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Coastal Fishing Boats in Bangladesh: Present Status and Policy Recommendations

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ABSTRACT

Coastal fishing boats play a vital role in the marine fishing sector in Bangladesh. However, they encounter many challenges such as safety and stability concerns, limited facilities, and a lack of technologies. The objective of the study is to investigate the current condition of the coastal fishing boats in Bangladesh, focusing on Alipur, Mahipur of Patuakhali, and Fishery Ghat in Chittagong and recommend some proposals for improvement. A structured survey was conducted to collect primary data from those locations. The study identified several major problems including structural limitations of the boats, frequent adverse weather, high fuel expenses, and inadequate facilities and technologies. Considering the challenges, structural modifications of the fishing boats are proposed as recommendations. Besides this use of new engines, and the use of modern technologies (VHF transceiver, fish finder) are suggested as strategies to mitigate these challenges. Modernization programs with low-interest loans, streamlined licensing, enhanced communication systems, and insurance plans are also highlighted in the policy recommendations. The significance of the study is to promote sustainable fishing practices and assist industry stakeholders and policymakers in improving the present status.

1. Introduction.

In Bangladesh coastal water, particularly the Bay of Bengal, represents a vital economic region supporting millions of fishers and contributing significantly to the nation's food security and economic growth, with the marine fisheries sector alone contributing 6.79 lakh MT in 2022-23 at an impressive annual growth rate of 3.28%. The marine fishing sector provides 13.28% of total fish production. Bangladesh earns 0.80% of the total national export earnings by exporting fish, shrimp, and other fish products. Bangladesh is the fifth largest country in the world in terms of aquaculture production. The GDP growth rate of the fisheries sector is 2.43% and the contribution of the fisheries sector in the overall agriculture sector is 22.14% in the 2022-2023 fiscal year. (Department of Fisheries, 2023)

In Marine fishing there involves over 232 industrial trawlers and 67669 artisanal vessels. Artisanal small-scale fishery contributes 78.50% (5.33 lakh MT) of total marine fish catch and large industrial fishery contributes 21.50%. i.e. 1.65 lakh MT (Department of Fisheries, 2023). Fishes and fishery resources play a vital role in improving the socio-economic condition through food security, poverty alleviation, creating work opportunities, and earning foreign currency. But nowadays this important sector is highly affected by climate change, frequent adverse weather, habitat destruction, and other anthropogenic effects (Md. Mizanur Rahman, et al., 2020). Fishing boats are the main focus of the entire economic activity. To encounter the above situation a strong fishing boat with the necessary structural modifications, facilities, equipment, a modern communication system, and fishing technology is needed. The reviewed literature only highlights the challenges and innovations in small-scale fishing communities, particularly regarding boat construction and livelihoods ((CNRS), 2022). The decline of

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traditional boat-building methods due to industrialization and scarcity of quality

wood is also indicated, with advocacy for eco-friendly practices (Shantanu & Vijith, 2012). Fishermen often underestimate cyclone risks and face pressure from boat owners and captains to operate boats with limited facilities. (Md. Monirul, et al., 2013). For artisanal fishermen's better and meaningful livelihood status, strong monitoring of Coast Guards, access to formal credit sources, and installation of sufficient buoys to indicate submerged chars are crucially needed (Aysha, et al., 2017). Low literacy rates and lack of formal education limit awareness of sustainable practices, while no formal training on fishing technology, restricts these fishermen to traditional, less efficient fishing methods (Md. Mizanur Rahman, et al., 2020). The growing importance of small-scale fisheries is emphasized, with calls for policy reforms, including improved monitoring and safety measures, to enhance livelihoods and sustainability (A.K. Ataur, 2012).

The literature has not discussed the overall condition of the boats. Under this scenario, a comprehensive study is needed to understand the present status of the coastal fishing boats. The objective of the study is to explore the current facilities, structural components of the boats, equipment, and technologies in fishing boats, and the challenges faced by the fishermen during fishing voyages. At last some strategies and policies are to be recommended to improve the present scenario. For this, a survey is to be conducted with a structured questionnaire to collect data about the fishing boats. The data represents the current specifications and structural limitations of the boats, their dimensions, facilities, and challenges that the boat faces during fishing voyages.

