



Marine Pollution: A Menace to the Ocean We Want



100 million marine animals die from plastic waste yearly



500-1000 years plastics degradation period



80% global marine pollution from agriculture runoff and untreated sewage



500 marine locations recorded as dead zones globally



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Editorial

Marine Pollution: A Menace to the Ocean We Want

Life on earth, as we know it, started in the oceans. 76% of Planet Earth's surface is water, and the survival of humanity depends upon it. However, the ocean we want for a healthy planet is now in peril. One of the most significant environmental issues threatening our planet today is Marine Pollution. With the increasing number of industries, and the careless disposal of waste into the ocean, our marine ecosystem is facing a severe threat. Marine pollution is not only hazardous to marine life, but it also has a severe impact on human health. Marine pollution causes the accumulation of toxic substances in the fish we eat, resulting in severe health problems, including neurological damage and cancer.

Marine pollution can be attributed to a wide range of human activities, with industrial waste dumping, plastic waste disposal, and oil spills, among many others. The impacts of marine pollution are far-reaching, including the destruction of marine habitats and the death of millions of marine species. It is long overdue that we act to protect our oceans and marine life before it is too late. To combat marine pollution, we need a collective effort from every individual, corporation, and government to work together and find sustainable solutions. We must reduce the number of single-use plastics we use and recycle as much waste as possible. Industries should adopt environmentally-friendly methods of production, and governments should impose strict laws and regulations to ensure that corporations are held accountable for their waste disposal practices.

Marine conservation organizations and maritime institutes play a significant role in raising awareness about the issue and implementing measures to prevent further pollution of the ocean. The current issue of PAAL is also a small contribution in that direction. However, it is essential to note that each individual plays a part in reducing pollution. Simple and small actions on a person's behalf, such as proper disposal of trash, reduction of plastic use, and societal awareness, can have a significant impact. The problem of marine pollution is a significant concern that requires immediate attention from all of us. We must take responsibility for our actions and make conscious efforts to protect our oceans and marine life. The future of our planet depends on it, and we owe it to ourselves and future generations to preserve the beauty and diversity of our oceans.

In that regard, the theme of the present issue is titled "Marine Pollution: A Menace to the Ocean We Want." This issue has been designed to provide insightful articles on different sources and aspects of marine pollution. It has covered wide-ranging topics related to marine pollution's scientific and socio-political explanations. This issue contains various articles related to marine pollution due to contamination of micro-plastics and heavy metals, land and tourism-based pollution, noise pollution, pollution from shipping and oil spillage, legal aspects of marine pollution, etc. This edition is enriched with a special article on feature news related to Bay of Bengal security. The magazine also includes other exciting sections like BIMRAD Feats and Marine News. The coastal window on coastal lives and livelihood has been included as a regular awareness-building section for the readers.

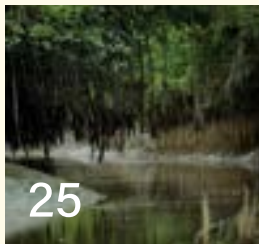
We hope this issue of PAAL will respond to readers' calls for contemporary marine issues. It will likely attract all relevant maritime stakeholders and readers to build awareness with evidence-based information about marine pollution.

Thanking you
Editorial Board

“ We've to keep it in mind that we cannot sacrifice the marine environment in pursuing economic growth. We should simultaneously look blue economic growth and think blue ”

- Hon'ble Prime Minister Sheikh Hasina

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Marine Pollution by Plastic: Menace to the Marine Environment

Capt M Minarul Hoque, (H), BCGM, psc, BN



Introduction

The Bangladesh coast is threatened by various forms of pollutants, leaving the whole coastal and marine environment vulnerable. The dependency on the coast and sea is growing exponentially for Bangladesh. With a large population within a tiny land mass, Bangladesh will be more focused on the Bay of Bengal in the future for economic growth. However, Marine pollution is a cause of concern for Bangladesh and needs to be addressed right now before it goes beyond manageable threshold. Coastal and marine pollution arises from sea-based activities, including marine transportation and offshore mineral exploration. However, such pollution in this region is mainly due to the direct discharge from the rivers, ships, waste from drainage, open dumping of solid waste, industrial effluent etc. Most marine plastic pollution comes from the land. The ever-growing dependence of humans on plastic has filled the oceans and the land. It consists of 80 percent of the debris found in the oceans. Plastic dumped in the oceans is dangerous for marine life. The rising level of plastic dumps in

the oceans is suffocating, ingesting and entangling the life underwater and above it.

Marine plastic pollution has been a growing concern for decades. It is now abundant in the marine environment. Plastics have been reported as a problem in the marine environment since the 1970s. However, the issue of marine plastic pollution has become a significant environmental concern worldwide. The existence of plastic in the marine environment presents a number of challenges that hinder economic development associated with numerous impacts on ecological, social and human food safety, public health and many more. The impacts are colossal and have long detrimental effects that need immediate attention globally. The contribution of plastic in manmade garbage is roughly 10%, and it is estimated that plastic debris accounts for 60-80% of marine litter, which may reach 90-95% in some areas. Due to its durability, the lifespan of plastic is estimated to be hundreds to thousands of years (Wang et al., 2016). The Bay of Bengal is

not free from marine plastic pollution. It is learnt that the Bay of Bengal and the South China Sea are the new marine plastic hotspots in Asia. Hence, it is imperative to understand the plastic pollution in the Bay of Bengal, its impact on us and ecological imbalance as a whole.

Plastic in the Rivers and Oceans

The first synthetic plastic was made in 1907, marking the world's plastics industry's beginning. However, the rapid growth in global plastic production took place only in the 1950s. Over the next 65 years, the annual production of plastics increased nearly 200-fold to 459.75 million tons in 2019. This is roughly equivalent to the mass of two-thirds of the world's population. At the global level, best estimates suggest that approximately 80 percent of ocean plastics come from land-based sources and the remaining 20 percent from marine sources. Of the 20 percent from marine sources, it is estimated that around half originates from fishing fleets (such as nets, lines and abandoned vessels). It is supported by figures from the United Nations Environment Programme (UNEP), which suggests abandoned, lost, or discarded fishing gear contributes approximately 10 percent to total ocean plastics.



Figure 1: How Plastic Ends up in Oceans

There are multiple routes by which plastic can enter the ocean environment. One key input is through river systems. This can transport plastic waste from further inland to coastal areas where it can enter the ocean. In Bangladesh's case, most of our country's industries are situated near the major river systems such as the Buriganga, Shitalakkhya, Balu, Turag, Karnaphuli, Rupsha and Meghna etc. All these rivers end up in the Bay of Bengal. So, pollution of rivers is interconnected to the sea. Mentionable here, the Karnaphuli River is linked by 37 canals which dump wastes, including polyethylene materials. All these dumped wastes' ultimate destination is the sea and Ocean. A study of BUET revealed that the riverbed of Karnaphuli is covered by polythene and plastic materials from 2 to 7 meters, and dredging is hampered due to plastic and polythene waste layers making it the worst victim of uncontrolled pollution and lack of proper waste management, posing a serious threat to the country and environment.

Plastic Degradation under Marine Environment

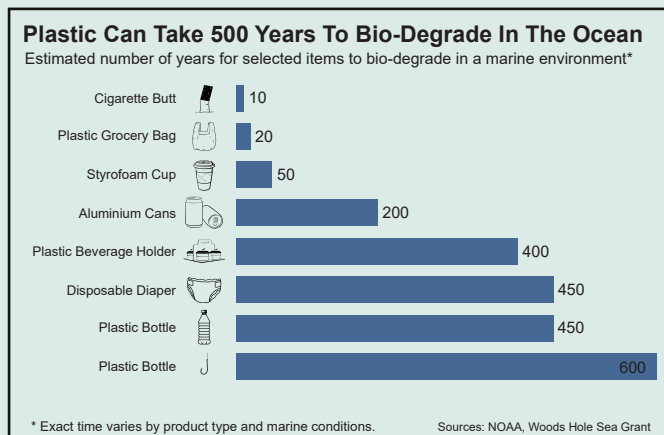


Figure 2: Plastic Degradation Timeframe

Now, what happens when plastic enters the Ocean? In contrast to other waste materials, plastic does not decompose. Degradation of plastics is a chemical change that occur over the years and become brittle enough to fall apart into fragments. Unlike larger fragments, microplastics are not readily visible to the naked eye. Microplastics, tiny pieces of plastic or fibres smaller than 5 mm, are even more dangerous forms of marine debris/litter. About 80% of marine litter is microplastics. Microplastics in the marine environment can travel vast distances floating in seawater or sediment to the seabed. A growing concern related to microplastic is that they enter the human food chain by ingesting fish and shellfish and causing potential human health impacts (UNEP, 2015). So, the hazardous impact of plastic in the marine environment can last many years, causing a prolonged effect on the marine environment. As example, Plastic shopping bags will take up to 20 years to break down, takeaway coffee cups take 50 years, and cigarette butts take 10. In a study by NOAA, it has been anticipated that some of the plastic material can take as long as 500 years to bio-degrade to the ocean.

Marine Plastic Waste Dumping in Bay of Bengal

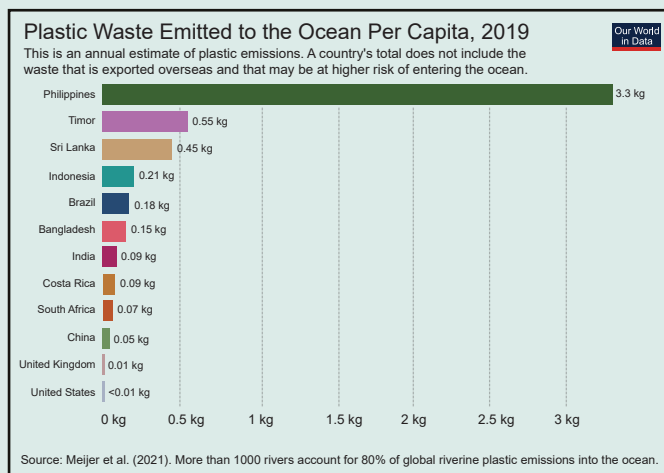


Figure 3: Plastic Waste Generated by Nations

Marine litter or debris, which includes plastic wastes; is the persistent, manufactured, processed solid material found in marine and coastal areas – predominantly the result of poor waste management – is a fundamental problem due to its harmful effect on the environment, wildlife and human health in the Bay of Bengal, says a country report based on the reviews of scientific and policy documents together with a recent preliminary survey on marine litter along four beaches of Bangladesh (Dhaka Tribune, 16 Dec 2018). The Bay of Bengal and the South China Sea are the new plastic hotspots in Asia. Every year about 2 lakh tons of plastics enter the Bay of Bengal from Bangladesh. According to the Earth Day Network of USA (2018), Bangladesh is ranked 10th among most plastic-polluting countries in the world.

Plastic Found at Four Beaches of Cox's Bazar and Chattogram				
	Length of beach in sample (km)	Total waste found (pieces)	Plastic found (pieces)	Proportion of waste that is plastic (%)
Inani Beach, Cox's Bazar	5.5	3742	2619	70
Laboni Beach, Cox's Bazar	5.5	831	432	52
Ananda Bazar Beach, Chattogram	6	1918	997	52
Patenga Beach, Chattogram	1.5	214	126	59

Waste Collected from Four Sea Beaches of Cox's Bazar and Chattogram		
	NUMBER OF PIECES	PROPORTION OF TOTAL (APPROX %)
Plastic	4193	63
Foamed Plastic	860	13
Paper and Card-board	610	9
Rubber	237	3
Cloth	146	2
Glass and Ceramic	90	1
Metal	36	1
Wood	90	1
Others	443	7
Total	6705	100

Figure 4: Survey Results. Source: Mehdi Al Amin, Reckless Plastic Waste Dumping Greatly Endangering Bay of Bengal Dhaka Tribune, 16 Dec 2018

The Department of Environment surveyed with SACEP and UNEPA about Marine litter. According to the report total of 6,705 pieces of waste products were found on an 18.5 km stretch of the four sea beaches – Laboni and Inani in Cox's Bazar, and Ananda Bazar and Patenga in Chattogram – in Bangladesh during the Survey. Among the litter, 63% were plastic, 13% foamed plastic, 2% cloth, 1% glass and ceramic, 1%

metal, 9% paper and cardboard, 3% rubber, 1% wood, and 7% other materials. Plastic bags were found to be the most common type of litter: at least 2,182 pieces of plastic bags were found on the beaches. The survey also found 589 pieces of insulation and packaging foam, 470 pieces of cigarette butts and filters, and 300 bottles. Around 80% of beach litter, including industrial products and waste, comes from the second source.

The Bay of Bengal stretches between India on the west and the Malay Peninsula on the east, measuring about 2,090 km long by about 1,600 km wide. The Bay of Bengal region includes selected coastal and EEZ areas of eight countries (Maldives, Sri Lanka, India, Bangladesh, Myanmar, Thailand, Malaysia and Indonesia) and the international waters between them. The Bay of Bengal occupies an area of 2,600,000 square km (1,000,000 sq mi). Several large rivers flow into the Bay of Bengal: the Ganges–Hooghly, the Padma, the Brahmaputra–Jamuna, the Barak–Surma–Meghna, the Irrawaddy, the Godavari, the Mahanadi, the Brahmani, the Baitarani, the Krishna and the Kaveri etc. There are 54 transboundary rivers in India and 3 in Myanmar. The overall marine pollution in Bangladesh is significantly larger as we are traversed by Asia's three major river systems, namely the Ganges, the Brahmaputra and the Meghna river system. Since we are at the lower end and are the lower riparian of both China and India, Bangladesh bears much marine pollution from these two countries. There is an urgent need to develop a tripartite understanding and agreement on reducing marine plastic pollution and other types of pollution.

Conclusion

The BoB is the third neighbour of Bangladesh, and it has one of the largest marine ecosystems. The government of Bangladesh has conceived the concept of Blue Economy for the sustainable growth of Bangladesh centering on the Bay of Bengal. Marine pollution is not only destroying the ecosystem but is also harmful to the human body and animals. Plastic waste poses a significant threat to marine life and human health. The impact of plastic pollution on the Bay of Bengal ecosystem is significant. Plastic waste degrading into microplastics, ingested by smaller marine organisms are eventually entering the food chain, potentially affecting human health. The Bangladesh government has addressed plastic pollution by banning single-use plastic bags and promoting recycling initiatives. While implementing and enforcing these measures remain a challenge, public awareness can play a vital role in reducing plastic pollution. Considering the dangerous impacts of marine pollution, more needs to be done to effectively manage plastic waste in the country and prevent it from entering the Bay of Bengal.

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Marine Pollution: Awareness and Strategy Build up is Crucial for Combating Threats Springing at Shipping Sector

R Adm A S M Abdul Baten, (E), BSP, ndc, psc, PhD, FIEB, BN (ret'd)



A seafarer may easily locate the root causes, if he desires so and knows the consequent impact of pollution at sea than any other professional. But every other profession in general and maritime stakeholders in particular need to perceive the importance of marine pollution as it continually affects the whole of humanity. Pollution of the oceans by carbon dioxide, oil spills, plastics, toxic metals, manufactured chemicals, pesticides, sewage, and agricultural runoff is killing and contaminating marine life and fish in particular. Fishes are major protein sources for almost 38% of the global population. Out of over 300 million tons of plastic produced yearly for use in a wide variety of applications, nearly 5% of plastics end up in the ocean every year. Plastic pollution threatens food safety, marine species, and human life. Again, increasing carbon dioxide levels are raising sea temperatures and resulting in ocean acidification.

International Maritime Organization (IMO) is the principal body for regulating all activities at sea by forming relevant rules and

conventions. Unless our policymakers and cohorts are fully aware of all maritime world activities, keeping the oceans safer for living creatures on earth would be challenging.

Worldwide marine scientists and specialists are regularly conducting research on this important maritime science sector and recording huge amounts of data for the good governance of oceanic activities. Keeping information and new data only for record-keeping or awareness-building is not enough at all unless these are used for building new strategies for pollution control in the maritime shipping sector.

In 1973, IMO adopted the International Convention for the Prevention of Pollution from Ships, now known universally as MARPOL, with relevant amendments. MARPOL has dramatically contributed to a significant decrease in pollution from international shipping and applies to 99% of the world's merchant tonnage. Almost 60% of humanity lives on or within 100 km of a sea coast (Hinrichsen, D). Major impacts which all

stakeholders need to be aware of are the following:

- Greenhouse gas released from shipping and ports can add to global warming.
- Air pollution from ships can harm the marine environment and human health.
- Pollution actions, like oil spills, can have intense effects on life.
- Research shows that underwater noise – caused by ships moving through the sea – contributes to hearing damage, raised stress levels, and behavioural changes in marine animals.
- Untreated ballast water, necessary for the safe operation of ships, plays a part in introducing species from one marine environment into another, thus threatening indigenous marine life.

MARPOL contains six technical Annexes. Particular areas with strict controls on operational discharges are included in most Annexes, and ship operators and owners must have explicit knowledge about the following annexes:

a. Annex I. Regulations for the Prevention of Pollution by Oil (entered into force on 2 October 1983) covers the prevention of pollution by oil from operational measures as well as from accidental discharges (provision of the double bottom hull); the 1992 amendments to Annex I, which was subsequently revised in 2001 and 2003.

b. Annex II. Regulations for the Control of Pollution by Noxious Liquid Substances in Bulk (entered into force on 2 October 1983). It entails the discharge criteria and measures for the control of pollution by noxious liquid substances carried in bulk. No discharge of residues containing noxious substances is permitted within 12 miles of the nearest land.

c. Annex III. Prevention of Pollution by Harmful Substances Carried by Sea in Packaged Form (entered into force on 1 July 1992) contains general requirements for the issuing of detailed standards on packing, marking, labelling, documentation, stowage, quantity limitations, exceptions, and notifications.

d. Annex IV. Prevention of Pollution by Sewage from Ships (entered into force on 27 September 2003) contains requirements to control pollution of the sea by sewage with some binding clauses and mentions that sewage which is not disinfected has to be discharged at a distance of more than 12 nautical miles from the nearest land.

e. Annex V. Prevention of Pollution by Garbage from Ships (entered into force on 31 December 1988) deals with different types of garbage and specifies the distances from land and the manner in which they may be disposed of; the most important feature of the Annex is the complete ban imposed on the disposal into the sea of all forms of plastics.

f. Annex VI. Prevention of 'Air Pollution from Ships' (entered into force on 19 May 2005) sets limits on sulphur oxide and nitrogen oxide emissions from ship exhausts and prohibits deliberate emissions of ozone-depleting substances.

The Energy Efficiency Design Index (EEDI) was made mandatory in July 2011 for new ships and the Ship Energy Efficiency Management Plan (SEEMP) for all ships at MEPC 62 with the adoption of amendments to MARPOL Annex VI, resolution MEPC.203(62).

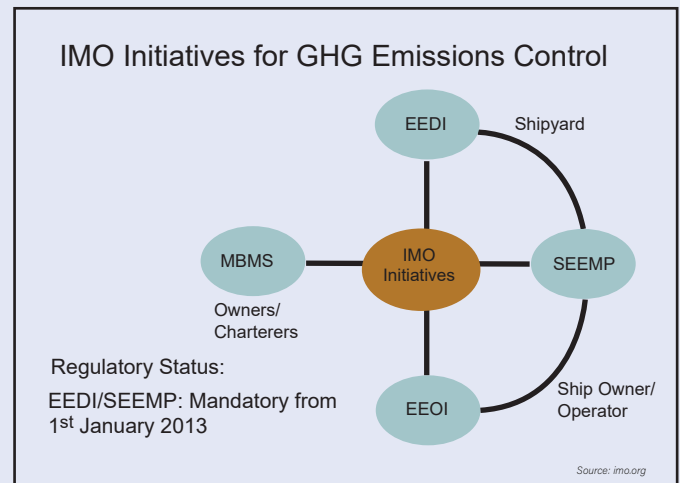


Figure 1: EEDI/SEEMP Model

EEDI reflects the amount of CO₂ generated per tonne-mile (cargo carrying capacity). It constitutes a uniform approach to calculating a ship's energy efficiency during the design and building of new ships and will be used to control CO₂ levels by improving the ship's design. [EEDI=Actual CO₂ Emission/Transport Work]. Here objective is to change ship/machinery design to reduce GHG emissions. There are several ways to achieve this, such as:

- Increase ship size to engine power ratio
- Reduce lightweight
- Innovative solutions (air bubble – friction reduction)
- Optimize propeller efficiency
- Hydrodynamics improvement
- Speed reduction
- Use of renewable power sources (wind, solar power)
- Low-carbon fuels (e.g., LNG)
- Energy saving devices (e.g., WHR, shaft generators)

As per revised MARPOL Annex VI for preventing air pollution from ships, Sulphur limit has been reduced to 0.50% from 3.5% (since January 2020). This can be complied with either by compliant fuel or installing an exhaust gas cleaning system with exorbitant prices. In order to manage ships' ballast water and sediment either by exchange method or by approved ballast water treatment system, Ballast Water Management (BWM)

convention was adopted in 2004. In 2017, resolution 1088(28) was adopted to maintain the BWM plan, and it states ships must have an international BWM Certificate. Recently there has been a remarkable increase in shipping activities in Polar Regions, and as such new rules have been integrated mandatory 'Polar Code', particularly for vessels built after 2017.

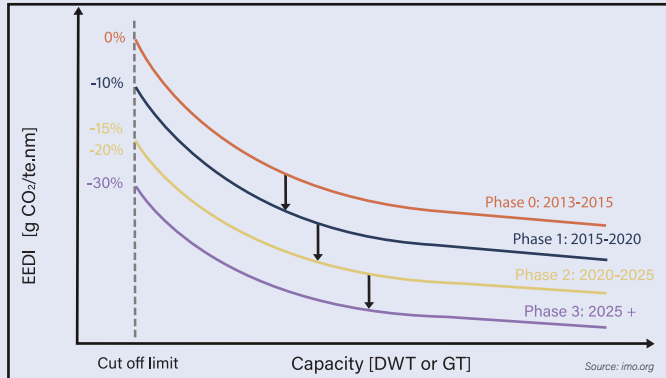


Figure 2: Reduction Factor and Cut-Off Limits

The IMO craving levels cannot be reached only by energy efficiency improvement. Therefore, researchers are regularly going on to find alternative fuels, electrical drives (also Hybrid): chemically stored electricity (batteries), solar panels and fuel cells (hydrogen); different propulsion engine units (nuclear), additional propulsion aids (sails, flattener rotor).

Mere awareness building to reduce /control pollution levels in the marine environment is not enough to meet the desired goals. An appropriate strategy needs to be adopted to combat the threats due to pollution in the national, regional, and international arenas. The state of awareness in the EU differs entirely from that in the Asia Pacific Region. European Maritime Safety Agency (EMSA) has been playing a dominant role in formulating their strategies for effective implementation of the conventions.

Unfortunately, such initiatives are absent in the Indian Ocean regions. The Bay of Bengal Initiative for Multi-Sectoral Technical and Economic Cooperation (BIMSTEC) is an appropriate regional organization that may be a leading

organization for controlling all types of pollution. The BIMSTEC member countries can address this problem both individually and collectively. Unfortunately, the Maritime Safety Administration in Bangladesh is not properly functional. Cases of accidents say fuel spillages are not properly investigated, and reports are not as open to the public as those in Japanese National Safety Agency cases. The Japanese safety authority reflects all types of accidents (land, air, and sea) through a common platform, which is a good example for every other similar authority across the world.

