



International Journal of Agriculture and Food Science

ISSN Print: 2664-844X
 ISSN Online: 2664-8458
 NAAS Rating (2026): 4.97
 IJAFS 2026; 8(10): 01-03
www.agriculturaljournals.com
 Received: 31-07-2026
 Accepted: 18-09-2026
 Published: 01-10-2026

Syed Hamza Syed Saidoddin

Assistant Fisheries
 Development officer,
 Government of, Mumbai,
 Maharashtra, India

Sana Kausar Mainoddin Patel

Assistant Fisheries
 Development officer,
 Government of, Mumbai,
 Maharashtra, India

Nikhil Madhavrao Salunke

Assistant Fisheries
 Development officer,
 Government of, Mumbai,
 Maharashtra, India

Valorization of low-value fish for sustainable and innovative seafood product development

Syed Hamza Syed Saidoddin¹, Sana Kausar Mainoddin Patel², Nikhil Madhavrao Salunke³

DOI: <https://www.doi.org/10.33545/2664844X.2026.v8.i10a.1993>

ABSTRACT

Low-cost and underutilized fish species often receive limited market value because of their small size, undesirable appearance, high perishability, seasonal availability, or limited consumer preference. Processing these fish into value-added products such as fish balls, nuggets, sausages, burgers, patties and imitation crab sticks can improve resource utilization and increase economic returns. Surimi technology is particularly useful because it concentrates functional myofibrillar proteins and allows different fish species to be converted into standardized products. Recent studies have demonstrated the potential of Indian mackerel, Indian major carps, tilapia and other species for surimi and restructured seafood production. Proper washing, dewatering, salt extraction, formulation, heating and frozen storage are important for obtaining desirable texture, colour and water-holding capacity (Somjid *et al.*, 2021; Gore *et al.*, 2022; Xie *et al.*, 2024). Fish analogue production can therefore contribute to post-harvest loss reduction, livelihood development and sustainable fisheries resource utilization.

Keywords: Low-cost fish, Fish analogue, Surimi, Value addition, Fish products, Sustainable fisheries

1. Introduction

Fish is an important source of high-quality protein, essential amino acids, omega-3 fatty acids, vitamins and minerals. However, many small-sized, irregularly shaped or seasonally abundant fish species receive comparatively low market prices. Fish prices may vary considerably according to species, season, abundance and market demand (Shyam *et al.*, 2018) [1]. Converting such fish into value-added products provides an opportunity to improve their economic utilization.

Seafood value addition can include products such as fish fingers, nuggets, cutlets, sausages, fish balls, burgers and surimi-based products. ICAR-CIFT has developed several value-added seafood products using low-valued fish and processing resources (Parvathy *et al.*, 2020) [2]. Such approaches can reduce dependence on fresh-fish markets and create opportunities for small-scale processing enterprises.

2. Low-cost fish as raw material

Low-cost fish are not necessarily nutritionally inferior. Their low price may result from small size, high bone content, unattractive appearance, dark muscle, strong flavour, seasonal abundance or inadequate market infrastructure. Suitable species should have good protein content, acceptable freshness, adequate meat yield and sufficient functional properties.

Table 1. Important characteristics of fish suitable for analogue production

Characteristic	Importance
Freshness	Improves protein functionality
Protein content	Required for gel formation
Low oxidation	Improves flavour and shelf life
Good meat yield	Improves processing economics
Suitable colour	Improves product appearance
Gel-forming ability	Essential for surimi products
Regular availability	Supports continuous production
Food safety	Essential for consumer protection

(continued on next page)

Corresponding Author: Syed Hamza Syed Saidoddin

Assistant Fisheries
 Development officer,
 Government of, Mumbai,
 Maharashtra, India

Indian mackerel has been investigated as an alternative surimi raw material, with washing treatments improving several quality characteristics (Somjid *et al.*, 2021) [3]. Indian major carps have also been evaluated for mince and gel production (Gore *et al.*, 2022) [4].

3. Fish analogues and surimi technology

Fish analogues are processed seafood products designed to reproduce selected characteristics of other seafood products. Imitation crab sticks are one of the most common examples. Other products include fish balls, sausages, nuggets and patties.

Surimi technology involves mechanical separation of edible muscle followed by washing, dewatering, refining and mixing with salt and other functional ingredients. Salt helps extract myofibrillar proteins, particularly myosin, which form a heat-induced gel responsible for the characteristic texture of many surimi products (Bagonoc *et al.*, 2021; Xie *et al.*, 2024) [5, 6].

General processing flow

Low-cost fish → Washing → Dressing → Meat separation → Mincing → Washing → Dewatering → Refining → Salt/ingredients → Chopping → Forming → Heating → Cooling → Packaging → Storage

Washing can improve colour and remove blood, pigments, sarcoplasmic proteins and undesirable compounds. However, excessive washing may reduce product yield and increase wastewater generation (Somjid *et al.*, 2021) [3].

4. Development of value-added products

Low-cost fish can be converted into several commercially useful products.

