



GSJ: Volume 8, Issue 1, January 2020, Online: ISSN 2320-9186

www.globalscientificjournal.com

Climate Change Impacts on Blue Economy in Bangladesh : A Study

Md. Rezaul Haque*

Abstract

Climate change has become one of the most pressing issues in the world. The trend of climate change is happening with passive scenarios. Climate change is one of the most important agenda to tackle the generation and possibly any generation in history. Recently, Bangladesh has become the most vulnerable state in terms of climate change impacts according to the international agencies research outcomes and reports in 2019 like UN report. The threatening impacts are many and all are destructive for the future consequences of Bangladesh. The negative impacts of climate change hampers all the social-economic as well as environmental establishments and amenities of a country and Bangladesh will suffer in near future. The study focuses on blue economy which is one of the most emerging economic sectors of Bangladesh and the climate change associated impacts on the sector. The study has an elaborative effort to identify the most potential impacts as well as the article has a holistic and sanguine endeavour to recommend to mitigate the indispensable challenges or impacts on blue economy of Bangladesh.

Key Words: Climate Change, Impacts, Blue Economy, Bangladesh

Introduction

The Blue Economy framework promotes sustainable economic development through the proper utilisation and preservation of marine resources. Blue Economy, concept has received worldwide attention in recent years. The Blue Economy stimulates economic growth through the sustainable utilisation of ocean resources with technological inputs to improve livelihoods and meet the growing demands for jobs without hampering the health of the ocean ecosystem (Sarker et al., 2018). Blue Economy supports food security, manages and protects the ocean environment, creates new jobs and has diversification to add new resources for energy, drugs, chemicals, food and minerals for human welfare (Ninawe, 2017). In addition, Blue Economy also builds resilience to climate change. It is estimated that ocean-based businesses contribute more than 500 billion USD to the world's economy (Ocean, 2017). According to the OECD's Ocean Economy Database (OECD, 2016), the economic value of the ocean outputs in 2010 was 1.5 trillion USD, which is equivalent to approximately 2.5% of world's gross economic value. Blue Economy also

***Research Fellow, Institute of Bangladesh Studies, University of Rajshahi**

contributed around 31 million direct full-time jobs in 2010, which is around 1% of the global workforce. Oceans contribute about 81.5 MT of global fisheries production annually (FAO, 2016). The marine fisheries sector directly or indirectly supports the livelihood of 8% of the world's population and contributes 230 billion USD to the global economy (Sumaila et al., 2011). The oceans also provide convenient routes of transportation for about 80% of global trades i.e. goods are transported by sea routes (Corbett and Winebrake, 2017). About 161 billion USD revenues come annually from the global marine and coastal tourism (FAO, 2016). Ocean energy including aquatic bio-fuels and renewable energies could be an important way to meet the world's energy demands. However, this sector is still in its early stage of development. Bangladesh is experiencing its blue economy finally since an international verdict on the disputed maritime areas with the neighboring countries India and Myanmar, the coverage of Bangladesh's marine system estimated to 118,813 sq. km., with an extended continental shelf about 37,000 sq. km. having up to 50 m depth. Now, the state owns a total area of 118,813 sq. km. There are lots of possibilities and potentials exist in the blue economy of Bangladesh. The sectors of blue economy is developing steadily and the Bangladesh is committed to the development of this sector for her own sake and Bangladesh is also committed to the fulfillment of goals and targets of SDG-14 which is about the sustainable use of marine resources both living and non-living and conservation of ecosystem and biodiversity.

