



ISSN Print: 2664-9926
 ISSN Online: 2664-9934
 NAAS Rating (2026): 4.82
 IJBS 2026; 8 (6): 96-99
www.biologyjournal.net
 Received: 05-03-2026
 Accepted: 07-04-2026

Prachi V Pawar
 N. E. S. Science College,
 Nanded, Maharashtra, India

Shrinivas K Pawar
 Gramin (ACS) Mahavidyalaya,
 Vasantnagar, Mukhed,
 Maharashtra, India

Corresponding Author:
Prachi V Pawar
 N. E. S. Science College,
 Nanded, Maharashtra, India

Estimation of revenue potential from fish scale waste-derived biofertilizer in major fish markets of Nanded city, Maharashtra, India

Prachi V Pawar and Shrinivas K Pawar

DOI: <https://www.doi.org/10.33545/26649926.2026.v8.i6b.864>

Abstract

Fish scale waste is one of the most neglected by-products generated in fish markets and is commonly discarded without economic utilization. This study estimated the potential revenue that could be generated through the conversion of fish scale waste into biofertilizer in three major fish markets in Nanded City, Maharashtra, namely, Taroda Fish Market, Itwara Fish Market, and Friday Fish Market. Data on fish scale wastage were obtained from a year-long survey conducted from January 2024 to December 2024. The annual fish scale waste generated was estimated to be 4,734 kg in Taroda Market, 3,954 kg in Itwara Market, and 1,530 kg in Friday Fish Market, resulting in a total annual generation of 10,218 kg. Assuming a conversion efficiency of 90%, the total biofertilizer production potential was estimated to be 9,197 kg. Considering a conservative market value of ₹20 per kilogram of biofertilizer, the projected annual revenue was ₹183,940. This study highlights the economic and environmental benefits of fish scale waste valorization and demonstrates its potential as a sustainable waste management strategy for fish markets.

Keywords: Fish scale waste, biofertilizer, fish market waste, waste valorization, revenue estimation, circular economy, Nanded

1. Introduction

The fisheries sector plays a crucial role in food security, nutrition, and livelihood generation in India (Singh *et al.*, 2024; Beraki *et al.*, 2022) ^[23, 8]. With the rise in fish consumption and commercialization, substantial quantities of waste are generated during fish handling, processing, and marketing activities (De Ungria *et al.*, 2023) ^[6]. Fish waste generally consists of scales, skin, bones, fins, heads, viscera, and other discarded materials that are not consumed (Padma *et al.*, 2024) ^[15]. These wastes often constitute 30-60% of the total fish biomass, depending on the species and processing methods (Ling Wen Xia *et al.*, 2024) ^[12].

Among the various fish processing by-products, fish scales are often overlooked and discarded as solid waste (Mangal *et al.*, 2023) ^[14]. Improper disposal of fish scales contributes to environmental pollution, foul odor generation, microbial contamination, and increased waste management costs (Junianto *et al.*, 2022) ^[11]. However, fish scales contain valuable organic and inorganic components, including collagen, hydroxyapatite, calcium phosphate, nitrogenous compounds, and trace minerals, making them suitable raw materials for fertilizer production (Safronova *et al.*, 2022) ^[17].

Recent advances in waste valorization have highlighted the conversion of fish processing waste into economically valuable products, such as collagen, gelatin, animal feed supplements, biochar, compost, and biofertilizers (Rigueto *et al.*, 2023) ^[16]. Biofertilizers produced from fish waste have gained attention due to their ability to improve soil fertility, enhance nutrient availability, and promote sustainable agricultural practices (Sameer, 2023) ^[18]. These products offer a viable alternative to synthetic fertilizers while simultaneously reducing the environmental burden associated with waste disposal (Babcock-Jackson *et al.*, 2023) ^[3].

Nanded City is a major urban center in Maharashtra, where fish marketing activities are concentrated in markets such as Taroda Fish Market, Itwara Fish Market, and Friday Fish Market (Gedam *et al.*, 2023) ^[10]. Significant quantities of fish scales are generated daily in

these markets (Mangal *et al.*, 2023) ^[14]. Despite their potential value, these scales are currently discarded without any organized utilization process (Bahariniya *et al.*, 2021) ^[4]. Estimating the economic potential of fish scale waste can provide scientific evidence for establishing community-level waste processing units and encourage sustainable resource-recovery initiatives (Padma *et al.*, 2024) ^[15].

The present study aimed to estimate the potential revenue that could be generated by converting fish scale waste into biofertilizer, using annual fish scale wastage data collected from major fish markets in Nanded City (Balkhande & Issak, 2024) ^[24].

