

**2018 -
2023**

Action Plan for Corals and Reefs in Jamaica

**Ecosystems Management Branch
National Environment and
Planning Agency
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(Revised September 2019)**

ACTION PLAN for CORALS and REEFS in JAMAICA

2018 - 2023

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ACRONYMS AND ABBREVIATIONS

APCAR - Action Plan for Corals and Reefs in Jamaica
CBD - Convention on Biological Diversity
CITES - Convention on International Trade in Endangered Species of Wild Fauna and Flora
CRHI - Coral Reef Health Index
EEZ - Exclusive Economic Zone
ERMD – Environmental Risk Management Division
FAD - Fish Aggregating Device
GCRMN - Global Coral Reef Monitoring Network
GDP - Gross Domestic Product
GLOBE – GLOBE International
GOJ - Government of Jamaica
IAS - Invasive Alien Species
ICRI - International Coral Reef Initiative
IPM - Integrated Pest Management
IWCAM - Integrated Watershed and Coastal Area Management
IYOR - International Year of the Reef
JCRAP - Jamaica Coral Reef Action Plan
JCRMN - Jamaica Coral Reef Monitoring Network
JDFCG – Jamaica Defence Force Coast Guard
JSIF – Jamaica Social Investment Fund
MICAF – Ministry of Industry, Commerce, Agriculture & Fisheries
MPA - Marine Protected Area
NBSAP - National Strategy and Action Plan on Biological Diversity in Jamaica 2016-2021
NCOCZM - National Council on Ocean and Coastal Zone Management
NEPA - National Environment and Planning Agency
NGO – Non-Governmental Organization
NRCA - Natural Resources Conservation Authority
ODPEM – Office of Disaster Preparedness & Emergency Management
RADA – Rural Agricultural Development Authority
Ramsar Convention - The Convention on Wetland of International Importance especially as Waterfowl Habitat
SDC – Social Development Commission
SPAW - Specially Protected Areas and Wildlife Protocol
UNFCCC – United Nations Framework Convention on Climate Change
UNDP - United Nations Development Programme
USCRTF - United States Coral Reef Task Force
UWI - The University of the West Indies

1.0 EXECUTIVE SUMMARY

Coral reefs provide economic and environmental services to millions of people and are one of the world's most threatened ecosystems. The effects from multiple stressors such as global climate change and direct human impacts are overwhelming their natural resilience and threatening to alter them irrecoverably. The most effective management approaches to protect these ecosystems are to significantly reduce all direct human impacts on them in order to build their resilience to the long-term effects of climate change, and joining the international calls which promote safeguarding biodiversity, wise use and protection of coastal ecosystems.

This updated Action Plan for Corals and Reefs in Jamaica (APCAR) builds on information presented in APCAR 2010 and provides clear and targeted actions to build resilience in coral reef ecosystems and in the people that rely on them over the five year period 2018-2023. The plan purports strategies and actions that are formulated based on guiding principles which integrate both biological and social resilience in line with the National Strategy and Action Plan on Biological Diversity in Jamaica (2016 - 2021) and the Aichi Targets 6, 7, 8, 9, 10, 11, 14 and 15 outlined in the Convention on Biological Diversity (CBD) Strategic Plan 2012.

If fully implemented, these actions will help to ensure that coral reefs continue to provide invaluable ecological, social and economic services to future generations and that their beauty, diversity and power to inspire will remain undiminished.

The plan lays out measures to better understand coral reef ecosystems and address and reduce the impacts of human activities through research, monitoring, policy promulgation and implementation as well as enforcement. It provides a framework for smart investment in coral reefs and associated coastal ecosystems by adopting an ecosystem-based adaptation approach that encompasses both the social and ecological aspects of the coastal environment. We live in an ever-changing world and as we proceed with this plan we have the expectation that based upon our continual assessment of our environmental, social and economic conditions, reviews and adjustments will be made accordingly. By acting now to reduce our impacts and dependence on coral reef ecosystems, we can provide a buffer to some of the long-term effects of climate change, reduce adaptation costs and contribute to achieving poverty reduction and sustainable development goals.

In addition to specific action strategies the plan also encourages citizens to foster an ethic of active participation and sharing of responsibility to care for our reefs. This challenge of safeguarding corals and reefs cannot be met by governmental action alone. Rather, it will require both concerted efforts and sustained

collaboration by many public and private entities concerned with the fate of coral reefs locally and worldwide.

2.0 INTRODUCTION

Jamaica's corals, reefs and its associated seagrass beds and mangrove forests are experiencing constant pressure from an array of sources namely coastal development, over-exploitation, pollution, habitat destruction, invasive species, disease, coral bleaching and global climate change. The rapid change of these complex and biologically diverse ecosystems has significant social, economic and environmental impacts across the country.

This *Action Plan for Corals and Reefs in Jamaica (APCAR)* builds on previous efforts such as the Draft *Jamaica Coral Reef Action Plan*, the International Coral Reef Initiative (ICRI) *Call to Action* and *Framework for Action* and the *Tropical Americas' Agenda for Action* which were intended to mobilize governments and other stakeholders whose coordinated, vigorous and effective actions are required to sustain fragile coastal resources, and the communities which depend on them.

The goal is not to create a static plan that will become obsolete in a few years, but rather a dynamic *road map* for conserving and protecting Jamaica's corals and reefs. Consequently, it is intended to be revisited, evaluated and updated regularly as conditions change and the relevant adaptive management strategies incorporated. As an integral part of this iterative process, memoranda of understanding between the National Environment and Planning Agency (NEPA), universities, research institutions and other relevant stakeholders will be formulated for the implementation and execution of specific portions of this plan.

PURPOSE

This action plan will chart a course that results in a reversal of the decline of Jamaica's coral reef through effective collaboration of government and non-government stakeholders.

OBJECTIVE

The conservation and ecologically sustainable use of corals and reefs in the Jamaican archipelago for the use and enjoyment of present and future generations and for their intrinsic biodiversity, ecological, aesthetic and other values from which benefits accrue.

The current document represents an update to the APCAR dated October 2010 and presents actions to be undertaken towards coral reef management until 2023. An overview of activities forwarded in the previous APCAR dated 2010 is presented below along with a status update on various activities implemented for the target period.

Table 1: Update on APCAR 2010 - 2017

UPDATE on APCAR 2010 - 2017

Conservation Strategies	Plan of Action	Status to date
Map Coral Reefs	<ul style="list-style-type: none"> Produce digital maps of all coral reefs that address locally identified conservation and management needs. 	<ul style="list-style-type: none"> Map of all reefs systems island wide in a GIS format. Completed
Monitor, Inventory and Assess Reef Status	<ul style="list-style-type: none"> Monitor reef habitats of high value and reefs in the vicinity of offshore cays and banks. Comprehensive report and a scorecard on reef health is to be produced every five (5) years 	<ul style="list-style-type: none"> Currently have data from 96 reef locations island-wide. Offshore cays and banks are still outstanding. Annual status reports have been produced on monitoring conducted since 2007. Comprehensive report prepared in 2013 Coral Reef Health Index Reports produced in 2012, 2014, 2016 & 2017.
Conduct Strategic Research	<ul style="list-style-type: none"> Develop a resilience/ coral bleaching monitoring and response plan. 	<ul style="list-style-type: none"> Coral Bleaching monitoring and response plan formulated with input from consultations with recreational and scientific divers. 27 sea surface temperature data-loggers installed island-wide.
Understanding the Human Dimension	<ul style="list-style-type: none"> Economic valuations of coral reef ecosystems. Site specific socio-economic studies in order to resolve user conflicts. Evaluating examples of best practices and lessons. Strategic Intervention *Co-management of coastal resources* 	<ul style="list-style-type: none"> Some staff members have received NRV training Plans to have consultations on the Beach Policy during 2013-2014. MOUs signed with NGOs to undertake management of some MPAs.

Jamaica and ICRI

It is noteworthy that Jamaica was one of the original eight co-sponsors of the ICRI (along with Australia, France, Japan, the Philippines, Sweden, the United Kingdom and the United States of America). The work of ICRI to develop the international *Framework* focuses on how the international community can support regional, national and local activities. The Tropical Americas' *Agenda for Action* consists of an evolving regional process outlining initial next steps, mostly national actions, to provide an early basis for enhanced regional collaboration. This APCAR is intended to be applied in a local context to protect this delicate but essential resource.

Fundamental Themes

Research and evaluation of available information have identified two fundamental themes that must be addressed to allow for the conservation and wise use of coastal resources. These identified themes require immediate and sustained national action.

