



## Maritime Literacy in Bangladesh: Cut the Gordian Knot

The earth has one big ocean with many features

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The ocean and life in the ocean shape the features of the earth

The ocean is a major influence on weather and climate

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The ocean makes earth habitable

07

The ocean is largely unexplored

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The ocean and humans are inextricably interconnected

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The ocean supports a great diversity of life and ecosystems



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#### About the Cover

The 7 Principles of "Ocean Literacy" provide a framework to understand the ocean's influence on humans and humans' influence on the ocean, as coined by NOAA.

#### Disclaimer

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## PAAL Editorial

### Maritime Literacy in Bangladesh: Cut the Gordian Knot

The vast expanse of the ocean has always been integral to human life—shaping civilizations, economies, and the environment. The Bay of Bengal, the world's largest bay, holds particular significance as it is critical to sustainable development for Bangladesh. The destiny of maritime Bangladesh is intricately linked to this water body.

The Bengal Delta, formed by the confluence of the mighty Ganges, Brahmaputra, and Meghna rivers, is a geographical marvel and a lifeline for more than one-third of Bangladesh's population. Understanding the ocean and its influence on us—what we term "Ocean Literacy"—becomes paramount in this context.

Maritime Bangladesh, with the direct and indirect influence on its entire population, is deeply connected to the rhythms of the sea. Mainly, the coastal communities rely on the ocean for their livelihood, from aqua farming to fishing, from travel to trade; their prosperity is directly tied to the well-being of the ocean. Ocean literacy is more than just knowledge about the sea; it is an awareness of how the ocean affects our lives and how our actions impact the ocean. This understanding is crucial for sustaining these communities' economic and environmental well-being and, by extension, the nation. It becomes essential to comprehend these limits to maintain the economic and environmentally suitable conditions in these communities and, consequently, the nation.

However, Bangladesh's current ocean knowledge level has some limitations and weaknesses. There is a pressing need to address the gross lack of awareness towards oceanic matters, even though the Bay of Bengal has been largely appended to our identity and economy. Most never receive education about this equilibrium in the oceans and the threats which endanger their ecological surroundings, e.g., water pollution, excessive fishing, and changes in climate. This lack of awareness is a "Gordian Knot" that is to be untied to protect the future of Maritime Bangladesh.

From this urge, this edition of "PAAL Magazine" has selected the theme "Maritime Literacy in Bangladesh: Cut the Gordian Knot." It aims to understand and inspire people from all walks of life that "Ocean Literacy" is one of the keys to a prosperous future. Our contributors look into the options using the prisms of the historical legacy of ocean literacy, literature, linguistic value, future expansion, governance etc., and the urgency to protect our seas and promote the use of the resources. Their opinions are likely to assist in developing a better perception of the ocean and what needs to be done to conserve it. Through our collective efforts, it is hoped that we can significantly foster the prospect of ocean literacy in Bangladesh.

As we navigate the complexities of the 21<sup>st</sup> century, the importance of the ocean in human life cannot be overstated. Ocean literacy is essential for maritime Bangladesh because of its unique geographical and cultural ties to the Bay of Bengal. It is time for us to deepen our understanding of the sea and embrace our identity as a maritime nation. By doing so, BIMRAD is confident to secure a prosperous future for all who call this land home.

Thank You for boarding the "PAAL" to join a magnificent journey with BIMRAD!

Editorial Board



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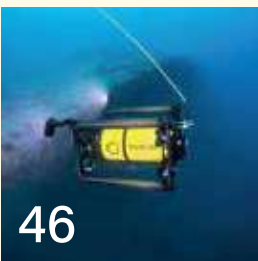
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رَبُّكُمْ الَّذِي يُزْجِي لَكُمْ الْفُلْكَ فِي الْبَحْرِ لِتَبْتَغُوا  
مِنْ فَضْلِهِ إِنَّهُ كَانَ بِكُمْ رَحِيمًا

“It is your Lord Who steers the ships for you through  
the sea, so that you may seek His bounty. Surely,  
He is ever Merciful to you.”

- (Al-Qur'an: Surah Al-Isra, Verse: 66)





## Section I: Maritime Education and Literacy





# Maritime Literacy: A Dip From the Past

Dr. Rashed Uz Zaman



Source: <https://www.indiatimes.com>

South Asia's checkered history has seen the rise and fall of great empires. It is replete with details of the exploits of famous kings, their spectacular reigns and monumental buildings, and their battlefield exploits and victories. While the map of South Asia reminds the keen observer that waters of the Indian Ocean wash the shores of the sub-continent and are ubiquitous in the day-to-day lives of billions of South Asians, there exists a remarkable indifference to the naval and maritime history of South Asia and its lessons for today. Perhaps this apathy should not come as a surprise! History tells us maritime and naval issues were important under the Cholas in the eleventh century. The Delhi Sultanate did not possess a navy and the Mughal Empire made infrequent attempts to build a navy. This should not surprise us for before 1650, no hostile powers ever threatened India's shores. The rulers of Delhi were preoccupied with military threats emanating from the North-West Frontier passes and maintained large armies to guard against them. Moreover, the

steppe nomadic ethos of the Mughal elites made them landlubbers (Roy, 2015). As the West European navies intruded into the Indian Ocean and established maritime supremacy in the seventeenth century, the Mughal rulers woke up to the naval threat and tried to make amends. However, lack of funding, absence of a skilled maritime workforce and internal security challenges hampered the Mughal naval effort and partly eased the way for the British to establish their hegemony over India.

With the establishment of the British rule in India, various schools emerged within the British establishment on how the British Indian Empire was to be secured. Two such schools emerged in the 19<sup>th</sup> century in British India and are known as the "Backward" (or Punjab) School and the "Forward" (or Bombay) School. The "Forward" School advocated the notion that the defence of British India lay beyond its frontiers in Afghanistan and Persia. The British should, therefore, be more



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concerned about these areas since any threats from hostile powers or internal troubles would ultimately endanger India. On the other hand, the “Backward” School suggested that any possible foreign invasion should be repelled on the banks of the Indus River and that meddling in Afghanistan or beyond should not be contemplated as it would only harm India’s security (Lowe, 1967). The debates between the two Schools continued for a long time and we need not go into the details. What matters is that although much emphasis was placed on implementing a particular security system around India, the Indian Ocean is scarcely mentioned. This absence does not imply a lack of maritime awareness on the part of the security establishment. Rather, it springs from the fact that during the entire 19<sup>th</sup> century, no power was able to challenge the maritime supremacy of the Royal Navy in the Indian Ocean region. Indeed, the victories over European rivals in the wars of the 18<sup>th</sup> and 19<sup>th</sup> centuries had established British supremacy over the Indian Ocean. The Royal Navy roamed the waters of the Indian Ocean at will and acquired detailed knowledge of most of the coastlines in the region. The control of the Ocean made the “Royal Navy a neighbour to every country with a coastline” and had turned the Indian Ocean into “the most Europeanized of all the world’s seas, not excluding the Mediterranean” (Jackson, 2004). Policy planners in India had no reason to pay much attention to the security of the sea lanes approaching India or any maritime issues for that matter. Since British naval mastery was guaranteed for most of the 190 years of colonial rule, the seaward approaches to India were perceived to be secured, and maritime discussion was pushed to the background. Complacency soon lulled one into passivity! The result was that even though Indian nationalists started discussing India’s defence and its army from the 1920s onwards, no concrete discussion on maritime and naval matters was forthcoming. Maritime blindness had well and truly set in!

It was in such a scenario that the first steps to make India and the Indians aware of the importance of the Ocean were undertaken by a small group of strategic visionaries. Of course, there is no doubt that protecting the interests of British India was of primary consideration for some of the members of the group. However, this should not make us oblivious to the fact the activities of the group played, dare I say, a trailblazing role in removing maritime blindness and making Indians aware of the importance of the Indian Ocean. This group, known as the “Viceroy’s Study Group,” was led by Sir Olaf Caroe, an Indian Civil Service (ICS) officer, who served as the Foreign Secretary to the Government of India from 1939 to 1945 and ended his Indian career as the Governor of the North West Frontier Province. In his brilliant study on Olaf Caroe, P. J. Brobst notes how Caroe viewed the Indian Ocean as a “natural” political and economic region and highlighted the security of the Indian Ocean (Brobst, 2005). Japanese forays into the Indian Ocean during 1941–42, and the fear and panic they caused among the officials and the populace of British India convinced Caroe of the need to highlight the deficiencies of the Indian Ocean. He lamented the fact that the supremacy of the Royal Navy had

lulled the official mind of the British Raj into inertia and brought on a parochial understanding of India’s defence. Caroe’s fellow members of the “Viceroy’s Group” Guy Wint and Lt. General Francis Taker also played an important role in making the officialdom and general population aware of the maritime dimension of India’s security. However, it was through the writings of K. M. Panikkar that the views of the “Viceroy’s Study Group” regarding the importance of the Indian Ocean and its meaning for India attracted widespread attention.

In 1945, Panikkar published his classic *India and the Indian Ocean: An Essay on the Influence of Sea Power on Indian History* and, through this book, highlighted the need to recognise the significance of the security of the Indian Ocean. While Panikkar rued how maritime blindness of Indian rulers allowed European supremacy in the East, he also examined various scenarios independent India might have to face with regard to the Indian Ocean. One such scenario was the rise of China as a maritime power and its implications for the security of India (Panikkar, 1945). In view of the fact that Panikkar was writing in 1945 when China was wracked by both external and civil wars, it is remarkable that such an assessment of the future could be offered. It is interesting to note that Panikkar himself worried about the chances of his book being published, given the rigorous wartime military censorship and the scarcity of printing materials prevalent at the time. In his autobiography, Panikkar writes that it was at this point that Guy Wint sent the manuscript to England by diplomatic pouch and got the Secretary of India, Leopold Amery, to authorize the release of the paper for publishing the book (Panikkar, 1977). Brobst points out that it was Caroe who impressed upon the powers that be in London that Panikkar’s *India and the Indian Ocean* was worthy of careful reading and notes that Caroe reported to the India Office in 1945 that many of the ideas of the “Study Group,” “are percolating through various channels, e.g. Panikkar’s books” (Brobst, 2005). Caroe’s notes on the dissemination of views on the Indian Ocean’s importance for India are also supported by Panikkar. He writes that the publication of the book saw all the major Indian newspapers devoting leading articles to it and that the book also served as a textbook for naval students (Panikkar, 1977). Given the importance attached to Panikkar’s book by Indian strategic thinkers, it is clear that the “blue water” aspiration of India is a legacy of the views on the Indian Ocean as held by Olaf Caroe, Guy Wint, and K. M. Panikkar.

The purpose of this brief foray into history is to highlight the importance of a small group of men in removing blinds, which prevented Indians from realizing the importance of the Indian Ocean. While there may be many a factor behind a state embracing a maritime identity, the first requirement has to be an awareness of the importance of such an identity, a maritime literacy which enables the population and strategic elites to accept that such an identity must be adopted. Of course, such acceptance is not easy, for it is a cultural choice. Once created, this artificial identity has to be sustained by constant repetition, slowly shaped into the identity of the state and often readjusted

to meet new realities (Lambert, 2018). Nearly eighty years after Caroe and his group members started the first steps for bringing maritime literacy to Indians, the question remains – who will fix the maritime blindness which afflicts Bangladesh? Perhaps a few dedicated souls centring around BIMRAD may wish to take up the onerous task.

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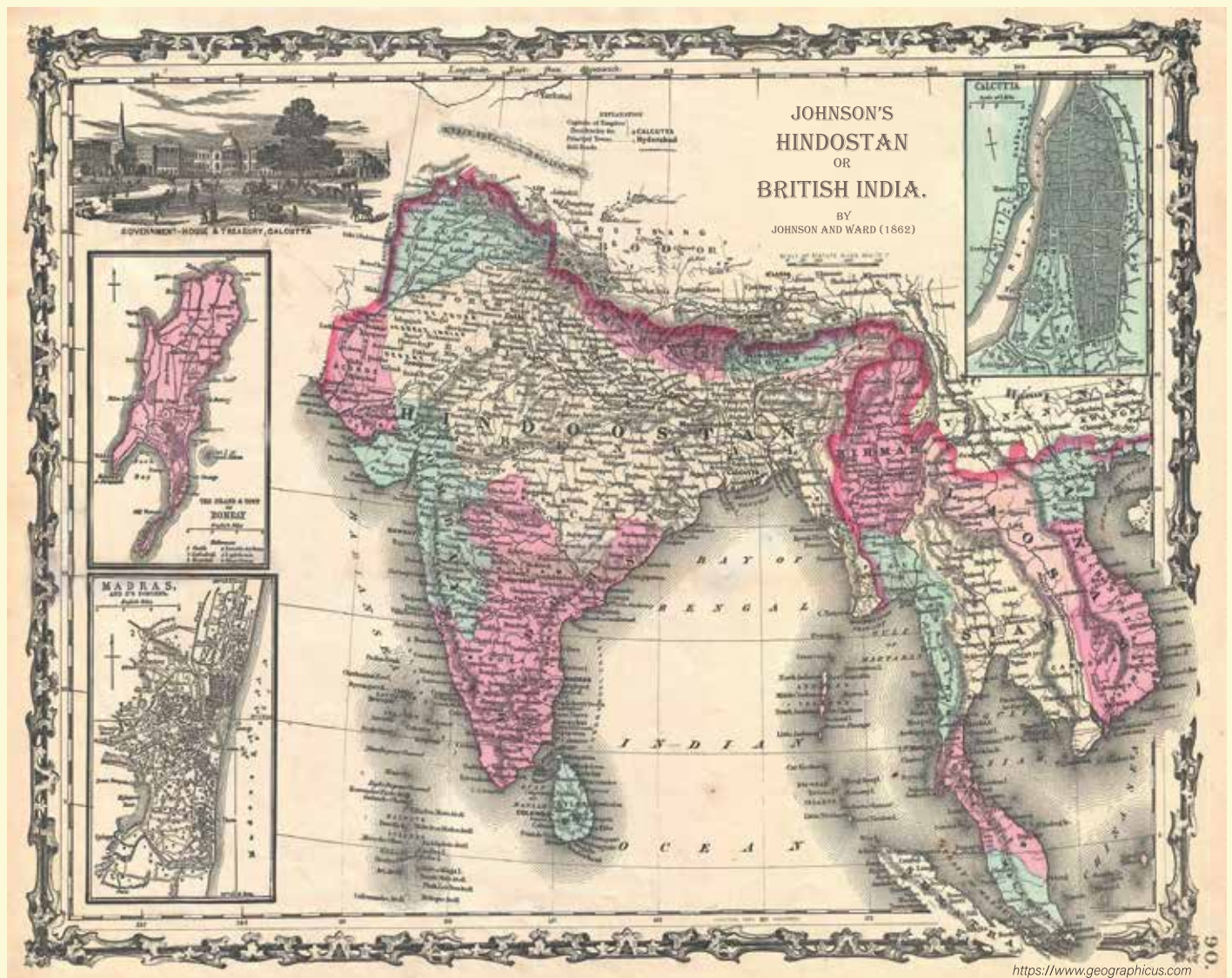
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# Challenges of Education Sector in Bangladesh and Way-out to Advance Specialized Skills in Higher Maritime Education

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Bangladesh allocates less than 2% of its GDP to education, positioning it among the lower end of education spending in the Asia-Pacific region. In contrast, the regional average for public spending on education is around 4% of GDP, with some countries like Tonga investing as much as 8% (Habib & Alamgir, 2024). This limited investment impacts the quality and availability of all types of education, hindering the broader socio-economic development of Bangladesh. To develop its education sector to a satisfactory level, Bangladesh needs to significantly increase its investment, improve infrastructure, and focus on teachers'/ trainers' training, including curriculum development, particularly both for general and specialized education at maritime institutions. Addressing these issues is vital for advancing the country's human capital and supporting its blue economy initiatives, which are being widely talked about these days in most of the seminars and symposiums.

## Education Sector of Bangladesh in General

One of the noteworthy issues with the education sector of Bangladesh lies in the quality of education. There are glaring

disparities in access to education between urban and rural areas, since rural regions often lacking adequate school facilities and qualified teachers. Access to higher education remains limited, particularly for students from low-income families and remote areas. There are hardly any functional quality assurance cells in most of the educational institutions. The curriculum is often outdated and not aligned with the skills needed in the modern job market. Many schools, particularly in rural areas, lack basic facilities such as safe buildings, good laboratories, electricity, clean water, and sanitation. There is a shortage of textbooks and learning materials, and where available, they are often not distributed equitably. Access to technology and digital resources is limited too that exacerbating inequalities in education quality between urban and rural areas. There are gaps between policy formulation and implementation. The net enrollment rate at the primary level is around 98%, but the completion rate is lower. The net enrollment rate at the secondary level is about 62%, with significant dropout rates and the enrollment rate in higher education is around 17%, reflecting limited access and capacity (Asian Development Bank, 2021).

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Despite having a weak foundation in the education sector, the government of Bangladesh has undertaken a new initiative to expand its maritime education systems in Bangladesh, which is encouraging. The number of institutes related to maritime education have been increased. The highest seat of maritime education now in Bangladesh is the recently formed maritime university named BSMRMU, which is the first dedicated maritime university in the country. It is supposed to take a role as a central hub for all sorts of maritime education, training, research, and development. It is designated as a specialized university by the official gazette. It should be nominated as a research university to lead from the front of all types of maritime research in Bangladesh. An institute like the Bangladesh Institute of Maritime Research and Development (BIMRAD) should have strong links with central maritime universities with more dedicated research fellows of their own. The maritime university has to upgrade its ranking by keeping pace with its vision.

Another important fact is that research budget for all public universities is funded by the University Grants Commission (UGC). UGC annual reports show that the amount of money allocated to different public universities, including BSMRMU, for research on maritime and oceanic matters is very scanty. As a result, it is difficult to conduct good research with dispersed diminutive sums of money.

### Areas that Upset Higher Education

Universities in Bangladesh often face challenges due to the not-up-to-mark level of their intake. Many of the students entering universities often lack foundational knowledge and critical thinking skills about the ocean, which makes it difficult to grasp advanced concepts. As a result, universities need to invest in remedial courses to bridge these gaps, which strains resources and delays progress in regular curricula. Poor early education affects students' research skills, resulting in lower-quality academic output. University faculty must spend extra time on basic education, diverting focus from research and advanced teaching. Improving primary and secondary education is thus crucial for enhancing the overall quality and effectiveness of higher education in Bangladesh. As per UGC's instructions, public universities in Bangladesh are supposed to carry out research. Again, teachers who are capable and competent to conduct research are often directly or indirectly engaged with consultancy services either personally or through the university administration. These influence them to be out of focus from their primary duties of teaching and research within the universities. Lack of good governance and weak administration often create chaos in the university arena on various occasions and affect the academic environment.

### Specialized Education Offers Crucial Opportunities for Blue Economy

To be a developed maritime country, Bangladesh needs to effectively mature the maritime industry and support the growth of its blue economy. Bangladesh has strong growth potential

due to its strategic location, young workforce, and prospective shipbuilding industry. With proper investment and policy support, it can become a more significant player in the global maritime industry.

It is, therefore, essential to identify and cultivate the necessary skills and competencies in areas that the authority would recognize as vital for economic development through the creation of new job opportunities. Creating new courses in demanding fields and closing unattractive courses should be a practice to maintain the standard of the institute and minimize the waste of resources.

### University-Industry Collaboration and Infrastructure Development

Globally the maritime industry encompassing shipbuilding, ship repair, ship breaking, port operations, maritime services, and logistics are expanding both in size and value. As of 2019, the total value of the annual world shipping trade had reached more than 14 trillion US Dollars (International Chamber of Shipping, 2019). There are opportunities to expand the shipbuilding industry on the already available basic elements of shipbuilding in Bangladesh. The shipping business is also gradually expanding. The local ship owners are now being motivated to invest more than USD 12 Billion freight market available with Bangladesh. In the last year, the contribution of the Bangladeshi ship owners was more than US \$600 million (Bangladesh Bank). However, there is a shortage of skilled manpower and entrepreneurs in Bangladesh to compete in the global market.

University and Academia collaboration is more or less overlooked in Bangladesh. Fostering partnerships between educational institutions, industry stakeholders, and government agencies is important to align education and training with industry needs. It will encourage industry input in curriculum design and provide platforms for industry-academia collaboration. Representatives from the industries may be engaged as joint supervisors for research. It is necessary to invest in training facilities, simulation labs, and research centers to provide high-quality education and practical training. By identifying and developing the necessary skills and competencies, Bangladesh can enhance its maritime industry and fully leverage the opportunities within its blue economy. Emphasis on higher education, training, and continuous professional development will ensure a skilled workforce capable of driving sustainable growth and innovation in the maritime sector.

### Attracting Talents and Their Retention for the Maritime Sector

Attracting and retaining talent in the maritime sector is critical for sustaining growth and competitiveness. Strategies to achieve this goal may include enhancing awareness and perception through campaigns. There is a need to launch campaigns targeting young people, highlighting the exciting and rewarding careers in the maritime industry. The public service



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commission has to take leading responsibility for building new career opportunities in the maritime sector. Success stories of successful maritime professionals may be shared to inspire potential candidates. There is a need to include maritime topics in school curricula to build early interest. The promotion of the maritime industry as a modern and high-tech field is essential, countering outdated perceptions.

## Advancing the Educational and Training Institutes

Comprehensive curriculum development is of paramount importance for maritime higher education. Specialized programs need to be regularly designed and updated with changing circumstances in the job market. Incorporation of hands-on trainings, internships, and simulations to provide real-world experience is highly beneficial. Scholarships to students pursuing maritime studies, especially targeting underrepresented groups. Provide financial assistance and loan programs to reduce the economic barriers to entering the maritime field. Regular training and up skilling programs to keep professionals updated with the latest industry developments. Promote certification programs that recognize and validate specialized skills and knowledge. Establishing mentorship programs pairing experienced professionals with newcomers to guide their career development is useful. Competitive compensation and benefits are of immense value. There is a need to implement programs to recognize and reward employees' contributions and achievements in maritime field.

Maritime professionals need to be equipped with modern tools and technology to enhance their work efficiency and satisfaction. The availability of research vessels has been a long-cherished need for maritime professionals. The size and specification of the vessels have to be decided by concerned stakeholders through careful study. Universities and research institutes need to be well organized with an adequate number of scientists (professors) to create innovation labs and incubators to foster a culture of creativity and technological advancement. Training programs are to be planned to improve digital literacy and proficiency in using industry-specific software and technology. There have to be endeavors to encourage familiarity with automation and AI applications in the maritime industry to stay ahead of technological trends. Public-Private Partnerships and collaboration with industry is important. Partner with private companies to provide internships and apprenticeships, offering students practical experience. Bangladesh government's new initiative (through an official gazette) to provide internship support to graduates at government /semi-government and autonomous organizations has been appreciated by different professionals (Ministry of Public Administration, 2023). The policy needs to be formed to provide internships to selected prospective final-year students at specialized universities. Engagement of universities in joint research and development initiatives would result in pragmatic innovation opportunities. Authorities of training and educational institutes have to build a system to seek enhanced government and private funding and grants to support educational programs

and infrastructure development. International collaboration may open new prospects and opportunities to expose students and professionals to global best practices.

## Recommendations

Addressing the existing challenges in Bangladesh's education sector requires a multifaceted approach that includes increasing funding, improving teachers' training, updating the curriculum, strengthening governance, promoting inclusiveness, and engaging communities. By tackling these issues comprehensively, Bangladesh can enhance the quality of its education system and better prepare its workforce for the future. Again, to attract and retain talents in the maritime sector, authorities need to continuously enhance awareness -building initiatives, provide robust educational and training opportunities, offer internships with competitive compensation and benefits, and foster a positive work environment. Additionally, leveraging technology, forming public-private partnerships, and engaging in international collaboration are crucial steps to ensure the development of a skilled and motivated maritime workforce. By addressing these areas, Bangladesh should build a strong pool of human resources to support its growing blue economy. Given the strategic importance of the blue economy to Bangladesh's future, a substantial emphasis on maritime education is imperative. By investing in comprehensive educational initiatives, Bangladesh ought to build a skilled workforce capable of driving sustainable growth and ensuring the long-term success of its blue economy.

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# Nautical Fiction: An Exquisite Confluence of Literature and Maritime Lineaments

Mahfuz Ul Hasib Chowdhury



World literature has been enriched and beautified with the contributions of different authors, novelists and poets who have penned unforgettable books on the affinity between human race and seas since time immemorial. There are scores of literary masterpieces both in forms of prose and poetry which come under the genre of nautical fiction or maritime literature. In this article, I am going to make a humble effort to narrate the stories of a few nautical fictional works which are widely read and applauded worldwide and have been translated in almost all major languages across the globe. In literary terms fictional works stand for novels and short stories which are sometimes based on true events as well.

Let me start off with famed 19<sup>th</sup> century American author Herman Melville's novel *Billy Budd*. This book was published in 1924 while Herman Melville died back in 1891. Billy Budd is the protagonist of the book. A British warship named HMS Bellipotent recruited Billy Budd as a sailor from a merchant ship who was a young man not exceeding 25 years of age. Billy Budd is characterized in the novel as a plain-dealing youth who keeps quiet most of the time except necessary conversations with his fellow sailors and superiors on the ship. Billy Budd gains admiration from most of the ship's company very soon by virtue of his skills at work and sincerity. The ship's commanding

officer Captain Vere was also impressed with Billy Budd's hard work and in particular with Billy Budd's feature of doing his duty without complaining about any of his colleagues onboard.

However, an experienced and elderly sailor named Dansker one day secretly informs Billy Budd that John Claggart, the master-at-arms of the ship, does not like Billy Budd. Dansker added that John Claggart is not happy with the way Billy Budd is becoming so popular with his fellow sailors and officers. Billy Budd did not take Dansker's message seriously and continued working in his own dedicated and professional way.

Soon Billy Budd identified some shady deals going on between a few members of the ship's company and some unknown people who don't belong to the ship. Billy Budd became concerned over the law and order on the ship and shared his trepidation with some sailors who were close to him. It took no time for John Claggart to figure out that Billy Budd has come to know about the suspicious things happening onboard. John Claggart started conspiring to put Billy Budd in trouble. Surveillance on the activities and movement of Billy Budd was conspicuously broadened. Billy Budd also sensed that he was put under strong monitoring.

One day all on a sudden rumours spread among the ship's



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company that some sailors are hatching a plot to stage a mutiny. Captain Vere, the ship's commanding officer, calls John Claggart in his cabin and asks John Claggart whether the rumours are true or not. John Claggart answered that some sort of dissatisfaction among the sailors has emerged which did not exist before recruiting Billy Budd. John Claggart further said that it needs to be investigated rapidly what is actually going on and added that most probably Billy Budd is the ringleader of the stratagem.

Captain Vere calls Billy Budd to his cabin and tells him about the allegations he has heard from John Claggart. Billy Budd denies the allegations in presence of John Claggart. But John Claggart insisted that keeping Billy Budd onboard would be risky because Billy Budd is adding fuel to the fury of sailors. An argument broke out between Billy Budd and John Claggart in front of Captain Vere. At one point Billy Budd blew out of his temper and delivered a heavy punch on John Claggart's forehead. John Claggart fell down on the floor with blood gushing out of his head. The ship's surgeon declared him dead.

