IJCRT.ORG ISSN : 2320-2882

INTERNATIONAL JOURNAL OF CREATIVE RESEARCH THOUGHTS (IJCRT)

An International Open Access, Peer-reviewed, Refereed Journal

An Assessment Of Marketing Strategies And Nutritional Health Status Of Selected Freshwater Fishes In Mayiladuthurai District, Tamil Nadu, South India

Sachithanantham Sindhuja[1]* and B. Varadarajan[1]

[1]P.G. and Research Department of Commerce, A.V.C. College (Autonomous), Mannampandal, Mayiladuthurai, Tamil Nadu, India. Affiliated to Bharathidasan University, Tiruchirappalli.

***Corresponding author**: Sachithanantham Sindhuja, Ph. D. Scholar, P.G. and Research Department of Commerce, A.V.C. College (Autonomous), Mannampandal, Mayiladuthurai – 609 305.

Abstract: Freshwater aquaculture plays a vital role in India's food system, nutrient enhancement, and rural livelihoods, particularly in inland districts in Tamil Nadu. The present study aims to assess the marketing strategies adopted by freshwater fish farmers and to evaluate the nutritional health status of major cultured fish species in the Mayiladuthurai district. Primary data were collected from 157 respondents, including fish farmers, market intermediaries, retailers, and consumers, using a structured questionnaire and stratified random sampling techniques. Nutritional analysis was conducted on selected freshwater fish species—Catla (Catla catla), Rohu (Labeo rohita), Mrigal (Cirrhinus mrigala), and Tilapia (Oreochromis niloticus)—to determine moisture, protein, lipid, carbohydrate, and ash content using standard laboratory procedures. The findings reveal that freshwater fish farming in the study area is predominantly polyculture-based, with most produce marketed through retailers and wholesalers due to limited access to cooperatives and direct marketing channels. Post-harvest constraints such as inadequate cold storage and high labour costs significantly influence marketing efficiency. Nutritional analysis indicates that all studied species possess high nutritional value, with Tilapia showing the highest protein content, while Catla offers comparatively higher energy value. The study concludes that improved marketing infrastructure, reduced reliance on intermediaries, and greater awareness of nutritional benefits can strengthen farmers' incomes and ensure the availability of high-quality freshwater fish to consumers. Policy interventions focusing on cooperative marketing, cold storage facilities, and digital platforms are recommended to promote sustainable freshwater aquaculture development in the region.

Keywords- Freshwater aquaculture, Marketing strategies, Nutritional composition, Carp culture, Mayiladuthurai District.

1. INTRODUCTION

Indian fisheries have grown more than thirteenfold with an increase in fish production from 0.752 million tons in 1950-51 to 10.07 million tons in 2014-15 (DADF, 2014), of which the share from the aquaculture sector alone is around 4.15 million tons (FAO, 2014). Particularly in developing nations, freshwater aquaculture is essential to rural livelihoods, nutrition, and global food security. India is the world's second-largest fish producer, and freshwater aquaculture plays a major role in the country's fish output (FAO, 2022). Freshwater fish resources in India play a vital role in nutritional security, rural livelihoods, and economic growth, particularly in inland states with extensive riverine, reservoir, and aquaculture systems. At the small-scale level, commercial fish production is growing in popularity. Freshwater fish farming is one of the most important methods of producing fish (Ghosh et al. 2019). India ranks second in the world in inland fish

production, next to China. China, with one-fifth of the world's population, accounts for one-third of the world's reported fish production and two-thirds of the world's reported aquaculture production (FAO, 2014). Markets handling species like tilapia, catla, rohu, mrigal, freshwater eel, murrel, pangas, and common carp exhibit structured channels involving fishers, auctioneers, wholesalers, retailers, and consumers, with tilapia dominating 90% of catches in reservoirs like Ujjani due to its taste and affordability. Indian freshwater aquaculture is dominated by carp-based polyculture systems because of their economic feasibility, high production, and adaptability (ICAR, 2020). Tamil Nadu is one of India's top inland fish-producing states thanks to its ideal climate, large irrigation tanks, and growing use of scientific aquaculture techniques.