Within these broad themes, several integrated conservation strategies have been proposed to comprehensively meet the most pressing challenges facing Jamaican corals and reefs today. These include tangible field-based actions and a suite of *guiding principles* to direct the government's future actions to ensure an integrated, consistent, sustainable and inclusive approach to conserving corals and reefs.

FUNDAMENTAL THEMES

- *Understand coral reef ecosystems and the natural and anthropogenic processes that determine their health and viability;*
- *Reduce anthropogenic impacts and take immediate action to quickly reduce the adverse impacts of human activities on coral reefs and associated ecosystems.*

Biodiversity Strategies

In addition to the execution of the fundamental themes, Jamaica has taken other steps towards the conservation of coral reef ecosystems. This includes the preparation of the *National Strategy and Action Plan on Biological Diversity in Jamaica (NBSAP) 2016-2021*. The report outlines the situational analysis of Jamaica's biodiversity and arising challenges. This NBSAP 2016-2021 was prepared to achieve Article 6 of the Convention on Biological Diversity (CBD) to which Jamaica is a signatory. It also incorporates the required revisions outlined in CBD's Strategic Plan 2012, which outlined 5 Strategic Goals and 20 Aichi Targets that Jamaica has chosen to undertake. The strategies guided the Implementation Plan presented in the NBSAP and outlines activities to be streamlined across sectors to achieve conservation and preservation of biodiversity required for Jamaica. Some key strategies for coral reef ecosystems outlined in the document are highlighted below:

- Fisheries - Increase the coverage and enforcement of Marine Protected Areas.
- Tourism - Conduct carrying capacity assessment of sensitive ecosystems such as coral reefs, rivers, mangroves, forests and other sensitive natural ecosystems.
- Coastal and Marine Protection - Enhance protection against marine invasive species; minimize the impact of dredging activities and enhance preparedness for marine oil spills.

The plan purports strategies and actions that are formulated based on guiding principles which integrate both biological and social resilience in line with the National Strategy and Action Plan on Biological Diversity in Jamaica (2016 - 2021) and Aichi Targets 6, 7, 8, 9, 10, 11, 14 and 15 outlined in CBD's Strategic Plan 2012. See excerpt of Aichi Targets that integrate both biological and social resilience below:

Table 2: Excerpt of Aichi Targets Outlined in CBD's Strategic Plan 2012

<p>1.0</p> 	<p align="center">Target 6</p> <p>By 2020 all fish and invertebrate stocks and aquatic plants are managed and harvested sustainably, legally and applying ecosystem based approaches, so that overfishing is avoided, recovery plans and measures are in place for all depleted species, fisheries have no significant adverse impacts on threatened species and vulnerable ecosystems and the impacts of fisheries on stocks, species and ecosystems are within safe ecological limits.</p>
	<p align="center">Target 7</p> <p>By 2020 areas under agriculture, aquaculture and forestry are managed sustainably, ensuring conservation of biodiversity.</p>
	<p align="center">Target 8</p> <p>By 2020, pollution, including from excess nutrients, has been brought to levels that are not detrimental to ecosystem function and biodiversity.</p>
	<p align="center">Target 9</p> <p>By 2020, invasive alien species and pathways are identified and prioritized, priority species are controlled or eradicated, and measures are in place to manage pathways to prevent their introduction and establishment.</p>
	<p align="center">Target 10</p> <p>By 2015, the multiple anthropogenic pressures on coral reefs, and other vulnerable ecosystems impacted by climate change or ocean acidification are minimized, so as to maintain their integrity and functioning.</p>
	<p align="center">Target 11</p> <p>By 2020, at least 17 per cent of terrestrial and inland water, and 10 per cent of coastal and marine areas, especially areas of particular importance for biodiversity and ecosystem services, are conserved through effectively and equitably managed, ecologically representative and well connected systems of protected areas and other effective area-based conservation measures, and integrated into the wider landscapes and seascapes.</p>
	<p align="center">Target 14</p> <p>By 2020, ecosystems that provide essential services, including services related to water, and contribute to health, livelihoods and well-being, are restored and safeguarded, taking into account the needs of women, indigenous and local communities, and the poor and vulnerable.</p>
	<p align="center">Target 15</p> <p>By 2020, ecosystem resilience and the contribution of biodiversity to carbon stocks has been enhanced, through conservation and restoration, including restoration of at least 15 per cent of degraded ecosystems, thereby contributing to climate change mitigation and adaptation and to combating desertification.</p>

3.0 CORALS and REEFS

3.1 CORALS and REEFS - ECOSYSTEMS AT RISK

3.1.1 Invaluable Coastal Ecosystems

Jamaica has 1,240 square kilometers of reefs within its Exclusive Economic Zone (EEZ) which hosts 64 hard coral species, 43 soft coral species and 8 black coral species. Fringing reefs and patchy fringing reefs occur mostly along the north and east coasts and on the broader shelf of the south coast respectively (Coral Reefs of Jamaica, 2007 quoted by NEPA, 2016a)¹. Apart from the reefs immediately surrounding Jamaica's mainland, reefs and corals are present on the banks and shoals within Jamaica's Exclusive Economic Zone – inclusive of Brune Bank and the Pedro Cays and Bank to the south, the Morant Cays and Bank to the southeast, and the Formigas Banks to the northeast (Coral Reefs of Jamaica, 2007 quoted by NEPA, 2016a). Additionally, reef habitats play a central cultural role among many coastal communities where subsistence fishing has been practiced for generations. Healthy marine ecosystems are also critical to development strategies to promote economic and food security, improved human health, disaster and climate change mitigation, and biodiversity conservation. They are critical to the survival of the tourism industry and vast economic benefits are derived from reef related or associated activities. These extremely valuable ecosystems constitute the economic base and future hope for sustained development in many countries, particularly small island nations.

The ecological health and economic benefits of coral reefs are directly and intimately connected with those of reef habitats in other countries as currents circulate through-out the region by way of the Florida Keys, the wider Caribbean and along the coast of Central America. These water masses carry essential larvae and juvenile corals, fish, and other invertebrates that replenish our reefs. They can however also carry potentially harmful pollutants, diseases and invasive species.

Coral reefs provide a vast array of valuable services. Worldwide economic estimates indicate that a single hectare of coral reefs provides annual services to humans valued at US \$130,000 on average, rising to as much as US\$1.2 million or US\$172-375 billion per annum if all services worldwide are included (Diversitas [2009, October 28]; GLOBE International, 2010). As reported in GLOBE International (2010), they provide food and raw materials, a physical barrier to protect coasts from extreme weather events, help to regulate climate and generate substantial

¹ National Environment & Planning Agency (2016a). *National Strategy and Action Plan on Biological Diversity in Jamaica*. Kingston, Jamaica.

tourism revenue. Over 20% of Caribbean coastline is protected by coral reefs. Estimated value of this service is between \$700 million and \$2.2 billion. Reef degradation could result in losses estimated between US\$140 million to US\$420 million per year by 2050².

In Jamaica, chief among these services are tourism, fishing, coastal protection and biodiversity. Ironically, the value of coral reefs to the nation is matched only by their vulnerability to harmful environmental changes, particularly those resulting from human activities. The degradation of coral reef ecosystems puts at risk the communities that depend upon them for services, jobs, food security and protection. Present estimates are that live hard coral cover on Jamaica's reefs averages 23.3%, ranging between 1.6% and 59.4% (NEPA, 2016b)³. Annual coral cover since 2011 has remained above 10% with an average of 18.5% for the five-year period (2011-2015). This trend represents a 44.7% increase over the average of the preceding four-year period (2007-2010) when the average was 12.8% (NEPA, 2016b) and even though encouraging, is still below the averages of reefs in Bonaire (38.4%)⁴.

3.1.2 Reefs in Crisis

Corals and reefs are critically threatened by the combined effects of climate change coupled with direct and indirect human impacts. Climate change is recognized as the most serious long-term threat to coral reefs and global temperature changes have already resulted in considerable damage. Temperature induced mass coral bleaching and the process of ocean acidification has already begun to affect marine life and affecting the ability of corals to maintain the complex structures we know today as coral reefs.

In addition to climate change, the anthropogenic threats to coral reefs have also been exhaustively documented and evaluated. In recent years all but the most remote reefs have been impacted by human pressures. An estimated 10% of the world's reefs have already been lost through the actions of humans; a further 30% is predicted to be lost in the next 20 to 40 years if such pressures continue unabated (USCRTF, 2000)⁵.

² http://www.icriforum.org/sites/default/files/ICRIGM24_Econ_valuation_Overview.pdf. Retrieved 22 August 2017.

³ National Environment & Planning Agency (2016b). *A Report Card for Reefs: Analysing reef health trends on coral reef sites*, Kingston, Jamaica.

