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RESEARCH ARTICLE

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TROUT FARMERS IN KASHMIR: SOCIO-ECONOMIC CHARACTERISTICS AND TRAINING PARTICIPATION

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ABSTRACT

Trout culture represents a key cold-water aquaculture activity in Kashmir, offering scope for livelihood diversification and sustainable rural development. This study examines the socio-economic characteristics of trout farmers in Kashmir and their implications for aquaculture development. Based on primary data collected from sampled farmers, the analysis employs descriptive statistical techniques. The results indicate that trout farming is largely practiced by middle-aged farmers, with a mean age of 43 years. While education and farming experience vary, most farmers possess adequate formal schooling and an average of nine years of experience, enabling effective engagement in trout cultivation. Trout farming contributes significantly to household income but generally remains a supplementary livelihood source. Access to extension services is uneven, with many farmers located more than 20 km from extension offices, and participation in training programmes is moderate. The study highlights the need for strengthened extension outreach and targeted capacity-building initiatives to support the sustainable growth of trout aquaculture in the region.

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INTRODUCTION

Aquaculture has become a crucial global food-producing sector due to declining capture fisheries and rising demand for high-quality aquatic protein. Over the past six decades, global apparent consumption of aquatic animal foods has grown at 3.0 percent annually—nearly double the population growth rate—raising per capita consumption from 9.1 kg in 1961 to 20.6 kg in 2021 (FAO, 2024). Aquaculture has surpassed capture fisheries, contributing 195 million tonnes—approximately 83 percent—to the record global aquatic production of 228 million tonnes in 2023. This reflects a 2.2 percent increase over 2022. The expansion is largely driven by Asia, which accounts for nearly 72 percent of global aquaculture output, with the sector sustaining more than 62 million livelihoods worldwide (FAO, 2025). India reflects this global expansion and is now the world's third-largest aquaculture producer. The fisheries sector supports about 28 million fishers and fish farmers and contributes 1.11 percent to national GDP and 6.72 percent to agricultural GDP. In 2022–23, India recorded its highest-ever fish production of 175.45 lakh tonnes, with inland aquaculture contributing 131.13 lakh tonnes. India also ranks among the world's top five seafood exporters, earning USD 8.09 billion in 2022–23 (Handbook on Fisheries Statistics 2023). Within this national context, Jammu and Kashmir holds a unique position because of its extensive cold-water resources—around 40,000

hectares of water spread area (Department of Fisheries, Government of Jammu and Kashmir, 2024)—and favourable climatic conditions for trout culture. Introduced in the early 1900s, trout farming in the region has expanded significantly with the establishment of hatcheries, farms, rearing units, and government-supported development programmes. As a result, trout farming has become an important livelihood activity for many rural households. A growing body of literature highlights that the success of aquaculture systems—whether for food security, income generation, or livelihood diversification—depends heavily on socio-economic and institutional factors. Studies on small-scale inland fisheries in Burkina Faso show that technological improvements and institutional transitions significantly enhance productivity and livelihoods, even though traditional and centralized governance structures continue to dominate management systems (Sanon, 2021). Similar findings emerge from Tanzania, where willingness to adopt aquaculture as an alternative livelihood is shaped strongly by socio-economic characteristics such as gender, time availability, social networks, and living standards. Bayesian Belief Network analysis further demonstrates how targeted policy interventions can increase aquaculture uptake among low-income households and women (Slater, 2013). Physical and management-related factors also play a critical role. Evidence from Western Kenya shows that infrastructure—particularly road access—is the strongest determinant of fish production, followed by pond management, water availability, feed access, and pond condition

