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National Report

Country: People's Republic of Bangladesh

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Names of members of national delegation attending IOCINDIO-IX

IOC Function A : Ocean Science and Research				
IOCINDIO Programme: Effects of human induced changes: Ocean acidification, eutrophication, hypoxia, harmful algal blooms (HABs) in coastal waters of the North-western Indian Ocean				
Projects Titles	**Activities**	**Geographical scope Regional/ National benefitting countries**	**Budget/ funding sources National/ Regional/ international**	**Results/impacts**
Vertical distribution of Physio-Chemical parameter and major nutrients in the adjacent water of Saint Martin's Island, Bangladesh at winter season.	1. **Collection of zooplankton samples from four different stations in the Moheshkhali Channel during the winter season.** 2. **Analysis of zooplankton abundance and composition, including identification of major groups or taxa.** 3. **Assessment of ecological parameters, such as tide levels and water quality, to understand their influence on zooplankton abundance and composition.**	**The study was conducted in the Moheshkhali Channel, located in Cox's Bazar, Bangladesh.** **The study benefits Bangladesh, as it provides important information on the abundance and composition of zooplankton in one of its significant open channel systems.**	**National Science and Technology Fellowship**	1. **The study found that the abundance of zooplankton in the Moheshkhali Channel varied significantly depending on the station and tide level, with copepods being the most dominant group of zooplankton.** 2. **The study also found that the zooplankton community in the Moheshkhali Channel exhibited high diversity and species richness, with a total of 15 major groups or taxa identified.** 3. **The results of this study can help inform policies and regulations related to the management and conservation of the Moheshkhali Channel and its associated ecosystems in Cox's Bazar, Bangladesh.**
A Study on the Water Quality and Analysis the effect of subsequent channel discharge in to the Kutubdia Channel with Mike 21/3 integrated Ecolab Module	1. **Conducting a study on the Kutubdia Channel to analyze the effects of Hydrodynamic characteristics and Ecological dynamics of the Channel.** 2. **Setting up an Ecological Model (EcoLab) for 29 days with collected water level data, precipitation, wind data, temperature, nutrients, Dissolve Oxygen (DO), BOD (5days), salinity.**	**Regional: Kutubdia Channel, Cox's Bazar district, Bangladesh.** **Benefitting Countries: Bangladesh.**	**National Science and Technology Fellowship**	1. **The study found that the Hydrodynamics of the channel suggest future deposition on the Northern Kutubdia channel opening and possible erosion on the Southern elongated tip of the Kutubdia Island.** 2. **No eminent ecological threat was found in the 29 days simulation of water system.** 3. **The water entering from the side channel on the Kutubdia channel showed low BOD from 2.5 mg/l to 3.5 mg/l, NO_3 ranges from 0.01 mg/l to 0.04 mg/l, PO_4 concentration range found from 0.89 mg/l to 5.82 mg/l, and DO level found on the day were within**

	3. Calibrating the Hydrodynamics Model output tidal elevation against the observed surface elevation collected from Bangladesh Inland Water Transport Authority (BIWTA) RADAR tide gauge station situated at the Boroghop Ghat at the Kutubdia Channel. 4. Analyzing the Hydrodynamics of the channel to suggest future deposition in the Northern Kutubdia channel opening and possible erosion at the Southern elongated tip of the Kutubdia Island. 5. Using DO, Biological Oxygen Demand (5days) and Nutrients data to set up an Ecological Model on the Kutubdia Channel.			the normal range from 4.60 mg/l to 5.65 mg/l.
Spatial Distribution of Nutrients and Physico-Chemical Properties of Seawater in the Adjacent Area of the Saint Martin's Island, Bangladesh	1. Measurement of physio-chemical parameters such as pH, TDS, DO, salinity, temperature, and conductivity. 2. Measurement of 5 major nutrients (Ammonium, Nitrite, Nitrate, Phosphate, and Silicate) at surface water, 2-meter depth and 5-meter depth. 3. Analysis of the collected data to determine the spatial distribution of nutrients and physico-chemical properties of seawater in the study area.	The geographical scope of the study would be national, focusing specifically on Saint Martin's Island in Bangladesh.	National Science and Technology Fellowship	1. The study provides important information about the physio-chemical characteristics and nutrient distribution in the adjacent water of Saint Martin Island, which can help in the management and conservation of the marine ecosystem in the region. 2. The study found that electrical conductivity, pH and TDS showed a strong correlation with the changes of salinity. 3. Nutrient concentrations were found to be higher at deeper depths, indicating the presence of a large number of phytoplankton and other living-nonliving organisms that use these nutrients for their living demand. 4. The study found moderate levels of DO, pH, and salinity in the study area, which are stable during the winter period due to low river water influx.

The potentiality of gas hydrate in the Bay of Bengal, Bangladesh			University Grant Commission (UGC)	1). Estimation of Phosphorus Concentration in Silicon Thin Film on Glass Using ToF-SIMS (Mass Spectrometry Letters, vol. 12, no. 2, pp. 47–52, Korean Society for Mass Spectrometry, Daejeon, Korea.doi: 10.5478/ MSL. 2021.12.2.47) Published: August 2021.
A Preliminary study to develop a Phased Approach for Maritime Tourism Development in Bangladesh	Research		Bangabandhu Sheikh Mujibur Rahman Martime University (BSMRMU)	2). I. Implementing a formative assessment model at secondary schools. Language Testing in Asia (Scopus indexed, Q1)
Developing a Transport Mode Choice Model for Matarbari Freight Transportation.	Research		UGC	II. Wash back of assessment on English teaching-learning practice at secondary schools. Language Testing in Asia (Scopus indexed, Q1)
Isolation and Characterization of Locally Available Marine Algae to Promote Food Supplements in Bangladesh.	Research		UGC	III. The prediction of the responsible determinants to institutional attributes for EFL student dropout at the Tertiary level. MEXTESOL (Scopus indexed, Q3 journal)
Challenges and Strategies to Address the IMO Sulphur Cap 2020: Perspective form Bangladeshi Ship Owners.	Research		UGC	IV. Feedback to student-works: lifeline of learning. Journal of Language and Linguistic Studies Language Testing in Asia (Scopus indexed, Q2 journal) Published: 2021-22.
Impact of Deep Seaport and Shipbuilding Over the Reduction of Extreme Poverty Rate in Bangladesh.	Research		BSMRMU	3). I). Pharmaceutical potential of entophytes associated to marine sponge and algae from the bay of bengal and their contribution to the blue economy of Bangladesh (International journal of pharmaceutical sciences and research)
Suspended and Dead Load of Sediment Transport in Rabnabad Channel Flowing Towards BoB and Their Impact on Clement Cycling.	Research		BSMRMU	II. Interaction pattern of aldose reductase with β-glucogallin: Active site exploration and multiple docking analyses (Informatics in Medicine Unlocked) III. Multiomics analysis of altered NRF3

MSP Prospect: Prospect of Maritime Spatial Planning for Bangladesh Delta Plan 2100.	**Research**			**BSMRMU**	expression reveals poor prognosis in cancer (Informatics I Medicine Unlocked) Published: 2022.
Sustainable and Integrated Management of Inland Water Transport (IWT): Towards a National Policy of Bangladesh.	**Research**			**BSMRMU**	I. Application of Cyanidin-3- Glucosides as a functional food ingredient in rice-based bakery products (Saudi journal of biological Sciences)

II. development and validation of a novel customized medium for the marine microbial culture (Bioresearch Communications)

III. Towards utilizing autonomous ships: A viable advance in industry 4.0 (Journal of international maritime safety, environmental affairs, and shipping) Published: 2021.

4). David J DEVLAEMINCK, Reciprocity and China's Transboundary Waters: The Law of International Watercourses (Airo Journals)

5). Blue Economy Bangladesh Perspective (Airo Journals)

6). Corporate Governance, board practices and performance of shipping firms in Bangladesh (Asian Journal of Shipping & Logistics)

7). A framework for Maritime English Language Planning in Bangladeshi Maritime Education and Training Institute (Journal: SN Social Sciences-Springer)

8). Dry Port location selection using a fuzzy AHP-BWM- PROMETHEE approach (International Maritime Journal)

9). New record of seven marine crabs from Saint Martin's Island of the northern Bay of Bengal, Bangladesh (Indo pacific Journal of Ocean Life)

10). Role and Contribution of Chittagong Port to the Economy of Bangladesh |

				11). **Use of treated domestic wastewater in managed aquifer rechange and homestead irrigation-A Hydro-geochemical study from Khulna, Bangladesh** 12). **Remote sensing Applications: Society and Environment**
DNA Barcoding of Marine Sponges and Sea Weeds (isolated from Bay of Bengal) for Biodiversity Assessment and Isolation of Bioactive Compounds to Evaluate Their Pharmacological Effects in Vitro and in Vivo.	**Research**	**-**	**BSMRMU**	**Manuscript Under Preparation**
Analysis of Natural and Anthropogenic Threats to Sustainable Management of NijhumDwip Marine Protected Area.	**Research**		**BSMRMU**	**Manuscript Under Preparation**
Pollution Analysis in the Aquatic System in Seawater and Sediments of Ship Breaking and Mangrove Areas of Bay of Bengal.	**Research**		**BSMRMU**	**Manuscript Under Preparation**
Surface and Subsurface Geo-environmental Assessment of the Cox's Bazar Coastal belt of Bangladesh.	**Research**		**UGC**	**Manuscript Under Preparation**
Numerical Investigation of the Decay of Solution to a Water Wave Model with Nonlocal Viscous Term.			**UGC**	**Manuscript Under Preparation**

Environmental Impact Assessment and Ecotoxicology Studies of Andarmanik River: Future Economic Hub of Southern Region.			**UGC**	**Manuscript Under Preparation Under**
Investigating the Accidents in Coastal and Inland Waterways of Bangladesh.			**UGC**	**Manuscript Under Preparation**
A Competitive Analysis of the Ship Recycling Industry Under the New Regulatory Framework of Hong Kong Convention.			**UGC**	**Manuscript Under Preparation Under**
Sustainability Assessment of the Water Resources and Ecosystem of Offshore Islands (Monpura and Hatiya) of the Meghna Estuary: An Eco-Hydrological Approach.			**UGC**	**Manuscript Under Preparation**
Gender in Maritime Sector: The Unsung Tales of Women Seafarers.			**BSMRMU**	**Manuscript Under Preparation Under**
Impact of Coastal Tourism on the Biota of South West Bangladesh.			**BSMRMU**	**Manuscript Under Preparation**
Sustainable use of Natural Resources of Tanguar Hoar: Can Community-based Tourism be a Solution?			**BSMRMU**	**Manuscript Under Preparation**

Sustainability of a Sustainability Indicator System: An Empirical Study on an Indigenous Community-operated Sustainable Tourism Indicator System at Boga Lake, Bangladesh			**BSMRMU**	**Manuscript Under Preparation**
Collaborative Multimodal Transport Network for Sustainable Maritime Logistics Operation in Bangladesh.			**BSMRMU**	**Manuscript Under Preparation**
Groundwater Resource Assessment and Determination of its Sustainability in the South central Offshore Region of Bangladesh.			**BSMRMU**	**Manuscript Under Preparation**
An Investigation on Current Financial and Cost Accounting Practices of Shipbuilding Industry of Bangladesh.			**BSMRMU**	**Manuscript Under Preparation**
Climate Change impact of Maritime Region on Environmental Economics Envisaging Blue Carbon Sequestration: A Remote Sensing Approach.			**BSMRMU**	**Manuscript Under Preparation**
Distribution mechanism of physicochemical parameters in Moheshkhali estuary, Northern Bay of Bengal.	**Spatial variation of physicochemical parameters and their inter relationship. Mechanism of the existing parameters.**	**Northern Bay of Bengal, Bangladesh. Water quality parameters will showcase the regional status.**	**BORI R&D budget/Ministry of Science and Technology**	**Water column density, stratification and the air-sea interaction parameters are major driving force for spatial distribution which are impacting on ocean ecosystem.**
Determination of sedimentological mineralogical distribution to delineate sedimentary process of the nearshore area of Moheshkhali-Kutubdia, Bangladesh.	**Surface sediment composition, mineral composition, economic mineral assemblage of the nearshore sediment.**	**Northern Bay of Bengal, Bangladesh. Economic mineral composition for national and regional research.**	**BORI R&D budget/Ministry of Science and Technology**	**Heavy mineral concentration is very high in the northern and southern part of the research area. Most of the area is covered by 4-12 percent of heavy minerals.**

Influence of physicochemical parameters on abundance and distribution of phytoplankton composition along the coastal waters of Cox's Bazar, Bangladesh.	Phytoplankton diversity identification in respect of physicochemical parameters. Canonical Correspondence Analysis (CCA).	Cox's Bazar Coast, Bangladesh. Coastal water quality for national and regional study.	BORI R&D budget/Ministry of Science and Technology	Investigation summarizes the seasonal fluctuations in physicochemical parameters and phytoplankton diversity at Cox's Bazar coastal waters.
Effects of Ocean Acidification and Global Warming on Mollusks and Coral Communities of Saint Martin Island, Bangladesh	To investigate the impacts of ocean acidification and warming on mollusks and coral communities of the study area	Bangladesh	Ministry of Education, People's Republic of Bangladesh	Thermo-tolerant and pH sensitive species will be identified Effective temperature and pH level for individual species will be measured Life stages vulnerable to ocean acidification and ocean warning of different mollusk and coral species will be known Different kinds of effects like morphological, anatomical and behavioral changes of different experimental species will be measured Adaptive responses of different mollusk and coral species to ocean warming and acidification will be known
Seismic characterization and modelling of gas hydrate occurrence in the northern Bay of Bengal, offshore Bangladesh	To explore the possibility to identify presence of Gas Hydrate in the Bay of Bengal	Bangladesh water	Government of Bangladesh	Gas hydrate deposits in the Exclusive Economic Zone (EEZ) of Bangladesh are estimated to be equivalent to 17-103 tcf (trillion cubic feet) of natural gas reserves.
Research on Marine Genetic Resources (MGR)	To determine the potential, presence, nature and reserves of marine genetic resources especially seaweed in the seas of Bangladesh.	Bangladesh water	Government of the Kingdom of Netherlands	Two years of research enabled red seaweeds available in the coastal waters of Bangladesh to be converted to Agar Agar. Now Ministry of Foreign Affairs is looking for commercial production of Agar Agar from seaweed which will provide a sustainable domestic source for a range of existing industries cosmeceuticals, food, nutraceuticals and animal feed sectors.

