

CRITICAL FACTORS IDENTIFICATION TO MERELY STUDY THE STAGNANCY OF MARINE FISHERIES PRODUCTION IN BANGLADESH

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Abstract

Bangladesh is a maritime country with enormous fisheries resources. Fisheries are among the most identified aquatic resources due to their export earnings and national animal protein options. This study aims to investigate the factors responsible for the stagnancy of the marine fish catch of Bangladesh during the last 20 years. It will allow the stakeholders to take proper action for sustainable production, exploration, and economic development of the country's marine sector. Literature reviews were done on several related works; quantitative data was obtained from the Ministry of Fisheries and Livestock (MoFL), Department of Fisheries (DoF), Bangladesh Bureau of Statistics (BBS) and also from different published documents and research works. In the last two decades, the annual fish production of Bangladesh has increased nearly two and a half folds. A significant amount of total production comes from inland aquaculture, and statistics show no significant advancement of marine fisheries contribution with time (in the last two decades). Although a long time has passed, marine fisheries are still in the same position. This study has identified and explained the factors responsible for the static status of marine fisheries production in Bangladesh that will ultimately help the stakeholders give more attention to the advancement of marine fisheries sector to boost up its economy.

Keywords: Fisheries, Production, Stagnancy, Fishing Methods, Sustainability, MPA, MSP, IUU Fishing

Introduction

After the successful demarcation of maritime boundary, Bangladesh's maritime area has been extended by 118,813 sq km comprising 12 nm of Territorial Sea and an EEZ extending up to 200 nm into the high Sea.¹ The Bay of Bengal

¹ MoFA, "Press release: Press statement of the Honorable Foreign Minister on the verdict of the arbitral", 2014, Available at: <http://www.mofa.gov.bd/PressRelease/PRDetails.php?txtUserId=&PRid=85>.

(BoB) is one of the 64 Largest Marine Ecosystems in the world² and has reasonably productive environment.³ It is mixed with a warm tropical climate and high rainfall. Nutrients come from the land and the rivers of the Ganges, Brahmaputra.⁴ The rich ecosystem of the Bay of Bengal supports 1093 marine aquatic organisms, where 44.35% are finfish, 32.23% shellfish, 15.10% seaweeds, and only 8.32% are other organisms, including shrimp for Bangladesh.⁵ The details in a number of species and their percentages are shown in Table 1.

SL	Group of the Organisms	Nos. of Species	Percentage (%)
1	Bony Fish	486	44.35
2	Shark, Ray, Skate and Dolphin	21	1.92
3	Shrimp	36	3.30
4	Lobster	06	2.01
5	Crab	16	
6	Sea Turtle	03	0.27
7	Crocodile	03	0.27
8	Squid and Cuttle	07	0.64
9	Shellfish	350	32.23
10	Seaweed	165	15.10
Total		1093	100

Table 1: Statistics on MDF of Bangladesh⁶

After the peaceful demarcation of maritime boundary with Myanmar and India in 2012 and 2014, "Blue Economy" activities started in Bangladesh.⁷ MoFL

² Bay of Bengal Large Marine Ecosystem (BOBLME), "Status of Marine Protected Areas and Fish Refugia in the Bay of Bengal Large Marine Ecosystem", 2011, Available at: <https://www.boblme.org/documentRepository/BOBLME-2011-Ecology-10.pdf>.

³ P. Kumar, P.M. Muraleedharan, P. Thoppil and M. Gauns, "Biogeochemical of the Bay of Bengal: Physical, chemical and primary productivity characteristics of the central and western Bay of Bengal during summer monsoon", *Advanced Earth and Space Science*, vol 29, no. 24, 2018, p. 881-896, DOI: <http://dx.doi.org/10.1029/2002GL016013>; Available at: www.boblme.org & library.enaca.org.

⁴ Md. Shahadat Hossain, "Biological aspects of the coastal and marine environment of Bangladesh Ocean & Coastal Management", vol 44, no. 3-4, 2001, p. 261-28, DOI: [http://dx.doi.org/10.1016/S0964-5691\(01\)00049-7](http://dx.doi.org/10.1016/S0964-5691(01)00049-7).

⁵ Humayun Kabir, "Marine Fisheries in Bangladesh An Overview", 2006, Available at: http://library.enaca.org/NACAPublications/MaricultureWorkshop/MaricultureWS2006_Bangladesh.pdf.

⁶ Available at: <http://fisheries.portal.gov.bd/>.

⁷ Dr. Md Nazmus Sadekin, "Potentials of Blue Economy in Bangladesh", Green Fiscal Policy Network, 12 August 2021, Available at : <https://greenfiscalfiscalpolicy.org/potentials-of-blue-economy-in-bangladesh/>.

has identified 26 sectors for economic development from the blue ocean. Marine Fisheries is the most productive, dynamic and already partially developed area out of 26 sectors identified by MoFL with an immense prospect for future development and present scope of contribution in the agrarian economy of Bangladesh. The term fishing is commonly used for the exploration of all marine aquatic organisms having commercial importance includes crustaceans (such as crabs, lobsters, and shrimps), molluscs (such as squids, octopi, cuttlefish, and snails), echinoderms (such as starfish, sea urchins, and sea cucumbers), and other invertebrates.⁸ The marine fisheries sector contributes directly to the country's food and nutrition security and economy through significant income, employment and foreign exchange. The activity accounts for 4.4% of the national GDP and supports ~22% of the agricultural GDP.⁹ Marine fish contributes at least 20% of the country's total fish production. The annual catch from the Bay of Bengal was 0.67 million MT in 2019-20.¹⁰ The possible estimated catch from the Bay of Bengal is around 08 million MT. If we see the marine fish production trend of the last 20 years (Figure 1), the production is more or less similar or stagnant in the last two decades. There has been no significant advancement in the last 20 years in marine fish production.

