

Sustainable Management Practices for Fish Waste in Madanpur and Simurali Fish Markets

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Abstract:

Fish is a vital source of protein in India, and the Indian fishing industry plays a pivotal role in the nation's economy. India ranks as the world's second-largest fish producer, yielding approximately 4.3 million metric tons of fish annually. To meet this high demand, fish production continues to rise, resulting in a significant amount of fish waste. In India, nearly 2 million metric tons of fish waste are generated annually, with West Bengal contributing a substantial 1,770.310 tons in 2019. Our research concentrates on the Madanpur and Simurali fish markets in the Nadia district. These markets generate substantial quantities of fish waste, often mismanaged due to the lack of awareness among fishermen. Various forms of waste, including fish scales, swim bladders, and fins, are prevalent. Our survey report underscores the need for proper management of these waste materials to ensure sustainable growth and mitigate the environmental pollution resulting from fish waste. Fish scales, in particular, serve as a valuable source of chitin and collagen, finding applications in cosmetics, pharmaceuticals, and the food industry. Additionally, fish waste can be processed into fish food, offering a balanced diet for Thai Magur and ornamental fishes. In today's context, it is imperative to educate stakeholders about fish waste management and raise awareness about the adverse environmental impact of neglecting this critical issue. By addressing these challenges, we can harness the full potential of the Indian fishing industry while promoting environmental sustainability.

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Introduction:

In recent times, there has been a drastic increase in the utilization of natural resources. From 1970 to 2017, the consumption of natural resources surged from 92.1 billion to 127 billion, reflecting a remarkable 254% hike (Guterres et al., 2019). Fishery, being an age-old activity, has significantly shaped human society (Ormanci et al., 2019; Sanyal et al., 2023). The Indian fishery industry alone generates approximately 2 million metric tons of fish waste, encompassing swim bladders, fish debris, scales, fins, and bones. India stands out as a major fish-producing hub, exporting around 11.5 lakh fish in 2015-2016, with the potential to yield 5.5 lakh tons of waste (Ahmad, 2019). Fish waste is characterized by a high organic content, making its management a costly affair. Effluents rich in fish waste can lead to eutrophication (Amirkolaie et al., 2011; Saha et al., 2017; Mondal et al., 2022). However, these fishery wastes harbor the potential to be transformed into eco-friendly products through certain processes, thereby offering a sustainable solution (Eseroghene & Ikechukwu, 2018). This book chapter aims to shed light on the production of fish wastes in Madanpur and Simurali fish markets situated in the Nadia district, exploring their plausible economically and environmentally sustainable applications.

Survey on fish waste in Madanpur and Simurali fish market:

India holds the position of being the second-largest fish-producing country, with an impressive capability to yield approximately 4.3 million metric tons of fish (Mukherjee et al., 2022a). Madanpur and Simurali serve as prominent fishing hubs in the Kalyani and Chakdaha regions, respectively. The fish market in Madanpur enjoys local popularity and is often bustling with activity. Typically, 12 fishermen occupy the main market area, while an additional 7-8 are situated along the roadside near the entry point. In comparison, the Simurali fish market, although less locally renowned than Madanpur, boasts greater diversity due to its involvement in fish import and export activities. Apart from being one of the significant markets in Nadia for international trade, Simurali also hosts a local fish market catering to the needs of the community. The Simurali local fish market is characterized by more confined space, yet it remains highly congested, accommodating around 30-32 fishermen.

The rate of waste production is generally lower, primarily due to a lack of awareness among the populace. A considerable number of people remain uninformed about the potential by-products of fish waste (Mukherjee et al., 2022b). Post-fish sales, many individuals are unsure about how to effectively utilize fish waste, such as rubbish and scales. Consequently, there is a general lack of interest in managing these waste products. It is during this period that fish waste collectors become pivotal figures in the process. They willingly collect the waste at no cost to the sellers and, in turn, generate a significant income from it. Those who are slightly more informed about the value of fish waste compensation receive a monthly sum ranging from 200 to 250 rupees. However, a substantial portion of fish sellers, unaware of the potential economic benefits, perceive the waste collector's role as merely ensuring the cleanliness of the area, deeming it sufficient. This survey was conducted during the months of June and July 2022.



