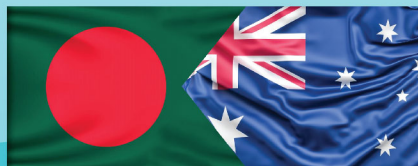


FINAL REPORT

Regulatory and institutional framework for sustainable use of coastal and marine resources: a comparative study between Bangladesh and Australia

Md. Rakib Hossain, M Aslam Alam, Md. Nasir Uddin Ahmed, Muhammad Abu Yusuf, Md. Mizanur Rahman, Shawkat Alam and Pradip Royhan



MACQUARIE
University

Bangladesh Public Administration Training Centre
Savar, Dhaka

Regulatory and institutional framework for sustainable use of coastal and marine resources: a comparative study between Bangladesh and Australia

Md. Rakib Hossain¹, M Aslam Alam², Md. Nasir Uddin Ahmed³,
Muhammad Abu Yusuf⁴, Md. Mizanur Rahman⁵, Shawkat Alam⁶ and
Pradip Royhan⁷

-
- 1 Rector (Secretary to the Government), Bangladesh Public Administration Training Centre, Savar, Dhaka
 - 2 Ex-Rector (Ex-Senior Secretary to the Government), Bangladesh Public Administration Training Centre, Savar, Dhaka
 - 3 MDS (Additional Secretary to the Government), Bangladesh Public Administration Training Centre, Savar, Dhaka
 - 4 Ex-MDS (Ex-Joint Secretary to the Government), Bangladesh Public Administration Training Centre, Savar, Dhaka
 - 5 Director (Deputy Secretary to the Government), Bangladesh Public Administration Training Centre, Savar, Dhaka
 - 6 Professor, Macquarie Law School, Centre for Environmental Law, Australia
 - 7 Coordinator, Bangladesh Projects and Researcher, Centre for Environmental Law, Macquarie International Office, Australia

REPORT WRITING TEAM

<i>Name</i>	<i>Designation</i>	<i>Role</i>
Dr. Md. Mizanur Rahman	Director (Research and Development) Bangladesh Public Administration Training Centre, Savar, Dhaka	Leading writer and data analyzer
Dr. Md. Moshir Rahman	Deputy Director, Bangladesh Public Administration Training Centre, Savar, Dhaka	Assistant Writer and Data Entry Operator
Md. Ashraful Alam Mizanur Rahman	Ex-PS to the rector, Bangladesh Public Administration Training Centre, Savar, Dhaka	Assistant Writer
Mohammad Mamun	Research Officer, Bangladesh Public Administration Training Centre, Savar, Dhaka	Assistant Writer

EDITORIAL BOARD

<i>Name</i>	<i>Designation</i>	<i>Role</i>
Md. Rakib Hossain, ndc	Rector (Secretary to the Government), Bangladesh Public Administration Training Centre, Savar, Dhaka	Editor in Chief
Syed Mizanur Rahman, ndc	MDS (Joint Secretary to the Government), Bangladesh Public Administration Training Centre, Savar, Dhaka	Executive Editor
Dr. Md. Mizanur Rahman	Director (Deputy Secretary to the Government), Bangladesh Public Administration Training Centre, Savar, Dhaka	Editor

EVALUATORS

<i>Name</i>	<i>Designation</i>	<i>Role</i>
Dr. Md. Nazrul Islam	Professor, Department of Geography and Environment, Jagangirnagar University	External
Dr. Md Sanwar Jahan Bhuiyan	Director (Joint Secretary to the Government), Bangladesh Public Administration Training Centre, Savar, Dhaka	Internal

RAPPORTEUR OF THE FACULTY SEMINAR

<i>Name</i>	<i>Designation</i>
Md. Rabiul Alam Lokman	Assistant Director, Bangladesh Public Administration Training Centre, Savar, Dhaka

CONTENTS

<i>Items</i>	<i>Page Number</i>
Report Writing Team, Editorial Board, Evaluators and Rapporteur	ii-iii
Acknowledgement	v
Executive Summary	vi-vii
Introduction	01-03
Methodology	04-05
Potential Marine Resources in Bangladesh	06-10
The regulatory framework in Bangladesh	11-17
The institutional framework in Bangladesh	18-29
The regulatory framework in Australia	30-35
The institutional framework in Australia	36-40
The success stories of Australia	41-48
The drawback of the regulatory and Institutional arrangements in Bangladesh	49-55
Socio-economic conditions of the fishermen community-a case from Sonadia Island	56-59
Recommendations	60-63
References	64-65
Appendix-1: Detail programme of 2019 Coastal Mini-Symposium held at Macquarie University	66-72
Appendix-2: External evaluator's feedback	73
Appendix-3: Internal evaluator's feedback	74
Appendix-4: Rapporteur's report on faculty seminar	75-78
Appendix-5: Regulatory and Institutional Framework for the Conservation of Coral Reefs in Bangladesh: A Critical Review (Accepted as a book chapter by Taylor & Francis, India)	79-101
Appendix-6: Challenges of Artisanal Fishermen: A Case Study from Sonadia Island, Bangladesh (Accepted as a book chapter by Taylor & Francis, India)	102-126

ACKNOWLEDGEMENT

This research was financially supported by ‘Capacity Enhancement of the Core Courses of BPATC’ Project. The team expresses gratitude to the Project Director of the project, as mentioned above, Syed Mizanur Rahman ndc for his wholehearted cooperation. We would like to extend our thanks to Ex-project director, Md. Zaydul Hoque Molla ndc for his supports. We are profoundly grateful to Peter Davies, Associate Professor, Acting Head of Department, Environmental Sciences, Macquarie University, for managing a very successful symposium in Sydney. We extend our profound thanks to Professor Laura Airoidi, University of Bologna, Italy, for presenting a thoughtful, informative and valuable keynote paper in that symposium. We are grateful to Dr. Moshiur Rahman, Deputy Director (Research), BPATC; Ashraful Alam, PS to Rector, BPATC; Mohammad Mamun, Research Officer, BPATC; Rabiul Alam Lokman, Assistant Director, BPATC for providing supports in data collection, data entry and reporting. We are also thankful to Md. Firoz Mia and Nilimesh Sarker, support staff of BPATC.

EXECUTIVE SUMMARY

Bangladesh is blessed with rich coastal and marine ecosystems of the Bay of Bengal. The sustainable use of potential marine resources can contribute a lot to the economy of Bangladesh. The marine and coastal resources are not rationally extracted. In some cases, the resources have been over-exploited, while unexplored in many cases. The sustainable use of marine resources is restricted by several factors like lack of knowledge of the potential resources; mapping of the resources; lack of sustainable extraction, lack of institutional and regulatory frameworks; and encroachment by the neighbouring countries. There are many laws and regulations providing policy and regulatory frameworks for the management of marine living resources. But these laws are not functioning correctly. On the other hand, the institutional framework like marine governance, involving stakeholders, coordination among administrative bodies and educating institutions are not clearly defined.

As a Marine State having the third largest marine jurisdiction in the world, Australia adopted comprehensive measures for maximizing the use of marine resources for narrowing down the significant development gaps, through promoting scientific, technological and other innovations, and establishing necessary mechanisms for regional cooperation among the neighbouring countries. Substantial efforts were made in the 2000s for promoting marine science in the country which ultimately culminated in the form of the National Marine Science Plan 2015-2025 identifying several priority areas. Therefore, Bangladesh has vast lessons from Australia to reform regulatory and institutional frameworks for sustainable marine and coastal resource management. In this regard, Bangladesh may apply the experiences of first-mover Australia. The study aims at analyzing the legal and institutional framework for sustainable use of coastal and marine resources applying Australia's lessons and the best practices. The study also aimed at the identification of potential marine resources of Bangladesh; and assessment of marine governance and coordination mechanism.

The literature related to the institutional and regulatory framework for sustainable marine resources management in Bangladesh and Australia was reviewed. The government initiatives, existing regulatory frameworks, gazette notifications, policy papers, and other official documents related to coastal and marine resource management as well as related

scientific articles were reviewed. Empirical data were collected both in Bangladesh and Australia through symposium, consultation workshops, focus group discussions, case studies, visiting and one to one discussion. Content analysis was done based on data collected through consultation workshops, case studies and key informant interviews.

There are numerous scattered and old laws relating to marine in our country. Except for Territorial Waters and Maritime Zones Act, 1974 and Bangladesh Flag Vessels (Protection) Ordinance, 1982 no specific act was enacted for marine resource management or any part of any act focused on this issue. The issue of sustainability, conservation, environmental protection, climate change and international obligations are not reflected in the existing laws. No laws address the newly emerged global problems like ocean acidification, global warming, and sea-level rise. Most of the laws were not enacted, defining sectoral governance or a distinct sector of oceanography. In many cases, the authority was not explained adequately. Non-compliance of the existing laws is one of the significant challenges in Bangladesh. On the hand, Australia has enacted sectoral laws covering national and international issues. These laws addressed environmental issues, sustainability and conservation. The jurisdictions of federal, state, territory and local governments have been demarcated.

Allocations of businesses of different public institutions are not clearly defined for sustainable marine resource management. Many departments are supposed to be involved, but their functions are ambiguous. There are overlapping jurisdictions among different departments. The operational, coordination and integration mechanisms are not supported by either any laws or the allocations of business. Like Australia, there is no statutory body for coordination and integration. Any forms of marine governance do not exist anywhere. Different stakeholders reported the laxity in performing duties and bribery of the government officials. The fishermen communities identified piracy as the first challenges followed by dadan (local credit system) and weak marketing system as the consequence of inadequate regulatory and institutional framework. Only a few sectors work on marine resource management in Australia. Different independent bodies coordinate and integrate all activities.

INTRODUCTION

Bangladesh is a coastal country having 710 km long shoreline and a Maritime Zone of 118,813 km² in the Bay of Bengal (Hussain et al. 2018) including Exclusive Economic Zone (EEZ) of 200 nautical miles into the sea and Continental Shelf of 354 nm from the Chittagong coast (Islam and Hossain, 2017). The Bay of Bengal is blessed with productive coastal and marine ecosystems, hosting rich biodiversity, such as fishes, shrimps, molluscs, crabs, mammals, seaweeds, etc. (FAO 2014). Extraction, exploitation, exploration and management of living and non-living resources of the Bay of Bengal have potentials to contribute to the economy of Bangladesh sustainably. The potential of the marine and coastal resources are not yet rationally extracted. In some cases, the resources have been over-exploited, while unexplored in many cases. Furthermore, it is found that marine fish harvesting is in declining trend (Shamsuzzaman et al. 2017). The sustainable use of marine resources is restricted by several factors like lack of knowledge of the potential resources; inadequate mapping of the resources; lack of sustainable extraction, lack of institutional and regulatory frameworks; and rampant encroachment by the neighbouring countries (Hussain and Hoq, 2010).

There are many laws and regulations providing policy and regulatory frameworks for the management of marine living resources. These laws are, however, very old and not appropriately enforced for multiple reasons. Consequently, the degradation of some resources occurs, while many resources are not unlocked due to absence of laws and non-compliance of the existing laws (Shamsuzzaman et al. 2017, Shamsuzzaman and Islam, 2018). On the other hand, the institutional framework like marine governance, involving stakeholders, coordination among administrative bodies and educating institutions are not clearly defined (Islam, 2012). There is ambiguity about the role and responsibility of the concerned institutions which will address the new emerging issues like increased sea acidification. This study will be carried out to investigate how the legal and institutional framework can be reformed, which can facilitate sustainable development and improved environmental outcomes for coastal and marine resources.

As a Marine State having the third largest marine jurisdiction in the world, Australia adopted comprehensive measures for maximising the use of marine resources for narrowing down the significant development gaps,

through promoting scientific, technological and other innovations, and establishing necessary mechanisms for regional cooperation among the neighbouring countries (Mohanty et al. 2015). In the Rio+20 Conference, Australia came up with a clear vision to manage marine resources sustainably with ambitious goals (Campbell et al. 2013). Substantial efforts were made in the 2000s for promoting marine science in the country which ultimately culminated in the form of the National Marine Science Plan 2015-2025 identifying some priority areas. Australia launched Oceans Policy in 1998 intending to coordinate marine activities. The policy aimed at creating an effective and efficient ocean management regime and establishing the framework for integrated and ecosystem-based planning and management for the maritime jurisdictions (Akwilapo, 2007). The critical administrative bodies involved in the implementation of the Policy are National Ocean Ministerial Board (NOMB); The Ocean Board of Management (OBOM); The National Ocean Advisory Group (NOAG), The Ocean Policy Science Advisory Group (OPSAG); The Marine Division of the Department of Environment and Heritage; and The Council of Australian Governments (COAG). The Environmental Protection and Biodiversity Conservation Act, 1999 of Australia, provide a national framework for Environment protection by focusing on protecting areas of national environmental significance and on the conservation of Australia's marine biodiversity. This act established institutional frameworks for sustainable marine resources management. Australia has also developed institutional and regulatory frameworks separately for State, Territory and Commonwealth Government. The Oceans Policy is treated as a high-level “umbrella” policy integrating and coordinating existing mechanisms (Akwilapo, 2007).

Therefore, Bangladesh has enormous lessons from Australia to reform regulatory and institutional frameworks for sustainable marine and coastal resource management. The formulation of an integrated regulatory and institutional framework for the utilisation and conservation of marine resources in Bangladesh is indispensable. In this regard, Bangladesh may apply the experiences of first-mover Australia. The study aimed at analysing the legal and institutional framework in achieving SDG-14 and make recommendations using Australia's lessons and the best practices. The objectives of this study were multifold:

- a) To identify potential marine resources of Bangladesh;
- b) To assess the suitability and applicability of the existing legal

and institutional framework for managing the coasts and marine resources;

- c) To assess marine governance, coordination mechanism, critical stakeholders including fishermen and institutional setup;
- d) To assess overlapping jurisdiction; conflict of interests; commitment levels of government officials; and the socioeconomic and cultural aspects of the coastal community;
- e) To way forward adopting the experiences and best practices of Australia.

METHODOLOGY

Review of relevant documents

The literature related to the institutional and regulatory framework for sustainable marine resources management in Bangladesh and Australia was reviewed (Bdlaws 2019, Austlii 2019). The government initiatives, existing regulatory frameworks, gazette notifications, policy papers, and other official documents related to coastal and marine resource management as well as related scientific articles were reviewed. Empirical data was collected through consultation workshops, focus group discussions, case studies, visiting and one to one discussion. Content analysis was done based on data collected through consultation workshops, case studies and key informant interviews (Krippendorf 2004, Neuendorf 2002, Spencer et al. 2003). Content analysis provides insights enhancing a researcher's understanding of particular phenomena as well as informing practical measures (Krippendorf 2004). The collected textual materials were coded into manageable categories of instrumental variables through classification, tabulation, and evaluation of its key themes (Spencer et al. 2003). For incorporating data collected from Australia, a summative content analysis was done involving counting and comparisons, usually of keywords or content, followed by the interpretation of the underlying context (Hsieh and Shannon, 2005). The analytic procedures specific to each approach and practices were delineated.

Data Collection from Bangladesh

Empirical data was collected through consultation workshops with different stakeholders and experts held in *Khulna* and *Barishal* division. Focus Group Discussion (FGD) was done at *Technaf* and *Moheshkhali Upazilla Parishad* taking all government officials, public representatives, fishermen community, civil society and NGOs. Approximately 50-60 participants were present in each consultation workshop and FGD. Focus Group Discussion (FGD) was also done at Bangladesh Oceanographic Research Institute, Marine Fisheries Academy and Bangladesh Marine Academy. A case study was carried out at *Sonadia* Island to assess the impact of weak regulatory and institutional frameworks on the socioeconomic conditions of fishermen community and the challenges they are facing during fishing in the Bay. Another case study examined the governance

of the coral island, Saint Martin. A total number of 120 fishers were personally interviewed with a semi-structured questionnaire at *Sonadia Island*, *Sundarbans* region, *Khepupara* and Saint Martin's Island. Besides the personal interview, FGD was done with the fishermen communities of Khepupara, Patuakhali, Char *Meher Ali*, *Alorkole* and *Dublarchar* of Sundarbans. A national consultation workshop was held in Dhaka where, SDG focal points of all government institutes, representatives from research and educational institutes, and civil society attended. In these workshops, experts' opinions were sought on to identify the gaps in regulatory and institutional frameworks and ways forward to overcome the challenges. A one-to-one discussion was conducted with 06 key informants including academicians, NGO persons, government officials, coastal managers and fisheries entrepreneur (who are knowledgeable in marine resource management) to know their opinions regarding the gaps in regulatory frameworks.

Data Collection from Australia

Seven case studies were done on Northern City Council (Sydney); Green Island (The Great Barrier Reef); Great Ocean Road (Victoria); Bruny Island (Tasmania); Scarborough **beach resort** (Perth); Surfers Paradise (Gold Coast); and Davenport (Tasmania), to understand the role of local government and community in managing marine resources, and their operational and coordination mechanism. A total number of 30 respondents from different stakeholders associated with marine resource management were personally interviewed. Coastal Mini-Symposium 2019 was held at the Macquarie University of Australia, where researchers from Australian Universities and Research Organizations presented papers on these aspects. Ten research works were exhibited in that symposium. A professor from the University of Bologna, Italy presented a keynote paper on the sustainable marine-urban ecosystem.

POTENTIAL MARINE RESOURCES IN BANGLADESH

Bangladesh has a broader scope in the operationalising sustainable use of marine resources within the present maritime boundary. The following sectors draw attentions to be emphasised: a) Marine Fisheries, b) mariculture and aquaculture, c) biotechnology, d) mining of minerals including gas and oil extractions, e) blue energy, f) trade and commerce, g) tourism, h) spatial planning, and i) surveillance (Anon, 2016). The Bay of Bengal based blue economy can create enormous opportunities for Bangladesh. On the other hand, it will generate decent works for the citizens. Tangible changes in lives and livelihood of millions of people living along the coastline as well as in mainland will occur if marine resources are managed sustainably.

Marine Fisheries

Artisanal and small scale fishery contributes 86.8% (0.51 MTs) of the total harvesting of fishes from the Bay of Bengal (DoF 2016). These fishes are harvested within 10 – 30 meters water depth. Large scale mechanised fishery contributes only 14.2% (0.084 MTs) of the total extractions. Large trawlers are engaged mostly in catching (DoF 2016) of total marine production. Large trawlers are penaeid shrimps and finfish within the depth of 40 – 100 meters (Hussain & Rahman, 2010). Bangladesh needs to emphasise on harvesting large pelagic fishes from deeper zones within the Exclusive Economic Zone (EEZ) and high sea. Longline fishing of Tuna & tuna-like fishes should be extended. The South Patches of the Bay of Bengal are the habitats of Indian salmon (*Eleutheronema tetradactylum*), Hilsa (*Tenualosa ilisha*), Pomfret (*Pampus chinensis*), Ribbonfish (*Trichiurus lepturus*), Bombay duck (*Harpadon nehereus*), Eel (*Anguilla spp.*), Jewfish (*Epinephelus itajara*), Catfish (Siluriformes), Sharks (Selachimorpha) and Rays (Batoidea). The Middle Ground is famous for Pomfret, Red snappers (*Lutjanus campechanus*), Ribbonfish, Silver Jew, Shrimp (Penaeid species), Indian mackerel (*Rastrelliger kanagurta*), Snappers, Groupers, Jewfish. The Swatch of No-ground is rich in the stocks of Shrimps, Hilsa, Pomfret, Ribbonfish, Bombay duck and Jewfish. A total number of 475 species of marine fish are found in the EEZ, where 250 species in the freshwater. The fishermen are incapable of harvesting demersal fishes below 50 m depth of water (Hussain et al. 2017). Long lines catching are absent in the deep sea. The fish extraction

from the benthic zone is also missing. In the Bay of Bengal Bangladesh catches only 8.4% of the total harvesting. The mechanised trawlers are engaged in fishing in the coastal waters up to 60 km (within 40m depth) from the shoreline (Hussain et al. 2017).

Mariculture/ Aquaculture

This is the fastest-growing marine sector in the world, meeting 47% of the fish consumption (Alam, 2014). Improper management leads to the degradation of biodiversity and hampers ecosystem functioning. Sometimes it causes eutrophication, marine pollution and outbreak of diseases due to lack of cautions. Growth in aquaculture/ mariculture in Asia is happening the fastest pace comparing to the rest world. Improved shrimp culture, mariculture of Black Asiatic Sea Bass, Sea Bass, Grouper, Pomfret, Mulletts, Marine Eel, and Soft Shell Crab are absent or very limited. There is a broader scope of the development of hatchery breeding techniques and inshore and off-shore cage farming of these fishes.

Marine Non-Traditional Species Culture

There is a vast scope of the culture of nontraditional living resources like seaweed, macroalgae, mussel, oyster, various shellfishes, sea urchin and sea cucumber. A total number of 168 species of seaweed and other macroalgae have been identified in the Bay of Bengal. Most of them are commercially important. The coastal areas of Cox's Bazar district are suitable for culturing these species. There is a scope of marine pearl culture in the areas where the tide is not so strong. To combat climate change "Integrated Multi Trophic Aquaculture (IMTA)" can be a novel process of growing of different finfish and shellfish with seaweeds in the integrated farming system (Ahmed and Glaser, 2016).

Marine biotechnology

The scope of adopting marine biotechnology in Bangladesh is highly promising. The living resources in the Bay of Bengal can be used as the raw materials for producing antibiotics, anti-cancer drugs, bioactive compounds pharmaceutical drugs, nutritional supplements and balanced food products. Hossain et al. (2014) reported that numerous unexplored microorganisms and other living resources have a massive potential of marine-based biotechnology. Production of biofuel/biodiesel from

microalgae as an alternative source of energy is possible in our country.

Crude Oil/ Gas

Due to proximity to the discovered gas fields of Myanmar, some blocks within the territory of Bangladesh are likely to have gas/oil prospects. A multi-client survey in the Bay of Bengal is required to identify potential oil and gas fields, and their reserves.

Maritime shipping

More than 90% of the export and import of Bangladesh is seaborne. The long coastline and history of sea navigation in Bangladesh have led to the relatively healthy development of maritime services. Presently 2500 foreign ships are involved in carrying the commodities originated from the import and export. During the last decade, importers, exporters and buyers have paid USD 95 billion to shipping companies, airlines and freight. There are only 74 registered Bangladeshi merchant ships which are not sufficient to carry even a fraction of our cargo (Alam, 2014).

Coastal shipping/Feeder services

Coastal shipping/ feeder services with India, Sri Lanka, Singapore, Malaysia, Thailand and Myanmar ports could play a crucial role in our economy and employment generation. Transshipment at Singapore, Kelang, Colombo and other ports of the region will be cost-effective and time-saving (Alam, 2014).

Seaports

Seaports are used for various maritime economic activities like cruise shipping, coastal shipping, international shipping, passenger ferries, fishing, marine mineral mining, oil drilling, off-shore or maritime monitoring. Bangladesh could enhance the existing capacities of seaports and build more modern ports to facilitate the increased trade and commerce of the country as well as the region (Alam, 2014).

Shipbuilding

The existing Shipbuilding yards construct maritime ships of 10,000 DWT capacities are expected to upgrade their ability to 25000 DWT. In the Dry

dockyards 15 ships repaired annually. This industry should be accelerated in all dimensions. The manufacturing and engineering fronts should be upgraded (Alam, 2014).

Ship recycling industries

On average, about 300 ships are dismantled in Bangladesh per year. There are approximately 125 ship breaking yards in our country whose annual turnover is about USD 2.4 billion. It provides about 70-75% scrap steel as raw material for steel and re-rolling mills. The technology should be up gradated with eco- friendly infrastructure (Alam, 2014).

Sea salt production

Traditionally, salt farmers can produce only about 20 tons/ha salts per year. In Thailand, the average is 43 tons/ha/year (Alam, 2014). Community-based land leasing systems, congenial credit facilities, use of machinery and access to weather forecasting can boost up the product from the same lands.

Ocean renewable energy

Wind, wave and tidal range and currents of the Bay of Bengal offer a significant potential to contribute to low-carbon energy supplies. Off-shore and coastal suitable locations for producing renewable energy need to be identified.

Minerals extractions

Beach Sands containing valuable heavy minerals are found in different surveys over the length of a 250 km coastal belt from *Patenga* to *Teknaf*. The deposit of a total number of 17 of valuable minerals such as zircon, rutile, ilmenite, leucoxene, kyanite, garnet, magnetite and monazite, etc., have been found in the entire coastal belt (Alam, 2014). Proper extraction and commercialisation of minerals from beach sand may enhance the growth of different industries.

Marine minerals mining

It is projected that by 2020, 5% of the world's precious minerals will come

from the ocean floors, where 10% by 2030 (Alam, 2014). Bangladesh should explore the mines of minerals located under the benthic zone.

Marine tourism

Marine tourism includes beach-based recreation and tourism; tourist activities in proximity to the sea, and nautical boating including yachting and marinas. Ecotourism can create decent work, promote local culture, local products and reduce poverty. Bangladesh has a vast scope of expanding marine-based ecotourism in *Cox's Bazar*, *Patuakhali*, *Bagerhat*, *Khulna* and *Satkhira* district.

Artificial islands

To minimise the demographic pressure on the mainland, Bangladesh can construct new artificial islands in the continental shelf of the Bay of Bengal. The existing 75 marine islands should be brought under conservation through planting salt-tolerant/mangrove plants (Alam, 2014). Marine Island can be used for tourism and port as well. Adaptive agriculture is also possible there.

Carbon sequestration

The diverse coastal habitats, *Sundarbans* delta, brackish-swamps, tidal rivers, estuary and the seagrass beds could be used for carbon sequestration.

REGULATORY FRAMEWORK IN BANGLADESH

The Constitution of the People's Republic of Bangladesh

Article 18 A of the Constitution provides the guarantee of protecting and improving the environment and of preserving and safeguarding the natural habitats, biodiversity, wetlands, wildlife and forests for both present and future citizens.

The Territorial Waters and Maritime Zones Act, 1974

There is a provision of establishing marine conservation zones in the areas adjacent to the territorial waters and of taking conservation measures to protect the living resources of the sea from over-exploitation or destruction. The government may take proper steps for the prevention and control of marine pollution and for maintaining the ecological balance in the high seas closer to the territorial water zone. In this act, the government was defined as authority. Institutional arrangements are absent in this act. St. Martin Island has not been established as a conservation zone until now.

The Bangladesh Shipping Corporation Act, 2017

This act repealed and re-enacted the Bangladesh Shipping Corporation Order, 1972 (President's Order No. 10 of 1972). Under this act Bangladesh Shipping Corporation (BSC) was empowered to acquire, hire, charter, hold or transfer ships or vessels; to repair, build, recondition or assemble ships, boats and other similar vehicles; to perform the tasks of adjusting machinery and spare parts of ships, vessels and other similar vehicles, assembling and manufacturing of machinery, and to perform repair works for reconditioning thereof; to establish or to make arrangements for establishing any institute for providing instructions and training for the potential candidates for employment or the persons employed in shipping-related activities or ancillary thereto; to acquire, develop, expand and hold or transfer of any movable or immovable property; to operate own workshops for repairing ships or vessels and, through the workshops, to repair own ships and any other domestic or foreign ships if needed; to acquire ships, vessels or naval crafts through ownership or joint ventures or any other arrangements and to conduct any additional business-related thereto; and to appoint shipping agents in the ports of the country and abroad.