In Bangladesh, the shipping market is getting more popular and more prominent day by day. There are new incentives of the present government through the reduction of VAT and Tax matters to investors earning foreign currency. As a result, there has been a considerable rise in the number of Bangladesh flag vessels at sea.

On the other side, the shipbreaking industry is already a matured industry, and it has also brought new threats due to pollution simultaneously. People associated with this business need to be much more cautious about safety matters, as the risk of pollution in coastal areas is rambling. The majority of the institutions in the shipping sector need to be more proactive in converting the huge number of available human resources to more useable capital with higher levels of skills to achieve international standards. Again, the role of owners in private industries is very important, and they need to be acquainted with the available conventions and critical safety rules so that the grading of vessels never goes down and strengthens their competitive advantages over their counterparts. Management bodies, which are prudent and skillful with knowledgeable employees on the threats and consequences of pollution, should control safer working platforms in all operational areas. Responsible leaders at the management level need to reinforce their regulatory mechanism so that strict compliance is made possible both at home and foreign ports by Bangladesh Flag carriers.

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Scrubber waste discharge from ships is toxic to the marine environment



From January 2020, the allowable sulphur content of marine fuels has decreased from 4.5% to 0.5%. Ships burning high sulphur heavy fuel oils (HFO) can use exhaust gas cleaning systems or “scrubbers” to remove excess sulphur to comply with the new sulphur standard.

Scrubbers turn an air pollution problem into an ocean pollution problem. How does it work?



Scrubbers neutralize the acidic exhaust gases, created when burning HFO, by mixing them with alkaline scrubbing material and remove pollutants such as sulphur.



Scrubber waste contains heavy metals and polycyclic aromatic hydrocarbons, which accumulate in the environment, have carcinogenic effects, can cause mutations, and impact marine life.



Scrubbers are not efficient at removing small sulphur particles from the exhaust gas which pose a significant risk to human health.



Scrubber waste discharge is warmer and more acidic than the surrounding water and increasing acidity makes toxic heavy metals more bioavailable to wildlife.



Using scrubbers slows down efforts to transition to cleaner fuels and creates a new marine pollution problem. Several countries have restricted the discharge of scrubber waste in ports and coastal waters. Scrubbers should be banned immediately in the Arctic and in other sensitive areas and phased-out globally.

Environmental Impacts of Hydrocarbon and Mineral Resources Exploration and Extraction from the Sea

Prof. Dr. Md. Sakawat Hossain



Introduction

Hydrocarbon and mineral resources are the main driving factors of the world's economy, which significantly impacts international geopolitical decisions, events, and the global environment. The industrialization of offshore and deep-sea hydrocarbon and mineral resources is expanding worldwide as easily accessible land-based energy resources have depleted, causing great concern for marine pollution. Environmental pollution of the sea may increasingly threaten a healthy marine ecosystem and human health. Direct environmental impacts of marine hydrocarbon industrialization include sediment re-suspension and burial by seafloor anchors and pipelines, oil-

based low-toxicity drilling fluid discharges, and produced water. The ecological impacts of the marine species at the population and community levels, specifically for its more fragile ecosystems, are very significant and may prevail in the sea for many decades. On the other hand, the impacts of deep seabed (seabed depth greater than 200 m) mining of metals and minerals may be further aggravated by eliminating habitats for many marine species. These metallic minerals take millions of years to form, hence their burial or removal due to seabed mining constraining marine organism capacity to recolonize in the mined zones for decades.

Bangladesh is a developing country with a growing economy and spent billions of dollars importing liquefied natural gas (LNG), crude oil, petroleum products, and minerals. Offshore hydrocarbon exploration in Bangladesh is relatively recent, which started in 1974 when the first production-sharing contracts (PSCs) were signed on the offshore areas in the Bay of Bengal. After discovering two natural gas reservoirs (Kutubdia and Sangu) in the Bay of Bengal, the exploration activities regrettably decelerated. The Government of Bangladesh now plans to extend the hydrocarbon and mineral resources exploration beyond the offshore area into the deep water. Therefore, considering the impacts on the marine environment from exploration and exploitation, and the need to minimize and control these impacts, appropriate national laws and regulations are vital in this exploration stage.

Effects of Routine Marine Hydrocarbon Activities

Routine hydrocarbon activities in the offshore and deep sea can have damaging impacts in each stage of exploration, production, and decommissioning of the facilities. During these stages, impacts on marine life can result from direct and indirect disturbances. Direct physical disturbance includes anchor chains, drill cuttings, drilling fluids, pipeline construction, and discharge of produced water, whereas indirect disturbance includes underwater sound, light, and traffic. During the exploration and production stage, positioning of hydrocarbon infrastructure on the seafloor will directly physically disturb the seabed and damage fragile benthic organisms (e.g., corals and sponges), which have very low resilience to external disturbance. Anchor and pipeline-related corrosion and leakage also risk exposing marine fauna to potentially harmful chemical pollution. Marine exploration and production-related drilling activities discharge different kinds of waste, which include drill cuttings, excess cement materials, drilling mud, chemical adhesive, and produced water. These discharge wastes cause chemical and physical damaging environmental effects to the sensitive marine ecosystem. Therefore, all these hydrocarbon activity-related wastes must be treated following strict regulations before being discharged. When designing management strategies for offshore and deep-sea hydrocarbon activities, it is necessary to consider all of these potential environmental impacts of routine hydrocarbon activities.

Effects of Accidental Discharges of Hydrocarbon in the Sea

An uncontrolled release of hydrocarbons from the subsurface reservoir, which is known as a 'Blowout', causes the greatest risk to the marine environment and ecosystem. Marine hydrocarbon activities have the potential to result in accidental releases of oil or gas, either in the form of a blowout or accidental spill. This accidental release, specifically the possibility of a blowout, increases with the depth of the hydrocarbon operations in the sea. On a global scale, during

offshore transport of hydrocarbon, one accidental spill of over 1000 barrels occurred every 2.5 months. In the Bay of Bengal, the accidental spill of hydrocarbon during the transportation is a common phenomenon. Several major offshore hydrocarbon blowouts have occurred, including the Macondo well blowout in the Gulf of Mexico in 2010, which discharged about 5 million barrels of oil; the IXTOC-1 well blowout in the Gulf of Campeche, Mexico, in 1979, where 3.5 million barrels of oil were released, and the Ekofisk blowout in the Norwegian sector of the North Sea in 1977 where 0.2 million barrels of oil were released. Although all these offshore blowout examples represent accidental discharges from the subsurface reservoir, the blowout occurrence frequency in the sea suggests that they can be expected during typical hydrocarbon production activities. However, fortunately, until now, blowout did not occur in the offshore or deep-sea areas of the Bay of Bengal.

Effects of Deep Seabed Mining Activities



Figure 1: Mineral Exploration Map in Deep Seabed

There is an increasing interest in the mining of the deep seabed mineral deposits due to exhausting terrestrial mineral deposits of high-value metals such as cobalt, lithium, zinc, manganese, aluminium, nickel, and copper, which are very important to produce different electronic products like smartphones, wind turbines, solar panels, and batteries. The extraction and often excavation of mineral deposits from the deep seabed, where ocean water depths greater than 200 m, could severely harm marine biodiversity and ecosystems. As of May 2022, the International Seabed Authority (ISA) had issued 31 contracts to explore deep-sea mineral deposits, collectively covering the international seabed of more than 1.5 million km² (Figure 1). However, the ISA has only issued exploration contracts so far, but not the exploitation contract yet. The ISA's regulations for exploiting the sea minerals deposits are currently under development as some countries have already shown their strong intention to start deep-sea mining. Based on the available information, it is assumed that deep seabed mining could commence as soon as 2026 in international waters.

The disturbance of the seabed through digging and gauging by mining machines can alter or destroy deep-sea habitats. In addition, deep-sea mining activities will stir up fine sediments on the seafloor, generating large plumes of suspended fine sediments

(Figure 2), which may disperse for hundreds of kilometers, take a long time to resettle on the seafloor and affect marine ecosystems, specifically fragile species. To assess seabed mining impact and understand the ecosystem's recovery time, scientists at the National Oceanography Centre (NOC), UK, recently revisited a site that was used to simulate deep-sea mining activity nearly 30 years before. The study findings reveal that the impacts of large-scale commercial deep-seabed mining could potentially lead to irreversible damage to the key function of the marine ecosystem and requires efficient regulation of commercial deep-seabed mining activities.

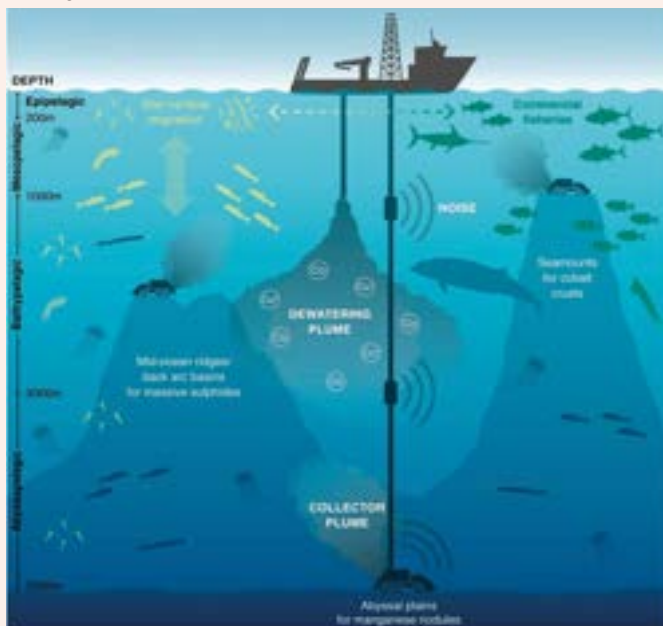


Figure 2: Possible Environmental Impacts of Deep Seabed Mineral Exploration

Recovery from the Impacts of Offshore Industrialization

Typical impacts from hydrocarbon exploration and production drilling may persist over the years to decades time scales in the marine environment. In general, the low-energy hydrodynamic regime in the deeper part of the sea may lead to the long-term perseverance of discharged toxic drilling material, whether deliberate or accidental. Seabed sediment contamination by drilling mud and hydrocarbon ingredients is of particular concern, as these toxic chemicals can persist for a long time, posing a significant risk of prolonged eco-toxicological effects on the marine environment. As the low-energy hydrodynamic regime limits the dispersal of cuttings and chemicals, recovery

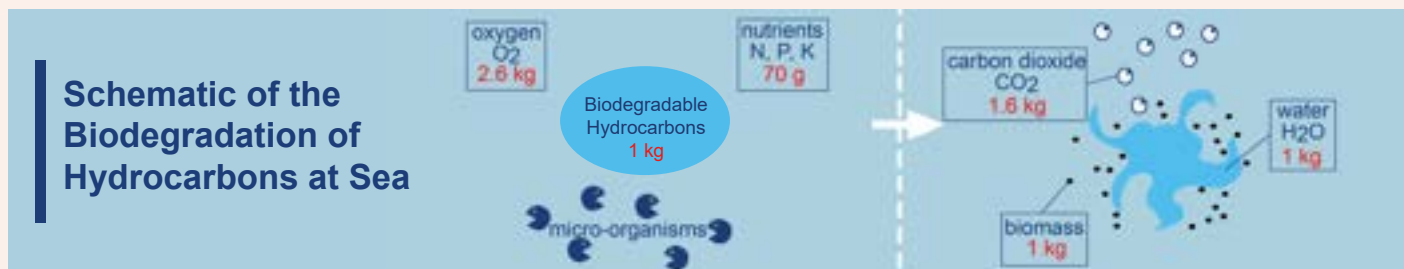
of these highly sensitive benthic habitats may take longer. On the other hand, while deep-sea mining has not started in any part of the world, 31 contracts to explore seabed metals and minerals have been issued. The available scientific report suggests that commercial seabed mining would negatively impact ocean biodiversity, fisheries, and ecosystems and that this new frontier of mining requires a precautionary approach.

Conclusion and Way Forward

The Government of Bangladesh is now in the final stage of being updated the new Production Sharing Contracts (PSCs) 2023 with a proclaimed aim to make a breakthrough in gas exploration, specifically in offshore and deep-sea areas of the Bay of Bengal. This new upcoming PSC drew widespread attention prompting US-based ExxonMobil to offer to explore all 15 deep-sea hydrocarbon blocks of the country. In this context, it is assumed that any blowout occurring in offshore areas of Bangladesh, part of the Bay of Bengal, would also affect the coastal areas of neighbouring India and Myanmar. Therefore, paying solemn attention to the environmental issues in the Model PSC 2023, specifically related to the accidental blowout during the exploration or production stage, is necessary. In particular, Article 10.27 of earlier Model PSC 2008 should be rewritten more specifically to include a loss of accidental discharge or blowout of the gas reserves. The environmental provision needs to be made by legal experts considering the Bangladesh Petroleum Act 2016, the Environment Conservation Act 1995, and the Environmental Conservation Rules 2023.

In addition, the Bangladesh government is now also prioritizing unleashing the full potential of ocean resources by making the Blue Economy the new frontier. In this connection, the government recently finalized Territorial Waters and Maritime Zones (Amendment) Act, 2021. The country now requires wholehearted support from the ISA for capacity building and knowledge transfer, particularly in the form of training and funding joint international research and studies. These collaborations from ISA will enable the Bangladesh government to make rules and regulations and exercise such powers and take such measures as it may consider necessary to regulate mining activities within its territorial sea, EEZ, continental shelf, and area in conformity with the guidelines of the ISA authority.

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Legal Aspects of Marine Pollution

Cdre Sheikh Mahmudul Hassan, (H), OSP, NPP, aowc, psc, BN (retd)



Introduction

Marine pollution refers to the presence of harmful substances in the oceans, seas, and other bodies of saltwater, such as oil, chemicals, plastics, and sewage. These pollutants can have severe impacts on marine life, the environment, human health, and the economy. The damage to marine ecosystems can have long-lasting effects on wildlife, including the death of marine mammals, birds, and fish, as well as the destruction of important habitats. The impact of marine pollution on human health is also a concern, as contaminated seafood and other products from the sea can pose a serious health risk to those who consume them.

Types of Marine Pollution

Pollution from Land-Based Sources. Land-based activities are a major source of marine pollution, including pollution from agricultural runoff, sewage discharge, and industrial effluent. Some of the contaminants produce eutrophication and oxygen depletion, resulting in the loss of marine life and biological diversity.

Pollution from Seabed Activities. Marine pollution can be caused by drilling activities on the seabed, which produces toxic pollutants

such as hydrocarbons as well as concentrations of heavy metals, including chromium, cadmium, copper, zinc, lead, mercury, and nickel.

Pollution from Dumping. It means any deliberate disposal of wastes or other matter from vessels, aircraft, platforms, or other artificial structures at sea; or any deliberate disposal of vessels, aircraft, platforms, or other artificial structures at sea.

Pollution from Vessels. This type of pollution is produced by the regular operation of ships where vessels with oil-burning engines discharge some oil with their bilge water, and the fumes are discharged through their funnels into the atmosphere, which eventually returns to the sea. Besides, pollution can also be caused by the accidents of vessels, which will generate oil spills and discharge other chemicals into the sea that exemplifies the scale and severity of the damage to marine ecosystems as well as to coastal communities.

Pollution from or through the Atmosphere. It is also possible for pollution to occur from material transported through the atmosphere and deposited on the ocean surface. This type of

pollution is capable of contaminating the essential elements of carbon, nitrogen, sulphur, and phosphates in the bio-geochemical cycle of the natural process, which is essential for maintaining life both on land and in the sea.

Pollution from Marine Scientific Research. It is needless to mention that marine scientific research is essential for the exploitation, conservation, and management of marine resources, both living and non-living. In addition, research may be undertaken for scientific or military purposes also. These would include geological, hydrographic, oceanographic and biological research and could include drilling into the continental shelf, using explosives, using noxious substances, interference with the surface and subsoil of the ocean floor, the erection of structures, the discharge of waste and the destruction of commercially important marine living or non-living species.

International Legal Framework

To address these various sources, a number of international legal instruments have been developed to regulate marine pollution and promote sustainable use of the ocean.

UNCLOS. United Nations Convention on the Law of the Sea (UNCLOS) is a comprehensive treaty that sets out the legal framework for the use and protection of the world's oceans and their resources. One of the key provisions of the UNCLOS (Art. 194) is the obligation of states to protect and preserve the marine environment. The UNCLOS sets out the rights and responsibilities of states in relation to the marine environment and outlines the measures they should take to prevent, reduce and control marine pollution from land-based sources, ships, and seabed activities.

To prevent pollution from ships, UNCLOS requires those ships to have appropriate equipment and procedures for the prevention and control of pollution, as well as ensuring that ship owners and operators are liable for any pollution caused by their ships. UNCLOS prohibits the dumping of any substances or objects that are likely to cause harm to the marine environment. This includes prohibiting the dumping of waste, including nuclear waste, into the marine environment.

While all States Party are entitled to conduct marine research programmes it is conditional on the protection of the rights of other States. These rights would include protection from damage and pollution of their marine reserves and environment. Great care should be taken by States conducting research, whether it be in their own maritime zone or, by consent, in another States area, and the involvement of international organisations in the process is therefore important.

The London Convention. The London Convention (LC) and its 1996 Protocol regulate the dumping of waste at sea, including radioactive waste, and establish a comprehensive framework for managing such waste. The convention requires that all dumping at sea be subject to prior authorization by the State whose flag the dumping vessel is flying and sets out strict

standards for the disposal of toxic and hazardous waste.

MARPOL 73/78. The IMO has adopted several international conventions, including The International Convention for the Prevention of Pollution from Ships (MARPOL 73/78) and the International Convention for the Control and Management of Ship's Ballast Water and Sediments, to regulate the discharge of pollutants from vessels into the marine environment. It sets out mandatory regulations for the design, construction, and operation of ships, as well as the procedures for the handling, storage, and disposal of ship-generated waste and cargo residues. The convention also requires ships to carry equipment and procedures to minimize the risk of accidental pollution and establishes provisions for emergency response and cooperation in the event of an oil spill.

OPRC. The International Convention on Oil Pollution Preparedness, Response, and Cooperation (OPRC) provides a framework for international cooperation and coordination in the event of a major oil spill. It establishes procedures for preparedness and response and sets out guidelines for cooperation and coordination among states, including the sharing of information, equipment, and personnel.

UNFCCC and the Paris Agreement. United Nations Framework Convention on Climate Change (UNFCCC), and the Paris Agreement provide a framework for global action to address the causes and impacts of climate change, including marine pollution from greenhouse gas emissions and ocean acidification. The Paris Agreement sets a long-term goal of keeping the increase in global average temperature well below 2°C above pre-industrial levels and pursuing efforts to limit the temperature increase to 1.5°C.

Regional Agreements and Frameworks

In addition, there are also regional agreements and frameworks in place to address marine pollution, such as the Convention for the Protection of the Marine Environment of the North-East Atlantic (1992), Convention for the Protection of the Marine Environment and the Coastal Region of the Mediterranean (1995), etc. These regional agreements provide for cooperation between countries in the region and for implementing measures to protect the marine environment and prevent marine pollution.

National Legal Framework

In addition to the international and regional legal frameworks, many countries have enacted their own national laws to address marine pollution. These laws may be based on the provisions of international and regional agreements, or they may establish their own standards and regulations to protect the marine environment. National laws may also provide for penalties and enforcement mechanisms to ensure compliance with the legal requirements.

There are several Acts/Ordinances/Rules/Plans, and Policies related to marine pollution in Bangladesh. Some of the important ones are:

SL	List of Act/Ordinance/Rule/Plan/Policy	Related Ministry /Division	Came into Force
1	The Ports Act, 1908	MoS	18 Dec 1908
2	The Bangladesh Merchant Shipping Ordinance, 1983	MoS	30 Jun 1983
3	The Environment Conservation Rule, 1997	MoEF	1997
4	National Water Policy, 1999	MoWR	1999
5	The Bangladesh Coastal Zone Policy, 2005	MoWR	2005
6	The Bangladesh Environment Conservation Act, 1995 (Amended in 2010)	MoEF	05 Oct 2010
7	Bangladesh Water Act, 2013	MoWR	02 May 2013
8	Bangladesh Biodiversity Act, 2017	MoEFCC	19 Feb 2017
9	Bangladesh Shipping Corporation Act, 2017	MoS	21 Mar 2017
10	National Environmental Policy, 2018	MoEFCC	2018
11	Marine Fisheries Act, 2020	MoFL	26 Nov 2020
12	National Oil and Chemical Spill Contingency Plan, 2020	MoEFCC	Feb 2020
13	Bangladesh Oil Gas and Mineral Corporation Act, 2022	MoPEMR	20 Nov 2022

Conclusion

In conclusion, marine pollution is a complex issue that requires the effective implementation and enforcement of international, regional, and national legal frameworks. These legal frameworks provide essential protections for the ocean and its inhabitants and ensure that the ocean remains a healthy and productive environment for future generations. The implementation

and enforcement of these legal requirements are crucial to reducing marine pollution and preserving the ocean for future generations.

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WHAT EVENTS LED TO SHIPPING CONVENTIONS ?

Event	Resulting Convention
Sinking Of Titanic After Sinking of Titanic, the first version of SOLAS was adopted in 1914	SOLAS Safety of Life At Sea
Numerous Collisions At Sea The increase in the size and number of ships in 1960s lead to increase in number of Collisions	COLREGS International Collision Regulations
Torrey Canyon Disaster UK's worst Oil Spill accident ever and first tanker disaster to attract such an enormous media coverage	MARPOL Marine Pollution
Extinction Of Marine Species Zebra mussel invasion in Great Lakes in the 1980s via ballast water discharged by ships from Europe	BWMC Ballast Water Management Convention
Attack Of 9/11 In the wake of the 9/11 attacks in the United States, ISPS code was introduced to avoid similar attacks using ships	ISPS CODE International Ship and Port Facility Security Code

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Oil Spill Intervention in the Bay of Bengal: A Pivotal Redux

Dr. Tafsir Matin Johansson



Torrey Canyon (1967), Amoco Cadiz (1978), and Exxon Valdez (1989) oil spill antecedent events have galvanized international movements against marine pollution and corresponding deleterious effects – but what is needed to allow “oil spill intervention” best be embraced at the regional level?

Patently, “operational discharge” and “accidental spills” are two prominent categories of marine pollution that reside parallel to “dumping”, and it is within the very ambit of those two that one could insightfully unveil the breadth and scope of intervention-governance dos and don'ts about ship sourced oil spill. Admittedly, the threads of intervention-governance, more specifically, have been weaved into a range of international conventions developed by International Organizations (IO). The role of IO in prescriptive and enforcement jurisdictions through “applicable rules and standards” has its roots in the United Nations Convention on the Law of the Sea of 1982 (UNCLOS). While general obligations are succinctly embedded in relevant parts, UNCLOS through the “rule of reference” requests Member States (MS) to implement Generally Accepted International Rules and Standards (GAIRS). In evaluating the role of GAIRS, scholars note the word “compatible” found in articles 311(2) and 311(3) aims to

strike a coherent and consistent balance with the rules promulgated by UNCLOS. Undoubtedly, rules of reference proffer cohesion and adaptability, especially with IMO code, conventions, and guidelines.