IOC Function B: Observing Systems & Data
IOCINDIO Programme: Ocean observations, coastal zone management, circulations and fisheries.

Projects Titles	Activities	Geographical scope Regional/ National benefitting countries	Budget/ funding sources National/ Regional/ international	Results/impacts
Long Term Variation of Phytoplankton Functional Types(PFTs) in the Bay of Bengal From Satellite Ocean Color Data	1. Data collection of monthly Chlorophyll-a, CDM, PAR and SPM from satellite ocean color data (2000-2020) provided by Glob Color, European Space Agency (ESA) 2. Derivation of 10 PFTs from monthly Chlorophyll-a data using equations of Hirata et. al. (2011) 3. Analysis of monthly and year-to-year variability of PFTs in the Bay of Bengal region 4. Examination of average Chlorophyll-a, CDM, PAR, and SPM trends from 2000 to 2020 5. Investigation of seasonal patterns and physio-biological changes affecting the abundance of PFTs 6. Determination of the dominant PFTs in the Bay of Bengal region over time	The study was focused on the Bay of Bengal region. The research provides important information about the phytoplankton community in the Bay of Bengal region, which is important for understanding the overall health of the marine ecosystem. This information can benefit countries that rely on the region for fisheries, tourism, and other industries.	National Budget	1. The study provides a long-term perspective on the changes in phytoplankton community structure in the Bay of Bengal region from 2000 to 2020. 2. The research highlights the dominant phytoplankton functional types (PFTs) in the Bay of Bengal and how their relative abundance varies over time. 3. The findings of the research can be used to inform policy decisions related to fisheries management, climate change, and ocean conservation in the region.
Species composition, abundance and distribution ofphytoplankton community in the MaheshkhaliChannel,north eastern coast of Bangladesh.	1. Conducting a study on the abundance and composition of phytoplankton in the Maheshkhali Channel 2. Examining the relationship between physico-chemical parameters and phytoplankton distribution 3. Analyzing the data using statistical methods	Geographical Scope: Regional: Maheshkhali Channel, Cox's Bazar, Bangladesh Benefitting Countries: Bangladesh	National Science and Technology Fellowship	1. The total abundance of phytoplankton varied between 76000 individuals/L to 340000 individuals/m3 during high tide, and 148500 to 502125 individuals/m3 during low tide 2. Coscinodiscus spp. comprised the apex composition in total phytoplankton groups of all two tides 3. The results of Pearson's correlation showed a substantial negative link between temperature, pH, and phytoplankton,

				suggesting that temperature, salinity, pH, and phytoplankton all are inversely proportion. 4. The study revealed that phytoplankton abundance and composition in the Maheshkhali channel is influenced by hydrometeorological parameters.
Coupled Hydrodynamic and Ecological Modelling in the Naf River of Bangladesh	1. **Development of coupled hydrodynamic and ecological model using MIKE 3 and ECO Lab for the Naf river estuary in Bangladesh.** 2. **Collection of data sets for calibration and validation of the model from Bangladesh Inland Water Transport Authority and Bangladesh Navy Hydrographic Department.** 3. **Collection of water samples from six different stations for Biological Oxygen Demand (BOD), Dissolved Oxygen (DO), and Nutrients (Nitrate and Phosphate) analysis.** 4. **Simulation of water quality analysis and comparison with collected data to assess the accuracy of the model.**	**Geographical Scope: Regional, focusing on the Naf river estuary in Bangladesh.** **Benefitting Countries: Bangladesh.**	**National Science and Technology Fellowship**	1. **The developed model provides an elaborative narration of the tidal characteristics and water quality analysis of the Naf river estuary.** 2. **The simulation results of the model show better agreement with the collected data, indicating its accuracy.** 3. **The highest surface elevation and current speed were found in the Kewarighat and ShahparirDwip jetty ghat areas, respectively.** 4. **BOD concentration was highest in Teknaf due to sewage and boat waste dumping.** 5. **DO concentration was highest in the downstream areas.** 6. **Nitrate concentration was highest in upstream areas of Kewarighat and Phosphate concentration was highest in Sabrang area.** 7. **Water quality degrading components like nitrate and phosphate were found to be in good condition, indicating suitability for aquatic estuarine flora and fauna and the environment.**
Spatiotemporal variations of the thermohaline structure and cyclonic response in the northern Bay of Bengal: The evaluation of a global ocean forecasting system	1. **Assessment of the performance of a high-resolution global ocean forecasting system, based on the First Institute of Oceanography surface wave-tide-circulation coupled ocean model (FIO-COM).** 2. **Evaluation of FIO-COM analysis**	**Geographic Scope: Regional: Northern Bay of Bengal** **Benefitting Countries: India Bangladesh**	**National Budget**	1. **The FIO-COM analysis and forecasting system has reasonable accuracy in the Northern Bay of Bengal, as demonstrated by comparison with moored buoy, satellite, and reanalysis datasets.** 2. **The FIO-COM outputs are able to capture daily variations in different thermohaline**

		Geographical Scope	Budget	
	and forecasting results by utilizing available moored buoy, satellite, and reanalysis datasets. 3. Comparison of thermohaline structure related variables (e.g., temperature, salinity) from FIO-COM with aforementioned datasets on a seasonal and daily basis. 4. Focus on evaluating FIO-COM outputs during a very severe cyclonic storm named Titli that formed in October, 2018.			structure related variables at two RAMA positions. 3. Both model and satellite data show pronounced sea surface temperature cooling and increased sea surface salinity on the right side of the cyclone track during cyclone Titli. 4. High sea surface temperature, TCHP, and deep isothermal layer depth were identified as the main oceanic triggering forces that intensified cyclone Titli.
Contributions of shortwave radiation to the formation of temperature inversions in the Bay of Bengal and eastern equatorial Indian Ocean: a modeling approach	1. Conducting a high-resolution Regional Ocean Modeling System (ROMS) simulation to investigate the effects of shortwave radiation on the formation of temperature inversions in the Bay of Bengal and eastern equatorial Indian Ocean. 2. Analyzing mixed layer heat and salt budgets to identify the role of shortwave radiation in temperature inversion formation.	Geographical Scope: The Bay of Bengal and eastern equatorial Indian Ocean.	National Budget	1. The study found that shortwave radiation plays a significant role in the formation of temperature inversions in the Bay of Bengal and eastern equatorial Indian Ocean. 2. A 30% change in shortwave radiation can change approximately 3% of the temperature inversion area in the Bay of Bengal. 3. Low shortwave radiation reduces the net surface heat flux and cools the mixed layer substantially, which ultimately enhances haline stratification and intensifies the temperature inversion layer by thickening the barrier layer. 4. The findings of this study could be useful for predicting how the Indian Ocean climate will respond to future changes in shortwave radiation.
Spatiotemporal variation and mechanisms of temperature inversion in the Bay of Bengal and eastern equatorial Indian Ocean	1. Analysis of long-term Argo and RAMA profiles data to examine the spatiotemporal variation of temperature inversion in the Bay of Bengal and eastern equatorial Indian Ocean.	Geographical Scope: Regional - Bay of Bengal and the eastern equatorial Indian Ocean. Benefitting Countries: India, Bangladesh,	National Budget	1. The study provides a higher resolution spatiotemporal variation of temperature inversion in the Bay of Bengal and eastern equatorial Indian Ocean. 2. The study identifies two new regions with frequent temperature inversion during

	2. Conducting mixed layer heat and salt budget analysis to identify the driving processes of temperature inversion in different subregions. 3. Identifying the spatial distribution of temperature inversion in the study area throughout the year and examining the seasonal variation. 4. Revealing the occurrence of temperature inversion in two other regions, the northeastern part of the Bay of Bengal and the eastern part of the Eastern Equatorial Indian Ocean (EEIO), during summer and autumn, in addition to the widely accepted winter inversion in the northern Bay of Bengal. 5. Investigating the impact of factors such as heat penetration, mixed layer cooling tendency, surface heat loss, mixed layer salinity, subduction of warm-salty Arabian Sea water, and downwelling of thermocline on the formation of temperature inversion.	Myanmar,		summer and autumn, in addition to the widely accepted winter inversion in the northern Bay of Bengal. 3. The study reveals the driving processes of temperature inversion for different subregions. 4. The study highlights the impact of factors such as heat penetration, mixed layer cooling tendency, surface heat loss, mixed layer salinity, subduction of warm-salty Arabian Sea water, and downwelling of thermocline on the formation of temperature inversion. 5. The study's findings can help in improving the understanding of the dynamics of the Bay of Bengal and the eastern equatorial Indian Ocean, which can have important implications for weather and climate forecasting and marine ecosystems in the region.
Dominant physical-biogeochemical drivers for the seasonal variations in the surface chlorophyll-a and subsurface chlorophyll-a maximum in the Bay of Bengal	1. Multivariate empirical orthogonal function decomposition and heterogeneous correlation analyses were applied to numerous observational, reanalysis, and satellite datasets. 2. Chlorophyll-a, nutrients, temperature, salinity, turbidity, and wind stress curl datasets were collected from various sources, including the Copernicus Marine Environment Monitoring Service,	India, Bangladesh, Myanmar	**National Budget**	1. Improved understanding of the seasonal variations and driving mechanisms of the surface and subsurface chlorophyll-a concentrations in the Bay of Bengal. 2. Identification of the drivers controlling the chlorophyll-a concentrations at both the surface and the Subsurface Chlorophyll Maximum (SCM), including riverine nutrient inputs, the intrusion of nutritious water from the Arabian Sea, coastal upwelling, and positive wind stress curl-induced uplift of the thermocline.

<table>
<tr><td></td><td>World Ocean Atlas, and ERA-Interim.
3. The concentration and depth of the subsurface chlorophyll-a maximum (SCM) were analyzed, and the depth of the 26 °C isotherm was used as a proxy of the depth of the SCM.
4. The drivers controlling the chlorophyll-a concentrations at both the surface and the SCM were identified, including riverine nutrient inputs, the intrusion of nutritious water from the Arabian Sea, coastal upwelling, and positive wind stress curl-induced uplift of the thermocline.
5. The study also identified five potential zones within the Bay of Bengal with high chlorophyll-a concentrations and their drivers.</td><td></td><td></td><td>3. Identification of five potential zones within the Bay of Bengal with high chlorophyll-a concentrations and their drivers, which can help identify the rich marine ecosystems in the region.
4. The depth of the 26 °C isotherm was identified as a proxy for the depth of the SCM, which can help future studies in the region.
5. The study can also help policymakers in the region make informed decisions regarding marine ecosystem conservation and management.</td></tr>
<tr><td>Measurement report: Regional characteristics of seasonal and long-term variations in greenhouse gases at Nainital, India and Comilla, Bangladesh</td><td>1. Weekly air sampling at Nainital (NTL) in northern India and Comilla (CLA) in Bangladesh from 2006 and 2012, respectively.
2. Analysis of air samples for dry-air gas mole fractions of CO_2, CH_4, CO, H_2, N_2O, and SF_6 and carbon and oxygen isotopic ratios of CO_2 ($\delta 13C\text{-}CO_2$ and $\delta 18O\text{-}CO_2$).
3. Discussion of regional characteristics of these components over the Indo-Gangetic Plain compared to data from other Indian sites and Mauna Loa, Hawaii (MLO), which is representative of marine background air.</td><td>Geographical Scope: Northern India and Bangladesh (Indo-Gangetic Plain)

