Economies Programme to better understand coastal processes in Grenada and address the risk of shoreline beach erosion. Models were used to understand the movement of sediment and training was provided in measuring shoreline change and undertaking coastal surveys.

Mangrove protection and planting

The Restoration and Community Co-Management of Mangroves (RECCOMM) project, funded by Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH, planted over 1900 mangrove seedlings in the Telescope area and provided training in propagating mangrove seedlings. Courses in beekeeping, charcoal making and eco-tourism were also given to promote sustainable livelihoods.

Barriers to adaptation

Across the Caribbean, there are barriers that hinder adaptation. These include limited finance and government resources, governance systems, social perceptions and distrust. For fisheries to adapt effectively, these barriers must be overcome.

Social aspects of climate change adaptation must be taken into account by including fisherfolk in adaptation decisions. There are also some adaptation options which might be possible but are thought unusual or unlikely in the context of Grenadian fisheries. These include diversifying into aquaculture and leaving the fishing industry completely, although fisherfolk could diversify to benefit from tourist use of coral reefs and recreational fishing.

Sustained public awareness of the impacts to fisheries in the Caribbean and increasing fisherfolk advocacy could help drive policy makers to prioritise action. Involving fisherfolk in decision making will help policy makers to ensure action is fair and equitable. Different user groups must work together to find solutions. In Grenada, policies have been drafted and are being implemented which will improve the health of the marine environment and accelerate climate change adaptation. The Maritime Economy Plan[9] is a tool for planning and Governance of the fisheries sector highlighting the challenges and recommended steps.

Development partners can help with funding for adaptation[10]. Policies and plans can be used to leverage climate financing, and income generated from fishing could be used to finance adaptation in fisheries.At the individual scale, fisherfolk co operatives can help by providing training and help with personal finance. Supported by the Commonwealth Marine Economies Programme, Grenada is one of the pilot countries for the Caribbean Oceans and Aquaculture Sustainability faciliTy (COAST) insurance, a country level parametric insurance product that provides payouts to fishers in the event of a storm or hurricane. Development of other types of fisheries insurance products would help support fisherfolk on an individual basis.

Lack of knowledge can also be a barrier to effective climate change adaptation. Across the region, further research is needed to fully understand the impacts of climate change on fisheries, including oceanographic, fisheries and biodiversity monitoring, detailed regional and local climate change modelling, fish distribution changes and migration patterns of offshore fish stocks and impacts on seamoss. Monitoring of Grenada fish catches is helping to ensure sustainable management of the stocks.

In Grenada, there are various initiatives training fisherfolk in sustainable fishing practices, habitat rehabilitation and personal finance. It is important that individuals get involved to increase their own knowledge and adaptive capacity, and to share experience and best practice in climate change adaptation so it can be replicated elsewhere.

Acknowledgements

Many thanks to the Grenada Fisheries Division for their support and input to this work. We are very grateful to all the participants of the workshop for their engagement and discussion.

REVIEWERS:

Peter A. Murray
Caribbean Regional Fisheries Mechanism

Keith Nichols
Caribbean Community Climate Change Centre

For more information on climate change impacts and adaptation in the Caribbean region, please see the Caribbean Marine Climate Change Report Card, the Climate Change Adaptation for Caribbean Fisheries report card, and the supporting papers which contain a full list of adaptation actions. These can be accessed at: **bit.ly/cmecaribbean**

Please cite this document as:

CMEP (2022) Grenada Fisheries: Adapting to Climate Change. (Eds. Bryony Townhill, Paul Buckley, George Phillip, Rickie Morain, Olivia Harrod, John Pinnegar, Georg Engelhard). Commonwealth Marine Economies Programme, 12pp.

References

1 NOAA (2022) NOAA's climate change web portal: CMIP6 https://psl.noaa.gov/ipcc/cmip6/
2 Melendez, M., Salisbury, J. (2017) Impacts of Ocean Acidification in the Coastal and Marine Environments of Caribbean Small Island Developing States (SIDS), Caribbean Marine Climate Change Report Card: Science Review 2017, pp31-39.
3 Stephenson, T.S., Jones, J.J. (2017) Impacts of Climate Change on Extreme Events in the Coastal and Marine Environments of Caribbean Small Island Developing States (SIDS), Caribbean Marine Climate Change Report Card: Science Review 2017, pp 10-22.
4 CMEP (2019) Coastal Vulnerability in Grenada: A framework for assessing likely effects of inundation from hurricane-induced storm surge and climate change. CMEP Report. June 2019.
5 Monnereau, I., Mahon, R., McConney, P., Nurse, L., Turner, R., Vallés, 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. CERMES, The University of the West Indies, Cave Hill Campus, Barbados. 86pp.
6 Bueno, R., Herzfeld, C., Stanton, E. A., Ackerman, F. (2008) The Caribbean and climate change: The Costs of Inaction. Medford, MA, Tufts University Global Development and Environment Institute and Stockholm Environment Institute— US Center.
7 CMEP (2021) Climate Change Adaptation for Caribbean Fisheries. (Eds. Bryony Townhill, Paul Buckley, Peter A. Murray, Keith Nichols, Iris Monnereau). Commonwealth Marine Economies Programme, 12pp. **bit.ly/cmecaribbean**
8 IPCC (2022) Climate Change 2022: Impacts, Adaptation, and Vulnerability. Contribution of Working Group II to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change. Cambridge University Press.
9 CMEP (2021) Grenada Maritime Economy Plan https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1031761/Grenada_Maritime_Economy-Plan_March_2021.pdf
10 P.A. Murray et al. (2021) Key climate change effects on the coastal and marine environment around the Caribbean and Mid-Atlantic UK Overseas Territories. MCCIP Science Review 2021, 27pp.

IMAGE CREDITS: **PAGE 1** B. TOWNHILL, J. BLUEMEL, **PAGE 2** B. SILBURN, **PAGE 3** B. TOWNHILL, **PAGE 4** E. MCMANUS, **PAGE 5** B. SILBURN, **PAGE 6** E. MENGO, **PAGE 7** J. BLUEMEL, **PAGE 8** L. BENSON, **PAGE 9** B. SILBURN, PAGE 11 B. SILBURN

For more information on the Commonwealth Marine Economies Programme, please visit:

www.gov.uk/guidance/commonwealth-marine-economies-programme

CME.ProgrammeEnquiries@fcdo.gov.uk

@CME_Prog

Centre for Environment Fisheries & Aquaculture Science

National Oceanography Centre

United Kingdom Hydrographic Office