The Bangladesh Merchant Shipping Ordinance, 1983

This ordinance defines various terms of inland, maritime and foreign shipping. It provides guidelines for maritime transportation and registration procedures. The safety of the maritime shipping is mentioned in this ordinance. Service rules of the seamen are elaborately discussed in this ordinance.

The Bangladesh Flag Vessels (Protection) Ordinance, 1982

This ordinance has defined Bangladesh Flag Vessel and the competent authority of the vessel. It described the limitation on the carriage of cargoes of seaborne trade, carriage of cargoes by third-country flag vessels, restrictions on non-Bangladesh Flag vessels, the prohibition to join liner conference without a licence, conditions for granting a licence, penalties for violation of the laws and offences by the companies. There is also a provision for making rules under this ordinance.

The Mongla Port Authority Ordinance 1976

The Mongla Port Authority was established under this ordinance. This ordinance described the power, functions and indemnity of the authority.

Chittagong Port Authority Ordinance, 1976

The Chittagong Port Authority was established under this ordinance. This ordinance described the power, functions and indemnity of the authority.

Payra Port Authority Act, 2013

The Payra Port Authority was established under this ordinance. This ordinance described the power, functions and indemnity of the authority.

The Bangladesh Ship Recycling Act, 2018

This act defines various terms associated with shipyard and ship recycling. This act empowered the government to establish a Bangladesh Recycling Board, to announce zone, to install yard and to recycle ships. The functions and powers of the Bangladesh Recycling Board are mentioned here. This act emphasises international conventions and guidelines.

The Bangladesh Oceanographic Research Institute Act, 2015

Under this act, the Bangladesh Oceanographic Research Institute was established. This act describes the functions of this institutes, director-general and board of directors. The institute will carry out research on Physical Oceanography; Geological Oceanography; Chemical Oceanography; Biological Oceanography; Climate Change and the Ocean; any other subject on maritime matters. The institute will take responsibility for the management, coordination and control of all activities related to the implementation of the fundamental and technical research related to maritime science, its application and the results of the research results. It will collect, preserve and distribute the research data and results through the establishment of a modern Oceanographic Data Center. Also, it will report on oil spillage and provide suitable recommendations.

The Bangladesh Institute of Biotechnology Act, 2010

Under this act, the Bangladesh Institute of Biotechnology was established. This act describes the functions of this institute, director-general and board of directors. The institute will be applying the benefits of human welfare, including modern biotechnology, innovative research and development programs. Besides, it will assist in the field of biotechnology, genetically modified (GM) food and genetically modified organisms (GMOs). It takes measures in case of bio-safety, bio-ethics and bio-surveillance.

The Bangladesh Oil, Gas and Mineral Corporation Ordinance, 1985

Bangladesh Oil, Gas and Minerals Corporation (PETROBANGLA) was established under this ordinance. This ordinance has empowered the corporation to undertake research in the field of oil, gas and minerals; to prepare and implement programmes for the exploration and development of oil, gas and mineral resources; to produce and sell oil, gas and mineral resources; to undertake research for alternative use of natural gas; to carry out geological, geophysical and other surveys for the exploration and development of oil, gas and mineral resources; to carry out drilling and other prospecting operations to prove and estimate the reserves of oil, gas and mineral resources and collect all data required for adopting the most suitable extraction and mining method; and to set up mining industries and to continue production and sale of the mined commodities.

The Sustainable and Renewable Energy Development Authority Act, 2012

Under this act, Sustainable and Renewable Energy Development Authority (SREDA) was established. This act empowered this authority to encourage energy efficiency and conservation related research and development and to identify innovative financing for implementation of projects or associated works relating thereto, and arrange necessary training in this behalf; to coordinate the implementation activities of energy efficiency and conservation in government, semi-government and autonomous bodies and create commercial market for sustainable energy in private sector through demonstration; to assist the government in making necessary laws, rules, regulations for sustainable energy development; to prepare and update inventory of renewable energy resources and associated technologies, indicating its geographical location of sites and verify its suitability for commercial use after assessing possibilities of its exploitation; to prepare short, medium and long term development project to extend the use of renewable energy with specific targets and take necessary steps to implement it; to provide technical and financial assistance in research, development, demonstration and training on renewable energy; to assist to identify sources of financing and make necessary arrangement to provide financial incentives to attract and encourage private investment in renewable energy sector; to help the government to coordinate the implementation of renewable energy development related activities in government, semi-government and autonomous bodies; to encourage commercialisation of renewable energy and energy efficiency activities in private sector through implementation of pilot project; to assist the government to formulate, update and implementation of policies made under this Act, including revision of Renewable Energy policy; to coordinate with different Ministries, Divisions and organisations in matters related to sustainable energy; and to establish linkage with regional and international organisations on sustainable energy.

The Abhawa Ain, 2018

This act describes the functions of the Bangladesh Meteorological Department. Under this act, the department will prepare the strategy and action plan aligning with the Intergovernmental Oceanographic Commission (IOC) and the International Maritime Organization (IMO).

The Coast Guard Act 2016

This act was enacted to define the functions, jurisdictions and code of conducts of Bangladesh Coast Guard.

The Disaster Management Act of 2012

This act defines various terms associated with the disaster, organisational structure and committees for disaster management are formed under this act. Their functions are described here. Under this act, the President is empowered to declare any region or area as a distressed zone.

The Bangladesh Biodiversity Act, 2017 (Act No. II)

This Act focuses on achieving three goals of the ‘Convention on Biological Diversity (CBD)’. The Act describes conservation and prohibited activities; formation of different committees and their functions; management, action plan, strategy, anthropogenic disturbances, fundraising, criminal activities, prosecution, and punishment. Activities of various committees were described, but no specific business was allocated to any department. This act excluded Maritime Affairs Unit and Bangladesh Tourism Board.

The Bangladesh Environment Conservation Act, 1995

The act covers the conservation of biodiversity through ecosystem management and controlling pollution. There is a provision of declaring an ecologically critical area (ECA) in this act. The Department of Environment was established under this act. It has created the post of a Director-General of that Department. The authority or the department is empowered to take measure against the emission of smoke harmful to the environment and to take appropriate steps to protect environmental degradation. The department issues Environmental Clearance Certificate.

The Bangladesh Environment Conservation (Amendment) Act, 2010

This act is the amendment of The Bangladesh Environment Conservation Act, 1995, which clearly defined hazardous waste, ecosystem, ecologically critical area, waste management, and wetland. This act did not clarify the mono-centric authority. The punishments for the non-compliances described in the ‘Bangladesh Environment Conservation Act, 1995’ have been increased in this amendment.

The Bangladesh Environment Court Act, 2010

This act was enacted to ensure justice against any sorts of environmental and social damage. There is a provision of establishing one or more Environment Court in each Division and of appointing an officer from the judicial service of the rank of Joint District Judge. There is also a provision of establishing one or more ‘Special Magistrate Court’ in each district and of appointing an officer from the judicial service of the rank of ‘First Class Judicial Magistrate’ or any Metropolitan Magistrate. The Director-General of the Department of Environment can authorise a subordinate officer as a prosecuting and inspecting officer.

The Wildlife (Conservation and Security) Act, 2012

The act covers different elements of forest biodiversity and conservation. There are provisions of defining, declaring and managing different types of protected areas for enhancing biodiversity conservation. There is a provision of constituting a board comprising a chairperson and necessary experts to the preservation of biodiversity. Through this Act, the Forest Department has been empowered for the conservation and management of biodiversity of the country. This act has defined wetland and ecotourism or nature tourism.

The Marine Fisheries Ordinance, 1983

Part VIII of this ordinance provides the provision of establishing marine reserves through official gazette notifications to protect aquatic habitat where flora and fauna are endangered or face a risk of being extinct. This part has forbidden attempting to fish; to discharge waste or pollutants, to dredge, to alter or destroy natural breeding grounds or habitats, and to construct infrastructures on or over any reserve land or water bodies.

The Protection and Conservation of Fish Rules (1985)

The Rules were framed to fulfil the overall objectives of the ‘Protection and Conservation of Fish Act, 1950’. The Section-5 has forbidden making any attempt to destroy or catch any fish by using ammunition, guns, arrow, bow and any sorts of explosives neither in freshwaters nor coastal waters. Additionally, the section-6 has strictly prohibited making any attempt to destroy fishes by applying poisons to water and depleting fisheries through pollution. These rules were framed to protect freshwater

fishing and fishing in the estuaries.

The State Acquisition and Tenancy Act, 1950 (East Bengal Act)

The section-90 under chapter XIII of this Act imposed restrictions on the non-bonafide cultivators to purchase lands. They cannot buy lands for commercial or industrial purposes and charitable or religious purposes without the prior written permission of the prescribed Revenue Authority. Here revenue authority means Collector or Deputy Commissioner of a district. The management of government-owned land, including alluvial and diluvial land, is described in this act.

The Bangladesh Water Act, 2013

This act was enacted for effective and efficient usage and conservation of water resources of the country. This act gave ownership of all sources of water like sub-surface, marine, rainfall and atmosphere to the government.

The protected areas of tourism and particular tourism zone Act -2010

This act was enacted to identify the critical areas where tourism will be restricted for sustainability. The government may declare any crucial area for the conservation, and any developmental activity shall not be carried without prior permission of the government.

The Ecologically Critical Area Management Rules, 2016

The Rules were framed in line with the fulfilment of the overall objectives of Bangladesh. These rules formed various committees, starting from national to grass root levels incorporating diverse stakeholders. These rules restrict all activities against biodiversity conservation, pollution, and exploitation of natural resources in the Ecologically Critical Areas (ECA). Without prior permission of the Forest Department, none can change the land category based on the usage. Co-management was encouraged in these rules.

THE INSTITUTIONAL FRAMEWORK IN BANGLADESH

Table 1: *Allocations of business of different Ministries related to Marine Resource Management in Bangladesh*

<i>Ministry</i>	<i>Departments/ Unit</i>	<i>Allocation of business associated with marine resource management</i>
Ministry of Foreign Affairs	Maritime Affairs Unit (MAU)	• Arrangement of agreements and treaties including boundary and territorial treaties with other countries and international organisations and treatment, custody and preservation of state documents connected therewith • The synchronisation of matters related to foreign and extra-territorial jurisdictions; • Dealings in the matters of piracies and crimes committed on the high seas or in the air • Promotion of the matters relating to continental shelf, territorial waters, contiguous zones and questions of fishery rights in the high seas and other subjects of international law
Ministry of Fisheries and Livestock	Department of Fisheries Bangladesh Fishery Research Institute Marine Fisheries Academy	• Preparation of schemes and coordination of national policy in respect of fisheries • Prevention and control of fish diseases. • The utilisation of fish and fish wastes and development of fisheries resources and fishing.

		• Control, management and development of Government Fisheries which are under the development scheme of this Ministry and such other fisheries which will be included in future in the development scheme of the Ministry • Fish farms management and conservation of fish and other population of aquatic organisms of economic importance • Refrigeration and cold storage facilities for fish. • Improvement and augmentation of aquaculture and cultivation of pink pearls • All matters relating to Marine Fisheries including permission for acquisition, licensing and monitoring of the operation of fishing vessels including Factory Ship • Fishing and fisheries beyond territorial waters (including deep-sea fishing), fish harbour, fish quality-testing, laboratories and other ancillary organisations • Planning Cell-Preparation of schemes and coordination in respect of fisheries Research and training in fishery Mechanised fishery and livestock operations • Participation in the relevant internal conference, associations, other bodies and implementation of decisions made thereof • The utilisation of coastal land for Brackish shrimp culture
--	--	--

Ministry of Shipping	• Port Authorities • Department of Shipping • Bangladesh Shipping Corporation • Marine Academy • National Maritime Institute • Bangladesh Inland Water Transport Authority and Corporation	• Ports • Light-house and light-ships • Navigation, Shipping, Maritime Administration of Safety • Mercantile marine • Admiralty jurisdiction, offences committed on high seas • The welfare of merchant navy seafarers, employment of seamen • Education, training, standards and certification for Mercantile Marine and Inland Water Transport • Organisation and maintenance of mainland, islands and inter-island shipping services • Matters relating to marine pollution from ships and crafts • Registration and safety administration of fishing vessels • Marine search and rescue • Coordination and research relating to this Ministry • Legislation about shipping and navigation • Recruitment of seaman • Liaison with International Organizations and matters relating to treaties and agreements with other countries and world bodies relating to subjects allotted to this Ministry • All laws on issues allocated to this Ministry
----------------------	---	--

Ministry of Commerce	• Export Promotion Bureau • Bangladesh Tariff Commission • Bangladesh Foreign Trade Institute	• Promotion and regulation of internal commerce • Price Control • Export policies including protocols, treaties agreements and conventions bearing on trade with foreign countries • Purchase and supply of internal and external stores • Tariff commission, tariff policy, tariff valuation, commonwealth tariff Preference, general and international agreements on tariff • Quality control, standardisation and marking of the agricultural products/ animals products for export
Ministry of Power, Energy and Minerals	• Sustainable and Renewable Energy Development Authority (SREDA) • Geological Survey of Bangladesh (GSB) • Bangladesh Oil, Gas and Minerals Corporation (ROBANGLA) • Bangladesh Petroleum Exploration and Production Company (BAPEX)	• All policies and matters relating to power • General policies relating to the generation, transmission and distribution of electricity including Thermal power, Hydro and Mini Hydro-Electricity • Formulation and Administration of National Power Policy • Regulation and development for electrical energy • All policies and matters relating to Petroleum, Natural Gas and Mineral Resources • Policy relating to mineral resources other than Petroleum and Petroleum products • General Policy (Regulatory & Development) relating to Petroleum, Gas & Mineral Resources other than radioactive materials and nuclear fuels • Mineral Exploration & Development • Administration, Planning, Programming and Policy about Geological Survey • Administration & control of the Geological Survey of Bangladesh

<i>Ministry of Environment, Forest and Climate Change</i>	• Department of Forest • Department of Environment • Bangladesh Fishery Research Institute • Bangladesh Climate Change Trust Fund	• Tackling the risks arising from climate change • Environment and Ecology • Matters relating to environmental pollution control • Conservation of forests and development of forest resources (Government and Private), forest inventory, grading and quality control of forest products • Afforestation and regeneration of the forest, extraction of forest products • Tree plantation • Research and training in Forestry • Protection of wild birds and animals and establishment of sanctuaries
<i>Ministry of Disaster management and Relief</i>	• Department of Disaster Management	• Formulation review and execution of legislation, policies, plans, procedures, standing orders and guidelines relating to overall disaster risk reduction and emergency response management including relief, rehabilitation and safety net programmes • Maintaining a database on the recipient of Vulnerable Group Feeding (VGF), Vulnerable Group Development (VGD) and other safety-net management information system • Relief and Disaster risk reduction programmes, planning, research and monitoring • Coordination of all activities relating to disaster management and relief incorporating disaster risk reduction and emergency response management • Mainstreaming Disaster Risk Reduction across line ministries and agencies at all levels

		• Implementation of the disaster-related programmes/projects undertaken due to adverse impacts of climate change • Construction and maintenance of small bridges/culverts, multi-purpose disaster shelters, Cyclone shelters, flood shelters to eliminate/reducing disaster risks • Administration and coordination of aids, loans, grants, search and rescue operation, emergency relief and technical assistance on disaster management under regional and international cooperation • Assessment of disaster situation and recommendation to declare State of Disaster Emergency and issuance of evacuation notices and monitor disaster early warning dissemination • Establish, strengthen and improve the national disaster response mechanism • Expanding prevention and preparedness measures across a broader range of hazards such as earthquake, infrastructure collapse, Tsunami, fire and events causing mass casualties • Develop, manage and coordinate training learning and development and awareness-raising on disaster management
<i>Ministry of Local Government, Rural Development and Cooperatives</i>	• Local Government Bodies • Local Government Engineering Department	• Matters relating to the Local Government including the Local Government Institutions • Development of Rural Water supply, Sanitation and Sewerage System • Rural Development Policy • Co-operative Law, Rules & Policy

	• Department of Public Health Engineering	• Implementation of Poverty Reduction Programmes in rural areas assigned to this Division • Promote entrepreneurship development • The innovation of new models for rural development through action research
<i>Ministry of Agriculture</i>	• Department of Agriculture Extension • Bangladesh Agriculture Research Institute • Soil Resource Development Institute	• Agricultural research and education • Agricultural extension and training • Soil survey • Development of crops
<i>Ministry of Civil Aviation and Tourism</i>	• Bangladesh Parjatan Corporation • Bangladesh Tourism Board	• Legislation relating to tourism • Registration of travel agencies
Ministry of Land	• Commissioner • Deputy Commissioner • Upazilla Nirbahi Officer • Assistant Commissioner (Land) • Department of Survey & Settlement	• Rights in and over land and water and laws regarding land tenure • State acquisition and management • Transfer, alienation of Government land, devolution of land by escheat and otherwise • Disposal of Government land and alienation of land revenue • Demarcation of boundaries Maintenance of land records, survey and settlement operations • Management of government land • Wasteland • Alluvial lands • State purchase operation • Requisition and compulsory acquisition of land • Reclamation and colonisation of wasteland in general • Un-classed state forest

Ministry of Planning	• Statistics and Informatics Division • Planning Division	• All matters relating to Statistics and Informatics • Formulation and revision of policy on Statistics and Informatics • Development and maintenance of central Geographical Information System (GIS) platform • Assisting with the integration of GIS from other agencies into the central GIS platform • Preparation and revision of National Strategy for Development of Statistics (NSDS) • Preparation of national plans-annual, five-year and perspective for the economic and social development of the country by the socioeconomic objectives of the government of Bangladesh • Preparation of annual development programmes within the framework of national plan and formulation of policies for the implementation and impact on the economy • Periodic review of the national development plan, the study of its implications and effects on the economy • Study of critical economic issues and formulation of economic policies and measures • Undertaking and promoting economic research and initiating surveys and investigations needed to support effective planning and development • Coordination of development activities of various Ministries/ Divisions and their agencies where such actions are inter-related or inter-dependent
-----------------------------	--	--

		• Coordination of economic policies which have across the financial impact or involve more than one Ministry/Division • To act as the National Focal Point on New and Renewable Sources of Energy as well as perform the coordinating role on all energy-related inter-ministerial matters
Ministry of Social Welfare	Department of Social Welfare	• National policy regarding social welfare • Community development with particular emphasis on disadvantage segment of the society
Ministry of Water Resources	• Bangladesh Water Development Board • Water Resources Planning Organization (WARPO)	• General policy and technical assistance in the field of irrigation, flood control, antiwater-logging, drainage and anti-erosions • All matters relating to irrigation, flood control, flood control works, causes of floods and damage caused by floods to irrigation projects, dams, etc. • Soil conservation drainage and water-logging • Storage of water and construction of reservoirs, embankment and barrages • Land reclamation, estuary control • Anti-salinity measures and anti-desertification • Hydrological survey and data collection.
Home Ministry	• Bangladesh Coast Guard • Bangladesh Tourist Police • Bangladesh River Police	• Internal security matters relating to public security arising out of dealings and agreements with other countries, INTERPOL • Border security • Anti-smuggling and related matters

		• Poisons • Offences against laws concerning any of the issues dealt with in this Ministry • The Foreigners Act • Bangladesh (Control of Entry) Act
Ministry of Education	Public Universities	• Formulation of the sectoral plan on University education • Technical education • Educational research and training • Educational Policy and Reforms • Curriculum development • International Organisation and other international programmes in the field of education and science • Educational exchange programmes, exchange of teachers, professors, educationists, scientists, technologists, etc. • Overseas studies and scholarships, foreign teachers and students in Bangladesh • Publication of scientific and professional books • Matters relating to the recommendations of the Education Reforms Commission
Ministry of Defence	• Bangladesh Navy • Bangladesh Meteorological Department	• Meteorological observations • Hydrographic surveys and preparation of navigational charts • Survey of Bangladesh
Ministry of Finance	• Financial Institutions Division • Economic Relation Department	• Insurance and law of Insurance. • Banking, including Co-operative Banking. • Coordination, review and monitoring of the utilisation of foreign aid • External economic relations with international development agencies

		• All international agreements involving financial-economic and technical cooperation • External Economic Policy
Ministry of Science and Technology		• Formulation and review of national policies on Science and Technology (S&T) in pursuance of national objectives and plans • Implementation of recommendations of the National Committees on Science and Technology • S&T related research, development and similar areas and coordination among the users • Coordination of areas of S&T in which other Ministries/Divisions have interest and capabilities • Undertaking appropriate steps for integrating Bangladesh with the current S&T related development initiatives in the international arena • Matters relating to National Institute of Biotechnology (NIB) and Oceanographic Science
Ministry of Industries	• Bangladesh Chemical Industries Corporation • Bangladesh Steel & Engineering Corporation (BSEC) • Bangladesh Standards and Testing Institution (BSTI) • Bangladesh Industrial Technical Assistance Center	• Preparation of schemes relating to the public sector industries • Promotion of foreign investment in industrial enterprises, international investment problems and employment of foreign nationals in commercial and industrial fields • Promotion and protection of investment through international investment agreements • National agencies and institutions for (a) promoting industrial productivity, and (b) Testing industrial products • Standards and quality control • Prescription and review of criteria for the assessment of spare parts and raw materials for industries

	• Department of Patents, Designs & Trademarks (DPDT) • National Productivity Organisation (NPO) • Boilers	• Production, supply and distribution of processed foodstuff • Matters relating to patent, design and trademarks department • Testing and quality control of industrial and commercial products • Development of salt industry, including manufacture and trade in salt, control of price and development of salt cottage industry • Coordination of the development work of small scale industries
--	---	---

THE REGULATORY FRAMEWORK IN AUSTRALIA

The Fisheries Management Act 1991

This is an Act (No 162, 1991) which has been updated on 7 November (Act 123, 2017) (Australian Government, Federal Register of Legislation). The regulatory control over fisheries in Australia is shared among the Federal Government and the constituent States and Northern Territory. An independent Australian Fisheries Management Authority (AFMA) was set up by the Fisheries Management Authority Act 1991, as a statutory authority to manage fisheries on behalf of the Federal Government. This act covers all aspects of marine fisheries including management, conservation, fishing vessel, gear, rights, research, national and international agreements, access right, commercial and non-commercial fishing, fishing in different maritime zones, integrated biodiversity management, cartilaginous fishing, etc. AFMA looks after commercial fisheries from three nautical miles out to the extent of the Australian Fishing Zone. The states and the Northern Territory are responsible for recreational, commercial coastal and inland fishing and aquaculture. It provides fisheries management services to Joint Authorities of the Commonwealth and state governments, including the Torres Strait Protected Zone Joint Authority (PZJA).

The Navigation Act 2012

This is Act (No128, 2012) relating to maritime safety and the prevention of pollution of the marine environment, and for related purposes (Australian Government, Federal Register of Legislation). This act modernized the ways of the international shipping regulated by Australian Maritime Safety Authority. It provides high levels of safety and protection of the marine environment through transparent and flexible regulation. It has been clarified to address contemporary conditions and practices, removed unnecessary and outdated provisions, and provided much-needed confidence and certainty for industry. The Navigation Act 2012 incorporated the latest international standards for seafarer living and working conditions required by the Maritime Labour Convention 2006. Under the National Law, the Australian Maritime Safety Authority (AMSA) is the National Regulator. State and Northern Territory maritime safety agencies will continue to deliver operations and services to the industry as delegates of the National Regulator.

The Offshore Petroleum and Greenhouse Gas Storage Act 2006

This is an Act (No 14, 2006) known as *Offshore Petroleum and Greenhouse Gas Storage Act 2006* which has been updated (Act 11, 2017) on 23 February 2017 (Australian Government, Federal Register of Legislation). This act covers the regulatory framework for all offshore petroleum exploration, production and greenhouse gas activities in Commonwealth waters (those areas more than three nautical miles from the territorial sea baseline and within the Commonwealth Petroleum Jurisdiction Boundary). Similar provisions are conferred on National Offshore Petroleum Safety and Environmental Management Authority (NOPSEMA) under other relevant state and Northern Territory legislation as they apply in coastal waters (those areas less than three nautical miles from the territorial sea).

The Offshore Minerals Act 1994

This is an Act (No 28, 1994) known as *Offshore Minerals Act 1994* which has been updated (Act 140, 2001) on 16 October 2001 (Australian Government, Federal Register of Legislation). This act regulates the exploration and extraction of minerals, other than petroleum, in the first three nautical miles of the territorial. The act provides for the management and use of mineral resources in the area and contains provisions on licences for the exploration, retention and mining of minerals and related fees. The act also provides for exploration and mining in marine reserves and fish habitat protection areas.

The Environment Protection and Biodiversity Conservation Act 1999(EPBC Act)

This is the Australian Government's key piece of environmental legislation-commenced 16 July 2000 (Australian Government, Department of the Environment and Energy). It enables the federal government to join with the states and territories in providing a truly national scheme of environment and heritage protection and biodiversity conservation. It focuses on the protection of matters of national environmental significance, with the states and territories having responsibility for issues of state and local significance. The objectives of this act are: to provide for the protection of the environment, especially matters of national environmental importance; to conserve biodiversity; to provide a streamlined national environmental assessment and approvals process; to enhance the protection and management of significant natural and cultural places;

to control the international movement of plants and animals (wildlife), wildlife specimens and products made or derived from wildlife; to promote ecologically sustainable development through the conservation and ecologically sustainable use of natural resources; to recognize the role of Indigenous people in the conservation and ecologically sustainable use of Australia's biodiversity; and to promote the use of Indigenous peoples' knowledge of biodiversity with the involvement of, and in cooperation with, the owners of the knowledge.

Water resources have been given national environmental significance, due to coal seam gas and extensive coal mining development and hence, an amendment to the EPBC Act became law on 22 June 2013. The nine matters of national environmental significance (MNEs) were incorporated. These are world heritage properties; national heritage places; wetlands of international importance (often called 'Ramsar' wetlands); nationally threatened species and ecological communities; migratory species; Commonwealth marine areas; the Great Barrier Reef Marine Park; nuclear actions (including uranium mining); and a water resource, concerning coal seam gas development and extensive coal mining development.

The basis of the development of this act is that in November 1997, the Council of Australian Governments (COAG) agreed in principle to the Heads of Agreement on Commonwealth/State Roles and Responsibilities for the Environment. Subsequently, all heads of governments and the Australian Local Government Association signed an agreement. In the agreement, the States and Territories and the Commonwealth agreed that reform in the following five areas was needed to develop a more effective framework for intergovernmental relations on the environment: matters of National Environmental Significance; environmental assessment and approval processes; listing, protection and management of heritage places; compliance with State environmental and planning legislation; and better delivery of national environmental programmes. This agreement helps COAG to finally enacted the *EPBC Act* 1999 and has been updating continuously based upon the needs.

