CLIMATE CHANGE, THE CARIBBEAN SEA, AND THE OCEAN ECONOMY – SECURING LIVELIHOODS OF CARIBBEAN PEOPLE

Laverne Walker *

Caribbean people have always had a special relationship with the ocean and coast, with most of the population, infrastructure, and economic activities located along the coastal zone in Caribbean small island developing States (SIDS). Marine and coastal ecosystems provide employment, recreation, livelihoods, and ensure food security for millions of people across the subregion in the areas of fisheries, tourism, transportation, and energy.

Patil et al (2016) noted that for Caribbean island States and Territories, the gross revenue generated from marine and coastal activities in 2012 was estimated at US$53 billion, equivalent to over 18 percent of the total GDP. Further, the marine and coastal environment and its natural capital represents significant potential for the development of the sustainable blue economy in the subregion (UNEP, 2019).

Notwithstanding this potential, many of these ecosystem goods and services are under threat from several sources, both human and natural. The anthropogenic pressures negatively impacting on the wider Caribbean's nearshore marine resources include population growth, urbanization, coastal development, pollution, and over-exploitation of natural resources, including overfishing (UNEP, 2020). These are occurring against the backdrop of climate change and its impacts. These impacts further add pressure and exacerbate existing vulnerabilities (UNEP, 2020). Climate change and climate variability are increasingly impacting vulnerable marine and coastal ecosystems that Caribbean SIDS depend on, potentially resulting in an increasingly negative impact on economic sectors already struggling, a result of the COVID-19 pandemic and geopolitical instability. This article assesses the potential impact of climate change on the Caribbean marine and coastal environment and makes recommendations for adaptation.

CLIMATE CHANGE AND THE MARINE ENVIRONMENT

Increasing sea surface temperatures (SST) and marine heat waves

An assessment of SST in the Caribbean between the period 1982-2016 shows that SST have warmed at a rate of between 0.01°C and 0.04°C annually, with higher rates of warming observed in the Gulf of Mexico and the eastern Caribbean extending into the eastern tropical Atlantic (figure 1) (Climate Studies Group Mona (Eds.), 2020).

Increased SST and marine heat waves have negatively impacted economically important coastal and marine habitats such as coral reefs and seagrass beds (UN, 2021). The widespread coral bleaching event of 2005 resulted in high mortality of Caribbean coral reefs already under stress from disease and increased sedimentation.[1] Coral reef mortality can impact negatively on reef fisheries, and put coastal communities and coastal infrastructure at higher exposure to damage from waves and storm surges associated with storms and hurricanes (UN, 2021). It is recognized that increases in sea surface temperatures are resulting in a greater proportion of category 4 and 5 hurricanes (figure 2) (ECLAC, 2022; UN, 2021). The National Ocean and Atmospheric Administration (NOAA) predicted an above-average hurricane season for 2022, a result of higher-than-normal SST.[2] This prediction makes it the seventh consecutive above-average hurricane season. Storms and hurricanes can have devasting consequences for coastal tourism and fisheries activities and can result in damage to coastal infrastructure. In September 2017, Hurricane Maria passed over the island of Dominica resulting in 65 lives lost[3] and some US 1.3 billion in damage or 224 per cent of GDP.[4] The damage from the 2017 hurricane season for four Caribbean islands was estimated to have exceeded US$ 1.5 billion (ECLAC, 2022).

Warmer seas have also led to the massive influx of Atlantic Sargasso in the Caribbean Sea, affecting the tourism and fisheries sectors, as well as coastal communities (Oxenford et. al. 2015; Doyle and Franks 2015).

Figure 2: Caribbean Mangrove

Anse Lapin, Saint Lucia. Photo Credit Christopher Cox

* Laverne Walker is a Sustainable Development Officer at the Economic Commission for Latin America and the Caribbean, Subregional Headquarters for the Caribbean.

[1] Jones et al, 2005. The Effects of Coral Bleaching in the Northern Caribbean and Western Atlantic. https://www.coris.noaa.gov/activities/caribbean_rpt/SCRBH2005_07.pdf

[2] NOAA, 2022. NOAA Predicts Above Normal 2022 Hurricane Season. Accessed on 22 July 2022: https://www.noaa.gov/news-release/noaa-predicts-above-normal-2022-atlantic-hurricane-season

[3] UN Women Accessed, 2 June 2022 https://wrd.unwomen.org/node/134

[4] World Bank. 2017 A 360 degree look at Dominica Post Hurricane Maria. https://www.worldbank.org/en/news/feature/2017/11/28/a-360-degree-look-at-dominica-post-hurricane-maria