At the outset, explicit reference to the term “intervention” is observed in the International Convention Relating to Intervention on the High Seas in Cases of Oil Pollution Casualties of 1969 (Intervention Convention). Despite the reference, unfortunately, the application of the Intervention Convention limits itself to the high seas and does not accompany prescribed measures for an actual intervention in the texts. Ergo, heavy reliance is made on the prescribed provisions of the International Convention on Oil Pollution Preparedness, Response and Cooperation of 1990 (OPRC), and Regulation 37 of Annex I of the International Convention for the Prevention of Pollution from Ships (MARPOL). While both Conventions endorse the development of a “shipboard emergency plan”, a distinct attribute inherent to the OPRC is how it details the obligation of State parties to take stock of equipment, conduct exercises and develop pertinent plans at the national level, and cooperate with counterparts from other countries, as deemed fit.

Cooperation manifests through bilateral or multilateral agreements, which venture into the hallways of nitty-gritty details. Examples of this are ripe in multiple regional strategies enshrined in, inter alia, the Agreement for Cooperation in Dealing with Pollution of the North Sea by Oil and Other Harmful Substances; Convention on the Protection of the Marine Environment of the Baltic Sea Area; Convention on the Protection of the Black Sea Against Pollution; Convention for the Protection of The Mediterranean Sea Against Pollution; and Agreement on Cooperation on Marine Oil Pollution Preparedness and Response in the Arctic. These agreements are characterized as being the merger of individual proactive strategies while maintaining the brisk momentum of joint intervention processes. Joint review of oil pollution incident response, exchange of information, joint exercise and training, mutual assistance, and joint guidelines are to name a few exemplary elements that simultaneously serve as key takeaways from international best practices.

Turning to the focal point of discussion, i.e., the Bay of Bengal - the first strand that is axiomatic is the region's interaction with commercial ships, especially tankers and cargo ships that traverse the waters at regular intervals. Interactions are many, to say the least. In addition, the same region that is characterized by unique geographical features is also marked with natural anomalies, e.g., storm surges, strong tidal currents, and wide tidal fluctuations. Evidence-based research points to the fact that semi-diurnal tides in certain areas of the Bay of Bengal can attain the highest and or double amplitudes owing to the coastline's geometrical configuration and the width of the continental shelf. Indeed, consequently, the Bay is no stranger to oil spill incidents. In retrospect, the 2014 collision between a small coastal oil tanker and another vessel in the Sundarbans, the 2017 collision of LPG vessel MT BW Maple and oil tanker MT Dawn Kanchipuram near the Chennai harbor, the 2021 incident developed as a result of underwater crack on the Portuguese flagged Devon, and the 2022 incident between Haian City and Orion Express are perhaps stark cautionary tales for the coastal states bordering the Bay of Bengal.

Unique is also the ecosystem services provided by the Bay to the coastal inhabitants. Recognized as the largest Bay on earth, the Bay of Bengal is home to one of the most distinguished, diverse, and dynamic natural ecosystems and untapped hydrocarbon resources. A complex but highly productive area, the waters of the Bay of Bengal Large Marine Ecosystem (LME) nurture six million tonnes of pelagic and demersal species and shrimp fisheries that supplement approximately seven percent of the global supply of seafood-based nutrition. It stands to argue that stakes are high for coastal states if large quantities of crude oil, fuel oil, sludge, oil refuse, or generic substances contaminate the LME that buttresses the economic pillar of the region.

Government protocol and penchant for precise action rendered Coast Guards of respective coastal nations of the Bay of Bengal the sentinels of oil spill intervention. For example, s. 7

of the 2018 Coast Guard Act of Bangladesh empowers the Coast Guard "to guard against polluting activities in the territorial waters and take measures to prevent such activities". While the Bay of Bengal littoral states are parties to both MARPOL and OSPAR, there is an observed discrepancy in how international guidance has trickled down to the national levels of respective countries. More importantly, while national capacities continue to struggle with a timely intervention using state-of-the-art equipment, in some cases, the absence of a response policy, let alone a contingency plan, has left a question mark on the Bay of Bengal's campaign towards cooperation in the likelihood of large-scale oil spill intervention.

Turning to the regional side of things, the South Asia Co-operative Environment Programme (SACEP) consolidated a Regional Oil and Chemical Contingency Plan in August 2016, which aligns with the spirit of "cooperation" according to OPRC. However, in the present discourse, one may find oneself concerned with the materialization of the term "cooperation" taking into account the impacts of protracted resolutions on the bilateral relationship between and among parties to maritime boundary disputes. Notwithstanding, the efforts of SACEP are commendable as it resonates with international best practices.

Ocean governance through stakeholder engagement is indubitably a well-established concept. The Bay of Bengal, when faced with oil spill challenges and the like, remains under the auspices of that concept. Those that purport to support collaborative engagement, present ocean management through a unique and modern prism salient to all ocean stakeholders working within the complex architecture of contemporary ocean governance. For the Bay of Bengal littoral states, this could entail cooperation with the right political mindset when adhering to SACEP recommendations in oil spill interventions that extend to the "grey areas" of the boundary.

The answer to the question of opening this pivotal redux is not an easy one. The best way forward could be a careful consideration of collateral arrangements on the margins of other initiatives that could bolster support for the wants and needs of regional cooperation at large. Cooperation, as it exists today, could ideally detail the feasibility of establishing a regional contact point, integrating "places of refuge" as a part of the contingency plan, developing a protocol for assistance from "vessels of opportunity", and reaping the advantages of remote technologies and Robotics and Autonomous Systems (RAS) for intervention. Farfetched as it may seem, the aforementioned options are, being explored at other regional levels. Whether or not funding an established mechanism to facilitate advanced "oil spill intervention" is doable, rests upon further discussions aimed at protection sustainably and collaboratively.

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Bangladesh Ship Recycling and Marine Pollution Aspect

Cdre Khandokar Akhter Hossain, (E), NUP, ndc, psc, PhD, BN



Ship recycling is a viable engineering process of recovering shipbuilding material by dismantling End-of-Life (EOL) ships profitably and safely. Ship recycling activity was concentrated in industrialized countries, mainly USA, UK, Germany, Turkey, etc., until the 1960s. But from the early 1980s, old ships have been coming for recycling to India, China, Pakistan, Bangladesh, and other East Asian yards; where marine pollution is slightly neglected, health and safety standards are minimal, and workers are desperate for work. A few dozen ship-recycling yards exist along the coastal belt at Chittagong in Bangladesh. The local ship recycling industry provides the country's primary source of steel, reconditioned equipment, and machinery, create employment opportunities, generates government revenues, and contributes to the national shipbuilding industry. No doubt this industry promotes the economy of this country. At the same time, the negative image, such as environmental pollution, health hazard, and very few accidents, brings a significant challenge that should be overcome

for the constancy of this industry in the long run. Shipbreaking is a global industry, and because of the changing socio-economic scenarios of the world, it is necessary to develop the industry in such a way that it is stable and sustainable in the long run.

The worldwide ship recycling industry dismantles around 1000 large ocean-going vessels annually, such as container ships, cargo & bulkers, oil & gas tankers (LNG, LPG), passenger ships, and other types of ships, to recover steel and other valuable metals or recyclable items. However, almost all ship recycling activities are concentrated in five countries: the three South Asian countries (India, Bangladesh, and Pakistan), China, and Turkey. Further capacity is available in North America (US, Canada, Mexico) and within the European Union (Denmark, Belgium, and UK). South Asia is undoubtedly the global center for ship recycling activities. Global central recycling yards are located in India, Bangladesh, Pakistan,

China, and Turkey. These countries are main ship recycling centers for annual Light Dead-Weight Ton (LDT) recycled. In 2020, around two-thirds of reported tonnage or LDT sold for recycling was in Bangladesh and India. Global ship recycles in LDT in thousand gross tons sold in 2020, has been shown in table 1.

was brought to shore near Fauzdarhat by the 1960s cyclone. The abundant ship was dismantled in 1965 by Chittagong Steel House. Subsequently, the Pakistani ship Al Abbas was salvaged, beached at Fauzdarhat, and dismantled in 1974 by Karnafully Metal Works. These incidents draw the attention of a few entrepreneurs to the suitability of the coastline near

Ship Types	Bangladesh	India	Pakistan	Turkey	China	Rest of the world	World Total	Percentage
Bulk Carries	5,254	1,317	1,718	34	125	61	8,509	48.9
Container	160	1,428	282	206		68	2,143	12.3
Oil Tankers	616	410	617	159	10	226	2,038	11.7
Offshore supply	125	257	4	308	3	273	969	5.6
Ferries	26	279		545	3	26	879	5.1
General cargo	176	219	175	203	47	29	848	4.9
LPG/ LNG	169	241		8		176	594	3.4
Chemical Tankers	12	125	94	1		10	241	1.4
Others	157	786		135	9	93	1,180	6.8
Total	6,694	5,061	2,890	1,598	195	962	17,401	100
Percentage	38.5	29.1	16.6	9.2	1.1	5.5	100	(%)

Table 1: Global Ship Recycles in LDT in Thousand Gross Tons Sold in 2020

In Bangladesh, an average of 200 obsolete ships is recycled annually in different yards in Chattogram. For easy understanding, the total number of different types/categories of ships recycled annually in Bangladesh between the years 2009 to 2015 is shown in figure 1. Again, from on-ground statistics of ship recycling yards in Bangladesh, an average of 2000000 LDT, different types of obsolete ships are recycled annually. The reusable material factor and average materials output per year in Bangladesh are shown in figure 2. However, the highest share increase has been observed for Pakistan, by 14.7%, and for India, by 3.2% (UNCTAD 2021).

Fauzdarhat for beaching. Over the years, the ship recycling industry in Chittagong has gone through lean and boom periods to become the world's largest ship recycling industry in 2015. Now the shipbreaking and recycling industry (SBRI) spans over 20 km coast of the Bhatoyar- Fauzdarhat-Baroiyawlia area. SBRI consists of over a hundred ship recycling yards in the register, where a few dozen are in regular operation. The industry directly employs over 200,000 laborers and accounts for the supply of more than half of Bangladesh's steel products. Around one million people indirectly earn their bread and butter from this industry.

On the contrary, there were visible reductions in Bangladesh by 15% and in China by 2%. China's market share has reduced due to the ban on international ship recycling. At the same time, Bangladesh's market share has declined due to local restrictions by government regulation.

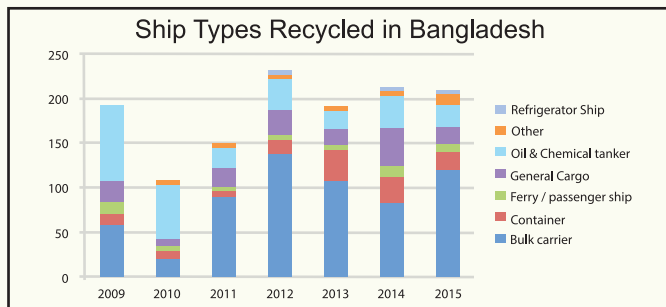


Figure 1: Number of Ships Recycled Annually in Bangladesh (From 2009 to 2015) (Hossain, 2017)

Local ship recycling in Chittagong of Bangladesh started accidentally by dismantling the Greek ship M D Alpine, which

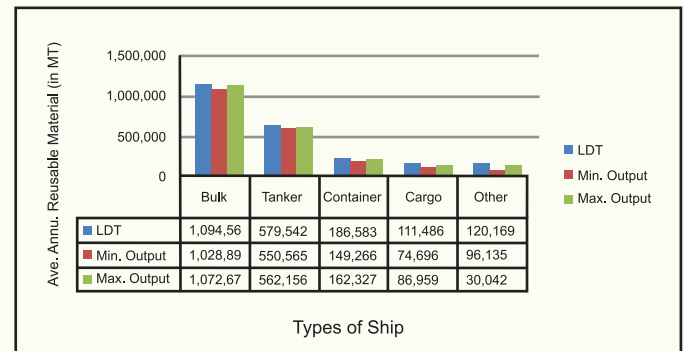


Figure 2: Average Annual LDT and Reusable Material Output of SBRI (2009 to 2015) (Hossain, 2018)

Several factors have pushed the growth of this sector over time which include the favorable beaching condition, which is God-gifted, the closeness of the beach to the industrial hub of Chottagram, mainly the steel rerolling mills, which consume most of the output from the industry, availability of risk-taking entrepreneurs, access to abundant labor from the northern

districts of Bangladesh, the favorable legislative framework allowing the operation of the industry for decades even without it being considered as an industry. The high demand in the local market for scrap ferrous and non-ferrous metals and other cheaper items recovered from the industry, access to finance from formal financial institutions, and informal money lenders. Again, the growth of upstream and downstream industries has formed an informal industrial symbiotic and interdependent network. The interesting point is that almost every output from the EOL ships is sold in the local market and consumed or processed by the forward and backward linkage industries closer to the recycling yards.

The main problems of SBRI are poor labor-management due to the harsh work environment for the manual labor, the lack of protective clothing and equipment, the predominance of manual processes and the rate of accidents along with environmental issues caused by poor hazardous waste management, coastal contamination, water, and air pollution, the spread of hazardous materials into the environment, forest destruction, etc. Based on these visible problems, the Bangladesh Environmental Lawyer's Association (BELA) petitioned the High Court in 2008. This resulted in the order by the Bangladesh High Court directing the expert-supervised removal of hazardous wastes from ships before dismantling. It also ordered ship recycling yards to obtain Environmental Clearance Certificates (ECC) from the Department of Environment (DoE) to be allowed to import ships and the Government to formulate regulations to control SBRI. Due to the ruling by the High Court in 2010, the import and dismantling of ships in Bangladesh were stopped. Ship recycling activities resumed a few months later in 2011, as the

Ministry of Industry (MoI) implemented and issued the Ship Breaking Waste Management Rules.

Currently, the SBRI is bound by the Ship Breaking and Ship Recycling Rules 2011 under the MOI along with Environmental Protection Act 1995 and Environmental Protection Rules 1997 under the supervision of DoE under the Ministry of Environment, Forest and Climate Change (MoEFCC). Presently, the local yards' labor safety and environmental management standards have shown signs of distinct improvement after implementing those roles and regulations and taking those measures. Now, Bangladesh Government has established the "Ship Building and Ship Recycling Board" (SBSRB) as the one-stop service provider under the MoI. It provides integrated services, including granting required permissions and certificates for Shipbreaking, recycling, and other related activities in cooperation with other responsible departments and ministries. DoE is working to ensure sustainable environmental governance for pollution control. This department is solely responsible for issuing an ECC before establishing any industrial unit in Bangladesh and thus shipping recycling yards as well. It also issues authorizations for handling hazardous wastes generated from ship recycling activities. At present central recycling yards of Bangladesh are following a viable recycling technique and are almost at the door to achieving international standards for the Health Safety and Environment (HSE) aspect.

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Plastics in Seafood: Human Health Concern Regarding Microplastics in Aquatic Environment

Asst. Prof. Md. Masud Rana



Microplastics are tiny pieces of plastic that measure less than 5 millimeters in length. They can be divided into two main categories: primary microplastics and secondary microplastics. Primary microplastics are designed to be minor, such as microbeads found in personal care products like facial scrubs and toothpaste. Secondary microplastics are created from more oversized plastic items that have broken down over time due to weathering, exposure to UV light, and physical abrasion. These particles can come from various sources, including plastic products that have broken down over time and microbeads in personal care products such as toothpaste and exfoliants. Unfortunately, microplastics are increasingly found in seafood, which can negatively impact human health and marine ecosystems. Much is still unknown about the potential long-term effects of microplastics on human and environmental health, and research is ongoing to understand these impacts better. Efforts are being made to reduce the amount of plastic waste that enters the environment, such as

through plastic bag bans and increased recycling programs. However, further action is needed to address this complex issue.

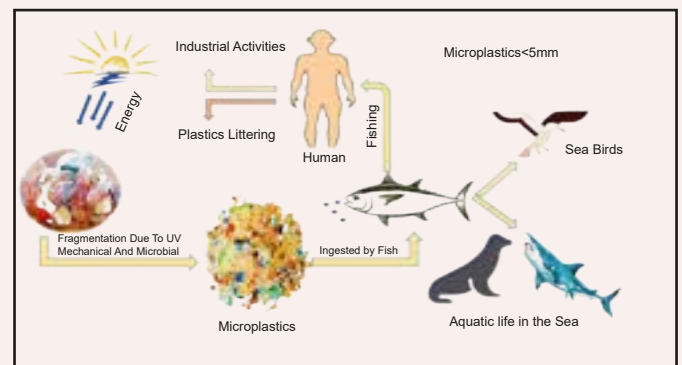


Figure 1: Breakdown and Conversion of Microplastics

Seafood refers to a wide variety of edible aquatic animals and plants harvested from the oceans and adjacent areas. Some

common examples of seafood include fish (such as rupchanda, loita, poa, hilsa, tuna, cod, haddock, trout, sardines, etc), shellfish (including shrimp, prawns, crab, lobster, oysters, clams, mussels, and scallops), cephalopods (such as squid, octopus, and cuttlefish), seaweed and other sea vegetables (including nori, dulse, wakame, and kelp). Seafood is a rich source of protein, omega-3 fatty acids, vitamins, and minerals and is an essential part of many cuisines worldwide. However, it is important to be aware of issues such as overfishing, pollutant contamination, and sustainability when consuming seafood. Seafood can become contaminated with microplastics in several ways. For example, marine animals may ingest microplastics when they mistake them for food. These microplastics can then accumulate in the animals' tissues, potentially exposing humans who consume the seafood to the harmful chemicals released from the plastic particles.

of microplastics to human health and to develop strategies to mitigate these risks.

The adverse effects of consuming microplastic-contaminated fish for humans are not yet fully understood, but there are some concerns that scientists and researchers have raised. Microplastics ingestion via seafood could accumulate in the human body over time and potentially cause health problems. Studies have shown that microplastics can penetrate the gut lining and enter the bloodstream, and there is concern that these particles could cause inflammation, tissue damage, or other adverse effects. Microplastics can absorb and concentrate toxic chemicals from the environment also, such as persistent organic pollutants (POPs) and heavy metals. If humans ingest these chemicals via seafood, they could cause health problems. Actually, microplastics are a relatively new area of research, and there is still much unknown about their

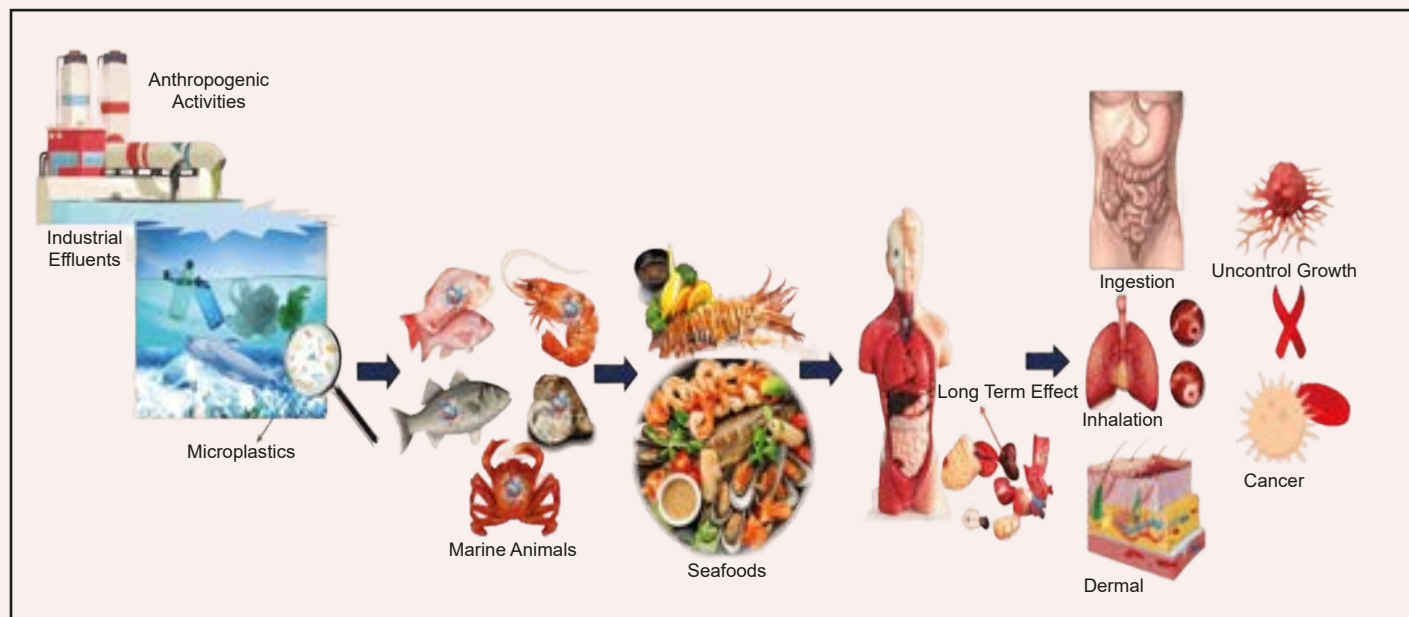


Figure 2: Accumulation Routes of Microplastics on Human Health

Seafood can become contaminated with microplastics from a variety of sources, including plastic waste (such as discarded packaging, fishing nets, and other debris, can break down over time and release microplastics into the ocean), sewage and wastewater, microplastics from personal care products and other consumer goods can enter the wastewater system and be released into rivers and oceans through sewage outfalls and runoff. Microplastics can be transported over long distances through the air and deposited in marine environments. Even fishing gear (such as nets, lines, and traps) can also contribute to the release of microplastics into the ocean. Aquaculture operations can generate microplastics through the use of plastic nets and other equipment. These sources of microplastics in seafood highlight the importance of reducing plastic waste and improving waste management practices to prevent further contamination of the environment. Additionally, efforts are needed to understand the potential risks

long-term effects on human health. Chronic exposure to microplastics through seafood could have unexpected or unknown health effects that have not yet been identified. More research is needed to fully understand the potential risks of consuming microplastic-contaminated seafood. However, it is clear that reducing plastic pollution and improving waste management practices is an essential step in protecting both marine ecosystems and human health.

Fish and other aquatic organisms can suffer from the effects of microplastics in a number of ways. Small aquatic organisms, such as plankton, and filter-feeders, such as mussels, clams, and oysters, can ingest microplastics along with their food. Microplastics in their digestive systems can cause blockages or physical damage to their internal organs, reducing their feeding efficiency and leading to malnutrition or starvation. Microplastics can absorb and concentrate toxic chemicals from

the surrounding water, such as Persistent Organic Pollutants (POPs) and heavy metals. When aquatic organisms consume microplastics, they can be exposed to these chemicals, negatively affecting their health, growth, and reproduction. Microplastics can also cause physical damage to the gills, eyes, and other organs of fish and other aquatic organisms, impairing their ability to swim, feed, or avoid predators. Some studies suggest that microplastics can cause behavioral changes in aquatic organisms, such as altered feeding behavior, reduced activity levels, and increased vulnerability to predation. The effects of microplastics on aquatic organisms can have ripple effects throughout the food web, potentially leading to ecosystem-wide impacts. For example, if a predator consumes a contaminated prey item, it can be exposed to the same toxic chemicals and physical damage as the prey. Additionally, if contaminated prey is less able to feed and reproduce, this can lead to population decline and the loss of an important food source for predators.