Billy Budd was immediately placed on a trial on charges of murdering John Claggart. The judges including Captain Vere at the trial did not take much time to conclude with the verdict that Billy Budd should be executed. Billy Budd remains absolutely calm and soundless while all these catastrophic things were happening. Finally Billy Budd was hanged but right before being executed Billy Budd yelled out "God bless Captain Vere" (Melville 2002).

After several weeks HMS Bellipotent faced a battle with a French frigate in which Captain Vere, the commanding officer of HMS Bellipotent, sustained serious wounds. He was soon admitted at a hospital in Gibraltar but he succumbed to his injuries. The last words that Captain Vere muttered before his death were "Billy Budd, Billy Budd" (Melville 2002). This novel bears themes of professional envy, humanity and penitence. The last words mumbled by Captain Vere reflect the fact that it was painful for him to order the execution of Billy Budd but Captain Vere at the back of his mind was suffering from the contrition of executing Billy Budd but he had no choice as he was a man in uniform commanding a ship and the murder took place in front of him.

Herman Melville's another novel, which is considered his masterpiece, is *Moby Dick* which was first published in 1851. This book portrays a bizarre seafarer named Captain Ahab who leads a whaling ship named "Pequod." Captain Ahab walked on a stick and had a false leg made with the jaw of a sperm whale. Captain Ahab lost his leg several years ago when a huge whale attacked his ship. Since then it became Captain Ahab's obsession to hunt down and kill the whale that caused him to lose a leg. He named the whale Moby Dick.

Gabriel, a man who worked on a merchant ship, had a prophetic power, according to the novel. He once advised Captain Ahab to move away from his pursuit to catch Moby Dick. Gabriel added that all the sailors and harpooners that attempted to kill Moby Dick faced mysterious disasters. So, the idea of trapping Moby Dick and to kill the gigantic whale would be a risky one, Gabriel cautions Captain Ahab.

Nevertheless, Captain Ahab did not pay heed to the advice from Gabriel and stuck with this lifetime target to hunt down Moby Dick. The aim of catching Moby Dick drove Captain Ahab crazy and persuaded him to behave absurdly with his ship's crew. The narrator of the novel is Ishmael, an ordinary sailor on Captain Ahab's ship. Ishmael was astonished to see the fearsome magnitude of Captain Ahab's lust for taking revenge on a whale. Ishmael had worked for some other ships in the past he did not come across anyone so crackpot like Captain Ahab.

Captain Ahab makes the lives of his sailors troublesome with frequent instructions to catch Moby Dick and often gets angry whenever chances are missed to catch whales that resembled Moby Dick. One day a typhoon hammered Captain Ahab's ship and a sailor gets killed. Starbuck, the ship's first mate, reminds Captain Ahab about the prophecy of Gabriel and says that some more dangers are looming ahead if Captain Ahab does not stop his mad quest for the whale Moby Dick but convincing Captain Ahab has already crossed all borders of human capability. Captain Ahab stopped all daily chores of his ship and engaged all sailors to find Moby Dick by any means. Captain Ahab even declared that he would not have the slightest regret even if he loses his own life in his combat with Moby Dick.

Finally one day Captain Ahab sighted Moby Dick and identified the mammoth whale. He sent out all his harpoon boats to kill Moby Dick. The monstrous whale devastated all the harpoon boats and then attacked Captain Ahab's ship. Ahab gets caught in a harpoon line and is thrown overboard by the massive blow from Moby Dick. Captain Ahab's ship was shattered by Moby Dick which led to Ahab's death. Captain Ahab was prepared for this kind of death because he knew too well that a confrontation between him and Moby Dick would imperil his own life. *Moby Dick* is taught in a lot of universities across the world. This novel has immortalized Herman Melville and ornamented him with the status of an icon in the field of nautical fiction, according to renowned literary connoisseur John Updike in his book *Hugging the Shore* (Updike, 2013).

Another landmark work of nautical fiction is *Mutiny on HMS Bounty*. This novel was first published in 1932. It was jointly authored by Charles Nordhoff and James Norman Hall, both of whom are American novelists. Roger Byam, the novel's protagonist, is introduced to the reader, and we learn that he was invited by Captain William Bligh to embark on an expedition to Tahiti to gather breadfruit trees and take them to the Caribbean Islands, where they will be planted and their fruits will be fed to the slaves of English colonists. Byam is ordered to formulate a dictionary of the Tahitian language.

HMS Bounty sets sail in November 1787 and its crew is introduced to the reader. The ship stops for a while on several islands during its journey to Tahiti and meanwhile, conditions aboard the ship begin to deteriorate. Foodstuff started rotting while the crew suspects Captain William Bligh of hoarding food for himself while several men are accused of stealing food. Anger was mounting among the crew.

HMS Bounty reaches Tahiti and Byam began studying the Tahitian

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language with the aid of some of the natives. Members of the crew begin the task of digging up young breadfruit trees and storing them on board the ship. Many of the men entered relationships with the Tahitian women and the realization that HMS Bounty would soon be sailing from this idyllic life caused displeasure among the crew. As a result three members of the ship's company deserted before the ship left.

HMS Bounty sets sail for the Caribbean Islands to deliver the trees, and early in the voyage, Captain William Bligh scolds his crew - in particular, he accuses some of them of stealing coconuts. His officers, remarkably Fletcher Christian, began grumbling over the poor treatment that they are receiving at the hands of Captain Bligh. Consequently, one morning, some of the crew, led by Fletcher Christian, seized the ship and forced Captain William Bligh, along with some of Bligh's followers, on to HMS Bounty's launch to fend for themselves on the high seas. A few sailors and officers wanted to accompany Captain William Bligh but could not because of the packed up conditions of the launch on which Captain William Bligh and his loyalists were accommodated forcibly by the mutineers.

Fletcher Christian immediately began sailing to the South Sea in search of an uninhabited island, but finding none and tired of the complaints of his fellow mutineers, Christian returned to Tahiti, where he dropped off those who wished to stay on the island, including Roger Byam. Then Christian resumed his search for an unexplored and uninhabited island.

Byam liked the easy-going lifestyle he experienced the first time on the island and soon he married a Tahitian princess. A child was born to the couple and life on Tahiti continued to be a paradise until an English ship drops anchor at the island. Byam rushed to meet the vessel and was immediately imprisoned as a mutineer, along with the other Englishmen on the island.

While taking the prisoners back to England to be prosecuted for mutiny, the ship ran aground on a reef and sinks, but not before the crew and prisoners have taken refuge in the ship's smaller boats. The small boats made an open-sea journey, and finally, after several months of sailing and woeful hardships, they reached land safely. The mutineers were jailed aboard another vessel, which took them back to England to await their court martial.

The court martial of Byam and his companions began. Testimony was given by the men of HMS Bounty who made it back to England. Byam and the other men were then allowed to present their defenses. The adjudicators examined all evidences and listened to the statements from eyewitnesses and found Byam, along with five of the other nine men, guilty of mutiny against HMS Bounty. Three of the six condemned men were taken to be hanged, and the other three, Byam included, were saved from execution only hours before their apparently unavoidable deaths. Byam was forgiven because Robert Tinkler, a friend of Byam onboard the HMS Bounty, strongly supported Byam's testimony with convincing descriptions at the court martial regarding Byam's innocence

and the other two men were also saved from capital punishment after being vindicated by the British judges.

Roger Byam went back to his family and started leading a rather carefree life free of worries and trepidations after undergoing so many vicissitudes. However, as seamanship ran in his blood, he joined another ship at the behest of the ship's captain. The ship battled the Dutch off the coast of Spain and came off victorious.

As the novel comes to a closure we find Roger Byam getting promoted to the rank of a Captain, given his own ship and he ordered his staff to sail to the South Sea. He paid a visit to Tahiti where he came to learn that his wife was no more, but that their daughter was alive. Captain Roger Byam met his daughter Helen, now a grown up girl, but did not reveal his identity to her. The magnificent novel ends with Captain Roger Byam recalling all the memories of the ups and downs he had to confront, looking back on his romance with the Tahitian princess whom he had married and stowing away a wish in the core of his heart to reunite with his wife in the world hereafter.

There are many more highly celebrated works of nautical fiction such as *Captains Courageous* by British author Rudyard Kipling, *Toilers of The Sea* by French novelist Victor Hugo, *Mr. Midshipman Easy* by British author Frederick Marryat, *Treasure Island* by another British litterateur Robert Louis Stevenson, *Twenty Thousand Leagues Under the Sea* by French science fictionist Jules Verne, *The Hunt for Red October* by Tom Clancy, and the list goes on and on.

Seas, oceans, maritime discourses, naval history of different countries etcetera have been very intimately bonded with literature for thousands of years if we glance back at ancient Greek bard Homer's imperishable epic *Iliad* with repeated allusions to seas which was written long before the birth of Jesus Christ. The authors and books described above are timeless gems in the realm of nautical fiction. These literary creations have splendidly stood the test of time and till today entice readers from all walks of life.

In postmodern Bengali literature Harishankar Jaladash's noteworthy novel *Jalaputra* is based on the lives, livelihoods, smiles and tears of fishermen living along the coastal areas of Bangladesh. This novel was published in 2011 while it was translated into English by Quazi Mustain Billah with the title *Sons of The Sea*. Quazi Mustain Billah is a retired Professor of Department of English Language and Literature in University of Chittagong. *Sons of The Sea* was published in 2014.

Around forty million people of Bangladesh live in the country's coastal region whose livelihood is for the most part dependent on fishing in the Bay of Bengal. Institutions like Bangla Academy, prominent academic scholars and the concerned ministries can motivate litterateurs to produce novels on equal terms with nautical fiction and effective steps need to be taken to have these literary works translated into English language so that these books can draw attention and applause from readers in foreign countries.



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# Navigating Maritime Literacy in Bangladesh: Challenges and Ways Ahead

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Maritime literacy is not just a skill, it is the skill and knowledge of maritime geography, including navigational principles and operation of vessels used for various purposes, concepts, and awareness that concern the sea and coastal areas. This also means understanding the maritime ecosystem, and how humans impact its composition are part of this holistic idea called maritime literacy. This also includes understanding the importance of protecting marine habitats through basic knowledge of safety measures, emergency management and survival techniques required by marine activities, and knowledge of practical conservation methods.

Bangladesh has a rich maritime past including historic trade routes and a long history of shipbuilding and avid fishermen. An understanding of international maritime laws, policies and organizations governing maritime activities and issues related to the latest developments in the maritime sector is important for Bangladesh. The economic importance of ocean knowledge for maritime industries, including shipping, fishing and tourism and how it affects international trade and finance faces many

challenges. This article highlights solutions or pursue "Cut the Gordian Knot" to these complex challenges that have been explored, considering the knowledge necessary to navigate, perceive and interact with marine environments and activities often referred to and related to maritime literacy.

## Importance of Maritime Literacy

Maritime literacy is important for a variety of reasons, including safety, environmental protection, economic rationality, cultural appreciation, science and emergency management skills, navigation principles, and weather information, which can help prevent accidents and save lives. Learning marine safety procedures, emergency signals, and first aid ensures that people are prepared in the event of a disaster. Proper maritime literacy can demonstrate the importance of marine life and resources, environmental protection and conservation by developing a strong understanding of marine ecology. Awareness is required of how humans save marine environments by promoting sustainable fishing, pollution control, and preservation. Learning the role of international trade through the Sea Lines



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of Communication (SLOC) can help significantly boost the economy (Muna, 2023). Understanding the way of working in the marine-related industry, fishing, science, and tourism can create new job opportunities.

Learning maritime history reveals how maritime transportation has affected human civilization, including cultural exchange and exploration. Understanding maritime customs and traditions helps to preserve cultural heritage and develop progress and identity. The idea of knowledge of marine biological resources fosters interest in marine research and contributes to scientific literacy. An understanding of marine engineering enables creativity and advances technology, including ship design and marine engineering.

### Benefits of Maritime Literacy

Maritime literacy helps people be better prepared for work and leisure at sea, reducing risk and increasing safety. Environmental policy and management of marine resources involve more knowledgeable people and planning. Thus, maritime literacy can promote a sense of shared responsibility. It encourages community participation in coastal marine conservation initiatives. It can integrate biology, geography, history, economics and engineering to ensure prosperity for a maritime nation like Bangladesh.

Advance learning of maritime literacy ensures the safety of people who work at sea or participate in waterborne activities. Due to the importance of marine ecosystems, people are increasingly aware of the need for conservation and eco-friendly behavior. Understanding the importance of the maritime industry promotes sound business practices and clarifies its place in the global economy. Knowledge of the history and culture of the marine world improves our understanding of human civilization and intercultural relations. Increasing people's understanding of marine ecological concepts in marine science can promote scientific literacy and encourage careers in the maritime sector.

### State of Maritime Literacy in Bangladesh

Bangladesh's current maritime literacy shows that the country is increasingly recognizing the value of maritime infrastructure due to its location, economy dependent on maritime trade and growing interest in marine conservation. The location of the country is advantageous for shipping lanes and regional maritime trade. Major ports like Chittagong and Mongla handle most of the country's imports (Munim, 2022). Exports are important for trade. A large portion of the population derives its livelihood from fishing and related activities.

Seafarers can get training at Bangladesh Marine Academy, Marine Fisheries Academy, and other marine academies across the country. Programs in marine science and related disciplines are available at several public and private universities. There is limited integration of maritime literacy in primary and secondary school curricula. However, the country needs more focus on specialized training in marine fisheries, marine engineering, and other marine-related higher studies.

Although there are occasional items and segments, maritime news is rarely covered by the mainstream media. Government and non-profit organizations often run awareness campaigns on marine conservation and protection. The Bangladesh Navy and Coast Guard are trying to build awareness in promoting maritime literacy in Bangladesh by organizing Maritime Domain Awareness (MDA) seminars. This is the major initiative dedicated to promoting maritime literacy. However, the awareness remains low amongst the vast population of the country.

The Sundarbans mangrove forest protects a unique ecosystem. It is recognized as a UNESCO World Heritage Site. There are many policies to protect marine life and its conservation. However, problems such as pollution and overfishing remain. NGOs and local associations are involved in awareness-raising activities. They promote sustainable fishing methods, beach clean-up, etc.

Efforts are being made to develop a comprehensive maritime strategy. This strategy focuses on maritime security and sustainable development. The government is pushing the idea of "Blue Economy." The goal is to make better use of marine resources. Bangladesh participates in regional maritime conventions and organizations. These bodies work to improve environmental protection and maritime security, and enable partnering with global organizations for research. They assist in technology transfer and capacity building.

### Challenges and Ways Ahead

The general education system of Bangladesh does not include a strong integration of maritime literacy. In addition, there are not many facilities or resources available for offshore training and education. One of the main barriers to achieving maritime literacy in the country is the lack of public outreach and awareness. The media often does not cover maritime issues regularly and widely. Furthermore, the lack of implementation and enforcement of marine policies and regulations undermines the regulations and public awareness required to address major environmental concerns.

Encouraging public-private partnerships to build ocean education programs and resources to ensure effective coverage and information sharing through the media, social networks, and community activities can be very beneficial. Appropriate syllabi for schools and universities will bring a more educated future generation. Planning for multi-sectoral programs to encourage collaboration between government, educational institutions, and maritime industries will be an appropriate futuristic goal. A centralized maritime authority should be created for communication to showcase Bangladesh's maritime history through museums, cultural programs and tours. This will create an interest in nautical issues and a sense of pride. Improving marine literacy can lead to a more educated and engaged population while fostering a stronger sense of connection between people and communities in the world's ocean and coastal regions.

Bangladesh's maritime literacy rate is changing as more and more people realize the importance of the Bay of Bengal in its economic development. It is also vital for environmental protection.

Cultural heritage is benefitting as well. Despite efforts to improve policy frameworks, public awareness, and education, obstacles remain. These need to be overcome by the Government, and educational institutions must collaborate. NGOs and businesses should work together regarding these. By addressing these issues, they can mobilize the public to encourage great learning on maritime aspects. If oceanography is not emphasized in the educational system, it leaves a large portion of the population unaware of ocean issues.

Improving Bangladesh's maritime literacy is a challenging but important task. Bangladesh can realize the potential of all "Blue Economy" and marine resources by implementing a comprehensive strategy, including coordinated planning, public awareness campaigns, more investments, and reforms in education in order to pursue cutting the Gordian Knot of maritime illiteracy and secure the bright future of the nation.

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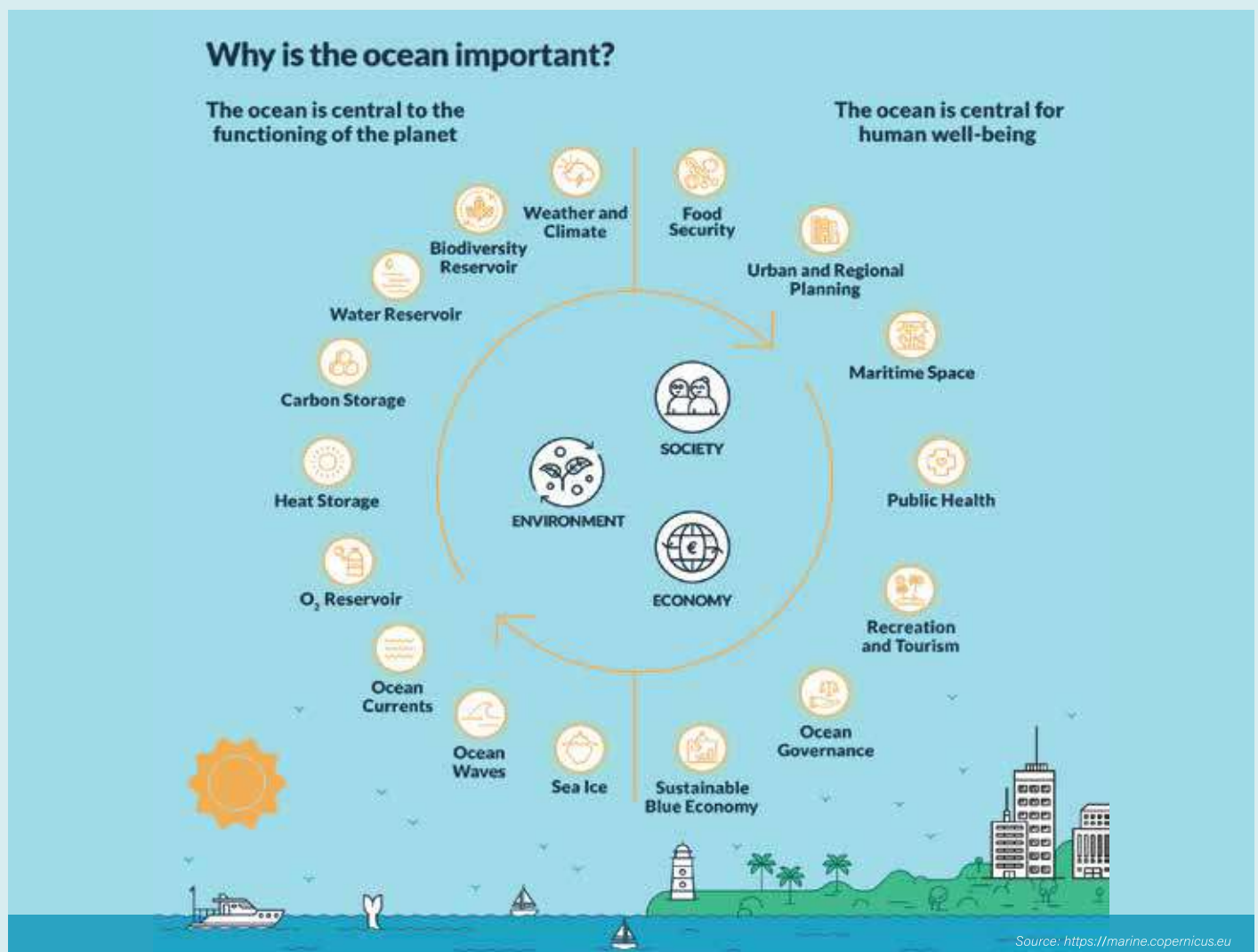
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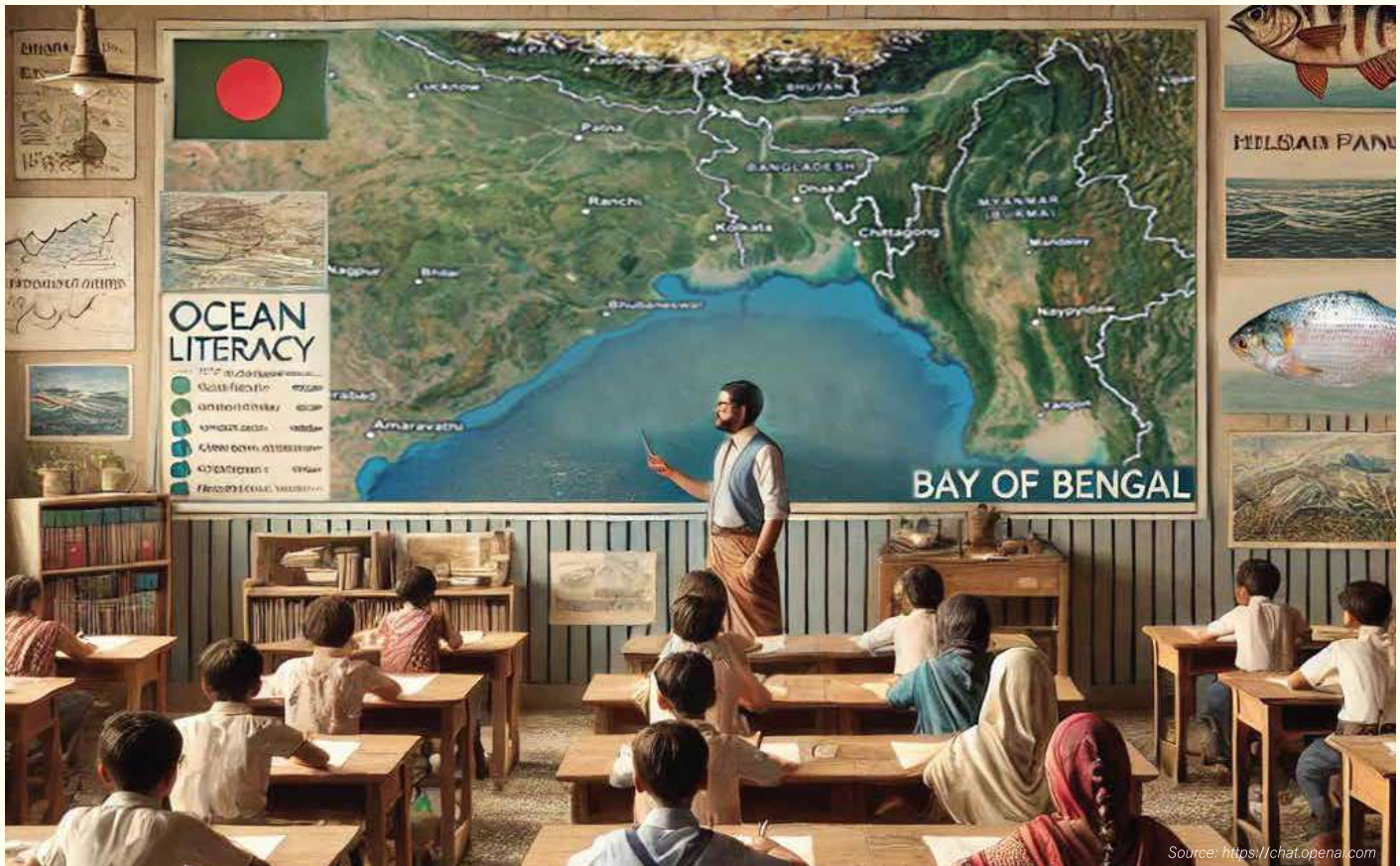
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# Embedding Ocean Literacy in School Curriculum: A Pathway to Sustainable Maritime Bangladesh

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Oceans are considered as the fundamentals to the existence of life on Earth. Five boundless, interconnected ocean basins, the Atlantic, Pacific, Indian, Arctic and Southern, make up the only ocean in our solar system and contain 97 per cent of Earth's water (Payne & Marrero, 2022). The wellbeing of human lives on Earth depends on the ocean's health. At the same time, human actions on Earth significantly affect the health of the oceans. Comprehending the ocean system is essential to understanding and protecting this blue planet on which we live. Ocean literacy, the understanding of the ocean's influence on people and people's influence on the ocean, is a concept aimed at improving public understanding of ocean-related issues, fostering stewardship, and encouraging responsible behaviour toward the ocean and its resources.

Bangladesh, a coastal state of South Asia with an expansive coastline along the Bay of Bengal, is heavily dependent on maritime activities and oceanic resources. The country relies on the sea for food, energy, security, trade, tourism, and climate regulation. Having a deltaic and low-lying mainland crisscrossed by numerous river systems directly connected to the sea, it also

faces moderate environmental and socio-economic challenges. Due to its reliance on maritime sectors and vulnerability to climate change, nurturing ocean literacy in the nation is indispensable. Despite its importance, ocean literacy is not sufficiently highlighted in Bangladesh's educational system. This essay explores the significance of integrating ocean literacy into the school curriculum in Bangladesh and offers a pathway for implementing this crucial educational modification.

## What is Ocean Literacy?

Globally, the well-accepted definition of Ocean Literacy is "the understanding of the ocean's influence on us and our influence on the oceans" (NOAA, 2022). It contains seven fundamental principles:

- The Earth has one big ocean with many features.
- The ocean and life in the ocean shape the features of the Earth.
- The ocean is a major influence on weather and climate.

- The ocean made Earth habitable.
- The ocean supports a great diversity of life and ecosystems.
- The ocean and humans are inextricably interconnected.
- The ocean is largely unexplored.

The Intergovernmental Oceanographic Commission (IOC) of UNESCO (UNESCO-IOC) promotes that "an ocean-literate person understands the essential principles and fundamental concepts about the ocean, can communicate about the ocean meaningfully, and can make informed and responsible decisions regarding the ocean and its resources" (90th UNESCO-IOC Manuals and Guides, 2022). Ocean literacy is not only about informing or educating people about the ocean system and its significance to human wellbeing; it also encourages and helps people to do responsible behaviour towards the ocean to support the sustainable use of its resources.

## The Need for Ocean Literacy in Bangladesh

**Significance of Ocean:** The Bay of Bengal, only gateway for Bangladesh to the rest of the world, plays a vital role in shaping the country's economic activities. The extensive 710 km long coastline, along with 118,813 sq km of sea area, houses enormous economic activities related to shipping, fisheries, ports and harbours, exploration of minerals, shipbuilding, ship recycling, aquaculture, tourism, coastal zone management, etc. In the country, more than 90% of international trade is seaborne. Moreover, the sea plays a significant role in shaping country's climate and weather, ensuring national security, and monitoring and preparing to reduce the loss caused by natural disasters.

