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# Crew Position-Based Assessment of Fishermen's Knowledge Needs in The Coastal Districts of Tamil Nadu

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## HIGHLIGHTS

- Skippers/drivers show proficiency in navigation and modern tools, with less need for further training.
- Net haulers and helpers require more training, especially in GPS usage, sustainable fishing, and gear management.
- Tailored training programs for each crew position, especially focusing on the gaps identified for Helpers and Net Haulers.
- Policymakers, NGOs, and training institutes should focus on creating tailored training programs based on crew positions.

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**Keywords:** Knowledge needs, Crew-specific training, Skipper, Net hauler, Helper, Training need, Fishermen.

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## ABSTRACT

The study conducted in 2025 (January to May) examined the knowledge needs of fishermen in Tamil Nadu, focusing on their roles within the fishing crew: Skippers/Drivers, Net Haulers, and Helpers. Tamil Nadu, with its extensive coastline, plays a vital role in India's marine fisheries, supporting millions of fishermen. The study identified key knowledge gaps in areas such as modern navigation technologies, sustainable fishing practices, and gear handling. A total of 150 fishermen were surveyed from coastal districts, including Nagapattinam, Ramanathapuram, Thoothukudi, and Kanyakumari, using a structured questionnaire. The findings indicate that Skippers/Drivers are generally proficient in knowledge and require less training, whereas Net Haulers and Helpers exhibit a higher need for knowledge in technology, sustainability, and gear management. Statistical analysis, including regression and correlation, reveals significant relationships between fishermen's knowledge needs and their experience, educational background, and crew position. The results highlight the necessity for tailored training programs to address the specific needs of different crew members. This study emphasises the importance of crew-specific capacity-building to enhance operational efficiency, improve sustainability practices, and foster economic resilience within the fishing communities of Tamil Nadu.

## INTRODUCTION

Tamil Nadu, with its extensive coastline of 1,076 km, stands as one of India's leading marine fish-producing states Government of Tamil Nadu, 2024). It is home to a significant population whose livelihoods are intricately tied to the sea. According to the Marine Fisheries Census 2016, Tamil Nadu hosts 575 marine fishing villages and 349 landing centres, supporting over 2 million marine fishing families and nearly 8 lakh individuals engaged in various fishing-related activities (CMFRI, 2020). The state's contribution to India's marine fishery is indispensable, underlining its vital role in both the national economy and ecological sustainability. India recorded 3.45 million tonnes of marine fish landings in 2023, with Tamil Nadu accounting for a substantial share, showcasing the state's resilience

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and continued ecological and economic importance within India's marine fisheries landscape (ICAR-CMFRI, 2025).

The roles of fishermen in Tamil Nadu vary significantly, primarily based on the position they occupy within the boat crew. These positions include Skipper/Driver, Net Hauler and Helper, each with distinct responsibilities and knowledge requirements that contribute to the overall efficiency and success of fishing operations. The responsibility of skippers navigating and managing the fishing process requires advanced navigational skills and knowledge of fishing zones, especially with modern technology GPS (Byron, 1980). In contrast, other crew members, such as net haulers and helpers, while crucial in ensuring a productive catch, typically need a more specialised understanding of gear handling, the quality of the catch and maintenance procedures (Van Sittert, 2015). Their roles, though less focused on navigation, are integral to optimising operational efficiency and maintaining high standards of sustainability.

A fundamental factor influencing the sustainability and productivity of fisheries is the knowledge and expertise within the fishing communities. According to Orensanz et al., (2014), fisher knowledge (FK) encompasses a wide range of experiential insights, including an understanding of fish populations, ecosystems, fishing techniques, community dynamics, governance structures and market practices. The importance of tailored knowledge based on specific crew positions becomes evident as advancements in fishing technology, such as GPS systems and sonar, have transformed operations. Gopal (2023) underscores that more experienced roles, such as Skippers, require extensive knowledge of these technologies, while other roles may only need basic operational skills. The shift in fishing techniques, particularly in Chennai's shrimp trawl fisheries, reflects the growing complexity of fishing practices and the need for diversified knowledge across crew members to ensure sustainability and efficiency (Bavinck, 2012). This study seeks to systematically assess the specific knowledge needs of fishermen in the coastal districts of Tamil Nadu. The research aims to provide a comprehensive understanding of the knowledge gaps across different crew positions. The findings will offer evidence-based recommendations for extension services, training institutes, NGOs, and policymakers focused on equipping fisher communities with the necessary tools for enhancing their economic resilience, ensuring ecological sustainability and fostering social development. Understanding this knowledge needs will not only improve fishing operations but also contribute to the long-term viability of Tamil Nadu's marine fisheries.