Figure 1. Simurali fish market.



Figure 2. Madanpur fish market.

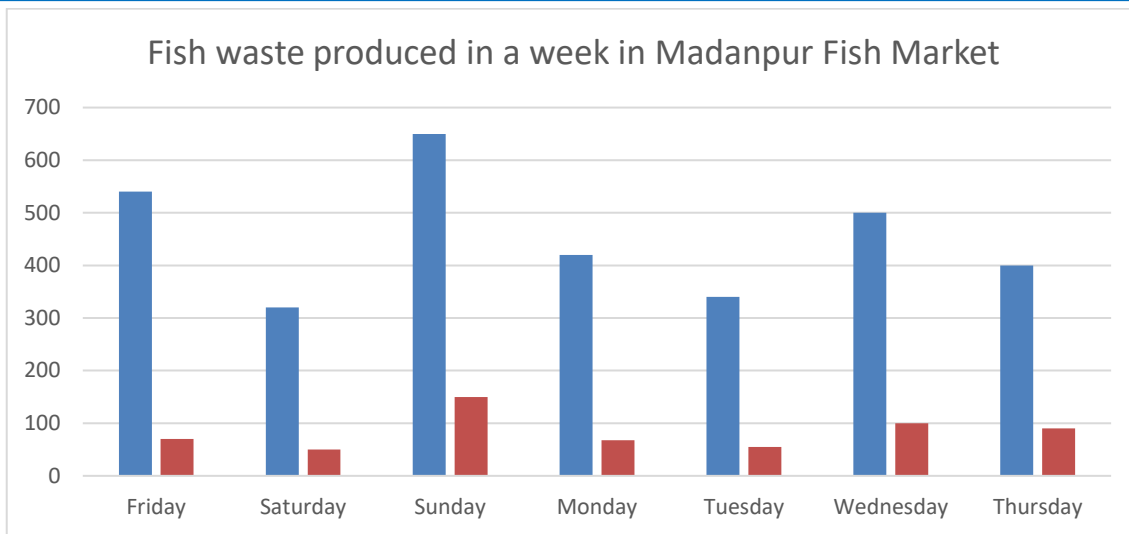


Figure 3. The fish waste production chart in which the blue line denotes the total amount of fish present in the fish market denoted as kg and the orange line signifies the production of fish waste.

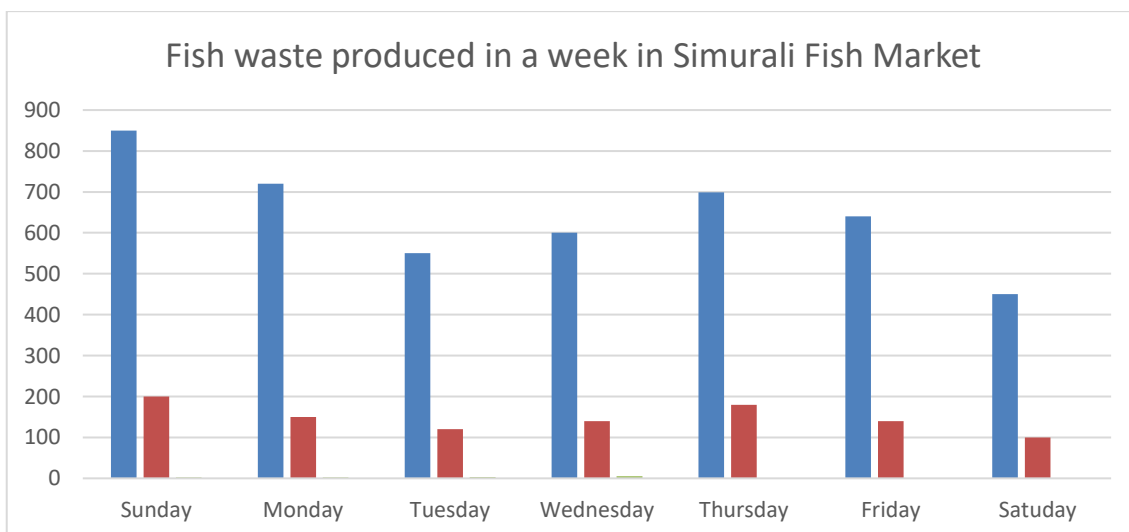


Figure 4. The fish waste production chart in which blue line denotes the total amount of fish present in fish market is denoted as kg and the orange line signifies the production of fish waste.