**Challenges Facing the Maritime Environment:** The Maritime environment of Bangladesh faces various challenges, such as the impacts of climate change, coastal erosion, and overfishing. Low-lying coastal areas of Bangladesh are prone to the various adverse effects of climate change, including rising sea levels, increased frequency of cyclones, and coastal erosion (Mimura et al., 2014). Furthermore, unplanned and uncontrolled urbanization, non-compliance industrialization, and lack of awareness among mass people cause severe marine pollution, threatening ocean health. Plastic waste is an alarming anxiety for Bay of Bengal. According to the World Bank, the Bay of Bengal is one of the regions heavily affected by plastic debris (World Bank, 2020).

**Linking Education and Sustainability:** To ensure the sustainable management of ocean resources and to confront the challenging issues related to the ocean environment, Bangladesh has no alternative to make the nation truly ocean literate. To achieve that, it is imperative to incorporate ocean literacy into the curriculum at all formal and informal education levels. The country can empower its future generations to better understand and address these challenges by promoting ocean literacy.

## Incorporating Ocean Literacy into the School Curriculum

The importance of embedding ocean literacy in the school

curriculum can easily be understood from the statement of the then Director General of UNESCO, Ms Audrey Azoulay. At the One Ocean Summit 2022 in Brest, she stated that:

*"The international community must make education one of the pillars of its action for the ocean. Because if we want to protect it better, we must teach it better. On the occasion of the One Ocean Summit, I am setting a common goal for our 193 Member States: to include ocean education in school curriculum by 2025."*

In July 2023, UNESCO-IOC circulated a letter calling to its member states to include ocean literacy in school curriculum by 2025 as a part of the Education for Sustainable Development (IOC Circular Letter no. 2951). In the same letter, IOC Secretariat offered support to Member States in the following aspects:

- "Advocating for the promotion of a Blue Curriculum within Educational Ministries, National Specialized Agencies, and Secretaries;
- Encouraging all regions to embed Ocean Literacy in national educational frameworks, including syllabuses, textbooks, and lesson plans;
- Ensuring that Ocean Literacy is adapted to local realities, allowing conscious decision-making regarding the ocean;
- Organizing locally tailored Blue Curriculum training in the local, national language, which can encourage efforts at the national level and help with coordinated action around the world, and
- Holding training workshops and developing resource materials in different languages."

Around the world, many nations have recognized the significance of ocean literacy in promoting sustainable practices and have incorporated it into their educational systems. For instance, the United States and Australia have developed comprehensive ocean literacy frameworks that have increased public awareness and improved marine stewardship (Cava et al., 2005). A study showed that, in Japan, 21.7 % of the content of elementary school textbooks and 34.5 % of high school textbook content are of topics related to rivers, oceans, and water (Sasaki et al., 2010).

## The Current State of Ocean Literacy in Bangladesh's Educational Framework

According to an eminent promoter of ocean literacy in Bangladesh, "Although ocean literacy is a growing movement across Europe and worldwide, and the community of marine educators is increasing much faster than another sector, in reality, its necessity is yet to be felt nationally in most of the underdeveloped and developing countries like Bangladesh" (Moslem, 2015). To grow awareness of the sustainable use of ocean resources, institutions like Bangladesh Oceanographic Research Institute (BORI), Bangladesh Institute of Maritime Research and Development (BIMRAD), Institute of Bay of Bengal and Bangladesh Studies (IBBS), Blue Green Foundation



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(BGF), Radiant Ocean Research and Education Center (ROREC), etc., are promoting ocean literacy in Bangladesh. Besides, the Bangladesh Navy and other government bodies also arrange seminars/workshops on Maritime Domain Awareness to bring the maritime stakeholders to a common understanding. National-level coordination among these disconnected initiatives will undoubtedly achieve much better positive outcomes.

In Bangladesh's formal education system, a dedicated Maritime University and a few other Public Universities have faculties related to marine sectors. These Universities focus on creating specialist educators on specific marine subjects like oceanography, marine fisheries, port and shipping management, maritime law, etc. Despite its undeniable importance, ocean literacy has minimal coverage in the school-level curriculum. The curriculum focuses mainly on terrestrial sciences and general environmental awareness, with little emphasis on the specifics of marine ecosystems and ocean processes (Miah & Rahman, 2016).

## Pathway to Embed Ocean Literacy in Bangladesh's School Curriculum

**International References:** The 90<sup>th</sup> edition of the IOC Manuals and Guides (2022), titled "A New Blue Curriculum: A Toolkit for Policymakers", gives Member States comprehensive suggestions and guidelines for implementing ocean literacy in school curriculum. Section 5, Scope and Sequence, of this new blue curriculum provides clear guidelines on how best ocean literacy can be incorporated at different school levels. In 2021, the National Oceanic and Atmospheric Administration (NOAA) and the National Marine Educators Association (NMEA) published a book titled "A Handbook for Increasing Ocean Literacy- Tools for Educators and Ocean Literacy Advocates." This handbook is a good resource for learning, teaching, and communicating about the ocean.

Considering the undeniable dependence on oceanic activities and marine resources, there is no alternative to Bangladesh to make the nation ocean literate. The gaps highlight the need for a comprehensive approach to integrating ocean literacy into the educational framework. In this regard, the government must take a holistic approach, including reexamining and reconstructing the national education policy. According to Ahmad (2024), "the new education policy should include the UNESCO-IOC sponsored Blue Curriculum. Furthermore, the new policy should embrace ocean literacy for students at all levels and people from all walks of life."

**Proposed Curriculum Modules:** Several steps can be taken to incorporate the "Blue Curriculum" into Bangladesh's schools. For example, Integrating ocean literacy into Existing Subjects, Developing New Educational Modules, Training Teachers and Professionals, Developing Educational Resources, and Establishing partnerships. For Bangladesh, to develop a solid understanding of marine environments among the students at all levels, the following four levels of approaches can be adopted:

- **Primary Level:** Students at the primary level may be introduced to basic concepts about the ocean and its importance to human wellbeing. This may include the ocean's role in providing food, energy, climate regulation, and supporting biodiversity. They should learn about simple actions to protect the ocean, such as reducing plastic use and conserving water.
- **Secondary Level:** At this stage, more intricate topics like understanding the marine ecosystems, the impact of human activities on the ocean, and the importance of sustainable fishing practices may be included. Various practical hands-on experience programs such as beach cleanups or water quality monitoring may be added.
- **Higher Secondary Level:** Advanced topics like maritime policies, ocean governance, and the ocean's role in global climate systems may be added at this level.
- **Higher Study Level:** To address the significant challenges in the marine environment, students at higher study level, under the supervision of expert educators or researchers, should undertake critical research projects and find the best attainable policy to implement.

## Benefits of Ocean Literacy for Bangladesh

Incorporating ocean literacy into the school curriculum will offer several significant benefits for Bangladesh:

**Promoting Sustainable Development:** Ocean literacy can foster the sustainable development of our nation by educating future generations with the understanding of marine resources along with the importance of the management and conservation of those invaluable and renewable possessions. Students accomplished with ocean science will be more likely to recognize and hold sustainable practices, such as reduction of pollution, responsible fishing, and protection of marine habitats. This awareness can bring a huge positive change and support to the practical management practices of the marine resources of Bangladesh (Mimura et al., 2014).

**Enhancing Climate Change Awareness:** Ocean literacy has become inevitable for the people of Bangladesh, most importantly for the new generations, as there is a huge connection between the ocean and climate regulations. According to Cava (2005), "Understanding the interconnections between ocean processes and climate will help the students recognize the impacts of climate change on the environment and economy of the nation. This knowledge will empower them to advocate for practical adaptation and mitigation strategies, such as coastal protection measures and climate-resilient infrastructure."

**Empowering Future Generations:** Incorporating ocean literacy in the school curriculum will provide students with knowledge and tools related to the ocean. By utilizing that, they can contribute to initiatives for sustainable management of marine resources and help protect the ocean environment actively. They will develop a sense of responsibility and a close connection with the ocean in the process.

**Career Pathways in Maritime Sectors:** Career opportunities connected to maritime sectors, like experts on marine biology, fisheries management, oceanography, and maritime law, are increasing daily. Following the developed nation, in support of national development, Bangladesh's government prioritized the promotion of sustainable blue economy initiatives. According to Islam and Haque (2018), "As Bangladesh looks to expand its blue economy, which encompasses the sustainable use of ocean resources for economic growth, education will play a crucial role in developing the skilled workforce needed to manage and protect marine ecosystems." Introducing ocean literacy in the school curriculum will provide the new generation with more opportunities to pursue multifaceted career paths in the maritime sector from their early life.

In conclusion, regardless of the inseparable connection between the ocean and human health, around the globe, especially in under-developed or developing countries like Bangladesh, the importance of ocean health is misunderstood, under-represented or absent from school curriculum. Due to the undeniable importance and dependency on the sea, Bangladesh needs to incorporate ocean literacy into the school curriculum. Without a strong foundation in ocean science, students may not fully understand the significance of marine ecosystems or the impacts of human activities on the ocean. The country can promote a greater awareness of the ocean and its vital role in supporting life by incorporating ocean-related information into already-existing disciplines, creating new educational modules, training teachers and professionals, and developing educational materials. Ocean literacy will play a crucial role in preparing students to safeguard and manage the maritime environment that their country depends on as it moves toward a more sustainable future.

To achieve this vision, policymakers, educators, researchers, and the community must cooperate and prioritize ocean literacy as a fundamental element of the educational framework. By doing so, Bangladesh can steer towards a future where the younger generation takes the lead in preserving its priceless marine resources and sets the standard for sustainable ocean stewardship. By equipping the next generation with the knowledge and skills to understand and protect marine environments, Bangladesh can ensure its nation's long-term health and prosperity.

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## Section II: Maritime Security and Geopolitics

# AI as Smart Technology is the Effective Solution of Maritime Surveillance for Bangladesh

Rear Admiral Khandakar Akhter Hossain, NUP, ndc, psc, PhD



Bangladesh, being a maritime nation, has a sea area of 1,18,813 km<sup>2</sup> with a coastline of 710 km and is connected to the globe through the Indian Ocean. The Bay of Bengal, spanning 2.6 million square kilometers, is bordered by India, Bangladesh, Myanmar, the Andaman and Nicobar Islands, Sri Lanka, and Sumatra. All these nations rely on the bay for fishing, tourism, resource extraction like oil and gas, live resources, as well as maritime transport. However, intrusions like Illegal, Unreported, and Unregulated (IUU) fishing, drug and illegal arms trade, and human trafficking pose significant threats to regional security and stability (Mack, 2005). Bangladesh's maritime economy relies on fishing, shipping, port activities, and maritime resource extraction. In the maritime sector, ensuring safe navigation, protecting fishing grounds, and securing ports and relevant assets are vital. This nation has few maritime surveillance challenges, and that can be mitigated effectively by the optimum use of Artificial Intelligence (AI) and other smart technologies (K. A. Hossain, 2023a). The research and exploration of seas began centuries ago, with the aim of business

and military function. But now, it's an organized discipline and a significant branch of earth sciences (Food and Agriculture Organization of the United Nations, 2024).

## Maritime Surveillance Challenges of Bangladesh

**IUU Fishing:** Today, IUU fishing is well-known to us, and that captures a broad variety of fishing activities. IUU fishing is found in all types and sizes of fisheries. It occurs both on the high seas and even in any areas of national jurisdiction. IUU fishing depletes fish stocks, disrupts ecosystems, and affects livelihoods. According to innovative research that used satellite technology, water observations, and Machine Learning (ML) to track and monitor unreported vessels, a dark fleet of many fishing vessels of a single nation has illegally caught around half a billion USD worth of squid in other nations' waters since 2017 (Hanich & Seto, 2020). Interestingly, the ghost ships that turn off their Automatic Identification System (AIS) exacerbate the problem. AI, ML and other smart technology can be utilized to mitigate IUU fishing issues.



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**Drug trafficking (the “Ya-ba” Trade):** Bangladesh faces a drug epidemic due to the abuse of Ya-ba, a methamphetamine caffeine mixture, and other prominent drugs. Smugglers use Rohingya refugees as carriers of Ya-ba or exploit fishermen to transport drugs. The drug enters Bangladesh through multiple routes including the Bay of Benge, threatening public health and stability, mainly the young generation. The United Nations Office on Drugs and Crime (UNODC) in Bangladesh undertook the global scheme against trafficking in 2007 for attainment out to strengthen Bangladesh’s ability to fight trafficking on a legal and financial level (United Nations Office on Drugs and Crime, 2020). UNODC also works at a regional scale with the neighbors of Bangladesh on anti-human and narcotics trafficking. However, AI and other smart technology can be utilized to monitor, track and battle against drug trafficking.

**Human Trafficking and Smuggling:** Today, billions are suffering globally from the consequences of being displaced due to the creation of conflicted states. The Rohingya refugee camps in Southern Bangladesh are facing a rapid rise in serious organized crimes across the Cox’s Bazar (Bangladesh) and Rakhine (Myanmar) border. The influx of Rohingya refugees has led the chance of human trafficking in the Bay of Bengal. Strengthening coastal patrols and intelligence sharing can address this issue. Collaborating with regional partners is vital to combat smuggling networks. AI and other smart technology can help to monitor and track such sensitive matter effectively.

## Efforts to Enhancing Maritime Surveillance and Security in Bangladesh

Bangladesh has made progress in its strides towards reducing poverty with the emergence of Millennium Development Goals (MDGs) and the now committing to the Sustainable Development Goals (SDGs) by planning a COVID-19 pandemic recovery national development agenda. Accordingly, the country is committed to Global Goal 16, which talks about ensuring and maintaining peace and security within the national and regional territories. Again, prior to the commitment to Goal 16, the country passed anti-trafficking legislation in 2012, well-known as The Human Trafficking Deterrence and Suppression Act. While the legislation is in place, much utilization of the actual Act 2012 is a challenge. On the other hand, Bangladesh, with its extensive coastline along the Bay of Bengal, recognizes the critical importance of maritime security. Balancing economic interests, environmental concerns, and national security imperatives is essential. The nation has a few key strategies and collaborative efforts aimed at enhancing effective maritime surveillance and security in the country.

**Modernizing the Bangladesh Coast Guard:** The Government of Bangladesh has unveiled an ambitious plan to transform the Bangladesh Coast Guard into a modern and technologically advanced force for maritime security and development. The visionary plan focuses on equipping the Coast Guard with a state-of-the-art maritime platform, enhancing infrastructure, including smart technology, and developing manpower capabilities. The Bangladesh Coast Guard performs the duty of

maritime border security of Bangladesh. Over the years, the force has grown to include thousands of personnel and 57 vessels. By bolstering the Coast Guard’s capabilities, Bangladesh aims to establish a formidable force that can effectively safeguard valuable resources and protect maritime borders. AI and other smart technology may play a crucial role in developing an effective Coast Guard.

**Regional Cooperation:** Bangladesh collaborates with neighboring countries and regional forums to address common maritime challenges. Initiatives like the Colombo Security Conclave (CSC), involving Sri Lanka, India, and the Maldives, focus on maritime security, counter-terrorism, and disaster relief. Membership in such regional blocs enhances information sharing, joint exercises, and coordinated responses. Maritime security countering terrorism and other crimes in the Indian Ocean have emerged as a focus area for India as part of its Indo-Pacific Strategy, and the doctrine of security and growth for all in this region (Dhali, 2021).

**Multinational Information Sharing:** Effective information sharing among littoral states is vital for combating maritime threats. Information sharing has both advantages and costs, and is subject to both enabling factors as well as barriers. Bangladesh actively participates in multinational efforts to exchange intelligence, track vessels, and address security issues. Collaborative platforms enhance situational awareness and response capabilities.

**Blue Economy and Sustainable Practices:** The ocean is the earth’s life support. Sometimes, human activities have defined a negative relationship with the ocean. Today, we dump too much bad substance in, and we take too much good substance out of ocean. The new “Blue Economy” is the term of art for identifying those activities that improve the human relationship with the ocean, and for aligning our systems of accounting and metrics to both define and enhance our ocean-positive economy. It also allows us to account for ecosystem services. Bangladesh aims to harness its maritime resources like gas, oil, minerals, fish, and other living resources for sustainable development. A modern Coast Guard equipped with cutting-edge technology like AI and ML not only enhances security but also contributes to economic growth. Safeguarding marine ecosystems and promoting responsible practices are integral to long-term maritime security.

**Countering Human Trafficking and Smuggling:** The influx of Rohingya refugees has led to human trafficking in the Bay of Bengal (Sengupta, 2015). Strengthening coastal patrols, intelligence sharing, and collaboration with regional partners is essential. Bangladesh’s vulnerable geographical location, mainly Myanmar borders, creates a rather porous situation and a hub for human trafficking. Both “push” and “pull” factors are responsible for rising cross-border crimes. Bangladesh is connected to the Gulf region and Asia Pacific via South Asia, which has 20 specific drop-off and pick-up zones for traffickers to use the sites for transporting people across the country’s border areas (Inter-Sector Coordination Group, 2021). Since the

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trafficking of narcotics and humans is posing threats to other Bilateral missions in the country, international legal systems and human rights standards need to be at par by making effective use of bilateral agreements that can be universally applied to all trafficked persons. Again, combating smuggling networks requires joint efforts, effective enforcement, and utilization of smart technology for real-time surveillance and monitoring the maritime activities.

## AI-Driven Smart Solution for Bangladesh

Bangladesh has been gradually investing in technology-driven solutions to enhance its maritime security capabilities. However, AI-based maritime security in Bangladesh is very limited. The potential initiatives and considerations for AI and other smart technology-based maritime security in Bangladesh are necessary. Bangladesh can utilize AI-driven surveillance systems to monitor its maritime borders, ports, coastal areas, or even Exclusive Economic Zone (EEZ). These systems can analyze data from satellite imagery, radar, AIS, and other sensors to detect anomalies, track vessel movements, and identify potential security threats such as illegal fishing, smuggling, and piracy. Implementing AI algorithms and ML for vessel tracking and identification can improve Maritime Domain Awareness (MDA) in the water of Bangladesh. By analyzing AIS data and satellite images, AI, ML, or Blockchain can help authorities identify and classify vessels, track their trajectories, and detect suspicious activities in real time (K. Hossain, 2023). AI and other smart technology can enhance security measures at Bangladeshi ports by automating the analysis of cargo manifests, screening containers for illicit goods, and detecting unauthorized access to port facilities. Intelligent surveillance cameras equipped with AI algorithms can also help monitor port perimeters, improve surveillance, and identify security breaches promptly. With the progress of smart technology, AI approaches will be progressively applied to maritime research and development, complementing traditional marine and maritime forecasting models and observation techniques to further elaboration and enhancement.

Bangladesh can benefit from establishing partnerships with regional and international organizations to share maritime intelligence and collaborate on AI-based security initiatives. Information sharing platforms powered by AI can facilitate the exchange of real-time data and analysis among maritime stakeholders, enabling more effective responses to maritime security threats. Investing in training programs for maritime personnel on AI technologies and data analytics is essential to maximize the effectiveness of AI-based maritime security solutions. Building local expertise in AI and cyber security will enable Bangladesh to develop and maintain its own AI systems tailored to its specific maritime security needs. Bangladesh should also address legal and ethical considerations related to the use of AI in maritime surveillance

and security, including data privacy, algorithmic bias, and human rights implications (K. A. Hossain, 2023b). Establishing clear guidelines and regulations, governing the responsible use of AI technologies, will help to mitigate potential risks and ensure transparency and accountability. So, AI-driven maritime surveillance is the optimum solution for Bangladesh.

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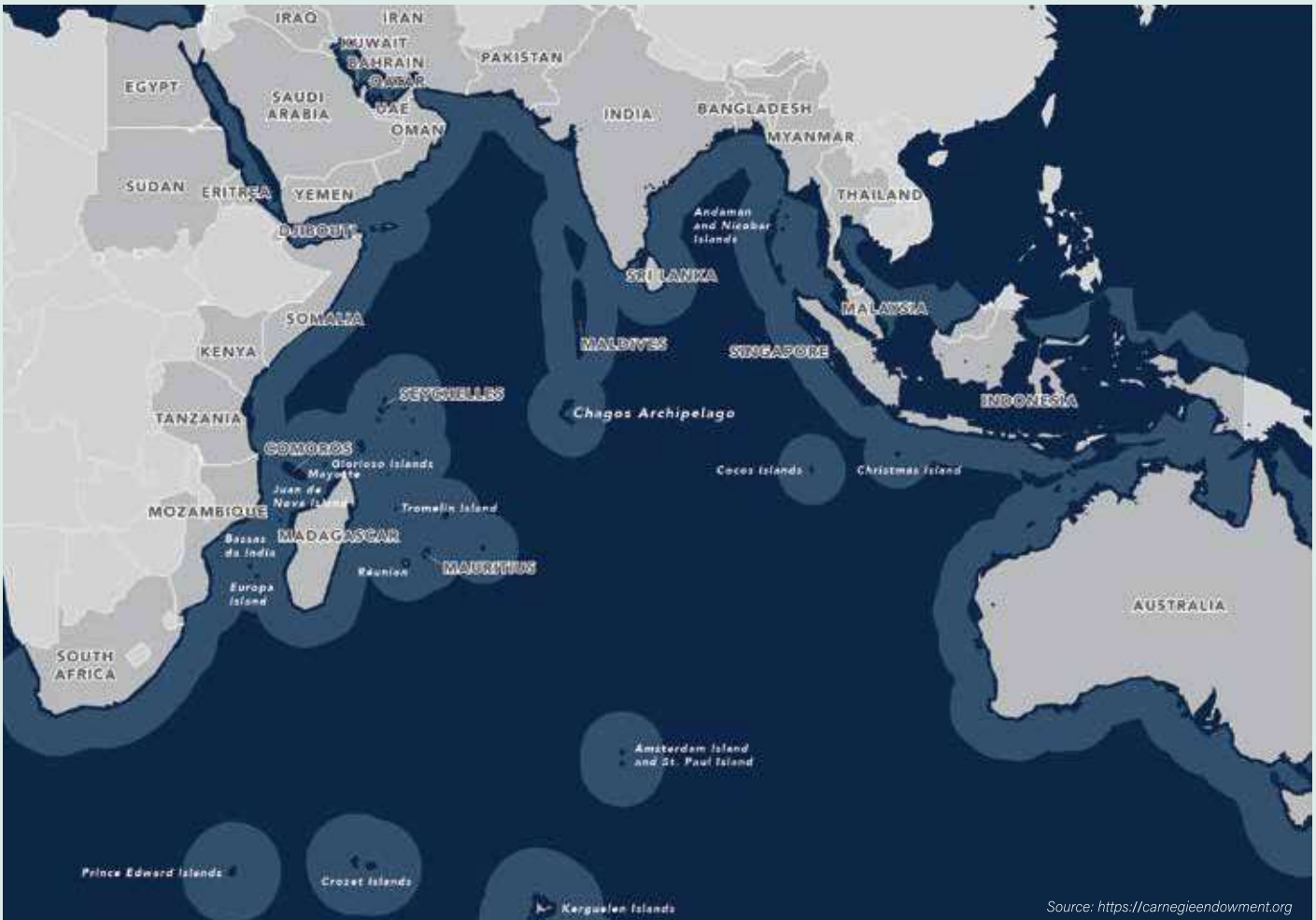
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# Maritime Realpolitik, the Role of Language as a Strategic Instrument and Blue Economy

*"The strategy of blue economy is blue economy."*

Commodore Syed Misbah Uddin Ahmad, (C), NUP, ndc, afwc, psc, BN, (LPR)



History of strategy covers wide stretch of human striving. The history of strategic thinking brings about diverse strategies; illustrates, appealing and insightful account of how strategy influences every aspect of human lives. The way the range of strategic narratives spans from pre-biblical period to the present, the strategic instruments used have also evolved through the ages. Through meticulous analysis of the political, military, maritime, business, and all other forms of strategies, one can find that the instruments applied to effectively translate the adopted strategy to bring victory varies in their application. They vary, for instance, due to the factors of time, space, and forces of such strategies. Interestingly one strategic instrument, the “language” is either ignored or forgotten though, according to Thucydides, perhaps it is the most important of the strategic instruments (Freedman, 2013).

An English professor of history and foreign policy John Bew has traced the term “Realpolitik” to the mid nineteenth century writings of a German journalist and politician, August Ludwig von Rochau. In 1853, Rochau, referred “Realpolitik” as the *Grundsätze der Realpolitik, angewendet auf die staatlichen Zustände Deutschlands* (Practical Politics: An Application of Its Principles to the Situation of the German States) (Bew, 2017). Realpolitik is becoming more important than ideologies because post “Westphalia” states want to defend their national interests first (Chaturvedi, 2007).

Encyclopaedia Britannica defines *Realpolitik* as “politics based on practical objectives rather than on ideals. In diplomacy it is often associated with relentless, though realistic, pursuit of the national interest.” The phrase *Realpolitik* is commonly referred



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today as “power politics.” The term appears to be understood, and also misunderstood when used loosely without connecting to the context. It may be understood most correctly as the realist approach to foreign policy. Many historians and International Relations (IR) gurus consider foreign policy of a nation to be a revered tradition that stretches from the antiquity, era before “written history and diplomacy” of the Peloponnesian war by Thucydides.

Thucydides was one of the Athenian *strategos*. After he failed to prevent a Spartan invasion of Amphipolis, he was exiled for twenty years. He utilised his time in exile to get to know Spartans as well as Athenians and their affairs to a certain degree. Thucydides, a former *strategos* morphed to be a historian is also considered as one of the founder of realism. Thucydides admired Pericles, writes Lawrence Freedman in his book, *Strategy A History*, due to “his ability to manage the Athenian political system by using his authority and eloquence to appeal to reason and persuade the crowd to adopt sensible policies...” (Freedman, 2013). Analysing Thucydides, it can be argued that the significance of persuasive arts clarifies why “language” the vehicle of speeches and dialogues is important. Pericles, the hero of Thucydides, had to be much more than a persuasive orator, for his speeches were strategic scripts. Another character, Diodotus reflected on the essential role of speech-making. According to him, in a democracy decent citizens should make cases based on rational arguments honestly expressed.

In the annals of human history, the Prophets of God (peace be upon them all) were the most eloquent of the people of their times. People, especially the downtrodden of the societies rallied behind them, not for their riches, for most of the Prophets were not wealthy, but for the superb eloquence they used in their speeches to inviting them to the truth. The main sources of their knowledge and wisdom were the revelations compiled as sacred scriptures. Of the three major monotheistic religions: Judaism, Christianity, and Islam; the Bible, of its many versions, the old and new testaments, and especially the miraculous Qur’an are full of literary wonders. They are terse, yet full of metonyms, analogies and inspiring phrases to rouse the believers to confront the evils.