Climate change is an important international issue now a days. Especially the trend of climatic changes has become a panic for the development of any sector of any country. Especially the LDCs (Least Developed Countries) and developing countries suffer and will suffer a lot in future. Bangladesh has become the most vulnerable state and economy due to climate change impacts according to the declaration of United Nations. The impacts are multidimensional and all impacts are embedded in the destructive scenario. The impacts like floods, droughts, coastal erosion, storms and surges, salinity intrusion, sea level rise, loss of crops and crop fields, ocean acidification, loss of biodiversity and ecosystems, high level of temperature, abnormal warming, increase of economic cost and so on. Especially, the blue economy-one of the most thrust and flourishing sectors of Bangladesh will suffer a lot due to the climate change induced impacts which will hamper the development of blue economy sectors, there are lots of overall pitfalls, challenges or impacts in the way of development pathway of blue economy. To tackle the challenges or impacts, mitigation approach is very much necessary through adaptation. The impacts can be mitigated or otherwise can be adapted through climate-resilient blue economy harnessing or practise. Moreover, innovative blue economy technology can be a measure to overcome the maximum passive impacts created by climate change on blue economy of Bangladesh.

Impacts of Climate Change on Blue Economy in Bangladesh

There are lots of destructive impacts of climate change on blue economy globally. The global ocean economy losses lots of its oceanic resources due to the climatic change trends. The global blue economy is in a threatening condition to achieve a sustainable blue economy for the ever harmful impacts of climate change. Like the other global blue economies, Bangladesh is an extremely helpless melancholic scapegoat of climate change impacts and the impacts are directly influencing the growth and development of blue economy sectors and overall the blue economy of Bangladesh. The impacts are discussed below.

- 1. Ocean Warming:** The ocean absorbs most of the excess heat from greenhouse gas emissions, leading to rising ocean temperatures. Increasing ocean temperatures affect marine species and ecosystems. Rising temperatures cause coral bleaching and the loss of breeding grounds for marine fishes and mammals. Rising ocean temperatures also affect the benefits humans derive from the ocean – threatening food security, increasing the prevalence of diseases and causing more extreme weather events and the loss of coastal protection. Achieving the mitigation targets set by the Paris Agreement on climate change and limiting the global average temperature increase to well below 2°C above pre-industrial levels is crucial to prevent the massive, irreversible impacts of ocean warming on marine ecosystems and their services. Establishing marine protected areas and putting in place adaptive measures, such as precautionary catch limits to prevent overfishing, can protect ocean ecosystems and shield humans from the effects of ocean warming. Climate change is affecting into ocean warming. The seas and oceans are becoming more warmer than the previous decades. The results are many multifarious negative effects on marine living resources and ecosystem mechanism in the Bay of Bengal of Bangladesh.
- 2. Surges and Storms:** Recently, the seas and oceans are suffering from huge surges and storms. The surges cause floods and the coastal areas suffer a lot due to the abnormal surges of seas and oceans. Storms and cyclones are happening more and more due to the severe impacts on climate change. More recently, the storms and cyclones like Aila, Nargis and Bulbul are the instances of climatic change impacts on blue economy in Bangladesh.
- 3. Sea Level Rise:** Global warming has raised and will continue to raise sea level due to thermal expansion (warmer water takes up more space) of the oceans and the melting of ice stored in glaciers or ice sheets (floating sea ice being lighter than water sits on the sea surface and when it melts it increases the seas volume causing sea level rise). The consequences of sea level rise include more frequent and more devastating flooding and loss of coastal land. For in coastal situations, a 50 cm rise normally results in a 50m loss of land (Arctic Climate Impact Assessment In: EEN, 2005b). According to the latest information from the IPCC global sea levels will rise by at least 18 cm, but in the worst case scenario as much as 59 cm by the year 2100 (Alley et al, 2007). As half of the world's population is living in coastal regions, flooding due to storm surges already affects around 46 million people a year, mostly in developing countries. But with a 50