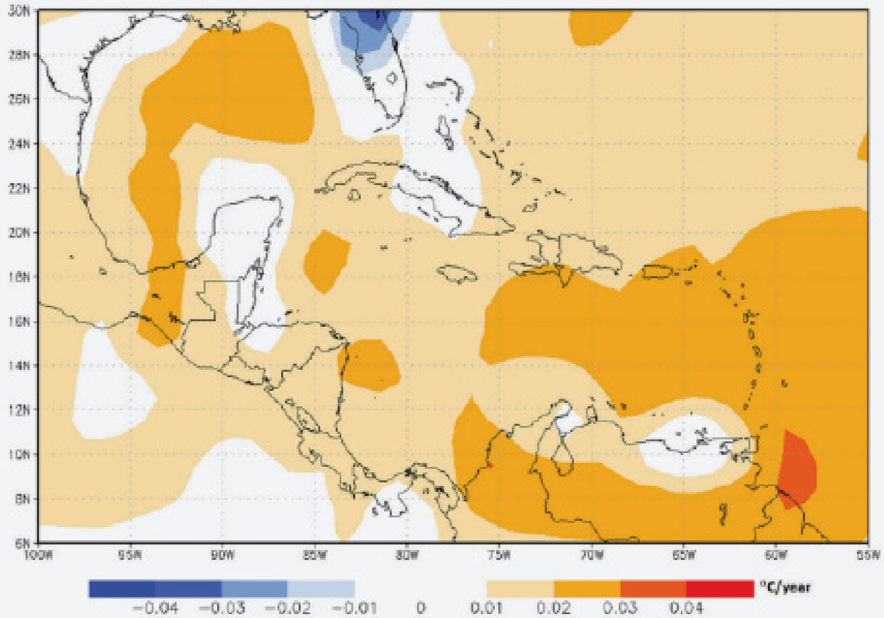
Ocean Acidification

The world's oceans act as large sinks, absorbing approximately one third of anthropogenic emissions of carbon dioxide (CO_2). However, when CO_2 is absorbed by seawater, chemical reactions occur that reduce the pH (increase the acidity of the water). "Ocean acidification" refers to this lowering of ocean pH. Ocean acidification negatively impacts the ability of calcifying animals' - such as corals and shellfish - to construct their shells and skeletons (NOAA, 2021). Over the last 20 years the Caribbean has experienced decreasing pH levels, which impacts on the ability of corals and shellfish to build skeletons.[5]

Sea level Rise

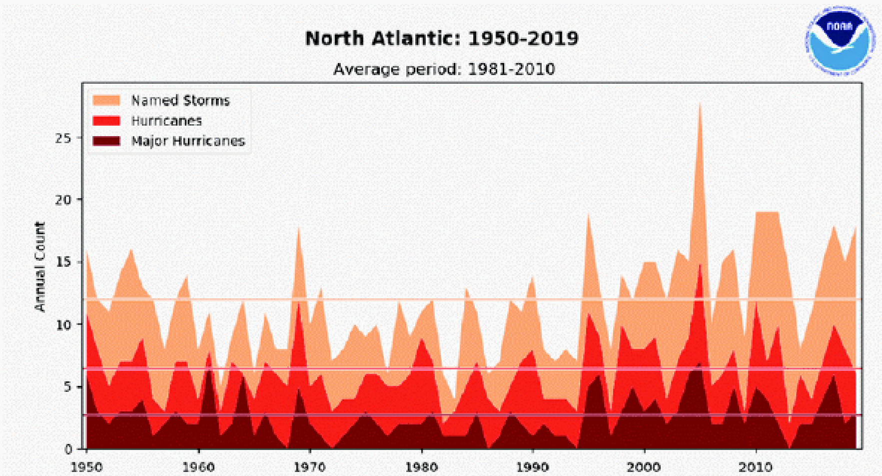
Another threat facing Caribbean SIDS is that of sea level rise. Many Caribbean coastal areas comprise of reclaimed land which house critical infrastructure such as air and sea ports, hotels, and roads. Increased sea levels mean increased risk of damage to this infrastructure. Parts of Port of Spain in Trinidad, more specifically the waterfront and port area, are located on reclaimed land and are at risk to rising sea levels estimated at 1.25m by the end of 21st century.[6] Regionally, Caribbean Sea level rise is estimated to be approximately 2.5 ± 0.4 mm/year (Climate Studies Group Mona (Eds.), 2020).

Figure 1: Map of sea surface temperature trends within the Caribbean and surrounding regions over the period 1982 to 2016.