Table 2. Major fish analogue products

Product	Major characteristics
Imitation crab stick	Surimi-based, coloured and shaped seafood product
Fish nugget	Breaded and fried/baked product
Fish ball	Gelled minced-fish product
Fish sausage	Emulsified fish product
Fish burger/patty	Formed minced-fish product
Fish cutlet	Seasoned and breaded value-added product

Product quality depends on fish freshness, protein functionality, salt concentration, starch or hydrocolloid addition, heating conditions and storage (Walayat *et al.*, 2022; Yang *et al.*, 2025) [7, 8].

5. Nutritional and economic importance

Fish analogues can provide high-quality protein in convenient forms. Depending on the raw material and formulation, products may also provide omega-3 fatty acids, minerals and other nutrients. However, formulation and processing can change moisture, fat, sodium and protein levels, so nutritional evaluation should be conducted for each product.

Value addition can increase the economic utility of low-priced fish by converting raw material into products with longer shelf life and wider market opportunities. Small processing units, cooperatives, women's self-help groups, farmer-producer organizations and seafood enterprises can participate in such activities. Consumer studies have also shown interest in value-added fish products, with taste, price and perceived health benefits influencing purchasing decisions (Tanuja *et al.*, 2020).

6. Quality and food safety

Important quality parameters include proximate composition, pH, colour, texture, gel strength, water-holding capacity, lipid oxidation, microbial quality and sensory acceptability. Packaging is equally im-

portant for maintaining product quality during storage. Vacuum packaging has been investigated for improving the refrigerated storage stability of shrimp analogue products (Priyadarshini *et al.*, 2022) [9].

Food safety and correct species identification are critical because processed seafood products can be vulnerable to species mislabelling. DNA barcoding and metabarcoding have been used to authenticate species in surimi-based products (Zhang *et al.*, 2024; Detcharoen *et al.*, 2024) [11, 10]. Commercial products should therefore comply with applicable FSSAI standards for fish and fish products.

7. Sustainability and future prospects

Utilization of low-cost fish can contribute to better use of fisheries resources and reduce avoidable post-harvest losses. Processing trimmings and edible portions that have limited fresh-market value can also support circular approaches to seafood production. FAO (2024) [12] emphasizes improved resource efficiency and value creation within sustainable aquatic food systems.

Future research should focus on reduced-water surimi processing, natural antioxidants, hydrocolloids, improved packaging, low-sodium formulations, rapid species authentication and advanced processing technologies. Artificial intelligence and machine vision may also support automated quality assessment and process control.

8. Conclusion

Low-cost and underutilized fish have considerable potential for development of value-added fish analogues. Surimi technology provides a practical platform for producing imitation crab sticks, fish balls, sausages, nuggets and other restructured seafood products. Proper selection of raw material, washing, dewatering, formulation, heating, packaging and quality control are essential for successful product development. Value addition can improve the utilization and economic potential of low-cost fish while supporting employment, entrepreneurship and sustainable fisheries resource management.

References

- Shyam SS *et al.* Valuation of marine fish landings in India. *Marine Fisheries Information Service*. 2018;237:13–16.
- Parvathy U, Binsi PK, Ashok Kumar K, Ravishankar CN. Seafood value addition: Current trends and future prospects. *Indian Farming*. 2020;70(11):38–40.
- Somjid P, Panpipat W, Cheong LZ, Chaijan M. Reduced washing cycle for sustainable mackerel surimi production. *Foods*. 2021;10:2717.
- Gore SB, Balange AK, Nayak BB *et al.* Comparative analysis of unwashed and single washed mince gel from Indian major carps. *Journal of Food Science and Technology*. 2022;59:377–387.
- Bagonoc RR C, Yoo MJ Y. Effects of formulation and processing techniques on physicochemical properties of surimi gel. *Food Life*. 2021;2021(2):35–46.
- Xie D *et al.* Various factors affecting the gel properties of surimi: A review. *Journal of Texture Studies*. 2024;55:e12847.
- Walayat N *et al.* Role of food hydrocolloids as antioxidants along with modern processing techniques on surimi protein gel properties. *Antioxidants*. 2022;11:486.
- Yang Y, Gao Y, He Y *et al.* Factors influencing surimi gelling properties and natural additive-based gel fortification strategies: A review. *Comprehensive Reviews in Food Science and Food Safety*. 2025;24:e70067.
- Priyadarshini MB *et al.* Effect of vacuum packaging on the shelf-life of shrimp analog prepared from *Pangasionodon hypophthalmus* surimi during refrigerated storage. *Journal of Food Processing and Preservation*. 2022;46:e16369.
- Detcharoen M *et al.* Metabarcoding for authentication of fish species in surimi-based products by Nanopore sequencing. *Food Bioscience*. 2024;61:104628.

11. Zhang X *et al.* Molecular authentication of surimi-based products using DNA barcoding and metabarcoding. *Food Control*. 2024;155:110110.
12. Food and Agriculture Organization (FAO). The State of World Fisheries and Aquaculture 2024: Blue Transformation in Action. FAO, Rome; 2024.

How to cite this article: Syed Saidoddin SH, Patel SKM, Salunke NM. Valorization of low-value fish for sustainable and innovative seafood product development. *International Journal of Agriculture and Food Science*. 2026;8(10):01-03. doi: <https://www.doi.org/10.33545/2664844X.2026.v8.i10a.1993>