⁴ Steneck, R.S. (2015) *Patterns and trends in corals, seaweeds*. In: Steneck, R.S., S.N. Arnold., R. de León & D.B. Rasher (Eds.) *Status and Trends of Bonaire's Reefs in 2015: Slow but steady signs of resilience*. 93pp

⁵ The National Action Plan to Conserve Coral Reefs. United States Coral Reef Task Force, Washington D.C.34 pp.

In Jamaica, calculating and reporting on Coral Reef Health Index (CRHI) via a report card has become a method of effectively tracking reef status. This is conducted every two years and allows for easy dissemination and understanding of technical information on reef health and resilience. Since the 2011 report card and subsequent reports on health index, the calculated overall Health Index indicates a poor outlook for the reefs. This trend continued in 2015 which reported 2.2 as the calculated overall CRHI, this implies that the reefs are in a poor state (NEPA, 2016b).

Determining the Coral Reef Health Index

Indicator Description

Coral cover: proportion of reef surface covered by live stony corals which form the three-dimensional network of the reef (recorded as % cover).	Macro-algal cover: proportion of reef surface covered by fleshy algae (recorded as % cover).
Herbivorous fish abundance: biomass of surgeonfish and parrotfish; the most important grazers on plants that could overgrow the reef (recorded as g/100m ²).	Commercial fish abundance: biomass of fish species (grunts, groupers, snappers) which are commercially significant in Jamaica (recorded as g/100m ²).

Coral Reef Health Index (CRHI)

Very Good: >4.2 - 5 **Good:** >3.4 - 4.2

Fair: >2.6 - 3.4 **Poor:** >1.8 - 2.6

Critical: 1 - 1.8

Index Calculations

The grades are calculated by converting the mean data-value of each indicator into a condition ranked from one ('critical') to five ('very good'), based on pre-determined data ranges. The four grades are averaged to obtain the health index score for each site.

3.1.3 The Global Response to the Coral Reef Crisis

The International Coral Reef Initiative. The global decline in coral reef health galvanized an international movement to save these invaluable ecosystems and in 1994, the International Coral Reef Initiative (ICRI) and its Framework for Action and Call for Action were created. ICRI and its Global Coral Reef Monitoring Network (GCRMN), has been instrumental in the monitoring and reporting on the "Status of Coral Reefs of the World". In a recent statement from ICRI, specifically the

representatives of the Government of the wider Caribbean region, to the 14th Cartagena Convention for the Protection and Development of the Marine Environment of the Wider Caribbean Region 17 March 2017 a call was made for a number of actions towards the protection of coral reef ecosystems to be implemented, some of which include:

- Encouraging the establishment of measures to protect coral reefs, mangrove forests and seagrass beds, as called for by the ICRI Plan of Action.
- Endeavouring to protect at least 10% of the marine environment by 2020 and to implement effective management measures for those areas (Aichi Target 11).
- Strengthening scientific cooperation, inter alia, through stakeholder networks, to address specific challenges encountered in the wider Caribbean region, such as protection of biodiversity, ocean acidification, and *Sargassum* sp. influx.

HUMAN IMPACTS ON CORAL REEFS

Pollution - including eutrophication and sedimentation from poor or overly intensive land use, sewage, chemical loading, oil and chemical spills, marine debris.

Over-exploitation and destructive fishing practices - overfishing of reef species for recreational and commercial purposes, and the collateral damage and degradation to habitats and ecosystems from these activities. This includes chemical and dynamite fishing that can destroy large sections of reef.

Dredging and shoreline modification - in connection with coastal navigation or tourism developments.

Vessel groundings and anchoring - that directly destroy corals and reef framework.

Disease outbreaks - that are increasing in frequency and are affecting a greater diversity of coral reef species.

Global climate change - associated impacts including increased coral bleaching, ocean acidification, mortality, hurricane frequency and intensity, and sea level rise.

Alien invasions - the introduction of species through ballast water from ships, illegal importation of pets and the accidental introduction of species resulting in the invasion of areas by more aggressive species (Lion fish, Green Mussel etc.).

The United Nations Framework Convention on Climate Change (UNFCCC).

The UNFCCC was adopted in 1992 with the focus of stabilizing greenhouse gas concentrations in the atmosphere. This was followed by the subsequent adoption of the Kyoto Protocol in 1997 and the Paris Agreement in 2015. The aim of the Paris Agreement is to strengthen the global response to the threat of climate change by keeping a global temperature rise below 2°C above pre-industrial levels and to pursue efforts to limit the temperature increase even further to 1.5°C.

The Intergovernmental Panel on Climate Change, IPCC 2018 special report suggests limiting global warming target to 1.5°C compared to 2°C as this is projected to reduce increases in ocean temperature and ocean acidity and reduce decreases in ocean oxygen levels. Limiting global warming to 1.5°C is therefore expected to reduce risks to marine biodiversity, fisheries, and ecosystems, and their functions and services to humans. The risks of climate-induced impacts are projected to be higher at 2°C than those at global warming of 1.5°C. Coral reefs, for example, are projected to decline by a further 70–90% at 1.5°C with larger losses (>99%) at 2°C. The risk of irreversible loss of many marine and coastal ecosystems increases with global warming, especially at 2°C or more.

The Convention on Wetlands of International Importance especially as Waterfowl Habitat (Ramsar Convention).

The international convention on wetlands signed in Ramsar Iran in 1971 also has coral reefs listed as a wetland type and hence areas of vital importance. This Convention promotes the wise, or sustainable, use of wetlands, including coral reefs, and encourages international cooperation for the management of shared wetlands. “Since 2009, the Ramsar Caribbean Regional Initiative on Wetlands has brought together countries from the region to work towards the sustainable management of wetlands.

The Contracting Parties in Recommendation 6.7 called for the conservation and wise use of coral reefs and associated ecosystems and urged the Convention Bureau to support the ICRI’s Call to Action and Framework for Action in Ramsar activities whenever appropriate, by undertaking research and monitoring as outlined in the Convention’s Strategic Plan 2016-2024 that will contribute to the sustainable use and conservation of coral reefs and associated ecosystems. The Strategic Plan lays out a new vision under the Convention mission, four overall goals and 19 specific targets which are designed to support the efforts of Parties, partners and other stakeholders in preventing, stopping and reversing the global decline of wetlands (including coral reefs).

Jamaica became a signatory to this Convention in 1997 and has since designated four wetland areas to the Ramsar List of Wetlands of International Importance. It is significant to note that two of these sites, Palisadoes-Port Royal and Portland Bight Wetland and Cays, have within them significant areas of corals and reefs.

3.1.4 National Action in Support of Coral Reef Protection

There have been varied and diverse actions geared towards protecting corals and reef. With the formulation of the Jamaica Coral Reef Action Plan (JCRAP) in 1999 the Government of Jamaica (GOJ), first through the Natural Resources Conservation Authority (NRCA) and later the National Environment and Planning Agency (NEPA) have instituted several actions geared at conserving coral reefs. These have been based primarily around two fundamental themes that have been universally recognized as critical to reef conservation efforts. These two themes “Understanding Coral Reef Ecosystems” and “Reducing Anthropogenic Impacts on the Sea” have been subdivided into nine (9) distinct conservation *strategies* as follows:

Understand Coral Reef Ecosystems –

1. *Create comprehensive coastal atlas which includes detailed maps of coral reef habitats.*
2. *Conduct long-term monitoring and assessments of reef health and trends.*
3. *Support strategic research to respond to the major threats to reef health.*
4. *Incorporate the human dimension into coral reef conservation strategies.*

Reduce Anthropogenic Impacts on the Sea –

1. *Strengthen the network of Marine Protected Areas that have properly delineated use zones and ‘no take’ type designations.*
2. *Reduce pollution and habitat destruction.*
3. *Rehabilitate damaged reefs.*
4. *Create an informed public on coral reef.*
5. *Facilitate supplemental or alternative livelihoods to reduce dependence on the exploitation of reef species.*

In addition to JCRAP and its successor APCAR 2010-2015 other interventions have been undertaken. These are highlighted below:

Jamaica Coral Reef Monitoring Network (JCRMN). The JCRMN has sought to design and implement management, education, monitoring, research and restoration efforts to conserve and sustainably use coral reef ecosystems. This entity was formed in June 2003 and is an Ad Hoc grouping of individuals and agencies involved in reef and coastal conservation issues. Coral reef monitoring is

mainly conducted by NEPA and there is currently data from 95 reef sites island-wide. Monitoring data has been reported on since 2007 in the annual Coral Reef Status and Trends report.