The Environmental Protection and Conservation Regulation 2000

This is a Statutory Rules No. 181, 2000 made under the *Environment Protection and Biodiversity Conservation Act 1999*(Australian

Government, Department of the Environment and Energy). It has 20 parts and 12 schedules through which it is regulated throughout Australia as its best practices. The parts are: matters of national significance, bilateral agreements, referral of proposals to take actions, accessing the impact of controlled activities, minister's advice on authorising actions, species and communities, interacting with cetaceans and whale watching, conservation and biodiversity in commonwealth areas, commonwealth reserves, activities in commonwealth reserves, conservation zones, enforcement, committees, publication, permits, permit fees, miscellaneous, application and transitional provisions. Through its schedules – it reinforces the environmental impact statement, import and export of CITES specimens, Australian world heritage management principles, management plans for national heritage places, Australian *Ramsar* management principles, heritage strategies, Australian IUCN reserve management principles, infringement notice offences etc. This regulation has been updated continuously, and the last update was made on 17 December 2018.

The Great Barrier Reef Marine Park Act 1975

This is an Act to establish a Great Barrier Reef Marine Park and for related purposes. The Great Barrier Reef is the world's largest coral reef, covering some 344 400 square kilometers of unparalleled biodiversity and unique ecosystems which internationally recognized as a World Heritage Area. The *Great Barrier Reef Marine Park Act 1975* established the Great Barrier Reef Marine Park some 30 years ago and has been during this time an exemplar for marine management and conservation. The great barriers reef authority has been working in collaboration with the Queensland Government in managing and protecting the Marine Park.

The main object of this act is to provide for the long term protection and conservation of the environment, biodiversity and heritage values of the Great Barrier Reef Region. The other objects of this act are to do the following, so far as is consistent with the primary objective:

- (a) allow ecologically sustainable use of the Great Barrier Reef Region for purposes including the following:
 - (i) public enjoyment and appreciation;
 - (ii) public education about and understanding of the Region;
 - (iii) recreational, economic and cultural activities;

- (iv) research concerning the natural, social, economic and cultural systems and value of the Great Barrier Reef Region;
- (b) encourage engagement in the protection and management of the Great Barrier Reef Region by interested persons and groups, including Queensland and local governments, communities, Indigenous persons, business and industry;
- (c) assist in meeting Australia's international responsibilities concerning the environment and protection of world heritage (especially Australia's responsibilities under the World Heritage Convention).
- (3) To achieve its objects, this act:
 - a) provides for the establishment, control, care and development of the Great Barrier Reef Marine Park; and
 - b) establishes the Great Barrier Reef Marine Park Authority; and
 - c) provides for zoning plans and plans of management; and
 - d) regulates, including by a system of permissions, use of the Great Barrier Reef Marine Park in ways consistent with ecosystem-based management and the principles of ecologically sustainable use; and
 - e) facilitates partnership with traditional owners in the management of marine resources; and
 - f) promotes a collaborative approach to the management of the Great Barrier Reef World Heritage area with the Queensland government.

In commissioning a review of the act, the Australian Government has recognized the evolving needs and challenges of safeguarding the Marine Park for the future. This review looks into the current, relevant legislation and provided appropriate approach necessary for continued protection for marine life and biodiversity. In 2005, the Australian Government made an election commitment to review the *Great Barrier Reef Marine Park Act 1975* to improve the performance of the Great Barrier Reef Marine Park Authority, its officeholders and its accountability frameworks. The review is chaired by the Secretary of the Department of the Environment and Heritage, Mr David Borthwick, assisted by Ms Barbara Belcher, Department of the Prime Minister and Cabinet and Mr Jonathan Hutson, Department of Finance and Administration, reporting to the Minister for the Environment and Heritage, Senator the Hon Ian Campbell. This review sets out a clear direction for the future management of the Great Barrier Reef Marine Park. The Australian Government is committed to the long-term protection and wise use of this precious asset and commends this report.

THE RENEWABLE ENERGY (ELECTRICITY) ACT 2000

This is an Act (No. 174, 2000) known as Renewable Energy (Electricity) Act 2000 enacted for the establishment and administration of a scheme to encourage new electricity generation from renewable energy sources, and for related purposes (Australian Government, Federal Register of Legislation). This has been updated with the last amended (Act 4, 2016) and in force on 10 March 2016. The objects of this act are:

- (a) to encourage the additional generation of electricity from renewable sources; and
- (b) to reduce emissions of greenhouse gases in the electricity sector; and
- (c) to ensure that renewable energy sources are ecologically sustainable.

This act described wave, tide and ocean as the sources of renewable energy. It has 17 parts and several divisions under each section which discusses renewable energy certificates; acquisition of electricity; shortfall charges; objections, reviews and appeals; audits, offences and penalties.

INSTITUTIONAL FRAMEWORK IN AUSTRALIA

Table 2: *Allocations of business of different Ministries related to Marine Resource Management in Australia*

Department/ Institution	Unit	Mandate
The National Oceans Ministerial Board	Consists of the Commonwealth Ministers responsible for industry, resources, fisheries, science, tourism, shipping and the environment	the implementation and further development of Australia's Oceans Policy
The National Marine Science Committee (NMSC)	An advisory board consisting of representatives of 29 organisations conducting and using marine research across Australia	• focus on promoting the nexus between high-quality marine science and growth of Australia's blue economy • provides a distinctive mechanism for coordination and information sharing between research institutions, universities, Australian Government departments, State/Territory Governments and the broader Australian marine science community • provide scientifically-robust, user-relevant advice on marine issues of national significance to Australia
Ocean Science Council of Australia	An independent group of leading Australian experts concerned with advancing marine conservation to ensure the protection of biological diversity, ecosystem health and the resulting economic and social benefits	Identification of the priorities for action to secure the future of Australia's oceans

Great Barrier Reef Marine Park Authority	• Reef Advisory Committees • Local Marine Advisory Committees	• Tackling the threats of climate change • Strategies to manage reefs • Managing activities and use • Using tools to manage reefs • Adopting programmes and projects for protecting and conserving the reefs
Department of Agriculture	• Fisheries • Forestry	• Aquaculture • Australian Fisheries Communication Strategy • Aquaculture industry • Domestic Fisheries • International fisheries • Seafood trade • Marine animal health • Illegal, unregulated and unreported fishing • Marine pest • Aquatic animal disease • Recreational fishing • The Torres Strait • Fisheries and the environment • Mangrove management
Department of Infrastructure, Transport, Cities and Regional Development	Maritime	• Maritime navigation • Maritime business • Maritime workforce • Marine Environment Protection • Protection of the sea legislation • The International Convention for the Prevention of Pollution from Ships, 1973 as modified by the Protocol of 1978 (MARPOL) • Control of Harmful Anti-fouling Systems on Ship • Maritime Safety • Australian Maritime Safety Authority • Maritime Consultation • Maritime Publication • Tasmanian Transport Schemes

Department of Industry, Innovation and Science	• Joint Authorities • The National Offshore Petroleum Titles Administrator (NOPTA) • The National Offshore Petroleum Safety and Environmental Management Authority (NOPSEMA)	• Invests in offshore petroleum exploration and offshore mining • promotes offshore oil and gas exploration and offshore mining • invites companies to bid for the opportunity to invest in oil and gas, and other minerals exploration in Australian waters • permits, leases and licences (titles) • environmental management • occupational health and safety • well integrity
Department of the Environment and Energy		• Implementing SDGs • Tackling climate change impacts • Protecting and conserving the marine environment and biodiversity • Environment assessment, pollution control, waste management, chemical management • Administering biotechnology • Protecting and conserving Great Barrier Reef • Protecting National Parks including Marine Parks • Protecting heritage • Regulating renewable energy • Regulating wildlife trade • Protecting and conserving threatened species and ecological communities • Conserving biodiversity • Implementing the Green Army Programme • Carrying out researches

Geoscience Australia		• Provides information regarding Australia's coasts and estuaries, seabed mapping and Antarctica • Provides information regarding natural risk, hazard and disaster, including coastal erosion. • Provides information regarding mineral and minerals exploration in Australia at the national and regional scale, mining and land use, sustainable development of resources, and levels of exploration activity
Department of Foreign Affairs and Trade		• Trade and investment • Tourism
The Australian Volunteer Coast Guard		• Marine Search and Rescue • Offshore Vessel Tracking • Recreational Vessel Monitoring via our SafeTrx Smartphone app • Marine Assist Membership • Marine Radio Monitoring • Public Education, including Marine Licence, Marine Radio Licence and Coast Navigation • Community Events • Memorial Services
Local Government		• Day-to-day maintenance of the beaches and coastal facilities • Shore protection • Ensuring access paths, roads and carparks • the keeping of public coastal land in public use • the development and maintenance of coastal reserve facilities • the maintenance of many boat ramps and jetties

The Australian Institute of Marine Science (AIMS)	A Commonwealth statutory authority established by the Australian Institute of Marine Science Act 1972	• Carrying out innovative scientific and technological research, and with the help of our people, industry and research partnerships, infrastructure, and comprehensive data sets • Conducting strategic and applied research into marine life, from microbes to whole-of-ecosystems, and the processes that sustain them • Monitoring the condition and trends in the health of the marine environment • Building models and decision-support tools to assist interpretation of the data collected • Developing a broad spectrum of enabling technologies, from molecular sciences to ocean technologies
---	---	---

THE SUCCESS STORIES OF AUSTRALIA

The northern beach council-a case

Local governments in South Australia have a mandate under the Local Government Act 1999 and the Development Act 1993 to contribute to the management of the coast. The local governments have a crucial role to play in coastal management. The population of Northern City Council is 266,000. The council is responsible for an active lifestyle with clean waterways, beautiful wildlife and vibrant events backed by excellent services and infrastructure. Managing Coastal ecosystems is a significant priority. Executive Manager of Development Assessment stated, *‘the Council guides and regulates land development processes, provide local services and manages public land. Strong community involvement is critical to its success. We have prepared Community Strategic Plan, Shape 2028’ with the consultation of the communities’*. Executive Manager of the Environmental Compliance of the council said, *‘we manage coastal erosion, headlands, rock platforms, coastal lagoons, creeks, middle harbour, Pittwater waterway, wetlands and water resources, the council works with the State Government to clean up the ocean pollution. The council is committed to the protection of trees and bushland on the Northern Beaches.’*



Figure 1: *Marine Waste Recycling by Northern City Council*

It has adopted a community-based adaptation of climate change. The Manly Environment Centre (MEC) works under this council which promotes sustainable living practices through practical projects. The MEC is an advocacy, research, education and resource centre. The council does everything to keep the environment and residents safe from the impact of hazard and disaster. They provide all public facilities.

Learning: The city council and the community manage the local marine resources effectively. They also protect the hazard and environmental issues and conserve the resources sustainably.

Surfers Paradise, Gold Coast

The city of Gold Coast works all year round to manage, maintain and protect Surfers Paradise beaches. The Councilor from Division 7 stated, *‘the council is responsible for managing beaches and seawalls, sand pumping and dredging, landscaping, coastal infrastructure development, protecting coastline against erosion in future storms, renewing the artificial reef, restoring dune amenity, increasing the health of the dune system and enhancing the recreational experience’*. One respondent from Surfers Paradise Alliance said, *‘we promote and event initiatives; stage events and entertainment in collaboration with event partners and City Council. Besides, we manage cross-promotional and event sponsorship opportunities; conduct market research; liaise and work with local traders and businesses concerning their objectives, and manage and operate the beachfront markets’*. Director Economy, Planning and Environment of City Council said, *‘we look after community partnership, community education, planning for environment, landscape protection, conservation of wildlife, water resource management, waste management and recycling’*.



Figure 2: *Dune preservation in the Gold Coast*

Learning: The city council and the community manage the local marine resources, including marine tourism effectively. They also protect the hazard and environmental issues and conserve the resources sustainably. An alliance of different stakeholders regulates business and economic matters.

The Green Island (The Great Barrier Reef)-a case

Captain James Cook named as Green Island in 1770. The Green Island National Park comprises 7.93 ha of the island covering the middle and eastern portions of the coral cay. Green Island was declared a Fauna Sanctuary in 1934; as the first island national park in Queensland in 1937; and a marine national park in 1974; combined into the Cairns Marine Park in 1989. Green Island also became part of the Great Barrier Reef Marine Park in 1975 and part of the Great Barrier Reef World Heritage Area in 1981. The reefs around the island are zoned as a green zone or no-take zone with no fishing or collecting allowed. In 1990, the surrounding reef; beaches and public areas of Green Island were also declared as a recreation area. One respondent from Big Cat Green Island Reef Cruise said, ‘*the tourist area includes the island national park, a public esplanade and jetty,*

mooring areas and navigation channel and the marine park from the edge of the reef out to 1.6 km'. One respondent from Queensland Parks Service stated, 'we manage the national park, marine Park and recreation area at Green Island. There are regulatory, physical, economic and educational frameworks for managing tourism sustainably on this island. The regulatory framework limits visitor numbers; prohibits certain activities (no fishing or motorized water sports); restricts areas to activities/use (snorkel trail removed), and separates activities (park zoning). The physical framework manages site hardening (brick pathways), facility placement (boardwalks, signs); facility design (low impact resort); sacrifice areas (day use visitor facilities); removing/altering attraction (resort redeveloped); and also rehabilitation (revegetation of resort lease, coastal tree planting). The economic framework includes Fees (permits, eco-certification, recreation levy); damage bond (resort construction company & contractors, resort manager liability); fines (illegal fishing); and rewards (15-year permits for eco-certified operators). The educational framework includes printed material (brochure, self-guided eco-walk, resort fact sheets); signs (Interpretive signs in six languages); a visitor centre (island information centre); and activities (beach cleanup, turtle release, Aboriginal dancing)'.

Learning: Only Queensland Parks Service and the tour operators manage the Great Barrier Reef, a UNESCO World Heritage Site locally and sustainably. Like Bangladesh, there are no many stakeholders in the local and operational level.



Figure 3: The jetty of Green Island where the tourist ship anchors only

All these strategies are used by the Queensland Parks and Wildlife Service and the Advisory Committee to manage tourism sustainably on Green Island. A recreation levy provides funding for visitor facilities and environmental improvement activities. These minimize disturbance, protect habitats and also improve marine and coastal ecosystems.

The Great Ocean Road- a case

The Great Ocean Road Coast Committee comprising of 10 members for a term of years is responsible for the management of 37 kilometers long of the iconic coastal reserves of Victoria. The committee members are selected through the public and skills-based expression of interest process and lastly appointed by the Minister for Environment and Climate Change. This committee builds and maintains a wide range of public facilities, assets and infrastructure ranging from artwork to amenity blocks. They also manage the lease of one privately operated park. They issue contracts, licenses and permits for various commercial and one-off activities and events on the coast.



Figure 4: Great Ocean Road

They eradicate weed and protect the sensitive coastal environment. One member of the committee said, *‘we are trying to be an example of world-leading environmental protection and coastal experiences for all. In partnership with our community, recreation, tourism and local economy, we enhance and effectively manage the coastal environment. We do*

this by reinvesting the income generated through our caravan parks, leases, permits and licenses back into conservation, facilities, assets and infrastructure and education and engagement programs. We protect and enhance our natural environment, and cultural heritage is of the highest priority. Our coastal reserves have strong health, well-being, community, economic, and heritage benefits supporting recreational and community enjoyment. Our activities and partnerships are built on mutual trust, open communication, collaboration and transparency. We engage and consult with our communities and stakeholders to inform our planning. We think long term, use strategic business planning tools and innovation to make the best use of our financial, human and physical resources. Good governance is core to everything we do and who we are’.

Learning: Only a committee manages this national heritage site of Australia. There is no coordination gap, overlapping jurisdiction and the conflict of interest here.

Davenport-a case

The management of Davenport started in 1992 as Budget Property Management; it became Davenport Professional Property Management in 2004. It focuses on customer service. The management consults with many stakeholders from Board Members, homeowners, Attorneys, Real Estate Agents and all kinds of Association Vendors. One respondent from the management said, ‘we want everyone to have a good experience with our company. The numbers of the association have been increased from 8 to 70 during 2004-2019. We have perceived ourselves as a customer service organization. Of course, the grass needs to be cut, and the bills must be paid, but the core value of our work is communication. We promptly respond to any calls. Everyone at Davenport is geared to communicate just as efficiently through email as any other medium. Our digital proficiency helps us to be a quick problem solver’.



Figure 5: Davenport, Tasmania

Learning: A port is managed by a company whose focus is to provide prompt and one-stop customer services.

The Bruny Island-a case

Kingborough Council is responsible for managing this Tasmanian Island. The Executive Director of Community and Economic Development division of the council stated, *‘the council is committed to caring for our natural environment including our bushland and coastal areas. We are developing and protecting a network of healthy natural, as well as planning for the impacts of climate change that will affect the community. The Natural Resource Management Unit is involved with a variety of functions that range from vegetation management, managing environmental weeds and supporting environmental volunteers, through to programs aimed at improving urban storm water discharges’*. Besides, the Bruny Island Advisory Committee (BIAC) was established by Kingborough Council to provide a communication link between the community and the council.



Figure 6: The neck between the south and north of Bruny Island

Learning: A city council is responsible for managing an island, including spatial planning, budgeting, environmental protection, biodiversity conservation and marine tourism.

Scarborough beach resort, Perth-a case

Scarborough, the coastal suburb was named from the English beach resort of the same name located in North Yorkshire on the east coast of Great Britain. The City Council of Sterling is responsible for managing this beach. Chief Executive Director of the Council stated, *‘it is important that we work together to protect the natural environment, so future generations can continue to enjoy a sustainable lifestyle. We’re lucky enough to conserve a wide variety of native animals. Wildlife in the reserves and beaches is highly diverse and includes biodiversity of all kinds. The council is responsible for facilitating and overseeing the staging of various activities, promotions, events, competitions and much more held along our beautiful coastline. The council approves most activity on beaches and reserves to ensure the safety of our community and that all activity complies with local laws and legislation’.*



Figure 7: Scarborough beach resort, Perth

Learning: A city council is responsible for managing the beach, including spatial planning, budgeting, environmental protection, biodiversity conservation and marine tourism.

THE DRAWBACK OF THE REGULATORY AND INSTITUTIONAL ARRANGEMENTS IN BANGLADESH

Dots in the allocation of business

Allocations of businesses of different public institutions are not clearly defined for sustainable marine resource management. Ministry of Fisheries and Livestock is responsible for living resource management directly, where; Ministry of Shipping, Ministry of Civil Aviation and Tourism, Ministry of Power, Energy and Minerals and Ministry of Industries should be responsible for the extraction of non-living resources. Ministry of Environment, Forest and Climate Change should be responsible for sustainability and environmental issues. The first business of the Ministry of Shipping is ‘port’. It is not clear whether this word indicates seaport or other ports like land, river and air. In the allocation of business of the Ministry of Fisheries and Livestock, nothing is mentioned about artisanal and small scale fisheries. But SDG-14 emphasizes on artisanal and small scale fisheries. The conservation aspects of estuary fisheries threatened species, coral reefs and critical areas are ignored. Bangladesh *Parjatan* Corporation and Bangladesh Tourism Board work under the Ministry of Civil Aviation and Tourism. Legislation relating to tourism and registration of travel agencies are mentioned in the allocation of business of that ministry. Nothing related to ecotourism or marine tourism can be found there. The Ministry of Disaster Management and Relief manages disasters, but the allocation of business does not reflect any issues relating to coastal management, coastal spatial planning and coastal erosion protection. The Ministry of Environment, Forest and Climate Change is supposed to ensure marine sustainability, environmental protection and ecological protection, and to tackle the challenges of climate change. A single word mentioning marine cannot be found in their allocation of business. Different stakeholders participating in the divisional and national workshops stated ‘*They do not know what to do in marine resource management*’. Section 8 of the “Territorial Waters and Maritime Zones Act (TWMZ) 1974” implies that “the government may, to prevent and control marine pollution and preserving the quality and ecological balance in the marine environment in the high seas adjacent to the territorial waters, take such measures as it may deem appropriate for the purpose”. The word government is not reflected in the allocation of business of any government department.

Department of Agriculture, Australia regulates the sustainable use of coastal and marine living resources, including mangroves and estuaries. Department of Infrastructure, Transport, Cities and Regional Development of Australia looks after the management of all non-living resources excluding petroleum extraction. Australian Department of the Environment and Energy regulates all aspects of the environment, sustainability and conservation. They are also responsible for regulating blue energy and marine biotechnology. Australian Department of Industry, Innovation and Science is responsible for exploring and mining of natural gas and petroleum products. The Department of Foreign Affairs and Trade, Australia regulates marine tourism, trade and investment. *Geoscience Australia*, a data hub, provides all necessary information regarding oceanography. They prepare different types of maps and offers to all stakeholders. Local Government manages the beaches, protects the shores and provides all public facilities. The Australian Institute of Marine Science (AIMS) carries out marine-related researches and coordinates with universities and other research organizations. The allocations of business of different government institutions are clearly defined. The State and Territory Government allocate business aligning with the Federal Government. There is no ambiguity and vagueness in the allocation of business of the federal government, state government, territory government and local government.

Overlapping jurisdiction

The institutional framework of sustainable marine resource management is characterized by a complex arrangement, involving a mix of formal and informal institutions, public departments, non-government organizations, private sectors, and community. Following the existing laws, the Department of Environment is responsible for controlling and managing pollution, waste, and chemicals. According to the provision of Bangladesh Environment Conservation Act 1995, the Department of the Environment will tackle water pollution problems and maintain water quality in the fishing grounds through developing coordination with the Department of Fisheries. The Ministry of Shipping controls from ships and crafts. The Department of Environment and the Department of Agricultural Extension have responsibilities of limiting the use of chemical fertilizers and pesticides in the agricultural fields. Department of Fisheries (DoF) has overall responsibility to regulate marine fisheries. According to Wildlife (Conservation and Security) Act, 2012 the Department of

Forest Department regulates the fisheries of the *Sundarbans*. According to Ecologically Critical Area Management Rules, 2016, without prior permission of the Forest Department, no citizen even can change the land category based on the usage. The State Acquisition and Tenancy Act, 1950 (East Bengal Act) empowered the collector (Deputy Commissioner) to do the same business. Bangladesh Tourism Board is supposed to regulate tourism including ecotourism and marine tourism. But in most cases the Department of Forest control ecotourism. In these rules, co-management or community-based conservation has been encouraged. Deputy Commissioner is the chairperson of ‘Ecologically Critical Areas (ECA) Management Committee’. They are also responsible for regulating tourism in critical areas. In Australia, the jurisdictions of departments are clearly defined. There is some overlapping jurisdiction in the areas of environment, sustainability and conservation, but the functions of each institution are demarked delicately.

Table 3: *Areas of overlapping jurisdiction among different public institutions*

<i>Areas</i>	<i>Between</i>	
Conservation	Department of Forest	Department of Fisheries
Fisheries in the Sundarbans	Department of Forest	Department of Fisheries
Marine Pollution	Department of Environment	Department of Shipping
Marine Tourism	Department of Forest	Bangladesh Tourism Board
Land Management	Department of Forest	Deputy Commissioner
Eutrophication	Department of Environment	Department of Agriculture Extension

Lack of coordination and integration

It is found that no coordination and integration mechanism exists among various stakeholders, neither at the policy level nor at the implementation level. The overlapping jurisdictions and conflict of interests are the leading causes of these problems. There are few institutions established by the legal provisions involved in marine resource management. They are supposed to be assigned with specific mandates, but the vagueness of the allocation of business in determining the authority creates obstacles in developing effective coordination. The institutional arrangements are very complex without defining specific responsibilities. One key informant stated *‘lack of coordination and integration is the major problem in the institutional framework of marine resource management. There is no coordination/integration among public departments, researchers, academia, and non-government organizations. Establishing strong coordination among different stakeholder is a crying need. Not only coordination but also both horizontal and vertical integration are highly important’*. Few respondents from the divisional level stated *‘we don’t know what to do, who will do and who will coordinate’*. One NGO worker from said, *‘there is no coordination among NGOs and coordination between GO and NGO’*. The fishermen community from Sundarbans region stated, *‘we do not know which department has the real authority. We take passes from the forest office, but the fisheries department provides identity cards and conducts mobile courts. Sometimes the forest guards take action against us’*. The participated respondents from different public universities said, *‘even there is no coordination among the researchers of an individual department of the same university’*. The focal point of Bangladesh Oceanographic Research Institute said, *“We are mandated for the environmental impact assessment, but the Department of Environment continues the same business. Other departments do not help us”*. The focal point of Bangladesh Marine Academy said, *“The Marine Fisheries Academy is more interested in producing mariners (engineers) instead of marine fisheries graduates, but Bangladesh Marine Academy was established and mandated to produce mariners (engineers)”*.

One respondent participated in 2019 Coastal Mini-Symposium held at the Macquarie University of Australia stated *‘the coordination and integration among marine states for conservation and tackling climate change. Suppose one country manages the resources sustainably and*

other countries over-extract the resources. In that case, an initiative of a single country will go in vain', One keynote speaker said, *'the integration and coordination among the urban community and government are required for discovering, understanding and sustaining the urban marine ecosystems'*. Another respondent stated, *'integration and coordination among not only the marine stakeholders but also among marine-land managers are highly essential. Most of the marine pollutions originate from the land'*.

Poor Marine Governance

The sectoral, temporal and spatial marine governance are not clearly defined in any laws or the allocations of business of different public departments. Environmental and ecological governance is not well functioning. High sea governance is absent in our country. The fishermen community stated, *'insecurity and piracy are the pivotal problems in marine fisheries'*. Maritime security governance does not work correctly.

Other problems

Taking bribery and negligence of duties create obstacle in sustainable marine resource management. Many respondents alleged, *'the staffs of the Department of Fisheries take bribe during identity card processing and boat registration'*. The fishermen from the Sundarban region stated, *'they have to pay ten times money of the real fee to the staffs of the Department of Forest'*. The fishermen community from different parts of the community said, *'the law enforcers are not active to control the piracy and robbery, in most cases the foreign pirates kill us and loot everything. The local pirates claim huge money to the family members for not killing. For this reason, we cannot go to the deep sea, and we catch fishes near the shoreline'*. From the FGDs held in Barisal and Khulna division, it was found that the representatives from the different department were not fully aware of sustainability, environmental issues and new emerging challenges like sea acidification. Their concepts were not clear enough. The fishermen communities stated, *'no private and state banks provide credit or micro-credit, even no departments help through providing microcredit. They have to depend on dadan (local credit system) from the Mahajan (local creditors). They have to pay 100% interest for the dadan, and they are bound to sell the fishes to that Mahajan who provided loans'*.

Old laws

Except for Territorial Waters and Maritime Zones Act, 1974 and Bangladesh Flag Vessels (Protection) Ordinance, 1982 no specific act was enacted for marine resource management or any part of any act focused on this issue. The issue of sustainability, conservation, environmental protection, climate change and international obligations are not reflected in the existing laws. No laws address the newly emerged global problems like ocean acidification, global warming, and sea-level rise. Most of the laws were not enacted, defining sectoral governance or a distinct sector of oceanography. One key informant stated, *‘the existing laws should be amended and should incorporate international laws like UNCLOS and MARPOL’*. Another key informant described, *‘there are so many laws, and they are scattered, the existing laws should be amalgamated laws sector-wise’*.