Benefitting Countries: India and Bangladesh</td><td>National Budget</td><td>1. The study provides information on the seasonal and long-term variations in greenhouse gases (GHGs) over the Indo-Gangetic Plain, an important agricultural region in India and Bangladesh.
2. The results show that agricultural activities, such as crop cultivation and the use of nitrogen fertilizer and biomass burning, contribute to the GHG concentrations in the atmosphere.
3. The study also reveals the influence of local emission and air mass transport on GHG concentrations.
4. The variability of the CO_2 growth rate at NTL is different from the variability in the CO_2 growth rate at MLO, which is more closely linked to the El Niño–Southern</td></tr>
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				Oscillation (ENSO).
				5. The growth rates of the CH_4 and SF_6 mole fractions at NTL show an anticorrelation with those at MLO, indicating the influence of southerly air masses on these mole fractions.
				6. The results of the study can be used for policy-relevant research on GHG emissions and their impact on the environment and climate change.
Occurrence, spatial distribution and ecological risk assessment of trace elements in surface sediments of rivers and coastal areas of the East Coast of Bangladesh, North-East Bay of Bengal	1. **Analysis of potentially toxic element contamination in surface sediments of several rivers and coastal areas in the East Coast of Bangladesh.** 2. **Assessment of ecological risks using pollution load index (PLI), geoaccumulation index (I_{geo}), and potential ecological risk (PER) indices.** 3. **Comparison of trace metal concentrations with neighboring countries.** 4. **Recommendation for a systematic approach for collecting pollutant data and using isotopes to trace anthropogenic sources of contamination.**	**Geographical scope: Regional (East Coast of Bangladesh, North-East Bay of Bengal).** **Benefitting countries: Bangladesh.**	**National Science and Technology Fellowship**	1. **Sediments in the analyzed rivers and coastal areas of the East Coast of Bangladesh were found to be contaminated with potentially toxic elements.** 2. **The contaminated sediments were shown to have negative effects on aquatic environments based on PLI, I_{geo}, and PER indices.** 3. **The Karnaphuli river was found to be the most contaminated, while St Martin's Island was the least contaminated.** 4. **Cd and Pb concentrations were found to be higher in the East Coast of Bangladesh compared to estuarine and coastal waters of neighboring countries.** 5. **The lack of water quality guidelines in Bangladesh for coastal, estuarine, and marine waters was identified as a factor contributing to the dumping of untreated wastewater.** 6. **The study recommends immediate measures to address ecological risks and a systematic approach for collecting pollutant data and using isotopes to trace anthropogenic sources of contamination.**
Trace Metals in water, sediment and fishes of the Ganges-Brahmaputra-Meghna Delta,	1. **Systematic review of heavy metal pollution in water, sediments, and fish in different rivers of the**	**Geographical Scope: Regional (Ganges-Brahmaputra-Meghna Delta, Bangladesh)**	**National Budget**	1. **The study found that most of the heavy metals' mean concentration in water, sediments, and fish exceeded the**

Bangladesh: A Review	Ganges-Brahmaputra-Meghna (GBM) Delta, Bangladesh 2. Evaluation of 12 heavy metals (Cr, Cd, Hg, As, Zn, Cu, Fe, Co, Pb, Ni, Mn, and Ba) 3. Analysis of heavy metal concentration levels in different rivers of the GBM Delta 4. Identification of potential sources of heavy metal contamination in the GBM Delta 5. Assessment of heavy metal contamination risk to ecosystem and public health 6. Recommendation of effective waste management strategies to control heavy metals pollution in different rivers of the GBM Delta in future	Benefitting countries: Bangladesh		maximum permissible limits (MPLs) in several rivers of the GBM Delta due to the discharge of untreated industrial effluents, municipal sewage, domestic wastes, and agricultural runoffs. 2. The level of heavy metal contamination in water and sediments of the upper Ganges was below the MPLs due to higher water flow in the river. 3. The concentration of heavy metals in sediments and fish were reported much higher than waters, indicating accumulation in the fishes' tissues and sediment deposition. 4. The study concludes that a few rivers of the GBM Delta are highly contaminated by heavy metals, posing potential risks to the ecosystem and public health. 5. The study recommends effective waste management strategies to control heavy metals pollution in different rivers of the GBM Delta in the future.
A Case Study on Metal Contamination in Water and Sediment Near a Coal Thermal Power Plant on the Eastern Coast of Bangladesh.	1. The paper presents a case study of metal contamination in water and sediment near a coal thermal power plant on the eastern coast of Bangladesh. 2. The study examines the concentrations of various metals, including chromium, nickel, and lead, in water and sediment samples collected from different locations around the power plant. 3. The authors investigate the sources and pathways of metal contamination and assess the potential ecological and human health risks associated with	Geographical scope: Eastern Coast of Bangladesh near a coal thermal power plant. Benefitting countries/regions: Bangladesh and the Eastern Coast region near a coal thermal power plant.	National Science and Technology Fellowship	1. The paper shows that metal concentrations in water and sediment samples near the power plant were higher than background levels and exceeded regulatory limits in some cases. 2. The study identifies the coal thermal power plant as a major source of metal contamination in the area, and suggests that other anthropogenic activities may also contribute to the problem. 3. The authors highlight the potential ecological and human health risks associated with exposure to contaminated water and sediment, and call for further research and monitoring to better understand the extent and impacts of metal

	exposure to contaminated water and sediment.			4. The findings of the study could have important implications for environmental management and policy in Bangladesh, as well as for understanding the impacts of industrial activities on the environment and human health in the region. contamination in the region.
Distribution of Biochemical Oceanography in the Bay of Bengal: A Review	1. Conducting a review of previous papers to identify and analyze the biological and chemical parameters in the Bay of Bengal 2. Collecting and analyzing data on major and trace elements, nutrients, primary productivity, and chlorophyll concentration in the sediments and surface waters of the Bay of Bengal 3. Identifying unique characteristics and differences between the Bay of Bengal and the Arabian Sea	**Geographical Scope:** Regional (Bay of Bengal) **Benefitting Countries:** Bangladesh, India, Myanmar, Sri Lanka, Thailand, Indonesia, Malaysia	**National Budget**	1. Revealed unique characteristics and differences between the Bay of Bengal and the Arabian Sea 2. Identified high concentrations of Ca and low concentrations of Ti in the sediments of the Bay of Bengal 3. Found considerable variations in primary productivity and chlorophyll concentration in the surface layer of water, while these were constant in greater depths 4. Showed a correlation between vertical line of chlorophyll and productivity change 5. Highlighted the need for further investigations and in-situ bio-chemical data collection in the Bay of Bengal region
Spatiotemporal variation and mechanisms of temperature inversion in the Bay of Bengal and the eastern equatorial Indian Ocean.	1. Examination of spatiotemporal variation of temperature inversion and its mechanisms in the Bay of Bengal and eastern equatorial Indian Ocean. 2. Analysis of long-term Argo (2004 to 2020) and RAMA (2007 to 2020) profiles data to determine the occurrence and distribution of temperature inversion. 3. Conducting mixed layer heat and salt budget analysis to understand the driving processes of temperature inversion in different subregions.	**Geographical Scope:** Regional (Bay of Bengal and eastern equatorial Indian Ocean) **Benefitting Countries:** Bangladesh, India, Myanmar, Indonesia, Sri Lanka	**National Budget**	1. The study provides a higher resolution spatiotemporal variation of temperature inversion and its mechanisms in the Bay of Bengal and eastern equatorial Indian Ocean. 2. Temperature inversion occurs throughout the year in the study area, with the highest occurrences in winter and the lowest in spring. 3. Two regions with frequent temperature inversion, the northeastern part of the Bay of Bengal and the eastern part of the EEIO, are identified for the first time. 4. The driving processes of temperature inversion for different subregions are

				revealed, including the penetration of heat, net surface heat loss, mixed layer salinity, subduction of warm-salty Arabian Sea water, and downwelling of thermocline. 5. The study emphasizes the importance of deeper isothermal layer depth and thicker barrier layer thickness in intensifying temperature inversion in both the Bay of Bengal and EEIO.
Horizontal and Vertical Distribution and Abundance of Zooplankton around the Swatch-of-No-Ground of Northern Bay of Bengal	1. Collection of water samples from 26 stations at depths ranging from 0 to 250 m of the northern Bay of Bengal 2. Identification of zooplankton species present in the water samples 3. Assessment of the horizontal and vertical distribution and abundance of zooplankton community 4. Correlation analysis of zooplankton abundance with water depth 5. Documentation of the findings for future research and use as a baseline study	**Geographic Scope: Regional (Northern Bay of Bengal)** **Benefitting Countries: Bangladesh, India**	**National Science and Technology Fellowship**	1. Identification of 55 zooplankton species, with Copepod being the dominant species 2. Spatial distribution of zooplankton species varied from station to station and cruise to cruise 3. Maximum zooplankton abundance was found in cruise 2, and the lowest in cruise 4 4. Zooplankton abundance ranged between 18 to 22,500 cells/L in all cruises 5. Negative correlation was found between zooplankton abundance and water depth 6. The study provides important information on the distribution and abundance of zooplankton in the northern Bay of Bengal, which can be used as a baseline study for future research.
Abundance, Diversity and Distribution of Phytoplankton in Coastal Water Adjacent to St. Martin's Island, Bangladesh	1. Collection of water samples from 14 stations in the coastal waters adjacent to St. Martin's Island during low tide in March 2020 2. Identification and enumeration of phytoplankton species present in the samples 3. Analysis of physicochemical factors such as water temperature, salinity, pH and dissolved oxygen 4. Calculation of species richness factor and diversity index factor	**Geographical Scope: Regional: Coastal waters adjacent to St. Martin's Island in the Bay of Bengal, Bangladesh** **Benefitting countries: Bangladesh**	**National Science and Technology Fellowship**	1. Identified a total of 62 diatoms and 6 dinoflagellates, with Coscinodiscus being the most dominant genus of centric diatoms. 2. Recorded a cell count of total phytoplankton ranging from 87,500-437,500 in d/m3 of sea water with the highest phytoplankton found at station 4. 3. Found that phytoplankton composition and abundance varied from one station to another, but not much difference was observed among the ranges of

				physicochemical factors.
				4. Recorded water temperature, salinity, pH and dissolved oxygen ranging from 26.5-27.17°C, 32.09-33.76 ppt, 8.16-8.20, and 5.85-6.12 mg/l, respectively, which were consistent with the optimum ranges reported for marine habitats.
				5. Calculated the species richness factor and diversity index factor, which revealed ranges of 1.51 -4.93 and 1.52-2.22, respectively.
				6. Noted that variability in population density of phytoplankton in different studied stations may not be responsible for different water quality parameters rather than oceanic currents and tides.
Spatial Distribution and Diversity of Marine Zooplankton Adjacent to the St. Martin's Island	1. Collection of plankton samples from 14 sampling stations adjacent to Saint Martin's Island in the Bay of Bengal 2. Preservation of zooplankton and phytoplankton samples 3. Analysis of physical parameters such as temperature, pH, salinity, and DO 4. Analysis of biological parameters by identifying and counting zooplankton using a microscope 5. Tabulation and examination of collected data using Microsoft Excel	Geographical scope: The research was conducted on Saint Martin's Island in the Bay of Bengal, which is located in Bangladesh.	National Science and Technology Fellowship	1. A total of 106 species of plankton were recorded from the selected stations, with 68 species being phytoplankton and 38 species being zooplankton. 2. Phytoplankton was mainly dominated by diatoms followed by dinoflagellates. 3. Among diatoms, the most important species were *Consinodiscus* sp., *Chaetoceros* sp., *Thalassiosira* sp., and *Thalassionema* sp. Among dinoflagellates, 4 *Ceratium* sp., 1 *Dinophysis* sp., and 1 *Gonyaulax* sp. were found. 4. Zooplankton was mostly composed of copepods, with *polychaetes* and rotifers also present. 5. *Oithona*sp. and *Microstella* sp. were the most dominant zooplankton species in all stations. 6. The highest phytoplankton and zooplankton were found at stations 4 and 7, respectively. 7. The study provides valuable information on