International Year of the Reef (IYOR). In 1997, the year of the first IYOR, Jamaica joined many other nations in activities to raise public awareness about the importance of conserving coral reefs and to facilitate actions to protect coral reef ecosystems. This was again the case in 2008 and 2018 when the second and third International Year of the Reef were declared.

Reef Rehabilitation Projects. In response to the increased threats from climate change, several reef rehabilitation projects have been established primarily by NGOs with management responsibilities for Protected Areas. These projects aim to strengthen coastal and reef resilience and provide habitat for marine life. Efforts are also geared towards increasing the population of endangered coral species and increasing coral cover by out-planting to restoration sites. The rehabilitation projects which consist of coral nurseries and out-planting sites will also provide an attraction for tourists, and potential income generation and employment for local stakeholders as tour guides and coral gardeners (NEPA, 2016b).

Reef Assessment Training and Certification Workshop. In 2015, in an effort to increase and strengthen the capacity of protected area managers to effectively monitor and report on reef trends in the marine spaces which they manage, training in the reef monitoring method Reef Check™ was conducted. The training and certification workshop was designed for both scientific and non-scientific divers to understand the goals of reef assessments and the usefulness of the standard Reef Check method in the collection of strong scientific data.

All participants completed the Reef Check EcoDiver Certification course which has resulted in an increased capacity to conduct reef monitoring activities island-wide (NEPA, 2016b). Delivery of training to employ GCRMN Caribbean protocol (level III reef assessment) for standardisation with the region for robust data and comparisons, should be made a priority.

Citizen Science: Eyes on the Reef (Bleach Watch). In 2011 training in the identification and reporting of coral bleaching was extended to Watersport Operators and scientific divers. This signaled the formation of a cadre of 'Eyes on the Reef' experts and the formulation of a coral bleaching monitoring and response plan (NEPA, 2016b). This is one of the plan of actions outlined for resilience/bleaching monitoring and response planning. The bleach watch programme will allow for an early warning system to predict bleaching events and a

response mechanism to be activated in the event of bleaching. This will also facilitate contribution of data to the regional bleach watch platform.

Watershed Management Area. Through projects such as the 'Integrated Management of the Yallahs and Hope Watershed Management Areas Project' and 'Watershed Area Management Mechanism (WAMM)' implemented in Drivers River Watershed, Portland 2009, Jamaica aims to undertake strategic land based interventions such as reforestation and agroforestry on critically degraded lands in the upper reaches of various Watershed Management Units (WMU). These interventions coupled with extensive training of farmers in best land husbandry practices and ongoing public education campaigns should reduce deforestation, restore biodiversity and increase carbon sequestration. It should also result in a reduction in sediment flow and an improvement in the quality of water flowing from the WMUs and subsequently reduce coastal turbidity.

In a continued thrust to improve the ecosystems, some of the WAMM activities have been replicated in other WMUs:

- Montego River: Developing Sustainable Livelihoods,
- Wag Water River: Capacity Building Trough Training,
- Rio Minho: Capacity Building Trough Training),
- Great River: Capacity Building Trough Training),and
- Yallahs/Hope River: Developing Sustainable Livelihoods- implement two initiatives – (1) Farmer Training and (2) Provision of Agriculture Material.

Marine Invasive Species. The 'Mitigating the Threats of Invasive Alien Species (IAS) in the Insular Caribbean' Project 2009 – 2013 aimed to mitigate the threat to local biodiversity and economy from IAS in the insular Caribbean, including terrestrial, freshwater, and marine ecosystems. One of the project output examined mechanisms for marine IAS control and management. The project supported the implementation of a pilot project on the management and control of lionfish in Jamaica. The project facilitated a national public education campaign: "*Let's Eat It to Beat It*" with support from the private sector. The project implemented various strategies including conducting scientific research, public awareness and community outreach programmes and promoting consumption of the fish.

Regulations and Guideline Documents. Over recent years the Government has developed various regulations and guidelines that contributes to the improvement of water quality within the freshwater and marine environment. These include:

- Ban on importation of phosphate-based detergent.
- Promulgation of Natural Resources Conservation (Wastewater and Sludge) Regulations (April 2013).

- Ocean and Coastal Zone Management Policy
- The Coastal Resources and Wetlands Policy, establishing guidelines for the protection and conservation of coral reefs, seagrasses and coastal wetlands.
- Coastal management and beach restoration guidelines: Jamaica
- Draft Overarching Policy for Jamaica's System of Protected Areas 2013 to 2017.
- Draft Jamaica National Ambient Water Quality Standard – Marine Water, 2009.

3.1.5 Constraints on Action

In addition to the combined effect of climate change and human impacts, the coral reef crisis is also a crisis of governance. Ensuring the survival of coastal ecosystems will require dramatic and bold steps along with strong political leadership. Although healthy coral reefs are vital to the economies of many nations through fisheries and tourism, political commitment to protecting coral reefs is often weak. This is partly due to the absence of the resource valuation which highlights the full economic value of reefs and the services they provide. This has resulted in a lack of recognition within many levels of government of the crucial importance of coral reef ecosystems in providing both social and economic benefits as well as a lack of appreciation of their intrinsic value. In addition, major capacity gaps in government departments, particularly those dealing with the environment or fisheries, often means that right advice is not reaching the decision makers (GLOBE International, 2010).

Resource Constraints. Ideally, ecosystem-based management of coral reefs and contiguous ecosystems must be made a higher priority within government, and funding for sustainable, reef resilience-boosting measures for coral reefs must be dramatically increased. In the local context, multiple agencies, departments, ministries and levels of government have managerial responsibilities for various aspects of coastal resources. The action plan therefore assumes that agencies will work cooperatively whenever their missions, authorities and resources allow for the implementation of actions laid out in this plan. All actions are subject to appropriations and budgetary constraints in the context of all administration priorities. Moreover, individual agency priorities from year to year will reflect emerging threats and needs, as well as new technologies available to meet those challenges.

Legal and Policy Constraints. In addition to fiscal constraints all actions proposed in this plan to protect coral reefs must conform to legal and policy limits set forth in domestic policy and international law. These include: applicable legal authorities; available appropriations; intergovernmental agreements; international laws, rules and standards, including the Law of the Sea Principles as reflected in the

United Nations Convention on the Law of the Sea; prior uses required by law and national security.

Annual Priorities. In recognition of the fluid nature of the challenge of protecting coastal ecosystems a comprehensive strategy for permanently conserving coral reefs, without specifying priorities has been developed. Consequently, the Action Plan would require the participation of various agencies in specific conservation objectives but does not represent a binding agreement for implementation as this will be driven by the prevailing economic situation and the extent of budgetary support available.

3.2 CORALS and REEF - CONSERVATION CORE PRINCIPLES

CORE PRINCIPLES

The core principles upon which the action plan is based are:

- *Ecosystem-based approach*
- *Integrated management*
- *Collaboration and stewardship*
- *Adaptive management*
- *Precautionary Approach*
- *"No net loss" Principle*
- *Zoning of resources*

The aim is to adopt a science-based ecosystem approach to coral reef conservation that recognizes and builds upon important linkages among adjacent and remote habitats associated with coral reefs. Under the ecosystem-based approach, the integrity of the ocean environment from which we derive so many of our benefits will be maintained as a whole in a sustainable manner. An integrated management system will be applied where the planning is comprehensive and coordinated. This planning will be based on the balanced consideration of the full range of activities, interests and environmental, social, cultural, economic and governance objectives of the coastal and marine environment. Integrated management will be achieved through collaboration with all interested and affected parties in an open, inclusive process and by engaging existing entities/organizations to implement management programs and develop, where needed, new legal mechanisms that protect, restore and enhance coral reef ecosystems. This is collaboration with the aim of fostering stewardship and gaining buy-in. In incorporating the human dimension into coral reef conservation strategies, management measures will reflect and be sensitive to the local socioeconomic environment. These measures will also result in an

informed and engaged public which is able to choose alternatives to activities that harm coral reefs.

We live in an ever-changing world with constantly evolving thought processes and operating procedures. As such adaptive management approaches that track and respond to environmental change and emerging threats will also be employed. This will however be coupled with the application of the precautionary principle which will be initiated in the absence of scientific certainty to ensure the implementation of appropriate measures to protect coral reefs. Where possible a “no net loss” principle will be applied in the decision-making processes for developments. Degraded reefs should be restored using suitable restoration techniques such as the establishment of artificial reef structures which aim to provide the same ecological function as the area to be impacted by development activities. Relocation of suitable species will also be required. Zoning of resources especially those located in marine protected areas (MPA)⁶ type designations such as marine parks and no-take ecological reserves (Fish Sanctuaries) will allow for the protection and replenishing of coral reef ecosystems by minimizing harmful human impacts and user conflicts in important habitats.