Several measures can be taken to control microplastic pollution in seafood. Sustainable fishing practices can help maintain healthy fish populations and reduce stress on the marine environment. This can include measures such as limiting the amount of fishing allowed in a particular area, using gear that minimizes bycatch and avoids damaging the seafloor, and implementing seasonal fishing restrictions. Improving waste management practices can prevent microplastics from entering the environment in the first place. This can be achieved through better recycling and disposal of plastic waste and by reducing the amount of plastic waste generated in the first place. Wastewater treatment facilities can be upgraded to better capture and remove microplastics from wastewater before it is released into the environment. Consumers can help to reduce the demand for single-use plastics by making more sustainable choices, such as using reusable bags, water bottles, and food containers. Raising awareness of the issue of microplastic pollution and the importance of reducing plastic waste can also help to promote behavioral change and drive demand for more sustainable products and practices. Finally, technological advancement is

important to capture and remove microplastics from the environment, such as microplastic filters for washing machines and devices that can be installed on stormwater drains to capture microplastics before they enter waterways. A combination of these measures will be needed to control microplastic pollution in seafood effectively. It will require action from governments, industry, and individuals to reduce plastic use and improve waste management practices to prevent further pollution and protect marine ecosystems and human health.

Plastic pollution is a major environmental problem that significantly impacts marine ecosystems and human health. One of the most concerning aspects of plastic pollution is the presence of microplastics in seafood. Fish and other aquatic organisms can ingest these tiny plastic particles, ultimately ending up on our plates. The sources of microplastics in seafood are varied, including plastic waste from fishing gear and land-based sources such as plastic litter and microfibers from clothing. Microplastics can adversely affect aquatic organisms' health, causing physical damage, toxicity, and behavioral changes. These can have ripple effects throughout the food web, leading to ecosystem-wide impacts. Strategies are needed to control microplastic pollution in seafood, including reducing plastic use, improving waste management practices, developing alternatives to plastic, cleaning up existing plastic waste, and regulating microplastics. In addition, sustainable fishing practices, consumer awareness and education, and emerging technologies can help to reduce the number of microplastics in seafood and protect the health of marine ecosystems and human populations.

Overall, addressing the issue of microplastic pollution in seafood will require a concerted effort from governments, industry, and individuals to reduce plastic use and improve waste management practices to prevent further pollution and protect the health of our oceans and the food we eat.

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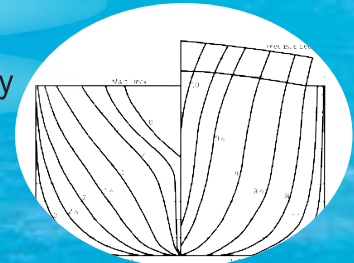
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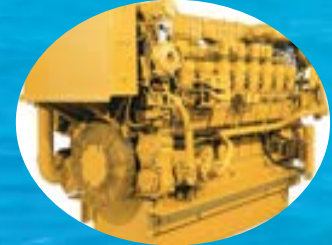
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Heavy Metals (HMs) Pollution in the Sundarbans Mangrove Estuary of Bangladesh

Mir Mohammad Ali

Amit Hasan Anik



Sundarban is reportedly formed from sediments deposited by three main rivers, including the Ganges, the Brahmaputra, and the Meghna, which provide a risk of pollution and metal toxicity. Although a large portion of the Sundarbans has been designated as Sundarbans Reserve Forests (SRF) for conservation and wise use, SRF protection is woefully inadequate because the area surrounding the forest has experienced unprecedented human and industrial encroachment and urbanization over the years. For example, a considerable proportion of the people (about 8,55,000) living in the defined terrain around SRF rely on the forest for a living and use SRF resources on a regular basis. Presently, around 190 separate industries are constructed along a 10km-wide strip bordering the Sundarbans' northeast limit known as the Ecologically Critical Area (ECA). Unfortunately, these enterprises indiscriminately dump untreated industrial waste into the river and transport raw materials and fuels by various heavy water vehicles across SRF waterways. Furthermore, the use of SRF resources by nearby populations, the construction of two coal-fired power plants near the forest, the release of untreated industrial wastes into the riverine aquatic environment,

the use of unauthorized river channels by water vehicles, oil spillage accidents into the river during transportation, and so on are the major reasons for deteriorating the quality of wild and eco-life in SRF. Over time, many of these issues have raised concerns for the SRF's sensitive water and habitat (Choudhury et al., 2021).

However, like other mangroves, the Sundarbans operate as a pollution sink and a source of nutrient flow into the marine environment (Islam et al., 2017). The Sundarbans are increasingly endangered by the activities listed above. The mangrove ecosystem is particularly vulnerable to inorganic contaminants such as heavy metals (HMs) (Costa-Böddeker et al., 2017). One of the most harmful contaminants of the mangrove environment, HMs are both non-biodegradable and extremely poisonous. These metals are notoriously hard to eliminate and tend to build up in all sorts of settings. Some of them are important micronutrients for certain types of flora and fauna, and they exist naturally at insufficient concentrations. On the other hand, pollutants such as wastewater, solid waste, particle materials, and so on find their way into mangroves because of their closeness to urban

environments and industries. Most studies on the abundances of HMs in Sundarbans mangrove water, soil, and sediment focused on arsenic (As), cadmium (Cd), cobalt (Co), chromium (Cr), copper (Cu), iron (Fe), manganese (Mn), nickel (Ni), lead (Pb), and zinc (Zn) (Ali et al., 2022).



Figure 1: Different Sources of HMs in the Mangrove Ecosystem of Sundarbans

Most importantly, HMs are one of the most pervasive contaminants caused by human activity (Choudhury et al., 2021). Anthropogenic activities, including domestic effluent discharge, oil residue from boats, over-siltation, extensive use of motorized boats for transportation and fishing, use of anti-fouling paints or burned oil in motorized boats, and herbicides and pesticides from nearby agricultural fields are contributing to the HMs pollution. Herein, Sundarbans mangrove silt has a greater aluminum concentration due to the presence of basaltic trappean rocks and laterites in the sediment. Because ferries, launches, and motorboats are so important for the transportation and tourist industries of this region. Moreover, they are also a major source of lead (Pb) pollution in the Sundarbans' incoming rivers. Since there aren't many mainland power lines reaching these places; thus, it's possible that lead (Pb) and cadmium (Cd) contamination has arisen through careless usage of rechargeable batteries and improper disposal of used batteries (Chowdhury and Maiti, 2016). Hence, the above discussion also suggests that human actions may possibly be the source of copper and nickel. But natural processes like weathering and erosion may also produce HMs (Bakshi et al., 2018). Mangrove sediments accumulate HMs as oxides and/or oxy-hydroxides from both natural and anthropogenic sources. Bacterial decomposition of HM oxides and/or oxyhydroxides occurs when organic matter is present, releasing the metals into pore water and increasing their bioavailability and release in soluble phases such as organic and sulfide forms of HMs. Albeit, the distribution of HMs in mangrove water, soil, and sediment are dependent on parameters such as pH, salinity, particle size, redox potential, and organic carbon content (Kumar et al., 2019).

As a consequence of fast industrial and agricultural development in Bangladesh and India, land retrieval for aquaculture, agriculture,

and urban development, the rapid expansion of human settlements, tourism activity, deforestation, intense fishing, and agricultural, industrial, and aqua-cultural activities, flooding, storm-runoff, atmospheric. In addition, wastes and effluents from home, municipal, and agricultural resources upstream of the Sundarbans' inflowing rivers are causing major ecological change. Due to the aforementioned activities, the Sundarbans ecosystem has become more endangered, despite the fact that it serves as a vital connection between marine and freshwater ecosystems, a pollution sink, and a source of nutrient flow into the marine environment (Islam et al., 2017). Due to the proximity to the urban environment and industry, mangroves receive a wide range of pollutants in the form of wastewater, solid waste, particulate matter, and so on (Kumar et al. 2019). It has been shown that HMs, among other contaminants, constitute a significant risk to the mangrove ecosystem (Costa-Böddeker et al., 2017).

The Sundarbans is the largest continuous stand of mangroves on Earth, and they are also famous for the wide variety of fish, shrimp, and crab that they contain. However, animals living in the Sundarbans have been exposed to HMs contamination to variable degrees as a result of rising industrialization and urbanization upstream of inflowing rivers, increasing anthropogenic and agricultural activities in the Sundarbans (Borrell et al., 2016). Polychaetes, mesozooplankton,

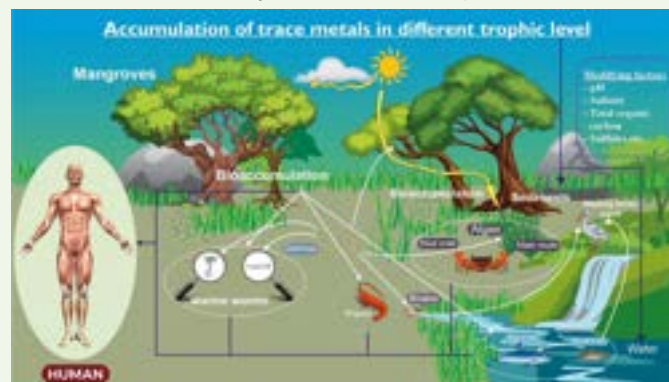


Figure 2: Bioaccumulation of HMs in Different Trophic Levels of the Mangrove Ecosystem

gastropods, copepods, crabs, oysters, shrimp, and fishes from the Sundarbans mangrove have all been tested for HMs (Ali et al., 2022). It was found that the concentrations of HMs varied widely among the various species studied, and several studies also reported the potentiality of bioaccumulation. However, fishes have been shown to have very high levels of arsenic (As) and mercury (Hg) pollution, whereas Mesozooplankton and Copepods have significant levels of copper (Cu), chromium (Cr), iron (Fe), manganese (Mn), nickel (Ni), and zinc (Zn) contamination, according to the obtained data from the previous studies on Sundarbans. The greatest levels of copper (Cu) contamination have been found in oysters, whereas lead (Pb) contamination has been seen in crabs. However, several biotic and abiotic factors influence the accumulation pattern of HMs by fauna, such as species type, feeding behavior (carnivore, omnivore, and herbivore), swimming patterns, metabolic

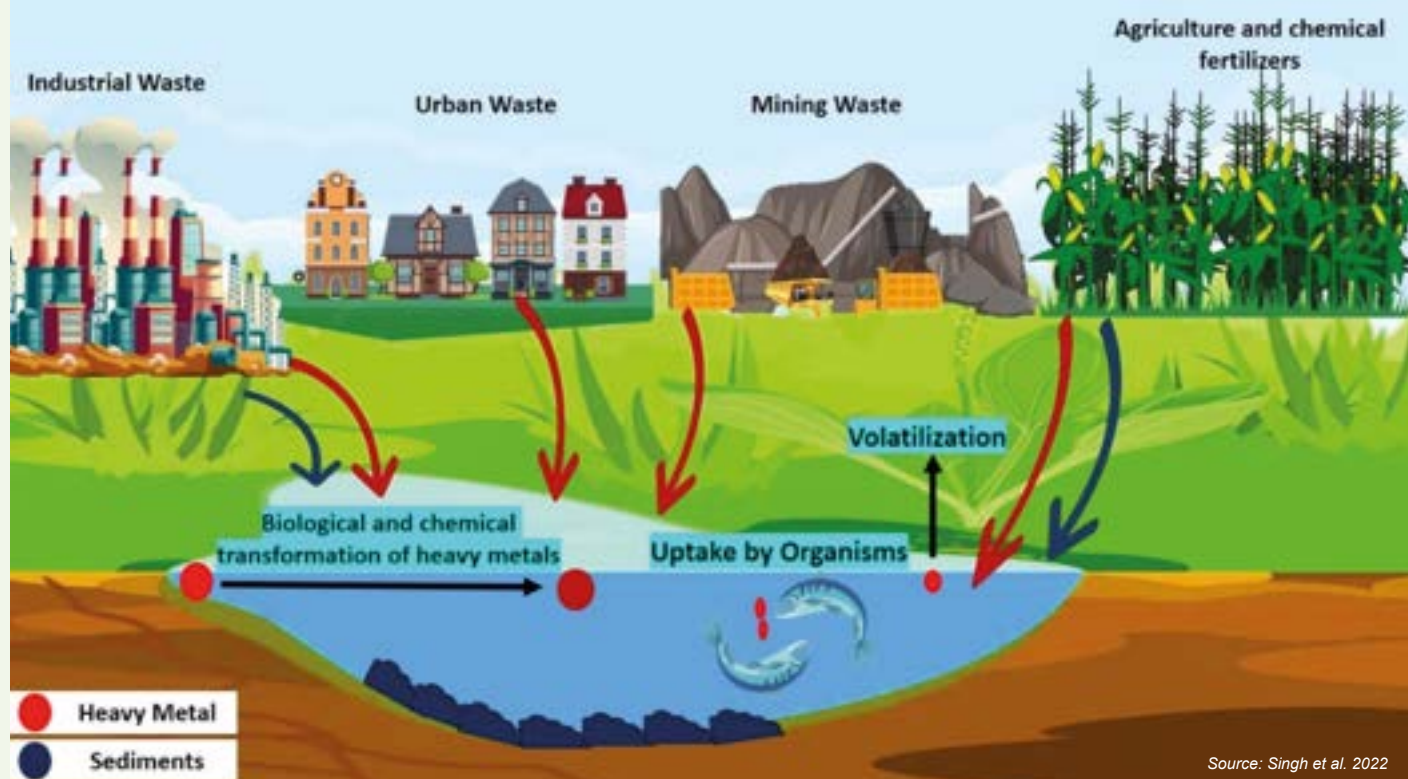
activity, sex, age, size, reproductive cycle, differences in habitat, and living environment (Niane et al., 2015). Most importantly, the bioaccumulation of HMs by mangrove plants and animals poses a concern to the related biota, which includes humans (Kulkarni et al., 2018).

The government and non-government groups in the vicinity of the Sundarbans need to take measures to lessen the pollution caused by HMs. More research is necessary to understand the true extent of metal poisoning in Bangladesh. Taking a core sample of the sediments here would be a great step toward learning more about the long-term effects of metal contamination on this extraordinary ecosystem. HMs may enter the body via the air, water, and food; thus, it's important to undertake model-based human health risk research to determine the extent of the dangers these substances pose. Further studies are needed to identify a suitable biomonitoring agent for trace metals in the Sundarbans. Biomonitoring of HMs in Sundarbans has received surprisingly little attention. Making people aware of the issue of metal pollution in the Sundarbans is another important step. Taking the necessary

steps and implementing the appropriate management plans are essential if we are to restore the Sundarbans' forest and prevent further damage to the ecosystem. When the Sundarbans are designated as an ecologically critical area, strict laws are put in place to protect the area's delicate ecosystem. There must be consequences for rule breakers. The department of the environment must consider nine key points to create an effective ECA management rule to protect the ecology, biodiversity, and natural heritage site that is the Sundarbans: no deforestation; no activities that degrade water quality; no activities that harm aquatic life; no waste disposal in the water body of the ECA area; no oysters, corals, etc. Furthermore, an alternate route must be discovered for the surrounding impoverished populations so that they may reduce their reliance on the Sundarbans.

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Sources of Heavy Metal Contamination in the Environment



PLASTICS

IN THE

OCEAN

Plastics are the most common form of marine debris. They can come from a variety of land- and ocean-based

SOURCES,

ENTER THE WATER

in many ways, and **IMPACT** the ocean and Great Lakes.

Once in the water, plastic debris never fully biodegrades.

COMMONLY FOUND PLASTICS



Cigarettes Butts



Food Wrappers



Beverage Bottles



Straws



Cups & Plates



Bottle Caps



Single Use Bags

HOW TO HELP?



Reduce



Reuse



Recycle



DISPOSE OF WASTE PROPERLY no matter where you are.



GET INVOLVED and participate in local cleanups in your area.



REMEMBER that our land and sea are connected.



ENTANGLEMENT

Marine life can get caught and killed in derelict fishing nets and other plastic debris.



BOATS/NETS

Fishing gear can become marine debris when it is lost or abandoned.

INGESTION

Animals can easily mistake plastic debris for food.

RAIN & WINDS

Rain and wind can sweep debris into nearby waterbodies.

LITTERING

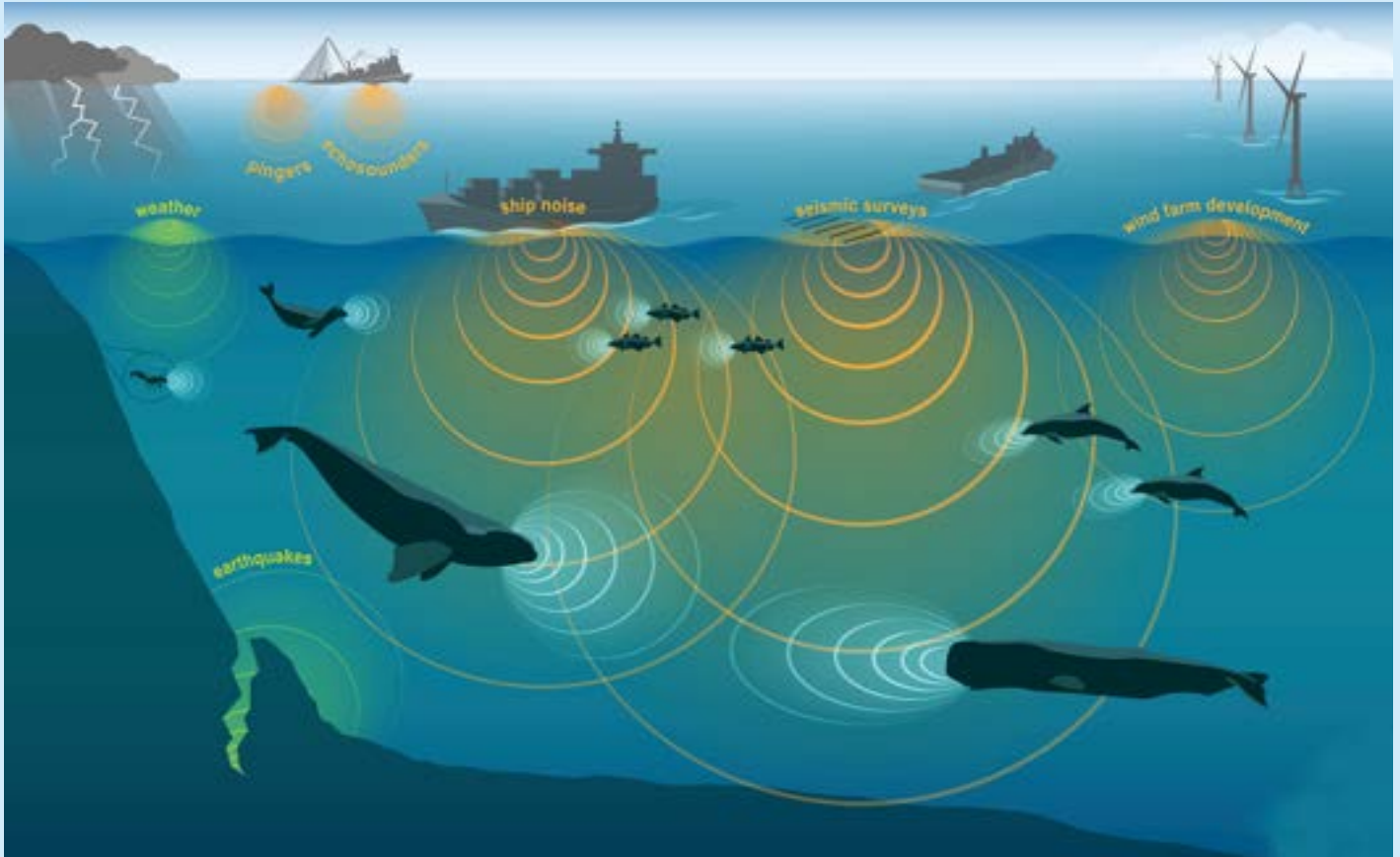
Intentional littering or improper disposal of trash can cause marine debris.

STREAMS & STORM DRAINS

Streams and storm drains can carry debris directly into the ocean or Great Lakes.

Noise Pollution in Marine Environment

Capt A N M Didarul Alam, (L), NUP, psc, BN



Introduction

Most of marine faunae highly rely on underwater sound. In the ocean, visibility is often low, but the sound is transmitted extremely well through water. As a result, it has become a significant sensory signal for marine wildlife, particularly for marine mammals such as whales, dolphins, and porpoises. They depend on sound to communicate, locate mates and prey, evade predators, navigate, and even protect their areas. However, over the last few decades, noise pollution in the marine environment has increased vividly and is threatening the usual soundscape of the marine environment. Ships, seismic surveys, explosions, underwater construction, and sonar devices have made the once peaceful environment into a chaotic area that is very harmful to marine wildlife. This type of pollution is frequently ignored compared to others, but its impacts are now being exposed across all marine ecosystems. Thus, it has compelled policymakers and stakeholders to take appropriate actions. For instance, in 2014, the International Maritime Organization (IMO) issued some guidelines to lessen noise pollution in oceans resulting from commercial shipping, commercial fishing, marine tourism, naval exercises, seismic surveys, oil and gas exploration, pile driving, offshore wind farms, etc.

Sources of Noise Pollution in the Ocean

Commercial Shipping. Commercial shipping is a key contributor to noise pollution in the oceans. Most of the underwater noise is produced by a ship's propeller cavitation. Another significant source of ocean noise pollution formed by ships is their hull vibrations and the vessel's diesel engines.

Construction Activities in the Ocean. These activities, such as dredging, drilling, and installing oil rigs, either along the shoreline or offshore, produce colossal noise. Continuous use of machinery and transports that emit loud noise at low frequencies end up disturbing the everyday life of the ocean's flora and fauna.

Seismic Surveys. Another critical source of underwater noise pollution is seismic surveys. In order to look for the areas that may contain gas or oil, the survey is carried out around the seafloor with the help of seismic air guns. These seismic air guns create low-frequency sounds that can sometimes travel up to 4,000 km, which may last from seconds to days up to months. The use of seismic air guns directly affects marine life. It can also have an impact on the sightings of these faunae and decrease fish catches as well.

Sonars. Sonars are also vital sources that contribute to underwater noise pollution. The active sonars are mainly used by the naval forces in exercises and routine activities such as finding underwater objects like enemy submarines. If not correctly monitored, sonar systems can end up severely disrupting the underwater beings' lives and behaviors, for example, causing hearing loss in fish and making whales lose their way as the unwanted noise interferes with their echolocation and can end up stranded ashore.

Effects on Marine Life

Fluctuations in Behaviors of Mammals Underwater. There is a substantial sign of a sound impact on marine mammals' behavior underwater, whether to a minor extent or significantly. Such behaviors include diving, surfacing, vocalizing, feeding, mating, etc.

Effects on Reproduction, Breeding, and Population. Acoustic communication frequently plays a critical role in the reproductive interactions of marine life. Over eight hundred species of fish have been found to communicate acoustically. A 2017 study described that noise affected acoustic communication and subsequent spawning success in fish. The study found evidence of less acoustic courtship in both species and reduced visual courtship in one species. Exposed species were also subject to less spawning.

