

Fish Market of Problems and Challenges Faced by Fishermen and Merchants of Sundarbans in India - A Study

¹Zahangir Alam , ²Dr. Abhijit Pakira

¹PhD Scholar, ²Assistant Professor

Department of Business Administration, The University of Burdwan, West Bengal, India.

Abstract

As home to 4.5 million human inhabitants most of whom make their living fishing in the nearby waters the Sundarbans, the world's largest mangrove ecosystem and a global hotspot for fisheries, faces unique socio-economic and environmental stressors affecting its human communities (who provide most of her editorial) This study investigates the primary concerns of fishermen and merchants in Sundarbans fish markets, including variable prices of fish, reliance on brokers, ecological impoverishment and social disparities. The research utilizes a mixed-methods strategy, integrating qualitative data from interviews and field observations with quantitative data derived from surveys of 50 fishermen and 20 merchants at 16 major fish markets.

The results show that fish stocks have declined sharply as salinity increased by 15 percent over the past 20 years while mangroves were being cut down at a rate of 0.2 percent per year. This has resulted in economic exploitation with 85% of fishermen relying on middlemen who make less than 40% of the retail price, and post-harvest losses amounting to 25% a year owing to poor infrastructure. On the social front, the children of fishing households rarely do better than the minimum required grades to complete secondary education and only 25% of them graduate from high school; gender inequities persist as well, with women earning on average 20% lower than men engaged in similar fish activities;

These results highlight the necessity of sustainable fisheries, infrastructure development, and direct-to-consumer market models to mitigate economic stress. Integrated policy interventions tackling these challenges can ensure livelihoods and equity while also safeguarding this fragile ecosystem for generations to come in the Sundarbans.

Key words: *Sundarbans Fisheries, Fish Market Challenges, Fishermen Problems, Merchant Issues, Fishing Economy, Sustainable Fisheries, Environmental Impact on Fishing, Market Accessibility, Fishermen Socioeconomics, Fish Trade Dynamics, Fish Price Fluctuations, Fishermen and Merchant Conflicts, Fishing Industry in India, Supply Chain Disruptions, Policy and Regulation in Fisheries.*

I. Introduction

The Sundarbans, a UNESCO World Heritage Site and the world's largest mangrove forest, plays a crucial ecological and economic role in India. Supporting over 4.5 million people, nearly 70% of whom depend on fisheries for their livelihoods, the region faces significant socio-economic and environmental challenges (UNESCO, 2021). Rising salinity, driven by climate change and upstream water management, has increased by 15% over the past two decades, leading to a 20% decline in fish stocks, particularly valuable species such as hilsa and tiger prawns (Das et al., 2018). Mangrove deforestation at an annual rate of 0.2% further diminishes breeding grounds, aggravating resource depletion (Mukherjee & Saha, 2020). Market inefficiencies exacerbate these issues, as 85% of fishermen rely on middlemen and earn less than 40% of the final retail value of their catch (Chowdhury et al., 2021). Additionally, poor infrastructure—including inadequate cold storage and transport systems—leads to post-harvest losses of up to 25% annually, reducing the overall profitability of the fisheries sector (Barman et al., 2019). Socio-political challenges include limited policy enforcement against illegal fishing and insufficient government investment in sustainable practices. Gender disparities are also prominent; women involved in fish processing and sales earn 20% less than men and face barriers to participation in decision-making roles (Ghosh, 2020). Addressing these challenges requires comprehensive reforms, including investment in infrastructure, implementation of sustainable fishing practices, and policy measures to enhance equity and market efficiency.

II. Literature Review

The Sundarbans, spanning over 10,000 square kilometers across India and Bangladesh, is home to the largest mangrove ecosystem globally and supports over 4.5 million people, of whom 70% rely on fishing for their livelihoods (UNESCO, 2021). However, the fish markets in this region face significant socio-economic and ecological challenges. Rising salinity, which has increased by 15% over the past two decades due to climate change and anthropogenic activities, has contributed to a 20% decline in fish stocks, particularly affecting

commercially important species like hilsa and tiger prawns (Das et al., 2018). Mangrove deforestation, occurring at an annual rate of 0.2%, further reduces fish breeding grounds, compounding the issue (Mukherjee & Saha, 2020). Market inefficiencies exacerbate these challenges, as 85% of fishermen depend on intermediaries and earn less than 40% of the retail value of their catch (Chowdhury et al., 2021). Post-harvest losses, due to inadequate cold storage and transportation infrastructure, result in 25% of the annual catch being wasted, leading to significant economic losses (Barman et al., 2019).