In India, the private sector is mostly in charge of fish marketing, with public bodies paying minimal attention to it (Waghmare et al. 2023). Farmers typically sell to wholesalers and retailers through common channels, and inefficiencies like high margins lower farmer profitability, as observed in comparable districts of Tamil Nadu. To increase pricing and efficiency, strategies could focus on digital platforms, cooperatives, or direct-to-consumer approaches. National wholesale marketplaces are run in an unorganized fashion, with agents and middlemen facilitating trade (Kumar et al., 2008). Fish is a crucial part of a balanced human diet since the industry offers premium animal protein and vital nutrients like vitamins, minerals, and omega-3 fatty acids (Mohanty et al., 2019). In addition to being a great source of protein, fish also includes minerals, omega-3 fatty acids, and other elements (Benjakul et al. 2014; Holub and Holub, 2004). Consumption determines the price of agricultural commodities, whereas supply is a major factor in determining the price of marine fisheries (Sathiadhas, 1997). The primary group of living things in the aquatic environment, zooplankton is an essential component of the food chain in aquatic habitats (Manickam et al 2017) rich in essential amino acids and fatty acids (Kanazawa et al., 1979). They are crucial to the diets of certain vertebrates and invertebrates. As the phytoplankton community shifts, the availability of food and water quality may affect zooplankton growth. Nutritional composition, particularly protein and lipid content, is influenced by feed quality, stocking density, water quality, and health management practices (Prabu et al., 2017). Indian fresh water aquaculture system mostly revolves around 3 to 6 species combination based composite carp culture; whereas in China, farmers stock as much as 10 or more compatible fish species in a single pond so as to effectively and efficiently utilize all the available feeding zones, feeding niches/sub niches and carrying capacity of the pond for optimizing the fish growth and productivity. In China, a large number of cultivable indigenous and exotic fish species such as big head carp, silver carp, grass carp, common carp, white Amur bream, mud carp, black/snail carp, stripped catfish, tilapia, Wuchang bream, black bream, crucian carp, freshwater yellow tail, snakehead, loach, Mandarin fish, roach, river.

Although marketing systems and nutritional elements of freshwater aquaculture have been the subject of several research, there are still few district-level integrated assessments that combine both aspects. There is a dearth of thorough study in the Mayiladuthurai District that connects marketing tactics to the nutritional health of freshwater fish raised in captivity. Developing sustainable aquaculture models that increase farmer income while guaranteeing the availability of nutrient-dense fish to consumers requires an understanding of this relationship. Therefore, the present study aims to 1) analyse the marketing strategies adopted by freshwater fish farmers in Mayiladuthurai District. 2) Assess the nutritional health status of major cultured freshwater fish species, and 3) Identify key challenges and suggest suitable interventions for improving marketing efficiency and fish quality.

1.2 The Scope of the Study

The present study concentrates on identifying the key determinants of marketing strategies employed in commercial freshwater fish farming under the economic stimulus package in Mayiladuthurai District.

2. MATERIALS AND METHODS

2.1 Selection of Study Area and Villages

The study area was confined to Mayiladuthurai District, Tamil Nadu, South India, which was purposively selected for its significant freshwater aquaculture activity, the availability of perennial and seasonal water bodies, and the presence of commercial fish farming practices. To ensure spatial representation, the district was stratified into different aquaculture zones based on the concentration of fish farming activities, irrigation sources, and water availability. From each stratum, representative villages were selected using stratified random sampling to avoid location bias and ensure coverage of diverse farming conditions and marketing environments.