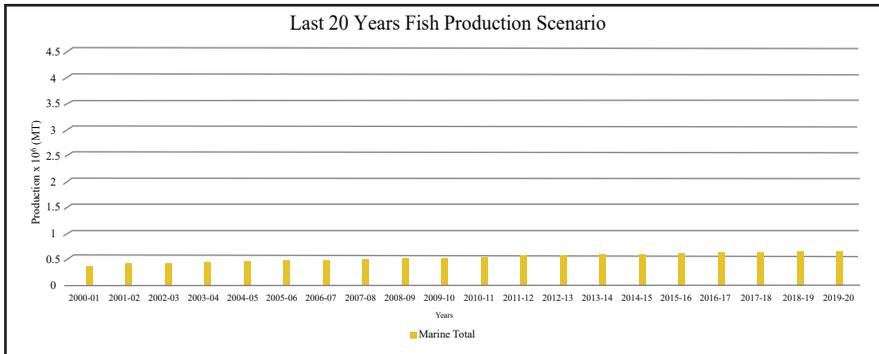


Figure 1: Last 20 Years, the Marine Fish Production Scenario¹¹

⁸ National Intelligence Council, “Global Implications of Illegal, Unreported, and Unregulated (IUU) Fishing”, 2016.

⁹ The World Bank, “Agriculture, forestry, and fishing, value added (% of GDP)”, Available at: <https://data.worldbank.org/indicator/NV.AGR.TOTL.ZS>.

¹⁰ Department of Fisheries (DoF), “Yearbook of Fisheries Statistics of Bangladesh 2019-2020”, Dhaka, Director General: DoF, 2020.

¹¹ Ibid.

Considering the sector-wise fisheries production in the last two decades, the inland fisheries growth rate in 2018-19 was 2.83%, the inland aquaculture growth rate was 3.46%. In contrast, the marine production growth rate was only 0.80% (Table 02).¹² Significant progress in the aquaculture sector has been made because of continuous research and technological advancement.¹³ But having a sizeable maritime boundary, Bangladesh is still with abysmal marine production.

Sector of Fisheries	Group of the Organisms							Growth Rate % (2018-19)	
	1993-84	1993-94	2003-04	2013-14	2015-16	2016-17	2017-18		2018-19
A. Inland Fisheries									
Inland Fisheries Total(A)	588620	837566	1646819	2952730	3251796	3496958	3621954	3724310	2.83
B. Marine Fisheries									
Industrial (Trawler Fishing)	14500	12454	32606	76885	105348	108479	120087	107236	(-)10.70
Artisanal	150382	240590	422601	518500	521180	528997	534600	552675	3.38
Marine Fisheries Total(B)	164882	253044	455207	595385	626528	637476	654687	659911	0.80
Total Fish Production (A+B)	753502	1090610	2102026	3548115	3878324	4134434	4276641	4384221	2.52

Table 2: Sector-Wise Fish Production Trend of Last Two Decades (Year Book of Agricultural Statistics, 2020)¹⁴

Bangladesh is a densely populated small country. With 148,460 km² area, Bangladesh supports almost 170 million people. On the contrary, not the whole area, only the land area 14.4 million hectares supports this huge population whereas per capita land is 25 decimal, out of which only 15 decimal is arable.¹⁵ The availability of per capita land is decreasing with the bursting growth of the population. Over time the land area is decreasing due to many developmental activities. Every day, about 225 hectares of land are reducing due to urban sprawl.¹⁶

¹² Available at: <http://fisheries.portal.gov.bd/>.

¹³ Ibid.

¹⁴ Ibid.

¹⁵ A.n.m. Nurul Haque, "Shrinking of Arable Land", daily sun, 11 April 2017, Available at: <https://www.daily-sun.com/printversion/details/218720/Shrinking-of-Arable-Land>.

¹⁶ Ibid.

There are so many statistics presenting that the country is losing its cultivable land and land based production day by day. For a densely populated country like Bangladesh, agriculture is our primary source of food and nutrition. But expert believes that as day by day land is decreasing to feed the future generation, there is no alternative to explore and exploit the sea resources. Sea is a blessing for the country as a home for many living and non-living valuable resources. If we earn marine fish sufficiently, that could minimize the dependency on land for animal protein and green vegetables.

Leading to achieving the 2030 Agenda, its Sustainable Development Goal (SDG-14), and sustainable graduation from the least developed countries (LDCs) category marine fisheries can play a vital role.¹⁷ So, emphasizing the country's economic growth, marine earning for livelihood sustainability, and supporting the future generation, the paper has been designed to identify the possible factors responsible for the stagnancy of marine products in the last twenty years. The paper aims to identify the pathway for future improvement of marine catch, considering its present hindrance.

Factors Identification for Production Stagnancy and Analysis to Improve or Discussion

1. Traditional and Undeveloped Fishing Method

According to the BoBLME project, it is possible to catch 8.0 million MT of fish from the BoB.¹⁸ But compared to that estimation, Bangladesh caught about 0.65 million MT, which is only 8.1 % of that possible catch. Though we have a huge fishing area in the Bay of Bengal, the rate of fishing vessels is comparatively very low in our country, which is only about 67924 in number (Table 3), including shrimp trawlers, fish trawlers, mechanized and non-mechanized boats.

¹⁷ UN, "Sustainable development Goal Report 2020", Available at: <https://unstats.un.org/sdgs/report/2020/The-Sustainable-Development-Goals-Report-2020.pdf>.

¹⁸ BFRI, "Sustainable Management of Fisheries Resources of the Bay of Bengal", Sustainable Management of the BOBLME Project, Available at: <https://www.boblme.org/documentRepository/BOB%20Bangladesh%20Report.pdf>.

Trawler		Boat		Gear	
Type	No.	Type	No.	Type	No.
Shrimp Trawler	37	MB (Mechanized Boat)	32859	Gill Net	118353
Fish Trawler	218	NMB (Non-Mechanized Boat)	34810	Set Bag Net	42429
				Long Line	11863
				Trammel Net	422
				Other Gear	15640
Total	255		67669		188707

Table 3: Different Gear Numbers Used in Marine Fishing¹⁹

During the last 15 years, those fishing vessels' size and engine capacity have increased very poorly and not much noticeable. The activities of those vessels have been minimal till now. Among those fishing vessels, a very few vessels are involved in deep-sea fishing, which is not even mentionable. Current fishing practices are carried out with smaller tonnage vessels (e.g. <20 m length, <1000 HP, <250 GT), usually, the size of larger boats is 25-28 meters in length, but 80% of our fishing boats are 5-10 meter and selective gears.²⁰ This is substantially limiting the scope of fishing across the geographic extent, i.e. specifically restricting the harvest of deep-sea and distant water fishery resources occurring at depth >80 m and distance >170 km. It is, therefore, necessary to develop the capacity to venture into distant and deep water fishing with high-tonnage vessels (e.g. >50 m, length, >2000 HP, >500 GT) using gears such as tuna long-lines and hooks (e.g. long liner 30-50 nautical mile, 1000-2000 hooks).²¹

The artisanal fisheries contribute about 92% of the total marine catch. Most of the boats used for pelagic fishing are wooden and steel-hulled and up to 15 years old. So, regular fishing has greatly been hampered by these traditional and low capacity vessels and resulting in poor harvest from the sea though we have ample natural resources.