1.1. Types of coastal fishing vessels.

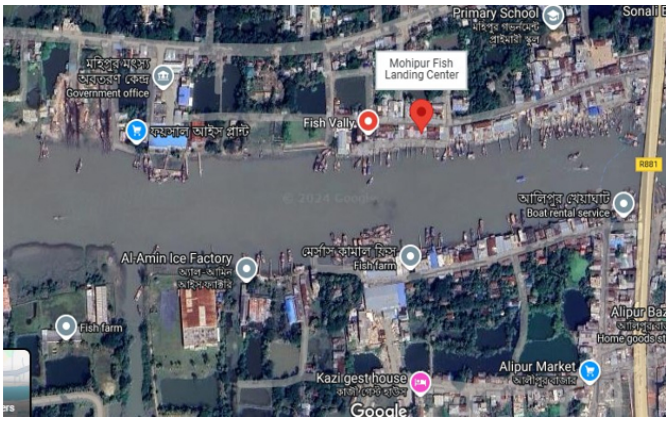
There are three types of fishing vessels operating in the coastal region of Bangladesh.

a. Deep-sea fishing vessels: Deep-sea fishing vessels commonly known as trawlers are 25-40 meters in length. Some trawlers are constructed in different shipyards in Chittagong and some of these are imported. The trawlers are equipped with modern technology (VHF transceiver, fish finder, life-saving and fire-fighting equipment), resulting in relatively low accident rates among these vessels.
b. Offshore wooden boats: Offshore wooden boats are 11 to 18 meters long and built with local or imported timber, with significant variation in construction quality. However, the local wooden boat builders have to import engines from China. The boats can sail for one to two weeks carrying 22 to 25 fishermen (Dr. Abdur Rahim, 2008). Apart from the local woods, they also import construction items from Thailand, Malaysia, Nigeria, and Myanmar ((CNRS), 2022). No regulatory authority controls their design or safety features. Due to the laborious manual procedure of deploying and hauling nets, these vessels demand physical labor. Generally, the design of a fishing boat is done to meet the requirements of the fisherman. However, boats are built in light of the experience of the fisherman. The type of fishing, the number of fishing days, the fish storage capacity, and the speed are roughly estimated. At the same time, the boat designed and built should be economical for the owner in terms of fuel consumption. In terms of design and environmental risks, offshore wooden boats are the most vulnerable. Built without regulatory oversight, these boats often lack basic safety features and operate in open, sometimes hostile waters, increasing their risk factors significantly (Dr. Abdur Rahim, 2008).
c. Small fishing boats: Small fishing boats are less than 11 meters in length. These boats operate close to shorelines or in estuaries and focus on catching juvenile fish, supporting the poor coastal population's livelihood. Some of it may have motorized propulsion systems and some may not. (Dr. Abdur Rahim, 2008).

2. Methodology.

The present study involves primary and secondary data collection approaches to offer a thorough evaluation of the state of the coastal boats engaged in coastal fishing operations. The majority of the data used in the research are primary data collected through field surveys carried out in Alipur, Mahipur in Patuakhali*, and Fishery Ghat in Chittagong from May to June 2024.

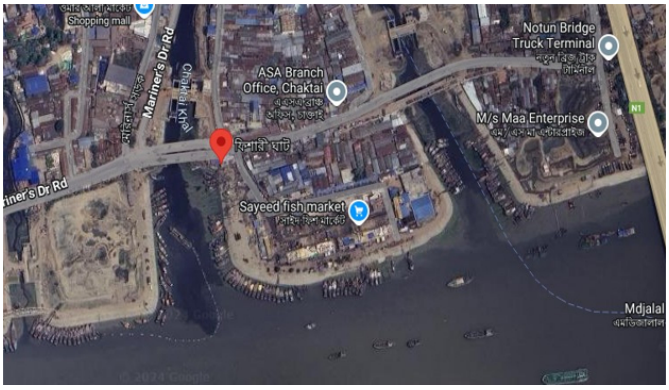
Figure 1: Survey area Alipur and Mahipur fish landing stations of Patuakhali.



Source: Google Maps.

Those locations were selected for data collection as there are lots of fishing boats and reflecting a variety of coastal fishing activities. A total of 52 boats, with one respondent from each boat, were selected for the study. Structured interviews were conducted with the fishermen. The interviews were guided by a pre-designed questionnaire that addressed various aspects of coastal fishing activities. Official documents from the Department of Fisheries were collected as a source of secondary data. The information was utilized to support the primary data and conclude the study with a more comprehensive framework. MS

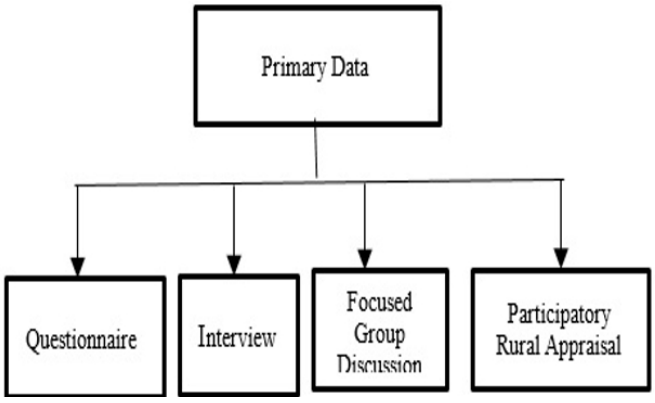
Figure 2: Survey area Fishery Ghat, Chittagong.



Source: Google Maps.

