



Assessment of Fish Production, Species Composition and Livelihood Constraints in Batticaloa Lagoon, Sri Lanka

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Abstract

In recent years, the demand and consumption for fish have increased significantly. Sri Lanka possesses abundant inland water resources, including lagoons; however, comprehensive data on fish production in these ecosystems remain limited. This study was conducted to assess the current status of fish production in Batticaloa Lagoon, with specific objectives of quantifying total yield, identifying major fishing methods and key species, and examining seasonal variations in fish production. A field survey was carried out using a pre-tested structured questionnaire, and fifty fishers were selected through cluster-based random sampling and also data were analyzed using SPSS version 22.0. The results revealed that 74% of respondents depended on fishing as their primary occupation, while 26% engaged in it as a secondary livelihood activity. The peak fishing season occurred from September to March, coinciding with the direct connection between the lagoon and the sea. The dominant fish species recorded were tilapia (16%), catfish (15%), herrings (14%), and *Gerres* spp. (11%), while crabs (1%) were harvested in smaller quantities. Despite high demand and market value for crabs and prawns, marketing facilities were found to be inadequate, with most fish sold in local markets or roadside stalls. Major constraints included adverse weather conditions, inadequate fishing equipment, low yields, poor market prices, limited credit access, and poverty. Strengthening market infrastructure, extension services, and financial support systems is essential to enhance the livelihoods of fishing communities.

Keywords: Batticaloa Lagoon, Fish production, Inland fisheries, Seasonal variation, Species composition

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Introduction

Background

Fisheries play an important role in the economy of Sri Lanka by providing the livelihood for more than 2.5 million people and contributing significantly to national food security through the provision of animal protein (Ministry of Fisheries, Aquatic and Ocean Resources, 2025). Fish has continued to be one of the main sources of animal protein in the diets of people in Sri Lanka. It is therefore necessary to ensure that there is sufficient intake of fish to provide food security for the populace. The fisheries sector in Sri Lanka is made up of three key sub-sectors.

According to the Sri Lanka Export Development Board (2025), in 2023, the marine fish production was 308,430 Mt (75.1%) and the total Inland and Aquaculture Fish Production was 102,330 MT (24.9%), and the total fish production was 410,760 MT. The marine fisheries sector is currently the primary producer in the fish production of the country. The fisheries industry is dependent on the presence of an Exclusive Economic Zone (EEZ) of about 517,000 km², which holds diversified fish resources having commercial values. Furthermore, there are 45 major brackish water lagoons and estuaries and 489,000 ha of inland water bodies, including reservoirs, perennial tanks, seasonal tanks, villus and brackish water lagoons in the country that hold immense potential for fisheries and aquaculture development (Amarasinghe *et al.*, 2022). The fisheries sector contributed about 0.9% to the GDP of the country in 2024 (Ministry of Fisheries, Aquatic and Ocean Resources, 2025).

Before 1985, Jaffna district was a dominant fish producing district that contributed more than 25% to the total marine fish production. But, at present, Kalutara district is the dominant fish producing district of the country. The main reason for that is well developed Beruwala fishery harbour which could be facilitated for fish landings (NARA, 2011). After relaxing the high security zone in the Northern and Eastern provinces, marine fish production of Jaffna, Killinochchi and Mulathive districts has been gradually increased.

Coastal lagoons are shallow brackish or marine bodies of water separated from the ocean by a series of barrier island, reef, or sand bank and connected at least intermittently to the open ocean by one or more restricted tidal inlets (Coastal Wiki, 2026). There are nearly 40 true lagoons around the coast of Sri Lanka. They are most common along the southern, south-eastern and eastern coasts, where coastal drift causes accumulations of sand as barriers at river mouths through which freshwater discharge is low (Coast Conservation and Coastal Resource Management Department, 2024). There are three lagoons; Vakaraï lagoon, Valaichenai lagoon and Batticaloa lagoon in Batticaloa district. Among these, Batticaloa lagoon is the third largest brackish water system in Sri Lanka and spreads over an area of 11,500 hectares. Batticaloa lagoon located in east coast of Sri Lanka located between 7° 24'-7° 46' N and 81° 35'-81° 49' E. The lagoon is about 56.8 km long along meridian