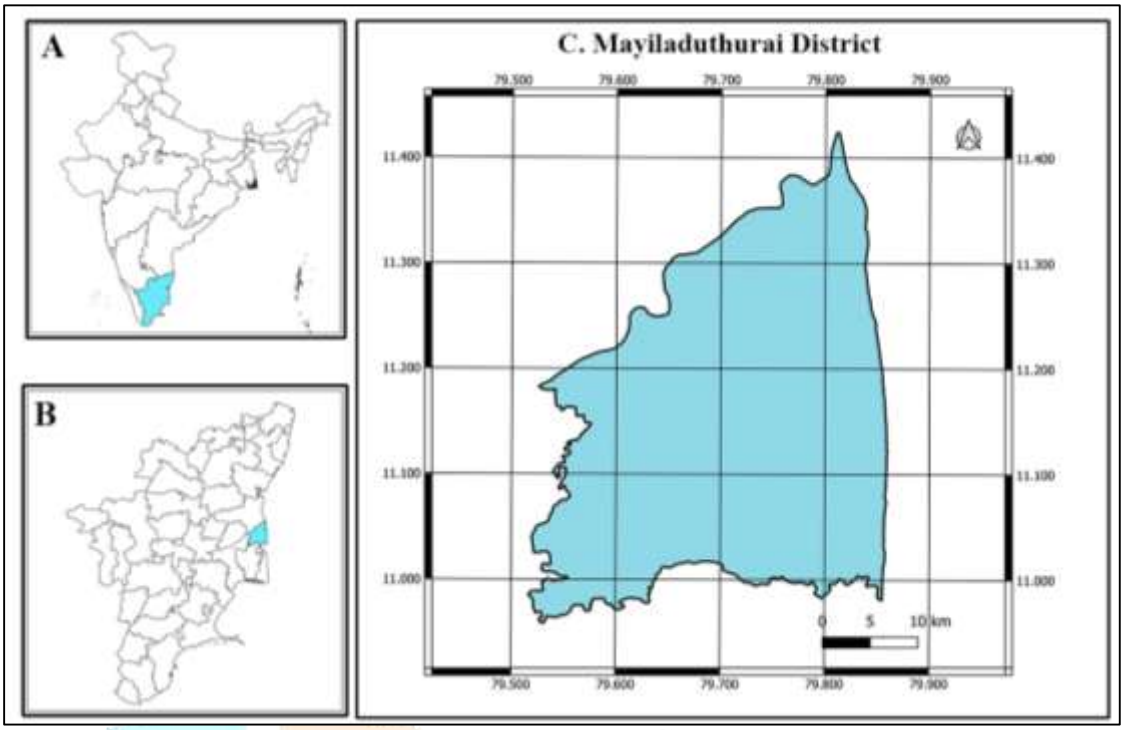

Fig. 01: Study Area Map

2.2 Selection of Fish Farms

Freshwater fish farms within the selected villages were identified through local fisheries department records, farmer associations, and village-level aquaculture networks. A stratified random sampling method was used to select farms. Farms were categorized into different strata based on:

1. Farm size (small, medium, and large-scale farms)
2. Type of culture system (extensive, semi-intensive, intensive)
3. Nature of operation (subsistence-oriented vs. commercial farms)

From each category, farms were randomly selected to ensure balanced representation of different production systems and business scales. This approach minimized sampling bias and enhanced the reliability and generalizability of the study findings. Respondents were selected using a various category such as, Fish farmers (primary producers), Market intermediaries (brokers, wholesalers), Retail fish vendors, Consumers.

2.3 Selection of Fish Species for Nutritional Assessment

Fish species for nutritional and health assessment were selected based on their economic importance, production volume, and market demand in the study area. The major freshwater species included:

Catla (*Catla catla*),

Rohu (*Labeo rohita*),

Mrigal (*Cirrhinus mrigala*),

Tilapia (*Oreochromis* niloticus).

These species represent the dominant carp-based polyculture system and commercially important freshwater fishes in the Mayiladuthurai District. From each selected farm, representative samples of market-size fish were collected to ensure consistency in nutritional and health analysis.

2.4 Fish Sample Collection Protocol

Fish samples were collected randomly from selected ponds using standard harvesting techniques. Only healthy, marketable-size individuals were included in the study to reflect the quality of fish entering the marketing system. Samples were transported under chilled conditions to the laboratory for nutritional and health analysis, maintaining sample integrity and preventing biochemical degradation.

2.5 Nutritional value analysis

The nutritional values, such as carbohydrate by Dubois et al.,1956, Protein (Lowry et al.,1951), Lipid (Folch et al., 1957) Ash and Moisture content were measured by AOAC (2005), were analysed by the standard procedure.

3. RESULTS AND DISCUSSION

3.1 Socio-Economic Profile

In total 157 respondents were surveyed, predominantly middle-aged (42.6%), with primary education common (46.7%) and fish farming as the main income for 57.3%. Experience varied widely, with 29.8% having <3 years. Catla (36.2%) was the leading cultured species in mostly polyculture systems (81.8%), sourced primarily from borewells (64.3%) (Table 01).