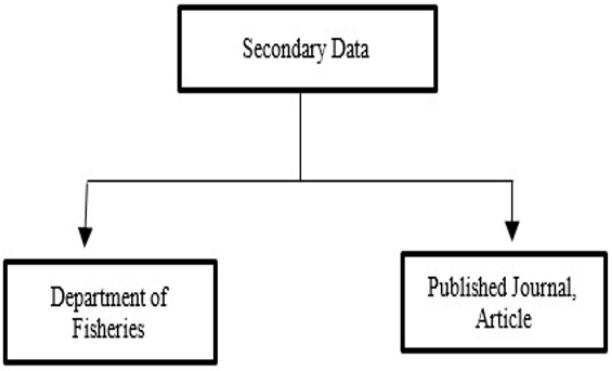
Excel was used to analyze the collected data. To make the understanding easier, the results were displayed in graphical form with various charts and diagrams.

Figure 3: Primary data collection process.



Source: Authors.

Figure 4: Secondary data sources.



Source: Authors.

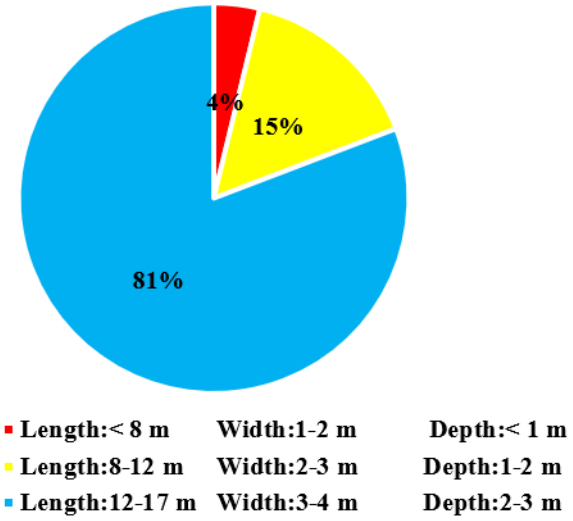
3. Present Status of the Fishing Boats.

This section focuses on the survey statistics obtained from the respondents. These statistics will be used to propose strategies and policy recommendations.

3.1. Survey Statistics.

Coastal fishing boats, the means of livelihood of thousands of people are constructed in different sizes and shapes. From the survey, it is found that most of the boats were, 12–17 m in length, 3–4 m in width, and 2–3 m in depth. Only 15% of the boat's length range is between 8-12 m, width 2–3 m and depth 1-2 m. The rest of the boat's length is less than 8 m, width 1-2 m, and depth less than 1 m as shown in Figure 5.

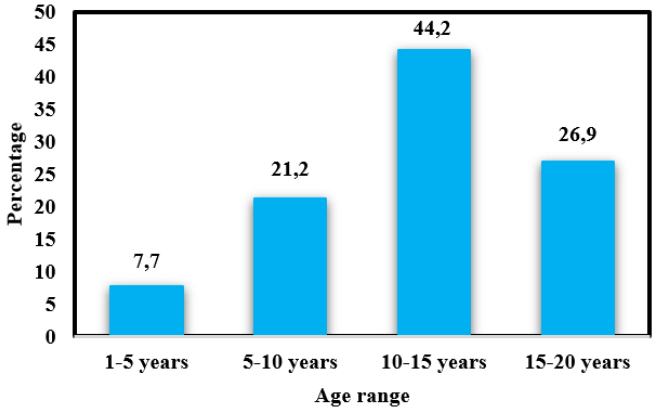
Figure 5: Dimension of the boats.



Source: Authors.

Study reveals that most of the boats are aged. Their age range is between 10–15 years. The boats aged between 15–20 years are the second largest in number. The rest of the boat's age is less than 10 years. The statistics of the age of the boats are shown in Figure 6.

Figure 6: Boat's age range in years.

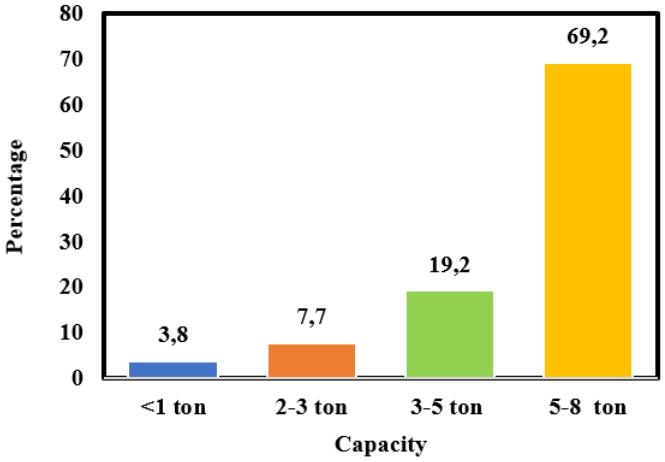


Source: Authors.