axis and it varies widely 0.5 km to 4 km. It opens up to the Indian Ocean via the two inlets one at Palameenmadu and the other at Kallar. The lagoon is shallow with irregular bottom topography (Wikipedia, 2026). Three distinct longitudinal zones could be recognized in this lagoon, the upper saline zone, the middle transitional zone with salinity fluctuations and the lower zone which is predominately fresh water zone. Lagoons are very important ecosystems that offer variety services provisioning, such as the production of food and water, regulating of gases, supporting, such as nutrient cycles, and cultural, such as spiritual and recreational benefits (Sugirtharan, Pathmarajah and Mowjood, 2014).

Batticaloa lagoon has been used for variety of purposes since prehistoric times. It plays a significant role in fulfilling protein requirements of the people and it has been as the second largest employer in this district since over 11,844 families depend on fishery sector in Batticaloa district. Although this lagoon has seasonally direct connection to the sea, it still displays fairly different characteristics than those of

the sea (Sugirtharan, Pathmarajah and Mowjood, 2019). There are many populations of fish found in Batticaloa lagoon such as *Leiognathide*, *Siganusjavus*, *Sillagoshiana*, *Chanidae*, *Clupedae*, *Anchovies*, *Mugilidae*, *Aridae*, and bivalve are also found in some areas of the lagoon like Kallar, Vallayiravu and Amirthakali. In spite of the availability of data on overall fish production in the official records species-wise data are not reported from the fishery of Batticaloa lagoon. In this lagoon there are about 12,312 fishermen whose livelihoods are entirely or mainly derived from the small scale, artisanal fishery. The fishing communities in the Batticaloa region have faced various problems such as water pollution, rapid increase in human population and the population pressure on ecosystem, lack of supportive facilities for fishermen, unstable production, sudden environmental changes, direct discharge of untreated water into lagoons, such as increasing in the supply of fishing equipment by NGOs and other organizations (Harris and Vinobaba, 2013).

The total population enumerated in the Batticaloa district is 515,857. This represents 56.2 percent increase since the last Census in 1981. The average annual growth rate during the period of 1981-2007 shows a decline from 2.7 percent to 1.7 percent. Due to increasing population, the need of fishing also increasing (Department of Census and Statistics, 2007). High catch of fish causes rapid reduction in fishing population. Therefore, the objectives of this study were to estimate the current fish yield of Batticaloa Lagoon, identify the main fishing methods and catch species, and assess seasonal variations in maximum fish production. Furthermore, the study aimed to identify the key constraints faced by fishers and provide recommendations for improving the sustainability of the fishing sector in the lagoon (Aruniya, Wickramaratne and Thilakarathne, 2024).

Materials and Methods

Description of study area

Batticaloa District is located in the Eastern Province of Sri Lanka (Figure 1) and covers an area of 2,854 km². Administratively, the district is divided into 14 Divisional Secretariat (DS) divisions, which are further subdivided into 346 Grama Niladhari (GN) divisions and 908 villages. In addition, the district comprises 17 Agrarian Service Centers supporting agricultural activities. The region experiences a tropical climate with average minimum and maximum temperatures of 26 °C and 31 °C, respectively. The annual rainfall ranges from 1,600 to 1,756 mm, and the average relative humidity is approximately 66%. The district falls within a distinct agro-ecological zone, supporting diverse agricultural and inland fisheries activities.