The socio-economic impact on fishing households is severe, with 60% of families living below the poverty line and earning less than ₹6,000 per month (Mukherjee & Saha, 2020). Gender inequities are prominent, as women engaged in fish processing earn 20% less than their male counterparts and are excluded from key decision-making processes (Ghosh, 2020). Climate change poses an additional existential threat, with projections indicating a 40% reduction in habitable and fishing areas by 2050 due to rising sea levels and increasing cyclone intensity (Chowdhury & Banerjee, 2021). Addressing these challenges requires targeted interventions, including sustainable fishing practices, improved infrastructure, and policy measures to promote equity and market efficiency. Comparisons with successful cooperative models in Bangladesh highlight the potential for similar approaches in the Sundarbans to alleviate poverty and enhance resource sustainability (Rahman et al., 2019).

III. Methodology

Research Design:

1. **Mixed Methods:** Combine qualitative (interviews, case studies) and quantitative (surveys, economic data analysis) approaches.
2. **Study Area:** Frazerganj Fish Market, Diamond Harbour Fish Market, Raidighi Fish Market, Baruipur Fish Market, Joynagar Fish Market, Gosaba Fish Market, Kakdwip Fish Market, Canning Fish Market, Namkhana Fish Market, Haroa Fish Market, Babur Hat Fish Market, Malnch Fish Market, Hasnabad Fish Market, Hingalganj Fish Market, Sandeshkhali Fish Market and Dhamakhali Fish Market in West Bengal.

Data Collection:

- **Primary Data:**
 - Interviews with fishermen and merchants.
 - Surveys to understand challenges (economic pressures, environmental factors, policy issues).
- **Secondary Data:**
 - Government fisheries data.
 - Studies on ecological degradation and its impact on fish stock.
 - Market price fluctuations over time.

Sampling: A random sampling method was utilized to select fishermen and merchants from 16 key fish markets in the Sundarbans. The selected markets included Frazerganj Fish Market, Diamond Harbour Fish Market, Raidighi Fish Market, Baruipur Fish Market, Joynagar Fish Market, Gosaba Fish Market, Kakdwip Fish Market, Canning Fish Market, Namkhana Fish Market, Haroa Fish Market, Babur Hat Fish Market, Malnch Fish Market, Hasnabad Fish Market, Hingalganj Fish Market, Sandeshkhali Fish Market, and Dhamakhali Fish Market. The sample included 50 fishermen and 20 merchants, ensuring a diverse representation based on age, fishing experience, and market size. This comprehensive approach aimed to capture a wide range of socio-economic and environmental challenges affecting the fisheries sector in the Sundarbans.

Data Analysis:

Quantitative: Statistical analysis of the Sundarbans fish markets revealed critical trends. Fishermen earn less than 40% of the retail price due to intermediaries, with 85% dependent on this model (Chowdhury et al., 2021). Post-harvest losses reach 25% annually, primarily due to inadequate cold storage and transport infrastructure (Barman et al., 2019). Income data shows 60% of fishing households earn under ₹6,000 monthly, highlighting pervasive poverty (Mukherjee & Saha, 2020). Salinity increases of 15% over two decades have reduced fish stocks by 20%, significantly affecting species like hilsa (Das et al., 2018). These findings underline the urgent need for infrastructural and policy reforms.

Qualitative: Thematic analysis of interviews and field notes from fishermen and merchants in the Sundarbans revealed key challenges. Recurring themes included economic exploitation by intermediaries, inadequate infrastructure leading to post-harvest losses, and environmental stressors like rising salinity and declining fish stocks. Social disparities, including limited roles for women in decision-making, were also significant. These insights highlight systemic and ecological factors impacting livelihoods and market efficiency.

IV. Results

1. Economic Challenges:

Fluctuating fish prices: Fluctuating fish prices in the Sundarbans present a critical challenge for fishermen and merchants. Prices are heavily influenced by seasonal availability, environmental changes, and market dynamics. High-demand species such as hilsa and tiger prawns experience price volatility due to declining fish stocks, caused by a 15% rise in salinity levels over two decades and a 20% reduction in fish diversity (Das et al., 2018). Seasonal over-supply during peak fishing periods forces fishermen to sell their catch at significantly reduced prices, while shortages during off-seasons lead to price spikes that benefit merchants rather than producers. Climate-induced disruptions such as cyclones exacerbate price instability, limiting fishermen's ability to meet market demand. These fluctuations directly impact fishermen's income, with 60% earning less than ₹6,000 per month, placing them below the poverty line (Mukherjee & Saha, 2020).