(Kundu, 2016). Beyond economic or physical inputs, socio-cultural dynamics such as gender norms, labour division, cultural values, and intra-community power relations shape adoption, resource access, and the equitable distribution of aquaculture benefits. These factors can affect both productivity and outcomes related to income, nutrition, and food security (Morgan, 2017). At a broader scale, adoption of specific aquaculture technologies depends on socio-economic readiness and institutional support. Evidence from southern Benin shows that age, education, experience, access to credit, membership in farmer organizations, project support, and income levels significantly influence the uptake of fish farming technologies such as fingerlings, ponds, and improved feeds (Babatounde, 2024). Meanwhile, cross-country comparisons indicate that despite global growth, institutional quality—related to governance, corruption, and competitiveness—does not necessarily predict aquaculture expansion, leading to what is called the “aquaculture paradox” (Nadarajah, 2017). This highlights the need to examine micro-level determinants rather than relying solely on national-level institutional indicators. Scholars also emphasize that misplaced, top-down interventions can hinder sustainability, particularly in countries with weak governance, where zoning and regulatory frameworks often fail. Instead, aquaculture development should be grounded in local socio-economic realities, community engagement, and rigorous cost-benefit analysis to account for upstream and downstream social and environmental impacts (Little, 2013). Complementing this view, GIS-based decision-support models have been proposed as tools for aligning aquaculture planning with local agro-ecological, socio-economic, and institutional conditions. Evidence from Bangladesh and Malawi demonstrates that integrating biophysical and non-spatial socio-economic indicators can substantially improve aquaculture targeting and adoption (Pensl, 2006). Collectively, these studies demonstrate that aquaculture performance is not determined by technical inputs alone but is deeply influenced by farmers’ socio-economic characteristics, access to services, institutional support systems, infrastructure, and cultural dynamics. This aligns directly with the context of Jammu and Kashmir, where trout farming—despite its strong potential—shows considerable variation in productivity across farmers. As the region expands trout production amidst differing levels of education, experience, credit access, training, and extension support, understanding these socio-economic and institutional determinants becomes essential. Therefore, the present study builds on global and regional evidence by examining how household characteristics, resource access, institutional arrangements, and farm-level management influence trout farming outcomes in J&K. In doing so, it contributes to improving aquaculture policies, strengthening farmer wellbeing, and enhancing the long-term sustainability of cold-water aquaculture in the Himalayan region.

1. *The present study is undertaken with the following objectives:*
2. *To profile the socio-economic characteristics of trout farmers in Jammu and Kashmir.*
3. *To assess access to institutional support among trout-farming households.*
4. *To examine access to extension services among trout farmers.*
5. *To analyse participation in capacity-building programmes related to trout culture.*
6. *To suggest policy and extension-based measures for strengthening capacity-building and promoting sustainable trout aquaculture in the region.*

This study contributes to the aquaculture literature by providing micro-level evidence from a cold-water aquaculture system, where limited research exists. The findings will help policymakers, extension agencies and development planners in designing targeted strategies to improve trout farming efficiency, farmer income, and sector sustainability in Jammu and Kashmir.

MATERIALS AND METHODS

The study was carried out in March 2023 in the Union Territory of Jammu and Kashmir that is in the northernmost region of the Indian

subcontinent. Which is recognized as one of the leading cold-water aquaculture regions in India. The region possesses favourable environmental conditions — including snow-fed streams, low-temperature water, and suitable topography — that support large-scale production of rainbow trout. The data was collected from sample farmers culturing trout fish. For sampling, three districts viz. Anantnag, Baramulla and Srinagar were selected because of the higher prevalence of trout fish farms in these areas. A total of 91 trout fish farms were selected.