Source: Climate Studies Group Mona (Eds.), 2020

Figure 2: The number of named storms, hurricanes and major hurricanes per year passing through the North Atlantic and Gulf of Mexico from 1950-2019.



Source: NOAA 2020.

Rising sea levels present risks to the region's freshwater resources and to its largely coastal population (IADB, 2014). For example, it is estimated that in Belize, sea level rise would negatively impact 49-60 per cent of tourist resort properties (CDKN 2014).

Climate change presents major security challenges for the Caribbean, and specifically the SIDS. This is attributed to the heavy dependence of life, livelihoods, and economies on the coast, magnified by the number of disasters which negatively impact populated areas. (Climate Studies Group Mona (Eds.), 2020). The subregion's vulnerability is further exacerbated by its limited land reserve capacity (due to the prevalence of mountainous areas or flood plains), resulting in most investments being limited to areas that are vulnerable to impacts from extreme events. This affects the resilience of Caribbean development, including the nature of adaptation options that can be explored. Further, continuous damage from extreme weather events is costly and diverts funds from development initiatives to recovery and rehabilitation projects (Climate Studies Group Mona (Eds.), 2020).

▸ (continued on page 12)

[5] IUCN. 2018. Latin American and Caribbean countries threatened by rising ocean acidity, experts warn. IUCN Caribbean
[6] Jeppesen, G. et al. 2015. Climate change adaptation case study: sea level rise in Trinidad and Tobago. IADB. Accessed on 30 June 2022: https://publications.iadb.org/publications/english/document/Climate-Change-Adaptation-Case-Study-Sea-Level-Rise-in-Trinidad-and-Tobago.pdf

▸ (continued from page 5)

CLIMATE CHANGE, THE CARIBBEAN SEA, AND THE OCEAN ECONOMY – SECURING LIVELIHOODS OF CARIBBEAN PEOPLE (CONTINUED)

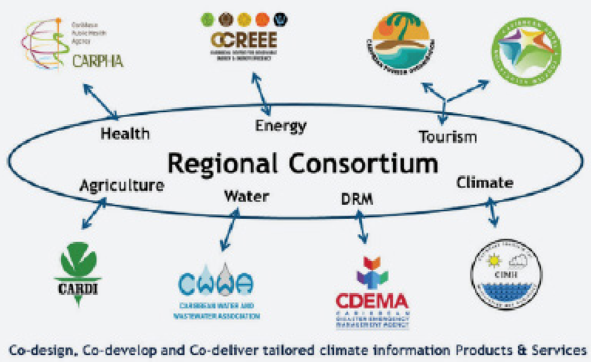
RESPONSES

The issues of climate change, species and habitat loss, and pollution, cannot be addressed in silos, due to the economic, social, and environmental connectivity of these systems. Sustainable management of marine and coastal resources therefore requires a holistic approach[7] (World Ocean Review, 2021).

This drive towards more holistic management approaches does not only pertain to the natural environment, but also to how agencies at the national and regional level cooperate and coordinate to ensure efficiencies of scale. Outlined below are management approaches which incorporate climate change as part of the system and present a best practice for regional coordination.

Working Together Regionally to Develop Early Warning Systems

The Consortium of Regional Sectoral Early Warning Information Systems was established in 2017. It consists of a group of seven regional sector agencies and a regional climate service provider (the CIMH) committed to the co-design, co-development and co-delivery of user-specific and actionable climate information products and services. As a formal, inter-sectoral collaboration mechanism, the Consortium arrangement allows for the identification of areas of joint complementary work and overlapping interests as a basis for partnership (Climate Studies Group Mona (Eds.), 2020). In 2019, the Consortium developed a Regional Roadmap and Plan of Action to guide the implementation of a long-term coordinated, multi-sectoral climate services portfolio for the period 2020-2030. The consortium has also developed tailored climate products and services in the agriculture and food security, disaster risk management, energy, health, tourism, and water sectors (Mahon, 2022).