		Coastal areas of Sundarban Mangrove Forest	Centennial Research Grant (CRG), University of Dhaka	the composition, abundance, and distribution of plankton in some parts of the Bay of Bengal adjacent to Saint Martin's Island, which can aid in understanding the marine ecosystem and informing future conservation efforts.
Sentinel-2 Derived Estimation and Spatio-temporal Distribution of Chl-a, Total Suspended Matter (TSM) and Colored Dissolved Organic Matter(CDOM) in the coastal areas of Sundarban Mangrove Forest	1. **Evaluation of the effectiveness of Sentinel-2 MSI and Landsat-8 OLI multispectral remote sensors for determining the spatial distribution and seasonal fluctuation of Chlorophyll-a (Chl-a), Total Suspended Matter (TSM), and Colored Dissolved Organic Matter (CDOM) in the complex tidal river systems of the Sundarban mangroves.** 2. **Application of several algorithms and processors to retrieve these water quality parameters.** 3. **Collection of in-situ samples for validation of remote sensing data.** 4. **Measurement of Chl-a, TSM, and CDOM in a lab using a standard protocol in order to validate remote sensing data.** 5. **Comparison of the performance of different bio-optical algorithms for Chl-a and TSM concentration estimations.** 6. **Use of the Case 2 Regional Coast Colour (C2RCC) processor in-built into the SNAP software to retrieve Chl-a, TSM, and CDOM for OLI seasons.** 7. **Determination of the biological status of the coastal water using**	Coastal areas of Sundarban Mangrove Forest	Centennial Research Grant (CRG), University of Dhaka	1. **The study showed that Sentinel-2 MSI and Landsat-8 OLI multispectral remote sensors can effectively determine the spatial distribution and seasonal fluctuation of Chl-a, TSM, and CDOM in the complex tidal river systems of the Sundarban mangroves.** 2. **The performance of different bio-optical algorithms for Chl-a and TSM concentration estimations was compared, and it was found that Ocean Color 2 (OC-2) gave better estimates for this region than Ocean Color 3 (OC-3).** 3. **The study also revealed that Chl-a concentrations are higher in winter than in pre-monsoon, especially in onshore areas compared to offshore areas.** 4. **The Green/NIR and Red/NIR band ratio algorithms were used for TSM concentration estimations, and the Green/NIR algorithm showed the best performance.** 5. **The highest concentration of TSM was located in nearshore and narrow waterway regions, and a low concentration was located offshore.** 6. **The study showed that TSM concentration was higher during the pre-monsoon season, when secchi disk transparency was found to be lower.** 7. **Average monthly wind speeds were higher during pre-monsoon in this study area, which accelerated pre-monsoon higher TSM concentrations due to resuspension of sediments regulated by the wind speed.** 8. **The Case 2 Regional Coast Colour (C2RCC)**

	remote sensing by estimating the water quality parameters.			processor was found to be very well suited in the complex river systems of the Sundarban mangroves for the estimation of aCDOM (m −1), while it is not well suited for Chl-a and TSM.
Spatiotemporal variability and vertical structure of mesoscale eddies in the Bay of Bengal	1. Utilizing satellite altimeter data to investigate the spatiotemporal variability of mesoscale eddies in the Bay of Bengal (BoB) over a 29-year period. 2. Identifying mesoscale eddies using a high-resolution daily sea level anomaly (SLA) data and an automated detection algorithm. 3. Analyzing the frequency, amplitude, propagation velocities, and eddy kinetic energy (EKE) of cyclonic and anticyclonic eddies (CEs and ACs). 4. Examining the seasonal cycle of mesoscale eddies and the factors that influence their formation and intensification. 5. Assessing the impact of El Nino Southern Oscillation (ENSO) and Indian Ocean Dipole (IOD) events on the mesoscale eddy field in the BoB. 6. Conducting a wavelet analysis to investigate the relationship between mesoscale eddies and climate indices.	Geographical Scope: The study focuses on the Bay of Bengal. Benefitting Countries: The results of this study could benefit countries that have coastlines on the Bay of Bengal, such as India, Bangladesh, Myanmar, and Sri Lanka.	National Science and Technology Fellowship	1. The study found that cyclonic eddies were more frequent than anticyclonic eddies in the Bay of Bengal due to the negative sea level anomaly and positive wind stress curl favoring their formation. 2. The seasonal cycle of mesoscale eddies in the BoB suggests that the eddy activities were enhanced during March and reached their peak during June and July due to the intensification of zonal wind stress and the robust flow of semi-reversing east India coastal current (EICC). 3. The study identified the factors that influence the formation and intensification of mesoscale eddies in the BoB, such as coastal Kelvin waves, radiated Rossby waves, and baroclinic instability of the EICC. 4. The study also found that ENSO and IOD events significantly impact the mesoscale eddy field in the BoB, with the strongest impact observed during the 1994 and 2019 summer monsoons. 5. The wavelet analysis revealed that the properties of anticyclonic eddies were strongly influenced by both ENSO and IOD events compared to the properties of cyclonic eddies. 6. The findings of this study have implications for validating ocean-climate interactions and can be incorporated into forecasting models for the ocean and atmosphere.
Groundwater Contamination and	1. Collection of groundwater samples	Geographical scope:	National Science	1. The concentrations of potential risky

Health Risk Evaluation of Naturally Occurring Potential Toxic Metals of Hatiya Island	from the Hatiya Island 2. **Analysis of 5 potential toxic metals (Zn, Fe, Mg, Mn, Cu) using an Atomic Absorption Spectrophotometer (AAS)** 3. **Evaluation of naturally occurring level of metal contamination and human health risk associated with deep groundwater in the Hatiya Island** 4. **Calculation of metal evaluation index (MEI), degree of contamination (Cd), metal pollution index (MPI), nemerow pollution index (NI), hazard quotient (HQ), and hazard index (HI) to assess the level of contamination and health risks**	Hatiya Island, Bangladesh Benefitting countries: Bangladesh	and Technology Fellowship	metals (Zn, Fe, Mg, Mn, Cu) in deep groundwater of Hatiya Island were evaluated and ranked in decreasing order: Mg > Zn > Fe >Mn> Cu. 2. All metal concentrations except Fe were within the drinking water limits of WHO (2017), BIS (2012), and BDWS (1997). 3. The groundwater of the study area is free from contamination based on the metal evaluation index (MEI) and degree of contamination (Cd), but exhibited little pollution in the mid-western part based on the metal pollution index (MPI) and nemerow pollution index (NI). 4. The hazard quotient (HQ) values revealed no oral and dermal health risk for individual metals (Cu, Zn, Fe, Mn). 5. The hazard index (HI) values showed no risk for combined metals, as none of the values exceeded the safety limit value of 1. 6. The deep groundwater on Hatiya Island was found to be non-carcinogenic and risk-free for children and adults, but children were more susceptible to oral health risks, while adults were more vulnerable to dermal health risks. 7. The study highlights the importance of using deep groundwater on Hatiya Island due to the arsenic, iron, and salinity problem in shallow groundwater.
In-situ datasets of important physical and bio-chemical parameters in the continental shelf of the northern Bay of Bengal.	1. **Collection of in-situ data for physical parameters, heavy metals, elements, Total Organic Carbon (TOC), nutrients, chlorophyll-a and phaeopigment in the Northern Bay of Bengal.** 2. **Conducting surveys with a fishing vessel to collect data from both**	**Geographical Scope:** The study was conducted in the Northern Bay of Bengal, encompassing both the eastern and western coasts of the continental shelf adjacent to Bangladesh.	**National Budget**	1. The data collected in this study provides important baseline information for the Northern Bay of Bengal in terms of ocean biogeochemistry. 2. The data can be utilized for future studies to investigate the influence of physico-chemical properties on biological resources in the coastal ecosystem.

		Benefitting Countries: Bangladesh		3. The data can also be used for validating other remotely-sensed physico-chemical parameters in the region. 4. The study can contribute to the management and conservation of marine resources in the Northern Bay of Bengal.
	eastern and western coasts of the Northern Bay of Bengal. 3. Deployment of SBE 19 plus V2 CTD machine, Niskin sampler of HYDRO-BIOS and Van Veen Grab sampler to collect samples for physical features, water and sediment samples respectively. 4. Analysis of water samples in the laboratory using standard procedures to access in-situ data.			
Species composition, abundance and diversity of phytoplankton inhabiting around the swatch-of-no-ground, a sub-marine canyon of Northern Bay of Bengal.	1. Collection of phytoplankton samples from 24 stations in Northern Bay of Bengal using Niskin water sampler 2. Preservation of samples using Lugol's solution before identification 3. Identification of phytoplankton species and estimation of their abundance and distribution at different depths of water columns 4. Calculation of species richness and Shannon-Wiener index to assess diversity of phytoplankton community 5. Analysis of correlations between phytoplankton abundance and depth, and between abundance and station location	Geographical Scope: Regional (Northern Bay of Bengal, Bangladesh) Benefitting Countries: Bangladesh	National Science and Technology Fellowship	1. Identification of 70 phytoplankton species in Northern Bay of Bengal 2. Bacillariophyceae, Dinophyceae and Chlorophyceae were the most abundant phytoplankton groups 3. Phytoplankton density was highest at surface water and decreased with increasing water depth 4. Weak negative correlation between phytoplankton abundance and depth was observed 5. Surface water had the highest species richness and moderate distribution of phytoplankton 6. The study provides a baseline understanding of the phytoplankton community in the Northern Bay of Bengal, which can be used to manage the ecosystem and sustainable fisheries in the region.
Macrobenthic faunal abundance, distribution and diversity in the Bakkhali River, East Coast of Bangladesh	1. Collection of macrobenthic and water samples from the Bakkhali River at three different stations 2. Identification and quantification of macrobenthos species 3. Assessment of macrobenthos abundance, distribution, and	Geographical Scope: Regional: Bakkhali River, East Coast of Bangladesh Benefitting Countries: Bangladesh	National Science and Technology Fellowship	1. Identification of 628 macrobenthic individuals representing 10 major taxa at three different stations 2. Higher abundance of macrobenthos at the lower stream compared to the upper and middle parts 3. Oligochaetes were the most abundant taxa,

	diversity 4. Analysis of correlation between macrobenthos and water parameters 5. Interpretation of study findings and recommendation for management strategies			followed by Nemertinas and Polychaetes 4. Correlation analysis revealed that macrobenthos abundance was increased with increasing salinity and pH, but decreased with increasing temperature 5. Higher diversity of macrobenthos at the upper part of the river 6. Moderately polluted condition of the Bakkhali River based on Shannon-wiener index 7. Study suggests proper management strategies to control aquatic pollution and conserve aquatic biodiversity.
Distribution and driving mechanisms of temperature inversion in the Bay of Bengal: modeling approach	1. Conducted a modeling study to investigate the mechanism of formation and intensification of temperature inversion in the Bay of Bengal 2. Derived monthly and daily distribution of temperature inversion from the model and compared with observational data 3. Conducted mixed layer heat- and salt-budget analyses to quantify the controlling factors of mixed layer temperature and salinity 4. Identified the dominant drivers of temperature inversion in the northern and southern Bay of Bengal	**Geographical Scope:Regional (Bay of Bengal and adjacent Andaman Sea)** **Benefitting Countries:Bangladesh, India, Myanmar, Thailand, Indonesia, Sri Lanka, and other countries in the region with a stake in the Bay of Bengal and Andaman Sea**	**National Budget**	1. Revealed the distribution and mechanism of temperature inversion in the Bay of Bengal, which is valuable for understanding the ocean ecosystem and the influence of climate change 2. Provided insights into the controlling factors of mixed layer temperature and salinity in the Bay of Bengal, which could aid in predicting changes in the marine environment 3. Increased understanding of the Bay of Bengal and Andaman Sea could potentially benefit fisheries, shipping, and other marine activities in the region.
Bangladesh Navy Annual Survey 2021-2022	**Collection of Periodical Oceanographic and Meteorological data in EEZ of Bangladesh.**	**Bangladesh**	**Bangladesh Navy**	**Assessment of Oceanographic and Meteorological data like: Seasonal change in Sea Surface Temperatural, Temporal and Spatial variation of CTD (Conductivity, Temperature and Density), Humidity, Windspeed and Direction etc. which are being used by BN and other maritime organization including universities for their plan and research work.**

Biogeochemical process of Cox's Bazar's different estuaries: Assessing its feasibility for Aquaculture	**Physicochemical parameters and its processes in the estuaries.**	**Cox's Bazar coastal area of Bangladesh. National and regional knowledge for aquaculture.**	**BORI R&D budget/Ministry of Science and Technology**	**Based on physicochemical study, these estuary waters are suitable to moderately suitable for aquaculture during winter.**
Monitoring of ecohydrological variables in the Meghna River estuary	**Monthly monitoring of essential Oceanographic variables in the Meghna River Estuary**	**Bangladesh**	**Funded by NF-POGO Alumni Network for the Ocean**	**Monitoring of data since December 2018**
Citizen based coastal ecosystem monitoring system initiative	**Citizen based data gathering (resources and plastics) from the coastal area of Bangladesh**	**Bangladesh**	**Funded by SUST research Centre**	**Resource data from the coastal area of Bangladesh**
Ocean literacy for young minds	**Literacy campaign with the high school students about ocean biodiversity**	**Bangladesh**	**Funded by NF-POGO Alumni Network for the Ocean**	**Literacy campaign in the Saint Martin's Islalnd**
Developing a data driven novel approach for coastal food web dynamics modelling through physical-biological coupling	**Data collection and model development**	**Bangladesh**	**Funded by SUST research Centre**	**Coupled model of food web dynamics**
Trophic transfer of microplastic in the aquatic food web of Sundarbans mangrove ecosystem, Bangladesh	**Microplastic identification in different marine organisms**	**Bangladesh**	**Funded by BANBEIS**	**Pathway identification of Microplastic transfer in the marine organisms**
Zoning of MPA for Saint Martin – Teknaf Peninsula through an inclusive and data driven approach	**Area delineation for MPA declaration**	**Bangladesh**	**Funded by WorldFish and USAID**	**Area delineation for MPA declaration**
Global-NANO-DOAP (A global study of coastal Deoxygenation, Ocean Acidification and Productivity at selected sites)	**Monitoring of essential oceanographic variables, developing data standardization methods, capacity development activities, Outreach activities**	**37 sampling sites from 18 countries of Asia, Africa and Latin America**	**Funded by NF-POGO Alumni Network for the Ocean**	**Monitoring of data since December 2017**