From the research, it has been found that most of the boats have 5–8 ton fish holding capacity. The boats have a 3–5 ton

capacity and 2–3 ton capacity respectively. The rest of the boats have a capacity of less than 1 ton as shown in Figure 7.

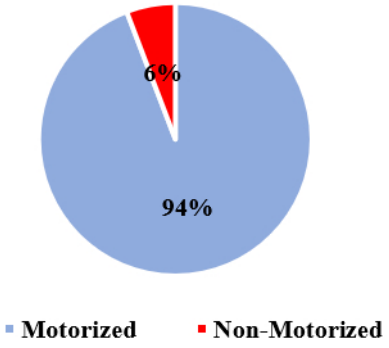
Figure 7: Fish holding capacity of the boats in tons.



Source: Authors.

The Survey indicates that the fishing boats predominantly use aged and reconditioned engines. The engines are four-stroke diesel engines with a power range between 278–320 HP for large boats and 105 HP for small boats. The study also reveals that nearly all the boats are motorized and only 6% are non-motorized as shown in Figure 8.

Figure 8: Percentage of boats by motorized and non-motorized.

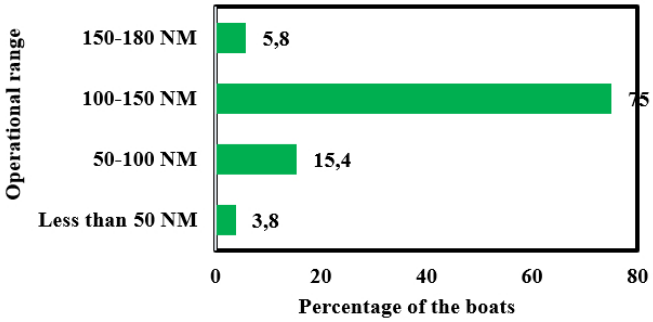


Source: Authors.

The operational range of the boats is mostly 100–150 nautical miles (NM) as shown in Figure 9.

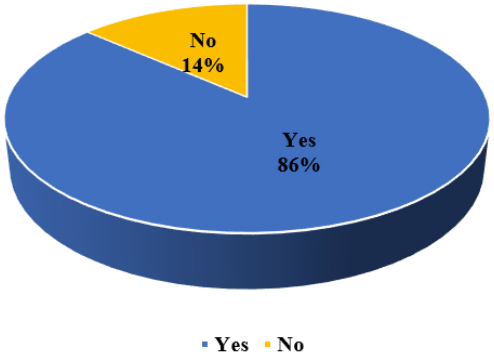
When fishermen were asked, if their boats were facilitated with necessary navigation lights, most of them answered that their boats have navigation lights as shown in Figure 10.

Figure 9: Operational range of the boats in nautical miles (NM).



Source: Authors.

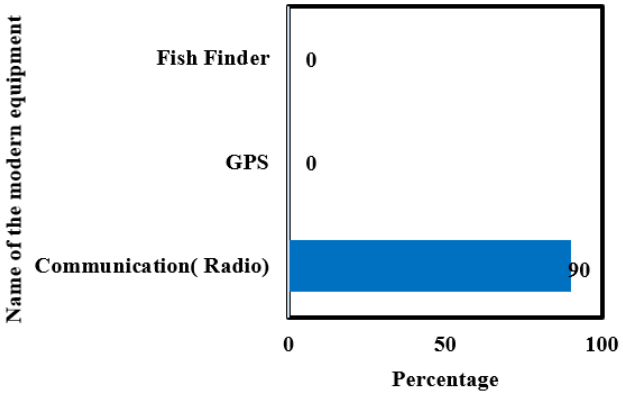
Figure 10: Percentage of boats that use navigation lights.



Source: Authors.

The boats can go for 20–25 round trips per year. The average duration of the trip is 8–10 days. Fishermen use traditional methods rather than using modern technology to find fish schools and drop fishing gear. Sometimes they get enough fish, sometimes a small amount is caught. When the investigation was conducted it was observed that nearly all the boats have a simple radio to get the weather forecast. But GPS (Global Positioning System) and Fish Finder are not used by any boat as shown in Figure 11.

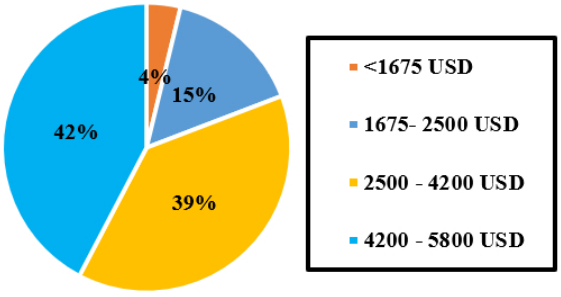
Figure 11: Use of navigation and fishing technologies on coastal fishing boats.



Source: Authors.

When the fishermen were questioned about the operational cost per round trip, around half of them responded that the operational cost is 4200–5800 USD. Also, a significant percentage of fishers responded that the cost range is 2500–4200 USD and the rest have said that operational cost is below 2500 USD depending on the size of the boats as shown in Figure 12.