Methodology: The study adopted a multistage sampling design, which is particularly suitable for socio-economic and extension-based field studies involving geographically dispersed populations. In the first stage, districts with significant trout production potential in Jammu and Kashmir were selected purposively to ensure that the investigation focused on areas where trout farming is well established and economically relevant. In the second stage, villages or locations with a relatively higher concentration of trout farms were identified from each selected district using information obtained from the Department of Fisheries and local extension personnel, thereby capturing active trout-farming clusters within the region. In the final stage, individual trout farmers were selected randomly from the identified villages or locations to minimize selection bias and to ensure that each farmer had an equal chance of inclusion in the sample. This multistage approach facilitated systematic area coverage while enhancing the representativeness, reliability, and contextual validity of the study findings. The study was based on primary data collected through a structured interview schedule developed in line with the objectives of the research. The schedule was administered through face-to-face interactions with the sampled trout farmers to ensure clarity, accuracy, and completeness of responses. The data collected encompassed socio-economic characteristics such as age, education, farming experience, and income, along with information on access to institutional and extension support, participation in training programmes, production-related aspects, and livelihood outcomes. After collection, the data were systematically coded and tabulated and subsequently analysed using SPSS and Microsoft Excel. Descriptive statistical techniques, including averages, percentages, frequencies, and frequency distributions, were employed to summarise and interpret the data. These tools facilitated the identification of key patterns, trends, and variations in the socio-economic profile of trout farmers, their access to extension and institutional services, and their participation in capacity-building activities. The use of descriptive statistics is consistent with standard methodological practices in socio-economic and extension research and is appropriate for achieving the objectives of the present study.

Description of Variables: Variables used in the study are divided into two categories, first category is socio-economic variables and second is institutional and farm management variables. Variables included in each category are shown in table 1:

Table 1. Description of Variables

Socio-Economic Variables	Definition	Units
Age	Present age of the farmer	Years
Education	Formal education attained by the farmer	Years
Experience	Experience (years) in fish farming by the farmer	Years
Gender of Farmer	Gender of farm owner (male=0, female=1)	Dummy
Family Size	Total members in a household	Number
Household Income	Income from all sources	₹
Institutional and Farm Variables		
Distance to Ext. office	Distance between farm and Extension office	Km
Seminars Attended	Number of seminars attended.	Number
No. of Extension Visits	Number of visits to extension agencies.	Number
Access to Credit	Farmers participating in credit loans (yes=1, no=0)	Dummy
Farm Type	dummy variable, 0=cluster and 1= single	Dummy

Source: Authors Compilation

RESULTS AND DISCUSSION

The summary statistics of the variables used for the analysis are shown in Table 2. The age profile of trout farmers shows substantial diversity, with a concentration in the middle-age categories. As presented in Table 2, 36.26 percent of farmers were aged 30–40 years, followed by 24.18 percent in the 50–60 age group. Approximately 16.48 percent were between 20–30 years, while 14.29 percent fell within the 40–50 age range. Only 8.79 percent of farmers were 60 years or older. The mean age of respondents was 43 years, with a standard deviation of 12, indicating considerable variability across the sampled trout farmers.

farmers. Most respondents (71 percent) belonged to households comprising 5–10 members, while 22 percent had smaller families with four or fewer members. Only 7 percent reported large families of 11 or more individuals. The mean family size was 6.17 persons (SD = 2.86) same result also found in the following study (Babatoude, 2024), reflecting moderate variation across households. The predominance of medium-sized families may have implications for the availability of family labor (Sule, 2002; Ayeloja, 2021; Zhang, 2022), which is often an important resource in aquaculture operations. The distribution of household income, measured across all income-generating sources rather than trout farming alone, reveals substantial economic variation among the sampled farmers. Over half of the respondents (53%) reported annual household incomes of \leq ₹600,000,