Partners encompassing the Consortium of Regional Sectoral Early Warning Information Systems
Source: Mahon et al. 2018

Ecosystem-based adaptation is a strategy for adapting to climate change that harnesses nature-based solutions[8] and ecosystem services by protecting coastal habitats.[9] Ecosystem-based adaptation (EbA) involves people using biodiversity and ecosystem services to adapt to the adverse effects of climate change and promote sustainable development. Like community-based adaptation (CBA), EbA has people at its center, and uses participatory, culturally appropriate ways to address challenges, with a strong emphasis on ecological and natural solutions.[10] Use of this management approach requires an understanding of climate impacts and adaptation responses that can be used to advance climate resilience (UN, 2021). The Caribbean Biodiversity Fund with the support of the German Government, established an Ecosystem Based Adaptation Facility which "seeks to help people adapt to the adverse effects of climate change, reduce disaster risk, and build resilient ecosystems and economies."[11]

Marine protected area networks[12] help to promote mitigation and adaptation to climate change by supporting ecosystem resilience (Roberts et al., 2017). More resilient ecosystems can cope with stressors and recover from adverse circumstances, ensuring the maintenance of ecosystems and provisioning services necessary for human well-being (Chong, 2014). To ensure ecosystem resilience, it is important that local stressors (e.g., pollution and destructive fishing pressures) are reduced and managed (UN, 2021). Efforts towards the creation of such a network within the Caribbean are being led by the Specially Protected Areas Wildlife Protocol through the Caribbean Marine Protected Area Management Network and Forum (CaMPAM).[13]

Marine/Maritime Spatial Planning (MSP) is being implemented worldwide to foster sustainable ocean use and management. MSP aims to minimize conflict and promote synergies among users, as well as between users and the environment. Mainstreaming climate change into MSP allows for improved preparedness and response, as well as reduced vulnerability of marine systems (UNESCO IOC, 2021). "Climate-smart MSP" refers to planning initiatives in the ocean space which integrate and may adapt

[7] Management of marine and coastal resources requires the involvement of the public sector, private sector and civil society. It also requires that environmental managers work with planners, civil society and others to identify areas for development and areas for conservation or restoration.
[8] ICUN describes nature-based solutions as actions to protect, sustainably manage, and restore natural and modified ecosystems by simultaneously benefiting people and nature. Accessed 13 September 2022 https://www.iucn.org/our-work/nature-based-solutions
[9] UNEP. Ecosystem Based Adaptation. Accessed 1 June 2022. https://www.unep.org/explore-topics/climate-action/what-we-do/climate-adaptation/ecosystem-based-adaptation
[10] IIED. Ecosystem-based approaches to climate change adaptation. Accessed, 1 June 2022. https://www.iied.org/ecosystem-based-approaches-climate-change-adaptation.
[11] Caribbean Biodiversity Fund. Accessed 13 September 2022. https://www.caribbeanbiodiversityfund.org/programs/climate-change
[12] An MPA network is a collection of individual MPAs or reserves operating cooperatively and synergistically, at various spatial scales, and with a range of protection levels that are designed to meet objectives that a single reserve cannot achieve. IUCN World Commission on Protected Areas (IUCN-WCPA) (2008). Establishing Marine Protected Area Networks—Making It Happen. Washington. Accessed on 13 September 2022 https://www.iucn.org/sites/default/files/import/downloads/mpanetworksmakingithappen_en.pdf
[13] Creating a Marine Protected Area Network in the Caribbean Accessed 13 September 2022: https://www.unep.org/cep/resources/factsheet/creating-marine-protected-area-network-wider-caribbean

to the effects of a changing climate. Climate smart MSP requires that data and information - on the impacts of climate change on marine ecosystems and livelihoods - are needed at appropriate spatial scales and can address uncertainties attributed to climate change (UNESCO IOC, 2021). This can be achieved through adaptive marine spatial plans, which seek to prevent loss of life and property from coastal flooding by establishing early warning systems for tropical storms and include coastal setbacks to protect property and communities from erosion.[14] As part of the Caribbean Regional Oceanscape Project (CROP), Coastal Master and Marine Spatial Plans were developed for five participating OECS countries. The methodology for the development of these plans involved the assessment of climate change risks (such as sea level rise and ocean acidification).[15]

Despite the subregion's continued dependence on its coastal and marine resources for livelihoods, its marine and coastal ecosystems are at risk from several factors. Caribbean countries[16] have begun to adopt a number of integrated management approaches highlighted above, but there is a need to integrate the impacts of climate change into such approaches if they are to successfully adapt. National governments, private sector, civil society, intergovernmental organizations and international donors and development banks need to promote enhanced coordination efforts both at the national and subregional level. The Caribbean must act now if we are to successfully adapt to a changing climate and secure our coastal and marine resources. ■

REFERENCES

Chong, J. (2014). Ecosystem-based approaches to climate change adaptation: progress and challenges. International Environmental Agreements: Politics, Laws and Economics, vol. 14, pp. 391–405. https://doi.org/10.1007/s10784-014-9242-9.