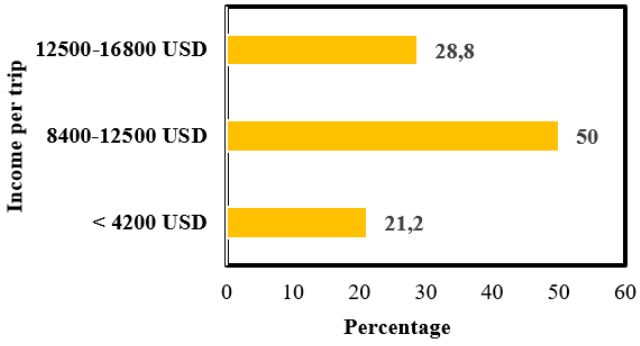
Figure 12: Operational cost per fishing trip in BDT.



Source: Authors.

Following this, fishermen were also questioned about the total income per trip. Then half of them answered that income per trip is between 8400–12500 USD. A modest percentage of fishers said that the income range is 12500–16800 USD. 21% of respondents said that their income range is less than 4200 USD as shown in Figure 13.

Figure 13: Income range per fishing trip in BDT.

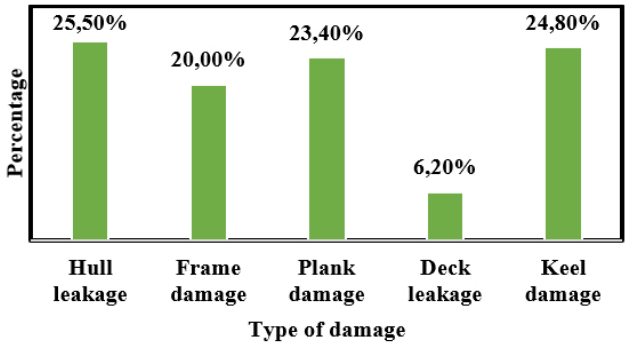


Source: Authors.

When fishermen were questioned about the damages that occur in the boats, they answered that leakage in the hull is the most common type of damage that occurs during the voyage. Then keel damage, plank damage, frame damage, and deck leakage are respectively the most common damages that occur as shown in Figure 14.

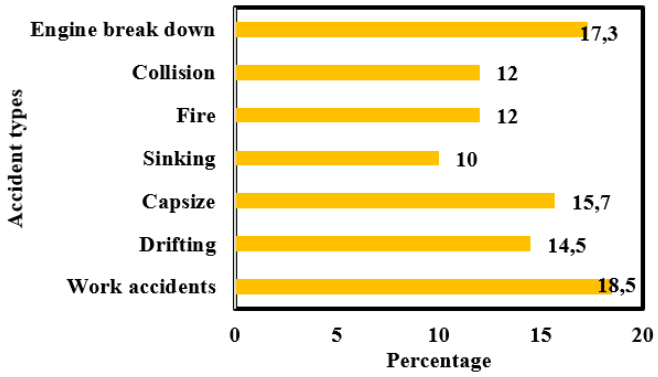
When respondents were questioned about different types of accidents that occur with boats during fishing trips, most of them answered that Engine breakdown, capsize, drifting, collision, fire, and sinking are respectively the most occurred accident types. Figure 15 shows the percentage of each accident type during operation. The boats do not have any insurance.

Figure 14: Type of damages that occur in the boats.



Source: Authors.

Figure 15: Type of accidents that occur during fishing trips.



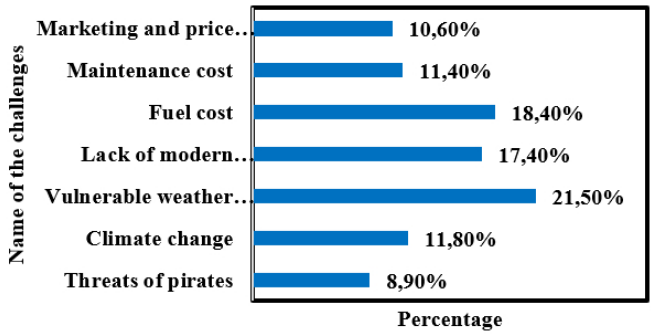
Source: Authors.

As a source of secondary data, a report of CNRS is studied and it is found that the boats have no bilge keel and freeing port. As capsizing, drifting, and sinking possess a large accident percentage, active appendages facilitating the stability of the boats are needed to reduce accidents. From the study, it has been also noticed that the propeller shafting system used on the boats is primitive and outdated. The transom area is not strong enough to handle the steering system during rough sea conditions. There is no access from the deck to the transom area. Moreover, the bulwarks and gunwales of the boats lack sufficient structural integrity.