Non-compliance of the laws

There are different prohibitions in the legislation, as mentioned earlier that are not implemented. According to the perception of the local community, there are many reasons for non-compliance of the laws and mismanagement. The penalties incorporated into legislation are not imposed due to lack of monitoring, surveillance, and absence of the staffs. One officer from Teknaf Upazilla said, *‘the implementation of laws cannot be ensured due to lack of logistic support’*. On the other hand, it was also noted that the existing regulation does not work correctly due to corruption. Weak enforcement of laws created the perception among the community that violation of laws will punish them rarely. A staff of a non-government organization involved in turtle conservation said, *“Most of the laws are backdated and not clear, clear legislation is required for marine conservation”*. One key informant stated, *‘Bangladesh is a land of laws, but the implementation of the laws is a sporadic case’*.

Table 4: *Ranks of causal factors for non-compliance of the laws among the fishermen community*

<i>Causal Factors</i>	<i>Rank</i>	<i>Causal Factors</i>	<i>Rank</i>
Seasonal employment	1st	High living cost	8th

Poverty	2nd	Insufficient aids during the ban system	9th
<i>Dadan</i> (local credit system)	3rd	The limited scope of alternative income generation activities	10th
Unemployment during monsoon	4th	Negligence/ corruption of public departments	11th
Intermediaries in the market chain	5th	Unawareness	12th
Unavailability of a loan from the banking systems	6th	Habit	13th
Disrupted communication with the mainland	7th	Greed	14th

SOCIO-ECONOMIC CONDITIONS OF THE FISHERMEN COMMUNITY-A CASE FROM SONADIA ISLAND

It was found that the socio-economic condition and lifestyle of the respondents were almost similar. The religion, educational status, house type, sanitation status, food habit, health condition, land ownership, occupation, monthly income, and expenditure follow a uniform pattern. Most of the participants represented 15-35 years age class. The illiteracy rate was 99%, and only one man passed the Secondary School Certificate from this island residing in the town at that time. The inhabitants of Sonadia depend on fishing and salt cultivation for their livelihoods. A few numbers of people involved in firewood collection from the Para forest, fish processing and cultivation of cereal crops in the *Char* land. Almost all the houses (94.7%) are made by mud, bamboo, and *Chhan* (a local tree species) which is locally known as *Kaccha*. Only 2% of houses were Tin shed building. The absence of electricity indicates this island is far away from getting citizen amenities. About 50% of household use the solar energy while 24.1% household use kerosene lamp, which is locally known as *Kupi* and rest of them use a candle for dinner time and go to bed earlier to save fuel. No health centre was established in the area to date. Sick people need to go *Moheskhal* Upazila by waterway which is 19 km away from this island. Community people have to depend on medicine shop and medicine seller for their primary treatment and normal sickness. Local people claim that they do not get Vulnerable Group Feeding (VGF) cards. Only *Hilsa* fishers get 10 kg rice during banning time of *Hilsa* fishing. However, all the fishermen do not get this rice as compensation. The average income of 94.7% fishers was within 15,000 to 20,000 taka per month, and most of the family (77.3%) had a single earning person. Despite having difficulties in earning, most of the family (73.7%) installed tube well. However, the sanitation condition of the household of the study area was extremely poor as only 1.9% household had a sanitary latrine, where 23.7% had semi *Pucca*. The rest of the toilet was *Kaccha*, but open defecation was not recorded in the study area. Community people do not have cultivable land as they mainly work for fishing and salt cultivation. Nevertheless, very few of them are involved in agriculture in Char area. Homestead vegetable production is very popular there though there is a high scarcity of open space. The land is *Khas* (government-owned fallow land) in nature.

Despite fishing as the main occupation, 73.1% of artisanal fishers do not have their boat and net and depend on others. They mainly harvest fish from the surrounding area of the coast. Most of the boats are shallow engine run (52%) while the rest is a country boat which is locally known as *Dingi*. Most of the time fishermen do not know weather forecasting while they are in the sea. Before going to sea, they try to know whether forecasting from the land. Sometimes, they stay in the sea for a couple of days, and in that time they hardly know weather information. In the sea, there is no coverage of the mobile phone network.

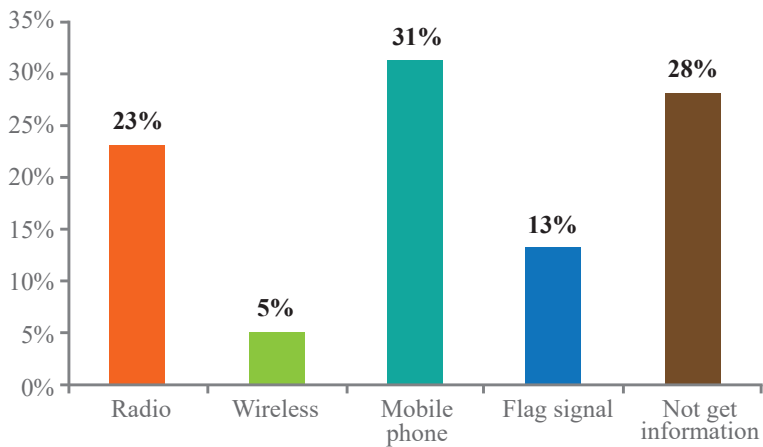


Figure 8: Medium of getting weather information

Fishers in the study area like radio to get authentic information and weather forecasting. Thus, radio is accessible to them till now. Radio is the only way of knowing the weather forecast while in the sea. But a significant portion has no devices either for communication and entertainment (Figure-8).

Only a few of the respondents keep life jacket during fishing in the sea. Most of them (44%) use tube and they feel comfortable to use it. Besides, some of them use a large aluminum pot, which is used for carrying fishes. A significant portion does not use anything as a safety measure (Figure-9).

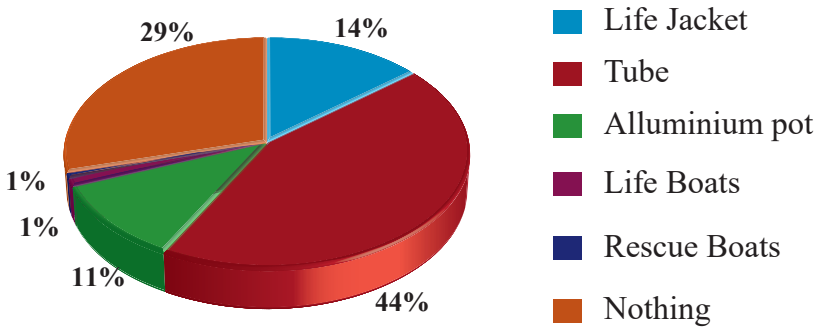


Figure 9: Safety measures during fishing

Challenges

The respondents identified a lot of challenges in artisanal fishing (Figure-10). Piracy, especially Burmese pirates, appears as the primary threat for the life and profession of the artisanal fishermen. They attack suddenly and loot fish and other valuable items. The local pirates sometimes involved in the kidnapping. Sometimes they kill the fishermen. The respondents reported that the Bangladesh Coast Guard is not proactive in controlling piracy. They do not have any formal channel to get the loan for improving their fishing techniques and technology such as a modern boat, nets, and equipment. Therefore, they have to depend on *Dadan* (a system of local credit with very high interest) and *Mahajan* (the loan provider). The state banks have no activities in this area. The fishermen have to pay 100% interest in the *Dadan* system.

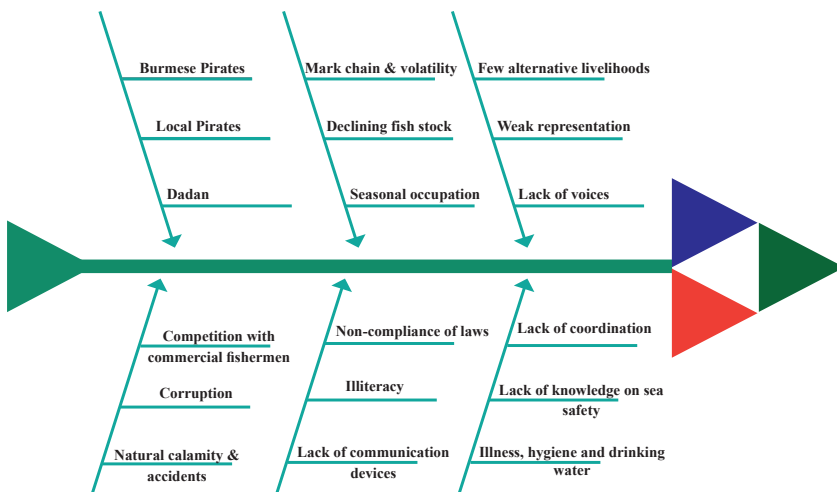


Figure 10: Fishbone diagram showing challenges identified by the respondents

The respondents reported that they get only 30% of actual price due to a complex market chain. They identified 07 classes of intermediaries like the collector, *Majhi* (Captain of a boat), *Chhota Mahajan* (traditional small moneylender and fish buyer), *Boro Mahajan* (traditional big moneylender and fish buyer), *Aratdar* (a commission agent for stocking and selling), Wholesaler and Retailer (Figure-11). In case of taking *Dadan*, the fishermen are bound to sell fishes to the specific *Mahajan* providing the loan.

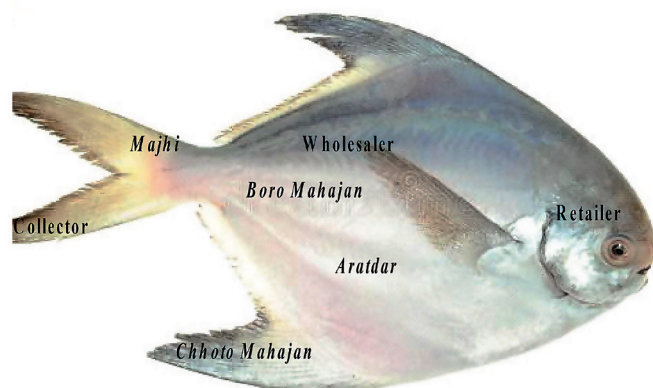


Figure 11: *Intermediaries in the market chain*

The respondents stated that the Department of Fisheries does not play any role in improving their capacities; instead, they take a bribe during vessel registration and issuing identity cards. The fish stocks in the shallow water declined drastically due to invasion by the commercial fishermen. They push the artisanal fishermen back to the coast. The corruption and nepotism of the Union *Parisad* in food grain distribution during *Hilsa* banning period was reported.

RECOMMENDATIONS

A Separate Department

The Maritime Affairs Unit (MAU) is working now under the Ministry of Foreign Affairs right now. It could be graduated to a Department of Oceanography and merged to the Ministry of Fisheries and Livestock. This department will play the role of coordination, integration and information hub. *Upazilla* and District administration will play a role in the field on behalf of this department. A post named as Additional Deputy Commissioner (Marine) can be created in the coastal districts. This post will coordinate the activities within a district.

Re-allocation of business

Table 5: Proposed re-allocations of business for different ministries of Bangladesh

<i>Department</i>	<i>Re-allocated business</i>
Ministry of Fisheries and Livestock	• Management of all living marine resources except forests • Trade and commerce of biological products • Marine biotechnology • Aquaculture, mariculture, pearl culture • Biological health management • High sea fisheries
Ministry of Industry	• Shipyard, shipbuilding and ship recycling • Salt Industries • Marine Cable Industries • Marine tourism
Ministry of Shipping	• Management of Sea Ports • Maritime navigation • Maritime business • Maritime workforce • Protection of the sea legislation • Controlling pollution from Ships • Control of Harmful Anti-fouling Systems on Ship • Maritime Safety

Ministry of Power, Energy and Minerals	• Invests in offshore petroleum exploration and offshore mining • Promotes offshore oil and gas exploration and offshore mining • Invites companies to bid for the opportunity to invest in oil and gas, and other minerals exploration in the sea • Regulates blue energy
Public Security Division	• Sea safety for fishermen
Ministry of Environment, Forest and Climate Change	• Implementing SDGs 14 • Tackling climate change impacts • Protecting and conserving the marine environment and biodiversity • Environment assessment, pollution control, waste management, chemical management, control anti-fouling agents and eutrophication • Protecting Heritages, Marine Parks, Sanctuaries, ECA, Coral Reefs and threatened species • Regulating wildlife trade • Management of the Mangroves and littoral forests • Tackling global emerging issues like ocean acidification • Coastal management including Sand Dune conservation
Ministry of Local Government, Rural Development and Cooperatives	• Day-to-day maintenance of the beaches and coastal facilities • Shore protection • Manage paths, roads and parking place
Bangladesh Navy	• Ensuring sea sovereignty • Playing the lead role in spatial and temporal marine governance • Help the high sea governance

Forming statutory bodies

Like Australia, a statutory and independent body like the National Oceanography Council chairing by Honourable Prime Minister and consisting of concerned Ministers and sectoral experts could be formed. The body will be responsible for the implementation and further development of marine policy. Every relevant ministry will create a national committee, including other ministries and stakeholders for coordination and integration. A National Marine Education and Research Committee could be formed to integrate research works and coordinate among researchers and academicians.

Strengthening marine governance

The sectoral governance could be redefined by re-allocating business of the concerned ministries. The high sea governance should be established based on UNCLOS, and it requires coordination with other marine states shared by the Bay of Bengal. In the spatial and temporal governance, the roles Bangladesh Navy and Coast Guard should be defined clearly. The coastal governance should be established, incorporating local governments and the communities. The governance of the critical areas should emphasize on co-management. The accountabilities of the marine security governance should be ensured. Bangladesh Coast Guard should play a proactive active role in controlling piracy as it was identified as the topmost challenge of the fisheries sector. The marketing system should be modernized by clearing the intermediaries group from the market chain. The state banks should provide loans to stop the monopoly business of the *Mahajan* and to improve the socio-economic conditions of the artisanal fishermen.

Abolishing overlapping jurisdictions is highly essential to specify the role of a specific institution. The departments should be equipped with necessary logistics and human resources.

Updating and integrating laws-sector-wise

Sectoral laws should be updated by merging scattered laws and integrating international laws and rules. The sectoral laws should incorporate sustainability, environmental issues and conservation issues. Sectors can be divided into living resources, non-living resources including tourism, maritime shipping including navigation, maritime sovereignty including

high sea governance, and marine environment protection and biodiversity conservation. The authority should be defined clearly in those laws. The transparencies and accountabilities of the concerned department should be ensured for the compliance of the existing laws.

Further Researches

Sustainable marine resource management is associated with multi-disciplinary and requires a highly skilled technical workforce and motivated researchers. The country presently also needs a large group of appropriate human resources in the field of oceanography, climate change, marine dynamics, ocean acidification, marine engineering, biotechnology, marine fisheries, marine trade, offshore mining, naval architectural engineering, marine geological aspect, marine environment and ecosystem science etc. Further researches should be carried out on policy analysis, stock assessment, mapping of potential resources, ecosystem services, biodiversity conservation, climate change and ocean pollution.

Scope and Limitations

The report may be interesting to the policymakers, professionals, practitioners and researchers. The relevancy of the data and information could be applied to practice and more use to further research work. The data and information also could contribute to achieving the primary goals of the government and private entrepreneurs. The output of this research project may have great significance to the sustainable use of marine resources in Bangladesh. The duration of the research was not sufficient enough to carry out such significant research. On the other hand, the researchers from Bangladesh part were not full-time researchers.

REFERENCES

- Ahmed, N. and Glaser. M. 2016. Can “Integrated Multi Trophic Aquaculture” adapt to climate change in Coastal Bangladesh. *Ocean and Coastal Management*, 132:120- 131.
- Akwilapo F 2007. *A Comparative Study on Marine Protected Areas between Australia and Tanzania*, the United Nations, Tokyo
- Akwilapo, F. 2007. A comparative study on Marine Protected Areas between Australia and Tanzania. United Nations
- Alam, MK 2014. Ocean/Blue economy for Bangladesh. In: Proceedings of International Workshop on Blue Economy, Ministry of Foreign Affairs, Dhaka, Bangladesh, pp 28 – 49.
- Anon 2016. Blue economy interventions for food security in Bangladesh. Background Paper of National Seminar. Chittagong, Bangladesh. 6pp.
- Austlii, 2019, Australian Legal Information Institute.
- Bylaws, 2019, Laws of Bangladesh, Legislative and Parliamentary Affairs Division, Government of the People’s Republic of Bangladesh.
- Campbell LM, Gray NJ, Fairbanks LW, Silver JJ and Gruby RL. 2013. *Oceans at Rio+20*. 6:6, 439-447.
- DoF. 2016. National Fish Week 2016 Compendium. Department of Fisheries, Ministry of Fisheries and Livestock in Bangladesh. 148pp.
- Food and Agricultural Organization of the United Nations. 2014. Opportunities and Strategies for Ocean and River Resources Management. Background paper for preparation of The 7th Five Year Plan, Dhaka, Bangladesh.
- Hsieh HF and Shannon SE. 2005. Three Approaches to Qualitative Content Analysis. *Qualitative Health Research* 15 (9): 1277 – 1288.
- Hussain MG, Failler P, Karim AA and Alam MK. 2018. Major opportunities of blue economy development in Bangladesh. *Journal of the Indian Ocean Region*, 14:1, 88-99
- Hussain, GM, Failler, P, Al Karim, A and Alam, MK 2017. Review on opportunities, constraints and challenges of blue economy

development in Bangladesh, *Journal of Fisheries and Life Sciences*, vol. 2, no. 1, pp. 45-57.

Hussain, MG and Hoq, ME Sustainable Management of Fisheries Resources of the Bay of Bengal: Compilation of National and Regional Workshop Reports: support to Sustainable Management of the BOBLME Project, Bangladesh Fisheries Research Institute, Bangladesh, 2010 (IWS Working Paper 10).

Islam MM and Hossain MM.2017. Community Dependency on the Ecosystem Services from the Sundarbans Mangrove Wetland in Bangladesh. In: Prusty B., Chandra R., Azeez P. (eds) Wetland Science. Springer, New Delhi

Islam MM.2012. Poverty in small-scale fishing communities in Bangladesh: context and responses, PhD Thesis, University of Bremen, Germany, 2012, p. 150.

Krippendorff K. 2004. Content Analysis: An Introduction to its Methodology Beverly Hills, Sage Publications, CA.

Mohanty SK, Dash P, Gupta A and Gaur P. 2015. Prospects of Blue Economy in the Indian Ocean. Retrieved from Research and Information System for Developing Countries.

NeuendorfKA.2002. The Content Analysis Guidebook, Sage publications.

Shamsuzzaman MM, Islam MM, Tania NJ, Al-Mamun MA, Barman PP and Xu X. 2017. Fisheries resources of Bangladesh: Present status and future direction. *Aquaculture and Fisheries* 2: 145-156.

Shamsuzzaman MM, Islam MM. 2018. Analysing the legal framework of marine living resources management in Bangladesh: Towards achieving Sustainable Development Goal 14. *Marine Policy* 87: 255–262.

Shamsuzzaman MM, Xiangmin Xu, Islam MM, Alam MW and Karim E. 2017. Sustainable Marine Fisheries Resources of Bangladesh: A Strategic Response for Economic Security. *Indian Journal of Geo Marine Sciences* 46 (04): 757-765

Spencer L, Ritchie J and O'Connor W. 2003. Analysis: practices, principles and processes, in: J. Ritchie, J. Lewies (Eds.), *Qualitative Research Practice: A Guide for Social Science Students and Researchers*, Sage Publications Ltd., London, pp. 199–218.

Appendix-1: Detail programme of 2019 Coastal Mini Symposium held at Macquarie University

DEPARTMENT OF ENVIRONMENTAL SCIENCES
AND CENTRE FOR SMART GREEN CITIES

Faculty of Science and Engineering



MACQUARIE
University

CENTRE FOR ENVIRONMENTAL LAW

Faculty of Arts

2019 Coastal Mini-Symposium

7 MAY 2019

Room 803

12 Wallye Walk



Tuesday 7 th May 2019		
Time	Name	Presentation title
8.30am		COFFEE AND REGISTRATION
8.45am	A/Prof Peter Davies and Prof Shawkat Alam (MQU)	Introduction
8.55am	Dr Muhammad Abu Yusuf, Researcher and MDS (BPATC)	Welcome speech
9am	Dr Md. Mizanur Rahman, Project Director and Director (BPATC)	KEYNOTE: Regulatory and institutional framework for sustainable use of coastal and marine resources in Bangladesh
10am	A/Prof Laura Airolti (University of Bologna)	KEYNOTE: Discovering, understanding and sustaining marine urban ecosystems
11am		MORNING TEA
11.15am	A/Prof Peter Davies (ES-MQU)	SHORT TALKS - Coastal Threats and Processes
11.15am	Giulia Filippini (ES-MQU)	Tiny and yet mighty: the microbial powerhouses that maintain healthy waterways
11.25am	Joni Pini-Fitzsimmons (BS-MQU)	Top shelf bottom feeders: how recreational fishing is influencing the movements of Australia's largest stingray
11.35am	Thomas Fellowes (ES-MQU/USyd)	Morphometric classification of swell-dominated embayed beaches
11.45am	Dr Maina MBui (ES-MQU)	Coastal-marine connectivity and decision support tools for land-sea management
12pm	Dr Katie Dafforn (ES-MQU)	SHORT TALKS – Coastal Management and Adaptation
12pm	A/Prof Paul Gribben (UNSW/SIMS)	Sydney Harbour Research Program
12.05pm	Francisco Martinez Baena (BS-MQU)	Remnant Oyster Reefs as fish habitat in NSW estuaries: a seascape perspective
12.15pm	Dr Maria Vozzo (BS-MQU/SIMS)	Living Seawalls
12.25pm	Kate Dodds (BS-MQU)	Stakeholders Rate Living Seawalls Benefits as Almost Double the Risks
12.35pm	Dr Ana Bugnot (SHRP-SIMS/USyd)	Healthy Harbours: Quantifying and restoring the health of soft sediment communities
12.50pm	Syed Mizanur Rahman, MDS (BPATC)	Concluding Remarks
1pm		LUNCH AND NETWORKING

About Our Keynote Speakers

Md. Mizanur Rahman, Bangladesh Public Administration Training Centre, Savar, Dhaka, Bangladesh (dirrd@bpatc.org.bd, mizan_peroj@yahoo.com)



Md Mizanur Rahman is Director (Research & Development) at Bangladesh Public Administration Training Centre, Savar, *Dhaka*, Bangladesh. He obtained his Ph.D. in Forest Ecology from the University of Natural Resources and Life Sciences, Vienna, Austria with support of North South Dialogue Scholarship Programme. He is the Executive Editor of Bangladesh Journal of Public Administration. He leads SDGs module, related training and other activities at Bangladesh Public Administration Training Centre. He carried out researches on European Alpine Ecology and *Dipterocarpus* Forests of Bangladesh. He also conducted a number of studies on the impact of climate change on the Sundarbans, the largest mangrove of the

world. He served as the Chairperson of Sundarbans Co-management Committee for more than three years. His research focuses on impact of climatic-anthropogenic stressors on biodiversity, natural dynamics of ecosystems, conservation strategies, institutional and regulatory framework, ecosystem services, increased salinity and SDGs related affairs.

Regulatory and institutional framework for sustainable use of coastal and marine resources in Bangladesh

Bangladesh is a **coastal country having 710 km long shoreline and a Maritime Zone of 118,813 km²** in the Bay of Bengal including Exclusive Economic Zone (EEZ) of 200 nautical miles into the sea and Continental Shelf of 354 nm from the coast. The Bay of Bengal is blessed with rich **coastal and marine ecosystems**, hosting a rich biodiversity, such as fishes, shrimps, mollusks, crabs, mammals, seaweeds, etc. Extraction, exploitation, exploration and **management of living and non-living** resources of the Bay of Bengal have potentials to contribute to the economy of Bangladesh sustainably. The potential of the marine and **coastal resources are not rationally extracted**. In some cases the resources have been over-exploited, while unexplored in many cases. It is found that marine fish harvesting is in declining trend. The sustainable use of marine resources is restricted by several factors like lack of knowledge of the potential resources; mapping of the resources; lack of sustainable extraction, lack of institutional and regulatory frameworks; and encroachment by the neighboring countries. There are many laws and regulations providing policy and regulatory frameworks for the management of marine living resources. These laws are, however, very old and not enforced properly for multiple reasons. Consequently the degradation of some resources occurs, while many resources are not unlocked due to absence of laws and non-compliance of the existing. On the other hand, the institutional framework like marine governance, involving stakeholders, coordination among administrative bodies and educating institutions are not clearly defined. I shall try to identify the potential marine resources of Bangladesh; to assess the suitability and applicability of the existing legal and institutional framework for managing the coastal and marine resources.

A/Professor Laura Airoidi, University of Bologna, Department of Biological, Geological and Environmental Sciences, Ravenna, Italy (laura.airoidi@unibo.it)



Laura Airoidi is Associate Professor at the University of Bologna, Italy. She received a Ph.D. in Marine Science from the University of Genova, and carried out research in Italy, Australia, USA and UK. She has been a Fulbright Research Fellow at Stanford University, an ECCo Fellow at Wesleyan University, a LINKECOL Fellow at the Marine Biological Association UK. She serves the editorial Board of Marine Ecology Progress Series. She co-leads the eco-engineering workgroup within the World Harbour Project, is Regional Coordinator for the Mediterranean Sea in the global Kelp Ecosystem Ecology Network, and Coordinator and/or PI in (inter)national multidisciplinary projects on marine biodiversity conservation. She was one of the first experimental marine ecologists in Italy and the Mediterranean

Sea, and is one of the forerunners of the new field of marine urban ecology. Her research focuses on designing conservation and restoration strategies in increasingly urbanized marine coastal systems, including consideration of sustainable shoreline protection strategies, coastal and offshore “green” infrastructures and nature-based solutions, aiming to maximise environmental, societal and economic benefits.

Discovering, understanding and sustaining marine urban ecosystems

Most people in the world live in **coastal cities**. As coasts have become more urbanised globally, natural habitats and associated biota have been damaged, with loss of environmental quality, vital ecosystem services and livelihood. Losses are accelerating, and the current and future challenges faced by urban coastlines are diverse and substantial. Mainstream urban ecology has largely overlooked the influence of human activities on marine environments. The marine biodiversity of ports and urban waterfronts is poorly documented, and mechanistic understanding of their ecological functioning is missing. Despite their human dominated nature, marine urban habitats can still support a variety of communities and ecosystem services, making them important areas for urban conservation and ecological rehabilitation. I will introduce a conceptual framework for designing marine developments that meet multifaceted project goals and provide better outcomes for the society, and I will offer examples of “green” engineering approaches aiming at mitigating the impacts to the native ecosystems and continue and/or rehabilitate relevant ecosystem services. I will also show that the conservation and restoration of target marine ecosystems offering **coastal protection**, such as coral reefs and saltmarshes, can be integrated in **coastal defence**, offering more sustainable, cost-effective and ecologically sound alternatives to conventional **coastal engineering**. I will finally discuss the management and societal challenges to the rehabilitation of natural marine habitats in urban systems subjected to multiple co-occurring and potentially interacting uses and stressors, and conclude by highlighting the relevance and potential of a sustainable “blue” economy.



MACQUARIE
University



Macquarie University is a vibrant hub of intellectual thinkers, all working towards a brighter future for our communities and our planet.

A PLACE OF INSPIRATION

Macquarie is uniquely located in the heart of Australia's largest high-tech precinct, a thriving locale which is predicted to double in size in the next 20 years to become the fourth largest CBD in Australia.