Climate & Development Knowledge Network (CDKN). 2014. "Analyzing Vulnerability of the Coastal Tourism Sector." Retrieved from https://cdkn.org/wp-content/uploads/2014/04/Vulnerability-assessment-report_final.pdf

Climate Studies Group Mona (Eds.). 2020. "The State of the Caribbean Climate". Produced for the Caribbean Development Bank.

Doyle, E., and J. Franks. 2015. Sargassum Fact Sheet. Gulf and Caribbean Fisheries Institute

ECLAC. 2022. A decade of action for a change of era (LC/FDS.5/3), Santiago. https://repositorio.cepal.org/bitstream/handle/11362/47746/S2100984_en.pdf?sequence=4&isAllowed=y

Inter-American Development Bank (IADB). 2014. Climate Change and IDB: Building Resilience and Reducing Emissions. Regional Study: LAC Small Island Developing States. https://publications.iadb.org/publications/english/document/Background-Paper-LAC-Small-Island-Development-States.pdf

Mahon, R, 2022. Linking Climate Early Warning Information to Early Response in Caribbean Tourism. 6th Growth and Resilience Dialogue Presentation. https://www.eccb-centralbank.org/files/Growth%20and%20Resilience%20Dialogues/6th%20G%26RD/Dr__Roch%C3%A9_Mahon%20Linking%20Early%20Warnings%20to%20Early%20Response%20Mechanisms.pdf

Mahon, R., et al. 2018. Climate Services and Caribbean Resilience: A Historical Perspective. Social and Economic Studies 67: 2 & 3: 239—260. ISSN: 0037-7651

NOAA. 2021. Ocean Acidification in the Caribbean. NOAA COASTWATCH https://coastwatch.noaa.gov/cw/stories/how-our-data-are-used/ocean-acidification-in-the-caribbean.html

Oxenford, H.A., D. Johnson, and J. Franks. 2015. "Facing the Threat of Sargassum Seaweed, Presented to the Symposium: Challenges, Dialogue and Cooperation Towards Sustainability of the Caribbean Sea, Port of Spain, Trinidad and Tobago." November 23-24, 2015. http://www.acs-aec.org/sites/default/files/oxenford__sargassum_acs_symposium_2015_23_ nov.pdf.

Patil, P.G., Virdin, J., Diez, S.M., Roberts, J., Singh, A. (2016). Toward A Blue Economy: A Promise for Sustainable Growth in the Caribbean; An Overview. The World Bank, Washington D.C.

Roberts, Callum M., and others (2017). Marine reserves can mitigate and promote adaptation to climate change. Proceedings of the National Academy of Sciences of the United States of America, vol. 114, No. 24, pp. 6167–6175. https://doi.org/10.1073/pnas.1701262114.

World Ocean Review. 2021. Marine Management – Aspiration and Reality.

WOR 7 The Ocean, Guarantor of Life – Sustainable Use, Effective Protection https://worldoceanreview.com/en/wor-7/marine-management-aspiration-and-reality/new-approaches-to-marine-management/.

United Nations Environment Programme (2019). State Of the Cartagena Convention Area: An Assessment of Marine Pollution from Land-Based Sources and Activities in the Wider Caribbean Region. https://wedocs.unep.org/20.500.11822/36346.

United Nations Environment Programme (2020). The State of Nearshore Marine Habitats in the Wider Caribbean. https://wedocs.unep.org/20.500.11822/36352.

United Nations, 2021. The Second World Ocean Assessment: World Ocean Assessment II. Volume II. https://www.un.org/regularprocess/sites/www.un.org.regularprocess/files/2011859-e-woa-ii-vol-ii.pdf

UNESCO-IOC. 2021. MSP global Policy Brief: Climate Change and Marine Spatial Planning. Paris, UNESCO. (IOC Policy Brief no 3) https://unesdoc.unesco.org/ark:/48223/pf0000375721

[14] World Bank, 2021. Climate Informed Marine Spatial Planning . Knowledge Fact Sheet Series 2. PROBLUE.

[15] Dominica Coastal Master and Marine Spatial Plan Accessed 13 September 2022: https://oecs.org/en/our-work/knowledge/library/ocean-governance/dominica-coastal-master-and-marine-spatial-plan

[16] The French Territories of Martinique and Guadeloupe have adopted Marine Protected Networks. Jamaica, and Dominican Republic, Grenada and Saint Lucia have implemented EBA projects. Marine Spatial Plans have been developed in St Kitts and Nevis, Dominica, Saint Lucia, Saint Vincent and the Grenadines and Grenada under the CROP.