Objectives

The objectives of this study were as follows:

Study Area

The study was conducted in three major fish markets in Nanded City, Maharashtra:

Taroda Fish Market

The Taroda Fish Market serves a large urban and peri-urban population and handles substantial quantities of freshwater fish, including Rohu, Catla, Mrigal, Tilapia, etc.

Itwara Fish Market

The Itwara Fish Market is one of the oldest fish markets in Nanded and acts as a central fish distribution hub.

Friday Fish Market

The Friday Fish Market operates weekly and attracts vendors from surrounding villages and nearby districts.

2. Study Duration

The survey was conducted from January 2024 to December 2024.

3. Data Collection

Data on fish scale waste generation were obtained through direct market observations, vendor interviews, and measurements of fish waste produced during fish-cleaning

and processing activities (Asiamah *et al.*, 2022) ^[2]. Monthly observations were compiled to estimate the annual generation of fish scale waste (Silvert & Sowles, 1996) ^[21].

4. Estimation of Biofertilizer Production

This study did not involve the actual production of biofertilizers. Instead, the revenue potential was estimated based on the theoretical conversion of fish scale waste into biofertilizer (Alvarado-Ramírez *et al.*, 2023) ^[1]. A conversion efficiency of 90% was assumed to account for processing losses during composting, drying, and stabilization (Sayara *et al.*, 2020) ^[20].

Formula

Biofertilizer Yield (kg) = Fish Scale Waste (kg) × 0.90

Biofertilizer Yield (kg) = Fish Scale Waste (kg) × 0.90

3.5 Revenue Estimation

The projected revenue was calculated using a conservative market price of 20 per kilogram ₹ of biofertilizer.

Formula

Estimated Revenue (₹) = Biofertilizer Yield (kg) × Selling Price (kg⁻¹) ₹ ₹ -

5. Revenue Estimation

The projected revenue was calculated using a conservative market price of 20 per kilogram ₹ of biofertilizer.

Results

Table 1: Annual Fish Scale Waste Generation

Market	Annual Fish Scale Waste (kg)
Taroda Fish Market	4,734
Itwara Fish Market	3,954
Friday Fish Market	1,530
Total	10,218

The survey revealed that the Taroda Fish Market produced the highest quantity of fish scale waste (4,734 kg/year), followed by the Itwara Fish Market (3,954 kg/year) and the Friday Fish Market (1,530 kg/year).

Table 2: Estimated Biofertilizer Production Potential

Market	Fish Scale Waste (kg)	Conversion Efficiency (%)	Estimated Biofertilizer (kg)
Taroda Fish Market	4,734	90	4,261
Itwara Fish Market	3,954	90	3,559
Friday Fish Market	1,530	90	1,377
Total	10,218	90	9,197

The projected biofertilizer production from all markets combined was estimated to be 9,197 kg annually.

Table 3: Estimated Revenue Potential

Market	Biofertilizer Yield (kg)	Price (₹ kg ⁻¹)	Estimated Revenue (₹₹)
Taroda Fish Market	4,261	20	85,220
Itwara Fish Market	3,559	20	71,180
Friday Fish Market	1,377	20	27,540
Total	9,197	20	183,940

The Taroda Fish Market contributed the highest projected annual revenue, followed by Itwara Fish Market and Friday Fish Market.

Table 4: Alternative Market Scenarios

Selling Price (₹ kg-1)	Estimated Annual Revenue (₹)
20	183,940
30	275,910
40	367,880
50	459,850

The projected revenue increased proportionally with the increasing market value of the biofertilizer product.

6. Discussion

The findings of the present study indicate that fish scale waste generated in Nanded fish markets represents a valuable bioresource with significant economic potential (Balkhande & Issak, 2024) ^[23]. Although fish scales are generally treated as waste, their nutrient-rich composition makes them suitable for conversion into organic fertilizers (Junianto *et al.*, 2022) ^[11]. The estimated annual production of 9,197 kg of biofertilizer demonstrates that even moderate quantities of fish scale waste can be transformed into marketable products (Alvarado-Ramírez *et al.*, 2023) ^[1].

The estimated annual revenue of 183,940, obtained under conservative assumptions, ₹ underscores the feasibility of waste valorization initiatives (Dhar *et al.*, 2021) ^[9]. Similar studies have reported the successful use of fish processing waste in the production of compost, organic fertilizers, and agricultural amendments (Devi *et al.*, 2024) ^[8]. The conversion of fish waste into biofertilizers not only reduces environmental pollution but also contributes to resource recovery and the principles of a circular economy (Mahari, 2024) ^[13].