Though the marine catch has increased slowly over time compared to

¹⁹ Available at: <http://fisheries.portal.gov.bd/>.

²⁰ Available at: https://en.wikipedia.org/wiki/Fishing_vessel.

²¹ M. S. Hossain, S. R Chowdhury and S. Sharifuzzaman, (eds.), "Blue economic development in Bangladesh: A policy guide for marine fisheries and aquaculture", 2017, Available at: https://www.researchgate.net/publication/319454363_Blue_economic_development_in_Bangladesh_A_policy_guide_for_marine_fisheries_and_aquaculture.

aquaculture, the sector-wise contribution sharing of marine fisheries' is the same in percentage over the last 30 years. This is because of traditional, low capacity and undeveloped technology use in marine sectors.

Bangladesh's standard marine fisheries items are Hilsa, Prawn, Sardine, Bombay Duck, Indian Salmon, Pomfret, Jewfish, Catfish, Shark/ Skate/ Ray and most of the catches are from artisanal fisheries limited to Hilsa, Shrimp and Sardine trawling (Table 4).

Type of Fishing	Shrimp (A)	Hilsa (B)	Group of the Organisms									Grand Total (A+B+C)
			Sardine	Bombay duck	Indian Salmon	Pomfret	Jew Fish	Cat Fish	Shark/ Skate/ Ray	Other Marine Fish	Total (C)	
A. Industrial												
Trawl Fishing	2733	12300	27421	2656	0	849	5020	3010	724	52523	92203	107236
C. Artisanal												
1. Gill Net Fishing												
a) Mechanized	0	254140	790	5085	245	2550	25550	2160	1930	30235	68545	322685
b) Non-Mechanized	0	23876	0	55	0	145	1850	100	30	19305	21485	45361
SUB-TOTAL	0	278016	790	5140	245	2695	27400	2260	1960	49540	90030	368046
2. Set Bag Net Fishing												
a) Seasonal	37146	0	25	59945	0	7400	2925	40	110	49860	120305	157451
b) All Seasonal	855	0	0	180	0	60	0	20	20	165	445	1300
SUB-TOTAL	38001	0	25	60125	0	7460	2925	60	130	50025	120750	158751
3. Long Line Fishing												
a) Jew Fish Long Line												
i. Mechanized	0	0	0	0	40	0	3750	5450	1405	6853	17498	17498
ii. Non-Mechanized	0	0	0	0	10	0	145	110	35	150	450	450
b) Other Long Line	0	0	0	0	0	0	60	40	20	35	155	155
SUB-TOTAL	0	0	0	0	50	0	3955	5600	1460	7038	18103	18103
4. Trammel Net Fishing	1015	0	0	30	0	0	1295	420	0	1485	3230	4245
5. Other Gears' Fishing	1000	0	20	150	0	0	1005	105	0	1250	2530	3530
TOTAL ARTISANAL	40016	278016	835	65445	295	10155	36580	8445	3550	109338	234643	552675
GRAND TOTAL (Industrial+Artisanal)	42749	290316	28256	68101	295	11004	41600	11455	4274	161861	326846	659911
%	6.48	43.99	4.28	10.32	0.04	1.67	6.30	1.74	0.65	24.53	49.53	100.00

Table 4: Species-Wise Catch of Marine Fisheries in 2018-19²²

Bangladesh's fishing zone is limited to 40-60 meter depth due to the lack of appropriate fishing gear and fishing boats as almost all are smaller in size with no modern facilities.

²² Department of Fisheries (DoF), "Yearbook of Fisheries Statistics of Bangladesh 2018-2019", Director General, Dhaka: DoF, 2019.

If we consider our littorals, 148 deep-sea fishing vessels operate from India; China has a distant-water fishing fleet of about 26,00 which is more than the USA as it has a distant-water fishing fleet of only 300 in number. Bangladesh Government has taken a 'Pilot Project for Extraction of Tuna and Similar Pelagic Fish in the Deep Sea'. The target is to buy some deep-sea fishing vessels from this project. Training and Capacity Development of the sea going fisher to enhance production and extend the fishing horizon with advanced technology is an essential and timely need for Bangladesh.

2. Lack of Data on Stock Assessment

Since 1958, many studies and surveys have been done on stock assessment scope identification on marine fisheries in Bangladesh.²³ The crucial one was the UNSF/PAK-22 Project conducted by BFDC in collaboration with FAO/UNDP within 1968 to 1971 time period.²⁴ The project kept in account for an area of 26,000 km², and the main four fishing grounds resulted from that project.

Shrimp is one of the largest export items of Bangladesh. Many reports have been concluded with the stock assessment of Penaeid shrimp but the values are showing dissimilarities ranging between 1000 and 9000 ton. Some authors reported that the Penaeid shrimp stock range is 2000–4000 ton.²⁵ Khan et al. reported the Maximum Sustainable Yield (MSY) of shrimp within 7000–8000 t up to a 10 m depth. So there is a significant mismatch among data.

Several stock assessment surveys in BoB have been conducted between the 1970s and 1980s. After a prolonged pause since 1999, the marine fisheries exploration survey within the Bay of Bengal (BoB) started with the recently acquired R.V. Meen Sandhani equipped with an ultramodern laboratory and a sonar system able of detecting objects up to a depth of 1,600 metres in 2016. A complete survey will take three years, said a fisheries department functionary. According to the last report, the Survey vessel identified 457 ocean creatures in the

²³ Md. Shahhidul Islam, "Perspectives of the coastal and marine fisheries of the Bay of Bengal, Bangladesh", *Ocean & Coastal Management*, vol 46, 2003, p. 763–796, DOI: 10.1016/S0964-5691(03)00064-4.

²⁴ Bay of Bengal Program, "Marine Small-Scale Fisheries of Bangladesh: A General Description", Available at: <https://www.fao.org/fishery/docs/CDrom/bobp/cd1/Bobp/Publns/Inf/008.pdf>.

²⁵ Md. Shahhidul Islam, "Perspectives of the coastal and marine fisheries of the Bay of Bengal, Bangladesh", *Ocean & Coastal Management*, vol 46, 2003, p. 763–796, DOI: 10.1016/S0964-5691(03)00064-4.