Table 01: Socio-Economic Profile of Freshwater Fish Farmers in Mayiladuthurai District

Sl. No	Category	Group	Percentage
1	Age (years)	30-40	34.0
		40-41	42.6
		50-60	17.0
		Above 60	6.4
2	Education	Uneducated	13.3
		Primary	46.7
		Secondary	16.0
		Higher secondary	4.0
		Graduate and above	20.0
3	Is fish farming your primary source of income?	Yes	57.3
		No	42.7
4	Fish farming experience	10 to 20	17.0
		4 to 6	27.7
		7 to 10	19.1
		Less than 3	29.8
		More than 25	6.4
5	Major fish species cultured	Catla	36.2
		Rohu	20.3
		Mrigal	17.4
		Tilapia	21.7
		Others	4.3
6	Source of water	Borewell	64.3
		River	21.4
		River and borewell	14.3
7	Type of culture	Polyculture	81.8
		Monoculture	18.2

3.2 Production

Fish farmers reported moderate annual fish production, with 80% sold in local markets, reflecting a strong commercial orientation. Harvesting was mainly seasonal (45%) or continuous (40%), with 15% demand-driven. The productivity, with 32% yielding 300-500 kg/ha/yr and 28% at 700-1000 kg/ha/yr and from the total production 80% in market-sold (Fig. 02). This replicates the growing change of inland aquaculture from subsistence-based activities to market-driven enterprises, a trend widely observed across many inland aquaculture regions in India (FAO, 2014; Jayasankar and Das, 2014).

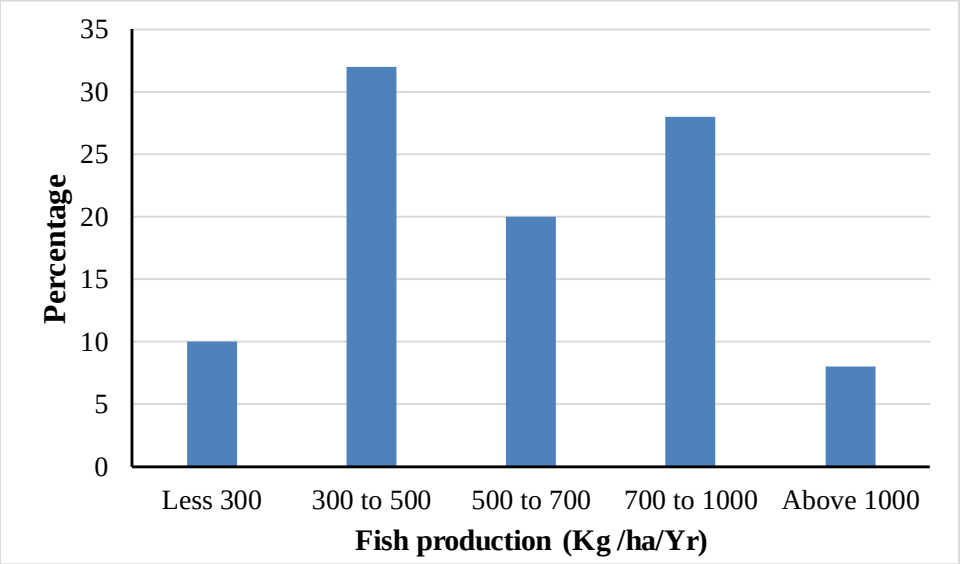

Fig. 02: Annual Fish Production Levels (kg/ha/yr) among Farmers in Mayiladuthurai District

3.3 Marketing Channels & Distribution

Marketing channels revealed retailer sales as primary (49%), followed by wholesalers (28%) and commission agents (21%), with negligible direct-to-consumer (3%) or cooperative (0%) use (Fig. 03). Marketing strategy includes all basic, short-term and long-term activities in the field of marketing that deal with the analysis of the strategic initial situation of a company, the formulation, evaluation, selection of market-oriented strategies and therefore contribute to the goals of the company. (Varadarajan et al., 1999). The majority of farmers prefer to quickly dispose of fish at the farm gate or at local markets to reduce transportation hazards and post-harvest losses, as evidenced by their strong reliance on merchants. Due to the perishable nature of fish, similar trends have been observed in other inland fisheries throughout India, where retailers are essential in connecting producers with final consumers (Kumar and Singh, 2008; Solanke et al. 2013).