⁶ The term “marine protected area” is not defined in the existing or draft policies for protected areas in Jamaica. The term is also not defined in the Protected Area System Master Plan: Jamaica 2013-2017, (PASMP) approved 2015. IUCN has defined an MPA as “any area of intertidal or subtidal terrain, together with its overlying water and associated flora, fauna, historical and cultural features, which has been reserved by law or other effective means to protect part or all of the enclosed environment”. Kelleher, G. (1999). Guidelines for Marine Protected Areas. IUCN, Gland, Switzerland and Cambridge, UK. xxiv +107pp.

4.0 ACTION PLAN FOR CORALS AND REEFS

4.1 UNDERSTANDING CORAL REEF ECOSYSTEMS

Coral reefs around the world are imperilled and deteriorating worldwide at alarming rates. They are threatened by a growing number of natural and anthropogenic stresses, including nutrient over-enrichment, sedimentation, over-fishing, climate change, bleaching, disease and habitat destruction. The origin and impacts of these threats range from very localized and potentially manageable events, such as resource extraction or coastal development, to poorly understood global phenomena such as climate change, ocean acidification, bleaching and disease which are affecting entire ocean basins. The challenge of interpreting, predicting and responding to such stressors on coral reefs is further exacerbated by the complexity and variability of reef ecosystems in space and time. Adjacent reefs on the same coastline may be inexplicably different, while a single reef may cycle through significant changes in composition and health in response to unknown events. Ultimately, our success or failure in conserving these highly complex and extremely fragile ecosystems will depend on a parallel approach of proactive, precautionary management measures coupled with a much more sophisticated level of understanding about their fundamental ecology and response to environmental stressors (USCRTF, 2000).

Actions must therefore be based on a real understanding of the ecosystem we are trying to save. With a clear understanding of corals and reefs in Jamaica, strategic interventions can then be implemented to slow down, prevent or reverse the decline of these invaluable coastal and marine resources.

4.1.1. Map Coral Reefs

Rationale and Need. Update maps completed under APCAR 2010-2017 to include geo-referenced information on the exact location of specific natural resources and habitat types is essential for effective management of any marine habitat. This need is particularly acute for coral reefs where reef-dwelling communities may be very different over short distances and where the consequences of misinformed management decisions, such as the siting of potentially harmful human activities, can have devastating and lasting ecological consequences. Comprehensive maps and habitat assessments form the foundation for a variety of reef conservation measures, including:

- creating accurate baselines for long-term monitoring.
- illustrating important community-scale trends in coral reef health over time.
- characterizing habitats for place-based conservation measures such as marine protected areas (MPAs).
- mapping work to determine boundaries for the two MPAs including Fish Sanctuaries and establish buffer zones in national spatial plan.
- map sensitive coastal habitats that are most sensitive to oil spills.
- development of a Climate Risk Atlas that maps areas vulnerable to disaster.

Clearly, a set of recent, accurate maps can greatly enhance coral reef conservation and management efforts. Unfortunately, most coral reefs have not been accurately mapped with modern techniques and at a scale relevant to emerging conservation issues. To address this critical information need, (i) the status of existing maps needs to be evaluated; (ii) determine local mapping and assessment needs for specific areas; (iii) prioritize mapping activities; (iv) identify strategies to fill gaps in technology and data access necessary to enhance mapping capabilities for coral reefs; and, (v) develop a detailed Mapping Implementation Plan that describes these activities and their outcomes.

Plan of Action. Produce comprehensive digital maps of all coral reefs by 2022. This effort will produce maps that address locally identified conservation and management needs. All mapping products will be uploaded to the Coastal Atlas and disseminated to managers, decision-makers and researchers.

4.1.2 Monitor, Inventory and Assess Reef Status

Rationale and Need. Successful coral reef conservation requires adaptive management that responds quickly to changing environmental conditions. This, in turn, depends upon monitoring programs that track trends in coral reef health and reveal significant trends in their condition before irreparable harm occurs. Monitoring can also play a vital role in guiding and supporting the establishment of complex or potentially controversial management strategies, such as ‘no-take’ ecological reserves, fishing gear restrictions or habitat restoration, by documenting the impacts of gaps in existing management schemes and illustrating the effectiveness of new measures over time.

When linked to comprehensive habitat mapping efforts, a rigorous monitoring and assessment program will contribute to coral reef conservation by:

- documenting the status of ecologically and economically important reef species using essential variables: live hard coral cover, macro-algal cover, and fish abundance and biomass.
- tracking and assessing changes in reef communities in response to environmental stressors or specific human activities and uses.
- evaluating the effectiveness of specific management strategies and identifying directions for future adaptive responses.
- evaluating the natural recovery and/or restoration of injured or degraded reefs.
- enabling informed decisions about the siting of potentially harmful activities.
- providing baselines for assessing catastrophic damage from natural events (storms, diseases) or man-made events (vessel groundings, toxic spills).
- serving as an "early warning system" for identifying declines in coral reef health.
- surveillance to identify and monitor the spread and impact of invasive alien species.

The Government of Jamaica is in the process of fulfilling the Convention on Biological Diversity (CBD) Strategic Plan 2011-2020 and has embraced the Strategic goals and Aichi Targets which include strategies and activities to support the Strategic Goal: *Address the underlying causes of biodiversity loss by mainstreaming biodiversity across government and society*. This will facilitate the transference of data from use on a site specific level for management processes to a local level for conservation planning and on a global level for reporting in relation to global targets (Aichi Target 10 and Sustainable Development Goal 14).

Plan of Action. Through continued collaborations with the JCRMN, UWI, NGO's and other researchers the program of annual assessments will be strengthened and expanded. There is a clear need for the integration of data gathered from other processes and as such the program will link new efforts to ongoing successful monitoring programs. Initially the focus will be mainly on reef habitats of particularly high value (e.g., existing or planned marine protected areas and fish sanctuaries) and on reefs at high risk of degradation from human activities (near port and tourism developments). Subsequent stages will expand monitoring coverage to fill in the gaps in the existing programme especially for reefs in the vicinity of offshore cays and banks. A scorecard on reef health is to be produced every two (2) years and a comprehensive report every five (5) years.

Monitoring Report on coral coverage and condition on key coral reefs would examine national indicators such as:

- Percentages in coral cover.
- Percentage in macro-algal cover.
- Number of herbivorous fish in monitored areas.
- Number of commercial fish in monitored areas.

4.1.3 Conduct Strategic Research

Rationale and Need. Reefs are being devastated by bleaching events, disease outbreaks, over-harvesting and other stressors. The causes and impacts of many coral reef stressors remain uncertain, as do many of the fundamental ecological processes that determine the structure, condition and dynamics of healthy coral reef communities and the recovery of impaired systems.

The threats to coral reefs are increasing faster than the scientific knowledge base needed to understand and eliminate them through active conservation measures. Further efforts are needed to identify and target critical knowledge gaps through cooperative assessment and planning by all agencies and entities involved in coral reef management. The twinning of economic and ecological research is also needed to guide *Payment for Ecosystem Services* which could be applied in cases of anthropogenic impacts on reefs such as in the case of ship groundings.

Plan of Action. Update the resilience/bleaching monitoring and response plan. This updated plan will include an early warning system to predict bleaching events and a response mechanism to be activated in the event of bleaching. It should also make plans to enhance the resilience of coral reefs to bleaching and disease by reducing land-based sources of pollution inclusive of thermal and nutrient loading. The plan which is to be used in conjunction with a long-term research programme, is critical to predicting coral reef response to natural and anthropogenic stresses, climate change or ocean acidification and to assess alternative management strategies to promote survival and recovery. This would see the active participation using Memoranda of Understanding of research agencies and institutions, universities, NEPA and related national committees where research updates on coral reefs are shared as well as collaboration and the creation of formal linkages with Academia for postgraduate studies to help fill some of the research gaps in coral reef management is also needed to successfully conduct strategic research on coral reefs.

Contribute to disease research through implementation of a monitoring protocol for tracking coral diseases and collaborate with local and regional networks on appropriate response mechanisms.

4.1.4 Understanding the Human Dimension

Rationale and Need. Most coral reefs occur in near shore shallow water. As a result, they are particularly vulnerable to the effects of human activities, both through direct exploitation of reef resources, and through the indirect impacts of adjacent land-based activities such as polluted run-off from upper watershed activities and coastal development. Many of these activities, and their eventual impacts on reefs, are linked to the social, cultural, and economic conditions within coastal communities. This human dimension is often overlooked in developing coral reef management strategies but is crucial for long-term success.