Bay of Bengal. 373 fishes, 24 shrimps, 21 sharks and rays, 21 crabs, 5 cuttlefishes, 5 squids, 4 octopuses, 3 lobsters, and 1 squilla have been identified till now.²⁶

Fish stock assessments help the authorities with sufficient information for sound and sustainable management opportunities. NOAA Fisheries' scientific stock assessment is a standard one for fisheries management.²⁷ Through the size of fish stock, predictions about how a fish stock will respond to current and future management measures, identifying the factors influencing the past and present stock, determination of catch per unit effort, carrying capacity and the maximum economic yield for that stock are easily possible. Stock assessments provide essential scientific valuable information for the conservation and management of fish stock. When stakeholders and policymakers get enough information on stocks, it helps boost production through proper management strategy for sustainable growth and fishers will go for target fishing with economic sustainability.

In the last 25 years no established data collection and management system has been developed for marine fisheries in Bangladesh to interpret the actual stock. Mostly stakeholders use fishery dependent data recorded via logbooks and vessel trip reports, on-board observers, landing records, port sampling or dockside surveys, point of the first sale, telephone surveys or experiential knowledge, and record the data for survey or further use.²⁸

For sustainable management and flourishing of the marine fisheries sector, immediate data availability is very important. We can go for advanced technology that may use sensor and video recording where the collected data will be directly sent to the network system. Through satellite communication the related authority will store, synthesize or preserve the data for the suitable management authority.²⁹

²⁶ The Business Standard, "Survey vessel finds 457 sea creatures in the Bay of Bengal: Minister", 30 November 2021, Available at: <https://www.tbsnews.net/tags/rv-meen-sandhani>.

²⁷ NOAA, "Fish Stock Assessment 101 Series: Part 1—Data Required for Assessing U.S. Fish Stocks," 23 May 2012, Available at: <https://www.fisheries.noaa.gov/feature-story/fish-stock-assessment-101-series-part-1-data-required->.

²⁸ Alexia C. Morgan and George H. Burgess, "Fishery-dependent sampling: total catch, effort and catch composition".

²⁹ Afifat Khanam Ritika, "Opportunities to Improve Fisheries Management through Innovative Technology and Advanced Data Systems into the Bay of Bengal", Agri News24, 10 March 2021, Available at: <https://www.agrinews24.com/opportunities-to-improve-fisheries-management-through-innovative-technology-and-advanced-data-systems-into-the-bay-of-bengal/>.

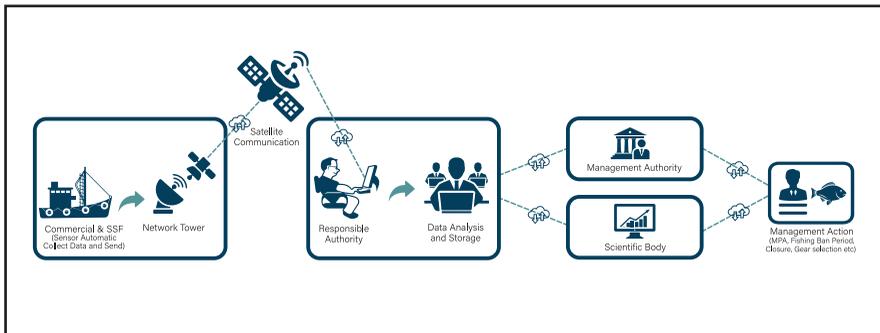


Figure 2: High Tech System for Fishery Dependent Data Collection³⁰

3. Overexploitation from the Limited Horizon, bycatch Activities and Stock Depletion

From 1985-86 to 1999-2000 the total number of engaged trawlers were 14. The number increased to 31 at the beginning of 2000-01 to 2009-10, sharply increased to 152 in 2012-13³¹ and in 2019-2020 the total number of trawlers is 255.³² The basic category of Bangladeshi sea-going vessels involved in trawling is mainly wooden body and steel hull types. The steel hull trawler is more efficient than wooden made. The Catch Per Unit Effort (CPUE) of steel hull trawlers is almost 4 to 6 times greater than that of wooden body trawlers.³³

Super trawlers are also found in the sea area of Bangladesh, which is mainly a threat to the marine ecosystem and biodiversity at present. Having the

³⁰ Afifat Khanam Ritika, "Opportunities to Improve Fisheries Management through Innovative Technology and Advanced Data Systems into the Bay of Bengal", Agri News24, 10 March 2021, Available at: <https://www.agrinews24.com/opportunities-to-improve-fisheries-management-through-innovative-technology-and-advanced-data-systems-into-the-bay-of-bengal/>.

³¹ S. Barua, E. Karim and Md. Humayun, "Present status and species composition of commercially important finfish in landed trawl catch from Bangladesh marine waters", International Journal of Pure and Applied Zoology, vol 2, no. 3, 2014, Available at: <https://www.alliedacademies.org/abstract/present-status-and-species-composition-of-commercially-important-fish-in-landed-trawl-catch-from-bangladesh-marine-waters-3551.html>.

³² Department of Fisheries (DoF), "Yearbook of Fisheries Statistics of Bangladesh 2019-2020", Dhaka, Director General: DoF, 2020.

³³ S. B. Ehsanul K, Md. H. Nasiruddin, "Present Status And Species Composition Of Commercially Important Finfish In Landed Trawl Catch From Bangladesh Marine Waters", International Journal of Pure and Applied Zoology, vol: 2, no. 2, 2014, p. 150-159.

double capacity of the existing industrial vessels' size and engine power makes them quick enough to catch the fast-moving pelagic fishes. They are fitted with sonar equipment to help them locate the fish schools. Four of these vast vessels arrived in Chittagong from abroad in 2019.³⁴ International monitoring organizations 'Ocean Mind' and 'International Justice Mission (IJM)' have been following the super trawlers since 2018 and confirmed through satellite imagery, the presence of both vessels in Chittagong port.³⁵ If such illegal vessels enter into Bangladeshi waters without any registration obstacles, Bangladesh is not so far to be a haven for the blacklisted vessels.