cm sea-level rise, this figure could double to 92 million. Indeed, it is estimated based on the IPCC reports, that by 2025 over half of all people living in developing countries will be highly vulnerable to floods and storms (La Trobe, 2002). However, these predictions from the IPCC excluded the melting of ice caps as scientists have been finding it difficult to assess their impact on sea levels (Hodson & Hodson, 2008). Melting of the Greenland Ice Sheet is expected to continue to contribute to sea level rise beyond 2100, as melting ice adds water to the sea. If ice sheet melting continues as global warming increases, eventually that would lead to virtually complete elimination of the Greenland Ice Sheet and a resulting contribution to sea level rise of about 7 m (Alley et al, 2007). Rising sea levels will cause livelihoods to be lost and people displaced as land permanently goes under water, while the costs of sea defenses will rise. Coastal areas are amongst the most densely populated areas in the world and support several important ecosystems on which local communities depend. Critical infrastructure is often concentrated around coastlines, including oil refineries, nuclear power stations, port and industrial facilities. Currently, more than 200 million people live in coastal floodplains around the world, with 2 million Km² of land and \$1 trillion worth of assets less than 1 m elevation above current sea level. Many of the worlds' major cities (22 of the top 50) are at risk of flooding from coastal surges, including Tokyo, Mumbai etc. Bangladesh has also huge risks to face such kind of situations especially the coastal areas of Bangladesh will be disappeared if the sea level rise continues with the regular trend.

- 4. Ocean Acidification:** Ocean acidification is the ongoing decrease in the pH level of the Earth's oceans, caused by the uptake of carbon dioxide (CO₂) from the atmosphere.¹ Seawater is slightly basic (meaning pH > 7), and ocean acidification involves a shift towards pH-neutral conditions rather than a transition to acidic conditions (pH < 7). An estimated 30–40% of the carbon dioxide from human activity released into the atmosphere dissolves into oceans, rivers and lakes. To achieve chemical equilibrium, some of it reacts with the water to form carbonic acid. Some of the resulting carbonic acid molecules dissociate into a bicarbonate ion and a hydrogen ion, thus increasing ocean acidity (H⁺ ion concentration). Between 1751 and 1996, surface ocean pH is estimated to have decreased from approximately 8.25 to 8.14, representing an increase of almost 30% in H⁺ ion concentration in the world's oceans. Earth System Models project that, by around 2088, ocean acidity exceeded historical analogues and, in combination with other ocean biogeochemical changes, could undermine the functioning of marine ecosystems and disrupt the provision of many goods and services associated with the ocean beginning as early as 2100. Increasing acidity is thought to have a range of potentially harmful consequences for marine organisms such as depressing metabolic rates and immune responses in some organisms and causing coral bleaching. By increasing the presence of free hydrogen ions, the additional carbonic acid that forms in the oceans ultimately results in the conversion of carbonate ions into bicarbonate ions. Ocean alkalinity (roughly equal to [HCO₃⁻] + 2[CO₃²⁻]) is not changed by the process, or may increase over long time periods due to carbonate dissolution. This net decrease in the amount of carbonate ions available may make it more difficult for marine calcifying organisms, such as coral and some plankton, to form biogenic calcium carbonate, and

such structures become vulnerable to dissolution. Ongoing acidification of the oceans may threaten future food chains linked with the oceans. Bangladesh has huge challenges in the oceanic environment due to rise in the trend of rapid ocean acidification situations like supply shock from oceanic food, goods and services including ecosystem settings.