## METHODOLOGY

The study was carried out from January to May in 2025 to assess the knowledge needs of fishermen. Data were collected from 150 respondents using the proportionate random sampling method in the study area mentioned below. The pilot study was conducted in Indinthakari fishing village, Tirunelveli district. The sampling was carried out in the coastal districts, Nagapattinam (87,013), Ramanathapuram (1,88,915), Thoothukudi (84,987) and Kanyakumari (1,52,447) in Tamil Nadu. These districts were chosen due to the higher fisher population, and from each district, two fishing villages, such as Akkaraipettai (n=17) and Seruthur (n=8) in Nagapattinam; Rameswaram (n=35) and Mandapam (n=20) in Ramanathapuram; Threspuram (n=14) and Thoothukudi Fishing Harbour (n=12) in Thoothukudi; and Kanyakumari (n=22) and Colachel (n=22) in Kanyakumari district were selected for the study by Proportionate random sampling. The survey was conducted for the study through personal interviews. Descriptive statistical methods, including frequency analysis, Spearman correlation, Multiple linear regression, and the Kruskal-Wallis test, were used to analyse the data through SPSS (Version 25.00). To analyse the knowledge needs, 12 statements were developed and assessed using a 5-point Likert scale with responses coded as: 5 = Most Need, 4 = More Need, 3 = Need, 2 = Less Need, 1 = Least Need (ordinal rankings without equal intervals). It is allowed for the quantitative assessment of the knowledge needs of fishermen. In order to determine how independent variables affect the dependent variable, multiple regression analysis was performed.

$$Y= \beta_0 + \beta_1 X_1 + \beta_2 X_2 .....+ e$$

Where Y = Dependent variable, $\beta_0$ = intercept, $\beta_i$ = slope, Xi, e= error term. The Kruskal-Wallis H test was used to compare crew position in the boat concerning the skill need assessment, with significant differences.

$$H = \frac{12}{N(N+1)} \sum_{i=1}^{k} \frac{R_i^2}{n_i} - 3(N+1)$$

Where, K = number of groups used for comparison, N = total size of the sample, ni = i-th group of the sample size and Ri = total of the ranks related to the i-$^{th}$ group. The software SPSS and Microsoft Excel were used to analyse the data. Origin Pro and Chart Expo were used to visualise the research data.

## RESULTS

### Role-based knowledge needs of fishing crew members

The mean score of twelve statements for skipper/driver, net hauler and helper was illustrated in Table 1. Among 150 respondents, nearly half of the respondents (43.3%) were net haulers/labourers, 34.0 per cent were skippers/drivers, and 22.7 per cent were helpers. Assuring to cover all the crew positions on a boat. The results revealed clear role-based differences in training needs, with Skippers consistently reporting the lowest scores, net haulers generally showing moderate scores, and Helpers recording the highest across most domains.

Navigation-related knowledge areas demonstrated the widest disparities. For example, the use of GPS to locate potential fishing zones was scored at 2.25 by Skippers, compared with 2.95 by Net Haulers and 4.74 by Helpers (Table 1). A similar pattern was evident for the use of modern navigation tools and techniques, where Skippers scored 2.27, Net Haulers 3.29, and Helpers 4.12. Accessing real-time weather forecasts through ICT applications such as mFish and Thoondil also followed this gradient (2.55, 3.14, and 3.71). These findings suggest that while Skippers are already highly proficient in navigation and weather monitoring, Helpers expressed a strong need for training in these areas, with Net Haulers positioned between the two.

In sustainability-related knowledge, scores were moderately high across all groups, reflecting general awareness but also