When fishermen were questioned about the multiple challenges they face in fishing activity, most of them answered that vulnerable weather condition is the prominent challenge. High fuel costs, lack of modern equipment and technology, climate change, boat maintenance costs, marketing and price fluctuations, and threats of pirates are respectively the most common challenges faced by the fishermen. Figure 16 represents the percentage of each challenge.

When fishermen were asked to suggest some policies and support that they needed. They have suggested more active rescue operations during natural disasters and accidents, training programs on modern technology, easy access to modern equipment and technology, access to low-interest loans, better infrastructure, and reduced pirate activities. Figure 17 shows the percentage of each policy and support suggestions from the re-

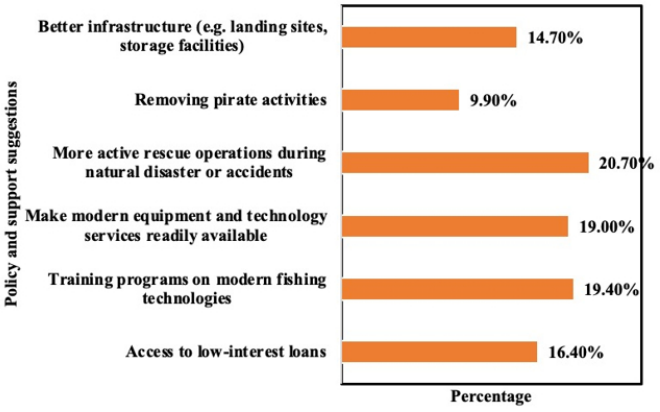
Figure 16: Challenges faced by fishermen.



Source: Authors.

spondents.

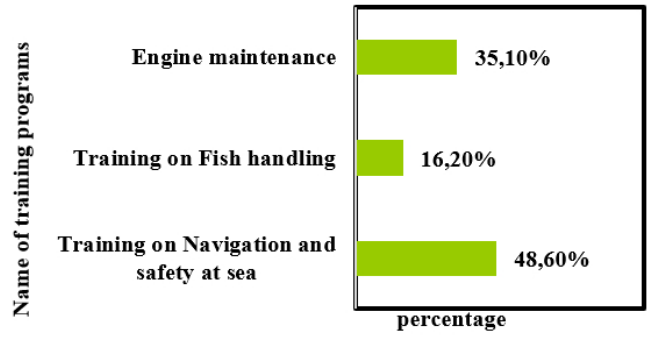
Figure 17: Policy and support suggestions provided by the fishermen.



Source: Authors.

From the survey, it has been noted that only half of the fishermen got navigation training. One-third of them have training in engine maintenance and only a few fishermen have got training in fish handling practices as shown in Figure 18.

Figure 18: Percentage of fishermen who got different trainings.



Source: Authors.

4. Results and Discussion.

4.1. Findings from the Study.

From the study an insight about the fishing boats current status is found. Such as nearly all the boats are motorized. Typical dimensions of the boats are 12–17 m in length, 3–4 m in width, and 2–3 m in depth. Most of the boats are powered by old reconditioned 4-stroke diesel engines. The engine's power is within 105–320 HP depending on the boat's size. The majority of the boat's age range is between 10–15 years. Most of the boat's fish hold capacity is 5-8 tons. From the study, it is noted that severe weather conditions are frequent nowadays. However, a strong boat with necessary structural components such as a bilge keel, a strong transom, and propeller shafting is absent on the boats that are investigated during the survey. A boat modified or constructed with components facilitates stability in rough sea conditions and ensures the safety of the crews. Moreover, there is no freeing port on the weather deck. Freeing port drains green water from the weather deck. There are no hooks or aids on the boats to access the transom area in case of any maintenance work. The bulwarks and gunwale area are not structurally robust, only a thin metal sheet is fitted on the gunwale surface that can corrode due to salt water and regular friction from the fishing net. The study reveals that the boats lack safety equipment, accommodation, galley and toilet facilities. Though basic navigation lights and radios are common. However, the boats do not use GPS and Fish Finder. Icing is the only fish preservation method. But the ice supply is insufficient. The operational cost per round trip is 4200–5800 USD. The income per trip is 8400–12500 USD. Boats do not have any insurance. The boat's common damages are hull leakage and keel damage. Work accidents including engine breakdowns, and capsizes are the most common accidents that occur during fishing. Adverse weather conditions, higher fuel costs, lack of modern equipment and technology usage, boat maintenance costs, market price fluctuations, and piracy are the challenges identified in the study. Fewer fishermen have training in navigation, engine maintenance, and fish handling. It is noted that government support rarely reaches the fishermen and boat owners. Fishing regulations are not strictly followed. Active rescue operations by the Coast Guard in any natural disaster and any type of danger during the voyage, easy access to modern equipment and technology, training programs on navigation and modern equipment usage, low-interest loans, better infrastructure development, and piracy removal are the policy and support suggestions from the fishermen.