Intense exploitation with high fishing efforts in a limited horizon is the present trend for Bangladesh, and also, bycatch is so common. However, recent declining trends of commercial trawlers' CPUE indicate an alarmingly dwindling stock. The overall total (catch) seems to be increasing in the short run, which might be correlated to an increased number of vessels in operation and the use of underwater fish finder technology.³⁶

If the fishing horizon cannot be extended soon in a sustainable management strategy, overfishing and fishing bycatch cannot be stopped; it is not so far that over exploitation for the livelihood within the limited zone with the use of destructive and intense fishing methods will sharply decline the fish stocks under Bangladesh fisher's catch capability zones. That will bring an enormous loss for the overall ecosystem and fishers' economic status. The catch status of the marine fish stocks has remained more or less the same since the early 1990s.³⁷ Recent information suggests that among the significant fish stocks, only the 33/34 species are caught regularly, whereas the almost 250 species are untouched. There is a huge lacking of scientific and practical knowledge on fish biology and genetics. The overfishing of limited species from the limited zone is responsible for the reduction of catch rate in Bangladesh.

³⁴ Ocean Mind, "Bangladesh Overfishing", Available at: <https://www.oceanmind.global/insights/bangladesh-overfishing/>.

³⁵ Abul Kalam Azad and Charlotte Pamment, "Bangladesh overfishing: Almost all species pushed to the brink", BBC Bengali, 16 April 2020, Available at: <https://www.bbc.com/news/world-asia-52227735>.

³⁶ S. M. Sharifuzzaman, M. I. Golder and M. S. Hossain, "Augmenting Marine Food Production Through Fisheries Management and Mariculture," *Journal of Ocean and Coastal Economics*, vol. 6. no. 2, 2019, DOI: <https://doi.org/10.15351/2373-8456.1098>.

³⁷ Md. Shahhidul Islam, "Perspectives of the coastal and marine fisheries of the Bay of Bengal, Bangladesh", *Ocean & Coastal Management*, vol 46, 2003, p. 763–796, DOI: [10.1016/S0964-5691\(03\)00064-4](https://doi.org/10.1016/S0964-5691(03)00064-4).

4. Lack of Information on Marine Fish Ecology, Biology and Genetics

Sometimes deep-sea fishes (pelagic tuna/ Scombridae, mackerel, Indian salmon/ Polynemidae, etc.) are found in the offshore catch history of the fishers despite their habitation in deeper areas.³⁸ This is maybe due to their behavioural changes or ecological attitudes. So, knowing the life cycle of the commercial essential fish species is very important for sustainable and cost-effective exploration.

In addition, habitats across the lifecycle of valuable species need to identify for choosing the right fishing season and allow sufficient time for recruiting stocks. In connection to this, analyses of hydro-meteorological, biological, oceanographic and bathymetric data are necessary to identify the distribution of valuable species.³⁹

However, stock assessment reports can provide updated life histories, biology and ecology for every species.⁴⁰ In coordination with stock data, species profiles need to develop not only for the management but also to identify the catch area about their behavioral distribution. It will also help to target catch without harassing the fishers.

5. IUU Fishing and Piracy

IUU fishing is another common factor for the low catch in the Bay of Bengal region, especially for the Bangladesh. No countries are enough to address the incidents and management options of IUU fishing. Among the Bay of Bengal littorals, Bangladesh is mainly under the threat of IUU fishing due to a lack of legal and administrative monitoring and surveillance mechanisms.

There is no standard regional policy to address IUU fishing and its management tricks. There should have harmony. Due to a lack of combination on management strategy, the Bangladesh Coast Guard arrested over 519 Indian

³⁸ Available at: www.plancomm.gov.bd.

³⁹ Mohammad Rokanuzzamanm and Dilruba Chowdhury, "Blue Economy Prospects and Challenges of Marine Fisheries of Bangladesh", Academic Press and Publishers Library (APPL), 2018, p.79-117, Available at: https://www.researchgate.net/publication/338035302_A_SWOL_Analysis_of_Deep-Sea_Fishing_of_Bangladesh.

⁴⁰ "Many stock assessments use statistical surveys as an index of biomass, and shifts in distribution may move a stock partially outside the survey footprint such that the survey index is no longer correlated in the same way to population biomass," Predicting Future Oceans, 2019, Available at: <https://www.sciencedirect.com/topics/earth-and-planetary-sciences/stock-assessment>.

fishers and seized 32 boats off the coast in Patuakhali, more than 125 km inside the Bangladesh EEZ, in 2019.⁴¹ This occurred during the 65-day ban period on marine fishing imposed by Bangladesh. It indicates the proportion of poor regional cooperation and management synchrony.

IUU fishing is highly detrimental not only for the livelihood of the coastal but also for the overall ecosystem. Still, there is no accurate estimated record of IUU fishing activities in the Bay of Bengal. There is a clear gap in the existing marine resource protection law of Bangladesh.

Bangladesh's Department of Fisheries (DoF) is the main governing body to continue duty regarding the sustainable management and exploitation of marine fisheries and the licensing of marine fishing in Bangladesh, which is under the Ministry of Fisheries and Livestock (MOFL). The head office of DoF is in Dhaka, including 13 coastal District Fisheries Officers out of the total 64 in numbers headed by District Fisheries Officers and 460 Sub-District Offices (Upazilla Offices) controlled by Upazilla Fisheries Officers (UFO).⁴² In addition to the DoF, at least 12 other government departments are involved in managing fisheries or their development.

DoF generally manages the marine fisheries by The Marine Fisheries Ordinance (1983) implemented by the Marine Fisheries Rules (1983). These rules contain many aspects, including vessel licensing, restrictions on fishing gear, and provisions for demarcating marine reserves. Different punishments for the violations of fisheries laws are also clearly stated there. The 'Protection and Conservation of Fish Act, 1950' as well as the 'Marine Fisheries Ordinance of 1983' address the necessity of conservation of inland and marine fish.⁴³ But with the time being the update of those laws and ordinances are important to address the threats properly.

⁴¹ Mohammad Arj, "Lines On Water Cannot Save Bay Of Bengal Fisheries", Go News Desk , Available at: <https://www.gonewsindia.com/latest-news/environment/lines-on-water-cannot-save-bay-of-bengal-fisheries-13333>.

⁴² T. J. Pitcher, G. Pramod and D. Kalikoski (eds), "An Estimation of Compliance of the Fisheries of Sri Lanka with Article 7 (Fisheries Management) of the UN Code of Conduct for Responsible Fishing", Fisheries Centre, University of British Columbia, 2006, p. 21.