Injury and Mortality. Ocean noise pollution has the potential to make a temporary hearing loss in underwater faunae if it is loud or long enough in duration. Research from a 2006 study found that temporary and permanent hearing loss in marine mammals resulted in a reduction in foraging efficiency, reproductive potential, social cohesion, and ability to detect predators.

Measures to Stop Noise Pollution in the Ocean

Awareness. Raising awareness of the problem will play a key role in its resolution. As more people learn about the issue of noise pollution in our oceans, more people will act in the interest of marine mammals to oppose ocean changes.

Annex in MARPOL for Noise Pollution. Adding an annex for noise pollution to MARPOL will aid in preserving marine life. Recognizing noise pollution as a pressing threat will contribute to forthcoming endeavors to resolve it.

Sound Maps. This attempts to survey human-made noises in the ocean by collecting data to make large-scale sound maps. The objective is to better understand the nature of the problem and its influence on sea mammals as a way to find a solution. This mapping allows us to visualize the issue and accelerate efforts to address it through treaties, laws, and regulations.

Acoustic Standards. There is a United Nations body that is accountable for reducing ship pollution and improving marine safety. Members of the organization have already started discussions about how to limit the amount of noise pollution in the oceans, but the issue requires greater attention to ensure better progress.

Restrictions on Sensitive Areas or Rerouting of Ships. Some 60,000 commercial ships occupy the ocean at any given time, creating an inescapable cacophony that threatens the planet's marine life in some places where animals breed, spawn, and feed. Regulatory authorities must restrict these biologically sensitive habitats by rerouting the ships and reduce the activities which cause harm to aquatic ecosystems.

Multi-Client Surveys. Concerned agencies in many countries do not often coordinate or collaborate amongst them when they carry out surveys off the coast; as such multiple surveys in the same area increase the problem of noise pollution. Whereas, coordinated surveys can reduce noise pollution drastically, as it is practiced in Norway. All countries should implement this wise policy to defend against noise pollution.

Refinement of Exploration Methods. Oil and gas exploration equipment like air guns is harmful to marine life. This technique and other systems that use sonar blasts have caused changes in the ocean environment and represent a continuous threat. As such, the concerned agencies should reassess and adapt their methods accordingly.

Redesign of Propellers. One of the most significant contributors to the problem is the standard propeller, which produces millions of collapsing voids and bubbles when it cuts through the seawater. To reduce this "cavitation," engineers have to shape propellers in a particular way, lessening noise and decreasing fuel consumption.

Quiet Technologies. In quieting measures for ship design, layers of sound-absorbing tiles for loud rooms may prove effective. Vibration isolators could also be a solution, and engineers can mount air compressors, pumps, engines, and other types of reciprocating machinery on these isolators to decrease noise.

Additional Studies on the Subject. We must understand the nature of noise pollution and its influence on marine mammals if we are to make a change. Although the subject has already received attention, researchers have to study more about the problem to reach conclusions on how best to manage it.

Conclusion

This ocean has its own lovely sounds, which are calm and harmonious. Research is being conducted to comprehend the impacts of noise pollution in the ocean and find reasonable mitigation methods. However, unlike smoke and oil spills, the noise completely disappears without a trace the moment we stop making it. With this in mind, we can feel confident as we continue our mission to restore ecological harmony. With the cooperative efforts of the concerned organizations around the world, we can return peace to the oceans and treat the creatures who live there with the respect they deserve.

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Need for Pollution-free Marine Tourism in Bangladesh

Lt Cdr S M Anisur Rahman, (H3), BN



Marine tourism has become increasingly popular in recent years as people seek to escape their busy lives and explore the beauty of our oceans. Our country has a long coastline along the Bay of Bengal. Marine tourism has great potential as the country has natural beauty, varied marine life, and cultural significance. In 2021-22 our GDP in arts, entertainment, and recreation was BDT 60,737 million, which was only 0.16% of our total GDP with a growth rate of 13.72% (BBS GDP report 2021-22). This arts, entertainment, and recreation sector mainly includes coastal and marine tourism contributions. The particular sector growth rate indicates Bangladesh has enormous potential to develop coastal and marine tourism. But, apart from infrastructure development, pollution is affecting our marine tourism industry for further growing up, making the beaches unattractive to tourists. The presence of plastic waste, toxic chemicals, and other pollutants is affecting the water quality and making it unsuitable for swimming and other water-based activities.

Major Marine Tourism Spots in Bangladesh

Bangladesh has a long coastline extending from Teknaf to Patuakhali. The famous Cox's Bazar lies in between these two

places. It is the home of the world's longest unbroken sea beach (120 km), which slopes down into the blue water of the Bay of Bengal. Apart from this beach area, other attractive tourist places in Chattogram Division are Inani Beach, Himchori, Sonadia Island, Moheshkhali Island, Teknaf, Kutubdia Island, and Saint Martin's Island. Teknaf lies at the southern tip of Bangladesh territory. Two major marine tourist attractions around the Chattogram city area are Parki and Patenga Sea Beach.

St Martine Island is a beautiful coral island situated 100 km away from Cox's Bazar sea beach and 9 km from Teknaf. Attractions of this island are coral reefs, coconut groves, sea crabs, turtle shells, pearls, etc. The Ministry of Environment, Forest and Climate Change on 4 January 2021 declared an area of 1,743-sq km adjacent to St Martin's Island in the Bay of Bengal as a marine protected area in light of the Wildlife (Conservation and Security) Act. Sonadia is a crescent-shaped island about 7 km northwest of Cox's Bazar. The area of the island is about nine sq km. Sandy western coast, dry fish processing, and colonies of red crabs are the main attractions of this island. In the winter season, a significant number of migrating birds also come here.

Sundarbans, the largest mangrove forest in the world and one of the UNESCO world heritage sites, is situated in the Khulna Division. Khulna has two other important coastal and marine tourist spots; Katka Beach and Dublar Char. The Kuakata sea beach, locally known as Shagor Konnya (Daughter of Ocean), is located in the Barisal Division. Islands such as Monpura, Nijhum Dwip, Char Kukri Mukri, and Sandwip are marine tourism destinations. The famous marine tourism spots of Bangladesh with their activities are shown in the following table:

Division	Marine Tourism Spots	Marine Tourism Activities
Chattogram	Cox's Bazar Beach, Himchori and Inani Beach, Parki Beach, Patenga Beach, St. Martin's Island, Maheshkhali Island, Sonadia Island, Hatiya Island, Sandwip Island, Nijhum Dwip, Teknaf	Sightseeing, surfing, fishing, trekking, hiking, swimming, festivals, local handicrafts, shopping, seafood, SCUBA diving, snorkeling, boat cruising, seafood
Khulna	Sundarbans mangrove forests, Katka and Dublar Char	Sightseeing, boat cruising, fishing, swimming, seafood
Barisal	Kuakata Sea Beach, Manpura Island, Char Kukri Mukri	Sightseeing, festivals, local handicrafts, shopping, fishing, swimming, seafood

Table 1: Famous Marine Tourism Spots in Bangladesh

Contribution to GDP

Presently, Bangladesh's tourist industry economy is about BDT 500 million. In addition, between 2009 and 2018, Bangladesh received US\$ 1157 million from the travel sector. It also created 2.23 million jobs (Akter et al., 2022). But the alarming fact is that, if we only count the number of tourists for marine tourism, it is increasing every year except few exceptions like the year 2020-21 (COVID-19 pandemic). But the rate decreases when we compare the number of inbound with outbound tourists (Table 2). This comparison unveils the need for improvement, which is mainly related to the environment and infrastructure.

Year	Number of Tourists		Growth (%)	
	Inbound Tourists (Arrivals)	Outbound Tourists (Departures)	Arrivals	Departures
2008	4,67,000	8,75,000	61.6	-62.4
2009	2,67,000	22,54,000	-42.8	157.6
2010	3,03,000	19,13,000	-42.94	-15.13
2011	1,57,000	21,27,000	12.95	11.19
2012	1,60,000	22,73,000	1.91	6.86
2013	1,04,000	14,60,000	-35	-35.77
2014	1,34,000	-	28.85	-
2015	1,26,000	-	-5.97	-
2016	1,82,000	-	44.44	-
2017	2,37,000	-	30.22	-
2018	2,67,000	-	12.66	-
2019	3,23,000	-	120.97	-
Average growth (2008-2019) (%)			12.66	10.40

Table 2: Inbound and Outbound Tourists of Bangladesh (Akter et al., 2022)

Marine Tourism and Coastal Pollution Relationship

Marine tourism and coastal pollution are closely related issues that significantly impact our oceans and coastal communities. Marine tourism provides economic benefits to coastal communities, but it also contributes to the problem of coastal pollution.

Marine tourism activities, such as boating and recreational fishing, generate significant waste, including sewage, oil, and plastics. This waste can harm aquatic wildlife and ecosystems, including coral reefs and sensitive habitats, and pollute our oceans. In addition, many tourist activities, such as souvenir shopping and resort development, can destroy essential habitats and the degradation of coastal environments, negatively impacting the tourism experience.

On the other hand, coastal pollution, including litter and sewage discharge, can have a negative impact on the quality of the marine environment and the overall appeal of marine tourism. Polluted beaches, contaminated waters, and the presence of litter can deter tourists and reduce their enjoyment of the marine environment. It can lead to a decline in tourism activity and a loss of income for coastal communities.

Plastic Pollution a Major Concern

A survey (Rakib et al., 2022) was conducted along Cox's Bazar Coastline to count and categorize marine litter.

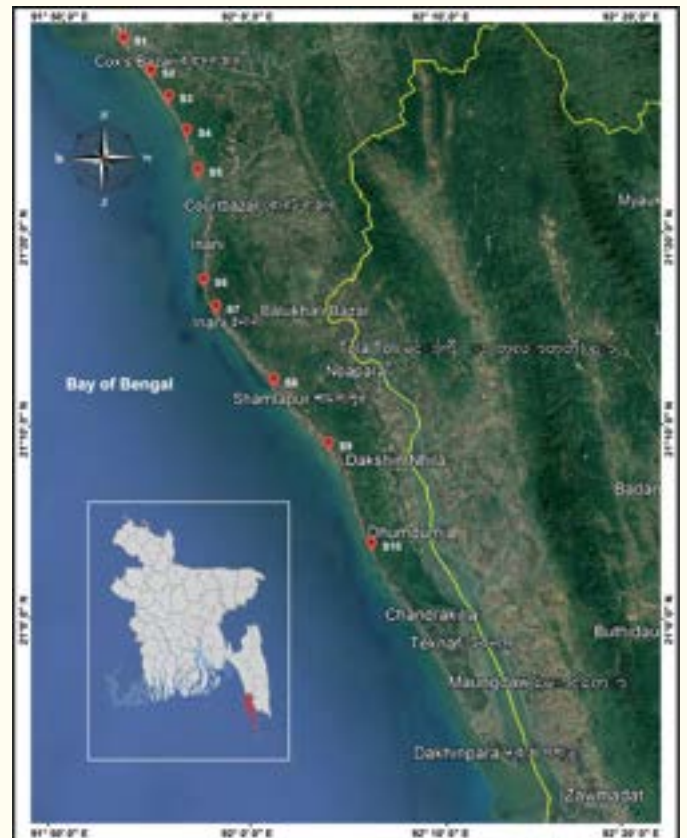


Figure 1: Sampling Stations

Ten sampling stations (Figure 1) were selected based on tourism activities, and litter was collected and counted weekly over a period of 12 weeks from November 2020 to January 2021. The study found 54,401 marine litter items, with plastic litter being the most abundant material in all sampling sites (Figure 2). Straws were the most dominant litter type (12.3%), followed by polythene bags (9.3%). The study concludes that significant quantities of plastic debris are being mismanaged from various activities on beaches and through beach visitors, coastal inhabitants, and beach vendors.

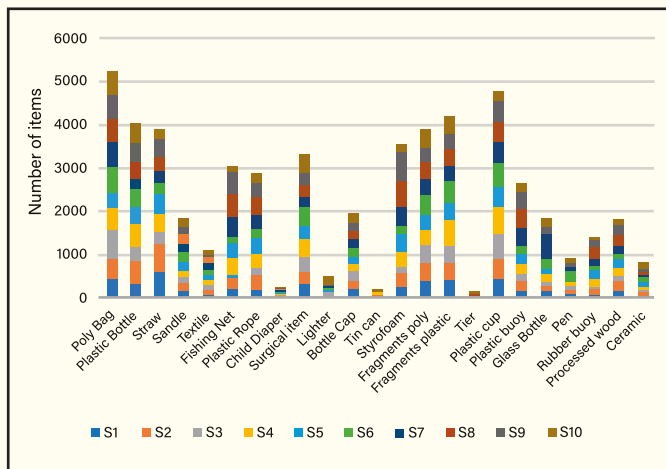


Figure 2: Beach Litter Items Found along Cox's Bazar Coastline

Challenges and Moving Ahead

To combat marine pollution and promote marine tourism, more emphasis should be put on the following activities:

Awareness and Motivation: An awareness and motivation program can help improve marine pollution due to tourists by educating them about the harmful impact of their actions and motivating them to adopt more sustainable behaviors. It can involve providing information about the effects of marine pollution on the environment and marine life and promoting responsible tourism practices such as reducing waste, using eco-friendly products, and supporting local conservation efforts. Additionally, the program can encourage tourists to participate in beach cleanups and other volunteer activities to reduce marine pollution. By increasing awareness and motivation, tourists can be empowered to take actions that contribute to protecting and preserving marine ecosystems.

Effective Waste Management Facilities: Waste management facilities can help enhance beach tourism by providing visitors with a clean and safe environment. Effective waste management ensures that litter and other waste are correctly disposed of, reducing the risk of pollution and environmental degradation. This can be achieved by providing sufficient waste bins and ensuring that they are regularly emptied and maintained. Moreover, waste management facilities can also promote sustainability by implementing practices such as recycling

and composting and by educating visitors about the importance of reducing waste and adopting more sustainable behaviors. By creating a culture of environmental responsibility, waste management facilities can protect the natural beauty and resources of the beach, making it a more attractive and enjoyable destination for tourists. Ultimately, this can increase tourism revenue and support local businesses and economies.

Planned Infrastructure Development: Planned infrastructure development can help to improve beach tourism in several ways. Firstly, it can provide necessary amenities such as public restrooms, showers, and changing areas, improving visitor comfort and convenience. This can encourage more people to visit the beach and spend longer periods there. Secondly, planned infrastructure development can also provide improved access to the beach, such as parking facilities and pedestrian walkways, making it easier and safer for visitors to reach the beach. Thirdly, infrastructure development can also support recreational activities such as beach sports, water activities, and other attractions that can increase visitor engagement and enjoyment. Fourthly, infrastructure development can contribute to preserving and protecting the beach environment by implementing measures such as dune restoration, beach nourishment, and erosion control, which can help maintain the beach's natural beauty and ecological health.

Controlled Tourism: Controlled tourism involves limiting the number of visitors to an area and managing their behavior through education and regulations to reduce the negative impact of tourism on marine ecosystems. This approach promotes sustainable and responsible tourism practices, such as reducing waste and supporting local conservation efforts and supporting the development of conservation initiatives. Controlled tourism helps to minimize the pressure on the marine environment and reduce marine pollution, creating a more sustainable and responsible approach to beach and marine tourism.

Conclusion

Bangladesh strongly depends on foreign currency reserves to manage its economy. The country has the world's longest unbroken sea beach and one of the largest mangrove forests, which can be a significant source of earning foreign currency. Only a healthy, pollution-free environment with adequate infrastructure and controlled marine tourism can ensure such growth. Along with the mentioned activities, Bangladesh needs a proper implementation plan that must be formulated based on intergovernmental coordination and cooperation to protect and maintain healthy marine tourism. All public and private sector stakeholders, including government policymakers, should take a holistic approach to sustainable and pollution-free marine tourism in Bangladesh.

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ANATOMY OF A DEAD ZONE

The term “oxygen producer” might conjure an image of a tree on land, but the world’s oceans contain lots of oxygen producers, too. Marine organisms, such as kelp and phytoplankton, produce more than half of all the oxygen in our atmosphere, as well as much of the oxygen that remains dissolved in the ocean to support marine life. However, in recent decades, scientists have seen an increase in areas of the ocean with too little dissolved oxygen to support life. These lifeless marine regions are commonly called dead zones.

Between 1950 and 2018, ocean dead zones around the world quadrupled in size overall; dead zones in coastal waters increased tenfold, affecting over 500 coastal sites.

Low-oxygen zones
(2 mg/L of O₂ or less)

- Coastal
- Open ocean



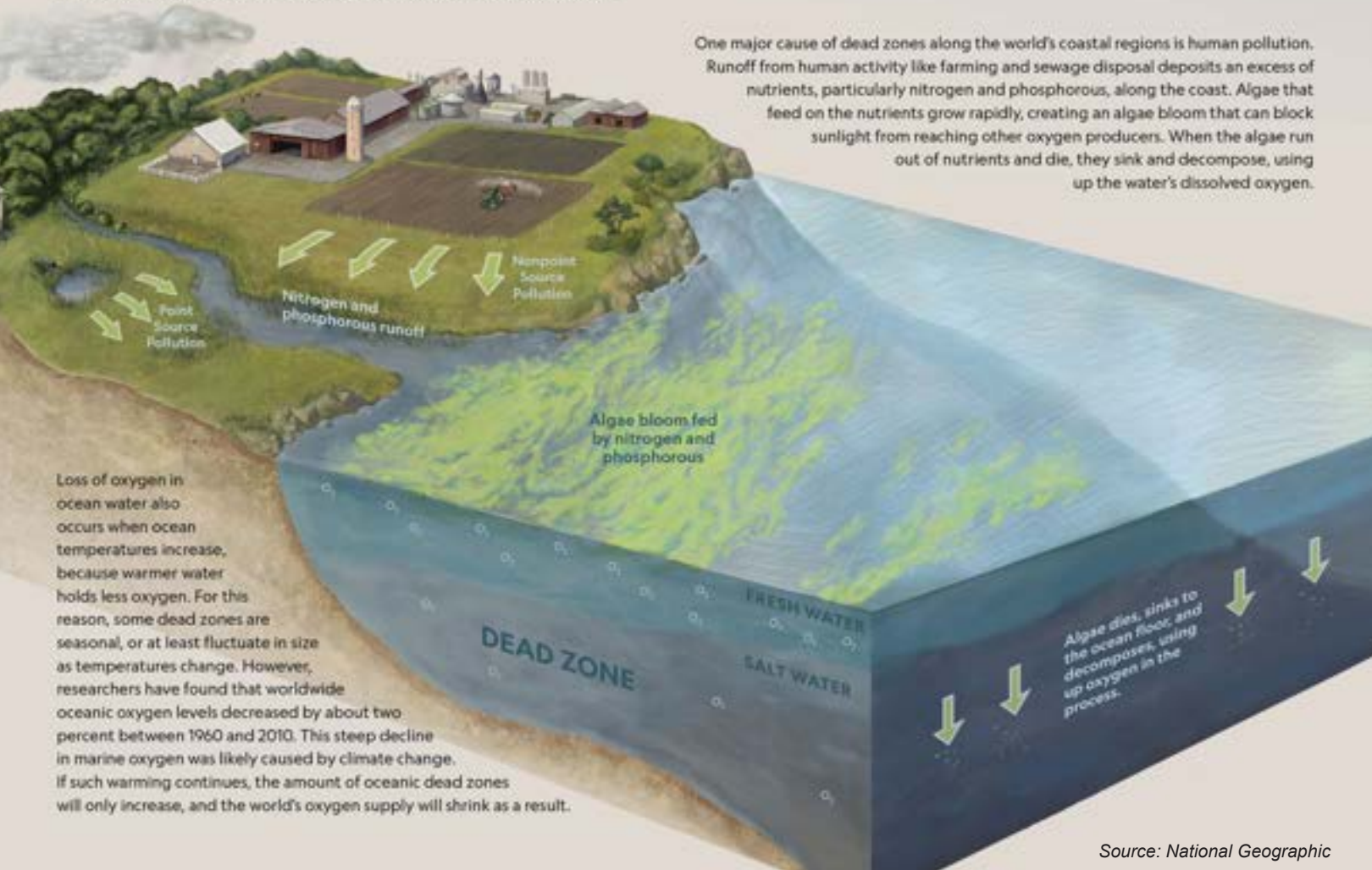
Data sourced from
World Ocean Atlas 2013

In 2018, scientists confirmed a dead zone in the Gulf of Oman measuring almost 165,000 square kilometers (63,700 square miles).

The Gulf of Mexico is home to a dead zone measuring thousands of square kilometers.

Causes of Dead Zones

Dead zones can form for many reasons. In places where fresh water meets heavier salt water, such as where a river empties into the ocean, the two layers have difficulty mixing. This can prevent the more oxygenated upper layer of fresh water from passing its oxygen to the lower layers of salt water.



One major cause of dead zones along the world’s coastal regions is human pollution. Runoff from human activity like farming and sewage disposal deposits an excess of nutrients, particularly nitrogen and phosphorous, along the coast. Algae that feed on the nutrients grow rapidly, creating an algae bloom that can block sunlight from reaching other oxygen producers. When the algae run out of nutrients and die, they sink and decompose, using up the water’s dissolved oxygen.

Loss of oxygen in ocean water also occurs when ocean temperatures increase, because warmer water holds less oxygen. For this reason, some dead zones are seasonal, or at least fluctuate in size as temperatures change. However, researchers have found that worldwide oceanic oxygen levels decreased by about two percent between 1960 and 2010. This steep decline in marine oxygen was likely caused by climate change. If such warming continues, the amount of oceanic dead zones will only increase, and the world’s oxygen supply will shrink as a result.

Dead Zone in the Bay of Bengal: Strategic Priorities for Bangladesh

Afifat Khanam Ritika



A dead zone, approximately half the size of Bangladesh, has been discovered by scientists in the Bay of Bengal, located at depths of 70 meters and below with minimum oxygen levels. Despite the controversy surrounding its existence, reports suggest that it has expanded to 60,000 square kilometers in the center of the Bay of Bengal. Dead zones are ocean areas where the water holds too little oxygen to support most life forms. They are formed when large amounts of nutrients from human activities, such as agriculture and sewage, enter the water and cause rapid algae growth. When the algae die and decompose, they consume all of the oxygen in the water, leaving none for other marine organisms.

The presently discovered dead zone in the Bay of Bengal is expected to impact six countries east of India severely, northeast of Sri Lanka, south of Bangladesh, and west of Thailand, Indonesia, and Myanmar. These countries rely heavily on their fisheries and tourism industries.

Naqvi's study indicates that the dead zone in the Bay of Bengal is not entirely devoid of oxygen but contains minute quantities. This small amount of oxygen is adequate to prevent the system from functioning entirely in anaerobic mode, despite the presence of a microbial population ready to do so. But, there is a high likelihood that the system will become utterly anoxic in the future as the systems are still uncontrolled.