5. **Droughts of Coastal Areas:** Droughts of coastal areas happening due to climate change impacts in Bangladesh. Due to severe droughts, the coastal peoples' livelihood system is destroying day by day. They are becoming jobless and uneconomic being. The coastal crop fields are becoming less fertile, to some extent infertile and becoming barren due to droughts or unavailability of rainfall. Temperature increases rapidly due to climate change and it also causes droughts in the coastal areas of Bangladesh.
6. **Ocean Deoxygenation:** The oxygen content of the ocean has declined by around 2% since the middle of the 20th century overall, while the volume of ocean waters completely depleted of oxygen has quadrupled since the 1960s. Ocean oxygen levels are expected to fall on average by 3–4% by 2100 overall due to climate change and increased nutrient discharges, though the scale of effect seen will vary regionally. Consequences of ocean oxygen decline include decreased biodiversity, shifts in species distributions, displacement or reduction in fishery resources and expanding algal blooms. Ocean deoxygenation threatens to disrupt the ocean's food provisioning ecosystem services. To slow and reverse the loss of oxygen, humans must urgently mitigate climate change globally and nutrient pollution locally. This dangerous impact will be happened in the case of Bay of Bengal of Bangladesh and blue economy resources will suffer in the long-run.
7. **Coastal Erosion:** Climate change will impact on coastal erosion in different ways. Here the focus is on sea-level rise; other potential impacts are related to changes in meteorological conditions – wind, temperature and precipitation. Changes in the precipitation regime will affect the sediment discharge of rivers and the resulting sand supply to the coast. Extreme conditions of strong precipitation and long periods of drought are expected to become more frequent. Temperature may play a role too, by its impact on soil erosion. The influence of variations of fluvial sand supply to the coast were shortly discussed in the previous section. Change in temperature will affect all life forms in the coastal zone. Coastal erosion is particularly sensitive to changes in coastal vegetation, dune vegetation for example. Mangrove coasts are sensitive to temperature change, but also to sea-level rise. Change in the wind regime and wave climate will modify the alongshore and cross-shore sand distribution. The alongshore sand distribution is very sensitive to the littoral drift, which strongly depends on wave direction. The shape of the cross-shore coastal profile is strongly influenced by wave run-up, with an important role for storm events with high waves and water levels. Great uncertainty still exists regarding predictions for local changes in wind regime and wave climate caused by climate change. The sea level will rise globally as a consequence of global warming, but regional differences are considerable. This holds in particular for relative sea-level rise, i.e. the change of sea level with respect to the local land level.

Some coasts experience uplift (especially in previously glaciated regions) while others are subject to subsidence. Uplift can always be considered "natural", whereas subsidence often has an important human-induced component (groundwater, oil, gas extraction). According to the so-called "Bruun rule", an increasing relative sea level will cause a shoreline setback, which is approximately equal to the sea level rise divided by the average slope of the active coastal profile, when considering equilibrium profiles. Consider, for example, a sea level rise of 0.5 m and an equilibrium coastal profile with a slope of the shore face and the shore of 1/100. The setback caused by such a sea level rise will be 50 m. Littoral coasts consisting of fine sediments will be exposed to higher setbacks than coasts consisting of coarser sediments. The coastal territory of Bangladesh will suffer a lot in the form of coastal erosion due to climate change.

8. **Salinity Intrusion:** Salinity will grow in the marine water of seas and oceans and at a certain stage of time severe level of salinity will be found in the ocean waters globally due to climate change. As a result, marine living species and resources will be under threat and some species may be extinct. At the same time, saline water intrusion in the crop fields will damage the crops and crop fields as well. To some extent, crop fields may be permanently barren due to excessive saline water intrusion in the crop fields in the coastal areas of Bangladesh in course of time.
9. **Biodiversity Loss and Migration of Marine Species:** Rapid climate change causes biodiversity loss. Biodiversity system in the marine conditions are very sensitive to climate changes. There is a possibility to extinct of some marine elements from biodiversity system due to negative impacts due to climate change. Migration of marine species will also happen due to climate changes because the extremely intolerable condition will be created in the marine environment of Bangladesh.
10. **Loss of Coastal Community Livelihoods:** Climate change occurs lots of natural disasters like earthquakes, storms, surges, cyclones, flooding, droughts, coastal erosion etc. These kind of disasters caused by climatic negative changes the coastal community losses their livelihoods. They become less earner and to some extent the coastal community become unemployed and they become the victim of poverty trap. This is really a very significant miserable consequence due to climate change and the coastal zones of Bangladesh will severely face the threats like loss of coastal community livelihoods.
11. **Displacement of Coastal Community:** Bangladesh is widely recognised to be one of the most climate vulnerable countries in the world and is set to become even more so as a result of climate change. Due to the unique geography of the country, Bangladesh suffers from regular natural hazards, including floods, tropical cyclones, storm surges and droughts. These natural hazards lead to loss of life, damage to infrastructure and adversely impact on livelihoods. They are also leading to the displacement of individuals and communities from their homes and lands. As a result of climate change, it is expected

that all of these natural hazards that are already causing displacement will increase in frequency and intensity in the coming years