IOC Function C: Ocean Hazards				
IOCINDIO Programmes - Coastal vulnerability assessment for sea level rise and storm surges. - Monitoring with Responsible Response of Oil Spill in inner ROPME Sea.				
Projects Titles	**Activities**	**Geographical scope Regional/ National benefitting countries**	**Budget /funding sources National/ Regional/ international**	**Results/impacts**
Occurrence, Spatial distribution and ecological Riskassessment of Total Petroleum Hydrocarbon and Heavy Metalconcentrations in the surface water of Naf river.	1. Evaluation of the surface water of Naf river for Oil & Grease (OG) concentration and ten toxic Heavy metals. 2. Collection of water samples from six sampling stations. 3. Analysis of the collected water samples for the presence of heavy metals and OG using standard laboratory procedures. 4. Comparison of the results with the standard limit of World Health Organization (WHO). 5. Identification of the sources of pollutants and anthropogenic activities that lead to the increase in heavy metal concentration in the river.	**Geographical Scope: Regional, Bangladesh-Myanmar border area** **Benefitting Countries: Bangladesh and Myanmar**	**National Science and Technology Fellowship**	1. The study found that all sampling stations were safe from Oil and Grease pollution except for station 6 where the OG level was >23.6 mg/L. 2. The concentration of heavy metals, specifically Pb, Cd, Zn, Ni and Se, exceeded the maximum limit for safety according to WHO standards. 3. The heavy metal concentrations in the Naf river were substantially higher than in earlier research, indicating that the river is under threatening conditions for both human health and the environment. 4. The study highlights the need for further research and temporal monitoring of the Naf river to assess the extent of heavy metal pollution and its impacts. 5. The findings of the study can inform policy and decision-making related to industrial and garbage management in the region, with the aim of mitigating the impacts of heavy metal pollution on human health and the environment.
Seasonal and long-term sea-level variations and their forcing factors in the northern Bay of Bengal: A statistical analysis of temperature, salinity, wind	1. Analysis of tide gauge and satellite altimetry data to investigate seasonal and long-term sea-level variations in the northern Bay of Bengal 2. Quantification of the contribution	**Geographical Scope: Regional, focusing on the northern Bay of Bengal** **Benefitting Countries:**	**National Budget**	1. The rate of sea-level rise in the northern Bay of Bengal (4 ± 1.33 mm/year) is higher than the global average (3.32 ± 0.46 mm/year) for the studied period of 1993 to 2018.

stress curl, and regional climate index data	of steric sea level to sea-level variations 3. Statistical analysis to determine correlations between sea level and various atmospheric and oceanic factors	Bangladesh India Myanmar		2. Sea level shows a strong seasonal variation, with the lowest levels in winter and the highest in autumn. 3. Contributions from thermosteric sea level are higher in winter to early summer, while contributions from halosteric sea level and wind stress curl are higher during autumn. 4. Long-term sea level variations show strong positive correlations with thermosteric sea level, indicating that temperature is a major local controlling factor for sea-level change. 5. Remote forcing (equatorial zonal wind stress) explains approximately 36% of the sea-level variation in the northern Bay of Bengal. 6. Sea level is low during positive Indian Ocean Dipole (IOD) and El Niño events, while it is high during negative IOD and La Niña events. 7. This study provides important groundwork for further model studies to quantify all components of the sea-level budget in the northern Bay of Bengal.
Spatiotemporal Distribution of Microplastic Debris in the SurfaceBeach Sediment of the Southeastern Coast of Bangladesh	1. Collection of beach sediment samples from 7 coastal beaches in Bangladesh 2. Characterization of microplastic debris based on abundance, polymer type, shape, size, and color 3. Analysis of spatiotemporal distribution of microplastic pollution in the study area 4. Identification of sources and trends of microplastic accumulation 5. Provision of critical information to aid coastal zone management	Regional (Southeastern coast of Bangladesh) Bangladesh.	National Science and Technology Fellowship	1. Significant seasonal and spatial differences in microplastic pollution were observed 2. Higher microplastic abundance, weight, and polymer diversity were found during winter season 3. Touristic and commercial beaches showed higher levels of microplastic pollution compared to non-touristic beaches 4. Polyethylene (PP) and Polypropylene (PE) were the most abundant polymer types 5. White particles were the most dominant coloration type of microplastics 6. Fibers were the most common type of microplastics identified

				7. The study provides critical baseline data for coastal zone management of the southeastern coast of Bangladesh.
Distribution and source apportionment of toxic and trace elements in some benthic and pelagic coastal fish species in Karnaphuli River Estuary, Bangladesh: Risk to human health	1. Quantifying trace metal concentration in edible parts of commercially important benthic and pelagic coastal fish species in Karnaphuli River estuary using Energy dispersive X-ray fluorescence (ED-XRF) 2. Assessing health taxation of the fish species due to the concentration of toxic and trace elements 3. Estimating daily intake, target hazard quotient, and cancer-causing risk for human health risk assessment	Geographical Scope: Regional: Karnaphuli River estuary, southeastern part of Bangladesh Benefitting Countries: Bangladesh	National Budget	1. Zn, Mn, V, Cu, Rb, Pb, Cr, and Co were detected in the examined fish species, with Zn having the highest concentration. 2. Benthic fish species had higher Metal Pollution Index (MPI) values compared to pelagic fishes. 3. Anthropogenic activities were identified as the sources of trace metals in the examined fish species. 4. Estimated daily intake, target hazard quotient, and cancer-causing risk data showed no significant non-carcinogenic and cancer-causing health risk for humans due to the consumption of the studied fish species.
Minerals and heavy metal composition in seaweeds of the eastern coast, Northern Bay of Bengal, Bangladesh	1. Collection of seaweed samples from the coastal waters of Bangladesh 2. Analysis of mineral and heavy metal content in the collected seaweed samples using Atomic Absorption Spectrophotometer (AAS) 3. Comparison of mineral and heavy metal concentrations in different species of seaweed from different phyla 4. Identification of factors affecting the affinity of different groups of seaweeds to absorb minerals	Geographical scope: Regional (Eastern Coast, Northern Bay of Bengal, Bangladesh) Benefitting countries: Bangladesh	National Science and Technology Fellowship	1. The mineral and heavy metal concentrations in seaweeds were found to vary from species to species 2. The concentration of calcium was highest in Phaeophyta while the concentration of iron, zinc, and manganese were highest in Rhodophyta 3. Mineral contents were higher in wild seaweed species compared to cultured ones 4. Heavy metal contamination in seaweeds, particularly in wild Hypnea sp. raised concerns about potential health risks for consumers 5. The study could help policy makers to establish health safety guidelines for safe consumption of seaweeds.
Heavy metal pollution and ecological risk assessment in	1. Measurement of heavy metal concentrations in surface water of	Geographical Scope: Regional (Swatch of No	National Science and Technology	1. Six heavy metals were found in the surface water, with concentrations in the order of

the surface water from a marine protected area, Swatch of No Ground, north-western part of the Bay of Bengal	Swatch of No Ground 2. Calculation of various indices such as Heavy metal pollution index (HPI), Heavy metal evaluation index (HEI), and Potential ecological risk index (PER) to assess the degree of pollution and ecological risk 3. Conducting principal component analysis, hierarchical cluster analysis, and correlation analysis to identify sources of heavy metal pollution	Ground, north-western part of the Bay of Bengal) **Benefitting Countries: Bangladesh, and potentially neighboring countries in the Bay of Bengal region**	Fellowship	Fe >Pb> Cu > Zn > Ni > Cd 2. Heavy metal pollution was found to be moderate to high according to various indices such as HPI, HEI, and NPI 3. Anthropogenic activities were identified as the primary source of heavy metal accumulation 4. Human health hazards were found to be comparatively low according to Hazard quotient (HQ) and Hazard index (HI) 5. Proper treatment of domestic and industrial waste management policies are needed to conserve the balance of marine ecology and reduce excessive risk.
Microplastic contamination in the sediments of the Saint Martin's Island, Bangladesh.	1. Collection of 12 surficial sediment samples along the coastline of St. Martin's Island 2. Extraction of MPs using sieving and density separation method 3. Visual identification of MPs using a stereomicroscope 4. Detection of associated polymers using ATR-FTIR spectroscopy 5. Analysis of MP concentration, abundance, and types 6. Identification of potential sources of MP pollution on the island	**Geographical scope: Regional (Southeastern coastal region of Bangladesh)** **Benefitting countries: Bangladesh**	National Science and Technology Fellowship	1. Microplastics were identified in all 12 sediment samples collected from St. Martin's Island. 2. Mean concentrations of microplastics were 20.8 items per 100 g of sediment. 3. Fibrous microplastics were the most prevalent type detected, followed by films, fragments, and foam. 4. Rayon, nylon, and polyethylene were the most commonly detected polymers associated with the microplastics. 5. MP concentration was higher in the Uttar Para areas compared to the Dakhin Para, potentially linked to unplanned industrialization, emerging tourism, and urbanization. 6. The study provides valuable information on the microplastic contamination status of the southeastern coastal region of Bangladesh. 7. The findings highlight the potential threat of microplastic pollution to marine and coastal environments.
Occurrence and Spatial	1. Collection of water and sediment	**Geographical Scope:**	**National Science**	1. Alarming results of microplastics

Distribution of Microplastics in the Coastal Water and Sediments from Sundarbans Mangrove Forest, Bangladesh	samples from 14 locations in Sundarbans Mangrove Forest, Bangladesh 2. Isolation and identification of microplastic particles using density separation approach, ATR-FTIR spectrophotometer, stereomicroscope, and SEM 3. Classification of microplastics based on polymer type, shape, size, and coloration 4. Statistical analysis to determine significant differences among sampling sites	**Regional (Sundarbans Mangrove Forest, Bangladesh)** **Benefitting Countries: Bangladesh**	**and Technology Fellowship**	abundance in sediments and waters of Sundarbans Mangrove Forest due to anthropogenic activities 2. **Significant differences observed among sediment and water sampling sites** 3. **Most abundant polymer types identified as Polyethylene (PP) and Polyethylene (PE)** 4. **Majority of identified microplastics in sediments were fibers, followed by fragments, film, foam, and pellets** 5. **Majority of identified microplastics in water were fibers, followed by fragments, film, and foam** 6. **Smallest particles (<1mm) constituted more than half of the total sediment microplastics load** 7. **Implications for trophic levels and biodiversity in the region** 8. **Call for policy interventions and pollution risk assessments to address emerging contaminants like microplastics in the Sundarbans Mangrove Forest**
Pervasiveness of Microplastic Contamination in the Gastrointestinal Tract of Fishes from the Western Coast of Bangladesh	1. **Investigating the prevalence of microplastics in the gastrointestinal tract of fishes from the western coast of Bangladesh** 2. **Using Fourier Transform Infrared Spectroscopy (FTIR) and Scanning Electron Microscopy (SEM) for polymer analysis and surface morphology detection of the particles** 3. **Analyzing the abundance, size, shape, and polymer types of the extracted microplastics** 4. **Correlating the microplastic abundance with the total body weight of the fish species**	**Geographical scope: Regional (Western coast of Bangladesh)** **Benefitting countries: Bangladesh**	**National Science and Technology Fellowship**	1. **Microplastics were detected in all 64 individual fish, with an average abundance of 7.1 ± 3.14 particles per specimen** 2. **LatesCalcarifer consumed the highest amount of microplastic, while Polynemusparadiseus consumed the lowest** 3. **Demersal species ingested more microplastics than pelagic species** 4. **A moderate positive correlation was observed between microplastic abundance and total body weight of the fish species** 5. **Polypropylene, polyethylene, and polyester were the most abundant polymer types among the analyzed particles** 6. **Fiber was the most prevalent shape among**

				the extracted microplastics 7. The study revealed that microplastic contamination in the western coast of Bangladesh is much higher than that of other marine regions worldwide 8. The study raises concerns about microplastic pollution and highlights the need for better actions to sustainably reduce marine plastic pollution and to protect and restore marine resources.
Long term shoreline change analysis of Sandwip and Kutubdia Island using geospatial techniques	1. Conducting a shoreline change analysis for the past 30 years of three important islands from Bangladesh's east coast (Kutubdia, Sandwip, and Matarbari) 2. Using tide synchronous, cloud free, pre-processed Landsat images for manual digitization 3. Analysis was done by ArcGIS and Digital Shoreline Analysis System (DSAS) for shoreline change rate calculation 4. Determining the rate of erosion and accretion of each island 5. Predicting future shoreline change and providing information for coastal management planners to address vulnerability associated with shoreline change	**Geographical Scope:** Regional (Bangladesh's east coast)Focus on three islands: Kutubdia, Sandwip, and Matarbari **Benefitting Countries:** Bangladesh	National Science and Technology Fellowship	1. Kutubdia lost roughly 7.29 km^2 (-0.243 km^2/yr) over the past three decades due to erosion 2. Sandwip lost -4.63 km^2 (-.15 km^2/yr) over the past three decades due to a combination of erosion and accretion 3. Matarbari gained 10.97 km^2 (-0.37 km^2/yr) over the past three decades due to accretion 4. The analysis can be used for future shoreline prediction and for coastal management planners to implement an appropriate plan to address vulnerability associated with shoreline change.
Occurrence of Microplastics in Sandwip, Kutubdia and St. Martin's Islands, Bay of Bengal.	1. Preliminary monitoring study to collect data on the identification, distribution, and quantity of microplastic particles in transitional environments along the beaches of Sandwip, Kutubdia, and St. Martin's Island in the Northeastern Bay of Bengal 2. Extraction of microplastics using conventional protocols and identification of five morphotypes	**Geographical Scope:** Regional (Northeastern Bay of Bengal) **Benefitting Countries:** Bangladesh	National Science and Technology Fellowship	1. Average microplastic particles per kg were 193±68.9, 175.5±63.1, and 266.3±232 for Sandwip, Kutubdia, and St. Martin's Island, respectively 2. Fiber was the dominant morphotype in all islands 3. ATR-FTIR spectroscopy identified Polypropylene (pp) as the most common polymer type, followed by polyethylene (PE), Polyvinyl Chloride (PVC), and Polyethylene terephthalate (PET) or Polyester (PES) 4. Hazard levels were classified as I, II, and IV