Our campus spans 126 hectares, with open green space that gives our community the freedom to think and grow. We are home to fantastic facilities with excellent transport links to the city and suburbs, supported by an on-campus train station.

RENOWNED FOR EXCELLENCE

We are ranked among the top two per cent of universities in the world, and with a 5-star QS rating, we are renowned for producing graduates that are among the most sought after professionals in the world.

A PROUD TRADITION OF DISCOVERY

Our enviable research efforts are brought to life by renowned researchers whose audacious solutions to issues of global significance are benefiting the world we live in.

BUILDING SUCCESSFUL GRADUATES

Our pioneering approach to teaching and learning is built around a connected learning community: our students are considered partners and co-creators in their learning experience.

FIND OUT MORE

Macquarie University NSW 2109 Australia
T: +61 (2) 9850 7111
mq.edu.au

Appendix-2: External evaluator's feedback

EVALUATION REPORT

Project Title: Regulatory and institutional framework for sustainable use of coastal and marine resources: A comparative analysis between Bangladesh and Australia

Suggested Project Title: Regulatory and Institutional Framework for Sustainable Use of Coastal and Marine Resources: A Comparative Study between Bangladesh and Australia

Project Investigator: Unknown

Impact of This Project:

The project's envisaged goal or impact indicated in the design and monitoring framework at both appraisal and project completion was quite excellent. It has also addressed some important issues that have been discussed in the Bangladesh's coastal and marine resources as well. The intended outcome (purpose) of the project, as indicated in both the report and recommendation of the project completion report, was enhanced local capacity to plan and manage the sustainable development of coastal and marine resources in Bangladesh experiencing from Australian regulatory framework.

Introduction and Executive Summary:

The executive summary and introduction sections of this report are nicely written but it could be seemed to look good if you delete the Paragraph:

"The study recommends the graduation of Maritime Affairs Unit (MAU) to a Department of Oceanography under the Ministry of Fisheries and Livestock. -----Special initiatives should be taken to ensure safety for the fishermen, to remove intermediaries from the fish markets and to provide micro-credit for the fishermen".

Objectives, Contents and Relevancy of this Research

Many chapters in this report describe many difficulties that have contributed to the current overexploited state of the world's marine fisheries. They include risk-prone management, political disagreements and lack of commitment to resource conservation, inappropriate socioeconomic rewards resulting from this report. The objectives of this report are very specific, clear and to quantify for achieving the possible goals. The contents of the report are more appropriate for intended audience. It is very interesting research findings and significant to the professional, practitioner and academician etc. Consistent has stated with objectives that are quite excellent.

The relevancy of the data and information could be applied to practice and more use to further research work. The data and information also could contribute to achieving the major goals of private and professionals. Though the research seems to be a review report from the secondary data or contents analysis but the output of this research project have the great significant to the sustainable development of marine resources in Bangladesh. Please revise the report according to my suggestions & guidelines that I have put in the report contents.

Congratulations and thank you so much to conduct this research for the nations! Good Luck.

Nazrul
22/07/2019

Prof. Dr. Md. Nazrul Islam

Dr. Md. Nazrul Islam
Professor
Dept. of Geography & Environment
Jahangirnagar University
Savar, Dhaka-1342

Appendix-3: Internal evaluator's feedback

The evaluation report on

Regulatory and institutional framework for sustainable use of coastal and marine resources: A comparative analysis between Bangladesh and Australia

About the research problem

1. The issue of research is very relevant which is addressing the problems of implementing Goal- 14 of SDGs
2. The comparative analysis of Bangladesh and Australia has made a scope for learning best practices of Australia as a standard level coastal and marine resource management
3. The research outcomes could be used for organizing or reorganizing the legal and institutional frameworks of Bangladesh for sustainable management of coastal and marine resources
4. The undertaken research scope was very wide; the scope and limitations of the study should be described. The issues of maritime shipping, coastal shipping, sea port, shipbuilding and ship recycling industries have distance relation with the central issue of research problem.

About the Report

5. In methodology part, the researcher (s) mentioned that 5 cases of Australia were analyzed. But in the Success Stories of Australia part, the author (S) described 7 cases. Moreover, in last part of the report, we found one more case on Sonadia island.
6. Seven success cases of Australia were described. It could be better, if each case contains a summary of the learnings or best practices.
7. In methodology part, the number of FGDs and interviews were not specifically mentioned.
8. In recommendation no-1, the researcher (s) made recommendation to form an independent department under Ministry of Fisheries and Livestock. If it is formed under MoF & L, it is not clear, how far it will be independent. Moreover, it is not clear, if there is an independent department under MoF&L, then what will be the role of ADC (Fisheries).
9. The recommendation no-3 is forming a statutory bodies (may be body). It is really a good recommendation. A bit more discussion is needed to clarify the formation, responsibility and legal status of the proposed body.
10. In recommendation part, there should be a recommendation for further research.
11. In reference part, a list of laws and Acts consulted could be included. Or could be included in reference.
12. There are some grammatical and spelling errors throughout the document; like, 1. act (if it is a law, better to write Act; the meaning of act is an activity while meaning of Act is a law; 2. Putting a 'the' before the title of a law or ordinance is essential, 3. Wrong sentence construction, like: in objectives, it is written ' To way forward adopting the experiences and best practices of Australia, the correct form will be 'To suggest way

Appendix 4: Rapporteur's report on faculty seminar

Rapporteur's Report On

Analyzing the regulatory and Institutional Framework for Sustainable Use of Marine and Coastal Resources: A comparative analysis between Bangladesh and Australia

**Research Project
Under Financial Year: 2018-2019**

**Rapporteur:
Rabiul Alam Lokman, Research Officer**

**Chairperson:
Dr. M Aslam Alam, Rector
BPATC, Savar, Dhaka.**



(Venue: ITC Rector's Conference Room (ITC-209))

Date: 15.07.2019

**Bangladesh Public Administration Training Centre
Savar, Dhaka**

A faculty seminar on two research project was held in the ITC Rector's Conference Room (ITC-209) of the Centre on 15 July 2019 (Monday) at 03:00 pm titled (i) "Analyzing the regulatory and Institutional Framework for Sustainable Use of Marine and Coastal Resources: A comparative analysis between Bangladesh and Australia" and (ii) "Assessing the Role of Foundation Training Course for enhancing the knowledge of The Young Civil Servants to Achieve Sustainable Development Goals (SDGs): A Case Study from Bangladesh Public Administration Training Centre" Dr. M Aslam Alam, Rector of the Centre in the chair. Dr. Md. Mizanur Rahman, Director (R&D), Md. Masud Ahmed, AD (Public Administration) presented their draft research reports. Rabiul Alam Lokman, Research Officers was the rapporteur of the faculty seminar. Faculty members were present in the seminar to give their feedback.

1.1. Inaugural Speech by the Chairperson

Dr. M Aslam Alam, Rector of the Centre and Chairperson of the seminar revealed the background of these draft research reports and the rationale of conducting these researches. He pointed out that these research projects will focus on various ongoing programs of the government and it will be based on action research. He also mentioned that two articles have been published and another two articles are going to publish related to this research. He also mentioned that BPATC has a significant role to provide information and suggestions to the government on policy intervention. He stated that the purpose of the faculty seminar and that was sharing ideas on some issues that can be explored through research conducted by BPATC. In addition to this, the Chairperson set the guiding principle of the seminar, every presenter will get 15 minutes for presentation and then the floor will be opened for their feedback. The Chairperson allowed the comments and suggestions from the faculty for further improvement of the draft research reports.

2.0 Working Session

2.1 Presentation of the First Draft Research Report

The working session began with the presentation of the draft research report titled "*Analyzing the regulatory and Institutional Framework for Sustainable Use of Marine and Coastal Resources: A comparative analysis between Bangladesh and Australia*" and the presenter was Dr. Md. Mizanur Rahman, Director (Research and Development).

2.2 Observation made by the faculty members:

After the presentation, floor was opened and faculty members were requested and encouraged to make their valuable comments and opinions related to the draft research report.

Md. Morshed Alom, PhD, SRO (Research) gave thanks to research team for their great effort. He said that there is no difference between objective 1 and objective 2. He also said to provide operational definition on Marine resources. He also suggested including process how they are managing their resources in Australia and how we can incorporate in our country.

Dr. M Aslam Alam, Rector said that definitions are available in main research report.

Dr. Md. Sanwar Jahan Bhuiyan, Director (PPR) said researcher should include scope and limitations. This is a huge area so objectives should be narrowed down. He also said it would be better if we are able to provide a structure of 'suggested legal regulatory framework'. Also this research can recommend for a commission who will work for formulating legal regulatory framework.

Dr. M Aslam Alam, Rector said that this research will not formulate draft regulatory framework. Base on this research institution can formulate a TOR.

Afia Rahman, Research Officer raised three questions:

1. What are the basis of selecting the items regarding legal regulatory framework between Australia and Bangladesh?
2. What is the linkage between artisan fishermen and intuitional framework?
3. Why new concept came in the recommendation?

Dr. Md. Mizanur Rahman, Director (Research & Development) replied that the issue is sustainable use, conservation of marine resources. He also said there is a strong relation between artisan fishermen and intuitional framework. *Dadon* system is working there. The problem identifies the fishermen and stake holders are the hazard of poor institutional framework. In the main article all are clearly defined.

Dr. M Aslam Alam, Rector mentioned we visited the coastal areas to get the information. Also we see the adverse affect of salt. In our country Ministry of environment is responsible for this to look after this issue. Local council in Australia is working on coastal resources management. We visited city council where independently look after the coastal resources management.

Mohammad Razibul Islam, Deputy Director (Management) raised an issue that sustainability is the core issue. He said that we need to find out the reasons why we are unable to manage coastal resources properly but in Australia they are able to manage their coastal resources. He suggested implementing Australian success story and experience in our country.

Dr. M Aslam Alam, Rector mentioned that Australia is pioneer in this sector they established a standard in trial and error basis. They have strong institutional framework. He motioned it's not possible to implement or replicate their success story in our country because of regulatory authority in our country is not performing their duty properly. Using their learning we can conceptualize in our concept. He mention that it's not possible of revolutionary change research will recommend implementation process as much as possible. No ministry will sacrifice their mandate and activities. Research will recommend which is possible to implement.

Abdullah Al Mamun, DD (PM) pointed out that this research project is the largest research project in amount of money. He wanted to know is there any observation and data collected in Australian part? In Bangladesh you collected data from different part and also conducted FGD

do the researcher done the same thing in Australia. He also wanted to know the benefit of conducting this research in perspective view of BPATC and Country.

Replying this Chairpersons Dr. M Aslam Alam said yes, we collected some data from Australia; we also conducted FGD as well as organized a symposium with collaboration of Macquarie University. People of different sectors of our country come to know about ability of BPATC. They are able to understand the capability and capacity of BPATC. BPATC can conduct a research on national and international level issues. BPATC can recommend the findings to the Government to formulate decision making and national and international policy. He also mentioned we get good feedback from Nation Workshop. This research increased reputation of BPATC in national and international level. Dr. M Aslam Alam also mentioned the name of Captain Maqsood from Navy who **put some valuable and precious** word about this research.



Appendix-5: Analyzing the regulatory and institutional framework for the conservation of coral reefs in Bangladesh

Md. Mizanur Rahman⁸, M. Aslam Alam⁹ and Muhammad Abu Yusuf¹⁰

Abstract: There is a worsening crisis threatening coral reefs across the globe, driven by the complex interplay of combined effects from natural and anthropogenic factors. It is predicted that coral reefs could soon become extinct across the world. Bangladesh has only one coral island named as Saint Martin, which is locally known as ‘*Narikel Jinjira*’. This location is one of the most popular tourist spots in Bangladesh, attracting thousands of tourists each year due to its unique landscape, blue water and the presence of coral colonies. Despite its popularity, this island has suffered the loss of most of its coral in recent times. Coral reef ecosystem management needs to focus on reforming the legal and institutional frameworks for enhancing the capabilities of the local management to address the adverse effects of multiple stressors, and to promote ecosystem services by improving resilience. Relevant international instruments, including the Convention on Biological Diversity and the Aichi Biodiversity Targets, as well as the international climate change framework, provide guidance on states’ obligations and guiding management principles. It is against this framework that the approach taken by Bangladesh to coral reef protection will be evaluated. This study thus analyzes the existing institutional and legal frameworks for conserving coral reefs. In addition, it draws on data collected through fieldwork conducted at Saint Martin Island and Technaf Upazila, and critically reviews the related literature on legal documents. This study concludes that despite the existence of legal mechanisms and institutional frameworks, non-compliance with laws and poor coordination between different sectors is widespread, resulting in the severe degradation of coral reef resources. In particular, there is widespread disregard for strong institutional arrangements prescribed by laws. Looking forward, this study recommends the integration of legal and institutional frameworks governing the environment, tourism and fisheries sectors. It will be suggested that effective marine governance, increasing coordination among different sectors, amending some existing

8 Director (Research and Development), Bangladesh Public Administration Training Centre, Savar, Dhaka 1343, E-mail: mizan_peroj@yahoo.com

9 Rector (Senior Secretary to the Government), Bangladesh Public Administration Training Centre, Savar, Dhaka 1343, E-mail: m.aslam.alam@gmail.com

10 Member Directing Staff (R & C) , Bangladesh Public Administration Training Centre, Savar, Dhaka 1343, E-mail: yusufjsps@yahoo.co.uk

rules and activating ‘monitoring, control, surveillance’ (‘MCS’) systems can improve the present situation.

Keywords: Anthropogenic, Disturbances, Stressors, Management, Tourism, Coordination

Introduction

Bangladesh has only one coral island, named as Saint Martin, which is known locally as Narikel Jinjira (Coconut Island) (see below Figure 1). It is situated in the northeast part of the Bay of Bengal, about 9 km south of the Cox’s Bazar-Teknaf peninsula (Rajasuriya et al. 2000). It is also about 8 km west of the northwest coast of Myanmar and the area of this dumb-bell shaped island is only 8 km² (Alam et al. 2015). There is a neighbouring small island called ‘Chhera Dwip’ which is connected during low tide and isolated in the high tide. That island is considered as the part of the Saint Martin Island. This is one the most popular tourist spots in Bangladesh attracting thousands of tourists per year due to its unique landscape, blue water and the presence of the coral community (Islam 2002). This island is highly rich with biodiversity (Billah et al. 2018, Hossain & Islam 2006) and is also the habitat of few globally threatened marine turtles and many migratory birds (Moudud 2010).

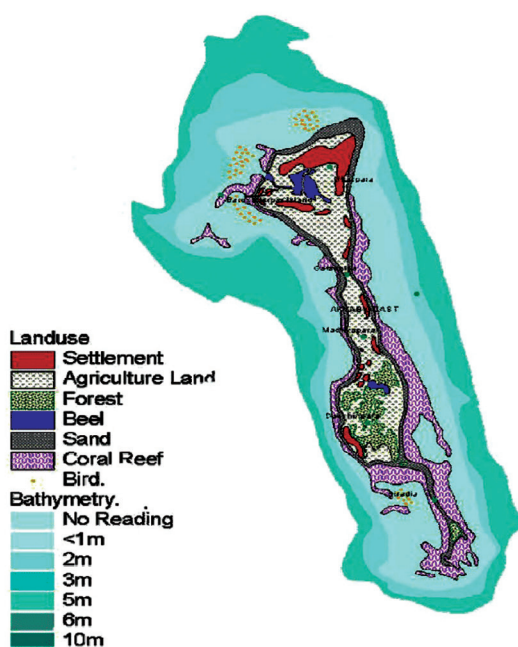


Figure 1: Map of coral reefs at Saint Martin's Island (Feeroz 2009)

In 2002, the coral communities in Saint Martin comprised of 66 coral species, sea fans, sea whips and 86 species of reef fishes (Rajasuriya et al. 2000) and by 2016 the number of coral species declined to only 41 (Ahammed et al. 2016) despite it having been declared as an Ecologically Critical Area (ECA) in 1999 (Hasan 2009). This constitutes a stark contrast with the diversity present during the 1980s, when the number of coral species was 141 (English et al. 1997). It is predicted that by 2045 all coral species will be extinct from this island (Ahammed et al. 2016).

The crisis of the coral reef loss and degradation across the globe is increasing (Edmunds et al. 2019, Hughes et al. 2017, Spalding & Grenfell 1997), with the combined effects of natural and anthropogenic disruption (Bruno et al. 2019, Doney et al. 2009, Gupta et al. 2007). The planet has been losing her underwater rainforests (tropical reefs) over the last thirty to forty years (Szmant 2002, Burke et al. 2011, Bruno & Selig 2007, De'ath et al. 2012 Bruno et al. 2019, Leingang & Dixson 2019, De'ath et al. 2012, Gardner et al. 2003, Hughes et al. 2018, Hoegh-Guldberg et al. 2007, Jackson et al. 2014, Schutte et al. 2010). Coral reefs provide numerous ecosystem services such as food (Burke et al. 2011); economic benefits from fisheries and tourism (Spalding et al. 2017); and coastal defence (Ferrario et al. 2014, Spalding & Grenfell 1997, Harris et al. 2018). Immediate and direct threats are posed by coastal development, fishing practices, pollution and tourism for 60% of the existing global coral reefs (Burke et al. 2011) and it is predicted that coral reefs could soon be extinct across the world (Hoegh-Guldberg et al. 2007).

Coral reefs are subject to multiple stressors originating from a rapidly changing environment and social dynamics (Mitchell et al. 2015). These stressors act simultaneously, degrading the biodiversity, functioning and ecosystem services of coral reefs (Burke et al. 2011, Brown et al. 2014, Côté & Darling 2010, Gilby et al. 2016, Saunders et al. 2014, Welle et al. 2017). Local pressures from pollution, sedimentation, extraction, habitat destruction and nutrient input originate from the land (land-based pressures), whilst pressures that result cumulatively from global pressures include ocean acidification, ocean warming resulting from climate change, and associated impacts from sea level rise (Mitchel et al. 2015).

It is important to note that issues originating in the global dimension of anthropogenic pressures exacerbate already challenging local pressures (Burke et al. 2011, Gupta et al. 2007, Hoegh-Guldberg et al. 2017). Another crucial observation is that biodiversity conservation plays a key

role in ensuring the ecosystem services at all levels of hierarchy (Georgina et al. 2012) and that strong action to manage climate change impacts is a critical requirement in order to safeguard the continued existence of coral reefs (Hoegh-Guldberg et al. 2017; Mitchel et al. 2015). This paper will examine the international framework and domestic legal and institutional frameworks in Bangladesh concerning these issues. It will also be explained that management practices balancing ecosystem protection and human wellbeing are a critical requirement in order to achieve the Sustainable Development Goals (SDGs) which seek to integrate ecosystem management and development activities (Sylvia et al. 2019).

This study concludes that despite the existence of legal mechanisms and institutional frameworks, non-compliance with laws and poor coordination between different sectors is widespread, resulting in the severe degradation of coral reef resources. In particular, there is widespread disregard for strong institutional arrangements prescribed by laws. Looking forward, this study recommends the integration of legal and institutional frameworks governing the environment, tourism and fisheries sectors. It will be suggested that effective marine governance, increasing coordination among different sectors, amending some existing rules and activating ‘monitoring, control, surveillance’ (‘MCS’) systems can improve the present situation.

Methodology

This research involved the collection of data through fieldwork, conducted at Saint Martin Island and *Technaf Upazila*, as well as a critical review of relevant legal frameworks and literature.

Collecting Primary and Secondary Data

Primary and secondary data were collected from Saint Martin Island and Technaf Upazila of Cox’s Bazar district. Primary data collection methods followed individual interviews, focused group discussion (‘FGD’), and stakeholder analyses during the month of December 2018. A total of 30 respondents were selected from the community through purposive sampling, holding different types of occupations including public representation. These participants were interviewed purposively using a semi-structured questionnaire. The questionnaire consisted of different types of questions aligning with legal and institutional arrangements, conservation, tourism, waste management, and socio-economic conditions. A FGD was held

at the office of Upazilla Nirbahi Officer, Technaf, including heads of all departments at the local level. Secondary data on acts, ordinances, rules, policies, and strategies relating to marine conservation were collected from Ministry, Division, and Department websites. Content analysis was based on the collected data from different tools (Elo et al. 2008, Hsieh & Shannon 2005, Spencer et al. 2003, Neuendorf 2002, Krippendorff 2004). The study also identified ecosystem services provided by the coral islands to support the SDGs (see below Figure 2).

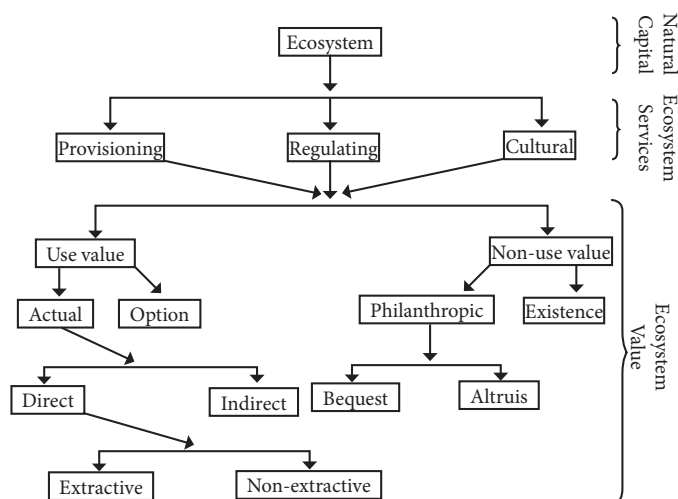


Figure 2: The categorization of Ecosystem Services provided by Saint Martin Coral Island

National and International Legal Frameworks

There is no single legal framework or law concerning coral reef management and protection. At the national level in Bangladesh related issues are managed by different acts, rules, and policies of the Ministry of Environment, Forest and Climate Change and the Department of Fisheries. In addition, Bangladesh has committed to achieving Sustainable Development Goal 14 by 2030, and has obligations under various instruments of international environmental law – most relevantly, the *Convention on Biological Diversity* and its associated Aichi Biodiversity Targets. The climate change framework also has relevance to this issue. The study analyzes the existing legal and institutional frameworks for conserving coral reefs, considering Saint Martin Island as an instructive case study. This study sought to identify regulatory and policy loopholes affecting reef conservation, and ultimately recommends

the integration of the legal and institutional frameworks governing the environment, tourism and fisheries sectors.

Results

International Legal Framework

The international community has responded to ongoing degradation of the environment, and severe losses of biodiversity, through a number of multilateral environmental agreements. The key international agreement relating to the conservation of coral reefs is the *Convention on Biological Diversity* ('CBD'), which recognizes the need for states to cooperate to conserve and promote the protection of biological diversity across the world. Within the CBD, state parties adopted the Aichi Biodiversity Targets, which provide further guidance and obligations relating to specific steps that are to be taken in seeking to further the aims of the CBD itself. Specific targets under the SDGs similarly support and strengthen these international obligations. In addition to biodiversity concerns, another area of international concern especially relevant to coral reef protection is climate change. The *United Nations Framework Convention on Climate Change*, and the *Paris Agreement* (the most recent development in international efforts to limit the impacts of global climate change) thus offer an extra dimension of obligations for states to meet in order to effectively manage and protect coral reefs. Each of these international instruments will now be examined in turn, firstly the biological diversity dimension of international law, and secondly, the climate change framework. This will provide an outline of the international legal framework within which Bangladesh is to carry out coral reef management and conservation domestically, and has implications for a national response to threats endangering the Saint Martin Island coral reef.

Obligations Relating To Biological Diversity

The Convention on Biological Diversity

The CBD contains key obligations relating to the management, conservation and sustainable use of biodiversity, ecosystems and their components and services. Several indicators of the required approach are identifiable in the Preamble which provides context for the interpretation of the operative provisions within the CBD (art 31(2) *Vienna Convention on the Law of Treaties*). The Preamble recognises the range of services provided by biological diversity and its components, including intrinsic,

ecological, genetic, social, economic, scientific, educational, cultural, recreational and aesthetic values. It acknowledges the significant benefits that are expected to result from substantial investment in conservation initiatives, including a broad range of social, economic and environmental benefits, and notes the severity of challenges facing biological diversity, voicing special concern for significant impacts and contributions of human activities to the reduction of biological diversity. In responding to these concerns, the Preamble invokes a range of principles and concepts in light of which states' actions pursuant to the CBD should be undertaken. It states that parties affirm 'that conservation of biological diversity is a common concern of humankind' and reaffirms that 'states are responsible for conserving their biological diversity and for using their biological resources in a sustainable manner', emphasizing the importance of sustainability for meeting future food and resource demands of a growing population. The need for a collaborative approach is thus required, and the Preamble outlines 'the need to promote international, regional and global cooperation among states and intergovernmental organizations and the non-governmental sector for the conservation of biological diversity and the sustainable use of its components'. Three additional principles of prevention, precaution and intergenerational equity are also invoked by the Preamble, further outlining the conceptual framework within which states are to meet their obligations under the CBD. The importance of taking a preventative approach and applying the precautionary principle is emphasized, and the principle of intergenerational equity is referred to, recognizing that the parties are 'determined to conserve and sustainably use biological diversity for the benefit of present and future generations'. Amongst the operative provisions of the CBD, Articles 7, 8 and 10 are of particular relevance to this study. It is important to note at the outset that each of these obligations contains a caveat that states will fulfill these obligations 'as far as possible and as appropriate'. The three provisions (Articles 7, 8 and 10) have great implications for domestic legal frameworks and institutional arrangements. In addition, the following provisions contain broader facilitating obligations which should be recognized here incidentally: Article 11 (incentive measures), Article 13 (public education and awareness), Article 14 (Impact Assessment and Minimizing Adverse Impacts). The CBD also includes numerous requirements for capacity-building (Articles 12, 16, 17, 18 and 20) which place states' obligations within a broader global context considering dynamic relationships between the Global North and the Global South. The CBD thus recognizes the

special needs of developing nations relating to technological and financial assistance, and the provisions therein therefore have implications for the global community and developed nations in particular in assisting developing nations to meet their obligations under the CBD. The CBD is further supported by the Aichi Biodiversity Targets which parties agreed to within the framework of the CBD, and also by the SDGs. This extra dimension of the international framework for biological diversity will now be explained.

Aichi Biodiversity Targets

States agreed to a range of comprehensive targets which give additional form and substance to states' obligations under the CBD. Target 10 is listed under *Strategic Goal B: Reduce the direct pressures on biodiversity and promote sustainable use*, and relates most directly to coral reef management: 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. Additional related targets include Target 14 ('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'); Target 2 ('By 2020, at the latest, biodiversity values have been integrated into national and local development and poverty reduction strategies and planning processes and are being incorporated into national accounting, as appropriate, and reporting systems'); and Target 4 ('By 2020, at the latest, Governments, business and stakeholders at all levels have taken steps to achieve or have implemented plans for sustainable production and consumption and have kept the impacts of use of natural resources well within safe ecological limits').