Appropriate uses of fish rubbish for sustainable growth and economical approach:

After conducting a survey between Madanpur and Simurali fish markets, we identified mainly three types of fish waste products, such as scales, digestive organs of fish, and swim bladders.

Fish scale:

Fish scales, a key component of fish refuse, are also a major source of pollution (Rahman et al., 2018). Despite their environmental impact, there is a high market demand for fish scales, leading to a systematic chain from collection to manufacturing. This business primarily focuses on the scales of Indian major carps such as *Labeo* and *Cirrhinus*. The process begins with scale

collectors gathering scales from fish markets, cleaning them, and sun-drying the scales before supplying them to middlemen or retailers. The middlemen then purchase the scales at rates ranging from 60-70 rupees/kg to 80-100 rupees/kg, depending on seasonal demand. The scales are subsequently sold directly to companies, which may choose to export them, sell them to other companies, or use them in manufacturing various products. Additionally, fish scales are openly sold online, expanding their market reach. Leveraging biotechnological processes, fish scales can be transformed into a valuable resource, simultaneously reducing their environmental toxicity (Coello, 1996).



Figure 5. Fish rubbish produced in Madanpur and Simurali fish market.

The biotechnological industry plays a crucial role in this transformation, extracting collagen and chitin from processed fish scales. Collagen, a structural protein found in fish scales, finds application in the pharmaceutical industry. Gelatin, a fibrous protein derived from collagen, is used in the pharmaceuticals, food, and photography industries (Jamilah, 2002; Liu et al., 2008). Chitin, another significant component of fish scales, is produced through deproteinization and deamination processes. Chitin has diverse applications in medicine, food preservation, and as food additive (Takarina, 2017). This innovative circular economy approaches not only adds

value to fish scales but also contributes to sustainable practices in the fishing industry (Saha, 2023).



Figure 6. Collected fish scales dried by middle woman.



Figure 7. Fish rubbish grinding machine for preparing fish feed.

Fish swim bladder:

Processed swim bladder stands out as one of the most valuable fish by-products in South-East Asian countries. Isinglass, an extract from fish swim bladders, is a gelatinous substance highly prized for its applications in the cosmetic, beer, and wine industries. Locally referred to as fish maw, the dried swim bladder holds significant economic importance (Akhilesh, 2022). In Kolkata, West Bengal, prominent traders like JB Group and Basu International export high-quality dry fish maw to Hong Kong and China at competitive market prices. Various types of fish maws, including those from dried Bhetki, dara, eel, yellow Croaker, among others, are sought after in the international market.

Typically, fish maws undergo a sun-drying process before being either packed for export or stored in a dark place. Some traders opt to use chemicals for preservation, ensuring an extended shelf life, while others prioritize maintaining a 100% natural product by avoiding preservatives. This strategic approach to processing fish maws not only caters to the diverse demands of international markets but also highlights the versatility and significance of fish by-products in the global trade landscape.

Conclusion and awareness:

Awareness plays a pivotal role in effective waste management, especially within the fishing industry. A significant number of fish sellers and fishermen lack knowledge about the recycling processes and potential by-products of fish waste. This lack of awareness can result in severe issues such as water and soil pollution. During our survey, instances of rotten fish were encountered, and due to insufficient knowledge, fish sellers were either giving them away for free or disposing of them improperly. The inappropriate handling of fish waste not only results in economic losses but also contributes to environmental pollution. To address this challenge and promote sustainable development and economic growth, it is imperative to instigate proper awareness and education programs. Workshops and awareness programs for fish sellers can be organized to enlighten them about the extraction, management, processing, and potential uses of fish waste. By enhancing the knowledge of those involved in the fishing industry, we can ensure the proper utilization of fish rubbish, minimizing economic losses and mitigating environmental pollution for the long-term benefit of communities and ecosystems.

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