Title	Methods/Objectives	Benefitting countries	Funding	Results/Findings
	3. ATR-FTIR spectroscopy to identify polymer kinds of microplastics 4. Calculation of microplastic induced risk index (H), contamination factor (CF), and pollution load index (PLI) for each island 5. Investigation of the relationship between microplastic abundance and sediment grain sizes			for Sandwip, Kutubdia, and St. Martin's Island, respectively, according to the microplastic induced risk index (H) 5. Sandwip and Kutubdia were moderately contaminated while St. Martin's Island was considerably contaminated according to the contamination factor (CF) 6. All islands were classified as hazard category I according to the pollution load index (PLI) 7. A slight but positive association was found between microplastic abundance and sediment grain sizes 8. This study provides preliminary data on microplastic contamination in coastal islands, which policymakers can use to develop effective management strategies.
APreliminary Approach to Investigate Abundance and Spatial Distribution of Microplasticsfrom Surface Water and Bottom Sediment in the Trans-boundary of Naf-River	1. Conducting field sampling of surface water and bottom sediment at seven sites along the Naf-River in Teknaf to Shah PorirDwip in Cox's Bazar, Bangladesh 2. Extraction and identification of microplastic particles using stereomicroscope and ATR-FTIR spectrophotometer 3. Analysis of the abundance and spatial distribution of microplastics in terms of amount, polymer type, shape, size, and color 4. Identification of the sources and trends of microplastic accumulation 5. Sharing the findings with local authorities and stakeholders for implementing microplastics pollution control measures and conservation plans	Benefitting countries: Bangladesh	National Science and Technology Fellowship	1. Identified significant differences in microplastic abundance and distribution between sediment and water sampling sites. 2. Identified Polyethylene (PP) and Polypropylene (PE) as the most prevalent polymer types in the samples. 3. Found that white particles were the most prevalent color of microplastics in both sediment and water samples. 4. Identified fibers, fragments, foam, film, and pellets as the most prevalent shapes of microplastics in sediment samples, with fibers being the most prevalent in water samples. 5. More than half of the sediment microplastics load was made up of particles smaller than one millimeter. 6. The findings of this project can provide critical information for local authorities to implement microplastics pollution control measures and formulate conservation plans for the coastal environment.

A baseline study of heavy metal contamination and risk assessment in the surficial sediments of the intertidal zone along the southeastern coast of Bangladesh	1. Collecting sediment samples from sixteen selected sites in the intertidal zone along the southeastern coast of Bangladesh. 2. Analyzing the samples for nine heavy metals using Atomic Absorption Spectrophotometers (AAS). 3. Applying contamination factors, pollution indices, and ecological risk assessment indices to evaluate the contamination and potential ecological risk of the metals. 4. Identifying the possible sources of selected metals in the study area through statistical analyses and existing data from previous research.	**Geographical Scope:** Regional: the intertidal zone along the southeastern coast of Bangladesh. **Benefitting countries:** Bangladesh	**National Budget**	1. The study demonstrated the decreasing order of analyzed metals in sediment as Mn>Pb> Ni > Cr > As > Co > Cu > Cd > Se. 2. Based on several pollution indices, almost all beaches were identified with low contamination of heavy metals, except for a few beaches identified with moderate contamination of heavy metal. 3. The potential ecological risk factor revealed low ecological risk for all metals except Cd, which revealed moderate to considerable ecological risk in the study area. 4. The potential ecological risk index suggested a moderate ecological risk for one beach and a low ecological risk for the rest of the other beaches. 5. The sum of toxic units in all sites was less than 4, indicating no serious toxicity for sediment-dwelling organisms. 6. The level of metals observed in the intertidal zone along the southeastern coast of Bangladesh was not alarming, but the continuation of pollution might raise the level of metals and produce a negative effect on the coastal ecosystem in the future.
Determination of the levels of heavy metal concentrations in the water, sediment and fish muscles and assessing their environmental impacts in the Saint Martin's Island	1. Determination of heavy metal concentration inwater, sediment, and fish muscles in Saint Martin's Island 2. Assessment of environmental impacts of heavy metals on the island 3. Evaluation of the spatio-temporal situation of heavy metals 4. Checking the pollution load and geoaccumulation in sediments	**Geographic Scope:**Regional (Saint Martin's Island, Bangladesh) **Benefitting Countries:** Bangladesh	**National Budget**	1. Heavy metals were present in the sediment and water samples, but their concentrations were relatively low, and the environmental impact was also low. 2. Contaminants were found in higher concentrations in lobster and shrimp, while crabs had lower concentrations. 3. Health impacts of shellfish consumption were found to be high, especially non-carcinogenic impacts.

	5. Analysis of shellfish samples to determine potential health impacts			4. As was the only metal found to have carcinogenic impacts. 5. The heavy metal pollution index indicated a significant amount of metals in the water column, and analysis of shellfish samples indicated potential health impacts from long-term consumption. 6. Overall, the condition of heavy metal pollution in Saint Martin's Island was found to have slightly crossed the line of no pollution.
Spatiotemporal Distribution of Microplastic Debris along the Kuakata Coast, Bangladesh	1. Collection of sand samples from coastal beaches in Kuakata, Bangladesh. 2. Analysis of the samples to determine the abundance and types of microplastic particles present. 3. Identification of possible sources and transportation processes of microplastic particles in the region. 4. Assessment of the impact of microplastic pollution on the marine environment. 5. Preparation of a report summarizing the findings and recommendations for mitigating microplastic pollution in the region.	Geographical Scope: The study was conducted in Kuakata, a coastal town located in southern Bangladesh, along the Bay of Bengal. Benefitting Countries: Bangladesh and other countries with coastal regions facing similar microplastic pollution challenges will benefit from this study.	National Budget	1. The study found a high abundance of microplastic particles on coastal beaches in Kuakata, with concentrations varying by season and location. 2. The research identified multiple sources of microplastic pollution in the region, including improper waste management and plastic debris from fishing and shipping activities. 3. The study's findings will help policymakers and local communities in developing strategies to mitigate microplastic pollution in the region. 4. The project generated awareness about the issue of microplastic pollution and the need for concerted efforts to address it. 5. The study's results will contribute to the growing body of research on microplastic pollution and its impact on marine environments globally.
Status of Oil-Grease in the south eastern coastal water of Bangladesh	Oil-grease concentration measurement. Coastal water oil pollution level.	South eastern coastal area of Bangladesh. Pollution control policy for national perspective.	BORI R&D budget/Ministry of Science and Technology	The level of oil-grease obtained in these coastal waters are lower than the threshold value for normal marine animations.
Assessing the micro-plastic distribution in water, sediment and fish species in the coastal region of Cox's Bazar.	Micro-plastic identification and measurements to determine pollution level.	Coastal region of Cox's Bazar, Bangladesh. National and regional pollution control policy	BORI R&D budget/Ministry of Science and Technology	Micro-plastic pollution levels surface water, bottom sediment and fish varied widely with the following order: surface water>sediment>fish.

			formulation.		
Projection of Sea Level Rise and Assessment of its Sectoral (Agriculture, Water and Infrastructure) Impacts	a) **Estimation of Sea Level Rise in Bangladesh using Satellite Altimetry Data** b) **Projection of Sea Level Rise for the year 2030, 2050, 2070, 2100; developing digital elevation models (DEMs) in support of SLR decision-making.** c) **Impacts of projected Sea Level Rise on Water, Agriculture and Infrastructure sectors of the coastal region with cost estimation for required investment**	**Entire coastal belt of the Bangladesh with specific focus on Ganges Tidal Flood Plain, Meghna Estuarine Flood Plain and Chittagong Coastal Plain.**	**National Budget Total: 100.00 lac BDT (Tenure: July 2017-June 2023)**	**Assessment of coastal vulnerability of Bangladesh due to Sea Level Rise.**
Pollution control operation and exercise	**Oil pollution has been a major environmental concern for Bangladesh as number of merchant ships, lighter ships and other maritime crafts have increased for cargo carrying and to support Blue Economy activities at sea. Few marine accidents took place in Chattogram Outer Anchorage and Sundarbans area which gives alarm to maritime oil pollution that needed immediate attention. Bangladesh Coast Guard has 04 in numbers OPVs and 04 in numbers 20m special pollution control boats (JICA boats) which are being used for Oil Pollution Control duties both at sea and riverine area. These ships and boats are equipped with oil pollution control gears**	**Bangladesh and Regional**	**Bangladesh Coast Guard own budget**	**Help keeping sea environment clean and healthy.**
IOC Function D: Assessments & information for Policy					
IOCINDIO Programmes:2050 Integrated Ocean Policy Advice for Proactive Planning and Management for IOCINDIO Member States.					
Projects Titles	**Activities**	**Geographical scope Regional/ National**	**Budget/ funding sources**	**Results/ impacts**	

		benefitting countries	National/ Regional/ international	

IOC Function E: Governance				
IOCINDIO Programme: Blue Economy Business opportunities in the context of climate change adaptation and Disaster Risk Reduction.				
Projects Titles	**Activities**	**Geographical scope Regional/ National benefitting countries**	**Budget/ funding sources National/ Regional/ international**	**Results/impacts**
Economic and non-economic loss and damage to climate change: evidence from a developing country shrimp farms to cyclone Bulbul	1. Assessing economic and non-economic loss and damage to coastal shrimp farms due to cyclone Bulbul in Gabura Union using a mixed method approach 2. Estimating the mean loss and damage per shrimp farm, and the loss and damage to other resources such as houses, solar panels, livestock, and agricultural crops 3. Identifying non-economic loss and damage to household members, access to services, social infrastructure, and cultural functions 4. Analyzing the impact of cyclone Bulbul on rich and poor shrimp farmers	**Geographical Scope:** ShyamnagarUpazila, Satkhira district, Bangladesh **Benefitting Countries: Bangladesh**	**National Budget**	1. All shrimp farms' dependent communities in Gabura Union of ShyamnagarUpazila, Satkhira district, were affected by cyclone Bulbul to some extent. 2. The estimated mean loss and damage per shrimp farm was worth USD 4,633, with 31% and 72% of the farms' fencing nets and traps being lost, which was worth USD 333 per farm. 3. The estimated mean loss and damage per household was worth USD 3,170, including damage to houses, solar panels, livestock, and agricultural crops. 4. Rich shrimp farmers encountered proportionately more economic loss and damage than their poor counterparts, but this does not mean that the poor suffered less. 5. Non-economic loss and damage included mental pain, deterioration of health, physical injuries, disabilities, and disruption of access to services, social infrastructure, and cultural functions. 6. Urgent short- and long-term actions may

				be taken to save the aquaculture farms and dependent livelihoods from economic and non-economic loss and damage to cyclones in the future.
Suitable Site Selection for Eco Friendly Sustainable Tourism ofan Ecologically Critical Area Using AHP and GISApplication: ACase Study of Saint Martin Island inBangladesh	1. Data collection using direct observation and key informant interview technique 2. Use of Analytical Hierarchy Process (AHP) to establish a resource inventory and a set of ecotourism requirements 3. Use of GIS techniques to calculate the rating of various sites based on criteria set and to recognize the "highest" sites 4. Development of suitability map for ecotourism based on linear combination of criteria and factors and their respective weights	**Geographical Scope: Saint Martin Island in Bangladesh** **Benefitting Countries: Bangladesh**	**National Budget**	1. Identified 27% of the island as highly suitable for ecotourism 2. Provided useful information for the development of tourist facilities and the use of ecotourism in Saint Martin Island 3. Can be used as a guideline for assessing the ecotourism suitability of other regions
Proximate Composition of Some Selected Seaweeds from Coastal Areas of Cox's Bazar and the St. Martin's Island, Bangladesh	1. Collection of seaweed samples from coastal areas of Cox's Bazar and St. Martin's Island 2. Analysis of proximate composition of eight wild seaweed species and one cultured species 3. Estimation of moisture, ash, lipid, crude fiber, protein, and carbohydrate contents using standard analytical methods 4. Comparison of proximate composition of different seaweed species 5. Identification of variations in proximate composition within species due to habitat differences, changes in body structures or physiological alterations, changes in growth rates and photosynthetic function of seaweed species, and geographical differences	**Geographical scope: Coastal areas of Cox's Bazar and St. Martin's Island,** **Bangladesh Benefitting countries: Bangladesh**	**National Science and Technology Fellowship**	1. The study provides information on the proximate composition of selected seaweed species from coastal areas of Cox's Bazar and St. Martin's Island, Bangladesh. 2. The results suggest that seaweeds can be a potential source of protein, fiber, and carbohydrate. 3. Wild *Hypnea* sp. was found to be more nutritive than cultured ones due to higher amounts of protein, fiber, carbohydrate, and lipid. 4. The study can be useful for the development of seaweed-based products and industries, as well as for promoting the use of seaweed as a potential source of nutrition in Bangladesh.