At this point it is important to note that Bangladesh has submitted a list of National Targets in line with the Aichi Biodiversity Targets (viewed 7/3/2019). National Target 1 states that 'By 2021, relevant stakeholders will be aware of the value of biodiversity and play an active role in ensuring sustainable use', whilst National Target 4 states that 'By 2021, Policy on Sustainable and Consumption Production (SCP) to maintain safe ecological limit of natural resources of major ecosystems will be furnished, and dissemination of the policy to all the stakeholders will be

done towards implementation’. Most importantly, Saint Martin Island is recognized explicitly in National Target 10, committing Bangladesh to the following target: By 2021, multiple pressures on coral associated island (St. Martin) and Sundarban mangrove ecosystem will be reduced through implementation of management plan of the ecosystems. The Aichi Targets thus provide a direct link between national obligations to be upheld by Bangladesh and the broader international framework provided by the CBD.

Mapping of SDG targets with the ecosystem services of Saint Martin Island’s coral reef

Management practices for achieving Sustainable Development Goals, which aim to balance ecosystem conservation objectives against the progression of social and economic development in human societies, are almost absent on Saint Martin Island. In total, twelve goals are aligned with ecosystem services provided by the coral island. In Bangladesh, the ecosystem services of the coral reef at Saint Martin Island can play a vital role in achieving a total of forty-one targets across those twelve SDGs in Bangladesh (see below Table 1). It can also be observed that those same ecosystem services resonate broadly with Goals 2, 6, 14 and 15.

Table 1: Aligning ecosystem services provided by Saint Martin Coral Island with the targets of SDGs

SDG	Targets	SDG	Targets
	1.1, 1.2, 1.5		9.1, 9.4
	2.1, 2.2, 2.3, 2.4, 2.5		11.5, 11.6, 11.7, 11.a, 11.c
	3.3, 3.4, 3.9		12.2, 12.3, 12.4, 12.5



6.1, 6.3, 6.4, 6.6



13.1



7.1, 7.2

14.1, 14.2, 14.3,
14.14, 14.5, 14.7

8.2, 8.4, 8.9

15.1, 15.2, 15.3, 15.4,
15.5, 15.8

Perhaps of greatest importance to Bangladesh's domestic implementation of the SDGs in relation to coral reefs is Goal 14 entitled 'Life Below Water'. This commitment, adopted in 2015, aims to 'conserve and sustainably use the oceans, seas, and marine resources for sustainable development'. The SDGs thus provide additional impetus for the above discussed measures aiming to achieve sustainable management and use of coral reefs and the component biodiversity and ecosystem service elements.

Obligations Relating To Climate Change

In addition to the comprehensive framework for conservation of biological diversity outlined above, the international legal framework relating to climate change as a matter of global concern imposes additional obligations relevant to the management and conservation of the Saint Martin Island coral reef in Bangladesh. The significant threat posed by climate change to coral reefs globally renders this international agreement of great relevance and crucial importance in seeking to safeguard the future existence of coral reefs (Hoegh-Guldberg et al. 2017; Mitchel et al. 2015). The *Paris Agreement* provides an overarching framework within which states submit Nationally Determined Contributions ('NDCs') (Article 3) in order to limit warming to well below a 2 degree increase in global average temperature above pre-industrial levels, whilst endeavoring to limit warming to a 1.5 degree increase (Article 2(1)(a)). In a similar vein to the CBD the *Paris Agreement* recognises the different social and economic circumstances of developed and developing nations, and thus makes reference to the principle of fulfilling obligations according to common

but differentiated responsibilities in light of states' respective capabilities and capacity to implement measures (Article 2(2)). Article 3 concerning NDCs also recognizes the need to support developing nations in order to facilitate effective implementation of the agreement. As in this paper's discussion of the CBD above, states must have regard to the Preamble of the *Paris Agreement* in order to understand the broader context in which obligations are to be pursued. Key themes of sustainable development, the common concern of humankind and intergenerational equity are present in the *Paris Agreement*, echoing the approach adopted earlier by the CBD. Importantly, the idea of ecosystem integrity is included in the Preamble of the *Paris Agreement*, stating as follows (emphasis added): Noting the importance of ensuring the integrity of all ecosystems, including oceans, and the protection of biodiversity, recognized by some cultures as Mother Earth, and noting the importance for some of the concept of "climate justice", when taking action to address climate change. States should thus recognize the interconnected relationship existing between the biological diversity framework and the climate change framework in order to address these synergies and achieve effective implementation of obligations under both regimes. Such a holistic approach is vital in seeking to manage and conserve coral reef environments sustainably and equitably.

National legal arrangements in Bangladesh

A number of laws are in operation for the conservation of critical areas in Bangladesh, but only the 'Ecologically Critical Area Management Rules, 2016' partially regulate the conservation activities of Saint Martin Coral Island. Even the Constitution of the People's Republic of Bangladesh guaranteed the conservation of natural resources and wetlands for the present and future generations. The conservation elements of the important laws and the empowered authorities are described below:

- ***The Constitution of the People's Republic of Bangladesh***

Article 18 A of the Constitution provides the guarantee of protecting and improving the environment and of preserving and safeguarding the natural habitats, biodiversity, wetlands, wildlife and forests for both present and future citizens.

- ***Bangladesh Biodiversity Act, 2017 (Act No. II)***

This Act focuses on achieving three goals of the 'Convention on Biological Diversity (CBD)'. The Act describes conservation and

prohibited activities; formation of different committees and their functions; management, action plan, strategy, anthropogenic disturbances, fundraising, criminal activities, prosecution, and punishment. Activities of different committees were described but no specific business was allocated to any department. This act excluded Maritime Affairs Unit and Bangladesh Tourism Board.

- ***Bangladesh Environment Conservation Act, 1995***

The act covers the conservation of biodiversity through ecosystem management and controlling pollution. There is a provision of declaring an ecologically critical area (ECA) in this act. The Department of Environment was established under this act. It has created the post of a Director-General of that Department. The authority or the department is empowered to take measure against the emission of smoke injurious to the environment and to take appropriate measures to protect environmental degradation. The department issues Environmental Clearance Certificate.

- ***The Bangladesh Environment Conservation (Amendment) Act, 2010***

This act is the amendment of The Bangladesh Environment Conservation Act, 1995, which clearly defined hazardous waste, ecosystem, ecologically critical area, waste management, and wetland. This act did not clarify the mono-centric authority. The punishments for the non-compliances described in the ‘Bangladesh Environment Conservation Act, 1995’ have been increased in this amendment.

- ***Bangladesh Environment Court Act, 2010***

This act was enacted to ensure justice against any sorts of environmental and social damage. There is a provision of establishing one or more Environment Court in each Division and of appointing an officer from the judicial service of the rank of Joint District Judge. Director General the Department of Environment will authorize a subordinate officer as a prosecuting and inspecting officer.

- ***Wildlife (Conservation and Security) Act, 2012***

The act covers different elements of forest biodiversity and conservation. There are provisions of defining, declaring and managing different types of protected areas for enhancing biodiversity conservation. There is a provision of constituting a board of a chairman and necessary experts

in the conservation of biodiversity. In this act, the Forest Department is empowered for the conservation and management of biodiversity of the country. This act has defined wetland and ecotourism or nature tourism.

- ***Territorial Waters and Maritime Zones Act, 1974***

There is a provision of establishing marine conservation zones in the areas adjacent to the territorial waters and of taking conservation measures to protect the living resources of the sea from over-exploitation or destruction. The government may take proper measures for the prevention and control of marine pollution and for maintaining ecological balance in the high seas closer to the territorial water zone. In this act, the government was defined as authority. Institutional arrangements are completely absent in this act. St. Martin Island has not been established as a conservation zone until now.

- ***Marine Fisheries Ordinance, 1983***

Part VIII of this ordinance provides the provision of establishing marine reserves through official gazette notifications to protect aquatic habitat where flora and fauna are endangered or face a risk of being extinct. This part has forbidden attempting to fish; to discharge waste or pollutants, to dredge, to alter or destroy natural breeding grounds or habitats, and to construct infrastructures on or over any reserve land or water bodies.

- ***Protection and Conservation of Fish Rules (1985)***

The Rules were framed are in line to fulfill the overall objectives of the ‘Protection and Conservation of Fish Act, 1950’. The Section-5 has forbidden making any attempt to destroy or catch any fish by using ammunition, guns, arrow, bow and any sorts of explosives neither in fresh waters nor coastal waters. The other section-6 has strictly prohibited making any attempt to destroy fishes by applying poisons of water and depleting fisheries through pollution. Actually, these rules were framed to protect freshwater fisheries and fisheries in the estuaries.

- ***The State Acquisition and Tenancy Act, 1950 (East Bengal Act)***

The section-90 under chapter XIII of this act imposed restrictions for the non-bonafide cultivators to purchase lands. They cannot purchase lands for commercial or industrial purposes and for charitable or religious purposes without the previous written permission of the prescribed Revenue Authority. Here revenue authority means collector or deputy commissioner of a district.

- ***Bangladesh Water Act, 2013***

This act was enacted for effective and efficient usage and conservation of water resources of the country. This law gave ownership of all sources of water like sub-surface, marine, rainfall and atmosphere to the government.

- ***Protected areas of tourism and special tourism zone Act -2010***

This act was enacted to identify the critical areas, where tourism will be restricted for sustainability. The Government may declare any critical area for the conservation and any developmental activity shall not be carried without prior permission of the government.

- ***Ecologically Critical Area Management Rules, 2016***

The Rules were framed to be in line to fulfill the overall objectives of Bangladesh. These rules formed different committees from national to grass root level incorporating diverse stakeholders. These rules restrict all activities against biodiversity conservation, pollution, and exploitation of natural resources in the Ecologically Critical Areas (ECA). Without prior permission of the Forest Department, none can change the land category based on the usage. Co-management was encouraged in these rules.

There are different prohibitions in the above-mentioned legislation that are not implemented. According to the perception of the community people, there are many reasons for non-compliance of the laws and mismanagement (Fig. 3). The penalties incorporated into legislation are not imposed due to lack of monitoring, surveillance, and absence of the staffs of the Department of Environment and Forest. One inhabitant states that only Upazilla Nirbahi Officer has been trying to save this island engaging the Union Parishad. Upazila Fisheries Office, Technaf argued the implementation of laws cannot be ensured due to lack of logistic support. On the other hand, it was also noted that the existing regulation does not work properly due to corruption. Poor enforcement of laws created the perception among the community that violation of laws will punish them rarely. Moreover, concerned officials rarely inspect the island for a breach of laws. One farmer said that they have been applying chemical fertilizers and pesticides for a long time like the mainlanders for increasing the agricultural productivity and nobody forbids such type of chemical usages. Few respondents reported that the outsiders purchased the lands for commercial purposes and have been using agricultural lands for tourism purposes without prior permission from the Collector

(Deputy Commissioner, Cox's Bazar). The tour operators and the owners of the hotels and restaurants discharge or dump the tourist's waste in the open place. The absenteeism of the Department of Environment poses a great threat to the non-compliances of the existing laws. A staff of a non-government organization involved in turtle conservation said, "Most of the laws are backdated and not clear, clear legislation is required to save Saint Martin Island and the unique coral communities". The existing regulatory frameworks embrace only fisheries and some aspects of the Mangrove, Sundarbans. A specific act was not enacted for the conservation of the coral reef, nor was any part of any act focused on this issue. No laws address newly emerged global issues like ocean acidification, global warming, and sea level rise.

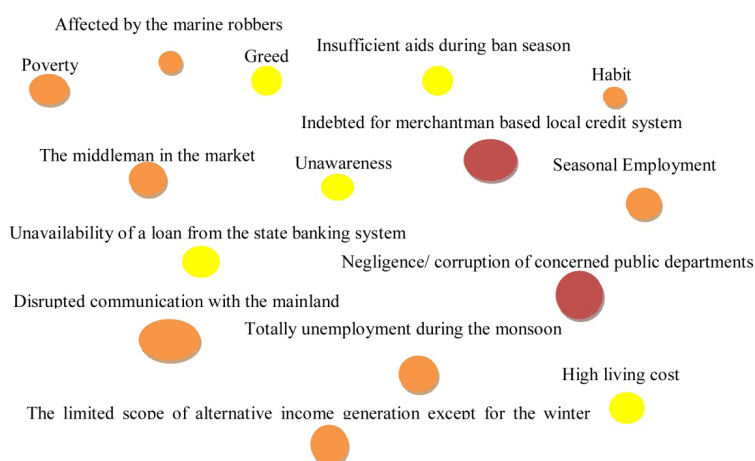


Figure-3: The map of causal factors of non-compliance of the laws

Institutional arrangements

The conservation of coral reefs is characterized by complex governance, regulatory and institutional issues, involving a mix of formal and informal institutions, public departments, non-government organizations, private sectors, and community. In accordance with the existing laws, the Department of Environment is responsible for controlling and managing pollution, waste, and chemicals. According to the provision of Bangladesh Environment Conservation Act 1995, the Department of the Environment will tackle water pollution problems and maintain water quality in the fishing grounds through developing coordination with the Department of Fisheries. Both the Department of Environment and the Department Agricultural Extension have responsibilities of banning the use of

chemical fertilizer and pesticide in the crop fields. Department of Fisheries (DoF) has overall responsibility to restrict over-extraction of fishes from the coral community. They are mandated for the conservation of marine aquaculture. The power has been delegated to the Forest Department for the conservation and management of biodiversity and wildlife of the country. According to Ecologically Critical Area Management Rules, 2016, without prior permission of the Forest Department, no citizen even can change the land category based on the usage. Along with Bangladesh Tourism Board, the Department of Forest will ensure eco-tourism or restrict tourism in the critical area. In these rules, co-management or community-based conservation has been encouraged. The Upazilla and District Administration are the authorities of land management. Deputy Commissioner is the chairperson of 'Ecologically Critical Areas (ECA) Management Committee', where Upazilla Nirbahi Officer at Upazila level. In 'Bangladesh Biodiversity Act 2017', Deputy Commissioner chairs the district biodiversity management committee, where Upazilla Nirbahi Officer (UNO) does the Upazila Committee. Therefore, Deputy Commissioner, Cox's Bazar and Upazila Nirbahi Officer, *Technaf* are highly responsible for the conservation of coral reefs at Saint Martin. Similarly, the Union Parishad Chairman chairs the Union Committee. He/she is empowered to protect and manage the coral community. The chairman can form Village Conservation Forum (VCF) to protect this island in accordance with 'Ecologically Critical Area Management Rules, 2016'. There are no institutional arrangements for coping with newly emerged global issues like ocean acidification, global warming, and sea level rise. It was found that no coordination exists among different research institutions.

Discussion

Hossain and Islam (2006) reported that over-harvesting of fisheries from the reefs, extraction of corals, removal of littoral vegetation and destructive fishing practices like the use of rock-added gill nets on the inshore soft reefs and unplanned tourism pose a great threat to the existence of the biodiversity of Saint Martin. The ecosystem is negatively impacted by the uncontrolled waste disposal; an increased load of solid waste; increased presence of antifouling agents like resorts, hotels, and tour operations on the island; the release of pollutants from supply sources and from boats; and the release of chemicals from various sources (Tomascik, 1997). Small boat grounding and anchoring are causing physical damage of the

corals, where chemical fertilizer and pesticide are causing eutrophication (Hossain and Islam 2006). In order to prevent the extinction of coral reefs from Bangladesh as well as to achieve all targets of SDG 14, it is highly essential to reform the legal and policy instruments. Shamsuzzaman & Islam MM (2018) revealed that in Bangladesh the acts and the rules for governing marine living resources are old and cannot keep pace with the changing situations. The current regulatory framework seems to be ineffective and non-functional in addressing the rapid socio-economic and environmental changes (Islam et al. 2017). An update of the marine regulatory framework is inevitable for not only conserving the coral reefs but also for achieving SDG-14 (Shamsuzzaman & Islam MM 2018). Shamsuzzaman & Islam MM (2018) correlated the laxity in enforcement of the law to the violators, the local politicians, and corruption of law enforcers. It is very much essential to analyze the causes of non-compliance of the existing regulatory framework. An integrated legal framework is required for coral reef management along with addressing the causes of non-compliance. There are few institutions established by the legal provisions involved in biodiversity conservation. Every institution is assigned with a specific mandate but the vagueness of the legal position in determining authority over conservation creates obstacles in developing effective coordination (Ehsanul 1999). The institutional arrangements are very complex without defining specific responsibilities. The absence or poor quality of coordination; lack of staffs and logistic supports; bribery; negligence regarding duties and responsibilities; political influences, lack of monitoring, control and surveillance; and conflict of interests have led to an inefficient and ineffective, and even non-functional institutional framework (Islam et al. 2017, Shamsuzzaman & Islam MM 2018, Islam et al. 2016). No institutions are responsible for facing newly emerging global challenges like ocean acidification.

Coral reef ecosystem management in Bangladesh should focus on the development of the legal and institutional frameworks for enhancing the capacity of mitigation and promotion of the ecosystem services through resilient initiatives. Ineffective implementation of public policy seems to be associated with the existing institutional and legal arrangements. Consequently, they affect the social and ecological sustainability to a greater extent. A poor regulatory framework leads to poor sectoral governance, where institutional loopholes obstruct the implementation of public policies (Mattos & Wojciechowski 2019, Shamsuzzaman and Islam 2018, Islam et al. 2016).

Recommendations

To overcome the challenges to conserve the existing coral reefs of Bangladesh, this study recommends:

- Including all poor people in the incentive programmes
- Prohibits boating in the route between Saint Martin Island and ‘Chhera Dip’
- Showing zero tolerance against coral extraction and destruction
- Banning the use of chemical fertilizers and insecticides in the agricultural lands
- Creating alternative income generative activities for the people who are extracting threatened reef resources for their livelihoods
- Making the concerned institutions effective, efficient and accountable
- Restricting or limiting tourism and waste disposal
- Making all tourism industries liable for waste management following 3R (Reduce, Reuse and Recycle)
- Updating national regulatory frameworks including newly emerged global challenges
- Immediate enforcing of all rules mentioned in Ecologically Critical Area Management Rules, 2016
- Developing proper monitoring, control and surveillance mechanism
- Enhancing awareness programme for the community as well as for the tourists
- Establishing the educational and specialized institutions for coral conservation and for facing the newly emerged global challenges
- Establishing a strong coordination among Local (District and Upazilla) Administration, Department of Environment, Department of Fisheries, Department of Forest and Wildlife, Tourism Board, Wildlife Advisory Board, Bangladesh Marine Fisheries Academy, Bangladesh Coast Guard (East Zone), Tourist Police (Cox’s Bazar), Bangladesh Oceanographic Research Institute, Cox’s Bazar, Chittagong Port Authority and Union Parishad, Saint Martin

Conclusions

Bangladesh is highly committed to achieving SDG-14, despite having limitations in the regulatory and institutional framework. The conservation of the coral reefs is an integral part of achieving SDG-14. The integration of regulatory and institutional arrangements and updating the existing arrangements are required for sustainable marine resource management as

well as for developing the blue economy. Recently, Article 18A has been included in the Constitution to show the commitment towards sustainable development. This article calls for the conservation of biodiversity. Any development activity including tourism should not accept sacrificing environmental conservation. The causes of non-compliance of the laws should be diagnosed and be addressed properly. Bangladesh should prepare herself to tackle emerging global challenges like ocean acidification. Strong networking among different research institutes and universities is highly essential to cope with the upcoming challenges.

References

- Ahammed, SS, Hossain, MA, Abedin, MZ & Khaleque, MA 2016 ‘A study of environmental impacts on the coral resources in the vicinity of the Saint Martin Island, Bangladesh’, *International Journal of Scientific & Technology Research*, vol. 5, no. 1, pp. 37-39.
- Alam, O, Deng, TL, Uddin, MN & Alamgir, M 2015 ‘Application of Environmental Ethics for Sustainable Development and Conservation of Saint Martin’s Island in Bangladesh’, *Journal of Environmental Science and Natural Resources*, vol. 8, no. 1, pp. 19-27.
- Billah, MM, Kader, MA, Mahmud, SS, Asif, AA & Siddiqui, AAM 2018 ‘Diversity and distribution of seaweeds in Saint Martin Island, Bangladesh’, *International Journal of Fisheries and Aquatic Studies*, vol. 6, no. 6, pp. 166-169.
- Brown, CJ, Saunders, MI, Possingham, HP & Richardson, AJ 2014 ‘Interactions between global and local stressors of ecosystems determine management effectiveness in cumulative impact mapping’, *Diversity and Distributions*, vol. 20, pp. 538–546.
- Bruno, JF, & Selig, ER 2007 ‘Regional decline of coral cover in the Indo-Pacific: timing, extent, and subregional comparisons’. *PLOS ONE*, vol. 2, no. 8, pp. 1-11.
- Bruno, JF, Côté, IM & Toth, LT 2019 ‘Climate Change, Coral Loss, and the Curious Case of the Parrotfish Paradigm: Why Don’t Marine Protected Areas Improve Reef Resilience?’ *Annual Review of Marine Science*, vol. 11, no. 1, pp. 307-334.
- Burke, L, Reytar, K, Spalding, M & Perry, A 2011 ‘Reefs at risk revisited’, *Report*, World Resource Institute, Washington, DC.

Côté, IM & Darling, ES 2010 ‘Rethinking Ecosystem Resilience in the Face of Climate Change’, *PLOS Biology*, vol. 8, no. 7, pp. 1-12.

De’ath, G, Fabricius, KE, Sweatman, H & Puotinen, M 2012 ‘The 27-year decline of coral cover on the Great Barrier Reef and its causes’, *PNAS*, vol. 109, pp. 17995–17999

Doney, SC, Fabry, VJ, Feely, RA & Kleypas, JA 2009 ‘Ocean acidification: the other CO₂ problem’, *Annual Review of Marine Science*, vol. 1, pp. 169–192.

Edmunds, PJ, Adam, TC, Baker, AC, Dool, SS, Glynn, PW, Manzello, DP, Silbiger, NJ, Smith, TB & Fong, P 2019 ‘Why more comparative approaches are required in time-series analyses of coral reef ecosystems’, *Marine Ecology Progress Series*, vol. 608, pp. 297-306.

Ehsanul, H 1999 ‘Management of Fisheries, Coastal Resources and the Coastal Environment in Bangladesh: Legal and Institutional Perspectives’, *PRIAP-ICLARM Work, Paper Series 4*, p. 112, International Center for Living Aquatic Resources Management Press: Manila, Philippines.

Elo, S, Elo, K & Kyngas, H 2008 ‘The qualitative content analysis process’, *Journal of Advanced Nursing*, vol. 62, no. 1, pp. 107–115.

English, S, Wilkinson, C & Baker, V 1997 ‘Survey Manual for Tropical Marine Resources’, *2nd Edition*, Australian Institute of Marine Science: Townsville.

Feeroz, MM 2009 ‘Effects of Environmental Degradation on Food Security in the St. Martin’s Island of Bangladesh’, *Final Report, supported by National Food Policy Capacity Strengthening Programme(NFPCSP)*, Government of the Peoples Republic of Bangladesh, pp.82.

Ferrario, F, Beck, MW, Storlazzi. CD, Micheli. F, Shepard, CC & Airoidi, L 2014 ‘The effectiveness of coral reefs for coastal hazard risk reduction and adaptation, *Nature Communications*, vol. 5, pp. 1-9.

Gardner, TA, Côté, IM, Gill, JA, Grant, A & Watkinson, AR 2003 ‘Long-term region-wide declines in Caribbean corals’, *Science*, vol. 301, pp. 958–960.

Georgina, MM, Norris, K & Fitter, AH 2012 ‘Biodiversity and ecosystem

services: a multilayered relationship', *Trends in Ecology & Evolution*, vol. 27, no. 1, pp. 19-26.

Gilby, BL, Tibbetts, IR, Olds, AD, Maxwell, PS & Stevens, T 2016 'Seascape context and predators override water quality effects on inshore coral reef fish communities', *Coral Reefs*, vol. 35, no. 3 pp. 979–990.

Gupta, J, van der Leeuw, K & de Moel, H 2007 'Climate change: a 'glocal' problem requiring 'glocal' action', *Environmental Sciences*, vol. 4, pp. 139–148.

Harris, DL, Rovere, A, Casella, E, Power, H & Canavesio, R et al. 2018 'Coral reef structural complexity provides important coastal protection from waves under rising sea levels', *Science Advances*, vol. 4, no. 2, pp. 1-7.

Hasan, MM 2009 'Tourism and Conservation of Biodiversity: A Case Study of St. Martins Island, Bangladesh', *Law, Social Justice & Global Development Journal (LGD)*, vol. 1, pp. 1-12.

Hoegh-Guldberg, O, Mumby, PJ, Hooten, AJ, Steneck, RS, Greenfield, P & Gomez, E et al. 2007 'Coral reefs under rapid climate change and ocean acidification' *Science*, vol. 318, pp. 1737–1742.

Hossain, MM & Islam, MH 2006 'Status of the biodiversity of St. Martin's Island, Bay of Bengal, Bangladesh', *Pakistan Journal of Marine Sciences*, vol.15, no. 2, pp. 201-210.

Hsieh, HFS & Shannon, E 2005 'Three Approaches to Qualitative Content Analysis', *Qualitative Health Research*, vol. 15 no. 9, pp. 1277-1288.

Hughes, TP, Barnes, ML, Bellwood, DR, Cinner, JE & Cumming, GS et al. 2017 'Coral reefs in the Anthropocene', *Nature*, vol. 546, pp. 82–90.

Hughes, TP, Kerry, JT, Baird, AH, Connolly, SR & Dietzel, A et al. 2018 'Global warming transforms coral reef assemblages', *Nature*, vol. 556, pp. 492–496.

Islam, MM, Mohammed, EY & Ali, L 2016 'Economic incentives for sustainable hilsa fishing in Bangladesh: An analysis of the legal and institutional framework', *Marine Policy*, vol. 68, pp. 8-22.

Islam, MM, Shamsuzzaman, MMH, Mozumder, X, Xiangmin, Y, Ming, MAS & Jewel, MBS 2017 'Exploitation

and conservation of coastal and marine fisheries in Bangladesh: do the fishery laws matter?' *Marine Policy*, vol. 76, pp. 143–151.

Islam, MZ 2002 'Marine Turtle Nesting at St. Martin's Island', *Marine Turtles Newsletter*, vol. 96, pp. 19-22.

Jackson, J, Donovan, M, Cramer, K & Lam, V 2014 *Status and Trends of Caribbean Coral Reefs: 1970–2012*, Global Coral Reef Monitoring: Gland, Switzerland.

Krippendorff, K 2004 *Content Analysis: An Introduction to its Methodology*, Sage Publications: Beverly Hills, CA.

Leingang, PM & Dixon, DL 2019 'Phenotypic variations in the preferred host coral impact the occupancy of an obligate coral-dwelling fish', *Coral Reefs*, vol. 38, pp. 93–101.

Mattos, SMG & Wojciechowski, MJ 2019 'Existing Institutional and Legal Framework and Its Implications for Small-Scale Fisheries Development in Brazil' in Salas, S, Barragán-Paladines, M & Chuenpagdee, R. (eds), *Viability and Sustainability of Small-Scale Fisheries in Latin America and The Caribbean*, MARE Publication Series, vol. 19, Springer: Cham.

Mitchell, SB, Jennerjahn, TC, Vizzini, S & Zhang, W 2015 'Changes to processes in estuaries and coastal waters due to intense multiple pressures—An introduction and synthesis', *Estuarine, Coastal and Shelf Science*, vol. 156, pp. 1–6.