**Table 1.** Mean Scores for Knowledge areas among skipper/driver, net hauler, and helper

| Statements | Mean scores | | |
|---|---|---|---|
| | Skipper/ Driver | Net hauler | Helper |
| Utilising GPS technology to locate potential fishing zones | 2.25 | 2.95 | 4.74 |
| Applying sustainable fishing practices during the breeding season | 3.12 | 3.68 | 3.76 |
| Selecting appropriate fishing gear for target fish species | 3.12 | 3.20 | 3.59 |
| Understanding boat maintenance and fuel management for efficient fishing operations | 3.20 | 3.22 | 3.53 |
| Maintaining and handling fishing nets and gear for efficiency and durability | 2.65 | 3.05 | 3.26 |
| Using ice storage techniques to preserve fish quality during extended trips (6). Navigating fishing vessels efficiently using modern tools and techniques | 2.96 | 3.24 | 3.49 |
| Navigating fishing vessels efficiently using modern tools and techniques | 2.27 | 3.29 | 4.12 |
| Accessing real-time weather forecasts through ICT tools and mobile apps like mFish, Thoondil, etc | 2.55 | 3.14 | 3.71 |
| Communicating and networking through social media platforms for fish marketing and buyer connections | 3.02 | 3.12 | 3.26 |
| Adhering to Marine Protected Area (MPA) guidelines for sustainable fisheries management | 2.82 | 3.37 | 3.79 |
| Implementing responsible fishing practices to sustain commercially important fish species | 2.80 | 3.35 | 3.68 |
| Managing finances effectively by evaluating the cost-effectiveness of fishing gear and operations | 3.16 | 3.52 | 3.79 |

highlighting specific needs. Applying sustainable fishing practices during the breeding season received mean scores of 3.12, 3.68, and 3.76 for Skippers, Net Haulers, and Helpers, respectively. Similarly, adherence to Marine Protected Area (MPA) guidelines was rated 2.82, 3.37, and 3.79, while responsible fishing practices to sustain commercially important fish species scored 2.80, 3.35, and 3.68. These results indicate that Net Haulers and Helpers identified stronger needs in sustainability practices, whereas Skippers expressed comparatively lower requirements, likely reflecting their prior experience and supervisory role.

Operational knowledge areas showed more balanced scores but still indicated role-based differences. Selecting appropriate fishing gear for target species was scored 3.12 by Skippers, 3.20 by Net Haulers, and 3.59 by Helpers. Net and gear handling, a domain central to Net Haulers, was scored 2.65, 3.05, and 3.26 across the three groups. Ice storage techniques, important for maintaining fish quality, were rated 2.96, 3.24, and 3.49, suggesting higher needs among Net Haulers and Helpers. Knowledge of boat maintenance and fuel management showed relatively similar scores across roles (3.20, 3.22, and 3.53), though Helpers again reported the highest mean.

Economic and communication competencies also reflected differentiated needs. Managing finances to evaluate gear and operational costs was scored 3.16 for Skippers, 3.52 for Net Haulers, and 3.79 for Helpers, highlighting a clear progression in training requirements. Communicating and networking through social media for fish marketing received slightly lower means overall but followed the same trend, with Skippers at 3.02, Net Haulers at 3.12, and Helpers at 3.26.

Overall, the results illustrate a consistent pattern, such as Skippers/Drivers reporting the lowest training needs, aligning with their greater experience and established responsibilities in navigation and operations. Net Haulers demonstrated moderate scores, reflecting their active role in gear handling, ice storage, and operational efficiency. Helpers consistently reported the highest mean scores across domains, particularly in navigation, sustainability, and financial literacy, signalling a substantial need for targeted training interventions to support their evolving roles in fishing operations. These findings suggest that training should be tailored to the specific roles of crew members rather than delivered uniformly to all fishermen. A crew-specific training approach would maximise efficiency and ensure greater impact by addressing the distinct knowledge gaps of each role.

**Effect of experience and education on fishermen's knowledge requirement needs**

Among 150 respondents, most fishermen (52.0%) had extensive experience with over 20 years in marine fishing, 30.7 per cent with 11-20 years and 17.3 per cent with less than 10 years. The Kruskal–Wallis test was applied to examine differences in perceived knowledge needs among fishermen with varying levels of experience. The test revealed a statistically significant difference ($H = 27.175$, $p = 0.0001$; $p < 0.05$), indicating that experience plays a significant role in shaping knowledge requirements (Table 2). Fishermen with less than 10 years of experience reported the highest perceived knowledge need (mean rank = 115.75), while those with 10–20 years (67.87) and more than 20 years of experience (66.58) reported substantially lower ranks. This pattern suggests that less experienced fishermen perceive greater training needs, likely due to their limited exposure and ongoing skill development, whereas more experienced fishermen demonstrate greater confidence in their existing competencies. These findings highlight that experience level must be considered when designing training interventions, as tailoring programs according to both crew role and years of experience will ensure more effective and impactful capacity-building.