For instance, one of the chapters of the Bible states, “For by now I could have stretched out my hand and struck you and your people with a plague that would have wiped you off the earth. But I have raised you up for this very purpose, that I might show you my power and that my name be proclaimed in all the earth” (Exodus 9: 14-16). Verse 4, chapter 55 of the Qur’an mentions, “He has taught him an intelligent speech.” Almighty Allah has given human being the power of expression: the ability to understand clearly the relations among things and the capability to explain them. The messenger of Allah (peace and blessings of Allah be upon him) himself said, “I have been sent with the *jawami al kalim*” (Bukhari), i.e., comprehensive but concise language that is able to express host of meanings in a few words. He was known to keep himself to brevity and non-superfluous speech. Each word of these is a gem worthy of being written in gilt (Bulandshahri, 2005).

In the history of the Arabs, in futile efforts, to match the miraculous literature of the Qur’an and to out manoeuvre the eloquence of the Prophet Muhammad (peace and blessings of Allah be upon him), the pagan Arab leaders, as part of their strategy, used to hire the best poets, oracles or orators available. Since strategy, as some school of thoughts conceive, equals to achieving the “ends,” through effective utilisation of correct “ways” and “means.” They, the pagan Arab military commanders, even strategize to include in their logistics singers, and poetess to employ them to use poems to ignite and instigate warriors to fight.

As said to be the norm in democracies, be it in the ancient civilized world as was in the Athenian democracy, or in the current systems of nation states of the Westphalia model, strategy cannot be implicit and has to be articulated, vetted through intense deliberations, debates, discourses, arguments to convince others that this is it. Pericles, noted Thucydides, enjoyed the company of the intellectuals. Notable among them was Protagoras, a self-proclaimed sophist — a “wise man” of the Athenian democracy. He was famous for his explorations into the proper use of language!

The part of the *Art of War* in the Athenian society was also to develop and apply “persuasive arts” (Leith, 2011). During the early stage of the Peloponnesian war, around 427 BCE, Gorgias came to Athens, where he displayed “rhetorical virtuosity.” “He saw words as equivalent to physical force.” (Freedman, 2013). He demonstrated how it was possible to make a feeble argument forceful through careful construction. Words can hurt, bring happiness as well. Some words can strike fear, usher hope, yet some words can stir the listeners to boldness, and some can shock and bewitch the soul with even evil persuasion.

The first Gulf War was code named “Desert Storm” (1991). One of the phases of the Iraq war (2003) was named, “Shock and Awe”; perhaps copied from the Qur’an (The Holy Qur’an 8:12). Even a single word used as rhetoric has strategic outcome. The recent landslide victory of the Labour Party ended fourteen years rule by the Conservative Party in Great Britain. The event has been accrued to a large extent, to a single oratory, “change,” to convince the voters. The Language Movement of 1952 is unique to us the Bangla speaking people, and of course is a case in point. Another glaring example of “language” effectively used as “strategic tool” was the historic seventh March speech given by Bangabandhu. It was not only electrifying and blazing oratory, but like the “strategic scripts” of Pericles, has been accepted worldwide as a “strategic guidance” to prosecute the glorious war of liberation. It is also believed to have inspired the then Major Zia (Later President) to declare the independence on 26 March 1971. Furthermore, the literary contribution of *Choromprotro* to inspire the freedom fighters cannot sufficiently be emphasized. The 2nd liberation of Bangladesh on 5 August 2024 with the fall of Sheikh Hasina’s government is yet another example of ‘Reverse’ or ‘Invert’ use of language as “strategic tool” by the then Prime Minister against the “correct” use of the language by this revolutionary

youngsters. Thus, apart from being a strategic tool, use of language and literature can historically be seen even as one of the 'lines of operations,' so to say as 'ways' and 'means' to achieve the lofty 'ends.'

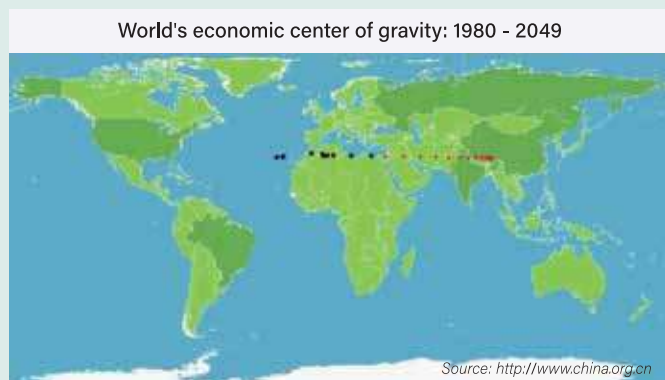


Figure 01: The World's Shifting Economic Center of Gravity. Black Dots Represent Movement from its 1980 Mid-Atlantic Position to the Present. Red Dots are Forward Projections to 2049

In, *The Future is Asian*, Parag Khanna visualizes "The Asianization of the World." Stipulating that diplomatic, economic and political leadership of the world for this century is shifting towards Asia. Likening him, this author specifies that "All our Fortunes are at Sea"; that "The Strategy of Blue Economy is Blue Economy." And that "Center of Gravity," (CoG) i.e., the *Schwerpunkt* as was coined by the Prussian born military theorist Clausewitz in his master work, *On War*, is the single most important 'Point,' the 'Hub of all Power' of a state must not be 'limited' in its understanding and application to the military affairs only, as some of the student of strategy inadvertently do. Rather it would be prudent to 'identify' all the ingredients of national power, and subsequently, 'select' the 'central' one as the CoG. To seize the initiative of the shifting from predominantly an agrarian economy, to an industrial economy mainly based on RMG, to a more sustainable 'Blue Economy.' Thus, the twenty first century maritime Bangladesh should select 'Blue Strategy' as the national strategy, where, the 'Blue Economy' is to be its CoG supported by 'Blue Diplomacy,' to secure 'Blue Security.'

Everyone needs a strategy, preached Freedman. The strategy of, if it can be said so, Blue Economy is tagged as part of "The Bangladesh Delta Plan (BDP) 2100." The businesses originate from 'Blue Economy' are expected to overcome 'Red Queen Effect' and offer opportunities from the 'Blue Oceans' by maximizing 'Blue Profits' for sustainable socio-economic development of Bangladesh to achieve top priority agenda of the national interest, i.e., 'Blue Security.' On a brief analysis of the document, BDP 2100 appears that the policy laid and strategy articulated especially about the 'Blue Economy' sector deserves special mention. However, the timely implementation of the plan(s) remain a daunting task. Besides, Kim and Mauborgne advised that 'Red Oceans' are sometimes unavoidable, and 'Blue Oceans' might eventually turn Red! (Freedman, 2013). Therefore, this author suggests to add 'realism,' the 'realpolitik dimension

of the 'maritime security,' the 'maritime realpolitik' in the revised strategy paper of BDP 2100 within the broad framework to identify core national interests. Once added, the 'maritime realpolitik' in its spirit can address the current VUCA (Volatile, Uncertain, Complex and Ambiguous) international world order.

It may be strongly argued that the peaceful delimitation of the sea boundary with both Bangladesh's neighbours can be termed as a pragmatic realist approach to secure national interests. It was indeed a smart manifestation of 'Maritime Realpolitik.' The subsequent praiseworthy actions range from arranging an international seminar on Blue Economy in September 2014, to formation of the initiative named *Samudra Sampod Ahoron*, to establishing the Blue Economy cell, including crafting the BDP 2100. The 'Role of Language as a Strategic Instrument' – the 'Ocean Literacy,' to make 'Blue Economy' and its related diverse activities, more attractive and popular, especially to the general mass and entrepreneurs of different echelons appears to have underperformed. Native maritime experts posit that of the total Blue Economy prospect of about US \$24 trillion, only a meager 2.5% to 3.0% is currently being harnessed worldwide. Reaping proportionate benefits from such a great opportunity for our country is yet to be up to the mark. The present blue economic activities in Bangladesh need to be really revamped, and if needed restructured.

The crystalization of 'Blue Strategy,' 'Blue Economy,' 'Blue Profits,' 'Blue Diplomacy,' and 'Blue Security,' using the 'strategic instrument of language' needs to be professionally weighed using VMOSA (Vision, Mission, Objective, Strategy, Action Plan) template within the broader 'Maritime Realpolitik' framework of national interest. Maritimization of riverine Bangladesh seems to be the correct realist approach. Maritime Bangladesh of twenty first century must keep a lofty long term aspiration beyond the Bay of Bengal to secure all our national interest across the globe without losing medium and short term sight of the action plans to reap the 'Blue Profits,' of: 'longline tuna fishing,' 'marine plants,' 'offshore energy generation,' 'biotechnology,' 'sea weeds,' 'aquaculture,' 'shipping,' 'marine tourism,' 'shipbuilding,' 'shipbreaking' and many more.

In the fascinating New York Times bestseller, *Prisoners of Geography*, Tim Marshall considers Geography as a prison of sorts. "One that defines what a nation is or can be, and one from which our world leaders have often struggled to be free." (Marshall, 2015). Bangladesh is gifted with the heavenly bounty of the Bay of Bengal that not only saves Bangladesh from being imprisoned, but offers us all the resources to win over the primal competition breaking free from the "riverine and landlocked" shackles that still imprison our minds. As forward looking citizens, we must not lose hope, even to 'go in harm's ways' as was lamented by John Paul Jones.

Imitating Pablo Neruda, Chilean poet and Nobel Laureate, let us embark on the strategic instrument, "language," to emphatically say in unison that Bangladesh is also very fond of the word "hope" for a golden Bengal. While the strategist aims for comedy but risks tragedy, and the dramatist knows from the



beginning whether (s)he is writing comedy or a tragedy: let the realist affirm that (s)he cannot be lover of wisdom “without sacrificng (wo)manly courage.”

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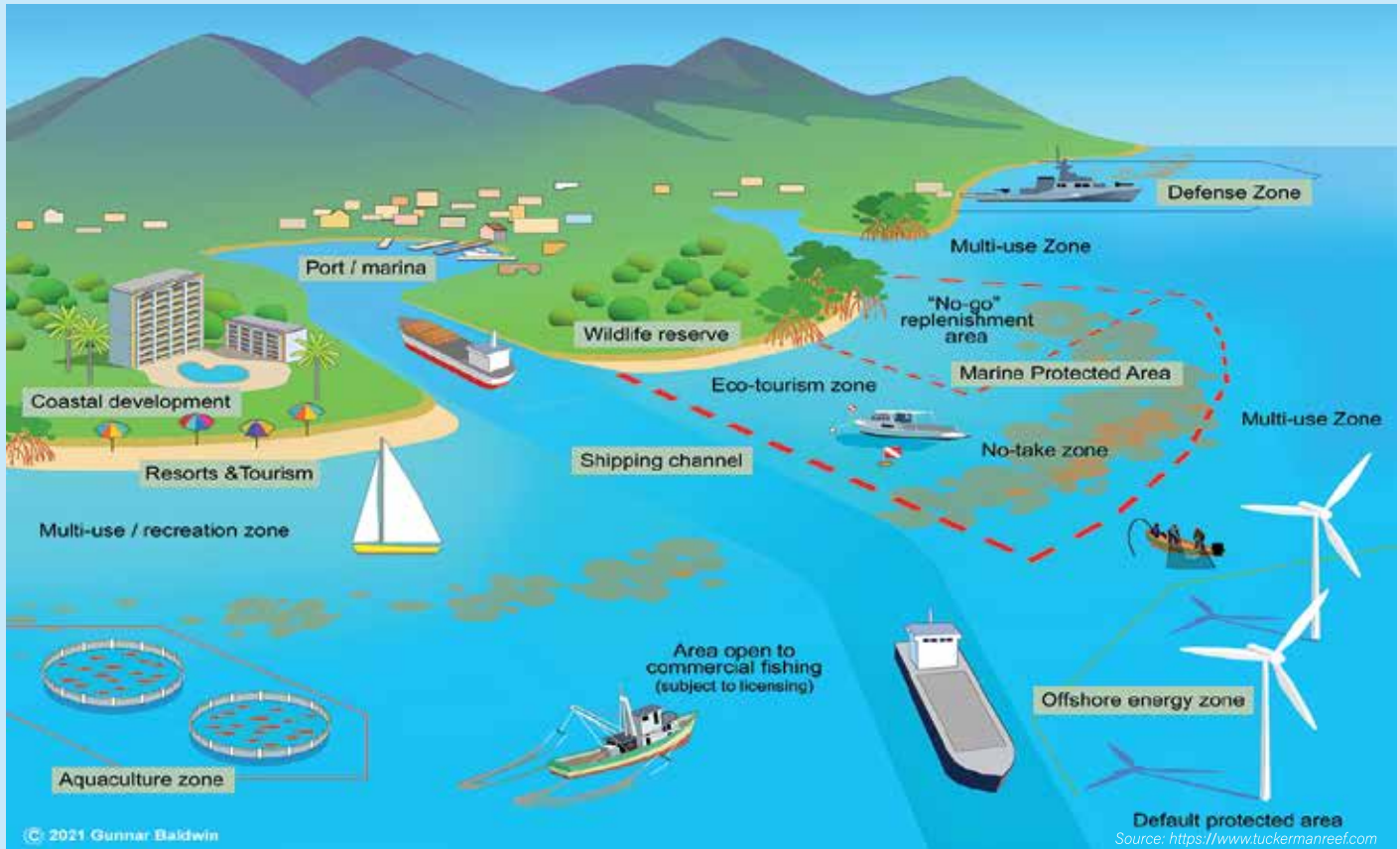
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# Marine Spatial Planning for Bangladesh

Dr. K M Azam Chowdhury



Marine Spatial Planning (MSP) is a useful technique for creating a framework for analyzing and allocating the temporal and spatial distribution of human activity in maritime zones (IOC-UNESCO). Its goal is to realize predetermined social, economic, and ecological goals using political means. MSP manages how people use ocean space and how they interact with the marine ecosystem as well as with other human uses (such as shipping, tourism, aquaculture, and the creation of renewable energy). More than 66 countries (44% of the countries having marine waters) are presently developing MSPs, and interest in MSP is increasing continuously. Most of the countries are still in the early phases of their MSP activities, whereas some countries have long since adopted, implemented, or even changed their plans. Bangladesh has to develop MSP because of its large coastal area and reliance on marine resources for economic activity, environmental stability, and sustenance. However, a substantial coastal region of Bangladesh is vulnerable to natural disasters like cyclones and sea level rise. For example, one of the promising sectors of MSP is the fishing industry; the sustainability of this industry is threatened by overfishing, marine pollution, habitat deterioration, and climate change, among other factors.

## Main Phases of MSP (Ehler & Douvère, 2009)

### Phase 1 Pre-Planning

- Step 1. Finding a need and developing authority
- Step 2. Getting financial assistance
- Step 3. Planning the steps by means of advance planning
  - Forming the MSP group (task 1)
  - Preparing a work plan (task 2)
  - Outlining parameters and a timeline (task 3)
  - Outlining guidelines, objectives, and goals (tasks 4 and 5)
  - Determining risks and determining backup strategies (task 6)
- Step 4. Coordinating the involvement of stakeholders  
(*who, when, how*)

### Phase 2 Analysis for Planning

- Step 5. Identifying and evaluating the current circumstances
- Step 6. Determining and evaluating future circumstances (scenarios)



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### Phase 3 Plan Development

Step 7. Putting together and approving the spatial management plan

- Determining alternate institutional arrangements, incentives, and spatial/temporal management strategies (task 1)
- Outlining standards for choosing spatial management initiatives (task 2)
- Developing a zoning plan (task 3)
- Assessing the plan for spatial management (task 4)

### Phase 4 Plan Completion

Step 8. The period during which the MSP plan is completed but not yet approved

### Phase 5 Approval

Step 9. Preparing and approving the spatial management plan

- Approving the spatial management plan (task 5)

### Phase 6 Implementation

Step 10. Carrying out and upholding the spatial management strategy

Step 11. Observing and evaluating output

### Phase 7 Revision

Step 12. Modifying the procedure for maritime spatial management

**Stakeholders:** Government Agencies, including local, regional, and national agencies, are responsible for marine and coastal management (Calado H. et al., 2012; Pomeroy & Douvere, 2008). Industry representatives in the fishing, shipping, tourism, renewable energy, and other marine industries sectors are stakeholders. Environmental groups like NGOs (WorldFish) and community organizations focused on marine conservation. Coastal residents and indigenous peoples with traditional marine uses. Academia and Researchers are also stakeholders of MSP. Universities (Dhaka University, Khulna University, Chittagong University, etc.) and research institutions (BORI, BIMRAD, BFRI, etc.) with expertise in marine sciences are also stakeholders.

**Cross-Cutting Issues:** Marine Spatial Planning (MSP) is an essential tool for the sustainable management of marine environments, aiming to balance ecological, economic, and social objectives. Cross-cutting issues are those that span multiple sectors and influence the effectiveness of MSP. Here are some key cross-cutting issues in marine spatial planning:

- a. Climate Change
- b. Biodiversity Conservation
- c. Economic Development
- d. Social Equity and Stakeholder Engagement
- e. Governance and Policy Integration
- f. Data and Knowledge Management Research

g. Technology and Innovation

h. Cultural Heritage

i. Transboundary Issues

**Monitoring and Evaluation of MSP:** Monitoring and evaluation of MSP is about more than the MSP preparation as it requires sufficient skills and resources for both the evaluators and the stakeholders who might be involved. Monitoring is a continual evaluation with the goal of informing all parties involved as soon as possible about any changes or status updates of the ongoing activity (Burg S.W.K. et al., 2023; De Vo. et al., 2008). An evaluation is a methodical, objective assessment of the applicability, efficacy, efficiency, and impact of an activity in relation to predetermined goals. The key idea of MSP is to provide a guiding principle of marine resource use and its conservation to serve the purpose of anthropogenic needs without any negative stress on the marine biodiversity and ecosystem. Some important components of the MSP monitoring are briefly explained below:

#### Monitoring Agency:

a. Department of Marine Fisheries, Bangladesh Navy and Coast Guard Jointly monitor the VMS (Vessel Monitoring System). They can jointly work to collect data to measure fishing intensity in a specific habitat. The collected data can be categorized based on habitat and can be used for MSP.

b. Bangladesh Navy works tirelessly to monitor the oceanographic data.

c. Ministry of Power, Energy, and Mineral Resources, Blue Economy Cell, and General Economic Division, Planning Commission coordinate the activities related to the blue economy. They can work together to develop a strategic plan to sustainably utilize marine resources.

d. The Department of Environment, Department of Fisheries, and Department of Forest can continuously monitor the biodiversity, habitat integrity, water quality, and pollutant levels, which are essential to demonstrate the functioning of the marine ecosystem.

e. The Department of Fisheries monitors the fish landing center and the number of fish per boat. A holistic approach can be taken to monitor the regular species. Acoustic surveys are a must to gather data on underwater fisheries and mammals.

f. Department of Fisheries (BFDC): Registration and categorization of small to large fishing vessels based on gear usage and fishing regions. Identify potential mariculture (Fish, Shrimp, Seaweed, Oyster, etc.) area.

g. Ministry of Environment, Forest & Climate Change: Assessment of plastics, chemicals, heavy metals, and nutrient loads are equally important for environmental monitoring in MSP.

h. Department of Fisheries: It can be beneficial to establish need-based guidelines for managing Marine Protected Areas (MPAs) and MSPs to attain maximum economic benefit while safeguarding biodiversity and ecosystem quality.

i. The Ministry of Foreign Affairs and the Department of Fisheries can adjust the fishing ban period with neighboring countries.

The Marine Spatial Planning (MSP) initiative in Bangladesh represents a transformative step towards the sustainable management of marine resources, with a particular emphasis on the fisheries sector. The MSP framework promotes inclusivity by addressing the diverse needs of fisheries, maritime transport, tourism, energy extraction, environmental protection, and research institutions. Utilizing a comprehensive database facilitates informed decision-making through effective spatial data management. Tailored for the coastal region and the Bay of Bengal, the framework aligns with SDGs and Integrated Coastal Zone Management (ICZM) principles, incorporating an Environmental and Social Management Framework (ESMF) for holistic marine resource governance. The fisheries sector, a cornerstone of Bangladesh's economy and a vital source of livelihood for millions is given special attention in the MSP initiative, including: i) habitat protection and restoration, ii) sustainable fishing practices, iii) monitoring and enforcement, and iv) community involvement achievement, providing stakeholders with accessible and up-to-date information. The MSP framework promotes inclusivity by addressing the diverse needs of fisheries, maritime transport, tourism, energy extraction, environmental protection, and research institutions. With the use of an extensive database, it enables well-informed decision-making by means of efficient geographical data management. The MSP endeavor has paid particular attention to the fisheries sector, which is a critical source of income for millions of people and a cornerstone of Bangladesh's economy. It includes i) habitat protection and restoration, ii) sustainable fishing practices, iii) monitoring and enforcement, and iv) community involvement. The monitoring plan incorporates ongoing assessment mechanisms supported by governmental initiatives. Looking ahead, the enduring success of MSP in Bangladesh will hinge on sustained stakeholder involvement, cross-sector integration, and adherence to national and international objectives. To ensure the enduring success of the MSP framework, it is essential to i) strengthen institutional capacity,

ii) promote research and innovation, and iii) enhance collaboration and investment. Hopefully, Bangladesh will set a successful MSP framework with the proper implementation of these steps.

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# Sino-Indian Power Competition in the Indian Ocean: A New Realpolitik Outlook

Badirujjaman



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In 1989, the Berlin Wall, which divided Europe into two fell in the hands of freedom-seeking Germans, and West and East Germany reunited again and solidarity prevailed. Consequently, the Communist flag bearer Soviet Union collapsed with its immense military power vis-à-vis domestic socio-economic and political crises. The end of the Cold War led the contemporary "Western King"- the United States of America- to achieve global hegemon status with unilateral power control capacity in the international system. The First Gulf War (1990), Afghan (2001) and Iraq War (2003), and Syrian (2011) and Libyan (2011) Civil Wars are some instances of the US unilateral power exercise exposure in the international system (Charny, 2003).

In the meantime, rapid economic growth of several countries entitled them for power proliferation nationally and beyond. Regional military giants like Russia and emerging economic powers like Australia, Brazil, China, India, Japan, South Africa, Turkey, etc. challenge the unilateral nature of the international

political system. Therefore, such massive economic output of China, the most economic emerging country of the present era, support to initiating Chinese global dream Belt and Road Initiative (BRI) in 2013. According to experts, BRI is a model initiated under Chinese President Xi Jing Ping's leadership that focus not only on the economic connectivity of China to the rest of the world, but also on extending geopolitical and geostrategic objectives of China.

BRI is a project that leads China beyond its national borders and undertakes a massive militarization presence there, particularly in the Indo-Pacific region. But India from the Indian Ocean (IO) and the USA, Japan, and Australia from the Pacific Ocean are considered such rapid militarization of China a serious challenge to their political and strategic ambitions in the region. Thus, the US unilateral power exposure capacity is in a transition period to shift to multilateralism. In academia, it is called paradigm shift of world order from unilateralism to multilateralism.

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Indian Ocean, which will be the epicenter of the 21<sup>st</sup> century world politics, discussed in details by the US strategist Robert D. Kaplan in his famous book title, "Monsoon: Indian Ocean and The Future of American Power" (Kaplan, 2010). At the outset of the 21<sup>st</sup> century, Kaplan's prediction seemed very obvious, particularly in the context of the Sino-Indian *realpolitik* rivalry in the Indian Ocean region (IOR), captured global attention.

Apart from the 20<sup>th</sup> century's global geopolitical history, particularly from the Cold War context, the geopolitical significance of the Indian Ocean has been historic. Connectivity, commerce, warfare, livelihood, etc., are some historic reasons that make IOR the most important waterline in world geopolitical history (Pabasara Kannangara, 2018). The commencement of modern science extends the prospect of the IOR. It fosters and broadens the capacity of exploration as well as exploitation of ample natural (living and non-living) resources in IO, easing energy and trade transportation, and the navigation via the IO safely.

Maritime traditional (political, strategic, military) and transnational security challenges (maritime terrorism and organized crimes, IUU fishing and illegal trespassing, climate change, trafficking and piracy, etc.) are taking over the Indian Ocean immense possibilities. To be specific within the two types of threats, the geopolitical and geostrategic competition among global powers roaming around the IO is regarded as the major challenges to IO security domain. Additionally, the power struggle between major powers is also threatened the security dimension of IOR smaller states. Moreover, the challenge has largely influenced the process of foreign policy formulation and implementation of these smaller states concerning maritime security establishment.

However, the Sino-Indian power competition in the 21<sup>st</sup> century has become obvious more than ever. The rivalry aggravated upon some land based crises regarding territorial integrity and maintaining sovereignty over these territories, including, Ladakh, Tibet, Doklam, Sikkim, etc. The two neighboring powers compete for maintaining sovereignty over the aforementioned lands. These territorial crises have instigated IO maritime security domain. According to some Indian decision-makers, Chinese rapid military establishment in the IOR and Chinese strategic and economic development projects there particularly BRI, is considered a major challenge to Indian national interest and security domain.

From India's end, Chinese rapid militarization in the IOR is threatening regional peace and stability, mutual consensus on security and prosperity, and the prospect of collaboration and partnership. Therefore, to exert India itself as a major (or the biggest, according to Indian security analysts) player in the IOR, India needs active and powerful participation in the power competition. Thus, considering the Sino-Indian geopolitical and geostrategic rivalry in the IOR, a new *realpolitik* context is prevailing.

For sustaining Chinese economic dominance, in 2013 China introduced its global dream, "Belt and Road Initiative (BRI)." BRI extends the opportunities for China to engage globally with

its dream project. Many countries from Africa, Asia, Europe, Latin and South America have already had membership of BRI, and some others are showing their interest in joining it.

"String of Pearls" is regarded as an important part of the BRI model. Scholars identify "String of Pearls" as a vital strategic instrument for China for successfully implementing BRI, and this project has initiated mostly focusing on the IO. Moreover, implementing the "String of Pearls" is necessary to China for grasping the geographic as well as demographic significance of the IOR and its potential market opportunities. Reaching to that goal, China in recent times been cooperating with IOR smaller states economically and is working on translating this economic partnership into a strategic partnership. To smaller states in the region, China is now their major economic and development partner, and they wish to extend it to strategic levels.

For China, IO is essential for its trade as well as energy transportation and commercial vessels navigation. In that consideration, security threats in the IO maritime domain are deeply concerning for China. Some experts held that for countering such security challenges to its trade and energy supply chains, Chinese strong military manifestation in the IO is increasingly visible (White, 2020).

On the other hand, experts refer that one of the major plans for China under the BRI project is to connect mainland China with IO via Myanmar, Laos, Cambodia, and Thailand (Mudunuri, 2020). It will decrease Chinese dependency on the Malaccan Strait. The tendency is called the Malacca dilemma for China. Therefore, for executing this plan, China has already signed some MoUs with IOR littoral states, proposed for developing ports, submarine canyons, and other necessary infrastructure development projects.

However, India contemplates IO as an integral part of its security and progress. India's external policy puts emphasis on the IO, particularly since the later half of the 20<sup>th</sup> century to the 21<sup>st</sup> century. In *realpolitik* consideration, usually, India describes such Chinese rapid economic emergence and military presence in the IO as a threat to India's national and regional political ambitions. In containing Chinese influence over the region, India is working in three ways (Bhatt, 2024): strengthening India's military power to counter maritime security challenges in the IOR; focusing on broader regional partnership building and exploiting the scope available in the IOR; and strengthening the regional capacity building and local defense system as regard to powerful entrance in the IO.