Moudud, HJ 2010 'St. Martin's Island and its unique biodiversity face serious threats', International Union for Conservation of Nature (IUCN), http://www.iucn.org/about/union/secretariat/offices/asia/working_together/asia_members/?4887/St-Martins-Island-and-its-unique-biodiversity-face-serious-threats, accessed on 28 November 2018.

Neuendorf, KA 2002 *The Content Analysis Guidebook*, Sage publications: Cleveland State University.

Rajasuriya, A, Zahir, H, Muley, EV, Subramanian, K, Venkataraman, MVM, Wafar, SM, Khan, MH & Whittingham, E 2000 'Status of coral reefs in South Asia: Bangladesh, India, Maldives, Sri Lanka, in Wilkinson, C (ed) *Status of coral reefs of the world 2002*, Australian Institute of Marine Science: Townsville, pp. 101–121.

Saunders, MI, Leon, J, Phinn, SR, Callaghan, DP, O'Brien, KR & Roelfsema, CM et al. 2013 'Coastal retreat and improved water quality mitigate losses of seagrass from sea level rise', *Global Change Biology*, vol. 19, no. 8, pp. 2569–2583.

Schutte, V, Selig, E & Bruno, J 2010 'Regional spatio-temporal trends in Caribbean coral reef benthic communities', *Marine Ecology Progress Series*, vol. 402, pp. 115–122.

Shamsuzzaman, MM & Islam, MM 2018 'Analysing the legal framework of marine living resources management in Bangladesh: Towards achieving Sustainable Development Goal 14', *Marine Policy*, vol. 87, pp. 255–262.

Spalding, M, Burke, L, Wood, SA, Ashpole, J, Hutchison, J & Ermgassen, PZ 2017 'Mapping the global value and distribution of coral reef tourism', *Marine Policy*, vol. 82, pp. 104–113.

Spalding, M & Grenfell, A 1997 'New estimates of global and regional coral reef areas', *Coral Reefs*, vol. 16, no. 4, pp. 225–230.

Spencer, L, Ritchie, J & O'Connor, W 2003 'Analysis: practices, principles and processes', in Ritchie, J & Lewies, J (eds.), *Qualitative Research Practice: A Guide for Social Science Students and Researchers*, Sage Publications Ltd.: London, pp. 199–218.

Sylvia, LR, Wood, SK, Jones, JA, Johnson, KA, Brauman, RCK, Alexander, F, Evan G, Line, JG, Carrie, VK, Lisa, M, Mark, M, Patrick, OF, William, KS, Louise, W, Wei Zhang, FA & DeClerck 2018 'Distilling the role of ecosystem services in the Sustainable Development Goals',

Ecosystem Services, vol. 29, Part A, pp. 70–82.

Szmant, AM (2002) 'Nutrient enrichment on coral reefs: Is it a major cause of coral reef decline?', *Estuaries*, vol. 25, pp. 743–766.

Tomascik, T 1997 'Management Plan for Resources of Narikel Jinjira (St. Martin's Island)', *Final Report, National Conservation Strategy Implementation Project -I*, Ministry of Environment and Forest, Government of the People's Republic of Bangladesh.

Welle, PD, Small, MJ, Doney, SC & Azevedo, IL 2017 'Estimating the effect of multiple environmental stressors on coral bleaching and mortality', *PLoS One*, vol. 12, no. 5, pp. 1–11.

Appendix-6: Challenges of Artisanal Fishermen: A Case Study from Sonadia Island, Bangladesh

Md. Mizanur Rahman¹, M. Aslam Alam², Md. Moshir Rahman³, Mohammad Mamun⁴, Muhammad Abu Yusuf⁵ and Ashraful Alam⁶

Abstract

This paper examines the unique social, economic, and environmental challenges surrounding the livelihoods of artisanal fishers, and the coastal communities who depend upon them, by analysing the experiences of the local communities on Sonadia Island in Cox's Bazar District, Bangladesh. These challenges have been understood, characterised, and examined by obtaining primary data from the fishers on Sonadia Island. This paper illustrates that the artisanal fisheries sector in Bangladesh contributes significantly to the socio-economic conditions of vulnerable coastal communities. To safeguard this important sector and achieve sustainable development, existing laws and policies should be reformed and institutions should be afforded adequate resources. A comprehensive understanding of areas within the regulatory framework that need reform was obtained by analysing the current laws, policies, and institutions that regulate artisanal fisheries. This paper identifies several weaknesses of existing regulatory frameworks that can be improved to enable a more effective protection for artisanal fishers and their livelihoods. Other suggestions include the implementation of specific Sustainable Development Goals (SDGs) and related targets at the international level, and reforming a range of issues pertaining to fishery, technology, weather, climate, and security at the national level. This paper finally argues that a holistic approach needs to be adopted to address the variety of challenges surrounding artisanal fisheries, the fishers and communities that depend on them. This approach will allow for the promotion of sustainable management by implementing a range of legal and policy-based strategies, to address the underlying socio-economic conditions that inhibit the artisanal fishers from attaining secure livelihoods.

Keywords: marine fisheries, SDGs, fisheries management, artisanal fishers, rights, pro-activeness, government departments

1. Introduction

Artisanal fishers usually live in coastal communities and harvest fish for their livelihoods using traditional techniques and equipment. They

rely on knowledge passed down through generations within their local communities (Rahman 2017). According to the *Marine Fisheries Sector Sub-Strategy 2006*, artisanal fishers are those that fish near the shore and largely depend on the catch for their own consumption. Artisanal fishing also refers to a particular method and technique applied to catch fish. It generally includes simple traditional methods such as the use of simple traps and traditional boats and equipment (Batista et al. 2014). The terms artisanal fishing and small-scale fishing are not always interchangeable. Whereas artisanal fishing involves a degree of simplicity or tradition, small-scale refers to the size and scope of the fishing activity (Batista et al. 2014). Artisanal is a form of subsistence fishing which provides food directly to the concerned family or community (Akhtar et al. 2017), requiring minimum capital and simple technology or traditional techniques that are acquired and maintained through generations. Nevertheless, some definitions include both type and scale elements. Strict differentiation between artisanal and small-scale fishing is therefore not vital (FAO 2012) and notably, if economic conditions permit, many traditional fishers would use advanced technology for fishing. Their approach now includes adopting the latest technology such as mobile phones to increase their fishing capacity and reduce risk (Salia et al. 2011, Sreekumar 2011). As the methods and techniques of fishing utilised by artisanal fishers differ from industrial/large scale fishing, the species of fish and the characteristics of those fish harvested by the artisanal fishers differ from the fish caught by commercial fishers. Generally, tropical traditional fishers catch a diverse range of fish species but most of the catch are small adults (Batista et al. 2014). In Bangladesh, artisanal fishers harvest fish within a 40-meter depth from the sea surface (Akhtar et al. 2017).

Bangladesh has a vast maritime area with an estimated 475 marine species (Billah et al. 2018). The marine fisheries sector forms a vital component of socio-economic support for its people (Al Arif 2017). This sector provides employment for more than 17 million workers (full-time and part-time), representing approximately 11% of the country's total population (DoF, 2016). Given these circumstances, Bangladesh has become a self-sufficient country for fish production. The fisheries sector is experiencing one of the highest growth rates, contributing approximately 3.6% of total export earnings, and 4.39% of the national GDP. Marine fisheries constitute 20-24% of total fish production in Bangladesh, with artisanal fishing constituting more than 90% of marine harvesting (Billah et al. 2018). Accordingly, marine fisheries play an important role in improving

the trajectory of socio-economic conditions by contributing towards food security, poverty alleviation, job creation and foreign currency earning (Billah et al. 2018). However, marine resources within the oceanic waters of Bangladesh are reportedly being overexploited (Al Arif 2017).

Furthermore, the importance of marine fisheries and the role of artisanal fishers are strongly emphasised at the international level, being explicitly referred to in the Sustainable Development Goals (SDGs). SDG 14 emphasises the need for the sustainable use of marine resources for sustainable development. Most targets within SDG 14 call for specific action to regulate harvesting, cease over-fishing and provide small-scale artisanal fishers with access to resources and markets. These factors require sufficient attention in order to be addressed promptly, as this indispensable sector is also vulnerable to the effects of climate change, habitat destruction and other anthropogenic impacts (Jackson et al., 2001; Diaz & Rosenberg 2008, Halpern et al. 2008). The overarching principle that defines the SDGs is the need to ensure that no one is left behind. Artisanal fishers are considered to be among the most vulnerable people in the fisheries sector, therefore unless they are afforded appropriate protection within legislative, policy and institutional frameworks, this vulnerable group will potentially be “left behind”.

A major concern surrounding the effective management of artisanal fishers, and the core focus of this paper is the fact that the overall ability of the artisanal fisheries sector in Bangladesh to achieve sustainable management has been significantly inhibited by a policy implementation gap and ineffective law enforcement (Billah et al. 2018). Policy intervention is reflected in two ways: formulation of appropriate policies and implementation of existing policies (Andrew et al. 2007, Pomeroy & Andrew 2011). In Bangladesh, marine governance is evidently weak because of the absence of an integrated and holistic regulatory and institutional framework (Akhtar et al. 2017). Further, the number of artisanal fishers is continuously decreasing at an alarming rate due to marketing issues, natural calamities and the increasing dominance of commercial fishers (Rahman 2017). These factors are creating untenable circumstances for artisanal fishers. They are losing their income through barriers affecting the maintenance of their livelihood, are forced to spend the majority of their income on food and clothing, and are facing competition by commercial fishers during peak fishing periods (Akhtar et al. 2017). This paper will analyse these unique social, economic and

environmental challenges faced by artisanal fishers to determine how existing laws and policies should be reformed with a view to safeguarding this indispensable sector in Bangladesh.

2. Method

2.1. Study Area

This study was conducted at *Sonadiadip* (Sonadia Island) in Cox’s Bazar District, Bangladesh. The island is situated between 21°28’45” N to 21°31’15” N Latitude 91°52’30 to 91°55’.0”E Longitude (see **Figure 1**).

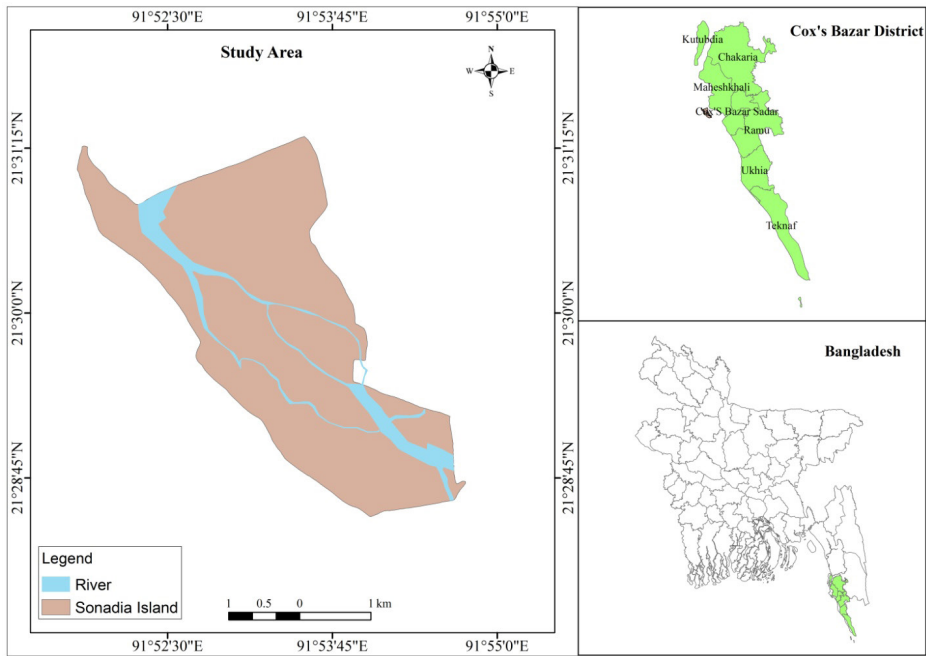


Figure 1: Location map of the study area- Sonadia Island

Sonadiadip (loosely translated as the ‘Island of Gold’) is a small island which is approximately nine square kilometres in surface area (3.5 square miles) and inhabited by around 2,000 people. It is a crescent-shaped island, lying about seven kilometres to the north-west of the Cox’s Bazar coast, which is the longest unbroken sea beach in the world. The legend behind the name of this island is premised on a local belief that hundreds of years ago, a large ship loaded with gold sank due to an attack by the Portuguese pirates. The local people went in search of the gold, and from

this, the island eventually acquired the name *Sonadia*. This island is rich in wildlife and natural beauty, and is a sanctuary for migratory birds, such as sand plovers, little stints, fantail snipes, avocet-sandpipers, grey plovers, black-bellied terns, geese, herring gulls, grey herons, cattle egrets, and yellow bitterns. These migratory birds attract tourists to *Sonadia Island* during the winter months. The western coast of Sonadia Island is sandy, and the waves bring in colourful shells which adorn the golden beach. Thousands of beautiful red crabs are another main attraction for tourists, and the island is also a famous fish drying spot. The main occupations of the people living on this island are fishing and salt cultivation. Notably, almost all fishers living on this island are artisanal fishers.

2.2. *Collecting Primary Data*

This study was mainly conducted based on primary data collected by means of a questionnaire survey and a focus group discussion (FGD). A total of 100 fishers were interviewed purposively using a semi-structured questionnaire at Sonadia Island in Cox's Bazar district. The focus group discussion was conducted to ascertain the real experiences of an artisanal fisher's profession and to facilitate an understanding of the inherent sectoral problems. Important information regarding the socio-economic conditions of fishers was collected through observation and from local government offices. Collected data was analysed using statistical tools. SDG targets have also been used as an analytical tool to understand the role and challenges of these important artisanal fisheries and the rights of the fishers.

2.3. *Collecting Secondary Data and Analysing Legal, Policy and Institutional Frameworks*

Secondary data was collected on the relevant Acts, Ordinances, Rules, Policies, and Strategies relating to marine fisheries and analysed in order to gain an understanding as to where opportunities lie for implementing more holistic and sustainable management practices. This data was collected from the websites of the concerned Ministries, Divisions, and Departments. Desktop research and document analysis methods were used to find appropriate fisheries management approaches and identify the laws, policies, rules and institutional arrangement that are applicable in the context. A literature review was also undertaken to glean a broader understanding of these approaches and challenges that were identified from the primary data collected for this study. There exists literature that

focusses on the legal and policy frameworks for small-scale fisheries in Bangladesh (see e.g. Mohammad Mahmudul Islam, 2012), however, few studies of this nature have been carried out in Bangladesh to gather primary data that allows for an in-depth examination of the socio-economic conditions of artisanal fishers. Moreover, the challenges facing the fishers, regulatory and institutional arrangements and their alignment with SDGs have not yet been thoroughly examined. This study considers the socio-economic conditions of artisanal fishers in Bangladesh by analysing and evaluating the existing regulatory and institutional frameworks. In particular, this study applies SDG targets as a lens through which the sectoral challenges experienced by artisanal fishers in Bangladesh have been examined. This study makes several recommendations aimed at addressing and ultimately overcoming these challenges.

3. Results

3.1. Socio-Economic Context and Challenges

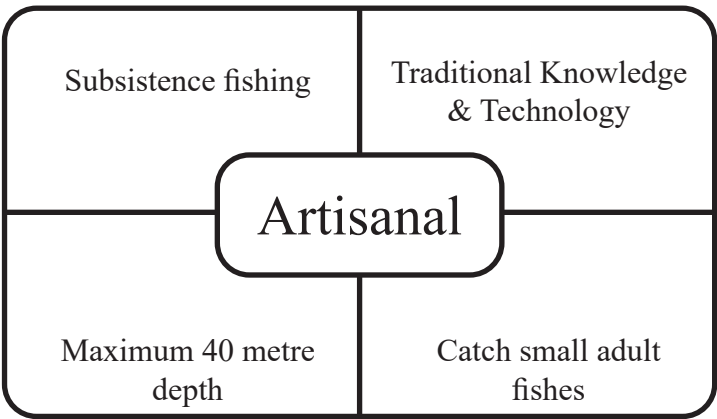


Figure 2: Conceptual framework of artisanal fishing

The inhabitants of Sonadia depend on fishing and salt cultivation for their livelihoods. A few people were involved in firewood collection from the Para (Banyan forest, fish processing, and cultivation of cereal crops in the Char (Island land. Community people did not have cultivable land as they mainly work for fishing and salt cultivation. Nevertheless, very few participants are involved in agriculture in the Char area. Homestead vegetable production is very popular there, although open space is scarce.

The land is *Khas* (government-owned fallow land).

Despite fishing being the main occupation of Sonadia inhabitants, very few had their own boat and net. Notably, 73% of artisanal fishers do not have their own boat and net and depend on others for these items. They mainly harvest fish from the surrounding area of the coast. Most of the boats are shallow engine run (52%) whilst the rest are country boats known locally as *Dingi*. Most of the time fishers are not aware of weather forecasts whilst at sea – instead, they try to learn the weather forecasts from land before departing. Fishers sometimes stay at sea for a couple of days, and during that period they are hardly aware of weather information as there is no mobile phone network coverage at sea.

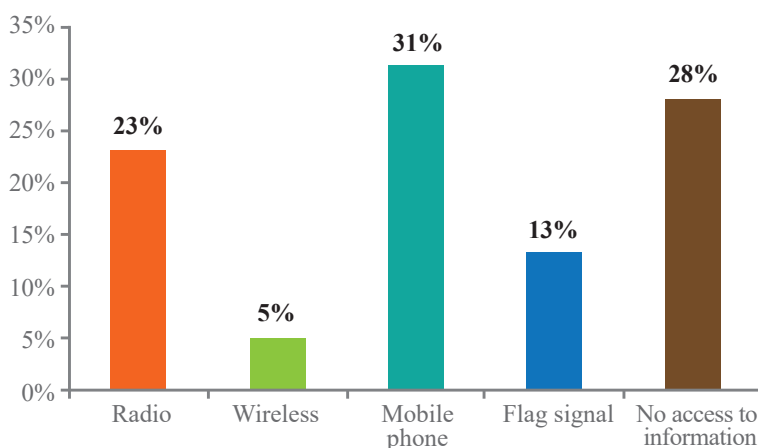


Figure 3: Medium of getting weather information

Fishers who participated in this study liked using radio to receive authentic information and weather forecasts. The popularity of this method is shown by **Figure 3** above, and is also the only way to obtain weather forecasts whilst out at sea. The most popular method of obtaining weather forecasts is via mobile phone, yet as mentioned above, fishers are unable to use these at sea due to mobile phone coverage. However, a significant portion of respondents (28%) do not have access to any devices for communication or entertainment.

Only a few respondents take the precaution of using a life jacket whilst fishing at sea, with 44% of fishers using a tube instead and feeling secure and comfortable in doing so. It was also found that some use a large aluminum pot for carrying fish, however, a significant number (29%) do

not take any safety precautions through such measures (see **Figure 4**).

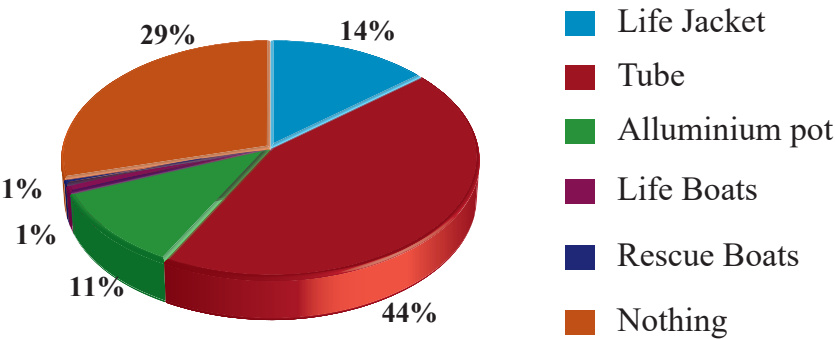


Figure 4: *Safety measures during fishing*

Respondents shared similar socio-economic conditions and lifestyles. A uniform pattern was identified in relation to religion, educational status, house type, sanitation status, food habit, health condition, land ownership, occupation, monthly income, and expenditure. Among the respondents 94% was Muslim and the rest was Hindus. The staple food was rice. Most participants were aged 15-35 years and the gender ratio of the respondents was 83: 17 (male: female). The literacy rate was 3%. Turning to the broader socio-economic context, almost all houses on the island (94%) are made from mud, bamboo, and *Chhan* (a local tree species), locally known as *Kaccha*. Only 2% of houses were Tin shed buildings. The absence of electricity indicates that the island is far away from opportunities to obtain and access citizen amenities. About 50% of households use solar energy whilst 24% of households use kerosene lamps, known locally as *Kupi*, and the remaining population use a candle for dinner time, and go to bed earlier to save fuel. At the time of this study, no health centre was established in the area, and sick people needed to travel to Moheskhali Upazila by waterway – a 19 km journey away from Sonadia. Community people depend solely on medicine shops and medicine sellers for their primary treatment and for common illness. Local people claim that they do not get Vulnerable Group Feeding (VGF) cards, a government benefit scheme to support the most impoverished citizens. Only *Hilsa* fishers receive 10 kg of rice during the closed season for *Hilsa* fishing, however, not all fishers receive this rice as compensation. A total 95% of fishers relied on an average income within 15,000 to 20,000 taka per month and most families (77%) had a single wage earner. Despite experiencing

difficulties in earning, most families (74%) have access to safe drinking water. Sanitary conditions of the households studied were, however, extremely poor – with only 2 % of households having a sanitary latrine, while 24% had semi *Pucca*. The toilet class of remaining households was *Kaccha* but open defecation was not recorded in the study area.

3.2. Additional Key Challenges

In addition to challenges and vulnerabilities inherent in the abovementioned local socio-economic context, key challenges were identified in security, enforcement, financial and sectoral mechanisms.

The respondents identified many challenges faced in artisanal fishing (see **Figure 5** below). Piracy constitutes the major threat to the life and profession of artisanal fishers, with the appearance of Burmese pirates posing a significant threat. These pirates mount sudden attacks, looting fish and other valuable items. Local pirates are sometimes involved in the kidnapping and killing of the fishers. Respondents reported that the Bangladesh Coast Guard is not proactive in controlling piracy.

Further, the respondents reported that they do not have any formal channel to obtain a loan to improve their fishing techniques and utilise technology such as modern boats, nets, and other necessary equipment. These artisanal fishers must, therefore, depend on *Dadan* (a locally offered credit scheme with very high rates of interest) and *Mahajan* (the loan provider). Formal banking services are not available in this area. According to the statements of the respondents, they pay 80%-120% interest in the *Dadan* system.

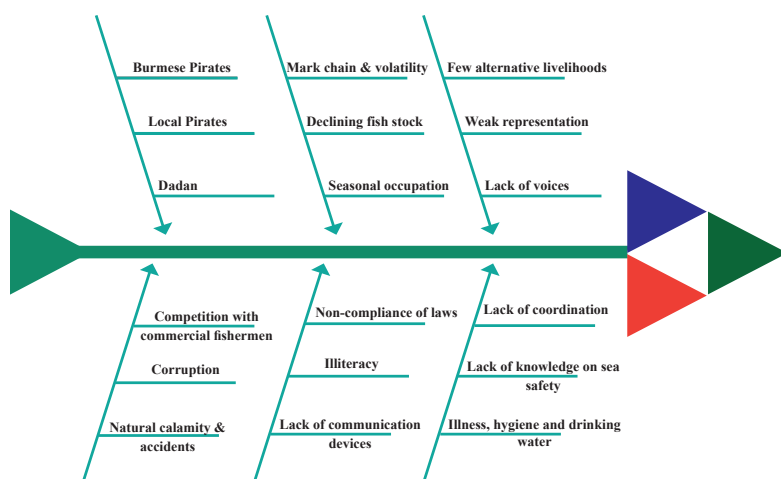


Figure 5: Fishbone diagram showing challenges identified by the respondents

This study learnt from the respondents that the fishers only receive 30% of actual prices due to a complex market chain. They identified seven classes of intermediaries, being the collector, *majhi* (the Captain of the boat who leads the team in fishing or collecting the fish), *chhoto mahajan* (traditional small moneylender and fish trader), *boro mahajan* (traditional big moneylender and fish trader), *aratdar* (a commission agent for stocking and selling fish), wholesaler and retailer (see **Figure 6**). In case of taking *Dadan*, the fishers are bound to sell fish to the specific *Mahajan* providing the loan.



Figure 6: Intermediaries in the market chain

In addition, respondents stated that the Department of Fisheries (DoF) does not play any role in improving their capacities; rather they take a bribe during vessel registration and issuing identity cards. The fish stocks in the shallow water declined drastically due to invasions of commercial fishers whose practices push the artisanal fishers back to the coast. Corruption and nepotism of the Union *Parisad* (locally elected representative) in food grain distribution during *Hilsa*'s closed season was also reported during this study.

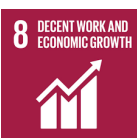
3.3. Regulatory and Institutional Frameworks

Sustainable Development Goals and Targets

Specific targets within the SDGs offer a broad framework within which more focused actions should be taken to reach the overarching goal of sustainable development. Artisanal fisheries are afforded special prominence within Goal 14, with Target 14.B stating the aim to 'provide access for small-scale artisanal fishers to marine resources and

markets'. SDG 14 also requires implementation of the *UN Convention on the Law of the Sea* (UNCLOS). In addition, Goal 16 reiterated the need for effective institutions to promote peaceful and inclusive societies for sustainable development. The targets set to achieve Goal 16 include developing effective, accountable and transparent institutions and ensuring responsive, inclusive, participatory and representative decision-making at all levels. Altogether, eleven of the seventeen SDGs closely align with artisanal fisheries and related objectives, with Goals 16, 14, 8, 2 and 1 having particular resonance (see **Table 1**). Within these goals, this study identifies thirty-four targets which are linked to this sector.

Table 1: Aligning targets of SDGs with artisanal fisheries

SDG	Targets	SDG	Targets
	1.3, 1.4, 1.5, 1.B		9.B
	2.1, 2.2, 2.3, 2.C		12.2, 12.3
	3.8, 3.D		13.2, 13.3, 13.B
	6.2, 6.3, 6.6, 6.B		14.1, 14.2, 14.4, 14.6, 14.B
	8.2, 8.3, 8.4, 8.5, 8.10		16.5, 16.6, 16.7
			17.14

It has been observed that the social and ecological sustainability of fishing communities in developing countries is affected by the ineffective implementation of fisheries policy, which, in turn, hinders the implementation of public policies to enforce management measures (de Mattos S.M.G., Wojciechowski M.J. 2019). The following section, which deals with the existing institutional and legal arrangements for marine fisheries in Bangladesh, identifies the weaknesses of the current regime and indicates solutions to the problems found in the marine fisheries management framework.