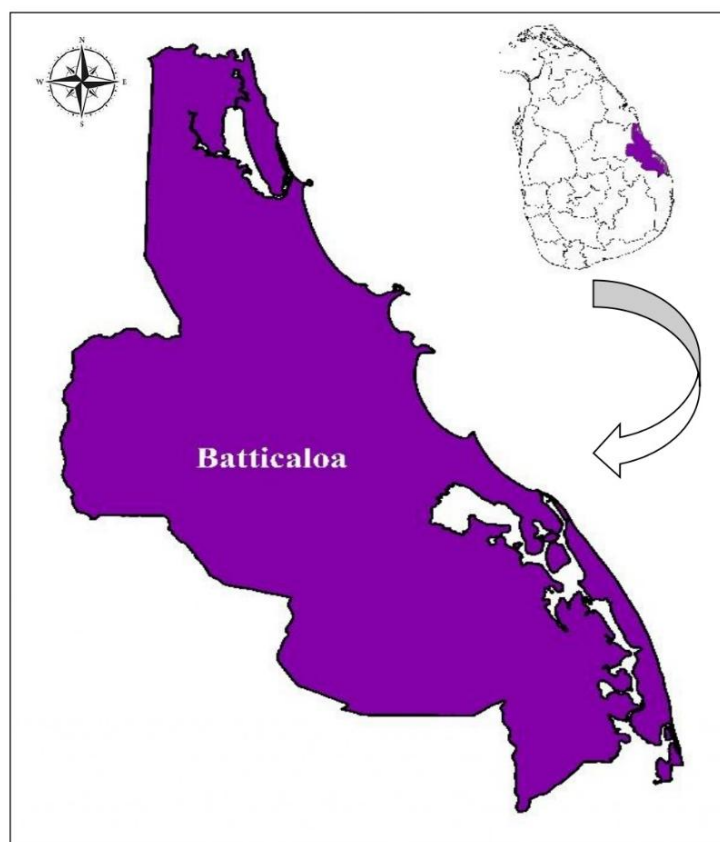


Fig. 1. Descriptive figure of Batticaloa district

Sampling

Target population of the study were fishers in Batticaloa (Figure 2). Fishermen of Batticaloa Lagoon from selected landing sites, namely Aarumuhathan Kudiyruppu,

Pillayaradi, Navaladi, Batticaloa, and Vavunathivu areas, representing different Grama Niladhari divisions, were included in this study.

Ten fishers from each landing site were randomly selected, and a total of 50 fishers were selected. Data collection was carried out using a questionnaire through oral interviews.

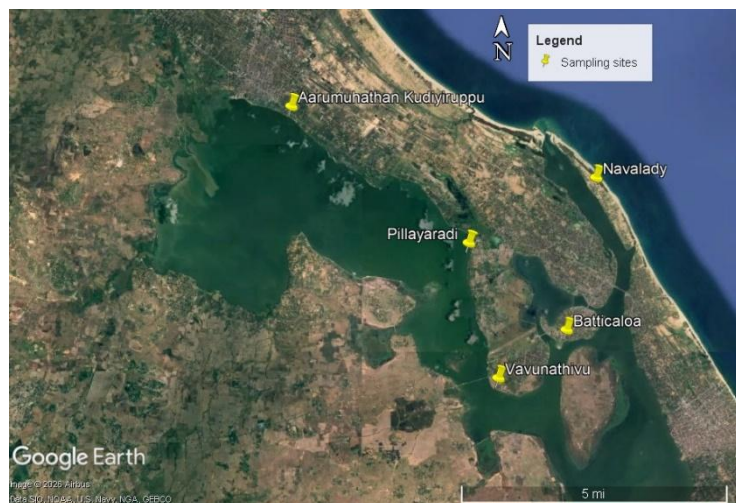


Fig. 2. Sampling sites of the study area

Table 1. Sample distribution in study area

GN division/landing site	Total population	Total fishers	Sample	Percentage (%)
Navalady	393	38	10	26.3%
Vavunathivu	695	32	10	31.25%
Arumunathan Kudiyiruppu	1813	40	10	25%
Batticaloa (kallady)	2275	45	10	22.2%
Kokkuvil (Pillayaradi)	2660	48	10	20.83%

Data collection

Structured questionnaire was designed for interviewing fishers of Batticaloa lagoon. The questionnaire consisted of general information of respondents and their families, fish production and marketing information, details of fishery societies, extension services, and problems faced by respondents.