In terms of education, nearly half of the respondents (44.7%) had secondary education, 27.3 per cent had primary education, and 13.3 per cent were graduates, while 10 per cent were functionally

**Table 2.** Mean Rank for Experience in Fishing

| | Category | Mean Rank |
|---|---|---|
| The knowledge need of the fishermen | Less than 10 years | 115.75 |
| | 10-20 years | 67.87 |
| | Above 20 years | 66.58 |
| | Total | |
| | Kruskal-Wallis H=27.175 | |

literate and 4.7 per cent were illiterate. The Kruskal–Wallis test was employed to examine differences in perceived knowledge needs among fishermen with varying educational backgrounds. The test yielded a statistically significant result (H = 16.631, p = 0.002; p < 0.05), indicating that education level significantly influences knowledge requirements (Table 3). Mean ranks revealed an inverse relationship: illiterate fishermen had the highest mean rank (108.36), followed by functionally literate (91.00), primary education (76.35), graduates (65.60), and secondary education (62.10). The slightly higher score for graduates compared with secondary-educated fishermen may reflect less practical exposure due to extended time spent in formal education. These findings suggest that fishermen with lower levels of education perceive greater training needs, likely due to limited prior learning opportunities or challenges in adapting to technical changes. Importantly, this underscores the necessity of education-sensitive training interventions, with emphasis on reaching illiterate and functionally literate individuals to bridge knowledge gaps and strengthen workforce competency.

**Table 3.** Mean Rank for Education Status

| | Category | Mean Rank |
|---|---|---|
| The knowledge need of fishermen | Illiterate | 108.36 |
| | Functionally literate | 91.00 |
| | Primary education | 76.35 |
| | Secondary education | 62.10 |
| | Graduate | 65.60 |
| | Total | |
| | Kruskal-Wallis H= 16.631 | |

**Correlation between socio-demographic profile and knowledge needs of fishermen**

The results from the study were used to analyse the association between the independent variables and the knowledge needs of fishermen (Table 4). Among the seventeen variables twelve variables such as age, experience in fishing, crew position in boat, average catch per trip, mass media exposure, information needs during fishing, scientific orientation, risk orientation, self-confidence, managerial behaviour, Indigenous Traditional Knowledge in fishing, and Information Communication Technology (ICT) tools usage during fishing were significant to the knowledge need of fishermen. Educational status, fishing type, fishing distance, extension agency contact, and Information sources were non-significant to the knowledge needs of fishermen.

The multiple regression analysis yielded the following model:

$$Y = 3.416+0.020(X1) -0.036(X2) +0.269(X3) +0.269(X4) +0.044(X5) +0.041(X6) +0.012(X7) -0.029(X8) -0.034(X9) +0.100(X10) -0.082(X11) -0.106(X12) +0.055(X13) -0.191(X14) +0.003(X15) -0.052(X16) -0.012(X17) = 0.668$$

The coefficient of determination adjusted ($R^2$) was 0.625, indicating that approximately 62.5 per cent of the variance in fishermen's knowledge needs is explained by the set of independent variables included in the model (Table 4). Furthermore, the regression model was found to be statistically significant, with a p-value less than 0.05, suggesting that the independent variables collectively contribute to predicting the dependent variable.

**Table 4.** Correlation and Regression Coefficients of independent variables and knowledge need of fishermen

| Variable code | Name of the variable | Correlation coefficient (r) | Regression Coefficient (β) |
|---|---|---|---|
| X1 | Age | -0.173* | 0.020 |
| X2 | Educational status | -0.094 NS | -0.036 |
| X3 | Experience in fishing | -0.317** | 0.269 |
| X4 | Crew position in Boat | 0.787** | 0.269 |
| X5 | Fishing type | 0.104 NS | 0.044 |
| X6 | Fishing distance | -0.076 NS | 0.041 |
| X7 | Average catch per trip | -0.188* | 0.012 |
| X8 | Mass media exposure | -0.199* | -0.029 |
| X9 | Extension agency contact | -0.032 NS | -0.034 |
| X10 | Information sources | 0.013 NS | 0.100 |
| X11 | Information needs during fishing | -0.251** | -0.082 |
| X12 | Scientific Orientation | -0.183* | -0.106 |
| X13 | Risk Orientation | -0.640** | 0.055 |
| X14 | Self Confidence | -0.628** | -0.191 |
| X15 | Managerial behaviour | -0.496** | 0.003 |
| X16 | Indigenous Traditional knowledge in fishing | -0.447** | -0.052 |
| X17 | ICT tools usage during fishing | -0.0162* | -0.012 |
| | R=0.817, | $R^2$=0.668 | |
| | Adjusted $R^2$= 0.625 | Std error= 0.2022285 | |