- 12. Loss of Food Crops and Crop Fields:** Climate change and agriculture are interrelated processes, both of which take place on a global scale. Global warming affects agriculture in a number of ways, including through changes in average temperatures, rainfall, and climate extremes (e.g., heat waves); changes in pests and diseases; changes in atmospheric carbon dioxide and ground-level ozone concentrations; changes in the nutritional quality of some foods; and changes in sea level. The salinity, acidification increases due to climate change in the marine waters of Bangladesh. At the same time, sea level rise is increasing rapidly and surges, cyclones and flooding are happening in the coastal areas of Bangladesh. As a result, saline waters enters into the crop fields and different species of food crops have been spoiled and will be spoiled in the course of time due to climate change. To some extent, crop fields may be lost due to the huge surges and oceanic flooding due to climate change in the coastal areas of Bangladesh.
- 13. Uncertainty of Sustainability of Blue Economy:** SDG-14 is linked to sustainability of blue economy or the main philosophy of SDG-14 is to achieve a sustainable blue economy in Bangladesh by 2030 but climate change is impacting marine ecosystems and their goods and services in diverse ways, which can directly hinder our ability to achieve the Sustainable Development Goals (SDGs), set out under the 2030 Agenda for Sustainable Development. Most climate change effects have a wide variety of negative consequences across marine eco-system services, though most studies have highlighted impacts from warming and consequences of marine species. Climate change is expected to negatively influence marine ecosystem services through global stressors—such as ocean warming and acidification—but also by amplifying local and regional stressors such as freshwater runoff and pollution load. Global experts indicated that all SDGs would be overwhelmingly negatively affected by these climate impacts on marine ecosystem services, with eliminating hunger being among the most directly negatively affected SDG.5. Despite these challenges, the SDGs aiming to transform our consumption and production practices and develop clean energy systems are found to be least affected by marine climate impacts. So, it is clear that climate change is a great threat to the attainability of a sustainable blue economy or climate change impacts are creating uncertainty to achieve a sustainable blue economy in Bangladesh.
- 14. Loss of Marine Habitats:** Most areas of the world's oceans are experiencing habitat loss. But coastal areas, with their closeness to human population centers, have suffered disproportionately and mainly from manmade stresses. Habitat loss here has far-reaching impacts on the entire ocean's biodiversity. These critical areas, which include estuaries, swamps, marshes, and wetlands, serve as breeding grounds or nurseries for nearly all marine species. Hurricanes and typhoons, storm surges, tsunamis and the like which are the impacts of climate change can cause massive, though usually temporary, disruptions in the life cycles of ocean plants and animals. Human activities, however, are

significantly more impactful and persistent The Bay of Bangladesh is also under threat in terms of habitat loss due to climate change.

- 15. Altered Life Style of Species:** Marine life faces challenges from warming waters and ocean acidification. Warming waters alter the latitude and depth at which certain species are able to survive, so many species are moving deeper or farther north in the Atlantic to find cold water. More acidic oceans keep crustaceans, coral, and other organisms from developing. etc. The result is widespread disruption of interconnected food webs. Ocean acidification is impacting marine ecosystems in a number of ways. The thin shells of some pteropods, for example, can be completely dissolved within a month at the levels of acidity found off the New England coast. And there is a detrimental side effect. In creating carbonic acid, free hydrogen ions are created. Those hydrogen ions react with carbonates to create additional carbonic acid, but those carbonates are needed by organisms to grow shells. The process of ocean acidification steals the molecules needed for organisms to thrive, in addition to corroding their shells and making the waters otherwise inhospitable. It's a double whammy. The coral, pteropods, shellfish, and crustaceans threatened by ocean acidification also serve as food sources for many other types of marine life and seabirds. As some species feel the direct effects and struggle, other food webs begin to collapse as well. The species of Bay of Bengal also faces the same threats due to climate changes especially the marine species are facing the alteration of life styles.