Exploration of the Possibility of Commercially important Seaweed Culture in the adjacent Seawater of the Saint Martin's Island, Bangladesh	1. Evaluation of commercially significant seaweed cultures in Saint Martin's Island 2. Measurement of physico-chemical characteristics of seaweed culture sites 3. Feasibility study of growing edible seaweeds (*Gracilaria* sp., Ulva intestinalis, and *Hypnea*sp.) 4. Cultivation of seaweed using floating net and long line methods 5. Measurement of growth rates and biomass production of seaweed	**Geographical scope: Regional (Saint Martin's Island, Bangladesh)** **Benefitting countries: Bangladesh**	**National Science and Technology Fellowship**	1. The physico-chemical characteristics of seawater in Saint Martin's Island are suitable for growing seaweed. 2. Seaweed culture using both floating net and long line methods is feasible and resulted in high growth rates and biomass production. 3. Saint Martin's Island has the potential for seaweed culture, which could contribute to Bangladesh's mariculture prospects.
Mathematical modelling and statistical optimization of fast cultivation of *Agardhiellasubulata*: response surface methodology	1. Development of a fast algae production system using carbon dioxide 2. Application of mathematical and statistical analysis for optimization of production 3. Assessment of the potential contributions of cultivation time, irradiance light, and carbon dioxide concentration on algae cultivation 4. Evaluation of interaction effects during the cultivation process 5. Analysis of experimental data using modified Logistics, modified *Gompertz,* modified *Schnute*, and modified Richards models	**World**	**National Budget**	1. Development of a fast algae production system utilizing carbon dioxide 2. Optimization of algae production through the use of response surface methodology (RSM) constructed on the central composite design (CCD) 3. Determination that cultivation time was the most significant contributor to algae cultivation, followed by light and carbon dioxide 4. Attainment of the highest A. Subulata of 0.24 g with 418 $\mu mol/m^2/s$, 7 days, and 19 mg/l for light intensity, cultivation time, and carbon dioxide concentration, respectively 5. Identification of the modified Logistics model as the best fitting model for the experimental data with a high value of R^2 (0.98) 6. Promotion of a sustainable environment and attainment of sustainable development goals (SDGs) through increased algae production using carbon dioxide.
Arsenic removal from contaminated water utilizing novel green composite Chlorella vulgaris and nano zero-valent iron.	1. Development and characterization of the novel composite of Chlorella vulgaris microalgae and nano-zero valent iron (NZVI) 2. Batch tests to evaluate arsenic	**World**	**National Budget**	1. The novel composite of CV/NZVI showed high potential for arsenic removal from aqueous environments, achieving 99% As(V) removal efficiency at a dosage of 1.5 g/L in synthetic groundwater systems.

	removal efficiencies using different initial concentrations 3. Kinetic analysis of the experimental data to determine the best model for fitting the data 4. Thermodynamic investigation to determine the nature of the adsorption reaction 5. Determination of the optimal dosage of CV/NZVI composite for arsenic removal in synthetic groundwater systems			2. The kinetic analysis showed that the pseudo first-order model was the best fit for the experimental data, indicating that physisorption was the primary mechanism for As-removal by the CV/NZVI composite. 3. The thermodynamic investigation revealed that the adsorption reaction was exothermic and spontaneous, and involved primarily physisorption and slight chemisorption phenomena.
Biotechnological application in marine pharmaceuticals: Prospects and Challenges in Bangladesh	1. Conducting a systematic review of marine pharmaceuticals in Bangladesh to identify potential resources for drug development. 2. Studying marine species in the Bay of Bengal for antibacterial, immunomodulatory, antifungal, anti-inflammatory, anti-cancer, anti-microbial, neuroprotective, and antimalarial properties. 3. Gathering, extracting, evaluating, and describing promising substances for use in the pharmaceutical industry. 4. Developing new drugs to treat serious illnesses such as cancer or malaria. 5. Improving Bangladesh's ability to study marine resources.	Bangladesh, specifically the Bay of Bengal and its surrounding areas.	National Science and Technology Fellowship	1. The study aims to identify potential marine pharmaceuticals resources in Bangladesh, which could lead to the development of new drugs to treat serious illnesses. 2. If successful, this project could contribute to the growth of Bangladesh's pharmaceutical industry and the country's GDP. 3. The development of new drugs could benefit not only Bangladesh but potentially other countries as well.
Physicochemical Characterization of Sodium Alginate and Evaluation of the Industrial Value of Common Alginophytes from St. Martin's Island, Bangladesh	1. Collection of five different seaweed species from the intertidal zone 2. Extraction of sodium alginate using two different techniques: the calcium chloride approach and the formaldehyde approach 3. Identification of peak properties of the main functional groupings of sodium alginate using FT-IR 4. Measurement of intrinsic viscosity	Geographical scope: Regional (St. Martin's Island, Bangladesh) Benefitting countries: Bangladesh	National Budget	1. The highest yield of sodium alginate was obtained from Sargassumbinderi in the formaldehyde approach, and the lowest yield was obtained from *Hydroclathrusclathratus* 2. The intrinsic viscosity and molecular weight of sodium alginate varied among the different seaweed species, with *Padinatetrastromatica* and *Sargassumbinderi* having the highest economic value for sodium alginate

	and molecular weight of sodium alginate 5. Comparison of economic value of different seaweed species for sodium alginate production			production 3. The results of this study may be useful for the development of the seaweed industry in Bangladesh and potentially provide economic benefits for the local communities on St. Martin's Island.
Assessment of Fishers' Livelihood and Fish Diversity in the Saint Martin Island: Present Status, Threats and Recommendation	1. Studying the livelihood status of fishermen on Saint Martin Island in terms of various aspects such as age structure, family size, occupation status, academic status, housing condition, and access to basic facilities. 2. Assessing the fish diversity on the island and identifying threatened species using IUCN criteria. 3. Examining the fishing methods used by the fishermen and the types of nets employed. 4. Providing recommendations for the betterment of the fishermen's socioeconomic situation and sustainable livelihood.	**Geographical Scope:** Regional (Saint Martin Island, southern coastal Bangladesh) **Benefitting Countries:** Bangladesh	**National Science and Technology Fellowship**	1. The study found that 81% of the fishermen surveyed were married and most of them belonged to the age group of 30-39 years. 2. Over 75% of the fishermen were engaged in fishing as their main occupation and 35% had education up to primary level. 3. The majority of the households had electricity services (74%) and received health services from upazilla health complex (45%). 4. The study identified a total of 77 fish species belonging to 13 orders, 39 families, and 63 genera. Perciformes was the dominant order (34%). 5. The island was found to be habitat for 18 threatened species, including 1 severely endangered, 7 endangered, and 10 vulnerable as per IUCN. 6. The study also revealed that BoroHilshajal was the most commonly used net for fishing. 7. The study recommended the need for institutional, organizational, and technical support to improve the fishermen's socioeconomic situation and promote sustainable livelihood.
Feasibility Study of Cage Culture and Involvement of localCommunities at Saint Martin's Island, Bangladesh.	1. Conducting a feasibility study of cage culture at Saint Martin's Island, Bangladesh 2. Analyzing physical parameters such as dissolved oxygen, temperature, salinity, current speed, pH, TDS, etc. 3. Cultivating three different species of fish in three different cages 4. Analyzing benefit cost ratio (BCR) of flathead grey mullet, red	**Geographical Scope:** Regional (Saint Martin's Island, Bangladesh) **Benefitting Countries:** Bangladesh	**National Science and Technology Fellowship**	1. Saint Martin's Island is found to be environmentally feasible for cage culture 2. Cultivating flathead grey mullet and barramundi in cage at Saint Martin's Island is economically feasible 3. Cultivating red snapper in cage at the same place is economically unfeasible 4. Some problems and constraints associated with cage fish farming are identified 5. Recommendations are given for

	snapper and barramundi 5. Identifying problems and constraints associated with cage fish farming 6. Providing recommendations for overcoming problems associated with marine cage culture			overcoming problems associated with marine cage culture.
	Baseline Study of Blue Economy	**Bangladesh**	**National/ International**	**Updating Blue Economy Strategy in BDP 2100**
In Aid to Civil Power and Disaster Risk Management 2021-2022	**a) Providing security to ongoing mega projects in coastal area like LNG Terminal, Deep Sea Port etc.**	**Bangladesh**	**Bangladesh Navy**	**Promote Blue Economy and social safety by ensuring securityand rehabilitation.**
	b) Conducting Search and Rescue operation, Relief operation in Sea and Coastal area during natural disaster.			
BIMRAD (Bangladesh Institution of Maritime research and Development) Initiative 2021-2022	**a) SOP has been made to train the fishing community to handle the climate change issues specially those who all are in the vulnerable group due to climate change.**	**Bangladesh and the Region**	**Bangladesh Navy**	**Enhance knowledge on climate change and find out better way to improve livelihood of coastal people.**
	b) Two Research projectsare ongoing to address climate change issues.			
Protecting Bio-Diversity in Islands and Coastal areas of Bangladesh.	**Naval contingents and Ships are in regular patrol at different Islands and Coastal area like St. Martins, Matarbari, Kutubdia, and Sundarban etc. to maintain and protect Bio-Diversity in the area.**	**Bangladesh**	**Bangladesh Navy**	**Help promoting and preserving Eco-system and Bio-Diversity in the Coastal area.**

Blue carbon stock assessment in the Moheshkhali channel and the Naf river estuary of Bangladesh.	**Estimating soil carbon pool, vegetative carbon pool and ecosystem carbon stock.**	**Southeast coastal area of Bangladesh as a guideline for national blue carbon assessment.**	**BORI R&D budget/Ministry of Science and Technology**	**Project exploredconsiderable volume of blue carbon stock in both research areas. Proper management and local peoples' participation is necessary for protecting this natural resource.**
Explore agarophyte and carragenophyte to optimization phycocolliods and continuation of taxonomic baseline study	**Red seaweed, Extraction of agar and carraginan, Environmental parameters.**	**Saint Martin's Island of Bangladesh. Blue Economy for national perspective.**	**BORI R&D budget/Ministry of Science and Technology**	**Experimental cultivation of commercial species was started near BORI. The study on exploring commercial seaweeds for sustainable blue economy need to be continued.**
Assessment of Coastal and Marine Biodiversity Resources and Ecosystems to Implement the Blue Economy Action Plan	**a) Survey of Coastal and Marine Biodiversity resources and ecosystems.** **b) Preparation of an integrated database of Coastal and Marine Biodiversity resources and ecosystems.** **c) Capacity needs assessments in terms of institutional and regulatory capacity.**	**The coastal zone of Bangladesh, which forms part of the world's largest delta (i.e. the Ganges-Brahmaputra-Meghna delta), covers 19 districts and extending over 47,000 km^2 area. The study area will cover both landward and seaward boundaries of the coastal zone. The artisanal fishing zone (<40 m depth) and the industrial trawl fishing zone (40-100 m depth) were focused for biodiversity and resource assessment study.**	**National: 493.75 Lack BDT (Tenure: January 2020-June 2022)**	**An inventory and integrated database of Coastal and Marine biodiversity resources and ecosystems.**

Capacity Buildup and Digitalization	Bangladesh Coast Guard (BCG) is enhancing its capability which includes number of ships, equipment and manpower as per the Vision 2030 modernization plan. To ensure Blue Economy and maritime security, Bangladesh Coast Guard is planning to incorporate advanced technology based ships, marine version Search and Rescue helicopter, maritime surveillance systems, hovercraft and more high speed boats by 2030. Besides, the coastal stations and outposts are modernized to support the coastal people and develop resilience in case of disaster and adaptation of climate change.	Bangladesh and Regional	Bangladesh Coast Guard own budget	Promote Blue Economy.
In Aid to Civil Power and Disaster Risk Management	BCG provides general mass awareness to coastal people to fight with natural disaster and give shelter to peoples is disaster prone area by Coastal Crisis Management Centers (CCMC), Bangladesh Coast Guard Base, Station & Outposts. BCG also conduct Search and Rescue Operation (SAR), relief operation in Sea and Coastal areas during and post natural disaster.	Bangladesh	Bangladesh Coast Guard own budget and USA for Coastal Crisis Management Center (CCMC)	Enhance social safety by ensuring security and rehabilitation both at sea and coastal areas.
Protecting Bio-Diversity in Islands and Coastal areas of Bangladesh	BCG Station, Outpost, ships and boats are deployed in different islands and coastal area like St. Martins, Matarbari, Kutubdia, Sundarbanetc to maintain and protect Biodiversity in close coordination with other stakeholders.	Bangladesh	Bangladesh Coast Guard own budget	Help promoting and preserving Eco-System and Bio-Diversity at sea and coastal areas.