The BoB is experiencing the formation of dead zones, and Bangladesh is believed to be one of the significant contributors. The country's intensive agriculture sector is responsible for most of the nutrient pollution in the Bay of Bengal. Fertilizers and other nutrients are washed into rivers and streams, eventually reaching the Bay of Bengal. Bangladesh's rapidly growing population and inadequate sewage and wastewater treatment facilities are other major contributors to the dead zones. Untreated sewage releases high levels of nutrients into the rivers and streams, leading to the

growth of dead zones. Bangladesh's industrial sector is also a source of water pollution, as factories release untreated waste into rivers and streams, contributing to dead zones' growth. The aforementioned arguments suggest that Bangladesh might play a vital role in developing the dead zone in the Bay of Bengal. Still, it's essential to remember that the problem is complicated and depends on several different elements. It would be inaccurate to solely blame Bangladesh for the dead zone's formation without considering the role of other factors and neighboring countries. The exact extent of Bangladesh's contribution to the dead zone would require further research and analysis.

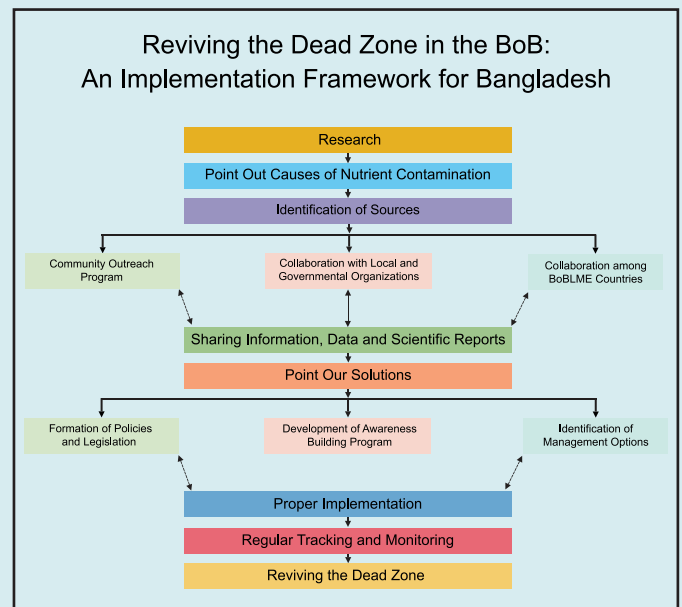


But it is for sure that the effects of dead zones in the Bay of Bengal will be far-reaching and may have severe consequences for the region's marine ecosystems and the people who depend on them, especially in Bangladesh. Dead zones can devastate the diversity and abundance of marine species, leading to declines in fish populations and other important species. The decline in fish populations can have severe consequences for the livelihoods of fishing communities and the region's overall economy. Furthermore, releasing toxic substances from the breakdown of dead algae can also threaten human health, especially in areas where saline water is consumed directly. Addressing this issue is crucial to protecting the health and welfare of the people who reside near the Bay of Bengal.

However, dead zones can expand when the number of nutrients entering a body of water increases in an uncontrolled manner. Climate change can also worsen dead zones by increasing

water temperatures and causing extreme weather events that lead to more nutrient runoff. One example of an expanded dead zone is the Gulf of Mexico's dead zone. The Gulf of Mexico is one of the world's largest dead zones, covering an area of about 8,000 square miles. The dead zone in the Gulf of Mexico is caused by nutrient runoff from agricultural lands in the Mississippi River basin, which drains into the Gulf of Mexico. The size of the Gulf of Mexico's dead zone varies yearly, depending on rainfall and agricultural practices. In recent years, the dead zone has expanded due to increased nutrient runoff from agricultural lands and more extreme weather events caused by climate change.

So, it is high time for Bangladesh to adopt a thorough strategy addressing the underlying causes of nutrient contamination to address the problem of dead zones in the Bay of Bengal. This can be achieved through various measures, including improving agricultural practices, upgrading sewage and wastewater treatment facilities, and enforcing regulations on industrial waste. For example, farmers in Bangladesh can be encouraged to use fertilizer more efficiently and adopt sustainable agricultural practices that reduce the amount of runoff entering the Bay. Similarly, upgrading sewage and wastewater treatment facilities can help to reduce the number of nutrients entering the Bay from human waste.



In addition to these measures, there is also a need for greater awareness and education about the issue of dead zones in the Bay of Bengal. The public, particularly those living near the coast, needs to understand the causes and consequences of dead zones and the steps that can be taken to prevent their development. Many activities, such as public education campaigns, community outreach programs, and collaboration with local organizations and governments, can help achieve this.

It is also essential to recognize that addressing the issue of dead zones in the Bay of Bengal will require international

cooperation and support. Several countries share the Bay of Bengal, and all of these countries must work together to address the problem. This can include sharing best practices, developing and implementing regional action plans, and working together to monitor and reduce nutrient pollution in the Bay.

Marine pollution control in Bangladesh is plagued by numerous gaps and challenges, ranging from information/data gaps to policy and implementation issues. Scientific information on pollution hotspots and pollution attenuation still needs to be improved, and there is only fragmentary primary data. Most BOBLME countries, including Bangladesh, do not know the allowable limit of toxic discharge, and there are no standard policies for data collection. BOBLME countries do not regularly share proper data, and the available data needs to be updated.

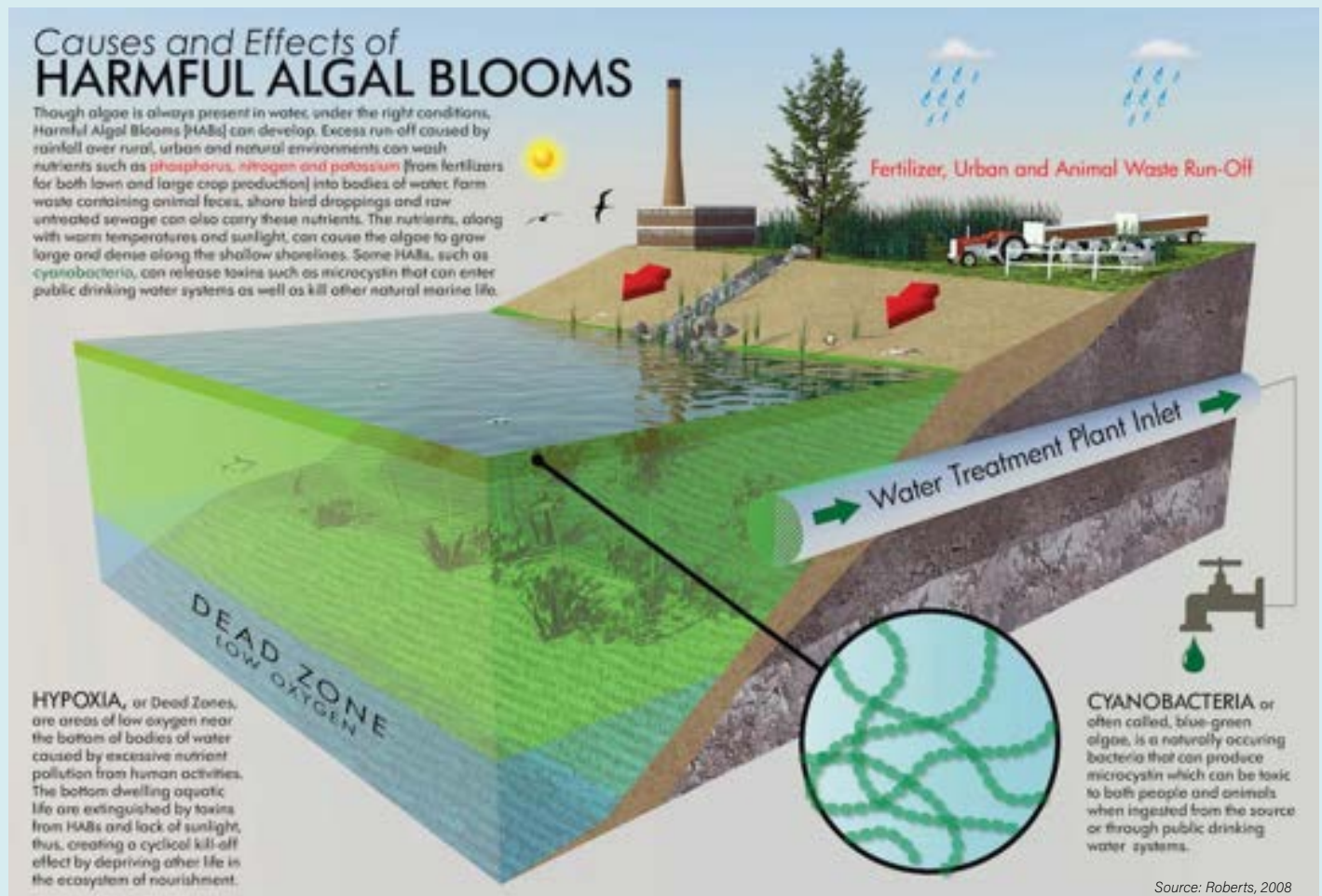
Policies and legislation also need to be improved in several areas. There needs to be vital networking among policymakers and a wide gap in collaboration between government and non-governmental organizations. Laws and management systems are deteriorating, and there is a blindness to laws and legislation among the people.

Implementation issues also contribute to the problem, with a lack of trained manpower and awareness, financial problems, and proper instruments at key institutions like BUET, IMSF, and BSTI.

Finally, there needs to be more reporting and publicity of pollution status to the public. There needs to be proper reporting, a remarkable report card of pollution status, and a lack of publicity through TV channels. These gaps in information, policy, implementation, and reporting are significant challenges that must be addressed to control marine pollution in Bangladesh effectively.

In conclusion, the formation and expansion of dead zones in the Bay of Bengal is a severe issue that requires immediate attention. The country must address the root causes of nutrient pollution and reduce the impact of dead zones on the region's marine ecosystems and the people who depend on them. By working together and taking a comprehensive approach, it is possible to protect the Bay of Bengal and ensure a sustainable future for the region.

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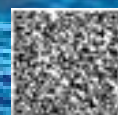
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Global and Regional Initiatives to Tackle Marine Pollution: Existing Frameworks and Way Forward

Nur Ahmed



Marine pollution is a global environmental issue that affects the entire world. It is caused by the release of various forms of waste and contaminants into the ocean, such as oil spills, plastic litter, chemicals, and sewage. This pollution poses a threat to the marine ecosystem and wildlife, as well as to the health of humans who depend on the ocean for food and livelihood. Various international frameworks have been established to tackle marine pollution. One of the most important international frameworks for combating marine pollution is the International Convention for the Prevention of Pollution from Ships (MARPOL). Established in 1973 and amended in 1978 and 1997, MARPOL is the leading international treaty to prevent pollution from ships. It sets out specific requirements for ship design, construction, and operation to minimize their impact on the marine environment, including releasing pollutants into the ocean. The Convention covers several forms of marine pollution, including oil, chemicals, and garbage. It requires ships to carry appropriate equipment and materials to prevent or minimize pollution in the event of an accident.

Another important international framework to reduce marine pollution is the London Convention and the London Protocol. Established in 1972, the London Convention is an international treaty aimed at preventing and reducing marine environment pollution from dumping waste and other matters. The Convention was amended in 1996 to include the London Protocol, which extends the scope of the Convention to cover the dumping of certain hazardous substances. The United Nations

Convention on the Law of the Sea (UNCLOS) is a landmark international framework that also addresses the issue of marine pollution. UNCLOS sets out the legal framework for using the ocean and its resources, including protecting and preserving the marine environment. It also provides for the cooperation of states in protecting the marine environment, including preventing and reducing marine pollution and settling disputes relating to protecting the marine environment.

There are various agreements that are aimed at protecting the marine environment against different forms of marine pollution. For example, the UN Fish Stocks Agreement 1995 aims to ensure the sustainable management of straddling and highly migratory fish stocks and to prevent marine pollution from fishing activities. Another UN treaty, Convention on Biological Diversity (CBD 1992), aims to conserve and sustainably use the world's biological diversity, including marine biodiversity, and prevent marine pollution. Global Programme of Action for the Protection of the Marine Environment from Land-Based Activities (GPA 1995): This initiative aims to prevent and reduce marine pollution from land-based activities, such as agriculture, sewage discharge, and industrial wastewater.

In addition to these international frameworks, various regional agreements and initiatives have been established to address marine pollution. For example, the OSPAR Convention is a regional convention to protect the North-East Atlantic and its marine environment from pollution. The Convention covers a range of issues, including reducing emissions of hazardous

substances, the management of waste from ships and offshore installations, and preventing and controlling marine pollution. Another regional initiative to address marine pollution is the Mediterranean Action Plan, an initiative of the United Nations Environment Programme (UNEP) to address marine pollution in the Mediterranean Sea. The Barcelona Convention 1976 was formulated to prevent and combat marine pollution from ships and aerial sources in the Mediterranean Sea.



South Asia is home to distinctive marine and coastal ecosystems, which are critical for the environment and people of this region. Marine pollution poses a threat to the marine ecosystem and wildlife, as well as to the health of the people of this region who depend on the ocean for food and livelihood. The nature of the problem of marine pollution resembles transnational impacts, which are not contained within the areas under national jurisdiction. Thus it becomes impossible to tackle the issue single-handedly, and it mandates regional cooperation. However, South Asia is not conducive to the idea of regional integration, as any initiative fails to yield substantive results due to political mistrust. The danger of regional non-cooperation can be huge in the case of marine pollution. Most South Asian countries are at high risk of maritime accidents induced oil spillage, which has the potential to endanger the marine environment. It is high time the countries took the issue seriously and opted for effective political cooperation.

Various regional frameworks have been established in South Asia to tackle the issue of marine pollution. The South Asia Cooperative Environment Programme (SACEP) was founded in 1982. It has established a number of initiatives and projects aimed at reducing the amount of pollutants entering the ocean and preserving the marine environment for future generations, including the development of joint policies and legislation, the implementation of targeted projects and activities, and the promotion of cooperation and coordination among countries in the region. The South Asian Seas Programme (SASP) is a regional initiative to address marine pollution in South Asia. It is a collaboration between the United Nations Development Programme (UNDP) and the United Nations Environment

Programme (UNEP) that seeks to promote cooperation and coordination among South Asian countries in their efforts to protect and conserve the marine environment.

Another regional framework to tackle marine pollution in South Asia is the Bay of Bengal Initiative for Multi-Sectoral Technical and Economic Cooperation (BIMSTEC). This initiative was established in 1997 and aimed to enhance economic and technical cooperation among the countries of the Bay of Bengal

region. One of the main goals of the BIMSTEC is to promote sustainable development and reduce marine pollution in the region. The BIMSTEC has established several working groups to address specific environmental issues, including marine pollution, and is working to develop regional policies and legislation to address this issue. Although the efficacy of SAARC is seriously questionable, it has established several working groups to address marine pollution. The Indian Ocean Rim Association (IORA) is another regional framework that works on the issue of marine pollution in South Asia. The IORA has established several working groups to address specific environmental issues, including marine pollution, and is working to develop targeted projects and activities to address this issue.

In conclusion, marine pollution is a global environmental issue that affects the entire world, and it is essential that international and regional frameworks are established to tackle this issue. These frameworks provide a basis for cooperation and coordination among countries. There are several existing regional frameworks aimed at tackling marine pollution in South Asia. These regional frameworks have to be reinvigorated in order to yield substantive results. By working together, these organizations can significantly reduce marine pollution in South Asia and ensure the long-term health of the marine environment and the people who depend on it. At the same time, newer forums on issues like oil spillage and climate change have to be explored to expedite the preparedness of the countries to tackle the adverse impacts.

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Fallout of Russia-Ukraine Conflict: Food Crisis is Looming on the Horizon

Cdre Md Mostafizur Rahman, (TAS), NGP, afwc, psc, BN



Introduction

Once again, the world realizes, though with massive cost, as the old powerful and heart-touching saying reminds us, "when elephants fight, the grass gets trampled." Over the last year, while the globe was just about to return to its regular track after the costliest sufferings of mankind from Covid-19, ongoing conflict appeared like "a bolt from the blue". Under a destructive global pandemic, the Russian-Ukrainian struggle has dashed hopes for a smooth recovery of the delicate global economy. It has also caused a global humanist crisis in Europe, raising food and commodity prices and worsening deflationary imperatives. On the other hand, the blockade of Black Sea ports due to this conflict, which significantly complicates the supply chain, reminds the importance of 'Sea Lines of Communication (SLOC).' Today, the confrontation in the Black Sea, one of the world's six bread basket regions and a significant

supply and transit hub for grain and fertilizer, is putting global food security at significant risk.

Changing Geopolitics

The conflict has opened up new fronts; Proxy War is being continued. Some are sweeping Russia politically and economically, whereas Russia is rocking Ukraine militarily. The world is reeling from conflicts, diplomatic tensions, recessions, and imbalances. Global energy crises are causing political instability and unrest in some places. This conflict has triggered a dramatic new phase in the long-term reshaping of our world. These power politics are changing the global geopolitical orbit. The conflict in Ukraine harbingers the most critical geopolitical shift since the end of the Cold War. The world order has become progressively volatile, which began a

shift from a unipolar to a multipolar world, from one global superpower to several great powers, and from non-align to multi-align policies.

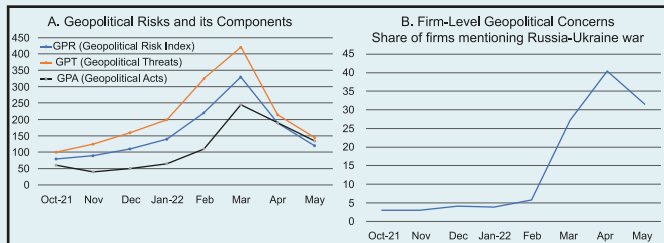


Figure 1: Risks and Concerns of Geopolitics (Source: Staff Calculations of Federal Reserve Board)

Grain Corridor Diplomacy of Turkey

Turkey has become an appropriate actor in the ongoing hostilities by pursuing HADR and mediation activities. Turkey's role in the grain corridor negotiations reflects its contemporary foreign policy. She is marching forward where soft power components are being used in a more poised manner. Her successful mediation in the grain corridor talks helped to normalize relations with the countries concerned and gave her more significant exposure to global geopolitics. Indeed, Turkey is a critical player in the Black Sea region precisely because it possesses maritime choke points and vital straits.

Russia and Ukraine in the Context of Global Food Supply Chain

Russia and Ukraine export about 31% of wheat and barley to the world market. They are the two leading suppliers of corn and sunflower oil. The importance of Black Sea region is dominant in the supply of various crops, fertilizers, and energy. Most of the world's countries, such as North Africa and the Middle East, EU countries, South Asian countries, and China, depend on this region for their nutritional needs.

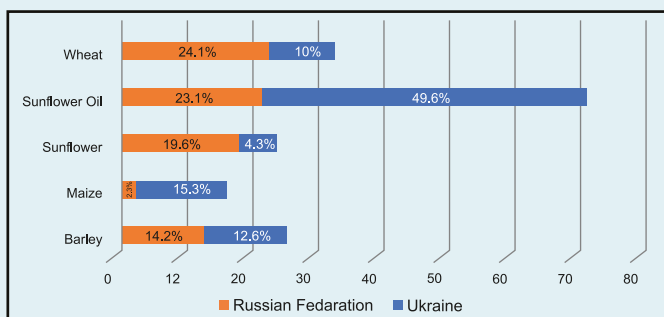


Figure 2: Statistics of Russia and Ukraine in Global Food Trade (Source: Laborde and Glauber)

Many developing nations depend so much on the import of food grain from Russia and Ukraine. Libya, Mauritania, Mongolia, and many high-income countries also import other grains from this region. "Among countries from the ECA region, the Netherlands imports 30% of its consumption from the Black Sea region and Portugal 24%" (Report of World Bank Group 2022). The following table is giving an idea about the

dependency on wheat of a few countries from this region:

Ser	Country	Dependency on Wheat
1.	Nicaragua	86%
2.	Lebanon	86%
3.	Congo	67%
4.	Niger	60%
5.	Bangladesh	41%

Table 1: Dependency of Few Countries on Wheat

Regarding the global market and trade in fertilizers, Russia is the primary initiator. Belarus is also a key country in this respect. Both countries are the center of supply of potassium fertilizers, occupying the 2nd and 3rd place in the world order, respectively. Brazil suffers the most as soybean cultivation heavily depends on potash fertilizers from Russia and Belarus. The country is severely affected as the world's largest soybean producer. This is a testament to the world's interdependence, especially regarding food.

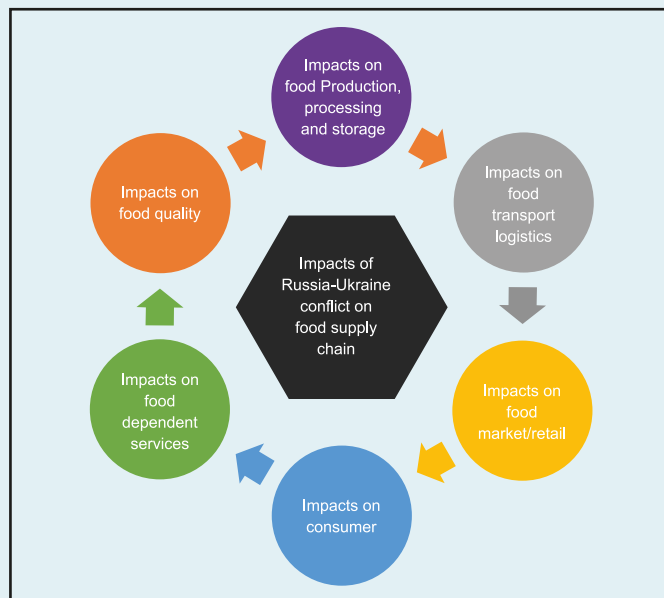


Figure 3: Impacts of the Russia-Ukraine Conflict on the Global Food Supply Chain

Importance of SLOC in The Black Sea and Turkey's Mediating Role

The world again realizes the dependency on the Black Sea in the global food trade. Approximately 90% of wheat and other grain from Ukraine are shipped to the world market by sea, which is now being disrupted. Ukraine provides 4% of the global seafarers. Sanctions on the banking sector and shipping make it harder for Russia to export food and fertilizer. Foreign shipping companies are also denying to carry those. Turkey proposes to open a grain corridor in the Black Sea to prevent the threat of famine in the global context as a repetition of the history of WW I. The agreement was signed on 22 July 2022 by the UN Secretary-General. Subsequently, a Joint Coordination Center (JCC) was established in Istanbul. This agreement brought

the Ministers of Defense to the negotiating table. Both sides showed how much they needed this corridor. The shipping commenced on 02 Aug 2022 with the sailing of an Egyptian vessel laden with food grain from the Port of Odesa destined for Lebanon. Although the corridor continues, there are still shipping problems. Insurance companies like P&I Club are urging for clearing the sea mines and international protection as a prerequisite. The IMO assumes that it is impossible to normalize shipping traffic unless the threat of sea mines is neutralized.