The discussed devastating impacts are so far on blue economy in Bangladesh. The impacts are extremely catastrophic for the development of blue economy. Climate changes affecting the marine overall infrastructures as well as marine environments of blue economy in Bangladesh. There are also some other impacts excluding the above impacts like lack of timely rainfall or untimely rainfall occurs due to climate change. All potential impacts have to be identified properly both visible and yet to be explored of massive passive impacts on blue economy in Bangladesh due to climate change and Bangladesh have to take necessary measures.

Recommendations

Climate change is a common phenomenon on earth. The gradual proceedings of climate change is happening and will happen in course of time because it is a global issue. No country can individually stop the negative changes of climate change. Especially, three most climate change impacts creating countries like China, United States and India are mostly responsible for the passive changes of climatic conditions. Because, the GHG emissions and Carbon Dioxide, the most responsible pollutants for the undesirable impacts of climate changes and the mentioned three countries emit the most portions of GHG and CO₂. But, the situation must be stopped for the sake of future generation. Otherwise the future generation will suffer in a magnified trend. So, all countries including China, USA EU and India will have to more cautious and serious steps should be taken to tackle the upcoming possible horrible situations. Blue economy of Bangladesh will have to take proper measures to mitigate or at least to adapt with the conditions of climate change impacts or challenges. The threats which are hampering and will hamper in future have to be identified and then climate-resilient blue economy exploitations culture have to

be established. The recommendations are given below by which Bangladesh's blue economy can adapt or can create a climate friendly resilience harnessing overall and can minimize or to mitigate the challenges.

- 1.** Climate resilient blue economy practise should be introduced by the govt. of Bangladesh by formulating a climate change blue economy conceptual framework.
- 2.** Climate resilient blue economy policy should be launched for the smooth activities of blue economy in Bangladesh
- 3.** Climate resilient blue economy infrastructures should be installed for the durability or sustainability of blue economy.
- 4.** Huge investment should be allocated for the blue economy sector including PPP(Public Private Partnership)
- 5.** Inclusive coastal community-oriented awareness programme should be enhanced by the respective authority of Bangladesh
- 6.** Climate Resilient Blue Economy Fund (CRBEF) should be established like the Climate Change Resilient Fund (CCRF) by GoB.
- 7.** Blue Economy Cell (BEC) should be strengthened for the fostering of its assigned responsibilities and activities.
- 8.** Climate change resilient blue economy research should be promoted at all academic grounds especially at university level both public and private.
- 9.** Special research allocation have to be allocated for the climate resilient blue economy research in the fiscal budget of Bangladesh.
- 10.** The grass root stakeholders of blue economy like fishermen, tourists have to be committed or have to show the climate friendly responsible behaviours or approach.
- 11.** Climate resilient blue economy technology has to be introduced in the blue economy sectors of Bangladesh, if not available then the technology has to be imported by technology transfer agreements by adopting MoU agreement tool by GoB.
- 12.** Mangrove plantation and restoration, sea grass, salt marsh and mussel bed conservation, coral reef protection and oyster reef development schemes and programmes should be seriously advanced by the respective authorities of Bangladesh.
- 13.** Tthe coastal zones and climate change projects of Delta Plan-2100 of GoB (BDP-2100) should be implemented properly so that ultimately blue economy can be a most-beneficiary sector in terms of combating climate change impacts.