Legislative, Policy and Institutional framework in Bangladesh

Two significant characteristics of Bangladesh's marine fisheries regulatory framework are open access and lack of property rights (Chowdhury 2016). In Bangladesh, exploitation of marine fisheries is regulated through an input control method which comprises a licence regime, gear restriction and closed season. The lack of property rights over fisheries resources and the open access nature of fisheries increase the race to fish which results in the overexploitation of selected fish stock. Since fishers do not enjoy any property rights in fisheries, they do not own the resource and try to maximise economic gain by increasing catch without due regard to long-term sustainability. The race to fish, however, benefits industrial fishers and does not help the artisanal fisheries in any way as they cannot compete with others due to inadequate equipment and a lack of modern technology. Property rights in fisheries have proven to be efficient and flexible tools for generating economic efficiency and conserving fish stocks (Arnason 2007). This would, in turn, help artisanal fishers to improve their socio-economic condition.

In recent times, ecosystem-based fisheries management (EBFM) is being considered globally as a solution to the enormous problems of fisheries management. Therefore, legislative, policy, and institutional frameworks for the management of marine fisheries should incorporate EBFM at all levels of governance—global, regional, national and local. Although EBFM does not have a universally accepted definition, the existing constructions of the concept have several common elements, including the adoption of a multi-species management regime, taking into account ecosystem considerations like interaction and interdependence among various species, the adoption of the precautionary principle to avoid risks in case of scientific uncertainties, and human factors (Arif 2018b).

The marine fisheries management framework in Bangladesh does not fully integrate the vital features of EBFM. While the single-species management mechanism has proven inadequate all over the world, Bangladesh's marine fisheries regulatory framework still draws upon this approach. Since the marine fisheries in Bangladesh comprise multiple commercially and ecologically important species, the policymakers and fishery managers should adopt a holistic, multi-species approach when framing fisheries management laws and policies. Bangladesh's marine fisheries regulatory framework predominantly relies on a traditional maximum sustainable yield (MSY) concept that does not consider relevant ecosystem considerations and environmental factors, despite an international shift towards a conditional MSY concept that considers the relevant ecosystem components such as interdependence and interaction among various species and environmental factors such as water quality and temperature (Arif 2017). Further, although the precautionary principle has been incorporated in most contemporary international, regional and national fisheries instruments and has become an indispensable part of fisheries management, it has not been incorporated in regulatory frameworks for exploitation, conservation, and management of marine fisheries in Bangladesh (Arif 2018a). Moreover, the fisheries management laws and policies of Bangladesh do not make adequate provisions to ensure the wellbeing of both people and the ecosystem, cooperation among the agencies involved, participation of relevant stakeholders in the management process, and adaptive management.

In addition, a robust institutional arrangement is essential to ensure that the benefits arising from the fisheries resources are distributed equitably across various users. Further, implementation of EBFM requires a superior institutional framework as it involves a range of functions, such as decentralising the management responsibilities, developing capacity at the proper level, ensuring transparency, mobilising participation and providing effective conflict resolution and enforcement (Garcia and Cochrane 2005).

However, the institutions involved in marine fisheries management in Bangladesh are poorly equipped to implement EBFM for several reasons. Foremost, achieving sustainability in the marine fisheries sector has not been given priority in Bangladesh. Also, whilst a desirable decision-making framework should be bottom-up, decentralised and participatory, the decision-making process in Bangladesh is top-down, centralised and

non-participatory. Integrated management, inter-agency collaboration and good governance—crucial qualities of an efficient institutional framework—are also lacking in the present institutional set-up for fisheries management in Bangladesh.

Overarching Policy Framework

The *National Fisheries Policy* 1998 played a key role in shaping the initial reformed approach to regulation in this area, undertaking a more integrated consideration of social and ecological concerns. The policy was a notable document with sensibly articulated objectives and ingenious provisions, highlighting the small-scale fisheries sector which includes artisanal fisheries. The policy contains realistic and achievable objectives such as the enhancement of fisheries production, poverty alleviation and improving the life and resources of the fishers' communities, economic growth and earning of foreign currency by exporting fish and fish products. These objectives are promoted whilst maintaining ecological balance, conserving biodiversity and improving public health. The policy, among other things, contains a provision providing fish harvesting rights for artisanal fishers in the coastal region. It also highlights the need for local and community control over fisheries resources at the lowest level, thereby affirming that it is not always possible to regulate and control through a centralised mechanism.

The latest policy document pertaining to the management of marine fisheries in Bangladesh is the *National Fisheries Strategy* 2006, issued by the DoF to align with the latest developments in the fisheries sector. These strategies were framed to help implement National Fisheries Policy and to offer support to guide the sector. The strategy consists of eight other sub-strategies formulated to give direction to their specific sectors. The *Marine Fisheries Sector Sub-Strategy* 2006 was exclusively drafted to guide the marine fisheries sector. The Marine Sector Sub-Strategy is the only policy that contains an express provision on the precautionary principle, which reads, '[a] Marine Fisheries Management Plan will be prepared based on existing information as a precautionary measure and updated as more information becomes available'.

The Strategy outlines detailed plans for artisanal sector management including reserving a fishing zone only for the artisanal fishers, and co-management or community management of artisanal fisheries, administered by the local government instead of direct regulation by the

central government. The three most significant proposals made in the Strategy to improve the management of marine artisanal fisheries were: (i) the introduction of a management plan for the coastal Upazilas, (ii) the formation of an artisanal fisheries regulation committee to regulate fishing effort and allocating quotas for fishing and (iii) the appointment of a coastal fisheries officer (CFO) in each of the 47 coastal Upazilas to monitor boats, gear, catches and the marketing of fish and advise on the preparation of management plans. These plans, if implemented, had the potential to convert the overall top-down and non-participatory fisheries governance into a bottom-up and more participatory governance.

The policies discussed above expressed support towards artisanal fishers and list several programs that should be implemented to secure the life and resources of these fishers and their families, and to improve their socio-economic conditions. However, in reality these policies have not been translated into actual practice through implementation and no visible sign of improvement has been seen in the livelihoods of coastal fishing communities. Moreover, the population in the coastal region is ever increasing and the dependence of this vast population on fisheries alone is leading to unsustainable exploitation of the resources. Therefore, the government should adopt new policies to introduce alternative livelihood options for these coastal communities.

Core Legal Framework

The artisanal fisheries sector is mainly regulated by the *Protection and Conservation of Fish Act 1950*, the *Marine Fisheries Ordinance 1983*, and the *Marine Fisheries Rules 1983*. The *Protection and Conservation of Fish Act 1950* is the key piece of legislation regulating fisheries in Bangladesh and the avenue for the national government to make rules and regulations (such as the 1985 *Protection and Conservation of Fish Rules*). The government may grant licences and impose penalties, and has prohibited the destruction of fish in inland water or within coastal territorial waters. This legislation prescribes closed seasons, closed areas, the fish size to be harvested and provisions of framing rules. The Act imposes penalties for contravening any of its provisions, but the Act does not contain any provision on the precautionary principle or precautionary measures for the conservation of fish. Moreover, the Act only applies to the inland and territorial waters of Bangladesh and does not cover the EEZ, which constitutes most of the maritime area of Bangladesh (Afroz and Alam 2013).

Alongside this law, the *Marine Fisheries Ordinance* 1983 is one of two primary regulations for managing marine fisheries in Bangladesh. Foundational terms are provided, including defining fish, fishery, vessel, local fishing vessel, and foreign fishing vessel. It provides for the appointment of a director and such other fisheries officers, and permits delegation of powers to a director. It also regulates the issuing of licences for all marine fishing, regulates non-interference in maritime navigation, and includes additional provisions of framing rules. The *Marine Fisheries Rules* 1983, another important regulation made under the Ordinance, prescribes the procedure for issuing licences for marine fishing, sets conditions for issuing licences for local and foreign fishing vessels, issues guidelines for local and foreign fishing vessels, the manner of stowage of gear, and inspection of fishing vessels, and regulates the area for artisanal fishing.

The *Marine Fisheries Ordinance* 1983 and the *Marine Fisheries Rules* 1983 stipulate the requirement for every vessel to have a licence when operating in Bangladeshi waters. The precondition for getting a fishing licence is registration of the vessel by the Mercantile Marine Department. There are fees for obtaining the registration, the licence and renewal of the licence. Moreover, there are closed seasons during which fishing is not allowed at sea. Fishers therefore only have the open season to catch fish and earn their livelihoods. Also, there is stiff competition to catch fish among artisanal fishers as there are 67,669 mechanised and non-mechanised boats that operate in the shallow coastal waters. Approximately 0.27 million fishers and their families depend on the income generated from fishing. Most of these fishers are marginalised, poverty-stricken and vulnerable.

In contrast, competition among fishers in industrial fisheries, which accounts for only 15% of total marine capture, is far less fierce. The industrial fishing fleet comprises 247 approved fishing trawlers, authorised to operate in offshore waters (beyond 40 metres depth), but only 223 are functional and operate in the vast Exclusive Economic Zone of Bangladesh. The owners of these industrial fishing trawlers are generally affluent. There is a big income gap between artisanal fishers and fish workers, and owners and shareholders of industrial fishing companies. These large companies are taking the larger share of catches by applying modern fishing techniques and sophisticated equipment, depriving artisanal and rural fisheries the benefits of fishing activities (Cochrane 2000). This illustrates the inequitable distribution of benefits

between different resource users. Thus, the legal framework seems to be biased towards industrial fishers, and artisanal fishers are persistently disadvantaged as the laws continue to operate.

Institutional Framework

In Bangladesh, several agencies are involved in marine fisheries management in various capacities, either directly or indirectly. The Ministry of Fisheries and Livestock is the highest government agency responsible for policymaking and regulation of fisheries, including marine fisheries, while the DoF (under the ministry) is the principal regulatory agency for the management of marine fisheries. The Mercantile Marine Department under the Ministry of Shipping is responsible for registering and providing fitness certificates to all ocean-going vessels including the fishing vessels. The Marine Fisheries Office (MFO) in Chittagong, a subdivision of the DoF, is dedicated to the management of marine fisheries.

The organisational structure of these government agencies is centralised and top-down. The Director of Marine Wing of the DoF in Chittagong is responsible for implementing the *Marine Fisheries Ordinance 1983*. This Director is also responsible for the management, conservation supervision and development of marine fisheries. Moreover, there is an absence of good cooperation and coordination between these agencies due to legislative gaps in their respective laws and policies.

Besides this, institutions responsible for regulating the marine fisheries sector of Bangladesh have been troubled with several governance issues, for example, politicisation such as political gains rather than conservation goals influencing management decisions, corruption, and a total absence of accountability and transparency. Due to corruption at various levels of the management framework, the prevalence of illegal fishing and the use of illegal gears means that fisheries projects cannot be implemented successfully. On occasion, law enforcing agencies and people involved in the management process are alleged to be engaged in illegal activities.

One clear example of corruption is the method of disbursing and obtaining fishing licenses. Fishing licenses are issued by the DoF amongst those who apply for it following a call for application. People originally issued with fishing licenses often sell those for a hefty amount to others. The licenses then change hands before real fishing companies buy them for a

hefty amount. Interested quarters use their political affiliations to obtain licenses which are often distributed based on political considerations – disregarding conservation and sustainable management principles.

Further, there is an acute shortage of fisheries infrastructure. Artisanal fishers do not have access to specific landing centers, so they land their catch anywhere they like. This, in turn, deprives the management agencies of essential information about the artisanal catch which includes the quantity, types and sizes of the fish caught. Hence, artisanal dockyards should be created so that artisanal fishers can land their fish after registering all the necessary information about their catch. In addition, a large amount of fish and other catches perish every year due to a lack of proper handling, processing and marketing infrastructure (Islam 2003).

Several other shortcomings in the existing institutional framework for marine fisheries management in Bangladesh that impede sustainable management of its fisheries resources include inadequate attention on the marine fisheries sector, budget constraints, lack of trained human resources and the absence of accountability and transparency. The existing institutional framework for marine fisheries management leaves no scope for stakeholders to intervene and partake in the management planning and implementation process.

It is within this framework that a more sustainable management of access to resources could be pursued. When considering the vulnerabilities of artisanal fisheries and their vital role in supporting coastal communities, it is clear that a re-evaluation of fishing licenses and the reining in of dominant commercial fishers is necessary. There are challenges in tackling corruption and there is a strong need to foreground the socio-economic concerns of these local communities as opposed to the presently favored interests of less vulnerable actors along the complex market chain. A new vision and commitment that is more in line with the SDGs will be crucial in order to exercise responsibilities under this core legal framework in an environmentally and socially sustainable manner.

There is a key role for the Department of Fisheries (DoF) to play here, as they have responsibility to formulate and implement development projects towards the sustainable use of fisheries resources, and to ensure food security. The DoF is responsible for assessing and managing aquatic resources, and mandated for increasing fish yield. As a nodal department, they should coordinate other departments for upgrading the socio-

economic conditions of the artisanal fishers. Additionally, the structure of the institutional framework for management of marine fisheries should be re-organized logically, giving adequate importance to the lowest tier of management, as that tier is directly involved in fisheries management activities on the ground.

Security and Technical Mechanisms Framework

This study identified several concerns relating to the impact of piracy and weak enforcement, as well as the lack of safety measures and access to technology which could improve such knowledge and competence gaps.

The Ministry of Home Affairs has a range of responsibilities under the *Coast Guard Act* 2016. Enforcement of a range of maritime laws by this agency would strengthen the position of artisanal fisheries and safeguard the interests of vulnerable communities that are dependent on their success. Pursuant to the *Coast Guard Act* 2016, the Ministry's mandate is to preserve the sovereignty of the Bangladesh's geographical boundary, prevent crimes, and establish rights over resources and ensure maritime safety. These responsibilities extend to the protection of adjacent land areas and to protect the national interests of Bangladesh. In most cases, artisanal fishing is the only option of occupation for the highly vulnerable coastal communities. These vulnerabilities include social, economic, political, environmental, and security vulnerabilities. It is more important that the public departments should comply with the domestic legal obligations. To address these vulnerabilities and achieve target 14.B of the SDGs, a strong institutional setup is essential. The accountability and liabilities of the law-enforcing agencies must be clearly defined.

Another aspect of safeguarding the artisanal fisheries sector is the provision of marine weather forecasting and the framing of rules (*Abhawa Ain* 2018). This will facilitate safer and more informed fishing practices, and in turn this will protect lives and local communities that are dependent upon the success of fishing trips for coastal livelihoods.

An additional concern is the potential for natural disaster impacts to impinge on the longevity and success of this sector, and the *Disaster Management Act* 2012 seeks to strengthen risk reduction to reduce the loss of life and properties. It also seeks to ensure humanitarian relief activities to the affected people. Fulfilling these obligations can further protect the vulnerable livelihoods of artisanal fishers and the coastal communities

in which they, and their work, are embedded. The resilience of artisanal fisheries and their coastal communities are intrinsically linked, and in aiming to achieve sustainable development in Bangladesh, these concerns must be managed by ensuring that existing obligations are met.

It is particularly important that the Bangladesh Coast Guard has sufficient capacity, as it has key responsibilities to deliver on the above security objectives to protect against piracy, to undertake rescues during times of disaster, and to communicate meteorological weather forecasts and alerts. The Bangladesh Coast Guard is thus required to ensure the security of the artisanal fishers and to control piracy in the maritime areas.

4. Recommendations

This study recommends that, in order to overcome the challenges of the artisanal fishers of Bangladesh, several initiatives must be taken. First, commercial fishing in the shallow waters should be stopped to end overfishing and to protect the rights of artisanal fishers in the coastal waters. Second, since literacy among the fishers is crucial for their socio-economic development, special informal educational schemes should be established to increase the literacy rate among the coastal communities. Third, to enhance the safety and security at sea for the fishers, DoF should conduct training or workshops on maritime safety among the fishers. In the same vein, the Department of Disaster Management should provide life jackets as relief in order to increase capacity to adapt and respond to future climate-related risks.

Fourth, communication and access to information are vital for fishing communities, which could be provided through the use of modern technology. ‘Fish telemetry technology’ in a broadcast environment or a community radio for fishers could be installed in the coastal area for time to time weather forecasting and providing guidelines for sustainable fishing. Fifth, most fishers belong to the low-income group of the society and they need to borrow money without collaterals. Commercial banks should provide such loans to stop the monopoly business of the *mahajan* and to improve the socio-economic conditions of artisanal fishers. Other relevant agencies such as Bangladesh Rural Development Board (BRDB), Social Welfare Department, and Cooperative Department should also provide microcredit for improving the socio-economic conditions. Sixth, Bangladesh Coast Guard and Bangladesh Navy should be proactive in controlling piracy.

Finally, real fishers are being deprived of the benefits of their fishing activities due to the presence of several layers of intermediaries in the market chain. It is therefore recommended that the government intervenes to remove those intermediaries from the market chain. This calls for adoption of a holistic approach that takes into account the need for the sustainable management of marine fisheries, on the one hand, and the improvement of the socio-economic conditions of artisanal fishers on the other.

5. Conclusions

Bangladesh is striving to achieve SDG-14, despite having limitations in the regulatory and institutional frameworks. Bangladesh is also committed to implementing the *UN Convention on the Law of the Sea* (UNCLOS) to conserve and use the marine resources sustainably. SDG target 14.B aims to ensure the protection of the rights of artisanal fishers and this aim is an integral part of achieving SDG-14. In addition, the guiding core principle of the SDGs is to ensure that no one is left behind. The objective of the present research was to identify the challenges faced by artisanal fishers and to recommend the way forward for future direction, based on a case study from Sonadia Island. The findings assist in piecing together an understanding of the conditions and status of artisanal fishers, so that policymakers can make appropriate reformation to the relevant policy.

This study explains the real experiences of artisanal fishers in Bangladesh. In that context, the integration of artisanal fisheries into policy agendas, namely in relation to poverty alleviation, food security, social protection, decent work, and climate adaptation, is highly essential. Facilitating the ongoing operation and success of artisanal fisheries will help conserve the marine resources in Bangladesh as well as in the Bay of Bengal. Policy interventions will be essential to ensure that artisanal fishers are able to understand and exercise their rights, and contribute to the ongoing development of Bangladesh. This paper, therefore, argues that a holistic approach needs to be adopted in order to incorporate the principles for sustainable management into the current framework surrounding marine fisheries whilst also addressing the underlying socio-economic conditions that inhibit the artisanal fishers from having secure livelihoods. By pursuing reform that addresses issues surrounding sustainability, social deficiencies and economic instability, the legal and policy framework for artisanal fisheries will be enhanced to cater for the unique social, economic and environmental challenges faced by artisanal fishers.

References

1. Afroz, Tanzim, and Alam, Shawkat 2013 ‘Sustainable shrimp farming in Bangladesh: A quest for an Integrated Coastal Zone Management’, *Ocean & Coastal Management*, vol. 71, pp. 275–283.
2. Akhtar, A, Bhuiyan, MA, Mia, MM., Islam, MS & Bhuyan, MS 2017 ‘Livelihood Assessment of Artisanal Fishermen in and Around Chittagong Coastal area of Bangladesh’, *Social Change*, vol. 7, no. 1, pp. 97-113.
3. Al Arif, Abdullah 2017, ‘Legal Status of Maximum Sustainable Yield Concept in International Fisheries Law and Its Adoption in the Marine Fisheries Regime of Bangladesh: A Critical Analysis’ *International Journal of Marine and Coastal Law*, Vol 32 issue 3, pp. 544 - 569.
4. Al Arif, Abdullah 2018a, ‘Legal Status of the Precautionary Principle in International Fisheries Law and Its Application in the Marine Fisheries Regime of Bangladesh’, *Asia-Pacific Journal of Ocean Law and Policy*, vol. 3, issue 1, pp. 95 - 114.
5. Andrew, N L, Bene, C, Hall, S J, Allison, EH, Heck, S & Ratner, BD 2007 ‘Diagnosis and management of small-scale fisheries in developing countries’, *Fish and Fisheries*, vol. 8, pp. 227- 240.
6. Arif, Abdullah Al 2018b, ‘Exploring the Legal Status and Key Features of Ecosystem-Based Fisheries Management in International Fisheries Law’, *Review of European, Comparative and International Environmental Law*, vol. 27, issue 3, pp. 320 - 331.
7. Arnason, Ragnar 2007, ‘Advances in Property Rights Based Fisheries Management: An Introduction’ 22(4) *Marine Resource Economics* 335, 337.
8. Batista, VS, Fabr , NN, Malhado, AC & Ladle, RJ 2014 ‘Tropical artisanal coastal fisheries: challenges and future directions’, *Reviews in Fisheries Science & Aquaculture*, vol. 22, no. 1, pp.1-15.
9. Billah, MM, Kader, MA, Siddiqui, AAM, Mahmud, SS & Khan,

- MR 2018 ‘Studies on fisheries status and socio-economic condition of fishing community in Bhatiary coastal area Chittagong’, Bangladesh, *Journal of Entomology and Zoology Studies*, vol. 6, no. 6, pp. 673-679.
10. Chowdhury, Nazneen Kawshar 2016, Essays on Natural Resource Management: Managing Industrial Marine Fisheries of Bangladesh (PhD Thesis, Australian National University) 19.
 11. Cochrane, Kevern L 2000, ‘Reconciling Sustainability, Economic Efficiency and Equity in Fisheries: The One that Got Away?’ 1 *Fish and Fisheries* 3, 5.
 12. de Mattos S.M.G., Wojciechowski M.J., 2019. Existing Institutional and Legal Framework and Its Implications for Small-Scale Fisheries Development in Brazil. In: Salas S., Barragán-Paladines M., Chuenpagdee R. (eds) Viability and Sustainability of Small-Scale Fisheries in Latin America and The Caribbean. MARE Publication Series, vol 19. Springer, Cham
 13. Department of Fisheries (DoF) 2016 *Fisheries Statistics in Bangladesh: Issues, Challenges and Plans*, Dhaka, Bangladesh.
 14. Diaz, RJ & Rosenberg, R 2008 ‘Spreading dead zones and consequences for marine ecosystems’, *Science*, vol. 321, no. 5891, pp. 926-929.
 15. FAO 2012 *Small-scale and artisanal fisheries*, accessed from <http://www.fao.org/fishery/topic/14753/en>, on 28 March 2019.
 16. Garcia, Serge M and Kevern L Cochrane 2005, ‘Ecosystem Approach to Fisheries: A Review of Implementation Guidelines’ 62(3) *ICES Journal of Marine Science* 311, 313.
 17. Halpern, BS, Walbridge, S, Selkoe, KA, Kappel, C, Micheli, V, D’Agrosa, F, Bruno, C, Casey, JF, Ebert, KS, Fox, C, Fujita, HE, Heinemann, R, Lenihan, D, Madin, HS, Perry, EMP, Selig, MT, Spalding, ER, Steneck, M & Watson, RR 2008 ‘A global map of human impact on marine ecosystems’, *Science*, vol. 319, pp. 948-952.
 18. Hossain, MS, Chowdhury, MSN & Barua, P 2008 ‘Artisanal fisheries status and sustainable management options in Teknaf coast, Bangladesh’, *Social Change*, vol. 1, no. 1, pp.48-64.

19. Ibrahim, M, Khan, ME, Hasan, MM & Khanam, R 2018 'Livelihood condition of fishermen at Amtali Upazila, Barguna, Bangladesh', *International Journal of Fisheries and Aquatic Studies*, vol. 6, no. 3, pp. 13-24.
20. Islam, KMN 2010 'A Study of the Principal Marketed Value Chains Derived from the Sundarbans Reserved Forest', United States Agency for International Development (USAID), Dhaka, Bangladesh.
21. Islam, Md Shahidul 2003, 'Perspectives of the Coastal and Marine Fisheries of the Bay of Bengal, Bangladesh' 46 *Ocean & Coastal Management* 763, 148.
22. Islam, MM, Mohammed, EY & Ali, L 2016 'Economic incentives for sustainable hilsa fishing in Bangladesh: An analysis of the legal and institutional framework', *Marine Policy*, vol. 68, pp. 8-22.
23. Islam, MM, Shamsuzzaman, MMH, Mozumder, X, Xiangmin, Y, Ming, MAS & Jewel, MBS 2017 'Exploitation and conservation of coastal and marine fisheries in Bangladesh: do the fishery laws matter?' *Marine Policy*, vol. 76, pp. 143–151.
24. Jackson, JB, Kirby, MX & Berger, WH et al. 2001 'Historical overfishing and the recent collapse of coastal ecosystems', *Science*, vol. 293, pp. 629-638.
25. Mozumder, Mohammad Mojibul Hoque, Shamsuzzaman, MM, Rashed-Un-Nabi, M, and Karim, Ehsanul 2018 'Social-ecological dynamics of the small scale fisheries in Sundarban Mangrove Forest, Bangladesh', *Aquaculture and Fisheries*, vol. 3, no. 1, pp. 38–49.
26. Pomeroy, R & Andrew, N 2011 'Small-scale Fisheries Management Small-scale Fisheries Management Frameworks and Approaches for the Developing World. Malaysia', WorldFish Center, retrieved from <https://www.cabi.org/bookshop/book/9781845936075>.
27. Rahman, MM & Vacik, H 2014 'Impact of climate change on the nipa palm of Sundarbans', In: Parrotta, JA, Moser, CF, Scherzer, AJ, Koerth, NE & Lederle, DR (Eds.), *Sustaining Forests, Sustaining People: The Role of Research*, XXIV IUFRO

- World Congress, 5-11 October 2014, Salt Lake City, USA, *The International Forestry Review* 16(5).
28. Rahman, MM & Vacik, H 2016 ‘Recruitment of invasive plant species in the Sundarbans following tropical Cyclone Aila’, In American Geophysical Union, *Ocean Sciences Meeting 2016*, New Orleans, USA.
 29. Rahman, MM & Vacik, H 2015 ‘Response of Pioneer Mangrove Tree Species of the Sundarbans to Increased Salinity’, In AGU Chapman Conference on “*The Width of the Tropics: Climate Variations and Their Impacts*”, 27-31 July 2015, Sante Fe, USA
 30. Rahman, SM 2017 ‘Marketing Challenges Faced by Poor Fishermen Communities of Rural Bangladesh’, *Society & Change*, pp.7-18.
 31. Rashed, M, Hossain, MA & Rahman, MM 2016 ‘A case study of the gears and craft used for artisanal fishing in Chittagong Patharghata Fishery Ghat, Bangladesh and socio-economic condition of the fishermen’, *Asian Journal of Medical and Biological Research*, vol. 2, no. 4, pp. 712-726.
 32. Salia, M, Nsowah-Nuamah, NN & Steel, WF 2011 ‘Effects of mobile phone use on artisanal fishing market efficiency and livelihoods in Ghana’, *The Electronic Journal of Information Systems in Developing Countries*, vol. 47, no 1, pp.1-26.
 33. Shamsuzzaman, MM & Islam, MM 2018 ‘Analysing the legal framework of marine living resources management in Bangladesh: Towards achieving Sustainable Development Goal 14’, *Marine Policy*, vol. 87, pp. 255-262.
 34. Shamsuzzaman, MM, Xiangmin, Xu, Ming, Yu, and Tania, Nusrat Jahan 2017 ‘Towards Sustainable Development of Coastal Fisheries Resources in Bangladesh: An Analysis of the Legal and Institutional Framework’, *Turkish Journal of Fisheries and Aquatic Sciences*, vol. 17, no. 4, pp. 831–839.
 35. Sreekumar, TT 2011 ‘Mobile phones and the cultural ecology of fishing in Kerala, India’, *The Information Society*, vol. 27, no. 3, pp.172-180.