Looking ahead to these goals, India allocates a substantial amount of its annual defence budget (Voices, 2022) to strengthen Indian naval forces. Moreover, India's indigenously made naval aircraft carriers, destroyers, and other war ships, and established naval bases, for example, in the Lakshadweep INS Jatayu and in Mauritius INS Kadamba are facilitating Indian naval forces to effectively engage and manage the IOR security (Bhatt, 2024).



Moreover to securitize the IO maritime domain, India signifies the role of nontraditional security challenges dominant in the IO. These challenges are transnational by nature and, therefore, cannot be alleviated through a singular state. Thus, India sought a unified approach, collaborating with other countries in the IOR and beyond. Joint naval exercise is an effective instrument that India emphasizes more to counter such transnational challenges. MALABAR, MILAN, ASEAN INDIA are some regular naval exercises that India leads the show. Moreover, India participates in joint naval exercise with Australia, Britain, France, and the USA. These naval practices have significantly empowered India to maintain security prospects in the maritime domain of IO.

According to some security specialists, concurrently India extends its diplomatic position to exhibit itself as a major security provider in the IOR (Mishra, 2024), and the US-led Indo-Pacific Strategy (IPS) have acknowledged that claim. Because the IPS needs India in the IOR to steer the strategy to contain Chinese gradual dominance in the Indo-Pacific maritime sphere. In consideration of the ongoing Sino-Indian rivalry in the IOR, the US-led IPS as well as AUKUS is sought to strengthen India with all necessary means to advance Indian role in this geopolitical and geostrategic game. The QUAD 2.0 (2017), a security umbrella that can facilitate and become a bridge among AUKUS (2021), IPS (2022), and Indian interests in the region in the years to come. The balancing of Chinese military influence in the Indo-Pacific has become necessary for those major powers in the region to attain their varied political ambitions.

Therefore, the Sino-Indian rivalry is not limited to land borders; rather, it spreads the IOR maritime domain. Experts said that the inclusion of other regional stakeholders, who are concerned about Chinese power projection over the IOR, into the ongoing Sino-Indian rivalry will perplex the geopolitical and geostrategic equation of the region (Bhatt, 2024). Thus, a new realpolitik outlook will emerge in the IOR, broadly in the Indo-Pacific region.

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# Section III: Maritime Technology and Innovation





# Ocean Literacy vis-à-vis Bold Investment: Thrusts to Convert Blue Prospects into Blue Resources

Marhaba Matluba



Although the ocean has been serving the earth and human beings since the formation of this planet about 4.2 billion years ago, the term "Blue Economy" isn't that old. The concept was coined for the first time in 1994 by the Belgian economist Gunter Pauli in response to a United Nations request to prepare for the third session of the Conference of Parties (COP3) in Japan.

Since then different organizations have defined "Blue Economy" in different ways. However, the most accepted definition was given by the World Bank in 2016, which is stated as "sustainable use of ocean resources for economic growth, improved livelihoods, and jobs while preserving the health of ocean ecosystem." To materialize this concept, there is no alternative to strategic investment and knowledge capital, which can primarily be generated through "Ocean Literacy."

*Ocean Literacy* can be defined as the dissemination of knowledge about the availability of ocean resources, sustainable exploration, and conservative approaches to the ocean. While making people literate about the ocean requires investment from

the government and non-government organizations, for resource exploration, on the other hand, requires Ocean Literacy and bold venture from the stakeholders of the relevant sectors.

Currently, Bangladesh encompasses a maritime area of about 1,18,813 sq. km, which is approximately the same as the area of Bangladesh's landmass. We have a 710 km coastline, 12 NM of territorial water, and a 200 NM Exclusive Economic Zone (EEZ), where we have the sovereign right to explore and sustainably extract both biotic and abiotic resources from the water column, sea floor, and subsoil.

## Blue Prospects and Areas of Investment

So far twenty six sectors of Blue Economy in Bangladesh have been identified by the Maritime Affairs Unit, Ministry of Foreign Affairs. Among them, the most viable fields for Bangladesh at this moment are discussed below:

**Fisheries and Aquaculture:** Currently, fish catch from the sea contributes only 20% of the total fish production of Bangladesh.

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The fishers of the country can go only up to a 40 meter depth with their conventional wooden trawlers. The rest of the sea is remaining untapped due to the lack of modern and efficient fishing trawlers and ships; in a word, it can be represented as a dearth of investment. Besides, there is a huge opportunity for mariculture and sea ranching in the water of our maritime boundary. While many of the foreign investors seeking the opportunity of mariculture and sea ranching in Bangladesh, the local investors don't even know the terms, and the main reason is a lack of Ocean Literacy.

**Tourism and Recreation:** Tourism is a rising industry in Bangladesh. According to Khondkar et al. (2014), tourism in Bangladesh was employing over 1 million people and generated a total value of 8.4 million USD. Again, Tourism Satellite Account 2020 of the Bangladesh Bureau of Statistics stated that tourism contributed 3.08% of the GDP of Bangladesh and also accounted for 8.07% of total employment. Bangladesh possesses a distinctive coast with many popular tourist destinations, including one of the world's largest sea beaches, Cox's Bazar as well as the largest compact mangrove forest. Proper management and investment are required to make the tourism industry a dominant one in Bangladesh. Coastal tourism, recreational water sports, yachting and marinas, cruise tourism etc., can be some potential tourism industries in Bangladesh. While investment in the tourism sector will be supported by Ocean Literacy, it is possible to reshape the tourism industries into ecotourism that will help Blue Economy as well as the health of the ocean.

**Port and Shipping:** Over 90% of Bangladesh's external freight is carried out by sea. Being the lifeline of the growing economy of the country, Chittagong Sea Port handles about 92% of the country's total import and export trade according to the report of Chittagong Port Authority (2021-22). Besides, Mongla and Payra ports combined to conduct 8-9 percent of the import and export of the country, facing the challenges of dredging and depth, rail and road links, infrastructure, and equipment. Meanwhile, the Matarbari Deep Sea Port, which is under construction, is expected to be a regional hub and a milestone for the shipping and port industry of Bangladesh. Investment from the Public Private Partnership for the hinterland connectivity, infrastructural development, dredging, and improvement of efficiency could add huge possibility to the industries as well as the economy of our country.

**Seaweed Farming:** According to a report of the Food and Agricultural Organization (FAO), the global market of seaweed was worth 9.9 billion USD in 2021, with a predictable growth rate of 2.3% from 2022 to 2030. Seaweeds are usually taken as a food item in different forms in many countries of the world. Besides, seaweed extracts like Agar, Alginate, and Carrageenan are highly sought-after thickening and gelling agents in a variety of industries, including pharmaceuticals, food processing, bio-stimulants, cosmetics, and even the production of substitute polymers for packaging. The top seven seaweed producing countries are located in Asia however Bangladesh is far behind in reaping the benefit of seaweed from the coastal water.

The Maritime Affairs Unit of the Ministry of Foreign Affairs has identified 220 species of seaweed available in the marine realm of Bangladesh. According to their study, currently, Bangladesh produces 400 tons of seaweed which is valued about BDT 55 million. The study also speculated that seaweed production in Bangladesh could be increased to 50 million tons by 2050. However, knowledge sharing, hands-on training of the seaweed farmers, guidelines, regulations, and proper monitoring are inevitable to reach the above point.

**Oil and Gas:** Although oil is rare, geo-physically Bangladesh is rich in natural gas. However, Shetol et al. (2019) claimed that Bangladesh is likely to reach the end of its land-based gas reserves by 2030. However, some of Bangladesh's offshore blocks are anticipated to have potential oil and gas reserves because of their proximity to Myanmar's recently discovered gas deposits. So, it has become an urgency to reveal the potential offshore gas fields as early as possible. However, a good fact is that recently, in March 2024, after a revised model, a Production Sharing Contract (PSC) has been approved, and Petrobangla (Bangladesh Oil, Gas and Mineral Corporation) launched an international tender for offshore oil and gas exploration where seven International Oil Companies (IOCs) have acquired bid documents (May 08, 2024, The Business Standard). Bangladesh is optimistic about the outcome of this offshore bidding round as significant oil companies worldwide are participating there.

**Gas Hydrates:** Gas hydrates are crystalline solid lattices of water that encompass methane in its physical structure. About 98% of gas hydrates are usually found on the ocean floor at the outer continental shelf, and 2% beneath the permafrost (Birchwood et al., 2010). One cubic meter of gas hydrate can generate 164 cubic meters of natural gas when it is lifted to the surface. So, they can be a major source of energy for the future generations. Once assumed to be rare, gas hydrates are now found to occur in vast volumes on the continental shelf of Bangladesh with a potential to produce about 17 to 103 trillion cubic feet of natural gas. Although sustainable extraction of gas hydrate is a challenging task, and there is a lack of technology for commercial extraction of gas hydrate, countries like China and Japan are initially exploiting it on small scales besides testing their equipment and methods (Hao et al., 2017; Oyama et al., 2017). Concerned organizations in Bangladesh may collaborate with China, Japan, and other developed countries for collaborative research, skill development, and technology sharing in this field.

**Ocean Renewable Energy:** Bangladesh Government has committed to producing 15% of its required energy from renewable sources by 2030, and rising it to 40% by 2041 (Abdulrazak et al., 2021). The major ocean renewable energy sources include coastal wind, tidal currents, ocean currents, tidal range, ocean waves, ocean temperature, and salinity gradient. Within this time, Bangladesh has made significant strides in wind power generation. Recently, the Khurushkul Wind Power Plant in Cox's Bazar launched operations on March 08, 2024, with a 60MW electricity generation capacity as well as three other wind power plants



in Kutubdia and Feni are running successfully with 11 other projects under construction (<https://ndre.sreda.gov.bd/>).

However, no progress is found in harnessing tidal, wave, and ocean thermal energy resources. A comprehensive energy resource mapping is inevitable to convert potential tidal, wave, and thermal energy into electricity which is yet to be done in Bangladesh where the national and international stakeholders have a huge opportunity for research, investment, and mobilize the benefits.

Apart from the resources discussed above, heavy minerals, ship breaking and building, marine genetic resources, biotechnology and pharmaceuticals as well as sea salt production are highly promising industries for the growing economy of Bangladesh. The author believes, government incentives can play a significant role in generating bold investment in Blue Economy. Again, the necessity of Ocean Literacy comes first. A logically customized series of chapters on ocean morphology, resources, and conservation approaches can be included in the curricula. A ministry dedicated to ocean exploration and conservation can help all the aspects including management of the blue resources, maintaining ocean health, human resource development, rising investment, and ensuring practical withdrawal of capitals.

## Ocean Literacy



Figure 01: Key Components of Ocean Literacy (McKinley et al., 2023)

The knowledge of the ocean in our country is limited to a few small groups. For example, the navy personnel work on the safety, security, and surveillance of the ocean. Some students and teachers, at the university level, study Oceanography and Marine Science. A few of them conduct discrete researches which rarely get the attention of the concerned authorities. Even, the people of the 19 coastal districts living on the lap of the ocean aren't aware of the scientific use and conservation of

the coastal resources. The people of 36 other districts of middle and northern Bangladesh have little knowledge about the seas. So, to achieve inclusive socio-economic development, the knowledge gap must be bridged through Ocean Literacy.

Bangladesh can be considered an ocean-literate nation when a person from Dinajpur is aware of seaweed as a food item, and mindful of the potential harm that a plastic packet could cause to a dolphin in the Bay of Bengal. Not only will Ocean Literacy support the Blue Economy, but it will also aid in the processes of climate change adaptation and mitigation. Thus, if studying the land is vital, gaining knowledge about the seas is more crucial as it makes up three times the land on earth.

The land-based resources are almost depleted. For the very survival, an alternative approach to the blue resources is existential to this hour. The extraction process of these resources must be sustainable as mentioned above in the definition of Blue Economy. Here, Ocean Literacy can play a vital role in increasing bold investment for Blue Economic Growth of Bangladesh. Knowledge sharing among the researchers, investors, seagoing fishers, seaweed farmers, salt producers, non-government organizations, and the government can play the most effective role in achieving the goal of a developed Maritime Bangladesh.

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# Significance of Ocean Literacy Principles



"Ocean Literacy" means understanding the ocean's influence on humans and humans' influence on the ocean. There are 7 principles of ocean literacy. Experts agree that everyone should understand about the significance of the principles.



## 1 One Ocean with Many Features

Understanding Bangladesh's connection to the global ocean underscores the importance of protecting its maritime boundaries and managing shared resources effectively.



## 2 Ocean Shapes Earth's Features

Coastal landforms and ecosystems in Bangladesh are shaped by the ocean, making coastal management and erosion control vital for sustainable development.



## 3 Ocean Influences Weather and Climate

The Bay of Bengal drives monsoons and cyclones in Bangladesh, making ocean literacy crucial for climate resilience and disaster preparedness.



## 4 Ocean Makes Earth Habitable

The Bay of Bengal supports life and agriculture in Bangladesh by regulating climate and nutrient cycles, highlighting the need for conservation efforts.



## 5 Ocean Supports Biodiversity

Bangladesh's rich marine biodiversity, including the Sundarbans, is vital for fisheries and livelihoods, requiring protection from overexploitation and pollution.



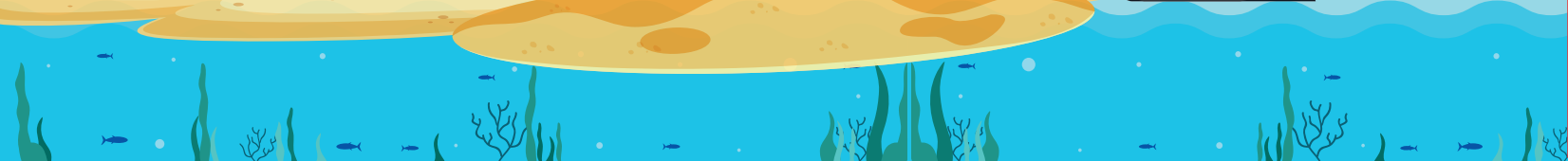
## 6 Ocean and Humans are Interconnected

The livelihoods of millions in Bangladesh depend on the ocean, making sustainable marine practices essential for economic and environmental well-being.



## 7 Ocean is Largely Unexplored

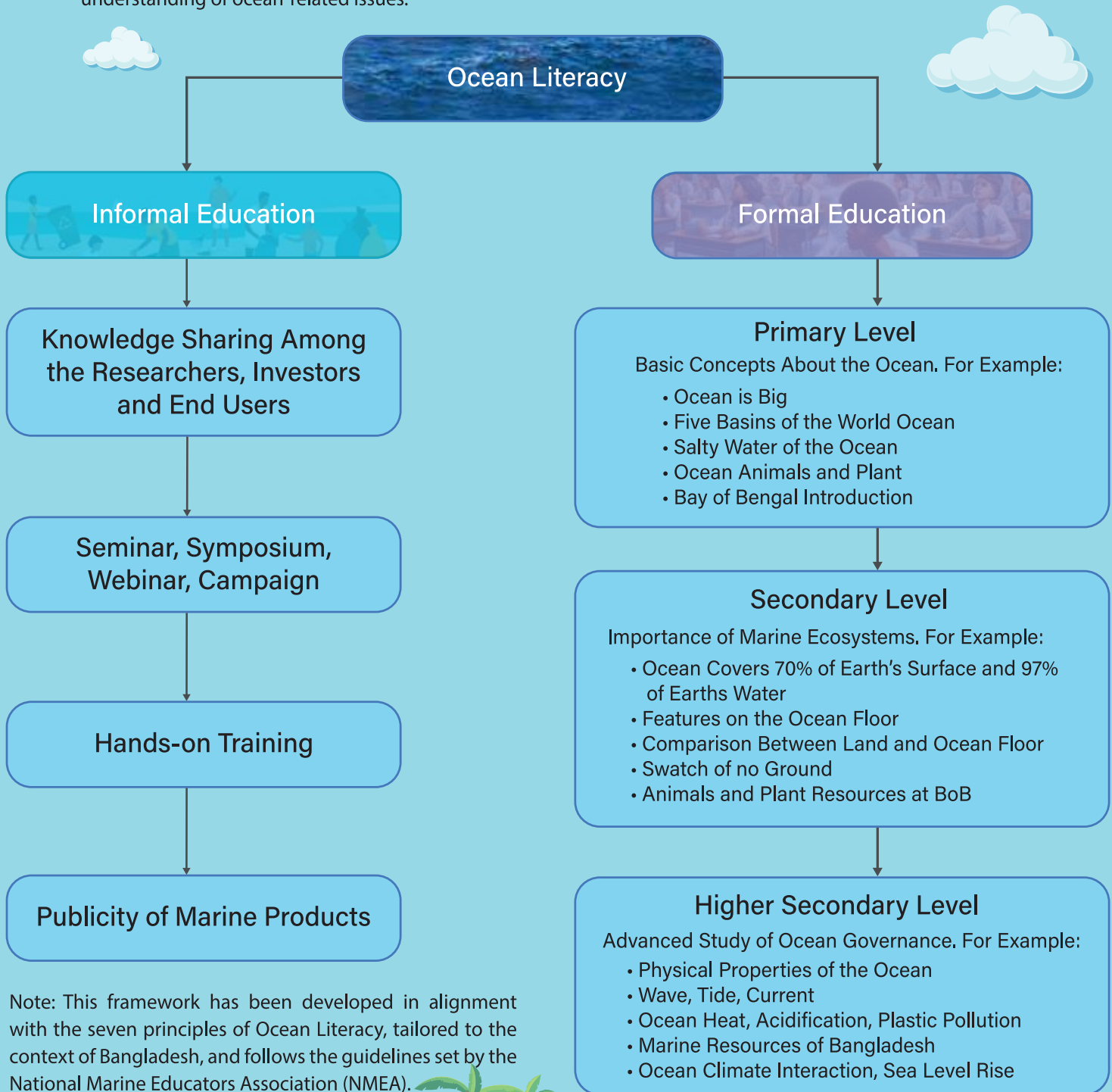
Unexplored areas of the Bay of Bengal hold potential resources and biodiversity, encouraging research and innovation for sustainable marine development.



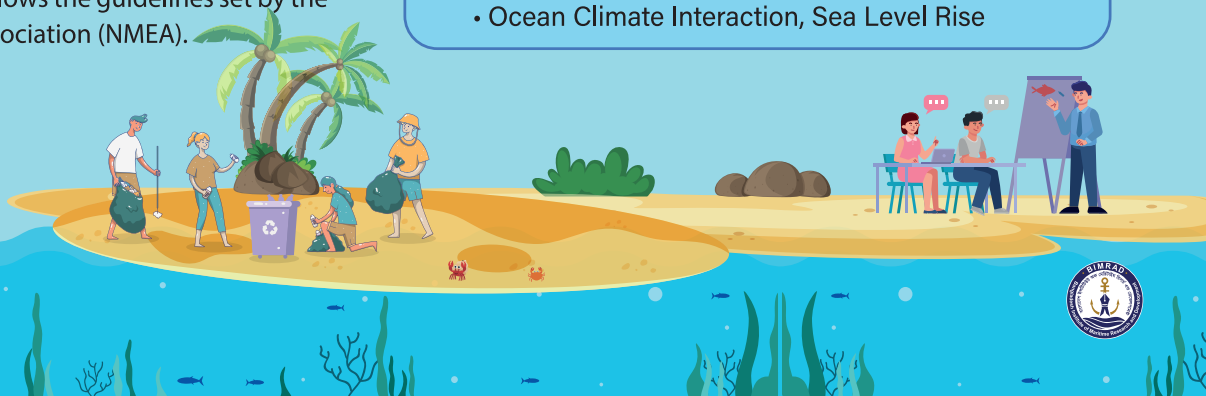


# Recommended Framework of Ocean Literacy for Bangladesh

This framework advocates for a holistic approach to promote “Ocean Literacy” in Bangladesh, integrating comprehensive education at primary, secondary, and higher secondary levels to instill the importance of the ocean in the younger generation. It also emphasizes community-wide engagement through knowledge sharing to foster a deeper understanding of ocean-related issues.



Note: This framework has been developed in alignment with the seven principles of Ocean Literacy, tailored to the context of Bangladesh, and follows the guidelines set by the National Marine Educators Association (NMEA).



# Marine Spatial Data Infrastructure - An Ocean Literacy Tool for Sustainable Development for Bangladesh

Commodore Sheikh Firoz Ahmed, (H), NGP, psc, BN



Data is the foundation of knowledge. It provides the information, and information provides the knowledge. However, the availability of comprehensive and authoritative data is one of the major hindrances for deriving knowledge. In the maritime domain, different stakeholders collect data as required and store those data in their respective databases. Interoperability of those data is mostly impossible as those are not collected maintaining a uniform standard. So, data cannot be reused, and duplication of efforts is evident in the maritime domain. Considering this, a global initiative is visible among the maritime states to have their Marine Spatial Data Infrastructure (MSDI) to ensure the availability of data for different stakeholders of the maritime domain. Sometimes, these spatial data sets are also called blue data as they support the blue economy of the country. For a thriving and sustainable blue economy, the requirement of data is paramount. Presently, apart from the traditional blue economy sectors, maritime nations are also focusing on emerging blue economy sectors, which are mostly data-driven. As a maritime nation, Bangladesh

can also expect to have a thriving and sustainable blue economy, provided the required data can be made available. Considering this aspect MSDI for Bangladesh is a need for the time.

## What is MSDI?

To understand MSDI, first, we need to know the spatial data. Spatial data provides the geographical location of different features on Earth. It is usually stored as coordinates and often accessed, manipulated, or analyzed through Geographic Information Systems (GIS) (International Hydrographic Organization, 2017). To facilitate the availability of spatial data, we need to have an arrangement so that it can be easily accessed when needed. Here comes the necessity of Spatial Data Infrastructure (SDI), SDI is the relevant base collection of technologies, policies, and institutional arrangements that facilitate the availability of and access to spatial data (Global Spatial Data Infrastructure Association, 2012). Marine Spatial Data Infrastructure or MSDI is the marine component of SDI. It is a framework of suggested best practices and guidance for



the management of marine geospatial data, underpinned by some key principles supporting interoperability, integration, institutional collaboration, and coordination (Huish, 2021).

## Key Components of MSDI

A conceptual framework can be used to describe the key components of MSDI. As per that framework, there are four pillars of MSDI: (1) Policy and Governance (People); (2) Technical Standards (Standards); (3) Geographic Content (Data); and (4) Information Systems (ICT).

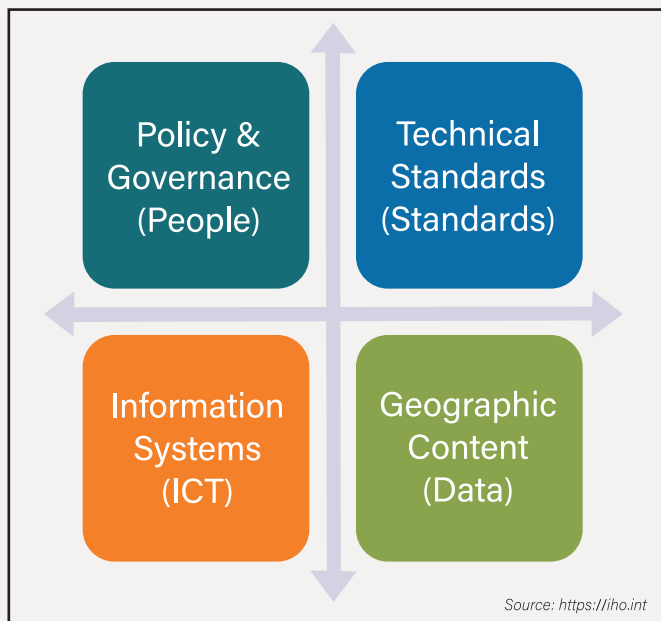


Figure 01: A Conceptual Framework of MSDI

The above framework is recommended by the International Hydrographic Organization (IHO). Other frameworks are also available for MSDI. However, in all such frameworks, the main focus is to make the spatial data available, maintaining specific standards through appropriate policy and governance using various innovations in all domains.

## Motivational Factors for Having MSDI in Bangladesh

The importance of marine space for Bangladesh is ever-increasing. As a densely populated country, we have a scarcity of resources. With the depletion of land resources, we have no other option but to look towards the sea. Peaceful settlement of maritime boundaries with neighbors has facilitated this endeavor to venture at sea and extract the blue resources. However, considerable time has already elapsed, and we still lack a comprehensive approach in this field. MSDI for Bangladesh would facilitate the initiative of different stakeholders for a common goal of prosperity through blue resources. So, the main catalysts of having MSDI for Bangladesh can be summarized as below:

**Socio-Economic Factor:** Maritime sector is considered one of the new and prospective avenues of economic growth for

Bangladesh. Mentionable, about 3 million peoples in Bangladesh are directly or indirectly involved in harnessing sea fish only (Karim, 2021). There are many other traditional and emerging economic functions in the maritime domain. So, if all these economic functions can be activated within a reasonable time, it will have a tremendous socio-economic impact on the livelihood of the general population of the country. MSDI can act as a facilitator in this aspect.

**Global and Domestic Agendas:** The UN 2030 agenda comprises 17 Sustainable Development Goals (SDG). MSDI will have a direct or indirect impact on SDG-14 (Life below water), SDG-6 (Ensure availability and sustainable management of water and sanitation for all), SDG-13 (Climate action), SDG-11 (Sustainable Cities and Communities), and SDG-15 (Life on land). Other global agendas like the Paris Climate Agreement, UN Decade of Ocean Science 2030, and "Seabed 2030" projects of the General Bathymetric Chart of the Oceans (GEBCO) can be complemented through MSDI. Apart from these, the formulation of Bangladesh Delta Plan 2100 can also be complemented through MSDI.

**Vision 2041:** As per the Vision 2041, Bangladesh will be a developed nation by 2041 where all citizens will be guaranteed a minimum quality of life (General Economics Division [GED], 2020). However, this can only be possible if we are able to unlock the potential of the blue economy. Mentionable, national MSDI will facilitate the blue economic activities of the country as envisaged for 2021-2041 Perspective Plan of Bangladesh.

**Climate Change Mitigation:** Bangladesh is a low-lying, densely populated deltaic country. Climate change events like tidal surges and coastal inundation, cyclones, erosion, accretion, etc., are very common phenomena here. So, Bangladesh needs to have appropriate adaptation and mitigation strategies. MSDI can act as a foundation for an integrated knowledge-based approach to mitigate these extreme events.

**Effective use of Public Funds:** A national MSDI would ensure efficient organizational process among the stakeholders. It ensures inter-operability of data. At the same time, it avoids duplication of effort through improved co-operation and co-ordination. Thereby, effective use of public fund is ensured. Moreover, spatial data gets greater reach through MSDI, and reuse of data is ensured.