14. Climate change and salinity resilient crops should be cultivated in the coastal inlands so that crop loss can be stopped or at least mitigated due to climate change.

15. Climate resilient skill and capacity building training and workshops have to be organised more and more for the coastal, mainstream stakeholder and authoritative community of blue economy of Bangladesh etc.

16. More renewable energy practise has to be enhanced in the coastal areas of Bangladesh.

17. Disaster Preparedness Programme (DPP) has to be fostered in the coastal areas of Bangladesh so that climate change induced disasters can be minimised.

18. Risk insurance scheme should be introduced for the affected community (like marine fishermen and fishing related grass root level stakeholders, coastal farmers etc) .

The abovementioned recommendations or suggestions are so far the measures to combat the climate change impacts on blue economy in Bangladesh. There may have another options which has to be explored through research, innovation and experiments. After all, there is no alternative to climate change resilient blue economy approach.

Conclusion

Climate change and blue economy are both extremely inter-correlated. If climate change occurs rapidly with negative trends then the impacts are created for blue economy which are really unexpected and unwanted. Bangladesh has some great visions and ambitions like Vision-2021, Vision-2041 and Delta Plan-2100 etc. Blue economy is being considered as one of the most potential contributor to the fulfillments of the visions and dreams. So, inclusive programmes have to be adopted and strictly implemented including both public and private sector have to be more responsible to combat the challenges against the climate change threats to the development of blue economy. As blue economy is a macroeconomic approach so all actions and functioning should be designed in such a paradigm so that climate change impacts can be minimised or flexibly adapted. To achieve SDG-14 and other SDGs (Sustainable Development Goals) there is no alternative to the climate resilient sustainable blue economy as blue economy has been declared as thrust and priority sector of Bangladesh and also to achieve the sustainable development of Bangladesh. After all, the respective bodies as well as the common people of Bangladesh have to be climate conscious showing wise behavior to climate so that climate change and climate change induced impacts can be halted or at least minimised for the sake of blue economy development and overall for the development of Bangladesh.

References

- Badrul, I. (2015). Bangladesh falls behind Myanmar in offshore gas exploration *The Daily Star*.
- Chowdhury, S.R., Hossain, M.S., Sharifuzzaman, S.M., and Sarker, S. (2015). Blue Carbon in the Coastal Ecosystems of Bangladesh. Project Document, Support to Bangladesh on *Climate Change Negotiation and Knowledge Management* on Various Streams of UNFCCC Process Project, funded by DFID and Danida, implemented by IUCN Bangladesh Country Office.
- Corbett, J.J., and Winebrake, J. (2017). The impacts of globalization on international maritime transport activity. In *OECD/ITF* (Mexico), pp. 31. Detsch, J. (2014). "Bangladesh: Asia's New Energy Superpower?" *The Diplomat*.
- FAO (2016). The State of World Fisheries and Aquaculture 2016. *Contributing to food security and nutrition for all*, pp. 200. Rome.
- Haider, S.M.B., and Mahmood, N. (1992). "The Coral Genus *Acropora* (Scleractinia: Astrocoeniina: Acroporidae) in nearshore waters of the St. Martins Island, Bangladesh". *Bangladesh J Zool* 5, 10.
- Hasan, M.N., Hossain, M.S., Bari, M.A., and Islam, M.R. (2013). *Agricultural land availability in Bangladesh*. Dhaka, Bangladesh: SRDI, pp. 50.
- Hossain, M.S., Chowdhury, S.R., Navera, U.K., Hossain, M.A.R., Imam, B., and Sharifuzzaman, S.M. (2014). Opportunities and Strategies for Ocean and River Resources Management, *Background paper for preparation of the 7th Five Year Plan*. Dhaka, Bangladesh: FAO, Bangladesh Country Office
- Hossain, M.S., Chowdhury, S.R., Sharifuzzaman, S.M., and Sarker, S. (2015). Vulnerability of the Bay of Bengal to Ocean Acidification. Dhaka, Bangladesh: International Union for Conservation of Nature, pp. vi+55.
- Hussain, Z., and Acharya, G. (1994). Mangroves of the Sundarbans. Bangladesh. International Union for Conservation of Nature and Natural Resources (IUCN).
- Islam, A.K.M.N., and Aziz, A. (1992). "Addition to the list of marine algae of St. Martins Island, Bangladesh II. Brown, red and blue green algae". *Nova Hedwigia* 34, 7.
- Islam, M.M. (2011). "Living on the Margin: The Poverty-Vulnerability Nexus in the Small-Scale Fisheries of Bangladesh". In *Poverty Mosaics: Realities and Prospects in Small-Scale Fisheries*, S. Jentoft, and A. Eide, eds. Dordrecht: Springer Netherlands, pp. 71-95.
- Islam, M.M., and Shamsuddoha, M. (2018). "Coastal and marine conservation strategy for Bangladesh in the context of achieving blue growth and sustainable development goals (SDGs)". *Environmental Science & Policy* 87, 45-54.
- Islam, M.S. (2003). "Perspectives of the coastal and marine fisheries of the Bay of Bengal, Bangladesh". *Ocean & Coastal Management* 46, 763-796.