⁴³ Mohammad Rubaiyat Rahman, "Analyzing the draft Bangladesh Maritime Zones Act", The Daily Star, 18 February 2020, Available at: <https://www.thedailystar.net/law-our-rights/news/analysing-the-draft-bangladesh-maritime-zones-act-1869532>.

Besides IUU fishing, piracy attack is another important reason for the depletion of coastal and marine fisheries production. In the first half of 2020, 51 incidents of piracy and armed robbery against ships were reported in Asia. This is almost two-fold in the total number of incidents reported in 2019.⁴⁴ The incidents mainly occur in Bangladesh, India, Indonesia, Philippines, Vietnam, South China Sea and Singapore Strait. These illegal activities are an uncontrolled threat in Bangladesh Jurisdiction and are responsible for production loss for the local anglers. Regular monitoring with properly addressing this unexpected event is very urgent at this moment. Regional management framework with fishing methods, vessel and gear control is another issue related to IUU fishing and ultimate loss of the local fisher of the coastal community of Bangladesh.

6. The Need for Maritime Spatial Planning (MSP)

The most commonly used definition of marine spatial planning was developed by the Intergovernmental Oceanographic Commission (IOC) of UNESCO:

“Marine spatial planning is a public process of analyzing and allocating the spatial and temporal distribution of human activities in marine areas to achieve ecological, economic, and social objectives that usually have been specified through a political process. Characteristics of marine spatial planning include ecosystem-based, area-based, integrated, adaptive, strategic and participatory. Marine spatial planning is not an end in itself, but a practical way to create and establish a more rational use of marine space and the interactions among its uses, to balance demands for development with the need to protect the environment, and to deliver social and economic outcomes in an open and planned way”.

There are twenty ministries involving and performing sectorial management of marine living and non-living resources in Bangladesh.⁴⁵ Fishing is one of the oldest sectors in the maritime field in Bangladesh.⁴⁶ Therefore, this

⁴⁴ Riyaz ul Khaliq, “Piracy incidents in Asia almost double in 2020: Report 50 incidents of piracy, armed robbery recorded in Asia from January to June this year”, WORLD, ASIA-PACIFIC, 17 July, 2020, Available at: <https://www.aa.com.tr/en/asia-pacific/piracy-incidents-in-asia-almost-double-in-2020-report/1914005>.

⁴⁵ Mostafa Ali Reza Hossain, "An overview of the fisheries sector of Bangladesh", vol 1, 2014, p. 109-126, DOI: <http://dx.doi.org/10.3329/ralf.v1i1.22375>.

⁴⁶ P.G. Patil, J. Virdin, C.S. Colgan, M.G. Hussain, P. Failler and T. Vegh, "Toward a Blue Economy: A Pathway for Bangladesh's Sustainable Growth". World Bank, Washington, DC, 2018, DOI: <http://hdl.handle.net/10986/30014>.

provides major stakeholders involvement in the maritime area. However, new sectors, including oil and gas exploration, coastal tourism, salt production, and renewable energy, struggle to find their stake. The conflict with each other considering marine fisheries in the maritime area of Bangladesh is not new.⁴⁷ Fisheries are a primary economic sector for Bangladesh. The whole marine area is not equally important for each species. MSP helps to restrict the area necessary for fish and fisheries. Including other areas, the MSP approach has to be included in all aspects of marine fisheries, from commercial to recreational purposes.

MSP generally presents through a map where the area based resource distribution, their availability, human exploration area included. Bangladesh Government is now very much aware of sustainable ocean governance and development of MSP for SDG-14 to avoid the conflicts among different stakeholders as well. Bangladesh has a large marine area with many prospects, but the prime condition is to develop an MPS plan. If we see at the other maritime nations, they all have proper MSP for proper marine resource extraction and better marine ecosystem/environment management. Following to the approach or steps for MSP in other countries, it is not so challenging for Bangladesh to develop an MSP plan in the present situation, and it is also an urgent need. Bangladesh's government has developed a plan to turn Bangladesh into a developed country by 2040. Marine resources and the blue economy can play a vital role in this achievement. Following the others plan of the maritime nation, we could develop a plan for MSP according to their procedure, and a better management strategy could grab as soon as possible. Without proper information, management, and an economic settlement plan, no development is possible.

As Bangladesh is planning for MSP, the updated data and technological advancement should be considered for a fruitful MSP idea. It will help develop the marine sector, including others with proper guidelines and pathways. Without such strategic development, flourishing the fisheries is impossible with time advancement and populating growth.

7. Lack of Marine Protected Area (MPA)

As per existing national and international law and based on the available information, a maritime country should have a 10% Maritime Protected Area

⁴⁷ Md. Mostafa Shamsuzzaman and Mohammad Mahmudul Islam, "Analyzing the legal framework of marine living resources management in Bangladesh: Towards achieving sustainable development goal 14", *Marine Policy*, vol 87, 2018, P. 255–262, DOI: <https://doi.org/10.1016/j.marpol.2017.10.026>

whereas Bangladesh has only 4.7%. Recently St. Martins has been declared as a marine protected area.

St. Martin is the only coral island we have so far. It is a home for diverse marine life such as; 68 types of corals, 234 species of fishes, 5 species of dolphins, 151 species of algae, 191 species of molluscs, 40 species of crabs⁴⁸, etc. St. Martin is also the breeding ground for sea turtles.⁴⁹ It will protect the species and biodiversity and their future recruitment.

Promoting and protecting this tiny island may not seem to be a big deal, but the process will create new thinking within the community of Bangladesh. Due to the use of the destructive fishing method and gear, the stock is already under serious threat. To protect the future growth of marine species, their proper breeding and recruitment should have to be ensured through MPA declaration and proper management strategy development. Considering MPA, Sundarban, a marine biodiversity home, should be kept under special consideration. Without proper care, management and stock enhancement, the marine capture trend will never be significantly upward.

8. Lack of Mariculture Practice

Bangladesh has 150,000–180,000 ha fitting area for coastal aquaculture and a huge doable area for mariculture. Although shrimp farming is common in coastal areas, the production level is compliant nature-based dependency, increased disease outbreaks and mortality, poor water quality and unscientific use of inputs by farmers. Consequently, mud crab fattening (i.e. rearing of small wild crabs up to marketable size) in pens or cages, which gained attention recently, holds great promise if hatchery technology for artificial propagation and fry production can be guaranteed.⁵⁰

⁴⁸ Rajib Kanti Roy, "Sculpture with Plastic Waste at St Martin's Island: A beauty born out of beast," daily sun, 30 January 2022, Available at: <https://www.daily-sun.com/post/602549/Sculpture-with-Plastic-Waste-at-St-Martin%E2%80%99s-Island:-A-beauty-born-out-of-beast>.