NS = non-significant; **Significance at 0.01 level; *Significance at 0.05 level

## DISCUSSION

The structure of crew positions and roles aboard fishing boats in India varies depending on the vessel type and fishing operation. In mechanised trawl fisheries, such as those in Chennai, the captain or "driver" oversees operations, while crew members take shifts to optimise fishing efforts and share profits. Larger vessels, like Sona-type boats, require larger crews, enhancing operational efficiency but increasing costs (Bavinck, 2012). Similarly, Kerala's ring seine fishery involves key positions like the Aaryakaaran (leader), with crew sizes ranging from 25 to 60. The growing size of fishing vessels has led to a shift from individual to collective ownership, influencing crew dynamics and profit distribution (Gopal, 2023).

This study confirms that fishermen's knowledge needs vary by crew role, reinforcing the importance of role-specific training. Similar patterns have been observed in agriculture, where tailored knowledge delivery improves adoption of practices (Kour et al., 2023). In fisheries, targeted dissemination through ICTs is vital, though in Tripura, limited access reduces extension effectiveness (Nirmalkar et al., 2022; Lahiri et al., 2024). Comparable knowledge gaps in aquaculture, such as fish disease and feeding practices in West Bengal (Mondal et al., 2025), highlight the broader need for structured, need-based training. Navigation knowledge was particularly limited among Net Haulers and Helpers. Viswanathan et al., (2023) also reported such gaps among support crews, emphasising risks to safety and efficiency. Training in GPS, radar, and digital mapping would address these needs, consistent with Thomas et al. (2020), who highlighted the benefits of modern navigational tools for safety and market access.

Post-harvest handling emerged as another gap, especially ice storage. Seenivasan et al. (2025) noted insufficient ice production in Tamil Nadu, reducing fish quality. Training for Net Haulers and Helpers in handling and storage could directly reduce losses. Financial literacy, particularly for Helpers, is also critical. Sajesh et al., (2021) emphasised equipping younger fishers with business and market skills to strengthen resilience. Similarly, Ismail and Khalid (2015) showed the potential of social media for marketing, which aligns with Helpers' expressed interest in digital tools. Gear selection and sustainability practices require further attention. Madhu et al. (2021) stressed the ecological impacts of gear design, while Gunakar et al., (2017) found that compliance with monsoonal bans depends on active crew participation. Awareness of Marine Protected Areas was also limited among support crews, echoing findings by Dineshbabu et al., (2022), who recommended short-duration training to improve compliance. Basic vessel maintenance and fuel efficiency training remain important for all crew roles. The FAO (2011) showed that improved engine handling reduces costs and enhances efficiency, suggesting broad benefits if such training is extended beyond Skippers.

## CONCLUSION

This study shows that fishermen's knowledge needs in Tamil Nadu vary significantly by crew role. Skippers demonstrated high proficiency in navigation and vessel operation, while Net Haulers and Helpers reported greater needs in modern technologies, sustainable practices, gear handling, post-harvest techniques, and financial management. Helpers in particular revealed critical gaps in navigation tools, marketing, and compliance with Marine Protected Area guidelines. Experience and education also influenced knowledge needs, with less experienced and less educated fishermen perceiving greater training requirements than their more experienced or better-educated counterparts. These findings highlight the importance of tailoring training interventions not only by occupational role but also by socio-demographic characteristics. Such targeted programmes would maximise training impact, strengthen operational efficiency, promote sustainable practices, and enhance economic resilience. Policymakers, training institutions, and NGOs should prioritise crew-specific role- and context-specific strategies to ensure safer, more profitable, and environmentally responsible fisheries, ultimately improving the livelihoods of coastal fishing families.

## DECLARATIONS

Ethics approval and informed consent: Informed consent was sought from the farmer respondents during the course of the research.

Conflict of interest: The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

The authors declare that during the preparation of this work, thoroughly reviewed, revised, and edited the content as needed. The authors take full responsibility for the final content of this publication. The authors dedicate their kind acknowledgement to all the fishermen for their valuable information and Tamil Nadu Dr. J. Jayalalithaa Fisheries University for supporting the research work.

Authors' contributions: All authors contributed significantly to the work. G Arul Oli conceived and supervised the study, C Lloyd Chirspin and R Durairaja were involved in designing the methodology and providing guidance. V. Dani Glenn carried out the investigation, collected and curated the data, and performed the formal analysis. The first draft of the manuscript was prepared by V Dani Glenn, and all authors contributed to reviewing, editing, and approving the final version of the manuscript.

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