Plan of Action. In recognition of the fundamental importance of the human dimension to successful coral reef conservation, social, economic and cultural aspects must be incorporated in the conservation strategies (Table 1) by:

- Developing economic valuations of coral reef ecosystems to help strengthen management approaches and ensure effective decision-making.
- Conduction site specific socio-economic studies in order to resolve user conflicts.
- Evaluating examples of best practices and lessons learned from traditional and community-based conservation efforts on coral reefs in other territories.

Table 3: Strategic Intervention – Co-management of coastal resources

Goal: To achieve sustainable development of the coastal zone, including the watersheds, through a partnership between the public and private sectors, resource users, local communities, NGOs, the scientific community, and donor agencies							
Objective	Activity	Responsible Agency/ Organization	Timeline (Years)				
			1	2	3	4	5
1. To develop a dynamic, on-going process of co-management, involving the empowerment of the resource users.	1. Review and analyze on-going initiatives in co-management in order to document and share experiences and technical data in co-management.	Lead: NEPA Support: NGOs					
2. To develop guidelines and procedures for facilitating co-management of natural resources.	1. Facilitate the formation of stakeholder groups by informing the stakeholders of the value of co-management and how to implement it.	Lead: NEPA Support: NGOs					

Goal: To achieve sustainable development of the coastal zone, including the watersheds, through a partnership between the public and private sectors, resource users, local communities, NGOs, the scientific community, and donor agencies							
Objective	Activity	Responsible Agency/ Organization	Timeline (Years)				
			1	2	3	4	5
	2. Provide scientific data (biological, economic, social, and cultural) necessary to guide the implementation and review of resource management plans.	Lead: NEPA Support: UWI, Jamaica Social Investment Fund (JSIF)					
	3. Prepare a resource co-management plan, including appropriate legislation that identifies and/or develops economic alternatives for resource exploitation.	Lead: NEPA Support: Environmental Risk Management Division (ERMD)					
	4. Establish mechanisms for involvement of stakeholders in the planning and implementation of the co-management plan.	Lead: NEPA Support: NGOs					
	5. Develop a platform for exchange of experience, knowledge and research in reef restoration undertaken by reef practitioners for recommended reef rehabilitation activities.	Lead: NEPA					
3. To disseminate information to all the stakeholders in the co-management partnership in a relevant and appropriate manner.	1. Develop the resources necessary to effectively implement a co-management plan, including the necessary documents and manuals for sensitizing and training stakeholders, government officials, international and local funding agencies.	Lead: NEPA					

4.2 REDUCING ANTHROPOGENIC IMPACTS ON CORAL REEFS

Rationale and Need. Anthropogenic impact on the marine environment is caused by varied types of human activity which cause obvious and/or hidden disturbances in the natural structure and functions of biotic communities, anomalies in habitats, changes in the hydrology and geomorphology, diminished

fisheries and recreational value, and other negative effects which are ecological, economic, or socioeconomic in nature.

Plan of Action. There is a need to focus on practical solutions to problems in coral reef management and preservation. Our success in this area is based on our technical capacity and our national priority will be to reduce or eliminate avoidable human impacts, both domestically and internationally.

4.2.1. Create an Optimal Network of MPAs

Rationale and Need. Coastal marine systems are under threat from intense and unsustainable human activities resulting in the potential loss of unique ecosystems. This is jeopardizing long term biological and economic viability and other benefits to the resource users. Ensuring that these coastal resources remain in a healthy and viable condition requires effective management.

Plan of Action. One tool which aims to improve coastal and marine policy and management is the concept of managed marine protected areas (Table 2). Another tool is the concept of developing an Integrated Watershed and Coastal Area Management (IWCAM) Programme (Table 3). A Marine Protected Area is an area of ocean, or a combination of land and ocean, where all human activities are managed toward a common goal. The establishment of these MPA's is based on sound scientific information which promotes reef resilience by ensuring that⁷:

- A. There is adequate replication and representation of species and habitats.
- B. Critical areas vital to the survival of species are maintained.
- C. There is connectivity between reefs and their associated habitats.
- D. There is effective management to meet the goals and objectives of the MPAs.

These areas can be open for multiple-use or areas for complete protection through a system of marine zoning. It is also important to develop models to predict changes to coral reef resources that may occur under different zoning schemes, taking into account ways to conserve and possibly enhance marine resources.

⁷ http://www.reefresilience.org/Intro_to_Resilience.html

Table 4: Strategic Intervention 1 – Establishment and management of marine protected areas

Goal: To achieve the sustainable management of marine resources through the establishment and management of marine protected areas.							
Objective	Activity	Responsible Agency/ Organization	Timeline (Years)				
			1	2	3	4	5
1. Increase coverage of protected areas by declaring Two (2) protected areas particularly for the marine environment.	1. Measure coverage of marine protected areas such as marine parks and other marine protected spaces in relation to Jamaica's territory.	Lead: NEPA Support: Fisheries Division					
	2. a. Declare and map boundaries of new MPAs. b. Declare and map boundaries of new Fish Sanctuaries.	Lead: NEPA Lead: Fisheries Division					
	3. Develop local capacities for strategic design, planning, and co-management of MPAs.	Lead: NEPA Support: Fisheries Division					
	4. Revision of policies and legislation to include the development of management plans which will include co-management arrangements and strategies, revised fines and offences, e.g. new Fisheries Bill to replace the Fishing Industry Act, 1975.	Lead: NEPA Support: Fisheries Division					
	5. Monitor key critical indicators for adaptive co-management including biological, physical, chemical, social, economic, and cultural indicators.	Lead: NEPA Support: Fisheries Division, JSIF, Social Development Commission (SDC)					
	6. Enhance human resource development in science, administration, education and enforcement through technical assistance and training.	Lead: NEPA					

Goal: To achieve the sustainable management of marine resources through the establishment and management of marine protected areas.							
Objective	Activity	Responsible Agency/ Organization	Timeline (Years)				
			1	2	3	4	5
	7. Provide infrastructural support for research, administration, resource management and environmental education and awareness.	Lead: NEPA					
2. To strengthen management capabilities in marine and coastal protected areas by finalization and implementation of existing draft management plans, and transform "paper" parks into real parks.	1. Ensure that existing Marine Parks and Protected Areas (MPAs) are properly funded to safeguard their long-term financial sustainability.	Lead: NEPA Support: Fisheries Division					
	2. Policy and legislation on Protected Area System (PAS) finalized.	Lead: ERMD Support: NEPA					
	3. Assess and report on management effectiveness of existing network of protected areas.	Lead: NEPA					
	4. Promote the incorporation of associated watershed areas into the co-management of the marine protected area.	Lead: NEPA					
3. To implement plans for sustainable harvest and consumption of marine resources and ensure the use of resources well within safe ecological limits.	Implement and enforce Close seasons for vulnerable fishery resources (queen conch, lobster).	Lead: Fisheries Division Support: NEPA, Jamaica Defence Force Coast Guard (JDFCG), Marine Police					
	1. Incorporating findings on sea cucumber population surveys into policy for the harvesting of sea cucumber for consumption (including a quota for harvest).	Lead: Fisheries Division Support: Ministry of Industry, Commerce, Agriculture & Fisheries (MICA)					
	2. Conduct regular monitoring of fish quotas.	Lead: Fisheries Division					
	3. Take steps to reverse unsustainable use of fisheries by enhancing	Lead: Fisheries Division. Support: Marine					

Goal: To achieve the sustainable management of marine resources through the establishment and management of marine protected areas.							
Objective	Activity	Responsible Agency/ Organization	Timeline (Years)				
			1	2	3	4	5
	monitoring, control, surveillance and enforcement of fisheries regulations.	Police, JDFCG					

Table 5: Strategic Intervention 2 - Integrated Watershed and Coastal Area Management (IWCAM) and related institutional, policy, and legal issues

A weak commitment to IWCAM in Jamaica exists due to its low priority in the national agenda and lack of funding by the government. There is fragmentation and overlapping IWCAM policies and legislation which may be due to the lack of understanding of national obligations, responsibilities, and implications of international conventions, treaties and agreements.