5. Policy Recommendations.

From the study, it is observed that because of climate change adverse weather conditions such as cyclones are frequently happening in recent years. To mitigate this challenge and ensure fishermen's safety a robust boat with necessary modifications and equipment is needed. To ensure sustainable fishing activity, other challenges are also to be mitigated. Under these conditions, some structural modifications on the boats are recommended. Some strategies are also suggested to enhance the

communication system, increase fish catching amount, and lower fuel costs. In the end, some policies that the government should introduce are also suggested that will help the fishing community to adopt the provided recommendations.

5.1. Strategies to Establish a Communication System and Increase Fish Catch.

Installing a VHF transceiver on the fishing boats makes two-way communication possible between fishermen and the Coast Guard or other boats within 20–30 nautical miles in case of any adverse weather or any type of danger. It has an integrated GPS, which is used for safe navigation and tracking boat location. In this way, the system can ensure the safety of the fishers during fishing voyages. Installing Fish Finder on the boats can increase the quantity of fish caught in a relatively short time.

5.2. Strategies to reduce higher fuel cost.

Regular engine maintenance can reduce both fuel consumption and sudden engine failure. Optimized engine power minimizes fuel consumption. It means avoiding the use of overpowered engines. Boat owners should use new engines as newer engines consume less fuel compared to old reconditioned engines. Lightweight vessel design with composite material should be considered to reduce the boat's weight. Lower weight needs lower brake horsepower, which ultimately reduces fuel costs. Electric propulsion systems can be considered as the efficiency of electric propulsion is higher than diesel engine propulsion.

5.3. Modification Proposals for Fishing Boats.

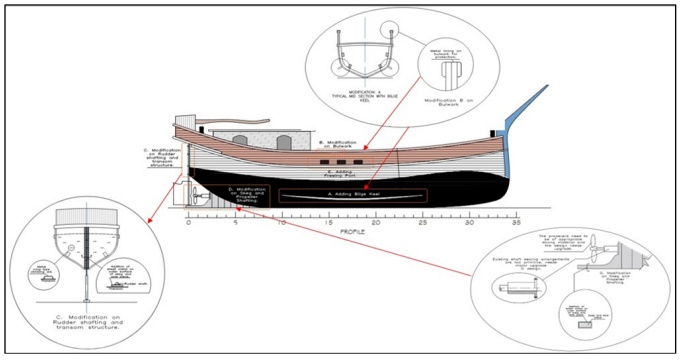
Adding bilge keel: Bilge keel is a structural component used to reduce a ship's tendency to roll. Bilge keels are employed in pairs (one for each side of the ship). A ship may have more than one bilge keel per side, but this is rare. Bilge keels increase hydrodynamic resistance, making the ship roll less (Lewis, 1989). Bilge keels are passive stability appendages. In our investigated boats we noticed that there were no bilge keels fitted on the boats. To improve stability and reduce the rolling motion of the fishing boats, it is recommended to fit bilge keels on both the port and starboard sides of the boats. Bilge keels as a hydrodynamic component increase the boat's resistance to rolling and, as a result, improve overall stability, particularly in rough sea conditions. Performing this modification, the boats will be better equipped to handle rough weather and provide safety to the fishermen.

Modification on Bulwark and Gunwale: Bulwark is a vertical barrier or wall that extends upward from the ship's side above the weather deck. It protects the crew from falling into the water. It also protects the vessel's weather deck from waves. Gunwale is the upper edge of a boat's hull. It typically runs along the boat's from forward to stern on both sides of the boat. In fishing boats, gunwale is made of wood. When fishers drop fishing gear into the water, fishing nets come in contact with the gunwale. Regular wearing with a fishing net can corrode the upper edge material of the gunwale. At present a thin metal sheet is used on the top of the gunwale. It is suggested that a thick layer of stainless-steel sheet is to be used to modify the existing gunwales

Strengthening the transom area: A transom is a vertical reinforcement that provides strength to the stern of a boat. A wooden fishing boat's transom supporting the rudder stock is a critical structural component. The addition of a strong wooden block for better support of the rudder stock and transom structure is recommended. The endurance and structural integrity of the boat can be greatly increased by stiffening this location with a solid wooden block.

Fitting hook: A metal rung-type hook or climbing aid is to be provided for ease of access from the deck to transom areas for maintenance works while in water.

Figure 19: Proposed modifications of Offshore wooden fishing boats.

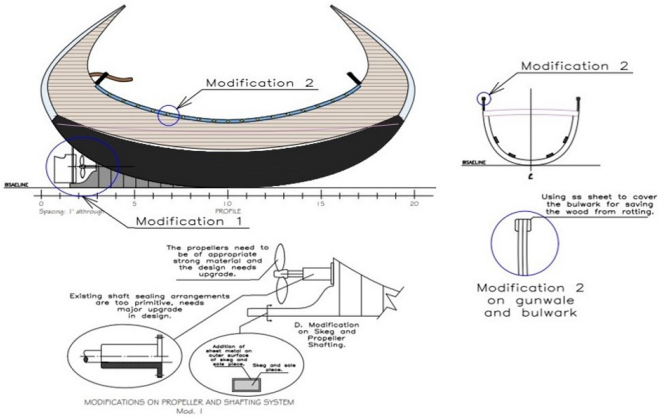


Source: Center for Natural Resource Studies (CNRS).