## Suggestive Approach for MSDI Maneuver in Bangladesh

For establishing MSDI in Bangladesh, data sources need to be identified first. A partnership may be developed among the stakeholders who can provide data. Probably, the biggest challenge of establishing MSDI in Bangladesh will neither be the availability of data nor the technical issues. The challenge will be building partnerships as well as sharing common goals. In this aspect, Bangladesh Navy (BN) Hydrographic Services can play a central role in bringing the stakeholders together.

This can be done through the National Hydrographic Committee (NHC), as it has members from various ministries and maritime stakeholders. A steering committee may be formed by NHC who will act on policy decisions and provide operational guidance. Thereafter, a working committee may be formed to identify the steps to make MSDI happen. A necessary technical committee may also be formed to look after the technical issues related to MSDI.

### Role of BN Hydrographic Services

Being the leading custodian of marine spatial data of Bangladesh waters, BN Hydrographic Services would play a pivotal role in realizing the MSDI initiative. The traditional role of BN Hydrographic Services is to conduct bathymetric surveys in the sea area, publish nautical charts, and Electronic Nautical Charts (ENC), and support the maritime defense of the country. But changing global scenario is serving as the motivational factor to expand its duties and responsibilities. By getting involved with the national MSDI, BN Hydrographic Services will gain a greater appreciation of the inherent value of data and information that is held in its archive.

### Key Challenges

As a relatively new concept, the development of MSDI for Bangladesh will have many challenges. Considering the experience of other nations, the key challenges for developing MSDI in Bangladesh can be identified as follows:

**Organizational Culture and Commitment:** The stakeholders who can provide data for MSDI are mostly from the government sector. These stakeholders work relatively in a restrictive domain, and their responsibilities are tightly defined. Due to the organizational culture, people who work there are skeptical of changes. However, considering the benefits of MSDI for all, the Government may come forward to redefine its role and commitment to society without compromising the strategic interest of the organization.

**Lack of Skilled Manpower and Technical Difficulties:** As mentioned before, MSDI has four pillars and a fifth key element which underpins the four pillars: education and learning (GED, 2020). As such, trained and skilled manpower will be a leading requirement for materializing MSDI in Bangladesh. This can be a major difficulty for many partner organizations, especially during the implementation phase of MSDI.

**Data Quality:** Data held in MSDI should have required authoritativeness. Those data should also pass the required quality assessment test. So, careful assessment must be done before accepting some data in the MSDI. This might be a challenge for some of the organizations in Bangladesh as their data might not pass the required quality assessment test.

**Data Sharing and Exchange:** To make data accessible for all, it should be archived in a commonly recognized format. This might be a big issue while realizing MSDI in Bangladesh. However, this problem might not exist in future if concerned organizations of Bangladesh adhere to internationally recognized formats in time.

**Operational Sustainability:** Operational sustainability is another challenge a country may face while maintaining national MSDI. For this operational sustainability, funding is an important issue. However, considering the cost-benefit ratio, this would not be a problem for Bangladesh. Moreover, data, being the currency of MSDI, has value, and MSDI could become a source of revenue, too. Mentionable, a study conducted by (Griffin et al., 2019) in New Zealand found that the direct cost of MSDI could result in a net benefit; for every US dollar invested, it is predicted that 2 to 18 US dollars would be returned.

### How MSDI Can Unlock the Potentials of Blue Economy in Bangladesh?

Oceans are critical to many aspects of our daily life, and we are growing increasingly reliant on ocean resources. Presently, the blue economy is experiencing a series of transformations. Established blue economic sectors are being disrupted, and new sectors are emerging, paving the way to a smart, sustainable, and resilient use of the ocean. For example, offshore renewables are helping the world combat climate change by reducing our dependency on fossil fuels and giving communities around the world access to more sustainable sources of energy. The maritime transport sector is going through a transformation towards autonomy. Ocean monitoring and surveillance sectors are getting wider scope and improved visualization. The maritime insurance sector is getting more mature with accurate prediction and risk assessment. All these emerging sectors are mostly data-driven. Comprehensive, reliable, and insightful data are needed to capture opportunities and mitigate the risks in these new sectors. A national MSDI should be able to serve all existing and emerging blue economy sectors of the country.

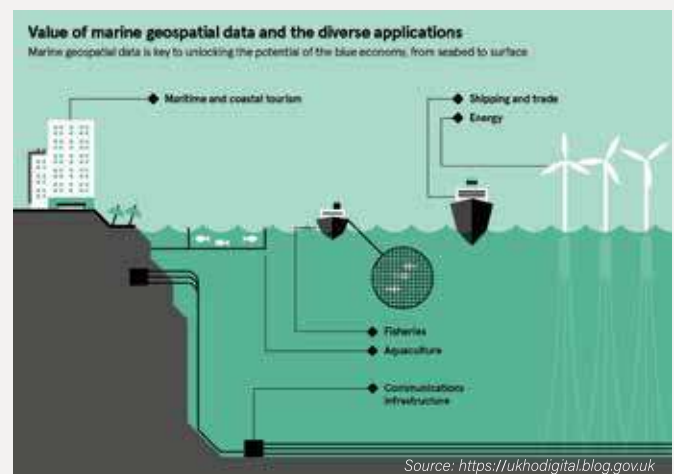


Figure 02: Marine Geospatial Data Can Help to Support a Number of Activities Within the Blue Economy

### Way Forward

A national MSDI for Bangladesh is a need of the time, considering its' huge benefits and various motivational factors mentioned above. The following action points may be considered in this regard:



a. Developing partnership among the stakeholders is one of the major tasks for establishing national MSDI. As the government is willing to engage itself to the thriving blue economic sector of the country, strategic directives may be sought from the government. NHC may engage itself with the government to get this directive.

b. A national-level steering committee may be formed to identify funding requirements, provide policy decisions, and make a perspective plan for 3 to 5 years to implement the MSDI.

c. Required number of working committee and technical committee may be formed to perform different steps of setting up the MSDI. They will survey and identify the data availability from different organizations, its' interoperability and suitability considering standard, and accuracy.

d. Developing necessary human capital is another major task for realizing national MSDI, considering the technical nature of the project. So, the required number of skilled manpower may be developed from different stakeholders through proper training.

e. As a prime mover, BN Hydrographic Services has to take the lead in all aspects of realizing the national MSDI. In addition, BNHOC may house the server, and provide the necessary space for organizing and managing MSDI.

From the above discussion, it is evident that MSDI can serve as the backbone of the blue economy for a maritime nation. There are many motivational factors to have a national MSDI in the context of Bangladesh. Bangladesh has to fulfill its' SDG by 2030. It also has some mega national agendas like "Vision 2041" and 100 years long integrated techno-economic mega plan "BDP2100," etc. MSDI can help Bangladesh in materializing these international and national agendas in time and in the most appropriate manner. MSDI can also help Bangladesh extract blue economic resources, and benefits in a sustainable manner. Apart from these, there are also many challenges for Bangladesh while establishing this MSDI. Organizational cultures, lack of skilled manpower, and technological hindrances are some of the challenges which Bangladesh may face while materializing MSDI. Being the custodian of major marine spatial data, BN Hydrographic Services will have to take the

leading role in establishing MSDI in Bangladesh. In this regard, NHC can pursue government willingness, funding arrangements, and other strategic decisions.

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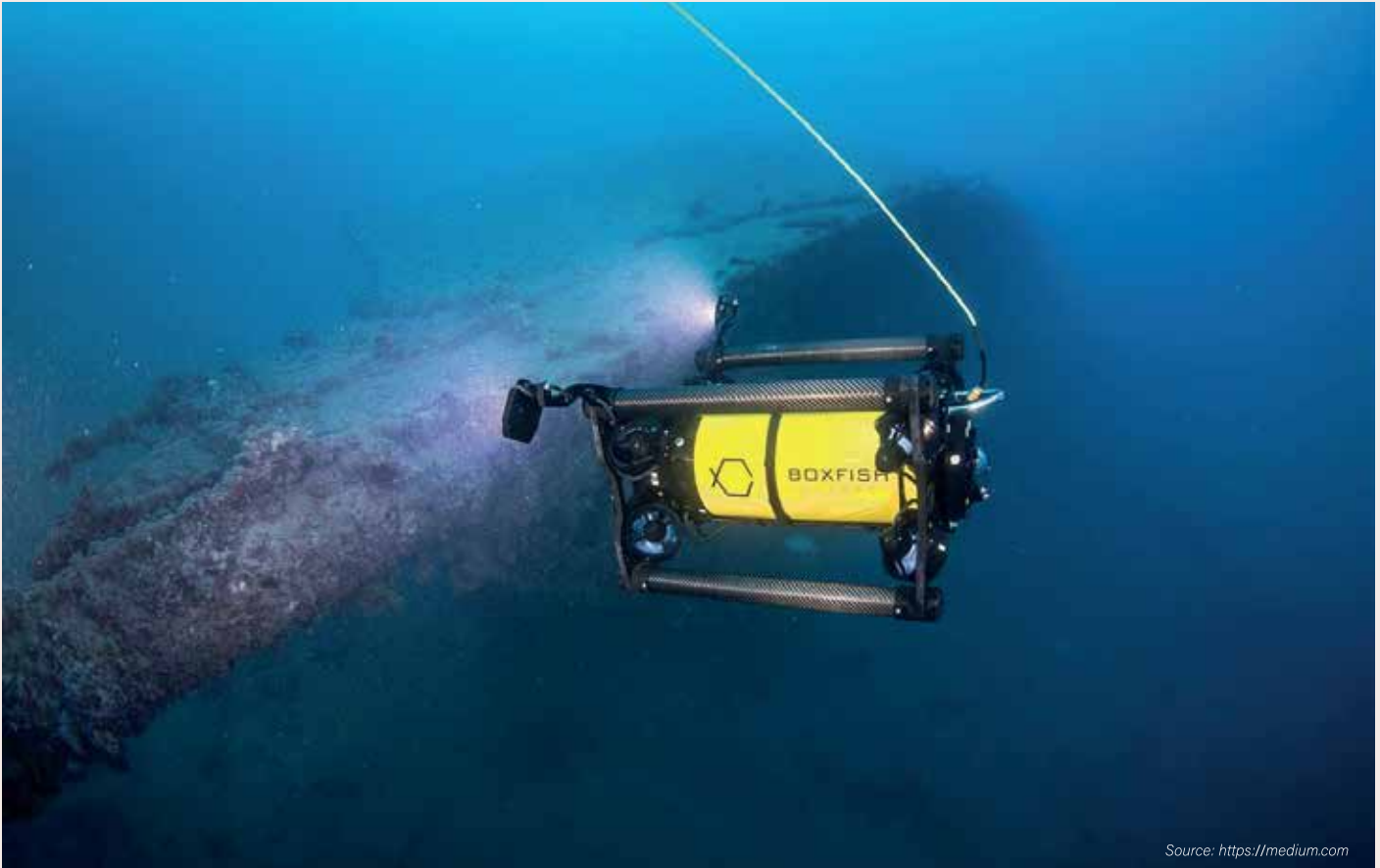
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# Marine Robotics: Upcoming Trends and Challenges

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



Marine robotics is an important part of robotics, which is certainly a vital outcome of maritime literacy. The idea of marine robotics started in the early 1970s (Yuh et al., 2011). It is a complex field, as huge challenges exist in the maritime environment that are not faced by ground and aerial robotics. However, marine robotics has gradually become a vital technology that enables us to carry out challenging and dangerous missions in the ocean. Rigorous research and development in this area have led to substantial progress and shown the utility of marine robotics in numerous fields. The core cause behind this success was the fruitful dialogue between marine robotic developers and end-users to address application-driven requirements. Nevertheless, various challenges are yet to be addressed despite the advancements in this field. It is, therefore, the appropriate time to overview the recent applications of marine robots and upcoming trends in this field to reach excellence in maritime literacy in Bangladesh.

## Classification of Marine Robots

### Operation Area

**Unmanned Surface Vehicle (USV):** USVs are marine robots that

operate without a crew on the water surface as an easy and inexpensive alternative to other water-borne surface platforms. These are smarter than buoys and have better flexibility compared to commercial ships. Renewable energy may be used to run their equipment and propulsion system, allowing them longer oceanic activity. When a survey vessel involves a USV, it can increase the active survey area and decrease the operation time. A significant role can also be performed by USVs by making connectivity of manned and/ or unmanned vehicles by acting as communication hubs of Radio Frequency (RF) networks (surface and air), acoustic frequency networks (water), and satellite networks (Sánchez-García et al., 2018).

**Unmanned Underwater Vehicle (UUV):** Numerous UUVs have been developed over time to assemble data from the subsurface of the sea. Progress in this field has not been encouraging due to difficulties of data transmission underwater which is yet to be resolved. However, notwithstanding these limitations, some UUVs have been used effectively.

**Unmanned Wave-piercing Vehicle (UWV):** UWV is an option that stands amid the USVs and the UUVs. It encompasses the swiftness, durability, GPS positioning, and radio communication



of USVs with enhanced stability and stealth of UUVs. However, it does not possess the complete criteria of either. Consequently, two strategies have been taken in the advancement of UUVs. One is with a surface platform with a slight liquid-plane area and spar of a minor size to pierce the waves (Unmanned Wave-piercing Surface Vehicle), and the second is a submarine hull immediately beneath the water level with a permanent snorkel penetrating the waves (Unmanned Wave-piercing Underwater Vehicle). As completely submerged vehicles have complicity in finding precise locations because of the ineffectiveness of GPS and lack of accuracy of Inertial Navigation System (INS) in subsurface areas, UUVs overcome the gap between USVs and completely sunken UUVs (Roberts & Sutton, 2006). These can be treated as a budget alternative to surface platforms for transporting sensors to considerable distances, collecting information, and transmitting back the information in real-time. The usage of UUVs also facilitates the elimination of noise and bubbles around sensors and corrosion in the ship's keel.

## Control Mechanism

**Remotely Operated Vehicle (ROV):** Marine robots that are tethered and controlled from distant locations are named Remotely Operated Vehicles or ROVs. However, their utility is restricted to a limited number of applications as it is a tiring task for operators. Besides, its operational cost is huge and safety concerns are also there. Still, ROVs have some utility like activities beyond the diver's depth where it is difficult to reach by divers but manual intervention is required.

**Autonomous Underwater Vehicle (AUV):** No navigator or tether is required to control AUVs. They are free-swimming vehicles. Built-in power supply and communication systems are available in AUVs. However, from time-to-time human intervention may be required for routine maintenance or change of assignment or reconfiguration due to changed marine environment, etc.

## Movement Mechanism

**Wave-Propelled Vehicle:** A USV that moves itself using waves is named as wave-propelled vehicle or wave glider. Its sensors, data, and navigation system are managed by its operating system.

**Drifter:** Drifters are USVs that move with the current. These are ideal marine robots for the study of current, wind, temperature and salinity of the ocean, air pressure, transportation system, etc.

**Glider:** A glider is an AUV that glides horizontally and vertically in the water by use of buoyancy engines and lifting surfaces. A glider maneuvers by the hydrodynamic lift and drag forces created due to variations in the weight of the glider (Jenkins et al., 2003). Presently, underwater gliders have become useful platforms in the sea for their low cost, long endurance, easy deployment, and noiselessness.

**Propeller:** Some marine robots use propellers for their movement in some parts of their maneuver to gain higher speed. Propellers are basically run by battery-driven motors and batteries are charged by solar power or available electric power when it is docked. The use of propellers in marine robots is mostly restricted to make them energy efficient.

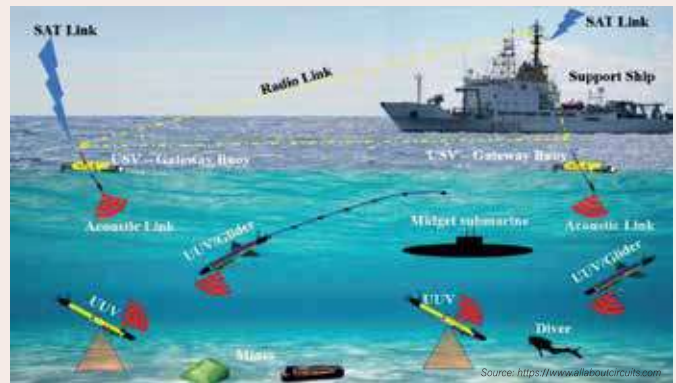


Figure 01: Different Marine Robots

## Marine Robot Applications

**Bathymetry/ Hydrography:** Marine robots integrated with the necessary sensors can perform bathymetry and hydrography.

**Survey:** Marine robots are employed to conduct surveys in the water to detect harmful elements and pollution. Marine organisms and ecosystems can also be monitored by the said robots. The survey is also carried out by these robots for seafloor mapping.

**Photography and Visual Inspection:** Video footage and high-resolution pictures can be taken by the cameras of marine robots to conduct visual inspections. This capability is useful in many applications like aquaculture inspection, ship/boat inspection, infrastructure inspection, pipe inspection, etc.

**Object Recovery:** Marine robots can assist with the search to recover lost objects. Many concerned have already begun to utilize them.

**Intrusion Detection:** Marine robots can have an important role in monitoring the security of a port or waterside of a defense or key installation and prevent intrusion by coordinating with surface and subsurface observation points. Thereby, the deployment of a group of marine robots to carry out patrolling may be quite effective to improve waterside security.

**Asymmetric Warfare:** Explosive may be carried by marine robots to attack maritime platforms, jetties, docks, etc., and thereby marine robots can be used as an asymmetric warfare platform. Besides, UUVs can be used as silent intruders because of their negligible signature than the ones of a diver, and they can travel faster, remaining below the detection level of active sonars.

## Upcoming Trend

Marine robotics has advanced very quickly due to the ample inventions in relevant areas. However, upcoming development trends of marine robotics may be grouped into two categories: platform aspect and information aspect.

## Platform Aspect

**Marine Animal Alike Robot:** Due to the developments in high-tech materials, various soft actuators or artificial muscles are presently available for creating animal-like movement in the water (Díez et al., 2021). These technologies have evolved a

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different research field to develop bioinspired water-borne platforms resembling marine animals. Most of such platforms are yet models that have only been verified in laboratory and mild natural environments. However, significant developments are required in the bioinspired platforms for their real-time utility.

**Complete Autonomous Marine Robot:** Independent response by marine robots is one of the significant requirements for future marine robotics. It is therefore required to develop totally autonomous marine robots that should identify the intervention zone, select the job to be executed and act accordingly without any human participation.

**Marine Robot for Critical Operation:** Operating in critical conditions or extreme environments will be an essential task for marine robots in the future. Extremely shallow waters, very deep ocean bottoms, areas with tremendous fast currents or large waves, polar areas with ice concealment, areas with weak GPS signals, and environments with nuclear hazards are some examples of extreme environments. New advancements are being stimulated to operate marine robots in these critical environments (Trevelyan et al., 2016).

## Information Aspect

**Computing Power of Marine Robot:** Many intelligent features are not available with marine robots due to their inadequate computing elements. Regular route planning of marine robots needs a considerable volume of computation. It is therefore apprehensible that additional investments will be made to upsurge the computing capability of marine robots.

**Organized Network of Marine Robots:** To create the map of ocean environments, normally a group of marine robots (gliders) connected by communication networks are involved. Arranging the movements of marine robots as well as an organized network is a vital issue to get a good map. New research plans are evolving in this field as well.

## Challenges

**Endurance:** The endurance of a marine robot greatly depends on its power storage or generation system. This power decides the time-on-task of the marine robots. Research is being made to improve the power management of marine robots to increase endurance, which is a great challenge to be materialized.

**Communication:** Only sound waves can be used for communication in the underwater environment, which is limited by range and bandwidth. Improvement of communication range and bandwidth is one of the critical challenges for underwater communication of marine robots.

**Determination of Subsurface Location:** The navigation ability of a UUV is limited due to the ineffectiveness of GPS underwater. Besides, the INS also does not give accurate location as the accelerometers can not sense accurate underwater gravity. A GPS feed is needed to eliminate the error compelling the marine robots to come up to the surface. Thus, a challenge remains to establish an effective subsurface positioning system.

**Universal Protocol:** A universal protocol for marine robotics is required to ensure compatibility and interchangeability with other devices which is a challenge for all concerned to take care of.

## Bangladesh Context

Different stakeholders are working silently in the field of marine robotics in Bangladesh on a small scale. BRACU Duburi and Dubotech are some of the privately owned pioneers in this field in Bangladesh, where people can easily share their thoughts and facts on maritime robotics. An underwater robotics laboratory is also there in Bangladesh University of Engineering and Technology (BUET), which is an effective platform for the research and development of marine robotics. Bangladesh Oceanographic Research Institute (BORI) could be one of the important end users of marine robotics in Bangladesh, which is planning to have some surface and underwater marine robots in the near future to conduct surveys in the ocean. There is also a "National Strategy for Robotics" prepared by the Bangladesh's government to encourage this field as well as maritime literacy.

Marine robotics has developed a lot by refining control and navigation algorithms and heading toward its full autonomous capability. Marine robots are presently diving beyond 6000 meters regularly (Stel, 2021). Submerged gliders already traversed the Atlantic Ocean, and USVs crossed the Pacific. Upcoming marine robotics will allow scientists with cutting-edge gears to discover and use the sea in a workable manner. Marine animal-like robots and completely autonomous robots are vital future trends in this field. However, the key recognized challenges are endurance and underwater communication, etc., and it is still to go a long way in this field, which will certainly be exciting and challenging. Bangladesh is no exception to it as a developing coastal state playing an encouraging role in maritime literacy.

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# খুলনা শিপইয়ার্ড লিমিটেড

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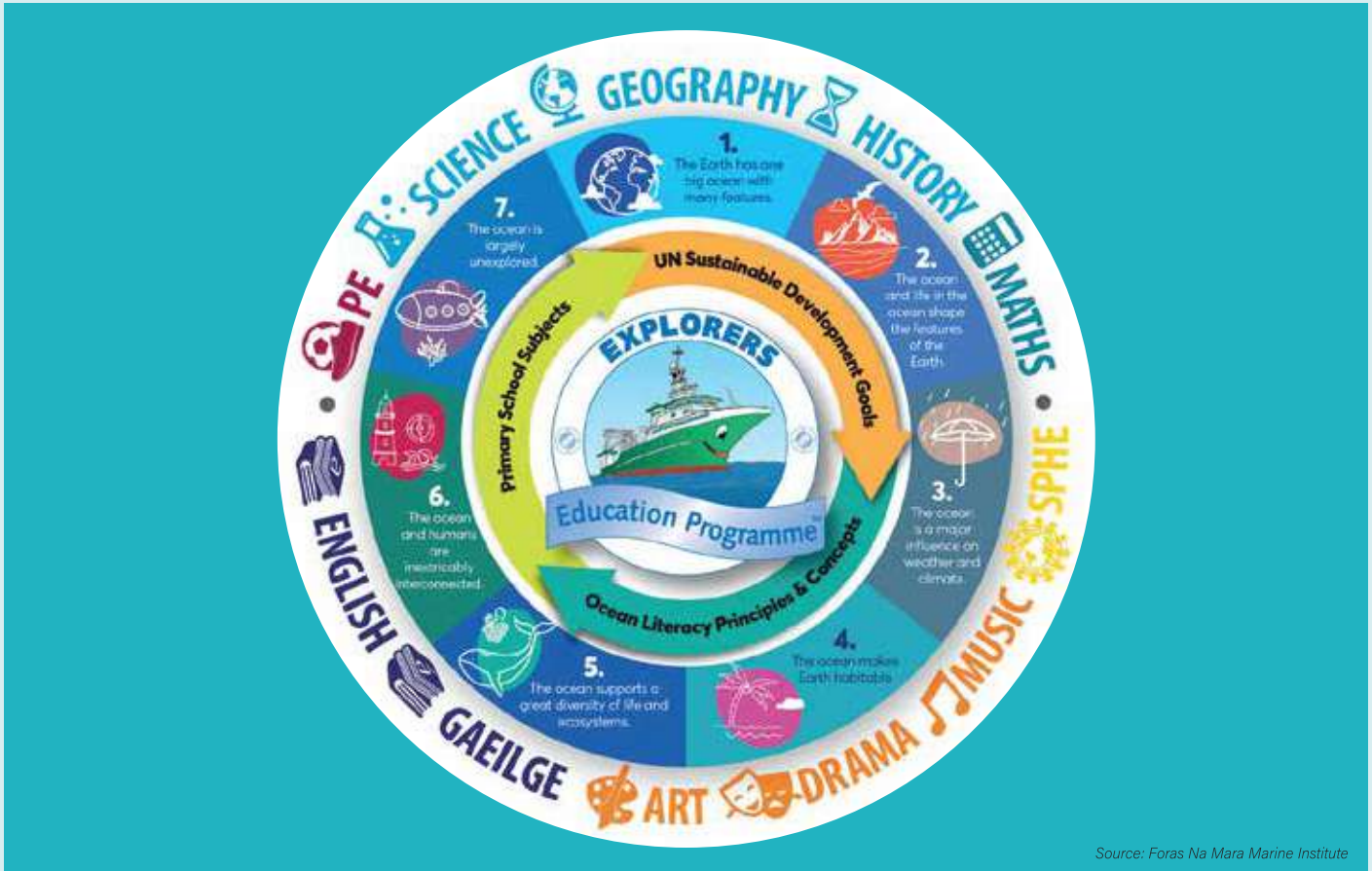


## Section IV: Ocean Governance and Sustainability



# Ocean Literacy: A Systemic Approach to Human-Ocean Relationship

Afifat Khanam Ritika



Source: Foras Na Mara Marine Institute

The concept of Ocean Literacy (OL) began to take shape in the early 2000s. In February 2002, the National Geographic Society initiated a pivotal step by convening a virtual workshop to identify key ocean concepts (National Geographic Society, 2002). This led to the development of an Oceans Scope and Sequence aligned with the National Geography Education Standards. Building on this momentum, the National Marine Education Association (NMEA) formed an ad hoc committee in July 2003 to define essential marine and aquatic science literacy concepts and integrate them with existing educational standards. Concurrently, Dr. Robert Stewart and colleagues presented a paper in July 2004 outlining crucial ocean knowledge for every student (Stewart et al. 2004). Furthering these efforts, the Center for Ocean Sciences Education Excellence (COSEE-New) embarked on a mission to strengthen regional ocean science education, culminating in a draft definition of OL. These concerted actions laid the groundwork for a comprehensive understanding of the ocean and its significance. On September 25, 2015, the 193 countries

of the United Nations General Assembly announced 17 Sustainable Development Goals, including Goal 14: "Conserve and sustainably use of the oceans, seas and marine resources for sustainable development." The 10 targets within this goal include sustainable management of fisheries, aquaculture, and tourism, and an increase in scientific knowledge of the oceans (United Nations Department of Economic and Social Affairs, 2023). This is how the term "Ocean Knowledge" or "OL" developed in the recent world.

Now the question is: What is the actual meaning of "OL," and why is it so important?

The most popular definition of OL currently in use was developed by the National Oceanic and Atmospheric Administration (2013): "OL is an understanding of the ocean's influence on you – and your influence on the ocean." So OL deals with the actions and reactions between humans and the ocean. To be straightforward, "ocean is what ocean gets."