⁴⁹ Nature Foundation St. Maarten, "Sea Turtles on St. Maarten", 8 May 2020, Available at: <https://naturefoundationsxm.org/portfolio/sea-turtles/>.

⁵⁰ BCS Admin Academy, "Economic and Development Prospects of Islands in the Bay of Bengal", Shahbag, Dhaka, 2018, Available at: https://www.academia.edu/38899189/Economic_and_Development_Prospects_of_Islands_in_the_Bay_of_Bengal.

Due to the demandable market price and consumer interest on crab species, it has come to the attention of the stakeholders.⁵¹ There are total 50 crab species available in the coastal and marine area of the Bay of Bengal, and 11 are solely marine. Only 3 species as *Scylla Serrata* (mud crab or mangrove crab), *Portunuspelagicus*, and *P. sanguinolentus* are commercially important.⁵²

Bangladesh found almost 133 seaweed species, and 8 of them are commercially important.⁵³ There are a lot of potentialities to expand the sector. Seaweed has great value in providing nutrition and medicinal utilization. Bangladesh should therefore promote the trend of seaweed culture and consumption practice among the people. Seaweeds are grown/culture in selected intertidal zones. Mass production techniques and marketing facilities should be developed.

There are also so many species that mariculture practice should adopt to avoid dependency on nature. Production intensification of already cultured fish or shrimp species and for the new species is important to make it economically sound. If we follow the same technique of inland aquaculture and give intensive concern to mariculture practice, it is possible to boost marine production sharply. Poor research capacity and facility in mariculture practice is also the main cause of marine production stagnancy in Bangladesh over time.

9. Pollution and Climate Change

The Bay of Bengal contributes nearly 4% of the global catch.⁵⁴ But the Bay is heavily littered with different types of pollutants, and vast amounts of plastic waste are found on the surface and bottom area. So many factors are responsible for fish degradation in rivers resulting in seawater pollution.⁵⁵ Every

⁵¹ Nipa Chaki, "Culture of Mud Crab, *Scylla serrata*", Bd FISH Feature, Available at: <https://en.bdfish.org/2011/02/culture-mud-crab-scylla-serrata/>.

⁵² Ibid.

⁵³ Near Ahmed and Wara Taparhudee, "Seaweed Cultivation in Bangladesh: Problems and Potentials", Kasetsart University Fisheries Research Bulletin, 10 December 2005, Available at: https://www.researchgate.net/publication/261595838_Seaweed_Cultivation_in_Bangladesh_Problems_and_Potentials.

⁵⁴ FAO, "The State of World Fisheries and Aquaculture 2020", Sustainability in action, Rome, 2020, DOI: <https://doi.org/10.4060/ca9229en>.

⁵⁵ Md. Mostafa Shamsuzzaman, Mohammad Mahmudul Islam, Nusrat JahanTaniaa, Md. Abdullah Al-Mamun, Partho Protim Barman and Xiangmin Xu, "Fisheries resources of Bangladesh: Present status and future direction", Aquaculture and Fisheries, vol 2, no. 4, 2017, p. 145-156, DOI: <https://doi.org/10.1016/j.aaf.2017.03.006>.

day, 3 billion microplastic particles enter into the Bay of Bengal. Bangladesh alone contributes about 2 lakh tons/year of plastics into the Bay of Bengal.⁵⁶

Plastics directly impact organisms both through entanglement and ingestion, resulting in suffocation. It generally affects the food chain by producing harmful chemicals that affect the water's primary productivity. Bangladesh is the 10th most plastic polluting country globally.⁵⁷ Besides plastic pollution, Bangladesh is also the second country after India in terms of ship recycling volume. Most of the hazardous materials are directly dumped into the environment, leading to pollution in the marine environment. The pollutants have a direct impact on animals and environments. The new dead zone of the Bay of Bengal is now at a point of concern about pollution. Fish and other animals are at high health risk due to several pollutants added into the Sea regularly in an uncontrolled manner. Ship breaking yards dump about 22.5 tons/year of polychlorinated biphenyls. Urban activities are responsible for more than 50% of marine oil pollution.⁵⁸

Climate change is ultimately the long term effect of pollution. The production of CO₂ and other greenhouse gases from industries, transportation, electricity production sector, commercial and residential activities, agriculture, and deforestation result in climate change and global warming. A report published at the IUCN World Conservation Congress concluded that oceans have taken up 93 per cent of the warming created by humans since the 1970s.⁵⁹ That determines if the heat production between 1955 and 2010 had gone into the Earth's atmosphere instead of the oceans, temperatures would have reached by nearly 36.2°C.⁶⁰

⁵⁶ Mia Seppo, "Beat Plastic Pollution", The Daily Star, 5 June 2018.

⁵⁷ "Every day, three billion micro plastic particles enter the Bay of Bengal", Open Access Government, 22 January 2021, Available at: <https://www.openaccessgovernment.org/bay-of-bengal/102056/>.

⁵⁸ J. Biswas, MD. M. Haque and N Kalra, "Coastal and Marine Pollution in Bangladesh: Pathways, Hotspots and Adaptation Strategies", European Journal of Environment and Earth Sciences, vol 2, 2021, DOI: 10.24018/ejgeo.2021.2.4.133.

⁵⁹ Brittany Patterson, "How Much Heat Does the Ocean Trap? Robots Find Out", ClimateWire, 18 October 2016, Available at: <https://www.scientificamerican.com/article/how-much-heat-does-the-ocean-trap-robots-find-out/>.

⁶⁰ Ibid.

The COP 26 credibility gap and future of climate change document projected that, if all announced targets are implemented fully including net-zero emission target, long term targets and nationally determined contributions; the total global temperature increase will be 3°C or move with present manner temperature increase will be 3.9°C by 2100 from the pre-industrial period (Figure 3). So, there is clear evidence that we are at a high risk of climate change.