Propeller and shafting system: Propeller shafts are mechanical components of a boat's propulsion system. It transmits torque and rotational power to the propeller. Propellers are typically made of bronze and shafting is made of forged steel. A shaft sealing system is used to make the shafting system watertight. The shafting and sealing methods currently used are outdated. It is suggested to use a more contemporary and effective propeller and shafting system in place of the current one. A shaft made of strong and durable material will significantly reduce vibration. The shaft sealing is also to be redesigned for proper cooling, lubrication, and efficiency. It will decrease vibration, increase propulsion efficiency, and reduce fuel consumption. The propeller needs to be of appropriate strong material and the design needs upgradation. A well-designed propeller can improve a boat's speed and fuel efficiency. A skeg is an extension of a vessel's keel at the stern protecting the rudder and propeller from underwater obstacles. Continuous exposure to saltwater can corrode the skeg. To protect the skeg from corrosion and increase its strength, the skeg needs to be covered with a thick.

Making a freeing port: A freeing port is an opening in the lower part of a boat's bulwarks that allows water on the deck to drain overboard. They are important as they help prevent water accumulation on the weather deck, which can reduce the risk of capsizing.

Figure 20: Proposed modifications of Sampan boats.



Source: Center for Natural Resource Studies (CNRS).

5.4. Boat Modernization, Low-Interest Loans, and Simplified Licensing.

Government and NGOs should provide low-interest loans to the boat owners to modify the boats with necessary structural components, modern equipment, and technologies. It will improve the safety of the fishermen as the boats can handle rough weather conditions and communication with Coast Guard will be possible. If fishing boats are equipped with modern fishing technology, it will increase fish catching amount with less fuel consumption in a relatively short fishing trip. A one-stop service should be provided by the fisheries authority to ease those licensing processes. It will encourage boat owners to adopt those technologies.

5.5. Insurance, Engine Incentives, and Training Programs.

Insurance schemes should be introduced for offshore wooden boats. Insurance offers financial stability to the boat owner. It encourages boat owners to invest in boat modernization. Incentives for new engines should be provided to encourage the use of new engines on the boat. More training programs should be conducted to educate the fishermen on safe navigation, engine maintenance, fish handling, and modern equipment usage.

If these recommendations are implemented properly, will encourage fishermen and boat owners to modify their boats with necessary structural appendages and adopt modern technologies that will ultimately increase safety and efficiency in fishing activities.

Conclusions.

The sea area of Bangladesh is almost the same size as its land area. Fish is the main protein source for most of the people in this country. However, the marine fishing sector provides 13.28% of total fish production. Artisanal small-scale fishery contributes 78.50% of total marine fish production. Offshore wooden fishing boats are the backbone of artisanal small-scale fishery. However, a comprehensive study on the current condition of wooden fishing boats has yet to be conducted. For this, a survey has been conducted in the coastal area of Bangladesh including Alipur, Mahipur of Patuakhali, and the Fishery ghat of Chittagong. The study provides valuable insights into the current state of the coastal fishing boats such as small aging boats 70% of which are over 10 years old. Most of the boat's fish holding capacity is 5-8 tons. Over 50% of the boats face structural difficulties such as 25.50% of boats face hull damage and 24.8% of boats face keel damage. Boats do not have the necessary stability appendages to keep the boats stable during rough sea weather. The boats have limited facilities, capacity, and basic engines, which are mostly 4-stroke diesel engines with power ranges between 278–320 HP. Sudden engine breakdowns are common, which alone represent 17.30% of all accidents. The operational range of the boats is only 100–150 NM. Boats have lack of safety appendages, modern equipment, and accommodation. Fishermen face lower income and higher operational costs which is 4200–5800 USD per round trip. The challenges such as frequent adverse weather conditions, higher fuel and maintenance costs, lack of modern technology usage, market price fluctuations, and piracy are identified. By identifying key challenges, policy recommendations are provided such as the boat's structural modifications for example fitting the bilge keel and making freeing port on both sides of the boat to reduce rolling of the boats, increase stability and drainage system, modification of bulwarks and gunwales, strengthening the transom area and modification of propeller shafting system. Approaches to increase the fish catching amount and develop a communication system between fishermen and the Coast Guard, Tactics to reduce higher fuel cost and increase boat's operational range, boat modernization program with a low-interest loan, simplifying licensing process, active Coast Guard services through the radio communication system, introducing insurance schemes and training programs are also recommended. By finding issues and recommending policies this research contributes to the sustainable development of the fishing sector. The findings can inform industry stakeholders and policymakers to promote responsible fishing practices and ensure sustainability in fishing activities.

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