Primary data required for this study were collected from the fishers through face-to-face interviews using the structured questionnaire. Respondents were interviewed at marketing places and fish landing sites, fisher's associations, and their residences. Secondary data were gathered from the Department of Fisheries and Aquatic Resources and Divisional Secretariat, Batticaloa. Before the commencement of the data collection, the questionnaire was pre-tested to assess the suitability of the questionnaire. Fish species were identified using standard taxonomic keys and field identification guides for Sri Lankan inland and brackish water fishes, following the nomenclature provided by relevant fisheries and aquatic biodiversity references (Silva and Punchihewa, 2021). The questionnaire survey was done at Arumuhathan Kudiyruppu, Pillayaradi, Navaladi, Batticaloa and Vavunathivu over a period of approximately three weeks, from the third week of July to the second week of August.

Data analysis

Collected data were analysed using SPSS Version 22.0 and Microsoft Excel spread sheets. Both univariate and multivariate analyses were performed to address the research objectives. Univariate analysis was used to generate frequency distributions, percentages, means, and standard deviations for each variable. ANOVA were applied to examine relationships and differences among variables. In addition, a multiple linear regression model was employed for multivariate analysis to identify the combined effects of explanatory variables on the dependent variables.

Results and Discussion

Socio economic characteristics of fishers

When considering the religion of fishers in the Batticaloa District, the majority are Hindu (82%), while the remaining 18% are Christian. The distribution of married and unmarried fishers was significantly different ($P < 0.05$). Most fishers were married (98%), while only 2% were single, indicating that fishing is mainly a livelihood activity among married individuals. All fishers in the study area were male, indicating that fishing is exclusively a male-dominated activity. Female involvement is minimal and mostly indirect in fishing-related activities. Fishers were distributed across age groups as follows: below 40 years (40%), 40–60 years (32%), and above 60 years (28%), indicating higher participation of younger fishers in the study area. The average fishing experience ranged from 15 to 20 years, indicating that fishers have considerable experience in the sector. Most fishers are in the middle-age group, reflecting long-term involvement in fishing activities. The educational level of fishers showed a significant difference ($P < 0.05$). Most fishers had secondary education (60%), followed by primary education (36%), while only 4% had ordinary level education. Family size of fishers ranged from 1-9 members, with most having large families (80%) and only 4% having small families. Large family size may contribute

to lower household income, although it is commonly observed in fishing communities.

Fishing information

The distance from home to the fishing site shows that most fishers (40%) live within 500-1500 m of the fishing area, indicating that fishing is mainly practiced by nearby communities. In contrast, only 8% of fishers live more than 2000 m away from the fishing site, showing lower participation from distant households. Most fishers in the study area used their own non-motorized crafts (80%) made of wood or fiber. About 18% of fishers did not own a craft and relied on gear such as cast nets, push nets, and fish traps in shallow or marginal lagoon areas. Some fishers also rented crafts on a daily or monthly basis when needed. Table 2 shows the Methods of fishing.

Table 2. Methods of fishing

Fishing method	Frequency	Percentage
Gill nets	3	6%
Cast nets	2	4%
Gill net /Cast net	21	42%
Hook & Line, Cast net & fish trap	16	32%
Gill net, fish trap & others	8	16%

The time spent on fishing directly influences fish yield. Most fishers (74%) conduct fishing in the morning and evening, while full-time fishers mainly operate from evening to early morning, often continuing throughout the night. Fishing time is also adjusted seasonally or based on weather conditions, and only a few fishers engage in daytime fishing.

Monthly income of fishers and their households

Table 3 presents the monthly income of fishers and their families. A significant variation was observed in income levels, indicating disparities among households. Fishers with higher incomes were generally those who invested greater effort in fishing activities.