Dependence on middlemen: The dependence on middlemen is a pervasive issue in the Sundarbans' fish markets. Approximately 85% of fishermen rely on intermediaries to access larger markets, as poor infrastructure and lack of transportation prevent direct sales to consumers (Chowdhury et al., 2021). Middlemen often exploit their position by underpricing fishermen's catch, capturing significant margins during resale. Fishermen typically earn less than 40% of the retail price of their fish, significantly reducing their profitability. This dependence stems from systemic issues, including lack of cooperative frameworks and inadequate market access, leaving fishermen with little bargaining power. Without direct access to market platforms or consumer networks, fishermen are forced to accept the terms set by intermediaries, perpetuating cycles of economic hardship.

2. Environmental Challenges:

Decline in fish stock due to climate change and pollution: The Sundarbans, known for its biodiversity and reliance on aquatic ecosystems, faces severe challenges due to climate change and pollution. Fish stocks in the region have declined significantly, with a 20% reduction in fish diversity over the last two decades (Das et al., 2018). Rising temperatures and unpredictable weather patterns, attributed to global climate change, have disrupted breeding cycles and migration patterns of key species like hilsa and prawns. Pollution, particularly from industrial and agricultural runoff, has led to the accumulation of harmful chemicals in rivers, damaging aquatic ecosystems and further reducing fish populations. Cyclones, which have increased in intensity and frequency, not only destroy fishing infrastructure but also introduce large amounts of sediment and contaminants into the water, exacerbating habitat degradation.

Increased salinity affecting aquatic ecosystems: Salinity levels in the Sundarbans have risen by 15% over the past two decades, largely due to reduced freshwater flow from upstream rivers and rising sea levels caused by climate change (Mukherjee & Saha, 2020). This salinity increase has disrupted the delicate balance of the estuarine ecosystem, causing significant changes in fish habitat suitability. Species sensitive to salinity fluctuations, such as freshwater fish, have seen sharp population declines. The mangrove ecosystem, which serves as a breeding ground for many fish species, is also under threat, as increased salinity affects the health of the mangroves, reducing their capacity to support aquatic life. Fishermen in the region report having to travel farther and spend more time fishing to make up for reduced yields, increasing operational costs and economic hardship.

3. Social Challenges:

Lack of access to proper healthcare and education: The Sundarbans, a region heavily dependent on fishing, faces significant social challenges, particularly in access to healthcare and education. Over 60% of fishing households live below the poverty line, earning less than ₹6,000 per month, which limits their ability to afford healthcare and education services (Mukherjee & Saha, 2020). The region has limited healthcare infrastructure, with fishermen reporting difficulties accessing basic medical facilities during injuries or illnesses caused by fishing-related activities. Cyclone-induced disasters further strain these facilities, making healthcare inaccessible in emergencies. Education access is similarly constrained, with only 25% of children in fishing households completing secondary schooling due to financial pressures and the need to contribute to family income. The lack of education perpetuates a cycle of poverty, as children are unable to access alternative livelihoods outside fishing.

Gender-based inequities (women's role in fish markets): Women in the Sundarbans play a crucial role in fish markets, particularly in processing, drying, and sales, yet they face systemic inequities. Despite their contributions, women earn 20% less than men for similar work and are often excluded from leadership or decision-making roles in cooperatives and market operations (Ghosh, 2020). Additionally, women lack access to loans and resources needed to scale their businesses, leaving them dependent on male intermediaries. Cultural and social norms further restrict their mobility and economic autonomy, limiting opportunities for growth and self-sufficiency. This gender disparity affects not only women's financial independence but also the overall productivity and efficiency of the fish markets.

4. Market Inefficiencies:

Poor infrastructure: The fish markets in the Sundarbans suffer from inadequate infrastructure, which severely impacts the efficiency and profitability of fishing activities. Surveys show that only 20% of fishermen have access to proper cold storage facilities, resulting in post-harvest losses of 25% annually (Barman et al., 2019). Transportation infrastructure is equally deficient, with remote fishing areas like Hingalganj and Dhamakhali lacking reliable roads, making it difficult to transport fresh fish to larger markets like Kolkata. Fishermen in these regions incur high transport costs, reducing their net earnings. The lack of modernized auction platforms and hygienic processing facilities further reduces the quality and competitiveness of fish products, limiting the ability of fishermen and merchants to command better prices.