If we discuss the broader aspect, the analysis of OL shows it is not only information that one possesses but also one's sentiments or attitudes towards different issues, one's practical approach or behavior in one's daily life and the workplace, and how often one discusses ocean-related issues with neighbors, siblings, friends, and other contacts. This could include small talk, encouraging posts/threads on social media, and standing up for change. Based on Umuhire and Fang (2016) definition of "Ocean Environmental Awareness," it incorporates willingness to engage in marine environmental activities.

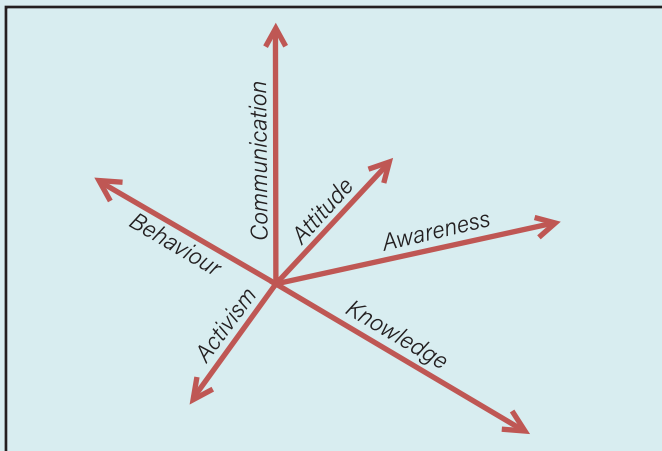


Figure 01: The Ocean Literacy Dimension (Brennan et al., 2019)

So, it is clear that OL deals with understanding the interconnection and interdependence between people and the ocean. This link comprises geological, climatic, biological, and socio-economic components. OL also focuses on raising societies' awareness that the ocean is a system sustaining life and its resources. As such, it focuses on humanity's responsibility to properly care for and maintain the ocean and its ongoing importance to human existence.

It is well known that, from the age of sail till the modern era, humankind has consistently ventured and explored the sea to ensure their better livelihood. Now, the problem is that with the population expanding each day, land resources are shrinking while the demand for ocean-derived food and nutrients continues to rise. This growing human presence exerts pressure on these ecosystems. Activities like overfishing, pollution, and coastal development degrade marine environments and endangered species and disrupt natural processes, underscoring the need for conservation efforts and effective management practices.

In contrast, despite these impacts, the sea remains largely uncharted. Researchers have only delved into 5 percent of our planet's ocean. This implies that 95 percent of our sea is still a mystery (Why Ocean Exploration Matters, NOAA). Progress in technology like satellites, buoys, and uncrewed underwater vehicles is broadening our ability to research and comprehend the depths and workings of the sea. This investigation is vital not only for exploration but also for making well-informed choices on managing ocean resources.

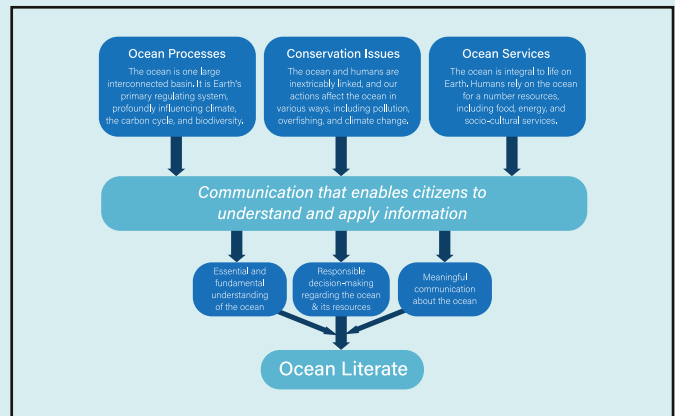


Figure 02: How Ocean Literacy Connects Human Perception Towards Ocean (Stoll & Kleemann, 2019)

On the one hand, there are many resources, and in contrast, there is a lot of destruction, so there is a massive imbalance between knowledge and exploration. It is a matter of fact that the role of the oceans and the interaction between people and the oceans has remained understudied. Therefore, in the past, the ocean was, for many people, the distant space necessary for several individuals to turn for food and transport. Although the last centuries were a period in which the use was further intensified for the extraction of oil and natural gas, onshore windrose, aquaculture, tourism, and especially mobility.

To be more precise, new maritime sectors are being identified, as captured by the "EU Blue Growth Strategy." This means that human use of the oceans has become more demanding, and therefore, we need to protect the seas from the impacts of people's exploitation. Stress factors affecting marine resources can be controlled and further development opportunities in the form of the ocean's benefits need to be balanced in the human-ocean interactions. Coordination and cooperation at the systemic level mean using an interdisciplinary approach, including incorporating ideas from biology, chemistry, geology, meteorology, and more to create holistic models of the ocean system and its relations with the Earth's climate and ecosystems to make it green.

OL has many facets in ocean-compatible behavior; it includes knowledge about the underlying systems and how they work, the relationships people have with them, and if they are willing and able to protect ecology and fix the failed management of resources; about issues like sustainable harvesting and consuming, traveling, policy, etc. In turn, it is essential to expand the understanding of our own and others' place and role in the web of interactions with the ocean.

Systematic thinking might be more relevant in helping us frame, explain, and solve problems relating to human-Ocean linkages. In other words, an ocean-literate person understands the ocean's influence on you - and your impact on the ocean. For example, through OL, a coastal community might recognize the importance of healthy mangrove forests for protecting from natural disasters and supplying food and marine fisheries. This

awareness can lead to community- driven efforts to reduce pollution, support sustainable fishing practices, and engage in mangrove protection projects, demonstrating a well-rounded understanding and commitment to the ocean's health.

Implementing OL as a systematic methodology may result in our harmonious and sustainable coexistence with the ocean. So, the emphasis on OL aims to provide people and society with the knowledge, tools, and well-informed background to understand marine ecosystems, processes, challenges, and actions that underline good decisions toward sustained ocean health. This systems perspective is crucial for tackling maritime challenges. As Bangladesh moves forward as a maritime nation, modifying education curriculum to improve the realm of oceanic science, marine literacy and ocean governance to support sustainable management practices of our ocean, and seas cannot be sufficiently emphasized.

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# The Contributions of Hydrographic Data Towards the Digital Twin of the Ocean

Commander Mohammad Mahmudul Hasan Khan,(H1), psc, BN



Source: <https://marine.copernicus.eu>

The ocean, encompassing 70% of the Earth's surface and 97% of its water, is absorbing carbon dioxide emissions, releasing half of the world's oxygen, regulating the climate, and supporting marine ecosystems (Keller et al., 2018). Hydrography is the science of measuring and mapping the physical features of the ocean and seas as well as their evolution over time. Its primary purpose is to produce a nautical chart of the ocean for safe navigation. However, it supports all other marine activities thus, plays a crucial role in supporting human understanding of the ocean's behavior and dynamics.

Hydrographic data is important for almost all activities that take place at sea. Hydrography provides critical data on the physical, biological and chemical properties of the ocean, including the nature of the seafloor, temperature, pressure,

salinity, turbidity, sound velocity, currents, waves, and wind. These data are indispensable for the development of a Digital Twin of the Ocean (DTO). The DTO is a digital replica of the ocean that uses real-time and past data to represent the past and present, and models to imitate future scenarios.

## Concept of Digital Twin of the Ocean

Digital Twin of the Ocean is a virtual imitation of Real Ocean (Figure 01). In this case, data, along with models, are used to create a digital twin that demonstrates how the real world changes. The concept is to demonstrate the ocean system by incorporating all resources related to the sea, i.e. data and models with digital technologies for the representation of real-time or nearly real-time portrayal of the ocean. A DTO allows citizens to be able to take well-informed decisions supported by

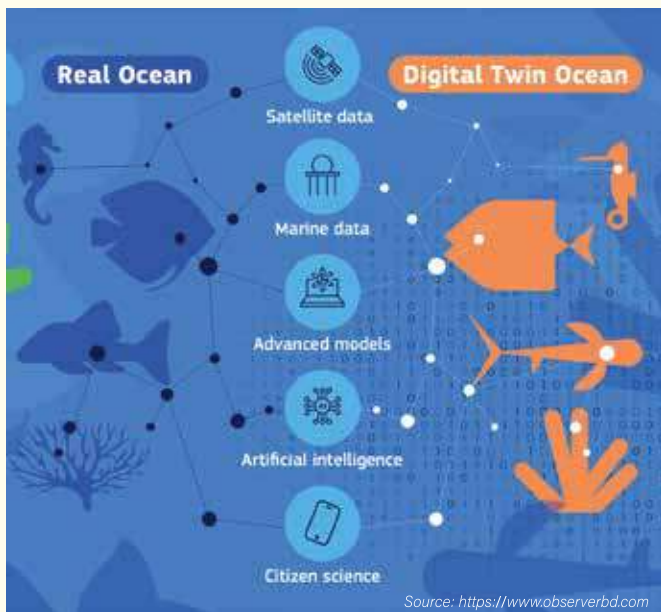


Figure 01: A Digital Twin of the Ocean

data and technology to conserve marine environments through the creation of a digital replica of the ocean.

The aim of DTO is to create knowledge available to every citizen on Earth, revolutionizing our understanding of the ocean environment and provide a true testing ground for prediction of future changes. By transforming ocean science into knowledge, the DTO will be a game-changer in decision making for the protection of ocean and sustainable resource management of it (Ossing et al., 2023).

## Hydrography – An Indispensable Foundation to the Development of Digital Twin of Ocean

The relevance and contributions of hydrographic services toward the digital twin of the ocean can be visualized in the subsequent paragraphs:

**Mapping the Seafloor:** The bathymetry and configuration of the seafloor are fundamental for understanding the circulation patterns of the ocean that affect climate and weather patterns, tides, waves, tsunamis, fishing, morphological and environmental changes, and much more. These data are used to develop a 3D



Figure 02: Mapping the Seafloor

model of the ocean floor. By creating a 3D model of the seafloor, it is possible to simulate the effects of ocean currents, tides, and waves, and predict changes in the ocean environment and ecosystems.

**Maritime Transport:** Sea-borne trade contributes more than 80% of international trade (Liang & Liu, 2020). The shipping industry needs a safe, smooth, and speedy operation. As such, uncharted or poorly charted areas or lacking navigational information can cause the ship to take more time than usual, and may not allow optimum loading of ships, thus increasing the costs. The accurate depth information and correct routing can save time and money. Besides, the International Convention for the Safety of Life at Sea (SOLAS) Convention Chapter V identifies a ship as unseaworthy if it does not comply with up-to-date charts. In such a case, hydrographic services provide a solution to these problems by supplying quality maps and charts.

**Developing Models and Simulations:** One of the most significant contributions of hydrography to the digital twin of the ocean is the use of hydrographic data in developing models and simulations. These models allow us to predict changes in ocean currents, tides, and sea levels, which are essential for understanding the ocean's complex systems.

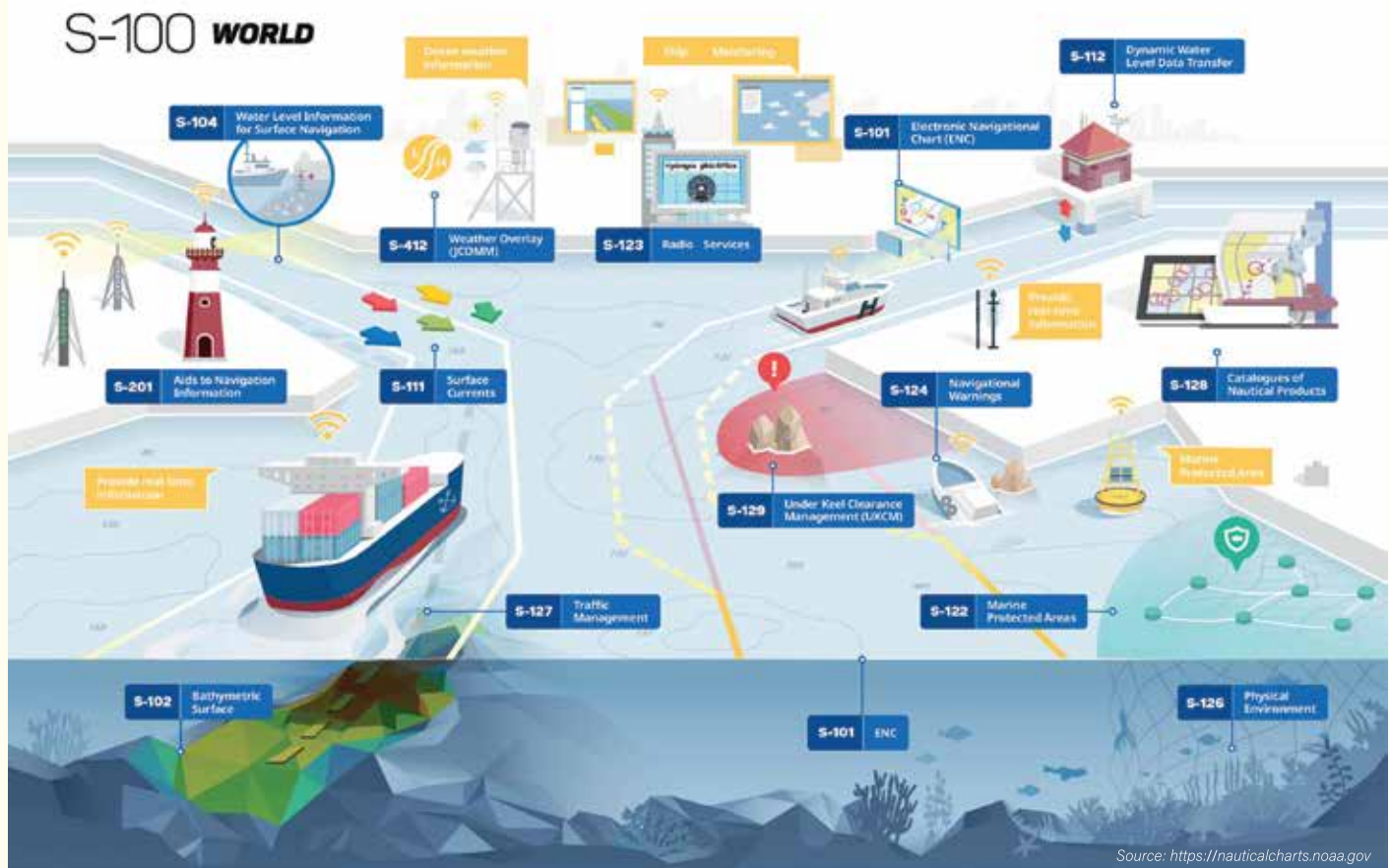
**Relevance to Sustainable Development Goal (SDG) 2030 and UN Decade of Ocean Science:** The relevance and contribution of hydrographic information to SDG 2030, and in particular “SDG 14: Life Below Water,” is greatly acknowledged. The vision of SDG-14 is: “Conserve and sustainably use the oceans, seas, and marine resources for sustainable Development.” The “UN Decade of Ocean Science for Sustainable Development” gives a unique opportunity to enhance the capacity to observe and understand the ocean. On the other hand, the Digital Twin offers for integration of research innovations and ocean science of the decade straightway into the decision-making process to allow people to sustainable development and protection of the ocean. All these activities are supported by hydrography.

**Incorporating Electronic Navigational Chart (ENC) Data Into the Digital Twin:** Electronic Navigational Chart (ENC) are digital representations of navigational paper charts for use with “Electronic Chart Display and Information System (ECDIS).” They provide accurate and up-to-date information about the ocean environment, such as water depth, hazards to navigation, and the location of navigational aids.

In the DTO, ENC data is used as a key component of the virtual model, providing information on the physical characteristics of the ocean environment. By incorporating ENC data into the Digital Twin, maritime industry stakeholders can visualize and better understand the ocean environment, and make more informed decisions. For example, vessel operators can use the Digital Twin to optimize route planning, improve safety, and reduce fuel consumption. It also helps for optimization of fleet, terminal, and container flows in the chain for optimum and smooth port operations such as vessel traffic and cargo handling.



## The S-100 Universal Hydrographic Data Model: A Way to Enable Autonomous Navigation and Create Comprehensive Digital Twin of the Ocean



International Maritime Organization (IMO) has recognized S-100 (Kim et al, 2017). S-100 is a revolution in software. Its data format has been internationally accepted as the baseline standard for building a universal data structure. This data will facilitate e-navigation and related services. "International Association of Lighthouse Authorities" (IALA) and "World Meteorological Organization" (WMO) are the two main stakeholders who brought the idea of S-100 into reality. Moreover, multiple data formats like bathymetry aids to navigation, marine meteorology, etc., will always be exchangeable with each other. The S-100 data has the potential to bridge hydrography and oceanography in order to build a fully digital marine data ecosystem- the DTO.

**Legal Obligation for Mariners to Use the S-100 Universal Hydrographic Data Model:** In 2022, IMO adopted a resolution on ECDIS for the compliance of S-100 and its interconnected digital products. This resolution thus augmented for enhancing the safety of navigation. S-100 ECDIS will be obligatory for mariners to comply from January 2026. The changeover stage for compliance of IMO resolution on ECDIS will be until 1 January 2029. This obligation for using S-100, thus, will make way

for e-navigation and a comprehensive DTO, Autonomous navigation, as well as operations, requires digital data exchange, which is a core feature of digital twins.

### Challenges in Developing the DTO

Despite many opportunities and benefits of the DTO, there are still several challenges that include the collection and integration of data, development of accurate models, interoperability of data, implementation of the seabed 2030 initiative, and the S-100 Universal hydrographic data model, etc.

Hydrography, by contributing critical data on ocean properties, serves as a building block for developing a DTO. It develops a reliable and near real-time virtual depiction of the ocean, combining ocean science and data, modeling and technology. It empowers citizens, and provides an accessible platform to all for global cooperation.

The ambitious global initiative of Seabed 2030, which strives to chart the entire ocean floor by 2030 and the S-100 Universal Hydrographic Data Model, which serves as the framework for organizing and sharing hydrographic data, drive advancements

in autonomous navigation and sustainable ocean management. The benefits of the S-100 are enormous and the foundation for the digital twin. Thus, it is evident that these all are possible with the use of hydrographic data.

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**The DIGITAL TWIN OCEAN**

**Testing scenarios**

**We can test what happens if...**

- ... the frequency of extreme events increases under climate change?
- ... we decide to strictly protect marine waters?
- ... we decided to combine wind energy and aquaculture?
- ... the average sea temperature increases?

- How would people living on the coastal area be affected?
- How would world fisheries be impacted?
- How would a specific offshore marine area be affected?
- What would happen to seagrass meadows?

Source: <https://european-union.europa.eu/>









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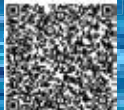
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# Addressing Pollution in the Bay of Bengal: A Strategy for Regional Ocean Governance

Lieutenant Commander Sk. Mahmud Hasan, (G), BCGM, psc, BN



Source: <https://www.thedailystar.net>

The vast Bay of Bengal (BoB), which is situated in the northeastern section of the Indian Ocean, is significant both environmentally and commercially. Over 2.2 million square kilometers in size, the BoB shares borders with multiple nations, such as Bangladesh, India, Myanmar, Thailand, and Sri Lanka. This vast body of water serves as a center for fishing and maritime trade in addition to being home to a wide variety of marine species (Blasco, 2002). It is well known for its rich marine biodiversity, which consists of a wide variety of marine life, colorful coral reefs, and extensive mangrove ecosystems. These habitats are essential for the survival of many fish species and are the backbone of the fisheries in the area (Sen & Ghorai, 2019). In addition to its biological significance, the BoB has significant economic worth. It is a vital trading route through its many ports, supports sizable commercial fishing companies, and makes a major tourist contribution. The Bay's waters serve as a pivot point in the worldwide commercial network,

linking Southeast Asia and South Asia. But beneath the surface of this supposedly unspoiled water, pollution is posing a serious threat. Large amounts of silt and pollutants from the higher catchments are carried by the Ganges, Brahmaputra and Meghna River System, which is one of the busiest river systems in the world. These are eventually combined with soil and water and discarded into the BoB (Sen & Ghorai, 2019).

In the BoB's east coast, sewage-borne diseases, persistent organic pollutants, and high heavy metal concentrations are prevalent, and they damage oysters and seashells. A significant amount of plastic reach the BoB from Bangladesh. Most of Bangladesh's industries release untreated wastewater and solid waste into the Karnaphuli River, which empties into the Bay of Bengal. The Bay receives a lot of untreated sewage, plastics, industrial wastes and other effluents from the agricultural and aquaculture sectors through several big rivers that have their sources in India (Kaly, 2004).



The implications of pollution in the Bay of Bengal are far-reaching. Diesel pollution damages sea stars and sea urchins, sometimes to the point of extinction. Oil refinery effluents contain phenol, which irritates the gills, produces copious secretion and mucus membrane breakdown, and impacts the endocrine and central nervous systems of fishes. Fish that feed on the bottom close to an oil refinery are observed displaying changes in their cells caused by hydrocarbons, which eventually lead to cancer (Albers, 2002). The Bay's contaminated waters have the potential to cause dead zones, which are areas where marine life cannot survive and oxygen remains at a very low level. Furthermore, the existence of marine species like seabirds and turtles is directly threatened when they consume plastics.

Since the BoB is a trans-boundary body of water, a coordinated regional strategy for ocean governance is necessary to successfully manage pollution. The term "Regional Ocean Governance" describes the coordinated efforts of adjacent nations to safeguard and manage their common marine resources and deal with shared issues. To enable coordinated responses to pollution incidents, cooperative monitoring, and information exchange, effective governance systems are required. There are several approaches towards the resolution of disputes and conflicts in international ocean governance.

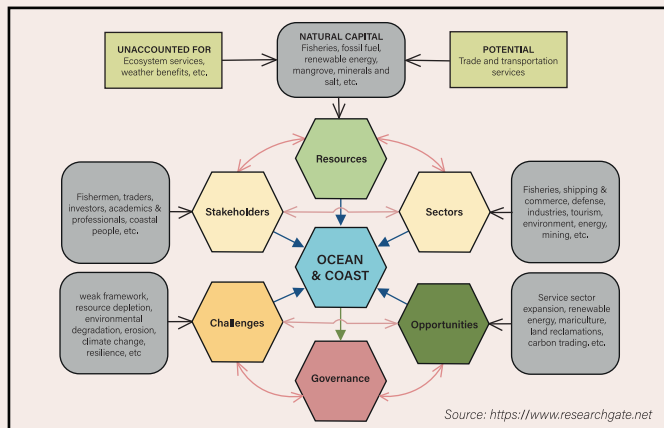


Figure 01: Ocean Governance Framework

Subsets of international agreements that concentrate on environmental issues are called Multilateral Environment Agreement, or MEAs. A few of these are: the Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter (1972), Ramsar Convention (1971), International Convention for the Prevention of Pollution from Ships (MARPOL) (1973), and United Nations Conference on Environment and Development (UNCED) (1992), and International Law Commission (ILC), (2006).

It should be noted that the five coastal states (Bangladesh, India, Myanmar, Thailand, and Sri Lanka) along the BoB are all common law countries with essentially the same legal agreements. The obligation to preserve and protect the environment is underlined in Article 18A of Bangladesh's Constitution, Article 48A of the Indian Constitution, as well as Articles 22 and 67 of the Maldives Constitution. Also, it is important to mention that these states have accepted the

International Convention for the Prevention of Pollution from Ships, 1973 as modified by the Protocol of 1978, (MARPOL 73/78) and the UNCLOS III (1982).

Although regional ocean governance has great potential, there are drawbacks and obstacles to consider (Hossain, 2020). First of all, effective collaboration in combating pollution is hampered by political tensions and disputes among neighboring countries. One of the biggest obstacles to regional governance is resolving these disagreements. Secondly, adequate data and information sharing are necessary for good governance. Some nations may oppose sharing the data as they fear issues about resource allocation or issues of the sovereign territory. Thirdly, the allocation of funds to the initiatives to address the issues of pollution and prevent new cases can be quite a controversial issue. A fair allocation is the most appropriate approach.

The BoB has optimism despite these obstacles because there are instances of effective regional ocean governance schemes. Despite facing its own set of environmental issues, the Southeast Asian region has benefited from cooperative efforts led by institutions such as the Association of Southeast Asian Nations (ASEAN). The efforts within ASEAN agreements, like the ASEAN Agreement on Transboundary Haze Pollution, have been put in place to tackle air pollution from forest fires that cross borders. Similar regional initiatives could help in controlling pollution in the BoB. Exploring how ocean governance is managed in seas like the Mediterranean, Black, Baltic, and Caspian Seas could benefit the framework for managing resources in this region. Key agreements such as the 1995 Mekong River Basin Agreement, the 1973 Itaipu Treaty between Brazil and Paraguay, and the 1998 International Commission for the Protection of the Danube play important roles in transboundary pollution management (Hossain, 2022). The EU Strategy for the Baltic Sea Region (EUSBSR) and Mediterranean Science Commission (CIEM) demonstrate collaborations across regions, which was commended in the 3rd International Conference on Marine/Maritime Spatial Planning, November 22-23, 2022.

To effectively prevent pollution in the BoB and get the benefits of ocean governance, it is crucial for the nations surrounding the bay to establish a framework for ocean management. This framework should outline strategies for handling pollution, information sharing, and coordinating responses to pollution events (World Bank Group, 2014). The first goal should be to enhance the region's ability to control and reduce pollution by providing training initiatives, technical assistance, and sharing approaches among countries. Secondly, international collaboration and diplomatic engagement are critical to overcoming any political barriers to regional ocean governance. Thirdly, appropriate practices and behaviors can be promoted via educational programs aimed at the general public, businesses, and coastal communities. Finally, the nations around the BoB should establish regional accords regarding pollution control, sustainable resource management, and disaster relief.

The BoB has reached a critical point due to its unique ecological richness and economic importance. The crucial issue of pollution is putting all of these in danger: the region's economic prosperity, the people's lives on the coast, and the health of the marine ecosystem. For such a precious resource, a regional ocean governance approach is necessary in order to protect it. Because there are no regional legally binding instruments, no significant advancements have been made to combat marine pollution in the BoB region. A sub-regional regulation and monitoring mechanism which makes significant contributions to a sustainable ocean ecosystem and a habitable coastal living environment for the livelihoods of the people should be developed.

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# Maritime Literacy: Oceanic Significance in the Formation of the Bangladesh Delta

Shahriar Khosnoor Prince



The Bengal Delta is one of the largest and most dynamic delta systems in the world (Gupta, 2007). It plays a critical role in the geography, geomorphology, and ecology of Bangladesh and the Bay of Bengal (BoB) region. The sediment load carried by the Ganges, Brahmaputra, and Meghna rivers, which drains the most sediments from almost all of the Himalayas, has shaped this delta. This delta system is a testament to the powerful interaction between riverine processes, such as river discharge and river bank erosion, and marine processes, like tidal cycles, storm surges, etc. The role of the BoB's predominant semidiurnal tidal cycle is crucial in forming the Bengal Delta. There is also a compelling correlation between river discharge and sediment deposition.