Fig. 03: Marketing Channels Used by Freshwater Fish Farmers in Mayiladuthurai District

3.4 Marketing Costs & Infrastructure

Only 20% of fish farmers had access to their own cold storage facilities, while 80% lacked them, relying instead on ice boxes as their primary temporary storage method. A maximum of farmers used only icebox storage. Major species, such as Catla, Rohu, Mrigal and Tilapia, fetch market prices of ₹220, ₹150, ₹150, and ₹180 per kg, respectively. These rates support profitability for moderate yields (Fig 04). Post-harvest costs were dominated by labour (40%) and ice storage (30%), reflecting reliance on manual handling and ice boxes amid 80% lacking cold storage. Transportation and commission each accounted for 20% and 5%, respectively (Fig. 05).

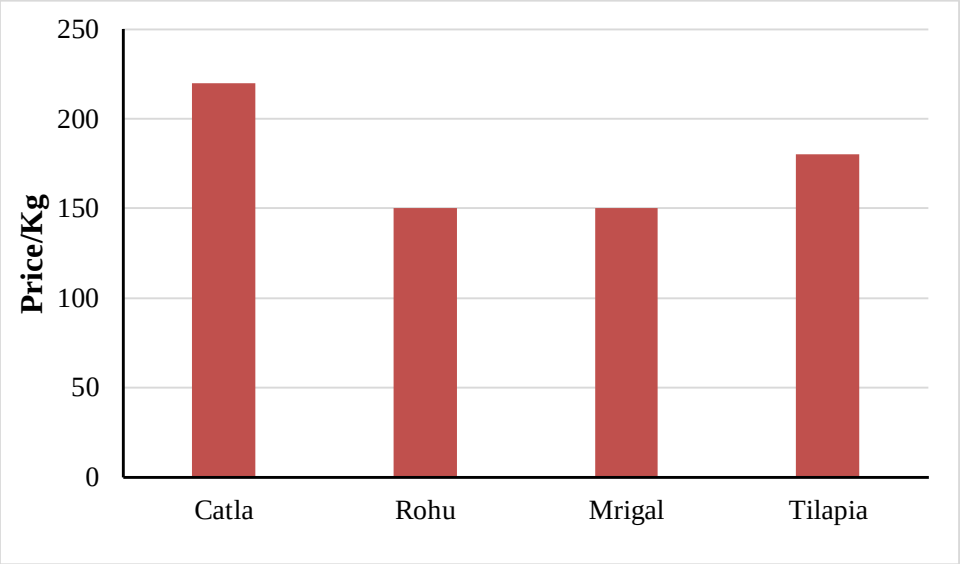

Fig. 04: Market Prices of Major Cultured Freshwater Fish Species in Mayiladuthurai District.

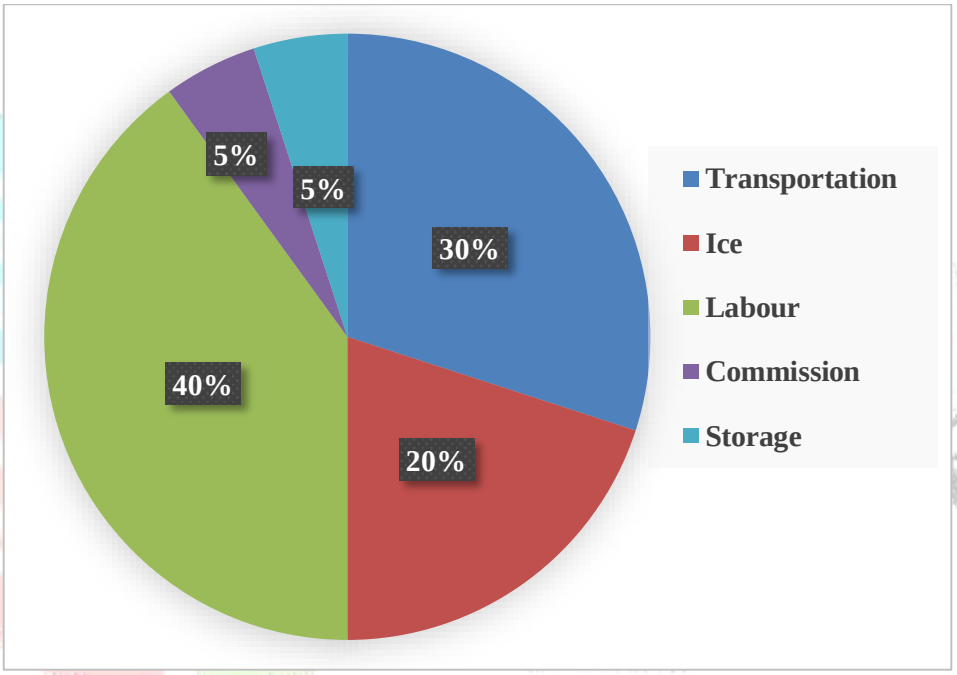

Fig. 05: Composition of Post-Harvest Marketing Costs in Mayiladuthurai District.