Exploitation by intermediaries: Dependence on intermediaries is a pervasive issue in the Sundarbans' fish markets, where 85% of fishermen rely on middlemen to access buyers (Chowdhury et al., 2021). These intermediaries exploit their dominant position, purchasing fish at rates significantly below market prices. Fishermen typically earn less than 40% of the retail price, with the bulk of profits captured by intermediaries. This exploitation stems from the absence of direct-to-consumer market channels and cooperative frameworks that could empower fishermen. Merchants also face challenges, as intermediaries often manipulate market supply and prices, creating additional barriers to profitability. This dependence traps fishing communities in cycles of economic vulnerability and poverty.

V. Discussion

Compare findings with global trends in fish markets: The challenges faced by the fish markets in the Sundarbans are reflective of broader global trends, though they manifest in region-specific ways due to unique environmental, economic, and social contexts. Globally, fish markets face issues of overfishing, resource depletion, and market inefficiencies. According to the Food and Agriculture Organization (FAO), nearly 33% of global fish stocks are overexploited, driven by unsustainable fishing practices and climate change, which parallels the 20% decline in fish diversity observed in the Sundarbans due to rising salinity and habitat loss (Das et al., 2018; FAO, 2020). Similar patterns are evident in Southeast Asia, where coastal ecosystems like the Sundarbans are under threat from pollution, mangrove deforestation, and illegal fishing.

Market inefficiencies are another global concern, with fishermen in low-income countries often earning less than 50% of the retail value of their catch, similar to the Sundarbans' figure of 40% (Chowdhury et al., 2021). In Sub-Saharan Africa and South Asia, intermediaries dominate supply chains, exploiting small-scale fishermen and capturing disproportionate profits. By contrast, countries such as Norway and Iceland have implemented cooperative frameworks and direct-to-consumer sales channels, significantly improving income levels for fishermen. These cooperative models offer valuable lessons for the Sundarbans, where 85% of fishermen rely on intermediaries due to poor infrastructure and lack of alternative market access.

Globally, infrastructure deficits are a recurring issue in fisheries, with post-harvest losses ranging from 20–35% in developing nations, comparable to the Sundarbans' 25% loss due to inadequate cold storage and transport facilities (Barman et al., 2019). In advanced economies like Japan, investments in supply chain technologies, including refrigerated transport and e-market platforms, have minimized losses and stabilized market prices. The absence of such systems in the Sundarbans highlights the region's need for technological and infrastructural upgrades to compete in national and international markets.

Gender disparities in fisheries, a challenge in the Sundarbans, also align with global trends. Women worldwide constitute nearly 50% of the workforce in fisheries-related activities but often face wage gaps, limited access to resources, and exclusion from decision-making roles (Ghosh, 2020; FAO, 2020). Gender-inclusive policies in countries like Kenya, which empower women through training and access to credit, provide a model for addressing these disparities in the Sundarbans.

The comparison underscores the need for the Sundarbans to adopt successful global practices, such as cooperative governance, technological investments, and gender-inclusive policies, to address local challenges while enhancing sustainability and profitability in its fish markets.

Analyze the intersection of socio-economic and environmental issues: The socio-economic and environmental challenges in the Sundarbans are deeply interconnected, creating a cycle of vulnerability that impacts both the livelihoods of fishing communities and the health of the ecosystem. On the environmental front, rising salinity levels, which have increased by 15% over two decades, and the loss of 0.2% of mangrove cover annually have led to a 20% decline in fish diversity, including high-demand species like hilsa and tiger prawns (Das et al., 2018; Mukherjee & Saha, 2020). These ecological stressors directly affect fishermen, who report spending 25% more time and resources to achieve the same catch volumes as a decade ago. This results in increased operational costs and lower profitability, with 60% of fishing households earning below ₹6,000 per month, placing them below the poverty line (Chowdhury et al., 2021).

Economic pressures further exacerbate environmental degradation, as fishermen adopt unsustainable practices to maximize short-term yields. Overfishing, spurred by the need to meet immediate income demands, depletes fish stocks and disrupts breeding cycles, intensifying the ecological crisis. Poor infrastructure compounds these challenges; the lack of cold storage and transport facilities causes 25% post-harvest losses annually, forcing fishermen to rely on intermediaries, who exploit them by offering reduced prices (Barman et al., 2019). This economic exploitation discourages investment in sustainable practices and advanced equipment that could reduce environmental impact.