Goal: To develop sustainable IWCAM through a coordinated, and action-oriented institutional, policy, and legal framework which emphasizes equity, empowerment, and transparency.							
Objective	Activity	Responsible Agency/ Organization	Timeline (Years)				
			1	2	3	4	5
1. To improve coordination of IWCAM efforts at national and local levels.	1. Conduct an audit of agencies and institutions working in the coastal zone, and review all existing IWCAM related policies and legislation.	Lead: NEPA					
	2. Based on the audit, develop appropriate policies and legislation to address the identified overlaps and gaps.	Lead: NEPA					
	3. Conduct training based on an assessment of IWCAM training needs.	Lead: NEPA					
2. To initiate broad based participation (public and private sectors, NGOs, resource users) in the	1. Develop inter-sectoral and interdisciplinary curricula for coastal zone management training, building on existing efforts at the tertiary level.	Lead: NEPA Support: Tertiary institutions					

Goal: To develop sustainable IWCAM through a coordinated, and action-oriented institutional, policy, and legal framework which emphasizes equity, empowerment, and transparency.							
Objective	Activity	Responsible Agency/ Organization	Timeline (Years)				
			1	2	3	4	5
formulation, implementation, and evaluation of coastal zone programmes and projects.	2. Develop and implement appropriate mechanisms for inter-sectoral, inter-agency coordination with stakeholders from the public, including the following: <ul style="list-style-type: none"> Strengthen existing arrangements and/or initiatives through the National Council on Ocean and Coastal Zone Management (NCOCZM) which will develop policy guidelines and recommend the necessary legislative framework. Develop inter-sectoral and inter-agency management committees/councils for integrated coastal zone management at the local level. 	Lead: ERMD Support: NEPA					
	3. Develop policy guidelines for use of economic instruments and incentives for broad-based participation in IWCAM programmes.	Lead: NEPA					
	4. To coordinate donor activities and commitments to IWCAM in Jamaica.	1. Develop policies and guidelines for funding mechanisms, including cost recovery and selective taxation, for IWCAM programmes.	Lead: NEPA				
	2. Seek to implement all obligations in international treaties related to IWCAM e.g. Ramsar Convention, CITES, Convention on Biological Diversity and United Nations Framework Convention on Climate Change and Specially Protected Areas and Wildlife (SPAW).	Lead: NEPA Support: ERMD					

4.2.2. Reduce pollution and habitat destruction and degradation

Rationale and Need. Marine ecosystems are experiencing high rates of habitat loss and degradation, and these processes are considered as the most critical threat to marine biodiversity. It is estimated that every day between 1960 and 1995, a kilometer of coastline was developed, causing permanent loss of valuable habitats, such as coastal wetlands, seagrass meadows and rocky

shores. Approximately 20% of the world's coral reefs were lost and an additional 20% degraded in the last several decades of the twentieth century⁸.

Coastal development is not only limited to tourism ventures and the requisite amenities but also include dredging for navigation or marinas, breakwaters and other shoreline protection measures, beach nourishment, sand mining, installations of pipelines and underwater cables, and land-use practices such as road construction. These activities invariably result in increased sewage, vessel traffic and run-off. Direct and repeated impacts by vessels, anchors and land-based pollution cause in some cases irreparable damage.

Coral reefs require good water quality and point and non-point pollutants, in particular nutrients and sediment, constitute a major contribution to the degradation of coral reefs in Jamaica. Worldwide, the threat to coral reef ecosystems from pollution is surpassed in severity only by coral bleaching and fishing (Puglise and Kelty (eds.), 2007). To some extent, these growing pressures are symptoms of urbanization and tourism and of current resource limitations in programs responsible for implementation and enforcement of existing conservation rules and regulations. Conserving the nation's coral reefs will require reductions in the amounts, sources and combined impacts of the major types of pollution namely: sediment, nutrients, marine debris, oils and chemicals (USCRTF, 2000).

Plan of Action. Many of the negative impacts of coastal development such as habitat destruction and pollution can be negated through proactive measures (Table 4). One measure is to investigate damage to coral reefs by tourists and ship groundings and to implement strategies to combat this. Additional measures such as enhancing vessel traffic management measures by installing and maintaining mooring buoys in areas where anchor damage is likely, strengthening and standardizing enforcement and damage assessment actions, and where needed refining and updating fines to match the crimes.

Table 6: Strategic Intervention – Prevention and reduction of sources of marine pollution

Goal: To reduce through the IWCAM process the pollution (from point and non-point sources) reaching the coastal and marine environment of Jamaica.								
Objective	Activity	Responsible Agency/ Organization	Timeline (Years)					
			1	2	3	4	5	

⁸ Retrieved from "http://www.marbef.org/wiki/Habitat_destruction_and_fragmentation

Goal: To reduce through the IWCAM process the pollution (from point and non-point sources) reaching the coastal and marine environment of Jamaica.

Objective	Activity	Responsible Agency/ Organization	Timeline (Years)				
			1	2	3	4	5
1. To achieve effective integrated co-management of the entire watershed and coastal zone.	1. Encourage sound application and reduction in the use of fertilizers and pesticides, as well as encouraging integrated pest management (IPM).	Lead: NEPA Support: Rural Agricultural Development Authority (RADA), SDC					
	2. Implement with urgency, erosion control practices such as re-vegetation, road paving, sediment screening and soil conserving agricultural practices, in light of the fact that sediments are a major threat to coral reefs.	Lead: NEPA Support: RADA, SDC					
2. Strengthen the scientific rigor and ecological relevance of existing water quality programs and permitting mechanisms that routinely affect coral reefs.	1. Finalization of Draft Jamaica National Ambient Water Quality Standard – Marine Water, 2009	Lead: NEPA Support: University of the West Indies (UWI)					
	2. Increase spread of water quality monitoring sites.	Lead: NEPA Support: UWI					
3. Regulate and control discharges from known point sources and attain a situation where there is less discharge of nutrients into the marine environment.	1. Identify and monitor appropriate bio-indicators.	Lead: NEPA					
	2. Complete negotiation, sign and accede to all conventions on land-based sources of marine pollution.	Lead: ERMD Support: NEPA					
4. To determine and set ambient water quality standards for Nitrates and Phosphates.	1. Excess nutrients and solid waste is brought to levels that are not detrimental to ecosystem function and biodiversity.	Lead: NEPA					
5. To encourage the establishment of tertiary treatment plants.	1. Ensure that the best and affordable technologies are considered and implemented if the very best available technologies, such as tertiary treatment, are unaffordable.	Lead: NEPA					
6. To encourage the use of treated sewage effluent for irrigation.							

Goal: To reduce through the IWCAM process the pollution (from point and non-point sources) reaching the coastal and marine environment of Jamaica.							
Objective	Activity	Responsible Agency/ Organization	Timeline (Years)				
			1	2	3	4	5
7. Prevent, prepare for, and respond to oil and chemical spills to reduce impacts on reef ecosystems.	1. Implement pollution prevention strategies to reduce industrial pollutants.	Lead: NEPA Support: JDFCG, Office of Disaster Preparedness & Emergency Management (ODPEM)					
	2. Implement strategies for prevention and management of oil spills and bilge water discharge.						
	3. Produce a vulnerability map for ports, harbours and bays which highlight quantities and type of product and siting of equipment available to combat spills.	Lead: NEPA					
	4. Using supporting data on ecosystem service valuation information services, update legislation for marine pollution and environmental damage to increase fines and other punitive measures.	Lead: NEPA Support: ERMD					

4.2.3 Restore Reefs

Rationale and Need. Corals and reefs are extremely susceptible to destruction from human induced and natural catastrophic occurrences. These areas recover very slowly particularly when the structure is destroyed, or when the prevailing environmental conditions have been chronically degraded over time. This dramatic and widespread loss and alteration have generated ideas about replacing what was lost or accelerating the rate of recovery from damage as full recovery of biodiversity and the full range of services formerly provided may require hundreds or thousands of years without active intervention by resource managers. Such measures may range from eliminating anthropogenic stressors that impede recovery, to more direct restoration of damaged habitats or depleted populations.

Plan of Action. Develop a comprehensive framework to reverse loss of ecosystems and biological resources through restoration initiatives. The science behind coral reef ecosystem restoration is still in its infancy. Locally, the few restoration efforts that have occurred to date have been relatively small-scale responses to dredging, and other coastal development activities or small-scale conservation and fisheries enhancement projects related to research. Outside of these activities, there is a need to be able to restore injured or degraded coral

reefs especially if the loss of the ecological services provided will greatly affect biodiversity, food security and shoreline protection.

Long-term monitoring programs to measure the success of restoration projects should be implemented and be based on hypothesis driven questions. The development of models that predict resource recovery with and without restoration may also guide decisions on where and when to intervene.

Information required to guide the decision-making process include:

- Criteria development for determining when restoration is a viable option.
- Investigating socioeconomic costs and benefits analysis of restoration.
- Monitoring over time of reef systems to determine trends and status.
- Evaluation of restoration techniques.
- Evaluating the effectiveness of restocking ecologically important species (such as *Diadema* and herbivorous fishes).
- Designing and evaluating techniques to control or eradicate organisms that may inhibit recovery of damaged or degraded habitats.