The Taroda Fish Market demonstrated the highest revenue generation potential due to its larger volume of fish trade and waste production. If organized collection systems and decentralized processing units are established, fish vendors and local entrepreneurs can benefit from additional income sources (H. Singh *et al.*, 2024). Additionally, biofertilizer production could reduce dependence on chemical fertilizers and promote sustainable agricultural practices in the region (Dutta *et al.* 2024) ^[5].

This study relied on projected estimates rather than actual biofertilizer production. Future studies should focus on pilot-scale processing, nutrient characterization, product quality assessment, market acceptance, and cost-benefit analyses to validate the commercial feasibility of fish scale-based biofertilizers.

Environmental Implications

The utilization of fish scale waste offers several environmental advantages:

7. Conclusion

The present study demonstrates that fish scale waste generated in major fish markets in Nanded City possesses substantial economic and environmental value. The total annual fish scale waste generation of 10,218 kg was estimated from the Taroda Fish Market, Itwara Fish Market, and Friday Fish Market. Assuming a conversion efficiency of 90%, approximately 9,197 kg of biofertilizer could potentially be produced annually. At a conservative selling price of 20 per ₹ kilogram, the projected annual revenue was estimated at 183,940. ₹

The findings indicate that valorizing fish scale waste can serve as a sustainable waste management strategy while

ultaneously creating economic opportunities for fish vendors, waste collectors, and local entrepreneurs. Establishing small-scale biofertilizer production units in Nanded could contribute to environmental sustainability, resource recovery, and the enhancement of rural livelihoods.

References

- Alvarado-Ramírez L, Santiesteban-Romero B, Poss G, Sosa-Hernández JE, Iqbal HMN, Parra-Saldívar R, Bonaccorso AD, Melchor-Martínez EM. Sustainable production of biofuels and bioderivatives from aquaculture and marine waste. *Frontiers in Chemical Engineering*. 2023;4. <https://doi.org/10.3389/fceng.2022.1072761>
- Asiamah A, Oduro-Yeboah C, Mboom F, Atter A, Idun-Acquah N, Nkansah J. Assessment of the volume of seafood waste generation, utilization and management system from selected seafood processing companies in Ghana: A case study. *African Journal of Food, Agriculture, Nutrition and Development*. 2022;22(112):20924-20941. <https://doi.org/10.18697/ajfand.112.21745>
- Babcock-Jackson L, Konovalova T, Krogman JP, Bird R, Díaz LL. Sustainable Fertilizers: Publication Landscape on Wastes as Nutrient Sources, Wastewater Treatment Processes for Nutrient Recovery, Biorefineries, and Green Ammonia Synthesis. *Journal of Agricultural and Food Chemistry*. 2023;71(22):8265-8296. <https://doi.org/10.1021/acs.jafc.3c00454>
- Bahariniya S, Ezatiasar M, Madadzadeh F. A Brief Review of the Types of Validity and Reliability of scales in Medical Research. *Journal of Community Health Research*. 2021;10(2). <https://doi.org/10.18502/jchr.v10i2.6582>
- Dutta S, Hazra A, Paul I, Mitra N. Exploring the current consumer market status of chemical fertilizer vs. biofertilizer industries in West Bengal, India: an on-site investigation. *South Asian J Agric Sci*. 2024;4(1):147-153. doi:10.22271/27889289.2024.v4.i1b.124.
- De Ungria ST, Fernandez LTT, Sabado SEF, Santos JPE, Sararaña ARB, Vincacruz-Abeledo CC. How is fish market waste managed in the Philippines? *Environmental Science and Pollution Research*. 2023;30(17):49512-49522. <https://doi.org/10.1007/s11356-023-25882-0>
- Devi NL, Singh AH, Nongthombam J, Kumar S, Chaudhary KP. Fish Waste Compost - A Fertilizer for Organic Agriculture. *Journal of Experimental Agriculture International*. 2024;46(11):778-785. <https://doi.org/10.9734/jeai/2024/v46i113098>
- Beraki T, Zerom H, Arefe T, Goitom M, Yemane A. Report of mass fish mortality along the Eritrean coast and islands. *Acta Entomol Zool*. 2022;3(2):36-39. DOI:10.33545/27080013.2022.v3.i2a.74.
- Dhar S, Singh R, Shrivastava M, Sangwan S. Waste to Wealth: Innovative Ideas and Technological Initiatives.