Table 3. Monthly income of fishers

GS division/landing site	Minimum (Rs)	Maximum (Rs)	Average (Rs)	SD (Rs)
Kokkuvil (Pillayaradi)	27000	43500	36827	4862
Arumugathan	29100	50175	41607	7194

GS division/landing site	Minimum (Rs)	Maximum (Rs)	Average (Rs)	SD (Rs)
Kudiyiruppu				
Batticaloa (Kallady)	29635	37300	34052	2621
Navalady	31375	55400	41607	8429
Vavunathivu	34000	55750	40845	6336

Fishing craft usage in the study area showed a significant difference ($P < 0.05$). The majority of fishers used their own crafts (80%), while only a small proportion used rented crafts (2%). Time spent per day on fishing activities varied among fishers. On average, fishers spent more than 7 hours per day, commonly operating from evening or night to morning, while some worked from morning to afternoon. The highest proportion of fishers spent more than 8 hours fishing. Fishers conducted 1–3 trips per day, though activities decreased during bad weather, festivals, and other constraints. They had strong indigenous knowledge of fishing seasons, recognizing that rainfall-induced salinity changes influence fish availability and spawning, along with variations in environmental conditions.

Major fish species and yield distribution in Batticaloa lagoon

High-yield fish species in the lagoon mainly included tilapia, catfish, mullet, and herring, while crab and milkfish were scarce and difficult for fishers to catch (Figure 3). As well as, monthly fish yield indicated that catfish, tilapia, herring, and *Gerres* spp. were the dominant species in the lagoon, while crab and shrimp yields varied with climatic seasons. Higher average yields were generally associated with higher market prices (Figure 4). Batticaloa Lagoon hosts diverse fish species, of which *Leiognathus* spp., *Sillago* spp., *Anchovy* spp., *Mugilidae* spp., *Chanos chanos*, *Sardinella* spp., *Oreochromis* spp., *Arius thalassinus*, *Gerres* spp., and herring are economically important and contribute significantly to fisher income. Shrimp and crab are also valuable resources with high consumer demand. Catfish and tilapia are the most regularly harvested species, while shrimp and crab fisheries are seasonal but economically important.

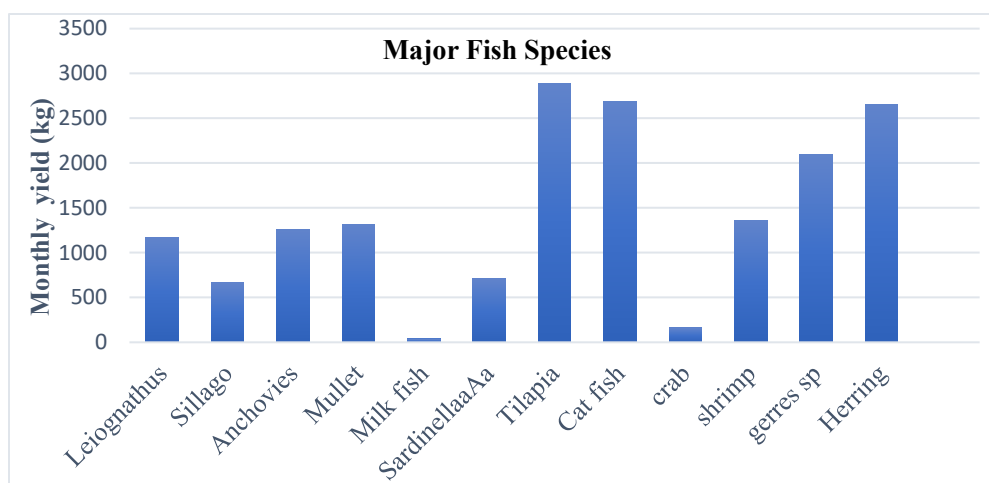


Fig. 3. Total yield of fish species



Fig. 4. Distribution of total average yield by fish species

Table 4. Major fish species statistics in Batticaloa Lagoon.

	Leiognanthus	Sillago	Anchovies	Mullet	Milkfish	Sardinella	Tilapia	Catfish	Crab	Shrimp	Gerressp	Herring
Maximum (kg)	69	45.5	94	109	27	56	251	136.5	17.5	68	83	139
Mean (kg)	16.34	9.32	18.45	38.67	0.54	10	40.48	37.63	2.29	19.1	29.39	37.18
Minimum (kg)	28.5	18	28	13	27	44	33	37	6.5	11	24	23
Range (kg)	69	45.5	94	109	27	56	251	136.5	17.5	68	83	139
Std. Deviation	22.18	16.32	24.80	30.26	3.81	20.26	60.33	45.48	4.81	14.12	25.94	39.66
Std. Error of Mean (kg)	3.13	2.30	3.50	4.28	0.54	2.86	8.53	6.43	0.68	1.99	3.66	5.60
price/kg (Rs)	150	200	100	150	200	100	100	100	800	600	100	150
Total monthly Yield (kg)	817	466	922.5	1933.5	27	500	2024	1881.5	114.5	955	1469.5	1859
Variance (kg)	492.23	266.45	615.31	915.99	14.58	410.69	3640.08	2069.23	23.205	199.57	673.10	1573.46