The Bengal Delta has been shaped mainly by the sediment load from the foreslope and backslope of the Himalayas. This sediment load is carried by two Himalayan rivers: the Ganges and the Brahmaputra (Islam & Gnauck, 2008). Another major source of the sediment load is the non-Himalayan Meghna River. These three rivers, collectively called Ganges-Brahmaputra-Meghna (GBM) river system, have shaped and reformed several deltas before settling into their present-day formation,

merging and emptying all sediments into the Bay of Bengal. The topset beds of an advancing and dynamic delta are deposited in turn over the previously laid delta sediments. Topsets are nearly level layers of sediment deposition on the top of the delta, forming an extension of the landward alluvial plain due to the sea-level jump in the Holocene period about 11,700 years ago (Hori & Saito, 2007). The delta formation has contributed to approximately 60% of Bangladesh's coastline (Shariot-Ullah et al., 2021). The delta can be divided into the inactive delta on the western part and the active Meghna deltaic plain on the eastern side, each with distinct geological features and significance.

## Geological History and Development

The Ganges-Brahmaputra delta first developed around 125 million years ago (Ma) after the fragmentation of Gondwanaland and has continued to develop since the early Cretaceous (145-100.5 Ma) (Islam, 2016). This process has continued through various geological epochs, influenced by the activities of tectonic plates of the earth's crust, major sea level changes during the shifts of ice ages, and the rise of the

Himalayas, which is still ever-changing due to tectonic activity. The delta's evolutionary phases can be divided into the proto-delta, the transitional delta, and the modern delta (Celis, 2021).

- Proto-Delta (126-49.5 Ma): This stage was characterized by four major sequences of carbonate-clastic associations deposited in both restricted marine and open marine equatorial areas of the BoB.
- Transitional Delta (49.5-10.5 Ma): This stage was marked by the collision between the Indian and Eurasian plates after the fragmentation of Gondwanaland. It saw significant sediment deposition from the rising Himalayas.
- Modern Delta (10.5 Ma-Present): Following a major sea-level fall due to the ice age, the delta began to take its current form, dominated by the old river channels of the Ganges river system. Neotectonic activity and Quaternary sea-level fluctuations continue to shape and form the deltaic arcs.

### Western Inactive and Eastern Active Delta

The western inactive delta includes districts such as Khulna, Satkhira, and Bagerhat in Bangladesh and covers approximately 31,500 square kilometers. This part is characterized by older geological formations, including the moribund, mature, and saline-tidal deltas, which have hardly any fluvial activity. Geologically younger and more dynamic eastern active delta covers about 15,000 square kilometers and includes districts like Barisal, Patuakhali, and Bhola. It is active mainly due to the high volume of river discharge through fluvial channels. The eastern active delta has a north-south length of about 300 kilometers and varying widths. The present size of the Bengal Delta is about 100,000 square kilometers (Akter et al., 2016).

The deltaic regions are almost flat, with elevations ranging from 15 meters in the northern part to nearly close to the sea level in the southern part. Tidal waves propagate approximately 200 km inland because the gradient is about 0.016 meters per kilometer (Bricheno et al., 2016). Bangladesh's deltaic plains are densely populated and highly fertile, which supports extensive agricultural activities. The major livelihoods of the local population are land cultivation, fishing, transportation, and collecting resources from the Sundarbans mangrove forest.

### Role of the Ocean and River Dynamics

The Bengal Delta is a complex setting with diverse hydrodynamic processes, predominantly tidal cycles, and strong fluvial influences (Tonkin, 2012). With periodical variations, the semidiurnal tides, the massive seasonal fluxes of water during the monsoon seasons, and sediment from the river discharges interact to shape the delta (Celis, 2021). The sediments are primarily deposited on the sea floor, leading to the rise of the depositional plain and the current formation called the Bengal Fan, with a length of approximately 3000 km and a width of about 1000 km (Peketi et al., 2021). The ice melts during the interglacial stages, and the sea level rises. Then, the ocean processes intensify, and river processes are subducted by ocean processes, causing more deposition at river mouths (Munch et al., 2022).

An expansive Fluvial-to-Tidal Transition Zone (FTTZ) is established due to the highly dynamic nature of the Meghna deltaic plain results from the interaction between high fluvial discharge and significant tidal velocities (1-2 ms<sup>-1</sup>) (Valentine & Wilson, 2023). Like in the case of Sandwip Island, morphologic changes in different areas around that island are driven predominantly by ocean processes like tidal currents. But in the case of Bhola Island, mainly the river currents influence the formation and changes. The erosion at Bhola depends on the precipitation rate over the region, and thus, this erosion process is mainly affected by the river discharge and is highly seasonal.

### River Discharge and Sediment Deposition

The correlation between river discharge and sediment deposition area is complex. River discharge affects the deposition areas in the estuarine river channels and the Bengal Fan region. Generally, if river discharge increases, it will bring on more sediments, and the sediment deposition area increases to a certain threshold (Wang et al., 2012). Beyond this threshold, if the flow velocity of the river increases, the river flow turbulence can reduce the depositional areas despite the continued rise in discharge and sediment supply (Guo et al., 2018). This phenomenon was tested in Rabnabad Channel near the estuary by using numerical modeling. The input data was collected from the Payra Port Authority (PPA) and was used to run the model for predicting the area of deposition zones with hypothetical increased and decreased river discharge scenarios (Figure 01). It can be easily said that the dynamics of sediment transport and deposition are crucial for understanding the delta's evolution.

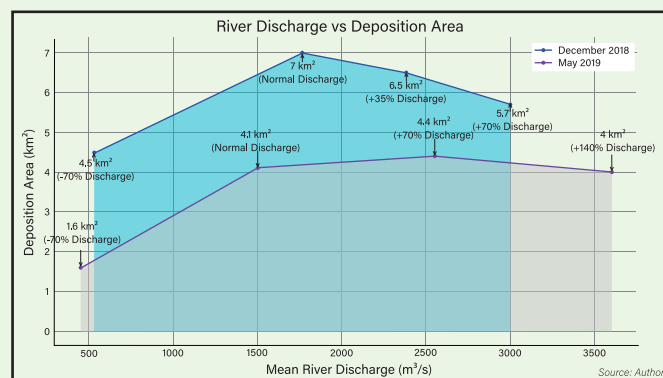


Figure 01. Graph showing correlation plot between mean river discharge (m<sup>3</sup>/s) and deposition area (km<sup>2</sup>) in Rabnabad Channel utilizing numerical modeling.

### Climate Change and Its Impact on the Bengal Delta

Climate change significantly threatens the Bengal Delta by hindering normal sea level fluctuations and coastal processes. Due to climate change, the global temperature is rising, and it is melting the polar ice caps which causes sea level rise. The rising sea levels are prompting the hindrance of freshwater runoff and creating increased saltwater intrusion into freshwater resources, adversely affecting agriculture and drinking



water supplies (Rahman et al., 2022). The change in weather patterns, with prolonged dry spells and more intense monsoons, disrupts standard river discharge patterns and affects sediment supply. However, it also affects the fluvial process and triggers abnormal sediment deposition and erosion. Climate change enables more frequent and intense cyclones coupled with storm surges, which leads to more significant coastal erosion and displacement of coastal communities (Dasgupta et al., 2023). Additionally, the loss of biodiversity in the Sundarbans mangrove forest due to anomalies in Sea Surface Temperature (SST), fluctuations in sedimentation, and habitat degradation further threatens the ecological balance of the delta (Chowdhury et al., 2021).

The Bengal Delta is a remarkable example and masterpiece of nature. It has been divinely created and continuously reshaped by the interplay between riverine and marine processes in an equatorial coastal landscape. About 80% of Bangladesh is deltaic. Understanding the formation and dynamics of the delta is highly significant for maintaining the environmental and socio-economic challenges faced by its densely populated community. Scientific assessment of the dynamics, influencing the Bengal Delta, is of utmost importance. It is significant to design a long-term master plan like Bangladesh Delta Plan 2100 to utilize the full potential of the Blue Economy. Advanced and comprehensive data collection, construction of Marine Spatial Data Infrastructure (MSDI), and proper monitoring of the geomorphological changes of the delta can contribute to enhancing maritime literacy in Bangladesh. This would assist in addressing the impacts of climate change, sea level rise, and anthropogenic activities. To forecast the delta's geomorphological changes, the numerical modeling approach can give dividends to these spatial and oceanographic data. These research outcomes are key to conducting an Environmental Impact Assessment (EIA) and Economic Sustainability Assessment (ESA) during any type of coastal urbanization and infrastructure development for a prosperous Bangladesh.

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## BIMRAD Graciously Acknowledges the Continuous Guidance of the Chief Patron



BIMRAD, nation's first maritime think tank under the patronage of the Bangladesh Navy, extends its heartfelt appreciation to the Chief of Naval Staff Admiral M Nazmul Hassan, OSP, NPP, ndc, ncc, psc, the Chief Patron of BIMRAD, for his invaluable guidance and unwavering support. As the Chief Patron of the organization, Admiral M Nazmul Hassan has consistently demonstrated a deep commitment to BIMRAD's mission and its potential to contribute significantly to Bangladesh's maritime development.

His encouragement has been instrumental in shaping BIMRAD's research goals and fostering collaborations with key stakeholders. Under Admiral Hassan's leadership, BIMRAD has been able to play a pivotal role in promoting maritime awareness, advocating for sustainable maritime practices, and contributing to the nation's maritime security.

BIMRAD is honored to have such a distinguished figure as its Chief Patron and remains committed to fulfilling its mission to conduct quality research in the maritime domain, reflecting the Chief Patron's wisdom and vision to guide its future endeavors.

## Navy Chief Visited Flood-Affected Fulgazi Upazila in Feni

On August 27, 2024, the Chief of Naval Staff Admiral M Nazmul Hassan, OSP, NPP, ndc, ncc, psc, the Chief Patron of BIMRAD visited one of the flood-affected areas of Fulgazi Upazila in Feni District. He personally inspected various flood-hit locations in Fulgazi, interacted with the affected people and concerned authorities, and provided necessary guidance regarding rescue operations, relief distribution, and medical services.

It is noteworthy that the Bangladesh Navy, which also patronises BIMRAD, swiftly initiated rescue, relief, and medical service operations in the flood-affected areas to manage the flood situation. The naval contingent in Fulgazi has so far rescued thousands of people and arranged safe shelters for them. Additionally, the Navy has set up a 30-bed field hospital in the Upazila to provide medical services to the flood victims.



## BIMRAD Welcomes New Chairman



BIMRAD, a prominent maritime think tank, is pleased to announce the appointment of Rear Admiral Mohammad Musa, OSP, NPP, rcds, afwc, psc, PhD, as its new Acting Chairman. Rear Admiral Musa brings a wealth of experience and expertise to the organization, having previously served as the Vice Chancellor of BSMRMU.

With a distinguished career spanning couple of decades, he has developed a deep understanding of the maritime sector and its challenges. His extensive knowledge of maritime affairs, coupled with his leadership skills, will undoubtedly be invaluable in guiding BIMRAD towards achieving its objectives.

BIMRAD is confident that under the leadership of Rear Admiral Musa, the organization will continue to play a vital role in promoting maritime research, policy analysis, and capacity building in Bangladesh.



## Introducing BIMRAD to Government Officials



On several occasions in August 2024, Commodore Syed Misbah Uddin Ahmad (LPR), Director General (DG) of Bangladesh Institute of Maritime Research and Development (BIMRAD), called on key government officials to foster collaboration for advancing Bangladesh's maritime sector. During these meetings, the DG introduced BIMRAD's mission and activities, emphasizing the Navy's initiatives in promoting sustainable practices and effective marine resource utilization.

On August 01, 2024, DG BIMRAD met with Md. Ashraf Uddin, Secretary of the Ministry of Defence, to discuss BIMRAD's future plans. DG BIMRAD also met with Dr. Md. Kawser Ahmed, Member (Secretary) of the General Economic Division, Ministry of Planning, to explore opportunities in Blue Economy initiatives and Delta Plan-2100. Additionally, a meeting was held with the Secretary of the Finance Division to strengthen collaboration for achieving BIMRAD's objectives and contributing to Bangladesh's growth as a maritime nation.

## BIMRAD's Participation in a Roundtable Discussion on "Developing the Blue Economy of Bangladesh: International Cooperation" Organized by BISS

The Director General of BIMRAD participated in a roundtable discussion on "Developing the Blue Economy of Bangladesh: International Cooperation," organized by the Bangladesh Institute of International and Strategic Studies (BISS) on July 07, 2024. The session was chaired by Ambassador AFM Gausal Azam Sarker, Chairman of BISS, and featured Rear Admiral (Retd.) Md. Khurshed Alam, Secretary of the Maritime Affairs Unit, Ministry of Foreign Affairs, as the chief guest. Researchers, academicians, Navy personnel, investors, and various other practitioners from different fields participated in the enthusiastic interactive session.



## Participation in a Day Long Advanced Training Workshop on “Ocean Color Remote Sensing (SatCO2-2024)”



A day long advanced training workshop on “Ocean Color Remote Sensing (SatCO2-2024)” was held on July 05, 2024 at the Department of Oceanography, University of Chittagong. Marhaba Matluba and Shahriar Khosnoor Prince, research officers from the Bangladesh Institute of Maritime Research and Development (BIMRAD) participated in the training.

## BIMRAD’s Participation in the Celebration of 27 Years of BIMSTEC at Sheraton



DG BIMRAD had the honor to attend the celebration of 27 years of BIMSTEC at Sheraton on June 6, 2024. There, he exchanged greetings and introduced BIMRAD to the Secretary General of BIMSTEC, His Excellency Indra Mani Pandey. It was an excellent event for BIMRAD to establish a strong network with different Dignitaries, Excellencies, Diplomats, Elites, Scholars, Think Tanks, and Senior Government Officials.

## BIMRAD’s Engagement with Global Maritime Experts to Foster International Collaboration

The Director General of Bangladesh Institute of Maritime Research and Development (BIMRAD), Commodore Syed Misbah Uddin Ahmad (LPR), actively participated in a series of high-profile international meetings and discussions in May 2024, aimed at enhancing maritime collaboration and security.

During a workshop on "Maritime Domain Awareness" in New Delhi, India, DG BIMRAD met with Dr. David Brewster, a renowned specialist in Indian Ocean and Indo-Pacific maritime security from the National Security College, Australian National University.



Additionally, DG BIMRAD presented a crest to Vice Admiral Pradeep Chauhan, Director-General of the National Maritime Foundation (NMF), India, as part of the same workshop.

On May 30, 2024, DG BIMRAD also participated in a significant discussion session with Mr. Arsenio Dominguez, Secretary-General of the International Maritime Organization (IMO), hosted by the Ministry of Foreign Affairs, Bangladesh.

## BIMRAD and BSMRMU Research Team’s Visit to Jakarta to Study Deep Sea Port Sustainability



A research team from Bangladesh Institute of Maritime Research and Development (BIMRAD) and Bangabandhu Sheikh Mujibur Rahman Maritime University (BSMRMU) visited Jakarta, Indonesia, from May 26 to June 1, 2024, as part of a deep sea port sustainability study funded by Nuffic, Netherlands. The visit was part of a project result dissemination program aimed at exploring possibilities for enhancing the sustainability of deep sea ports.

## Participation in a Workshop on "Awareness Building to Reduce the Carbon Footprint of Maritime Law Enforcement Agencies in South Asia" Hosted by the United Nations Office on Drugs and Crimes (UNODC) in Dhaka

DG BIMRAD has attended a workshop titled "Awareness Building to Reduce the Carbon Footprint of Maritime Law





Enforcement Agencies in South Asia" hosted by the United Nations Office on Drugs and Crimes (UNODC) in Dhaka, Bangladesh. Along with BIMRAD, representatives from the MoFA, Navy, Coast Guards, Police, Ports, Customs, etc. also participated in this workshop. Moreover, the discussants of the motion were from Bangladesh, Sri Lanka, and the Maldives.

In conjunction with the discussion, DG BIMRAD met with Mr. Pierre-Jean Bordahandy, Associate Researcher at the Marshall Islands-based maritime think tank, the Micronesian Center for Sustainable Transport (MCST).

### BIMRAD's Participation in an Expert Roundtable Discussion Titled "Maritime Security in the Bay of Bengal" Organized by BIPSS & British High Commission Dhaka



Bangladesh Institute of Peace and Security Studies (BIPSS) in collaboration with the British High Commission Dhaka organized an expert roundtable discussion titled "Maritime Security in the Bay of Bengal" on May 27, 2024 at the British High Commissioner's Residence in Dhaka. BIPSS President Major General ANM Muniruzzaman, ndc, psc, (retd) moderated the motion. The special guests of the discussion were Mr Jamie Moncrieff, Maritime Security Specialist and Mr Spiro Marcandonatos, Maritime Security Consultant.

DG BIMRAD, Commodore Syed Misbah Uddin Ahmad (LPR) shared deep insights and provided expert opinions regarding Maritime Security challenges including geopolitical

rivalries revolving around the Bay, realpolitik equation of major powers, and most significantly the transnational character of nontraditional security risks etc., dominant within the realm of the Bay of Bengal and beyond the Indian Ocean.

### BIMRAD, BSMRMU, and STC Next (Netherlands) Hosted Research Findings Dissemination Seminar on Matarbari Deep Sea Port



BIMRAD, BSMRMU, and STC Next (Netherlands) carried out a joint research on "Evaluating Matarbari Deep Sea Port Sustainability Roadmap: A Triple Bottom Line Approach." From BIMRAD, Lt Cdr Md Saiful Islam, (H1), psc, BN and Research Officer Ms. Afifat Khanam Ritika participated as members of joint research team. A research findings dissemination seminar was arranged on 13 May 2024, where Rear Admiral Mohammad Musa, OSP, NPP, rcds, afwc, psc, PhD (Former VC, BSMRMU) was present as chief guest.

### Editorial Board Meeting for Upcoming "PAAL Magazine"



A significant step towards enhancing the quality and presentation of the PAAL magazine was taken at a recent editorial board meeting. The meeting, attended by the esteemed members of editorial board including Professor Dr. Rashed Uz Zaman from the International Relations department of Dhaka University and DG BIMRAD, looked over the proposal of comprehensive guidelines for the improvement of PAAL magazine.



## The First Cyclone of the Year is a Major Threat to the Coast: Preparations Need to be Strengthened to Deal With Cyclones of Different Characteristics Like Remal

Rafiqul Islam Montu



Leaving behind the devastations, the cries and desolations for the victims - Cyclone Remal has passed. Even more struggles to survive have been added to the ongoing challenging life on the coast. A more difficult struggle has to be started to provide housing for the homeless, provide food for the hungry, and provide resources for the deprived.

The men who lost their fish farms due to the collapse of embankments during the cyclone are facing a new crisis. The high water level of the river during Remal's protracted rampage left significant damage, and increased wind speed ravaged nature. These issues makes it even more difficult for those who live by the sea to fulfill their needs. They have to struggle passionately to regain their lost property.

Because of climate change, coastal people are facing more hazards than before. Frequent cyclones and other natural calamities have become common for the coastal people. But how much can the people living along the coast manage these calamities? They lose everything in the frequent natural hazards, living expenses rise, and they fall into a debt trap. Many disaster-affected families are unable to overcome their debt throughout their life. Catastrophes block off all avenues for subsistence; individuals lose their jobs. Moving permanently to the city often becomes the last resort for many families. Tragedies upend the way of life along the coast. Many people's means of livelihood are impeded by Cyclone Remal. For many, the battle for a restart began immediately following Remal's passage.



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## Field Report: Deluti

In the wake of Cyclone Remal, the coastal areas that Cyclone Remal impacted were investigated. One of the hardest-hit places in Bangladesh by Cyclone Remal was Deluti Union in Paikgachha Upazila of the Khulna District. The storm affected around fifteen thousand individuals in ten villages inside the union. The tremendous tidal wave entered Deluti Union when the brittle embankment at Telikhali, which was located along the banks of the Manga River at the border of Dakop and Paikgachha Upazilas, crumbled. This resulted in a catastrophe.



Figure 01: A House Destroyed by Cyclone Remal

Mosharraf Morol (56), from Fulbari Bazar, claimed that they still hadn't lighted the stove. They occasionally get by on dry food and receive food from relatives' houses. Such has been the week. Akirun Nessa, the spouse of Mosharraf Hossain, stood by him during the conversation. Her cheeks were wet with tears. She had a plastic bag in her hand. The union council was going to provide Akirun with relief rice. But with their stove and house in such disarray, she was concerned about how she would cook the rice. Many others, including Mostafa Sheikh, Rina Bibi, and Abdul Majid, were busy putting their names in the notebook as the gathering grew while we were speaking. They thought it was crucial to write their names in the notebook to get help.

### Cyclone Remal had Different Characteristics



Figure 02: Children are Also at Risk in Remal's Destroyed House

Cyclone Remal differed substantially from other cyclones in terms of behavior. Remal did not lose its strength even after striking the land.

1. It took a long time to cross Bangladesh.
2. It did not strike in the same location as predicted on the weather map.
3. It created high tidal waves along the entire coastal area.

Cyclone Remal can be distinguished from other storms by these features. Not even meteorological specialists and old coastal residents had witnessed a cyclone taking so long to pass. The entire coast and the nation sustained significant devastation as it raged for a long time. So far, ten fatalities and approximately two hundred thousand demolished houses are listed in official reports. More damage than expected has been caused by the tidal surge along the shore. This time, the damage is very subtle. We don't see much of it, but there has been immense internal damage. It is true that Bangladesh is currently a global leader in cyclone preparedness. Looking back, we can observe significant advancement in cyclone management. The number of people killed by the cyclones in 1970, 1988, and 1991 has been considerably decreased. However, we still have a lot of work to do to reduce the damage caused by cyclones.

### Increasing Focus on Cyclone Preparedness

We have robust "Standing Orders on Disaster" (SOD), which outlines the duties and responsibilities of everyone during natural disasters. There are committees from the national to the local level. The SOD specifies who will be on these committees and what each person's role will be. However, proper implementation must be ensured through increased monitoring.

Red Crescent's Cyclone Preparedness Program (CPP) and other non-governmental volunteer organizations sent teams during the recent storm Remal. One day before the Remal cyclone, volunteers transmitting alerts regarding emergencies were seen. But there was a conspicuous absence of cooperation. Before a cyclone, volunteers from various groups should get together for coordination meetings to divide up the work. More than just making announcements should be the responsibility of volunteers.

On the other hand, it has been seen that whole coastal regions experience complete blackouts without power well in advance of the cyclone warning. The internet and electricity are linked, and when one or the other is down, the situation worsens multiple times for the residents in the impacted areas. In order to keep in touch during cyclones, alternative strategies must be taken from concerned authority.

Undoubtedly, the number of cyclone shelters has increased over time. However, people hesitate to go to the cyclone shelters. Residents of Burigoalini Union, during the Remal, blamed

the shelters' conditions, claiming that there is little room for stay and scarcity of food is acute, and problems become considerably more acute for women. Furthermore, there are still not enough storm shelters in many remote coastal areas.



Figure 03: Fragile Embankments are Risky Homes

After a tropical storm, providing aid to those areas is a gigantic task. Accurate lists are necessary in order to deliver relief to the real victims. But partisanship and partiality plague these rankings frequently. Helping individuals in their difficulties can be achieved by properly reaching everyone. For people to restore their lives after receiving emergency relief, rehabilitation help is required. However, concerns about aid not reaching the appropriate people also exist here. Since no one appears to be there to support them after emergency relief finishes, the real fight for people harmed by the cyclone begins. Long-term strategies should be implemented to help those impacted, allowing them to heal and start over.

### Climate Change Must be Taken into Account

Sea levels are rising silently due to climate change. Therefore, climate change must be considered when preparing for cyclones. Adaptation is now at the centre of global climate discussions. Coastal embankments are considered a fruitful approach to alleviate the effects of tropical cyclones.

There are multiple fragile embankments that have existed for a very long time. Every cyclone has demonstrated to us - the weak embankments are known to collapse under tidal pressure. We don't know, though, if the Water Development Board is informed of this. We observe that locals use volunteer work to restore embankments in a number of locations around the southwest coast. In that area, this scenario is still evident following Cyclone Remal. Strong and long-lasting embankments have long been desired by residents in cyclone-prone locations.

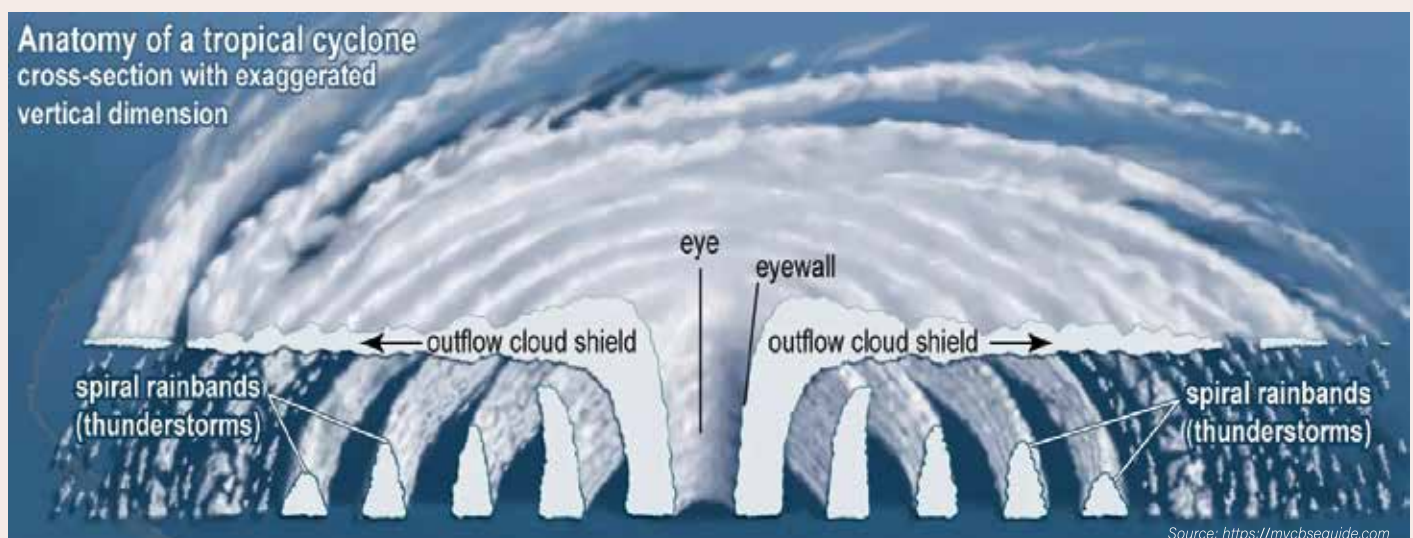


Figure 04: The People of the Coast are Afraid of the Signal of the Cyclone

With support from the World Bank, some embankments were constructed in the Shorankhola neighborhood of Bagerhat in 2007 following Cyclone Sidr. But those embankments have failed multiple times in different locations. Cracks were observed in the block-dropped region of Sharankhola Sadar following Cyclone Remal. Similar breaches were found in Khulna's Dakop embankments following Cyclone Aila. Building embankments necessitates a greater focus on cyclone readiness.



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