- CRC Press; 2021. p. 581-593. <https://doi.org/10.1201/9781003245384-33>
10. Gedam A, Amrawkar R, Dongare V. Fish Marketing System in Aurangabad District (Maharashtra). *International Journal of Advanced Research in Science, Communication and Technology*. 2023;204-206. <https://doi.org/10.48175/ijarsct-8141>
 11. Junianto J, Shabastiano HM, Aulia LN, Hadiana F, Rahmaniar A. Utilization of Fish Scales for Non-Food Products: A Review. *Asian Journal of Fisheries and Aquatic Research*. 2022;20(5):45-50. <https://doi.org/10.9734/ajfar/2022/v20i5508>
 12. Ling Wen Xia F, Supri S, Djamaludin H, Nurdiani R, Leong Seng L, Wee Yin K, Rovina K. Turning waste into value: Extraction and effective valorization strategies of seafood by-products. *Waste Management Bulletin*. 2024;2(3):84-100. <https://doi.org/10.1016/j.wmb.2024.06.008>
 13. Mahari W. AQUACULTURE WASTES AS A RESOURCE: AN OVERVIEW. *Planetary Sustainability*. 2024;2(2). <https://doi.org/10.46754/ps.2024.07.004>
 14. Mangal S, Ranjan G, Gupta SD, Ray M. Fish scales: Waste processing as a potential source of bioactive compounds. *FLORA AND FAUNA*. 2023;29(2):313-320. <https://doi.org/10.33451/florafaua.v29i2pp313-320>
 15. Padma KR, Anjum MR, Sankari M, Don KR, Nakka S, Harathi K, Sirisha T. Transforming Fish Waste into High-value Resources: A Sustainable Approach to Circular Bioeconomy. *UTTAR PRADESH JOURNAL OF ZOOLOGY*. 2024;45(23):48-59. <https://doi.org/10.56557/upjz/2024/v45i234685>
 16. Riguetto CVT, De Oliveira R, Gomes KS, Alessandretti I, Nazari MT, Rosseto M, Krein DDC, Loss RA, Dettmer A. From waste to value-added products: A review of opportunities for fish waste valorization. *Environmental Quality Management*. 2023;33(1):203-221. <https://doi.org/10.1002/tqem.22040>
 17. Safronova T, Vorobyov V, Kildeeva N, Shatalova T, Toshev O, Filippov Y, Dmitrienko A, Gavlina O, Chernega O, Nizhnikova E, Akhmedov M, Kukueva E, Lyssenko K. Inorganic Powders Prepared from Fish Scales. *Ceramics*. 2022;5(3):484-498. <https://doi.org/10.3390/ceramics5030037>
 18. Sameer MS. From Waste To Wealth: The Potential Of Fish-Based Fertilizers In Crop Production. *Journal of Survey in Fisheries Sciences*. 2023;10(3):705-709. <https://doi.org/10.53555/sfs.v10i3.3116>
 19. Sayara T, Basheer-Salimia R, Hawamde F, Sánchez A. Recycling of Organic Wastes through Composting: Process Performance and Compost Application in Agriculture. *Agronomy*. 2020;10(11):1838. <https://doi.org/10.3390/agronomy10111838>
 20. Silvert W, Sowles JW. Modelling environmental impacts of marine finfish aquaculture. *Journal of Applied Ichthyology*. 1996;12(2):75-81. <https://doi.org/10.1111/j.1439-0426.1996.tb00066.x>
 21. Singh A, Surasani VKR. Fish processing: An entrepreneurial opportunity for livelihood and income generation. *Journal of Krishi Vigyan*. 2020;9(1):144-149. <https://doi.org/10.5958/2349-4433.2020.00151.8>
 22. Singh H, Ranjan D, Verma P, Upadhyay AK, Kumar P, Singh A. Current Issues with Fish and Fisheries Sector: Challenges and Solutions. *Biotica Research Today*. 2024;6(1):39-45. <https://doi.org/10.54083/bioretoday/6.1.2024/39-45>
 23. Abioye OM, Olasehinde DA, Abadunmi T. The Role of Biofertilizers in Sustainable Agriculture: An Eco-Friendly Alternative to Conventional Chemical Fertilizers. *Applied Science and Engineering Progress*. 2023. <https://doi.org/10.14416/j.asep.2023.07.001>
 24. Balkhande JV, Issak SA. Fish waste to priceless asset a survey of fish waste from fish markets of Nanded city, Nanded (MS) India. *FLORA AND FAUNA*. 2024;30(2):375-379.