Income and yield distribution of fish species in the Batticaloa Lagoon showed variation in both price and catch. Prices ranged from Rs.100 to 800 and monthly yields from 17.5 to 136 kg. Catfish had the lowest price, while crab recorded the highest due to its seasonal availability and limited fishing capacity and resources of fishers. Figure 5 shows the monthly average yield of major fish species.

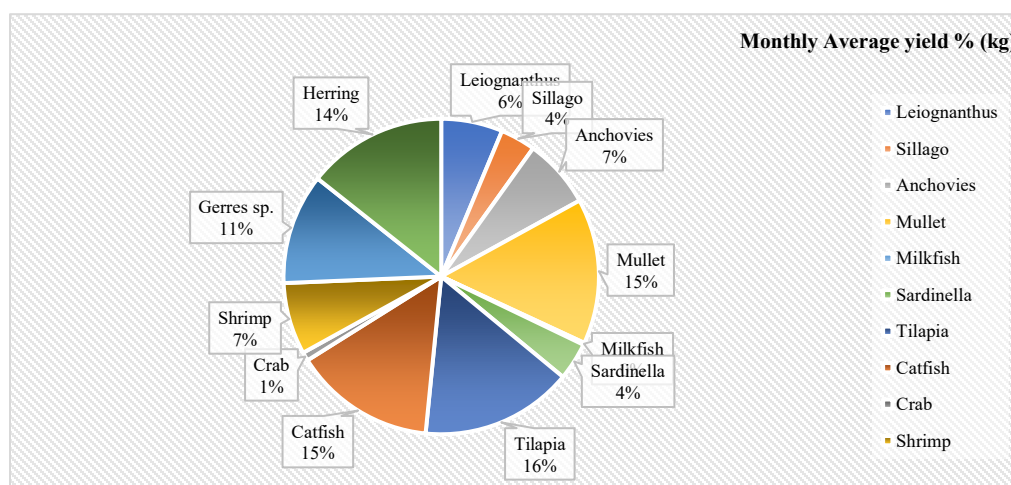


Fig. 5. Monthly average yield (kg) of major fish species

Socio-economic Aspects of Lagoon Fishermen

The average monthly income of a fisherman in the Batticaloa lagoon is Rs. 38,957.50, with an average total yield of 617.5 kg and an individual monthly fishing yield of 259.39 kg. Considering the 11,844 lagoon fishermen in the district, the total estimated monthly fish production is approximately 3,072,215 kg. In terms of production costs, fishermen who rent crafts spend around Rs. 3,500 per month on rental fees and about Rs. 5,000 on additional expenses such as food, alcohol,

cigarettes, and maintenance of fishing nets. Regarding institutional involvement, 85% of fishermen are members of fishing societies, which require a monthly subscription fee of Rs. 300. Membership is mandatory for those residing near the lagoon to engage in fishing activities. These societies provide support services such as short-term loans at low interest and financial assistance during difficult periods, while also enforcing regulations, including standardized net sizes, to prevent illegal fishing practices.

Monthly Household Expenditure of Fishers' Families

The monthly household expenses of fishers are presented in Table 4. During the survey, information on family expenses, savings, and unnecessary expenses was collected directly from the fishers, while other expenses were calculated as the difference between total income and the sum of these components. The results show that fishers spend the largest share of their income on family expenses, with 75.72% allocated to livelihood-related needs. On average, 14.4% of income is saved, while 2.65% is spent on unnecessary items such as alcohol, cigarettes, and beedi. The findings also indicate that a portion of income is spent on other categories beyond family expenses, savings, and unnecessary expenditures.