Way Forward

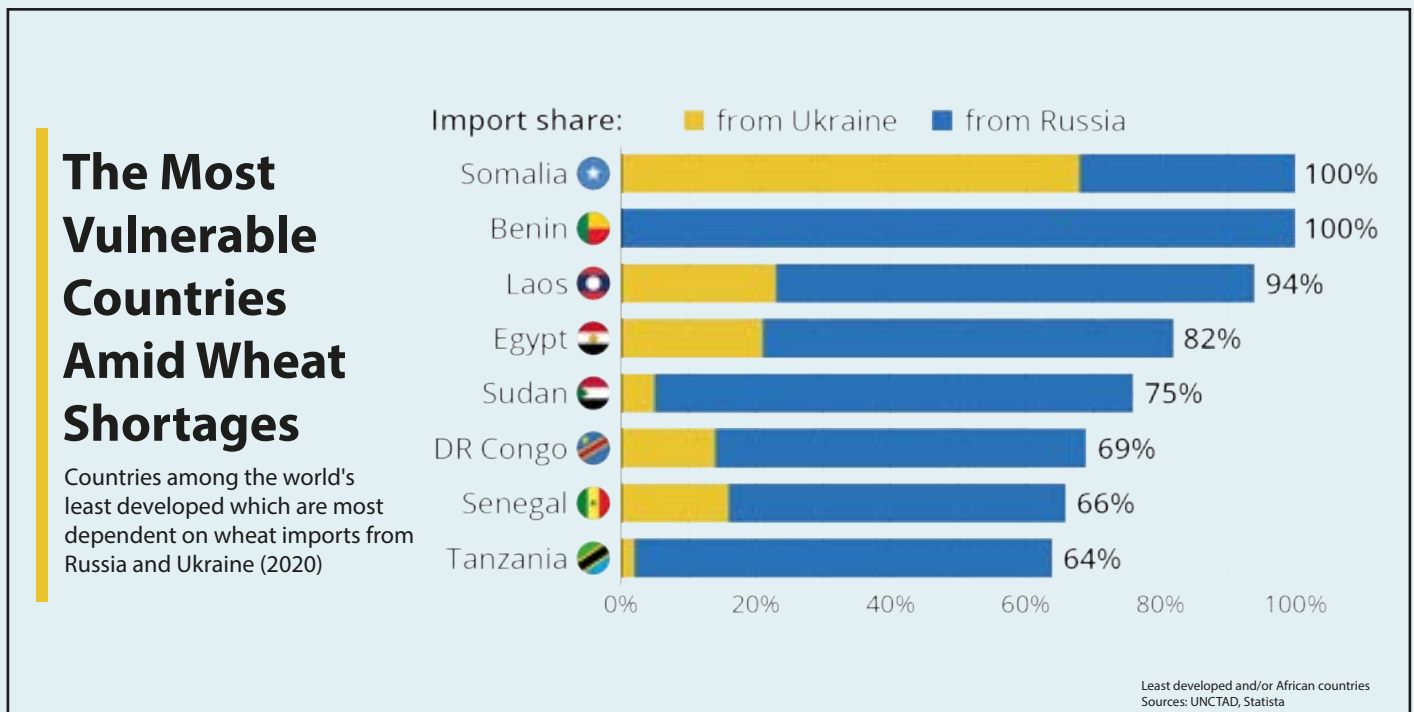
The global community needs urgent action to meet the Sustainable development goal requirements for food stability. The Secretary General of the United Nations urges world leaders to find a solution and must work in coordination with global solidarity. Developed countries can help others by abandoning food nationalism, export restrictions, and policies that badly affect the global food trade, such as lifting sanctions against Russia. The blockade of ports must be lifted immediately to ensure grains and fertilizers flow freely, where the IMO may play a pivotal role. Addressing the root causes of food insecurity is the way forward. Governments may have a long-term plan to diversify agriculture and reduce dependency. The role of the UN, FAO, the International Fund for Agricultural Development, and WFP could be strengthened. Global awareness to reduce food loss and waste is a call of the times. There is also the need to materialize the "leave no land uncultivated" policy. Like South Sudan, "although 50% of its arable land is primarily agricultural land, only 4% of this area is under cultivation. With its high potential for agricultural production, South Sudan could become the bread basket of

Africa". Global dependency on maritime choke points is growing for grain and fertilizer trade. Therefore, the IMO may design regulatory policies to keep maritime choke points open for peaceful use, even during the hostilities.

Conclusion

Finding ways out of hostilities is difficult as long as strategic interests and rights of geopolitical actors take precedence over the international system. Geo-economics is increasingly influencing modern geopolitics. As the ongoing confrontation drags on, global suffering continues. The effects of this conflict and economic shocks combine to create an unprecedented food crisis. The Pulitzer Prize-winning picture of 1993, "The Vulture and the Little Girl" by Kevin Carter, is still fresh in our memory, depicting the sufferings of starved children. Should we return to that while trying to portray the world as one family? Maritime trade depends on complex global shipping and port operations. If world trade is to be smoother, it must be ensured that ports are open to international shipping. In this respect, the Grain Corridor Agreement is a timely and effective measure that needs to work correctly. Humanity first and careful diplomacy in this VUCA world is at the heart of passage planning. Both Russia and Ukraine are considered 'global breadbasket.' What if they become a bottomless basket? Those who use food as a weapon may consider that revolutions are built on an empty stomach. Time flies, if not now, never again. We need to stop the conflict - is a clarion call of the times.

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Security Pluralism and Maritime Cooperation in the Age of Anthropocene: Challenges and Prospects in the Bay of Bengal

Dr. Niloy Ranjan Biswas



In the maritime domain, understanding insecurity is not just an epistemological dilemma; it is indeed more ontological in nature. What is security in the ocean and the surroundings? Whose security is at stake, and against what threats? This leads to another question. In what Paul Crutzen and others discussed, how do we frame security crisis in the age of Anthropocene—human dominance on the earth's geological, biological, and chemical processes? The Anthropocene lens highlights the fundamental transformation in ecological interdependencies by making human beings the dominant global species at the cost of damaging the relationship with the environment. The maritime domain is the most critical in this aspect, and it became a new ecologically turned geological space in the age of the Anthropocene. It may be implausible to confine the maritime security issues within the binary, i.e., traditional vs. non-traditional, lenses. Therefore, the big question will be whether or not addressing maritime security issues may rely on the balance of power. How would one shape the maritime security ecosystem in the Bay of Bengal

in the Anthropocene? This write-up attempts to dig deeper into the potentiality of Amitav Acharya's security pluralism to understand a cooperative security community's viability in the Bay of Bengal (BoB) context.

Why is the Bay of Bengal a critical maritime space? Sunil Amrith, in his books *Unruly Waters: How Mountain Rivers and Monsoons Have Shaped South Asia's History* and *Crossing the Bay of Bengal*, established how the Bay of Bengal constitutes a plethora of opportunities and complications and prospects of exploration of the marine resources. An epistemological perspective of security, as Amrith demonstrates, refers to the fact that the future of BoB is uncertain as it is constantly changing due to a mingling of traditional power rivalries between states and the non-traditional threats of people's movements and environmental challenges. It is not exaggerating even to argue that the BoB has re-positioned itself at the core of International Politics by re-branding the broader maritime vision of the 'Indo-Pacific' with an extension of some significant states' interests

in energy resources, shipping lanes, and cultural influences. Who controls the waves of the ocean—is, unfortunately, the dominant point of exit that plays a critical role in shaping the maritime security framework.

Undoubtedly, the geopolitics of oceans haunt states' foreign policies in various ways, and they often traverse beyond Mahan and Corbett's framing of sea power. The BoB and its littoral states are no exception here. The BoB's strategic location is reconstructed, and it has demanded that the coastal states reconsider their military, economic, and political relations with the states of concern accordingly. National interests become a key determining factor in facilitating such relationships. In this very statist posture, how would we address the anthropocentric maritime security concerns through the lens of cooperative security architecture? Does the BoB demonstrate any potential to formulate a maritime security community?

Non-traditional security concerns are multidimensional, involving many internal, regional, and transnational threats. The economic, environmental, and social forces are influenced and mobilized due to the inception of such threats. The security threats range from maritime terrorism to piracy, drug

norms, and mutual or shared imperatives to preserve the status quo and growth of the cooperative order. Inspired by Karl Deutsch's security community, Acharya and other scholars have excelled in the ideas of proactive, collaborative security frameworks. Security pluralism, as Acharya extends, is not an extension of national security doctrines. It rather respects the role and autonomy of all big or smaller nations.

The interdependence of coastal states in the BoB on marine issues is significant. Freedom of uninterrupted lawful navigation and countering irregular and transnational threats would enhance global stability benefitting all nations. The relative efforts to introduce and materialize collaborative efforts among the BoB Littorals with relative homogeneity. These countries, mostly remaining climate-vulnerable states, have experienced challenges and aspirations. India and Myanmar have settled maritime disputes with Bangladesh amicably through the international judiciary. The criticality of interdependence for the BoB coastal states is further evident in addressing climate-induced cross-border migration in Bangladesh, India, Myanmar, Sri Lanka, and Indonesia. Climate threats, internal migration, and resource competition have triggered long-standing ethno-religious cleavages in this region.

The Bay of Bengal's strategic location is reconstructed, and it has demanded that the coastal states reconsider their military, economic, and political relations with the states of concern accordingly. National interests become a key determining factor in facilitating such relationships

trafficking, and illegal and forced migration. The region's water has been experiencing one of the most significant refugee influx owing to the Rohingya Crisis. The BoB has become a hotspot of climate vulnerability with depleting resources. International Panel on Climate Change (IPCC) report highlights how extreme floods increase economic loss in the coastal cities of the Indian Ocean and the Bay of Bengal. Rising sea levels make cities susceptible to sinking. Several events of dead sea fish washed ashore in the last few years. The complex social, economic, and political drivers of environmental destructions demand a broadening and deepening of anthropocentric insecurity in the maritime domain in the Bay of Bengal. Amitav Ghosh's *The Great Derangement: Climate Change and the Unthinkable* narrated the insecurity dilemma more eloquently. Can the ontological insecurity in the Bay of Bengal be understood and resolved? How?

Amitav Acharya's security pluralism can be a plausible normative framework that embraces cooperative security through an inclusive multilateral framework. The normative aspect of security pluralism is vital and requires instrumenting a positive relationship between security conditions. Withering away containment and deterrence components, security pluralism refers to an interplay of interdependence, institutions,

These realities also enforce some forms of equilibrium or stability of relations between the littoral states to extend interdependence.

Harnessing the blue economy is the new norm in maritime trans-regional cooperation, which demands sustainable use of marine resources. It requires cooperation among the littoral states to continue the exploration of resources using sophisticated technologies. Regional and sub-regional connectivity is crucial in this regard. The BoB littoral states have promoted road, rail, and sea connectivity projects, resulting in more cooperation and opportunities. Bangladesh has continuously supported Bangladesh, Bhutan, India, and Nepal (BBIN) Motor Vehicle Agreement, Bangladesh, China, India, and Myanmar (BCIM) Economic Corridor, BIMSTEC, and Indian Ocean Rim Association (IORA) ventures to demonstrate cooperative security and development framework in multilateral platforms. It has also balanced between the connectivity projects of the China-led Belt and Road Initiatives (BRI) and the Indo-Pacific ventures of the West concerning maritime connectivity initiatives. It is important to note that the BoB crosses the path of the regional structures of the ASEAN, BIMSTECs, and SAARC and by the supra-structure such as the IORA. These plural multilateral platforms may need to move

forward with ideas of cooperation in preventing marine pollution, safeguarding traditional fishing communities, small-scale fishing in coastal regions, and protecting ecology through saving forests, flora, and fauna. The Anthropocene lens is significant in framing this cooperative dimension of connectivity.

Is the presence of big powers a challenge that targets a profound entanglement toward power politics and state-focused progress at the cost of the anthropocentric decline of ecology? China and the United States have vividly been mastering the security conditions in the Bay of Bengal, offering instruments for cooperation, such as investment, loans, and trading opportunities. They also pose the risk of hedging and balance of power in the framework of containment between the regional and extra-regional powers in the BoB. The commitments of these countries to protect the environment and, therefore, align strategic and economic development in line with the anthropocentric lens are not mutual and not very visibly promising yet. The presence of power politics is an existential reality in the region with security and economic implications. Nevertheless, a continuous effort from epistemic and policy communities of the region is necessary, which would enforce to create an opportunity to reorient a collective sense of security through the maritime ecosystem, improving the quality of life and increasing the livelihood opportunities of vulnerable communities of the littoral states.

Security pluralism offers more potential to frame the maritime security ecosystem in the Bay of Bengal. Only the state-centric

so-called comprehensive security may not excel in the outputs from trans-regional multilateral platforms. The slowness of the functionality of SAARC and BIMSTEC is a case in point here. Bilateral security agreements between littoral states are critical; nevertheless, they may need to focus on collective efforts to protect shared sustainability imperatives through promoting connectivity in norms, identities, and politics. Most importantly, there is a need to move beyond land-based geopolitics and conventional regional identity. The Anthropocene lens is a critical way out in this regard.

This write-up attempts to deconstruct the impression of maritime security, which is embellished mainly through the ideas of power politics promoted by conventional maritime military powers. The traditional wisdom “one who rules the sea rules the land” is not fully extraneous at this time; however, it remains biased in omitting the opportunity to grasp the totality of ontological insecurity in the age of the Anthropocene. The major normative appeal, therefore, is that maritime security should not be confined only to the geo-political great games. A south-south maritime security community perspective is more practical and essential to yielding visible outcomes and fostering relationships between the littoral states. Security pluralism merits further academic and programmatic interventions in promoting a cooperative security framework in the Bay of Bengal.

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Source: <https://fulcrum-maritime.groupcls.com/maritime-support-solutions/>

খুশিলি রাবার ফ্যাক্টরি

রাবার যন্ত্রাংশ তৈরীর বিশেষ প্রতিষ্ঠান



মান অম্মত রাবার যন্ত্রাংশ সরবরাহের মাধ্যমে কাস্টমারের অসুখি অর্জনই আমাদের একমাত্র লক্ষ্য

- ★ স্যাম্পল অথবা ড্রইং প্রাপ্তি সাপেক্ষে যে কোন ধরনের রাবার স্পেয়ার্স তৈরী করা হয়।
- ★ উন্নত কাঁচামাল ব্যবহার করে আন্তর্জাতিক মানের বিদেশী মেশিনে প্রতিটি রাবার স্পেয়ার্স তৈরী করা হয়।
- ★ আধুনিক ল্যাবরেটরীতে প্রতিটি রাবার স্পেয়ার্স নিরীক্ষার মাধ্যমে মান নিয়ন্ত্রণ করা হয়।
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- ★ আমাদের কার্যক্রম আন্তর্জাতিক ক্লাসিফিকেশন সোসাইটি **Bureau Veritas** দ্বারা সনদ প্রাপ্ত।



আমাদের প্রোডাক্ট সম্ভারঃ

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- * ইঞ্জিন মাউন্টিং * শেয়ার টাইপ মাউন্টিং * ওয়েল সীল * রাবার ইমপেলার * রাবার বেলুস * রাবার লিপ সীল * ডোর/ হ্যাচ/ পোর্ট হোল * নিউমেটিক ব্লাডার
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RUSI – BIMRAD Maritime Security in the Bay of Bengal Symposium 2023

BIMRAD Correspondent



The Royal United Services Institute (RUSI), UK, and TAG International, in partnership with Bangladesh Institute of Maritime Research and Development (BIMRAD) organized the Bay of Bengal Maritime Security Symposium on Tuesday 21 March at The Westin Hotel, Dhaka. H E Robert Chatterton Dickson, British High Commissioner to Bangladesh delivered the keynote address during the opening remarks of the symposium. Captain M Minarul Hoque, (H), BCGM, psc, BN Director General, BIMRAD delivered the welcome address.

The symposium brought together policymakers, practitioners, academics, and the private sector to discuss some of the mutual challenges facing the region within the maritime security domain. The BIMRAD research team presented the findings from the research conducted over the past six months in collaboration with RUSI and other regional partners. Project partners from India, Maldives, and Sri Lanka also presented their views and commented on the research findings. A distinguished panel of experts, including Dr. David Brewster, Senior Research Fellow at the National Security College, Australian National University, commented on the research findings at the symposiums. In addition to the commentaries

by the distinguished panelist, learned audiences engaged in constructive discussion at the end of each symposium session.

The Symposium was divided into four sessions focusing on the following topics:

- Session One: Illegal and Forced Migration - the challenge of human-trafficking and other maritime crime
- Session Two: Illegal Fishing - the challenges with monitoring and tracking illegal activities across the region
- Session Three: Climate change and Environmental Protection - impacts of sea-level rise, natural disasters, pollution and plastics in the sea
- Session Four: The Future of Regional Cooperation – the role of regional actors in promoting regional cooperation to tackle maritime security challenges in the region

The symposium was held as part of a joint collaborative research project. Bangladesh Institute of Maritime Research and Development (BIMRAD) signed an agreement with TAG International and Royal United Services Institute (RUSI), UK,

on September 2022 to conduct a joint research project on 'Maritime Security Challenges in the Bay of Bengal'. The project was part of the UK Government's Conflict, Stability and Security Fund (CSSF) Maritime Security Pilot Programme. The project had three key components:

- Component 1: Country-Specific Papers (Bangladesh, Sri Lanka and Maldives), Regional Paper, Maritime Security Expert Working Group (MSEWG), Community of Practice, and Political and Economic Modelling
- Component 2: Perception Surveys and Focus Groups
- Component 3: Two Regional Symposiums held in Dhaka and Colombo

BIMRAD formed a core research team, led by Professor Rasheduzzaman of Dhaka University to conduct the research works. Capt M Minarul Hoque, Director General (DG) of BIMRAD and Nur Ahmed, Research Officer of BIMRAD worked as Co-researchers of the team. The BIMRAD team

The involvement of global powers in the region highlights its importance and underscores the need for cooperation and strategic partnerships among countries in the region to maintain stability and security.

Apart from the geopolitical challenges, the littorals of the Bay of Bengal face a myriad of security challenges in the maritime domain ranging from unpredictable nature to ungoverned human migration. Bangladesh has established itself as a key littoral of this region due to its strategic location, economic progress and exemplary developmental track record. The maritime policies of Bangladesh prioritize the maintenance of a peaceful coexistence in the Bay of Bengal for the mutual benefit of the littorals. Bangladesh has always prioritized its adherence to the global regime on maritime affairs. It has therefore sought to seek multilateral approach to solve any type of disputes in the maritime domain. Bangladesh's maritime security challenges emanate from different factors. Its coastal region faces the wrath of natural calamities due to



drafted the Bangladesh specific paper and contributed to the other components completed by regional partners like the Pathfinder Foundation of Sri Lanka, Observer Research Foundation (ORF) of India. The project was completed in March, 2023 with the presentation of the research findings in two symposiums held in Dhaka and Colombo.

The project was taken at a time when the Bay of Bengal region has come under intense geopolitical competition among regional and extra-regional powers. The Bay of Bengal holds immense strategic significance due to its location as a crossroads between South Asia, Southeast Asia, and East Asia. The region is rich in natural resources, including oil, natural gas, and fisheries. It also has a large population and is home to important sea ports and shipping lanes, making it a crucial economic hub. In recent years, several global powers, including China, the United States, Japan, and Australia, have taken a keen interest in the Bay of Bengal region. The region is a crucial geopolitical space in the Indo-Pacific region due to its strategic location, natural resources, and economic potential.

the geographical location of the country and the growing impacts of climate change. Henceforth, climate change can be identified as the most critical factor that might destabilize the maritime domain of Bangladesh. The country has been hosting more than 1.1 million Forcible Displaced Myanmar Nationals (FDMN) in the coastal region and the ramifications have been wider than anticipated for the maritime security of Bangladesh. Moreover, issues like Irregular, Unreported, and Unregulated (IUU) fishing and marine pollution pose credible threats to the country's maritime domain.

The discussion at the Symposium produced some captivating ideas about identifying how countries can best align their responses against maritime security challenges in this region. The outcome of the RUSI-BIMRAD Maritime Security Symposium will play a significant role in developing some guidelines for further research works, strategies and principles in this field. BIMRAD's collaboration with RUSI will augment the future prospect of conducting joint research work with globally renowned think tanks.

Int'l Attention to Rohingya Diverted due to Ukraine war: PM Tells Al Jazeera



Prime Minister Sheikh Hasina has said the international attention to forcibly displaced Myanmar nationals was diverted to the war in Ukraine and the Ukrainian refugees—a reality that has created the Rohingya situation more difficult to resolve.

In an interview with the Qatar-based broadcast station Al Jazeera, she mentioned that the current focus is on the war and the refugees from Ukraine.

A part of the interview was aired on Wednesday, but its full episode will be run on Saturday.

Al Jazeera journalist Nick Clark interviewed Sheikh Hasina about the future of Rohingya refugees during her just-concluded visit to Qatar.

The PM talked about several issues, including the Rohingya camps in Cox's Bazar, the relocation of Rohingya to Bhashan Char, and the future of the Rohingyas from Myanmar.

Prime Minister Sheikh Hasina visited Qatar to attend the Fifth United Nations Conference on the Least Developed Countries (LDC5) held in Doha on March 04 last and returned home on Wednesday afternoon.

Prime Minister Sheikh Hasina said Myanmar is not favorable in returning their nationals to their country despite Dhaka having long engaged in talks to resolve the issue.

She said Bangladesh gave shelter to Rohingyas – the victims of

persecution, murder, and rape in Myanmar— on humanitarian grounds.

She stated that when the persecution of the Rohingyas started in Myanmar, they sympathized with them as they were subjected to torture, murder, and rape. As a result, they decided to open the border and allowed them to come. Furthermore, they have provided shelter and treatment for all of them on humanitarian grounds.

She said simultaneously, Bangladesh started talks with Myanmar and told them that the displaced people should be repatriated. She also mentioned that unfortunately, they are not responding positively and these people should go back to their land. The Prime Minister mentioned that Myanmar is under pressure from the international community, but it's proving to be challenging. She also shared that they have provided accommodation for the Rohingyas in a separate location, which she described as an excellent place to live. The place in question is Bhashan Char, and according to her, they have arranged suitable accommodation with excellent facilities for the children staying there.

Regarding the living conditions in the Rohingya camps and the recent fire that destroyed shelters for over 12,000 people, she acknowledged that the situation in the Cox's Bazar Rohingya camps is not ideal. She further stated that the Rohingyas face various challenges, including internal conflicts and engaging in illegal activities such as drug, arms, and human trafficking.

Carbon Dioxide Emissions Reached a Record High in 2022



Communities around the world emitted more carbon dioxide in 2022 than in any other year on records dating to 1900, a result of air travel rebounding from the pandemic and more cities turning to coal as a low-cost power source.

The emission of climate-warming gas caused by energy production grew 0.9% to reach 36.8 gigatons in 2022, the International Energy Agency reported Thursday (March 02). (According to NASA, the mass of one gigaton is equivalent to about 10,000 fully loaded aircraft carriers.)

Carbon dioxide is released when fossil fuels such as oil, coal, or natural gas are burned to power cars, planes, homes, and factories. When the gas enters the atmosphere, it traps heat and contributes to climate warming.

Extreme weather events intensified last year's carbon dioxide emissions: Droughts reduced the amount of water available for hydropower, which increased the need to burn fossil fuels. And heat waves drove up the electricity demand.

The report was disconcerting by climate scientists, who warn that energy users worldwide must cut emissions dramatically to slow the dire consequences of global warming.

Rob Jackson, a professor of earth system science at Stanford University and chairman of the Global Carbon Project, said that any increase in emissions, even as little as 1%, represents a failure. He emphasized that neither growth nor maintaining the status quo is acceptable; the only solution is to reduce emissions. Jackson stated that any year with higher coal emissions is detrimental to our health and the planet, and failure to reduce emissions will lead to disastrous consequences.