Table 7: Strategic Intervention – Coral reef fisheries management

The status and trends in the reef fisheries in Jamaica are cause for concern. Coral reef fisheries, including the inshore and offshore reefs are either over-exploited or depleted. Improved conservation and management is needed to ensure rehabilitation of depleted stocks, optimum sustainable utilization of fisheries resources, and preservation of habitat and biological diversity of the reef ecosystem.

Goal: To improve fisheries management to optimize resource use and ensure healthy coral reef ecosystems and rehabilitate depleted fish stocks through the reduction and diversification of fishing effort.							
Objective	Activity	Responsible Agency/ Organization	Timeline (Years)				
			1	2	3	4	5
1. To manage fishing effort through ecologically and environmentally sound fishing methods which ensure continued socioeconomic benefits to the resource users.	1. Promote use of fishing practices that protect the habitat.	Lead: Fisheries Division					
	2. Strengthen existing management legislation and enforcement mechanisms.	Lead: Fisheries Division Support: NEPA					
	3. Gather information on the number of fishers, their range of activity and gear types used in the fishery sector.	Lead: Fisheries Division					

Goal: To improve fisheries management to optimize resource use and ensure healthy coral reef ecosystems and rehabilitate depleted fish stocks through the reduction and diversification of fishing effort.

Objective	Activity	Responsible Agency/ Organization	Timeline (Years)				
			1	2	3	4	5
2. To expand and improve applied research as well as statistical reporting on fish stocks, catches, and investment trends	1. Conduct research and monitoring on reef fisheries including capture activity, biology/ecology, population dynamics and the recruitment of exploited species of coral reef fisheries.	Lead: NEPA Support: Fisheries Division					
	2. Update and maintain the national register of the vessels active in the fishery and include recreational fishing vessels. This register must include information on vessel capacity, power, gear, operating range, and area of operation.	Lead: Fisheries Division					
3. To reinforce existing local, national and regional mechanisms, organizations for research and management and dissemination of scientific information.	1. Establish a central coordinating mechanism at the national level to ensure participation of various interest groups in the planning and implementation of fisheries management measures, as well as ensure that these measures are integrated in the wider national plan for management of the coastal zone.	Lead: Fisheries Division Support: NEPA, Fish Sanctuary Network					
2. To coordinate fisheries management among the national agencies, scientific community, private sector, community interest groups and the resource users who have a stake in the coastal zone.	1. Development of a national pelagic fishery that could reduce current fishing pressure on demersal reef associated species supported by public private partnership that involves training of fishers in new fishing techniques and proper sharing of the benefits from these new harvests.	Lead: Fisheries Division					
3. To solicit active participation by stakeholders in developing and implementing measures	1. Establish a campaign to inform the public of the crisis facing the coral reef systems generally and solicit active participation in fisheries management strategies.	Lead: NEPA Support: Fisheries Division, Fish Sanctuary Network					

Goal: To improve fisheries management to optimize resource use and ensure healthy coral reef ecosystems and rehabilitate depleted fish stocks through the reduction and diversification of fishing effort.

Objective	Activity	Responsible Agency/ Organization	Timeline (Years)				
			1	2	3	4	5
to rehabilitate and ensure sustainable use of the fisheries resources.	2. Continue the campaign to inform the public of the lionfish control programme.	Lead: NEPA Support: Fisheries Division, Fish Sanctuary Network					
	4. To ensure fish and invertebrate stocks and aquatic plants are managed and harvested sustainably, legally and applying ecosystem-based approaches, so that overfishing is avoided, recovery plans and measures are in place for all depleted species, fisheries have no significant adverse impacts on threatened species and vulnerable ecosystems and the impacts of fisheries on stocks, species and ecosystems are within safe ecological limits.	1. Monitor and report fishing production (tonnage produced/target species).	Lead: Fisheries Division				
	2. Establish plan for reducing destructive fishing practices over a 10-year timeframe.	Lead: Fisheries Division					
	3. Increase the coverage and enforcement of Marine Protected Areas.	Lead: NEPA Support: Fisheries Division, Marine Police, JDFCG, Fish Sanctuary Network					
	4. Prepare and implement a Management Plan for Commercial Fishery species by 2018 (List of target species to be developed and should include Irish moss, and Spirulina). Sustainable extraction levels to be defined and recovery.	Lead: Fisheries Division Support: NEPA					

4.2.4. Create an informed public

Rationale and Need. Reducing human impacts on corals and reefs often requires changing the collective behaviour, beliefs and values. This is compounded by poor understanding of the value of coastal and marine resources; poor understanding of how the impact of human activities on these resources has resulted in environmental degradation throughout Jamaica. The existing taboo against the use of treated waste water also results in a further depletion of limited natural resources.

Plan of Action. Outreach and education are processes used to increase public awareness, change perceptions, increase appreciation, knowledge, and understanding about coral reef issues in order to promote informed decision-making and increase stakeholder support in reef conservation. Effective monitoring and enforcement, in turn, depend on the transparency of, and the

involvement of the stakeholders in, the management process.

Table 8: Strategic Intervention

Goal: To improve management of coral reef and related ecosystems and improve public awareness on coral reef fisheries							
Objective	Activity	Responsible Agency/ Organization	Timeline (Years)				
			1	2	3	4	5
1. To identify the relevant target groups to be addressed and involve them in the educational process.	1. Develop hands-on and activity-based teaching materials on marine and coastal resources for inclusion in primary and secondary school curricula, teachers training institutions and community colleges; and ensure their effective application. This will also include the preparation of questions for national quiz competitions.	Lead: NEPA					
	2. Develop educational packages for key economic, judicial and political sectors to demonstrate the economic benefits of selected coastal resources conservation measures, as well as cost effective management practices and technologies to minimize land-based sources of marine pollution.	Lead: NEPA					
	3. Promote public awareness of the status and importance of reefs, and foster a stewardship ethic.	Lead: NEPA					
2. Sensitize media	1. Develop a targeted and strategic educational program to enhance media effectiveness in communicating coastal issues to the general public.	Lead: NEPA					

Goal: To improve management of coral reef and related ecosystems and improve public awareness on coral reef fisheries							
Objective	Activity	Responsible Agency/ Organization	Timeline (Years)				
			1	2	3	4	5
	2. Prepare educational materials relating to coral reefs and associated ecosystems targeting the general public.	Lead: NEPA					
3. Access to information	1. Ensure that the public has to environmental information and empower them with the necessary advocacy skills to enable them to take action and enforce environmental legislation.	Lead: NEPA					
	2. Translate scientific research into information about the condition of coral reefs and the rationale for management decisions that the public can access and use.	Lead: NEPA					

4.2.5. Facilitate alternate livelihoods

Rationale and Need. Socioeconomic research can also clarify impacts to coral reef ecosystems by providing an understanding of human motivations. This is critical information for policymakers, managers, and outreach specialists and can provide information on possible income generating ventures. There needs to be more scientific research applied to the exploration of alternative livelihood strategies for existing fishers.

Plan of Action. Explore through feasibility research, the possibility of the promotion of mariculture so that there can be a reduction of pressure on coral reef fisheries. Other possibilities include:

- Agricultural ventures such as greenhouse farming and apiculture (bee keeping).
- Retraining/retooling fishers as tour guides/tourism workers.
- Retraining/retooling fishers for overseas work programmes such as farm work programmes.
- Promote alternative fishing activities to take fishers from reef systems such as deep sea fishing, squid fishing and the use of Fishing Aggregating Devices (FADs).

5.0 FUNDING CONSIDERATIONS

Financing of any government initiative always proves to be one of the main limiting factors which determine success or failure and compliance or non-compliance. The management of corals, reefs and related ecosystems is hampered by lack of adequate financial resources and difficulties in accessing them. Implementation of the plan requires an improvement in the national capacity to generate and access funds for managing coastal resources on a sustainable basis.

ACTIVITIES

1. Improve coordination among governments, NGOs, regional entities, and other relevant organizations to identify and access funds and to include this in their budget.
2. Establish endowment funds for the co-management of coral reefs and coastal resources.
3. Strengthen Jamaican institutions to enable them to effectively participate in regional strategies to expand the availability of financial resources.
4. Identify economic benefits and values of coral reef resources in order to demonstrate a case for financial support from public, private and international sources.
5. Improve financial accountability of environmental management agencies and organizations.
6. Provide training and technical assistance to environmental management agencies and organizations in the design and implementation of fund-raising programs, financial management and accounting.
7. Encourage the creation of dedicated environmental funds for coral reef management, research, management, and capacity building.
8. Facilitate development of revenue generating opportunities from marine parks and protected areas; services such as entrance and user fees, concessions, contributions, tourism related-activities, merchandizing.

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