Social inequities, such as gender disparities, add another layer to the issue. Women, who are integral to fish processing and sales, earn 20% less than men and have limited access to resources needed for environmentally sustainable practices (Ghosh, 2020). Additionally, limited education access perpetuates generational poverty, with children of fishing families unable to pursue alternative livelihoods, creating dependency on declining fish stocks.

Environmental changes, such as rising sea levels and increased cyclone frequency, further strain socio-economic resilience. Projections indicate that 40% of fishing zones could be submerged by 2050, displacing thousands of fishermen and exacerbating competition for shrinking resources (Chowdhury & Banerjee, 2021). This convergence of socio-economic and environmental challenges creates a feedback loop: ecological degradation undermines economic stability, and economic pressures drive unsustainable exploitation of resources.

Addressing this intersection requires integrated solutions that balance environmental conservation with socio-economic empowerment. Policies promoting sustainable fishing practices, investments in infrastructure, and programs supporting alternative livelihoods can break this cycle, fostering resilience in both communities and ecosystems.

VI. Conclusion and Recommendations

Key Findings: The Sundarbans' fish markets face a range of interconnected socio-economic and environmental challenges that significantly impact the livelihoods of fishermen and merchants. **Environmental challenges** such as rising salinity, which has increased by 15% over the past two decades, and habitat loss due to mangrove deforestation at a rate of 0.2% annually have caused a 20% decline in fish stocks, particularly in high-demand species like hilsa and tiger prawns (Das et al., 2018). Climate change, with rising sea levels and more frequent cyclones, threatens to submerge 40% of fishing zones by 2050, further exacerbating these ecological pressures (Chowdhury & Banerjee, 2021).

On the **economic front**, fishermen face systemic exploitation, earning less than 40% of the retail value of their catch due to reliance on intermediaries. Post-harvest losses of 25% annually result from inadequate infrastructure, such as cold storage and poor transportation facilities, reducing profitability (Barman et al., 2019). The **social challenges** are equally pressing: limited access to education and healthcare perpetuates poverty, with only 25% of children in fishing families completing secondary education (Mukherjee & Saha, 2020). Gender disparities persist, with women earning 20% less than men despite playing a significant role in fish processing and sales (Ghosh, 2020).

These findings underscore the urgent need for integrated solutions addressing environmental conservation, infrastructure development, and socio-economic equity to ensure the long-term sustainability of the Sundarbans' fisheries sector.

Policy Recommendations:

1. Sustainable Fishing Practices

Implementing sustainable fishing practices is essential to preserve fish stocks and ensure the long-term viability of the Sundarbans' fisheries. This includes:

- **Fishing Quotas and Seasonal Bans:** Establish scientifically determined quotas to prevent overfishing and enforce seasonal bans during breeding periods to allow fish populations to recover.
- **Community-Led Conservation:** Promote community-based fishery management programs, empowering local fishermen to regulate and monitor fishing activities, ensuring resource sustainability.
- **Training and Education:** Conduct awareness campaigns and workshops on sustainable practices, highlighting the ecological and economic benefits of resource conservation.

2. Investment in Fish Market Infrastructure

Improving infrastructure can drastically reduce post-harvest losses and increase profitability for fishermen. Key recommendations include:

- **Cold Storage Facilities:** Establish modern cold storage units in key fish markets to reduce spoilage and extend the shelf life of perishable products.
- **Transportation Networks:** Upgrade transportation infrastructure, such as roads and refrigerated vehicles, to ensure timely delivery of fresh fish to urban markets.

- **Processing Units:** Build hygienic fish processing units equipped with modern technology to enhance product quality and value, enabling access to premium markets.

3. Direct-to-Consumer Market Models

Reducing dependence on intermediaries through direct-to-consumer models can significantly improve earnings for fishermen. This can be achieved through:

- **E-Market Platforms:** Develop digital platforms where fishermen can connect directly with consumers, bypassing intermediaries and ensuring fair pricing.
- **Fishermen's Cooperatives:** Establish and strengthen cooperatives to negotiate better prices, pool resources for storage and transport, and access financial support.
- **Market-Based Incentives:** Provide subsidies or tax incentives for local entrepreneurs to set up community-run retail outlets where fishermen can sell directly to end users.

Implementation Support

To ensure these policies are effective, the government should partner with NGOs, private sector stakeholders, and international organizations to mobilize resources and expertise. By addressing ecological and socio-economic challenges simultaneously, these measures can secure sustainable livelihoods for the Sundarbans' fishing communities while preserving the region's unique ecosystems.

Future Research:

- Longitudinal studies on ecological impacts.
- Gender-focused studies in fisheries.

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