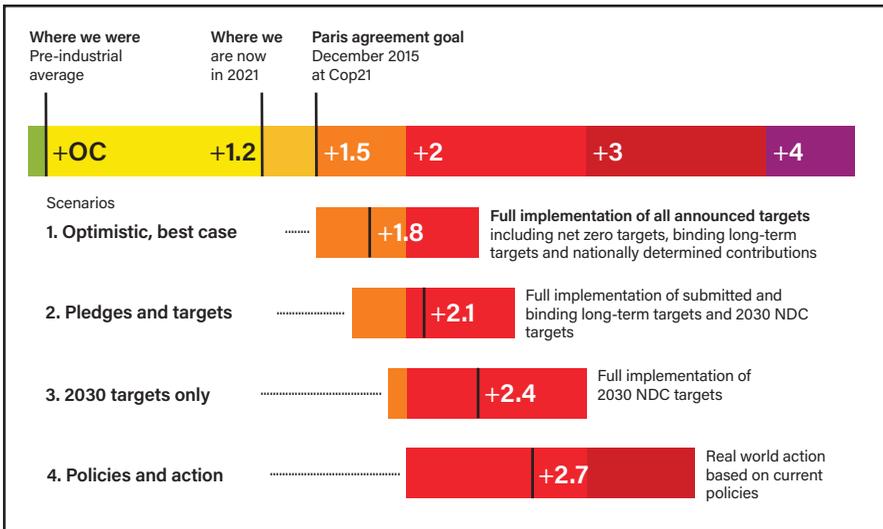


Figure 3: Climate Action Tracker, Warming Projections Global Update-November 2021⁶¹

The ocean is a home for many species. Climate change is the most significant global threat to marine ecosystems. It changes ocean chemistry and is responsible for sea-level rise, sea surface temperature, ocean heating, ocean acidification, coastal flooding, salinity intrusion, etc.

All those factors that occur due to climate change directly and indirectly impact commercially crucial marine biodiversity. Direct effects act on physiology and behavior and alter distribution, composition, growth, reproductive capacity, recruitment and mortality. Indirect effects mean the effect on the food web and habitat. Ocean heating, regular cyclone formation and other disaster destroy the

⁶¹ Climate Action Tracker, “Warming Projections Global Update November 2021”, November 2021, Available at: https://climateactiontracker.org/documents/997/CAT_2021-11-09_Briefing_Global.

feeding, breeding and nursery ground for fish and other commercially important species.

Due to pollution and climate change, fishes migrate or die. The shipping pressure on the water creates sound pollution and destroys breeding and hatching percentage. In the long-run production, deduction occurs in the environment. Though fishing gears have been increased in number, Bangladesh's catch trend for the last two decades may be the result of fish migration or species reduction.

Bangladesh Government has the vision to reduce climate change's impact on the coastal community and marine ecosystem. As a zero contributor with maximum risk holder Bangladesh should go for adaptation rather than mitigation measures. The Government of Bangladesh has developed Bangladesh Climate Change Strategy and Action Plan (BCCSAP), it has NAP for the community level management of the fisher community as well. As a direct fisheries conservation and protection strategy, more research should be carried out, more salinity tolerant species should be produced to combat impact. Many utilized or underutilized resources are available in the marine area that should be explored sustainably for economic growth and reimburse adaptation costs. To encourage the seagoing fisher by reducing climate change vulnerability more training and capacity building program should be arranged.

Along with local management strategy, regional cooperation in developing common rules and regulations to protect the BoB is an urgent need for the country.

Observation in Brief

All the mentioned above factors directly or indirectly impact marine catch. Production reduction is the ultimate result of low fishing capacity and low stock availability. With developing fishing capacity, advancing technology sustainability should be mentioned. Hampered in species recruitment and growth is the ultimate result of low catch. More knowledge sharing with the littorals and expansion of fishing activities in a sustainable way is the primary concern to feed the future generation.

General Recommendations and Conclusions

Although Bangladesh is participating in the global total marine catch significantly, there is a vast scope for improvement. The implementation of SDG 14 and its targets for sustainable growth and economy from fishery cannot have any prospect of success without expanding the marine catch substantially. Blue Economy is one of the topmost priorities for "Vision 2041", and marine fisheries are the most readily available and harvestable sector. Proper management, conservation, protection and exploration are the key factors in developing marine production and stretching the country's economy.

Natural stock enhancement, including cultural practice, is the ultimate goal for Bangladesh. Though many plans have been taken to improve marine production, many constraints regarding biological, social and economic aspects should be mentioned properly. Balanced participation of different related stakeholders, experts and academia should be encouraged to flourish the sector, the resources need to be managed and exploited on a sustainable basis. Regular monitoring and actual data collection are vital. Regional Common Fisheries Policy should develop for sustainable growth of these shared resources. However, technological advancement, control of pollution, adaptation strategy development against climate change and not least, people's awareness and perception of sustainable management, exploration and exploitation are sometimes even more important than the plan itself. Before any well-formulated plan and fishing effort with advanced technology, the fishers' ability should consider. There should be regular training and capacity building program; Government should be interested in more investment and develop learning opportunities from the neighboring countries on catching power and capability rate for further application.

Proper knowledge of the marine environment and biological cycle with stock data is vital to developing sustainable harvesting methods and techniques within the EEZ of Bangladesh. Regular monitoring of the catches and fishing efforts of industrial and artisanal marine fisheries and immediate data transfer system with regional networking is essential to avoid overfishing, IUU fishing, and piracy. Setting up proper and strict rules and their effective execution is critical to enhancing marine fish production. Over exploited species identification for their conservation, MPA declaration, expansion of fishing horizon from a limited area, deep-sea fishing capacity, monitoring bycatch and value-added product processing technology development are some of the immediate needs for enhancing the marine catch priority and demand for Bangladesh. Conflicting fishing practice, especially unplanned artisanal fishing pressure significantly reduces shrimp catch

rate and influence trawling operators to trawl in shallow water regions. The impact of destructive fishery is about 99% of the population does not get a chance to participate in the spawning process.⁶² Therefore, the scientists and related departments should understand the nature of the particular species and develop mariculture practices to reduce dependency on nature.⁶³ Responsible authorities should consciously consider the suggestions with valuable findings of the experts and support the research facilities and advancement facility adaptation from the littorals to have a significant production in the new century.

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⁶² Md. Shahidul Islam, “Perspectives of the coastal and marine fisheries of the Bay of Bengal, Bangladesh”, *Ocean & Coastal Management*, vol 46, 2003, p. 763–796, DOI:10.1016/S0964-5691(03)00064-4.

⁶³ Secretariat of the Convention on Biological Diversity, “Solutions for sustainable mariculture - avoiding the adverse effects of mariculture on biological diversity (CBD Technical Series no. 12)”, 2004.