3.5 Nutritional value

Table 02 shows the nutritional value composition of Catla, Rohu, Mrigal, and Tilapia. Tilapia had the highest moisture content, followed by Rohu, Catla, and Mrigal. High moisture content in freshwater fish muscle is generally inversely related to lipid concentration, as reported by Ackman (2000). Freshwater fishes are known for their high moisture content, which is inversely correlated with lipid concentration. Ash content, a measure of overall mineral composition, differed very slightly amongst species (1.0 ± 0.3 to 1.2 ± 0.2 g/100 g), indicating similar mineral availability among fish. Compared to Rohu and Tilapia, Catla and Mrigal. The protein contents varied significantly. Among the fishes under study, tilapia had the highest protein content (20g/100 g) followed by other species, consistent with previous findings on carp-based polyculture systems in India (Prabu et al., 2017). All species have very little carbohydrate content (0.2–0.3 g/100 g), which is normal for fish muscle tissue because glycogen is only found in small amounts (Table 02). Overall, the findings show that all four species have good nutritional profiles, with Catla offering somewhat more calories and Tilapia being especially strong in protein. The fatty acid content of fish varies due to species, sex, size and other external factors like feed, temperature, salinity, geographical locations and general rearing condition (Sener et al., 2005). Kamler et al. (2001) Consumption of fish and fish oils containing ω-3 fatty acids prevents cardio vascular diseases, arthritis, psoriasis etc (Kris-Etherton and Haris, 2002 and Giri et al., 2010). Freshwater fish species are also known to contain high amount of EPA and DHA (Wang et al., 1990).

Table 02: Nutritional Composition of Major Cultured Freshwater Fish Species.

Sl. No.	Fish	Moisture (%)	Ash (g/100g)	Protein (g/100g)	Carbohydrate (g/100g)	Lipids (g/100g)
1	Catla	75±2	1.2±0.2	15.5±3	0.2±0.01	2.7±0.8
2	Rohu	76±3	1.1±0.2	15±4	0.2±5.01	1.5±0.9
3	Mrigal	74±2	1.2±0.2	15±3	0.2±0.01	1.5±0.7
4	Tilapia	77±4	1±0.3	20±3	0.3±0.01	1.7±0.9

4. CONCLUSION

The study on freshwater fish farming in Mayiladuthurai District reveals key socio-economic patterns among 157 respondents, with middle-aged farmers holding primary education and relying on fish farming as their main income source. Polyculture systems dominate, primarily using borewells for Catla, Rohu, Mrigal, and Tilapia, yielding moderate production levels of 300-1000 kg/ha/yr for most farms, with 80% sold locally. Marketing channels favour retailers, followed by wholesalers and commission agents, while post-harvest costs are labour-heavy and ice-dependent due to limited cold storage access. Market prices support profitability, with Catla leading over Rohu/Mrigal and Tilapia. Nutritional analysis confirms high-quality profiles across species: Tilapia excels in protein and moisture, followed by others. underscoring health benefits like omega-3 content for cardiovascular wellness. Policy recommendations include fostering cooperatives and digital platforms to reduce middlemen margins, investing in cold storage infrastructure to minimize losses, and providing training on polyculture optimization and nutritional marketing to enhance farmer incomes and sustainable aquaculture growth in Tamil Nadu.

In addition to building district-level cold storage facilities to mitigate post-harvest losses from ice-only reliance, policymakers can create farmer cooperatives to lessen reliance on middlemen and improve price realization. Direct-to-consumer sales will be made possible by promoting digital marketing platforms, and polyculture optimization training programs can increase yields. In addition to awareness efforts highlighting nutritional advantages, subsidies for borewell maintenance and alternate water sources would guarantee sustainability.