Kamal, A.H.M. (2009). *Coastal and estuarine resources of Bangladesh: management and conservation issues*. Chang Wat Chiang Mae, Thailand: Maejo University.

Mridha, S. (1995) *The Bay of Bengal—biological oceanography and marine resources*. Dhaka: Bangla Academy, pp. 260.

Ninawe, A.S. (2017). “Blue Economy is the Economic Activities that Directly or Indirectly Take Place in the Ocean and Seas, Use Outputs, Goods and Services into Ocean and Land Based Activities”. *Marine Biology & Oceanography* 1, EMBO.000501. 002017

Ocean, P.P. (2017). “Why are oceans important?” *OECD (2016). The Ocean Economy in 2030* OECD Publishing

Pender, J.S. (2008). What Is Climate Change? And How It Will Effect Bangladesh. *Briefing Paper (Final Draft)*. Dhaka, Bangladesh : Church of Bangladesh Social Development Programme.

Quader, M.A. (1994). Strategies for proper management utilization of marine resource of the country. A Paper Presented at the Workshop on Sustainable Development of Marine Fisheries Resources in Bangladesh. Cox’s Bazar: FRI.

Quddus, M., and Shafi, M. (1983). “Bangopshagorer matsya shampad (Fisheries Resources of the Bay of Bengal)”. Dhaka: Bangla Academy.

Rahman, M.M. (1997). “Bangladesher upakulia abong samudrik matsha samphad unnayan o babastapana (in Beagali)”. Department of Fisheries, The People’s Republic of Bangladesh, pp. 56.

Sarker, S., Bhuyan, A.A.H., Rahman, M.M., Islam, M.A., Hossain, M.S., Basak, S.C., and Islam, M.M. (2018). “From science to action: Exploring the potentials of Blue Economy for enhancing economic sustainability in Bangladesh”. *Ocean & Coastal Management* 157, 13.

Sarker, S., Hussain, F. A., Assaduzzaman, M., & Failler, P. (2019). “Blue economy and climate change: Bangladesh perspective”. *Journal of Ocean and Coastal Economics*, 6(2), [6].

Sumaila, U.R., Cheung, W.W.L., Lam, V.W.Y., Pauly, D., and Herrick, S. (2011). “Climate change impacts on the biophysics and economics of world fisheries”. *Nature Climate Change* 1, 449-456.

Tomascik, T. (1997). “Management Plan for Resources of Narikel Jinjira (St. Martin's Island) Final Report”. Prepared for the National Conservation Implementation Project1 (Bangladesh: Ministry of Environment & Forest, Government of the Peoples' Republic of Bangladesh).

www. Wikipedia.com