IOC Function F: Capacity Development
IOCINDIO Programme:IOCINDIO Networking Research Infrastructures, Facilities and Human Resources.

Projects Titles	Activities	Geographical scope Regional/ National benefitting countries	Budget/funding sources National/	Results/impacts

			Regional/ international	
Seminar on "Port Development and Macro Economics for Sustainable Blue Economy"	1. The seminar discussed the role of port development in promoting sustainable blue economy. 2. It covered the economic aspects of port development, including macroeconomic indicators and the contribution of ports to national and regional economies. 3. The seminar explored the relationship between port development and sustainable development, including environmental sustainability and social responsibility. 4. The speaker discussed the challenges and opportunities associated with port development and the ways in which these can be addressed.	**Bangladesh**	**National Budget. Department of Oceanography, University of Dhaka**	1. The seminarhas led to increased awareness and understanding of the importance of port development for sustainable blue economy. 2. Participants may have gained insights into the economic benefits of port development and the ways in which these can be maximized. 3. The seminar may have also facilitated the exchange of knowledge and expertise among participants from different regions and countries. 4. Ultimately, the seminar may have contributed to the promotion of sustainable development and the achievement of the United Nations' Sustainable Development Goals (SDGs), particularly SDG 14 (Life Below Water).
International Centre for Ocean Governance, University of Dhaka.	1. Conducting research on ocean governance issues such as marine policy, law of the sea, and maritime security 2. Providing training and capacity building for government officials, civil society organizations, and academia on ocean governance topics 3. Organizing seminars, workshops, and conferences to raise awareness and disseminate information on ocean governance issues 4. Building partnerships and collaborations with national and international organizations to promote effective ocean governance 5. Developing policy recommendations and providing technical assistance to the	**The activities of the ICOG are primarily focused on Bangladesh, but the centre also collaborates with regional and international organizations working on ocean governance issues.**	**The ICOG receives funding from various sources, including the University of Dhaka**	1. Improved understanding and awareness of ocean governance issues in Bangladesh and the region 2. Increased capacity of government officials, civil society organizations, and academia to address ocean governance challenges 3. Development of evidence-based policy recommendations to inform decision-making on ocean governance issues 4. Strengthened partnerships and collaborations among national and international organizations working on ocean governance issues 5. Enhanced coordination and coherence in ocean governance policies and initiatives in Bangladesh and the region.

	government and other stakeholders on ocean governance issues.		
Youth Forum for Ocean Awareness and Management	1. Organizing seminars, workshops, and conferences on ocean science and governance topics for young researchers, academics, and practitioners 2. Promoting research, innovation, and knowledge sharing on ocean science and governance issues through collaborations with national and international partners 3. Providing opportunities for youth engagement and capacity building in ocean science and governance through internships, fellowships, and training programs 4. Facilitating communication and networking among youth organizations, academia, industry, and civil society on ocean science and governance issues 5. Developing policy recommendations and advocacy initiatives to promote sustainable and equitable ocean governance.	The activities of the Ocean Science and Governance Youth Forum are primarily focused on Bangladesh and the Bay of Bengal region, but the forum also engages with national and international organizations working on ocean science and governance issues.	The forum can receive funding from various sources, including the University of Dhaka, national and international development organizations, research grants from foundations, and donations from private sector and civil society organizations.	1. Increased engagement and participation of youth in ocean science and governance research and practice 2. Enhanced knowledge and capacity of youth on ocean science and governance issues 3. Development of evidence-based policy recommendations and advocacy initiatives to promote sustainable and equitable ocean governance 4. Improved communication and networking among youth organizations, academia, industry, and civil society on ocean science and governance issues 5. Strengthened partnerships and collaborations among national and international organizations working on ocean science and governance issues
Cruise 01	Field visits at BNHOC	Geographical scope: Regional: Bangladesh Navy Hydrography and Oceanography Centre, Chittagong National Benefitting Country: Bangladesh	National Budget. Department of Oceanography, University of Dhaka	• Hands-on activities to teach students how to collect samples using proper techniques and tools. • Students learned how to collect water samples using grab sampling or automatic samplers
Cruise 02	Physical, chemical, and biological samples collected from the middle ground area	Geographical scope: Regional: Middle Ground, Bay of Bengal National Benefitting Country: Bangladesh	National Budget. Department of Oceanography, University of Dhaka	• Hands-on activities to teach students how to collect samples using proper techniques and tools. • Students learned how to collect water samples using grab sampling or automatic samplers
Cruise 03	Physical, chemical, and biological samples collected from the middle ground area	Geographical scope: Regional: Middle Ground, Bay of Bengal	National Budget. Department of Oceanography,	• Hands-on activities to teach students how to collect samples using proper techniques and tools.

		National Benefitting Country: Bangladesh	University of Dhaka	• Students learned how to collect water samples using grab sampling or automatic samplers
Cruise 04	Physical, chemical, and biological samples collected from the pashur river area	Geographical scope: Regional: Pashur River, Bay of Bengal National Benefitting Country: Bangladesh	National Budget. Department of Oceanography, University of Dhaka	• Hands-on activities to teach students how to collect samples using proper techniques and tools. • Students learned how to collect water samples using grab sampling or automatic samplers
Cruise 05	Physical, chemical, and biological samples collected from the Karnafuli river area	Geographical scope: Regional: Karnafuli River, Bay of Bengal National Benefitting Country: Bangladesh	National Budget. Department of Oceanography, University of Dhaka	• Hands-on activities to teach students how to collect samples using proper techniques and tools. • Students learned how to collect water samples using grab sampling or automatic samplers
Cruise 06	Physical, chemical, and biological samples collected from the meghnariver estuary area	Geographical scope: Regional: Meghna River Estuary, Bay of Bengal National Benefitting Country: Bangladesh	National Budget. Department of Oceanography, University of Dhaka	• Hands-on activities to teach students how to collect samples using proper techniques and tools. • Students learned how to collect water samples using grab sampling or automatic samplers
Cruise 07	Physical, chemical, and biological samples collected from the Rabnabad channel area	Geographical scope: Regional: Rabnabad Channel, Bay of Bengal National Benefitting Country: Bangladesh	National Budget. Department of Oceanography, University of Dhaka	• Hands-on activities to teach students how to collect samples using proper techniques and tools. • Students learned how to collect water samples using grab sampling or automatic samplers
Cruise 08	Physical, chemical, and biological samples collected from the Karnafuli area	Geographical scope: Regional: Karnafuli river, Bay of Bengal National Benefitting Country: Bangladesh	National Budget. Department of Oceanography, University of Dhaka	• Hands-on activities to teach students how to collect samples using proper techniques and tools. • Students learned how to collect water samples using grab sampling or automatic samplers
Cruise 09	Physical, chemical, and biological samples collected from the pashur river area	Geographical scope: Regional: Pashur river, Bay of Bengal National Benefitting Country: Bangladesh	National Budget. Department of Oceanography, University of Dhaka	• Hands-on activities to teach students how to collect samples using proper techniques and tools. • Students learned how to collect water samples using grab sampling or automatic samplers
Cruise 10	Physical, chemical, and biological samples collected from the bhola area	Geographical scope: Regional: Bhola, Bangladesh National Benefitting	National Budget. Department of Oceanography, University of Dhaka	• Hands-on activities to teach students how to collect samples using proper techniques and tools. • Students learned how to collect water

		Country: Bangladesh		samples using grab sampling or automatic samplers
	Adaptive Watershed Management to Climate Change: Disaster Risk Reduction and Ecosystem Conservation	Bangladesh	National/ International	Acquiring Ecosystem-based Disaster Risk Reduction (Eco-DRR) skills by ecological methods in the watershed, thereby contributing to sustainable watershed management can be planned and implemented.
	Integrated Lake, River and Coastal Basin Management for Sustainable Use and Preservation of Water Resources	Bangladesh	National/ International	By utilizing the knowledge and technology of this course, participants who are technical officers, policy makers, and researchers will make and implement action plans for basin management (lakes, rivers, coastal waters, etc.) properly in their respective countries.
	Coastal and Marine Ecosystem Conservation Management for Global Biodiversity Goals	Bangladesh	National/ International	To designed to develop Human resources with the necessary knowledge to achieve both conservation and sustainable use of coastal and marine ecosystems, and To develop an action plan related to effective protected area management within the trainees' countries.
	Reinforcement of Meteorological Services	Bangladesh	National/ International	To promote activities to reinforce the meteorological services of each country, with application of meteorological data/products such as numerical weather prediction, satellite images and climate information.
	Sustainable Coastal Protection Measures	Bangladesh	National/ International	To understand sustainable coastal protection measures at island nation.
	Disaster Risk Reduction Measures for Typhoon-Related Hazards	Bangladesh	National/ International	The ability to plan comprehensive disaster risk reduction measures based on a better understanding of typhoon-related hazards and effective structural countermeasures based on regional characteristics will be improved.
Induction of 02 (two) Maritime Patrol Aircraft (MPA) – Oct 2022 for Bangladesh Navy	Patrolling the whole Sea Area of Bangladesh in a scheduled manner.	Bangladesh	Bangladesh Navy	Monitoring all activities in Sea area of Bangladesh and help prevention and preservation of healthy sea, Clean sea, productive sea as well as help maintaining good order at sea.
Induction of 02 (two) Survey Ships and 02 (two) Survey Boats for Bangladesh Navy.	Hydrographic and Oceanographic Survey in the Coastal area of Bangladesh	Bangladesh	Bangladesh Navy	Promote Blue Economy by ensuring safety of Navigation specially in critical waters in and around sea ports.
Maritime Cooperation 2021-2022	Provide assistance to other Maritime Organization and Universities	Bangladesh	Bangladesh Navy	Overall national capacity enhancement in oceanographic survey/research activities. Efficient and optimum use of marine data by different stakeholders. Provide coordinated support and ensure mutual benefit in the

				process of implementing MSP.
Bangladesh Navy Annual Survey 2021-2022	Publishing of 06 new National series charts, 02 new edition of International series ENC (Electronic Navigational Chart) 03 New national series ENC	International and local merchant ships/ lighter vessels coming to different sea ports of Bangladesh.	Bangladesh Navy	Promote Blue Economy by ensuring safety of Navigation specially in critical waters in and around sea ports.
Navigational Publication 2021-2022	New Tide Table-2023 and Annual Summary of Notices to Mariners-2022	International and local merchant ships/ lighter vessels coming to different sea ports of Bangladesh.	Bangladesh Navy	Promote Blue Economy by ensuring safety of Navigation specially in critical waters in and around sea ports.
16th Basic Hydrographic course-2022	IHO standard Cat-B Hydrographic course of 24 weeks duration for National and International students.	National and International (2 X Nigerian, 2 X Sri Lankan) professionals of Hydrographic Organizations	Bangladesh Navy	Capacity Building in production of International standard Navigational Chart and ENCs which eventually help promoting the growth of Blue Economy.
Cartographic Refresher Course-2022 and Operational Oceanography Course-2022	Theoretical and practical course on cartography and Operational Oceanography	National Students of Hydrographic Organization	Bangladesh Navy	Capacity Building in production of International standard Navigational Chart and ENCs which eventually help promoting the growth of Blue Economy.
IORA Blue carbon hub early career visiting professional programme-2022, Australia	Process of Blue carbon measurement and Blue carbon stock assessment.	National and regional. National blue carbon inventory.	IORA (International)	Research knowledge for blue carbon study. Bilateral blue carbon research
Sustainable management of blue carbon ecosystems in the Indian Ocean.	Management process for blue carbon ecosystems.	National and regional. National blue carbon ecosystem conservation.	IORA and Toliara University, Madagsrcar.	Exchange of research knowledge among 12 country representatives.
Tsunami community preparedness training course	Pre & Post preparation for Tsunami hazard.	National and regional.	BMKG, Indonesia.	Community preparedness for people's safety measures are covered.
NF-POGO Regional training program on marine resource management	Train the early carrier researchers about climate change, fisheries resource management, conservation, pollution, remote sensing and data analysis for marine resource management	Bangladesh, India, UK, Malaysia, Philippines	Funded by Nippon Foundation and Partnership for Observation of Global Ocean (International funding)	About 23 early carrier researchers are trained through this training

ANY OTHER PROGRAMMES/PROJECTS RELEVANT TO IOCINDIO
a) Development of National Oil Spill and Chemical Contingency Plan (NOSCOP)   National Oil Spill and Chemical Contingency Plan (NOSCOP) has been developed to control oil and chemical spills in the ocean. Under this plan "National Oil and Chemical

Spill Control Committee-NOCS" has been formed to take immediate measures to reduce the side effects of chemical and oil spillage by any accident in theocean, coastal areas, rivers, lakes, water lands, etc.

b) The Department of Environment (DOE) is regularly monitoring ocean water quality at four points to monitor the environment, ecosystem, and biodiversity of the coast and coastal areas. The monitoring stations'locations are given below:

1. KarnaphuliMohona,
2. 1 km straight from patanga sea beach,
3. Patangacharpara,
4. 1 km straight from CEPZ, Vatiyari shipyard area)