Carbon dioxide emissions from coal grew 1.6% last year. The IEA said that many communities, primarily in Asia, switched from natural gas to coal to avoid high natural gas prices worsened by Russia's invasion of Ukraine.

And as global airline traffic increased, carbon dioxide emissions from burning oil grew 2.5%, with about half the surge resulting from the aviation sector.

Global emissions have grown in most years since 1900 and have accelerated over time, according to data from IEA. One exception was the pandemic year of 2020 when travel all but came to a standstill.

According to the IEA, last year's record-high level of emissions was lower than anticipated. The reduction was attributed to the increased use of renewable energy, electric vehicles, and heat pumps, which prevented an additional 550 megatons of carbon dioxide emissions. In addition, strict pandemic measures and weak economic growth in China contributed to reducing production and limited global emissions. Moreover, the IEA highlighted that wind and solar power surpassed gas or nuclear energy for electricity generation in Europe, marking the first time.

Fatih Birol, the IEA's executive director, stated that clean energy prevented a nearly three-fold increase in CO₂ emissions. However, fossil fuel emissions are still rising, hindering efforts to achieve global climate targets.

Birol called on international and national fossil fuel companies to uphold their public commitments and take responsibility for meeting climate goals. Despite the concerning emissions levels, John Sterman, director of the Massachusetts Institute of Technology Sloan Sustainability Initiative, believes reversing the trend and achieving climate goals is still possible.

Sterman advocates for government subsidies for renewable energy, improvements in energy efficiency, electrification of industry and transportation, high carbon pricing, reduced deforestation, tree planting, and eliminating the use of coal. Although the required changes are extensive, Sterman believes they are necessary.

17 Invasive Plant Species Identified in 5 Protected Areas: Environment Minister



Environment, Forest, and Climate Change Minister Shahab Uddin have said Bangladesh National Herbarium has identified 17 foreign invasive plant species harmful to Bangladesh under the Sustainable Forest and Livelihood Project of the Forest Department, seven of which are pretty significant.

According to the Minister, a program has been implemented to manage invasive plant species in five protected areas of the country: Himchari, Kaptai, Madhupur National Parks, and Rema-Kalenga and Sundarban East Wildlife Sanctuaries. The program has developed five strategic management plans to ensure proper management of these plant species.

The Minister stated that implementing these management strategies will aid forest conservation and resource management while promoting sustainable development goals. He made the remarks at the final workshop of the program titled "Developing Bangladesh National Red List of Plants and Developing Management Strategy of Alien Species of Plants in Selected Protected Areas," organized at the Forest Department on February 22, 2023.

The Minister said under this program, which is being implemented with the help of the World Bank and the support of the International Union for Conservation of Nature (IUCN), all these invasive plants can be controlled by preventing their marketing and trade that hurt the environment, economy and

society, and by eliminating them from the ecosystem and preventing their spread.

The Minister emphasized the importance of managing invasive plant species in protected areas and formulated strategic plans for Himchari, Kaptai, Madhupur National Parks, Rema-Kalenga, and Sundarban East Wildlife Sanctuaries.

He highlighted the need for preventive measures such as early detection, screening of imported plant species, and quarantine procedures. Bangladesh is committed to protecting ecosystems and biodiversity as a signatory to the Convention on Biological Diversity.

The Minister stressed the necessity of identifying all invasive plant species in protected areas and developing proper management strategies to conserve indigenous plant species and forest areas while achieving sustainable development goals.

At a workshop on Invasive Plants and their Strategic Management Plan, Professor Dr. Mohammed Kamal Hossain presented the final results, and various experts discussed the issues.

The Secretary to the Ministry of Environment, Forest and Climate Change, Additional Secretary and Director of Bangladesh National Herbarium, Project Director of SUFAL Project, and Country Representative of IUCN Bangladesh spoke at the workshop as special guests chaired by the Chief Forest Conservator of the Forest Department.

Maritime Security in the Bay of Bengal Symposium, Colombo 2023



The Royal United Services Institute (RUSI), UK, in partnership with the Pathfinder Foundation, Sri Lanka has organized the Maritime Security the Bay of Bengal Symposium on Friday 24 March at The Galle Face Hotel, Colombo. HE Sarah Hulton OBE, British High Commissioner to Sri Lanka delivered the keynote address during the opening remarks of the symposium. Ambassador Bernard Goonetilleke, Chairman of Pathfinder Foundation, delivered the welcome address.

The conference brought together policymakers, practitioners, academics, and the private sector to discuss some of the mutual challenges facing the region within the maritime security domain. Professor Rasheduzzaman, Lead Researcher of BIMRAD for the Maritime Security Project with RUSI & TAG International, and Nur Ahmed, Research Officer of BIMRAD presented the findings from the research conducted over the past six months in collaboration with RUSI. A distinguished panel commented on the research findings at the symposium.

The symposium was divided into four sessions focusing on the following topics:

- Session One: Illegal and Forced Migration - the challenge of human-trafficking and other maritime crime
- Session Two: Illegal fishing - the challenges with monitoring and tracking illegal activities across the region
- Session Three: Climate change and Environmental Protection - impacts of sea-level rise, natural disasters, pollution and plastics in the sea
- Session Four: The future of regional cooperation – the role of regional actors in promoting regional cooperation to tackle maritime security challenges in the region

Partners from India, Maldives, and Sri Lanka also presented their views and commented on the research findings. The discussion at the symposium produced some captivating ideas about identifying how countries can best align their responses against maritime security challenges in this region.

BIMRAD Participation in U.S. Naval War College Webinar on 'National Security Significance of a Changing Climate: Naval Climate Engagement'



U.S. Naval War College organized a webinar on 19 January 2023 at 1800 hrs, intending to highlight the work of various U.S. naval community's efforts in climate as well as international engagement. The program was designed keeping the theme 'National Security Significance of a Changing Climate: Naval Climate Engagement.'

The webinar started with the welcome speech of the Chair of the session Stephen J. Mariano, Ph.D., Provost, U.S. Naval War College. Vice Admiral Ricky Williamson, Deputy Chief of Naval Operations for Fleet Readiness and Logistics, N4, Office of the Chief of Naval Operations delivered the keynote speech. A high-level discussion on climate change was held between Rear Admiral Paul Beattie, Director of Naval Staff, Royal Navy and Ms. Deborah Loomis, Senior Advisor to the U.S. Secretary of the Navy (Climate Change). A panel of experts comprising three distinguished speakers, discussed three separate topics i.e., 'Science and Technology', 'Contingency Engineering' and 'Public Health'.

Commander Andrea H. Cameron, Ph.D., Ed.D., Permanent Military Professor, National Security Affairs Department; Director, Climate & Human Security Studies Group, U.S. Naval War College moderated the whole session. Capt M Minarul Hoque, (H), BCGM, psc, BN, Director General, BIMRAD participated in the session.

BIMRAD Joined in BIPSS Roundtable on 'War, Famine and Turbulence: Global Trends 2023'

Bangladesh Institute of Peace and Security Studies (BIPSS) organizes a monthly roundtable on a contemporary geopolitical issue. The most recent one, held on 22 January 2023, focused on 'War, Famine and Turbulence: Global Trends 2023'.

A panel of experts comprising three distinguished speakers discussed the given topic. Dr Fahmida Khatun, Executive



Director, Centre for Policy Dialogue (CPD); Air Vice Marshal (retd) Mahmud Hussain, former ambassador and distinguished expert at Bangabandhu Sheikh Mujibur Rahman Aviation and Aerospace University; and Mr Shafqat Munir, Head of BCTR and Senior Research Fellow, BIPSS, spoke at the event as panellists. The speakers outlined the major issues likely to shape 2023: Ukraine-Russia conflict, possibilities of an accidental escalation, economic downturns, food security, geopolitical competition, climate security, upcoming elections in South Asia, disruptive technology, metaverse and the brand new front of artificial intelligence (AI). BIPSS President Maj Gen ANM Muniruzzaman, ndc, psc (retd) moderated the roundtable. Nur Ahmed, Research Officer (Maritime Affairs and Security), represented BIMRAD at the roundtable.

BIMRAD Took Part in BISS Seminar on 'Strengthening Bangladesh's Foreign Relations with Neighbours in the Evolving Global Order'



Bangladesh Institute of International and Strategic Studies (BISS) organized a hybrid seminar on 'Strengthening Bangladesh's Foreign Relations with Neighbours in the Evolving Global Order' on 24 January 2023. H E Mr Md Shahriar Alam, MP, Hon'ble State Minister, Ministry of Foreign Minister, Government of the People's Republic of Bangladesh graced the occasion as the Chief Guest.

The inaugural seminar was kicked off with the welcome speech of the Director General of BISS, Major General Sheikh Pasha Habib Uddin, OSP, SGP, BAMS, afwc, psc. It was followed by the speech of the Keynote Speaker, Professor Lailufar Yasmin, who outlined the current trajectory of Bangladesh's bilateral relations with its neighbours. Afterward, a working session chaired by Ambassador M Humayun Kabir, President, Bangladesh Enterprise Institute (BEI), was organized. A panel of three distinguished researchers presented their research findings. It was followed by a vibrant Q&A session featuring questions and comments. Afterward, the Chief Guest delivered his remarks. In his speech, he mentioned that the government is persistently working to consolidate relations with neighbours for regional stability, shared prosperity, and mutual development. Mr. Nur Ahmed, Research Officer, represented BIMRAD in this distinguished program.

BIMRAD Joined in Seminar on "Rohingya Crisis and the Emerging Security Challenges: Response Strategy of Bangladesh"



A Seminar on "Rohingya Crisis and the Emerging Security Challenges: Response Strategy of Bangladesh" was organized by Bangladesh Institute of International and Strategic Studies (BISS) on Thursday, 23 February 2023, from 1100 hours (Bangladesh Standard Time) at BISS Auditorium.

H E Mr. Anisul Huq, MP, Hon'ble Minister for Law, Justice and Parliamentary Affairs, Government of the People's Republic of Bangladesh, graced the occasion as the Chief Guest. Former BISS chairman Munshi Faiz Ahmad chaired the seminar at its auditorium.

Major General (ret'd) Mohammad Mahfuzur Rahman presented a paper in that seminar titled 'Regional Security Dimensions of the Rohingya Crisis', in which he expressed concerns over the plight of around 400,000 Rohingya children who are growing up in camps without access to education and harboring resentment due to the atrocities they have witnessed, including sexual violence against their mothers in Rakhine state. He warned that the Rohingya crisis is a potential "ticking bomb" for the region.

In response to the crisis, the Law Minister urged Myanmar to ensure that the legal rights of the Rohingya people are protected so that they can return to the Rakhine state voluntarily. He emphasized that resolving the crisis is the sole responsibility of Myanmar.

Other experts also presented papers on various aspects of the Rohingya crisis at the event, including Dhaka University's Associate Professor of International Relations Niloy Ranjan Biswas, BISS Research Fellow ASM Tarek Hassan Semul, and Bangladesh Public Service Commission member and DU Professor of International Relations Delwar Hossain. BISS Director General Major General Sheikh Pasha Habib Uddin delivered the welcome speech.

Affat Khanam Ritika, Research Officer, Bangladesh Institute of Maritime Research and Development (BIMRAD) participated on behalf of BIMRAD in this significant event.

BIMRAD Participation in BIPSS Roundtable on 'Two Years of Military Rule in Myanmar: Ramifications for the Future'



Bangladesh Institute of Peace and Security Studies (BIPSS) organizes a monthly roundtable on a contemporary geopolitical issue. The most recent one, held on 28 February 2023, focused on 'Two Years of Military Rule in Myanmar: Ramifications for the Future'.

A panel of experts comprising three distinguished speakers discussed the given topic. Brigadier General (ret'd) Shahedul Anam Khan, former associate editor of The Daily Star; Brig Gen (Ret'd) Sakhawat Hussain, PhD, Senior Fellow South Asian Institute of Policy and Governance (SIPG), North South University; and Parvez Karim Abbasi, Assistant Professor at the Department of Economics of East West University, spoke at the event as panelists. The speakers outlined the major issues that shaped the two years of military rule in Myanmar. These issues ranged from the nexus between the military regime's political and economic strategies and the regional powers' interests to Bangladesh's diplomatic posture vis-à-vis the authoritarian government. BIPSS President Maj Gen ANM Muniruzzaman, ndc, psc (ret'd) moderated the roundtable. Nur Ahmed, Research Officer (Maritime Affairs and Security), represented BIMRAD at the roundtable.

BIMRAD Took Part in BISS Seminar on 'Gig Economy and Bangladesh: Opportunities, Challenges and Way Forward'



Bangladesh Institute of International and Strategic Studies (BISS) organized a hybrid seminar on 'Gig Economy and Bangladesh: Opportunities, Challenges and Way Forward' on 15 March 2023. H E Dr Mashiur Rahman, Economic Affairs Adviser to the Hon'ble Prime Minister, Government of the People's Republic of Bangladesh graced the occasion as the Chief Guest.

The inaugural seminar was booted off with the welcome speech of the Director General of BISS, Major General Sheikh Pasha Habib Uddin, OSP, SGP, BAMS, afwc, psc. It was followed a working session chaired by Dr Zaidi Sattar, Chairman, Policy Research Institute of Bangladesh (PRI). A panel of three distinguished speakers presented their research findings. It was followed by a vibrant Q&A session featuring questions and comments. Afterward, the Chief Guest delivered his remarks who said that the gig economy would create a significant number of new jobs in Bangladesh. He also stated that the Fourth Industrial Revolution was going to leave a profound impact on traditional employment opportunities. Mr. Nur Ahmed, Research Officer, represented BIMRAD in this distinguished program.

BIMRAD Participated in a Seminar on "Celebrating 50 Years of Bangladesh-Nepal Friendship: Shared Vision of Peace, Progress and Prosperity"

The Bangladesh Institute of International and Strategic Studies (BISS) organized a Seminar on "Celebrating 50 Years of Bangladesh-Nepal Friendship: Shared Vision of Peace, Progress, and Prosperity." The seminar took place on Sunday, 12 March 2023, from 1400-1600 hours (Bangladesh Standard Time) at BISS Auditorium.

H E Dr A K Abdul Momen, MP, Honourable Foreign Minister, Government of the People's Republic of Bangladesh, graced the occasion as the Chief Guest.

Foreign Minister of Bangladesh, AK Abdul Momen, has said that as both Bangladesh and Nepal are set to graduate from



the LDC in 2026, there are many opportunities for the two countries to work together towards a smooth transition. Speaking at the Seminar, Momen emphasized the potential for cooperation in energy, tourism, education, migration, and connectivity. He also highlighted the need to explore the possibilities of a free trade agreement and increase two-way trade for shared prosperity. The seminar was attended by senior officials, ambassadors, business people, and representatives from various think tanks and international organizations.

Afifat Khanam Ritika, Research Officer, Bangladesh Institute of Maritime Research and Development (BIMRAD), participated in the seminar.

Participation in "Capacity Building Training on Integration of Gender Concerns and Equity in Climate Change Projects"



A 2-days capacity building training from 23 Nov 2022 on "Integration of Gender Concerns and Equity in Climate Change Projects" was jointly organized by Bangladesh Center for Advanced Studies (BCAS) and Center for Climate Change and Environmental Research (C3ER) funded by Bangladesh Climate Change Trust (BCCT).

Afifat Khanam Ritika, Research Officer, BIMRAD, took part as a participant in that capacity-building training event. A certification ceremony was held after the successful completion of the training session.



Climate-Related Natural Hazards: The Struggle for the Livelihood of the Coastal People of Bangladesh has Become More Difficult

Rafiqul Islam Montu



"I had five houses of my own here. I had 20 acres of land for cultivation and many buffaloes. There were many trees and plants in the houses. I spent my life's savings there. Now I am destitute. This Meghna River has taken everything away from me. Now I am searching for a new place to settle down."

While saying these words, Saiful Haque Haji (65) wipes his tears. His house is in Charfasson upazila of Bhola district, an island in the southern part of Bangladesh. He is one of the ten thousand people who have migrated from this island to elsewhere. The island of Dhalchar, where he used to live, is facing various natural disasters, such as river erosion, salinity, excess water from the sea, and cyclones, which have caused severe damage to the people living on the island.

The residents of Teliarchar Island in Ramgati Upazila of Lakshmipur district, including Jharna Begum, shared similar

stories. This woman, who has faced natural disasters several times, said, "I have changed my house five times. I have no savings. After losing the government-funded housing in the river, I built a house on the river bank. That house was also destroyed. In the rainy season, the house sinks in the water of the high tide. The saltwater destroys the crops. We are surviving through these fights against natural disasters."

When she told her own story, Jharna Begum went back almost a decade. In her imagination, she saw the cows grazing on the fields, the pond, the gardens, the houses, and all the wealth they had. But where did it go? Alauddin Master (49), Abdul Karim (60), Mafiz Uddin (75), Abdullah (64), and many others were waiting on the island of Teliarchar, hoping for a better tomorrow. They were residents of the Char Abdullah Union. This union was once connected to the mainland of Ramgati Upazila in the Laxmipur district. But almost a decade ago, the

entire union was submerged in the river. About 30,000 people lived in the union, most of whom have now scattered and migrated to big cities. Only 8,000 people remain in Jharna Begum's village.

The Same Picture of the Entire Coastline



Once a prosperous settlement for those who had lost everything to river erosion, the island of Dhalchar is now facing its disappearance. Settled in the 1960s by those displaced from other parts of the coast of Bangladesh, the island suffered extensive damage during the 1970 cyclone, leaving only a handful of survivors. Despite this, the island's population grew after Bangladesh gained independence in 1971, and it became a Union Council. The island's hilsa fishing industry flourished and brought prosperity to people's lives.

However, in 2003, the Meghna river began to erode the island at an alarming rate, causing the inhabited area of 12 square kilometers to dwindle to just two square kilometers. Many lost their homes and livelihoods, and the island's population decreased significantly.

The island was renamed Char Abdullah, though its history is more complex. The indigents who settled in Telirchar, which was then renamed Char Abdullah, destroyed the forest and took refuge there. Telirchar, in turn, also faced erosion, and more than half of the island has already disappeared. People were left with uncertainty regarding their habitats.

Interestingly, the old island of Char Abdullah, which disappeared in 1991, has risen again in the middle of the river as a new island. While a few people have started to settle there, most of the island's population has dwindled to just 7,500 people living in Telirchar. Many others have fled to nearby cities for shelter and livelihoods, while some have settled in nearby villages.

The story of Dhalchar island is a poignant example of the impact of extreme weather on coastal communities and the challenges faced by those who must constantly adapt and rebuild their lives.

The Number of Displaced People is Increasing

Once a prosperous region, coastal cities on Bangladesh's lost islands are now confronted with an increasing number of people

displaced by climate change. The erosion of these islands has resulted in families losing their homes and being forced to become day laborers to make ends meet.

A 2019 study by Young Power in Social Action (YPSA) revealed that 15,000 people in Banshkhali and Qutubdia alone had been displaced by climate change, with 60% of the displaced community earning only 5000-6000 taka per month. Many now live temporarily on embankments and roadsides, while others have had to change their occupations to earn a living.

The lack of safe drinking water has led to increased diseases, and those who remain in their original habitats face a higher risk of disaster due to climate change. The YPSA survey also showed that 25% of people have had to change their old occupations due to displacement, while 90% are accustomed to unsanitary sanitation, leading to various infectious diseases.

According to the Environmental Science Department of Jahangirnagar University, from 1980 to 2017, 570,000 people were displaced from the islands of Kutubdia, Sandwip, and Maheshkhali due to various natural disasters caused by climate change.

To address this issue, Mohammad Shahjahan, deputy director of YPSA, emphasized the importance of collecting and analysing data on displaced people due to climate change. He also suggested that awareness should be raised and technical education should be ensured for the displaced people and that they should undergo sustainable and community-based planned resettlement. This should include land, housing, agriculture, and alternative employment opportunities that align with the changing climate.

While the Bangladesh government has implemented various projects to rehabilitate landless and poor people, including housing projects in coastal areas, many families are still forced to move to cities to earn a living.



In reality, the displacement of people due to climate change in Bangladesh's coastal areas has profoundly impacted their livelihood and housing. With the increasing number of displaced people, it is crucial to address the issue through sustainable and community-based planned resettlement and alternative employment opportunities that align with the changing climate.

The Last Address is an Urban Slum



There was a time when the people of the islands off the coast of Bangladesh lived a simple and peaceful life. But as the sea and river raged on, their lives were suddenly uprooted. Cyclones and saltwater destroyed their homes and crops, leaving them with nothing. Being displaced and hopeless, they sought refuge in the cities.

Many of them flocked to Dhaka, the capital, for livelihood. But their lives in the city were far from easy. They were forced to live in slums, deprived of basic needs such as shelter, clean water, sanitation, education, and medical care. Overcrowding and unsanitary conditions made survival difficult, and the disease risk was high. Dhaka had become uninhabitable, yet every year, 4-5 lakh climate refugees were residing in its slums.

One day, a reporter visited the Kallyanpur slum in Dhaka to learn more about the people who had lost their homes and taken refuge there. The slum dwellers shared their heartbreaking stories of loss and struggle. Many had come from vanished villages on the banks of the Meghna in the island district of Bhola. Others had come from Patuakhali, where salt water had destroyed their crops. They had first built tiny houses near the barrier, hoping to stay in the area, but had eventually sought shelter in the slums of the district and upazila cities. Finally, they had come to Dhaka in search of work and food, forced to leave their homes due to natural disasters.

The situation in Dhaka is dire. The Global Livable Index 2019 listed it as one of the least livable cities in the world. The climate-displaced people were facing even more danger in the city. A survey conducted jointly by Bangladesh Nari Sramik Kendra (NSK) and Change Initiative (CI) showed that nearly 50% of the people living in the slums of Dhaka had only taken shelter there after losing their housing and livelihood to cyclones in Barisal, Noakhali, Bhola, Khulna, and Satkhira. About

93% of them had lost their livelihood, and 52% had sought shelter in the slums of Dhaka. The number of these people was constantly increasing at an alarming rate.

The survey also revealed that only 10% of people in Dhaka had formal jobs. The rest were living a low standard of living. As the pressure increased on the densely populated city, the IDPs longed to return to their home areas if guaranteed safe housing and work facilities.

Zakir Hossain Khan, Executive Director of Change Initiative, suggested that coastal cities should plan compact townships to benefit and rehabilitate people displaced by climate change. Capacity-based training should be provided, considering the capabilities and needs of the vulnerable population. Funding should be collected internationally, including from own sources and green climate funds, to create micro-entrepreneurs.

Eskander Ali Molla, President of Kalyanpur Basti Punarbasan Oikya Parishad, added that 95% of the people in his slum had their homes in different coast districts of Bangladesh. They had come to Dhaka after their native land was washed away by the river. The slum was built in 1998 with only 5 houses, but the number of people has increased. Despite assurances from the government to rehabilitate them, no initiative had been taken.

Many people like Saiful Haque of Dhalchar, Begum Begum of Teliarchar Jhorna, and Merina Begum of Kutubdia Island struggle to control their lives amidst the turbulent sea and rivers. Many more people like them are in the islands of Bangladesh's coastal region. They are fighting against natural disasters and are still surviving. Many of their fellow inhabitants have lost the battle and their lives. They are still fighting, but for how long?

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