Table 4. The monthly household expenses of fishers

Expense	Minimum (Rs)	Maximum (Rs)	Mean (Rs)	SD (Rs)
Family	25000	40000	29500.75	11356.23
Saving	4000	10500	5629.32	1013.81
Others	2000	5000	1035.65	1623.35

Extension Services and Problems of Fishers

The majority of fishers reported receiving extension services, mainly provided by government agencies and other extension agents either through fishing societies or directly. However, many fishers indicated that the most accessible support was through “Samurdhi” loan schemes, while a considerable number still reported limited access to proper extension services. In addition, many fishers expressed a need for credit facilities to improve their livelihoods or start small enterprises, but they lacked awareness of how to access such services, and financial institutions were noted to have limited outreach within fishing communities.

Regarding problems, all fishers (100%) reported facing climatic challenges, as heavy rain and strong winds restrict fishing activities. They also highlighted low selling prices of fish compared to their effort, insufficient fishing equipment, and financial difficulties in meeting household needs due to low income. Furthermore, fishers suffer from physical (Table 5) and mental health issues such as body pain, headaches,

vision problems, and hearing difficulties which are worsened by continuous exposure to water and working on muddy and sedimented lagoon bottoms during fishing activities.

Table 5. Physical problems facing by fishers

Problems	Frequency	Percentage
Skin problem, injuries	24	48%
Ear problem	2	4%
Affected dangers organism	8	16%
Eye problem	4	8%
Headache	3	6%
Not enough rest	12	24%
Body pain & tired	40	80%

Nearly all fishers reported experiencing body pain and fatigue due to the physically demanding nature of fishing, especially those using non-motorized crafts, which require continuous manual effort and lead to pain in the hands, legs, and hips. Injuries and skin damage are common in the feet due to oyster shells, sharp stones, and broken bottles, while prolonged exposure to water further contributes to specific health issues. Many fishers also reported insufficient rest and tiredness due to continuous hard work, with most engaging in night-time fishing. In addition, some fishers experienced ear problems, eye irritation, and headaches, often caused by diving without protective gear, prolonged sun exposure, or exposure to microorganisms and allergens in water. Long-term fishing activities were also linked to vision problems and respiratory issues such as cold and cough, which are further influenced by occupational habits like smoking.

Conclusion

The study in the Batticaloa lagoon area reveals that the majority of fishers are Hindu, with most being in the 40-60 age group, while the overall age range of fishers is 18-70 years. Fishing experience varies widely from 5 to 40 years. Most fishers engage in full-time fishing for more than 8 hours per day, while part-time fishers spend around 4 hours, with both day and night fishing practices being common. Gill nets and cast nets are the most frequently used fishing gears in the lagoon.

The lagoon supports a diverse range of fish species, with catfish and tilapia available throughout the year, while shrimp and crabs are seasonally abundant and economically more valuable. Income levels vary significantly by species, with shrimp providing the highest monthly income and milkfish the lowest. Fish prices range from Rs. 100 to 800 per kg, with crabs being the most economically valuable.

The study also highlights key socio-economic and environmental challenges, including inadequate fish storage facilities, resulting in post-harvest losses and forced low-price sales. Although average daily catch is around 8 kg per fisher, it remains insufficient for sustainable livelihoods. Water quality parameters, particularly pH, were found to vary across locations and seasons, indicating the influence of environmental conditions. Overall, sustainable lagoon management and improved infrastructure are essential to enhance fish production, income stability, and long-term livelihood security of fishers in the Batticaloa lagoon.

Future studies should focus on long-term monitoring of fish population dynamics, impacts of climate variability on lagoon fisheries, water quality assessment, and development of sustainable management strategies to improve fish production and fisher livelihoods in Batticaloa Lagoon. As well as, Future research should focus on developing and evaluating sustainable interventions to address poverty, improve access to fishing equipment and infrastructure, strengthen market linkages, and assess the long-term socioeconomic and environmental impacts of fisheries management strategies on the livelihoods of coastal fishing communities.

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