5. REFERENCES

1. Ackman, R.G., 1989. Nutritional composition of fats in seafoods. *Progress in food & nutrition science*, *13*(3-4), pp.161-289.
2. Benjakul, S., Yarnpakdee, S., Senphan, T., Halldorsdottir, S.M. and Kristinsson, H.G., 2014. Fish protein hydrolysates: production, bioactivities, and applications. *Antioxidants and functional components in aquatic foods*, pp.237-281.
3. Department of Animal Husbandry, Dairying and Fisheries (DADF). Annual Report 2013–2014. Ministry of Agriculture, Government of India, New Delhi.
4. FAO. 2014. The State of World Fisheries and Aquaculture. Food and Agriculture Organization of the United Nations, Rome.
5. Folch, J., Lees, M. and Stanley, G.S., 1957. A simple method for the isolation and purification of total lipides from animal tissues. *Journal of biological chemistry*, *226*(1), pp.497-509.
6. Jayasankar, P., Mohanta, K.N. and Ferosekhan, S., 2018. Freshwater aquaculture in India. *Aquaculture in India (Edited by: Tripathi SD, Lakra WS, Chadha NK)*, pp.23-49.
7. Kamler, E., Krasicka, B. and Rakusa-Suszczewski, S., 2001. Comparison of lipid content and fatty acid composition in muscle and liver of two notothenioid fishes from Admiralty Bay (Antarctica): an eco-physiological perspective. *Polar Biology*, *24*(10), pp.735-743.

8. Kanazawa, A., Teshima, S.L. and Ono, K., 1979. Relationship between essential fatty acid requirements of aquatic animals and the capacity for bioconversion of linolenic acid to highly unsaturated fatty acids. *Comparative biochemistry and physiology. B, Comparative Biochemistry*, *63*(3), pp.295-298.
9. Kris-Etherton, P.M., Harris, W.S. and Appel, L.J., 2002. Fish consumption, fish oil, omega-3 fatty acids, and cardiovascular disease. *circulation*, *106*(21), pp.2747-2757.
10. Kumar, A. and Singh, D.K., 2008. Livestock production systems in India: An appraisal across agro-ecological regions. Indian Journal of Agricultural Economics, 63(4).
11. Kumar, B. G., Datta, K. K., Joshi, P. K., Katiha, P. K., Suresh, R., Ravisankar, T., Ravindranath, K. and Menon, M. 2008. Domestic fish marketing in India-changing structure, conduct, performance and policies. Agricultural Economics Research Review, 21 (conf) : 345-354.
12. Lowry, O.H., Rosebrough, N.J., Farr, A.L. and Randall, R.J., 1951. Protein measurement with the Folin phenol reagent. *J biol Chem*, *193*(1), pp.265-275.
13. Mohanty, B.P., Mahanty, A., Ganguly, S., Mitra, T., Karunakaran, D. and Anandan, R., 2019. Nutritional composition of food fishes and their importance in providing food and nutritional security. *Food chemistry*, *293*, pp.561-570.
14. Prabu, E., Rajagopalsamy, C.B.T., Ahilan, B., Jeevagan, I.J.M.A. and Renuhadevi, M., 2017. Biofloc technology–an emerging trend in sustainable aquaculture: A Review. *Journal of Aquaculture in the Tropics*, *32*(3/4), pp.367-384.
15. Sathiadhas, R., 1997. *Production and marketing management of marine fisheries in India*. Daya Books.
16. Solanke, S.S., Krishnan, M., Sarada, C., Devi, B.N., Sivaraman, I. and Debnath, B., 2013. Production, price spread and marketing efficiency of farmed shrimp in Thane District of Maharashtra. Indian J. Fish, 60(3), pp.49-50.
17. Varadarajan, P.R. and Jayachandran, S., 1999. Marketing strategy: an assessment of the state of the field and outlook. *Journal of the academy of marketing science*, *27*(2), pp.120-143.
18. Waghmare, S., Prakash, S., Sharma, A., Yadav, B.K. And Qureshi, N., 2023. Market Analysis Driven Consumer Behavior Assessment of Selected Fish Markets in Maharashtra, India. *J. Inland Fish. Soc. India*, *55*(3), Pp.286-298.
19. Wang, Y.J., Miller, L.A., Perren, M. and Addis, P.B., 1990. Omega-3 fatty acids in Lake Superior fish. *Journal of food science*, *55*(1), pp.71-73.