Table 2. Psychometric Analysis

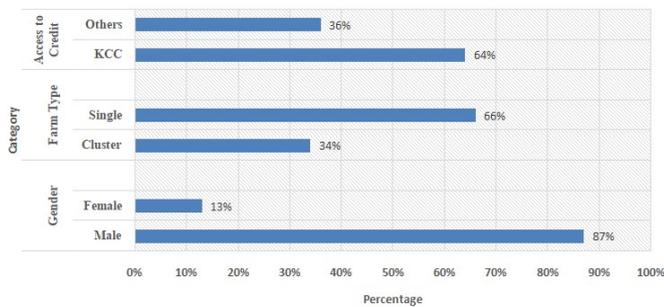
Variables	Groups	Frequency	Percentage	Mean	Std. Deviation
Age	20-30	1	16.48	43.2	12.16
	30-40	33	36.26		
	40-50	13	14.29		
	50-60	22	24.18		
	\geq 60	8	8.79		
Education	Illiterate	4	4.4	11.57	3.9
	\leq Middle	17	18.68		
	High School	10	10.99		
	Secondary School	31	34.07		
	\geq Graduate	29	31.87		
Experience	\leq 5 years	25	27.47	9.07	4.33
	5-10	27	29.67		
	10-15	33	36.26		
	\geq 15	6	6.59		
Family Size	\leq 4	20	0.22	6.17	2.86
	5 – 10	65	0.71		
	\geq 11	6	0.07		
Household Income	\leq 600000	48	0.53	7,71,587	5,93,415
	600000-1200000	27	0.30		
	1200000-1800000	8	0.09		
	\geq 1800000	8	0.09		
Distance to Ext. office	\leq 10 KMs	24	26.37	18.9	12.9
	10-15	16	17.58		
	15-20	17	18.68		
	\geq 20	34	37.36		
Seminars Attended	0	1	1.10	2.91	1.25
	1	14	15.38		
	2	17	18.68		
	3	29	31.87		
	4	20	21.98		
	5	10	10.99		

Source: Authors compilation

These findings align with earlier studies (Adewuyi, 2010; Ayeloja, 2021; Babatoude, 2024), which similarly report that aquaculture tends to be dominated by individuals in their economically active years. The education distribution shows that 34.07 percent of farmers had completed secondary school, representing the largest group in the sample. This is followed by 18.68 percent with education up to the middle level and 10.99 percent with high-school qualifications. A small proportion (4.4 percent) of farmers were illiterate. The mean years of schooling were 11.57, with a standard deviation of 3.9, indicating moderate variation in educational levels among respondents. Overall, the results suggest that most trout farmers possess at least basic formal education, which may enhance their ability to adopt improved farming practices and engage with extension services. Experience in trout farming exhibited a similar pattern of variation. The largest proportion of farmers (36.26 percent) had 10–15 years of experience, followed by 29.67 percent with 5–10 years, and 27.47 percent with less than five years of experience. Only 6.59 percent had more than 15 years of experience in trout culture. The mean farming experience was 9 years, with a standard deviation of 4, reflecting moderate differences in the length of involvement in the sector. These figures suggest that while the trout farming landscape includes both newcomers and long-term practitioners, it is primarily driven by farmers with mid-level experience—an aspect that may influence their managerial efficiency, adoption of innovations, and responsiveness to extension interventions. Family size patterns further highlight the socio-economic dynamics of trout

indicating that a large proportion of trout-farming households belong to lower-income categories. About 30% fall within the income range of ₹600,000–₹1,200,000, while only 18% report incomes above ₹1,200,000 per year. The mean household income stands at ₹771,587, with a relatively high standard deviation of ₹593,415, reflecting considerable dispersion in economic status. This wide variation suggests that households engaged in trout farming have diverse livelihood portfolios and differing levels of financial stability. The findings highlight the importance of trout farming as part of a broader livelihood strategy, particularly for lower-income households, while also pointing to potential disparities in resource access, diversification opportunities, and economic resilience across the sample. The distance to the nearest extension office also displayed significant variation, with implications for farmers' access to technical support. About 37.36 percent of farmers were located more than 20 km away from an extension office, indicating potential constraints to obtaining timely advisory services. Meanwhile, 26.37 percent were within 10 km, followed by 17.58 percent at 10–15 km and 18.68 percent at 15–20 km. The mean distance was 18.9 km (SD = 12.9), reflecting considerable spatial disparities in access to public extension services. Such variations may affect technology adoption, management practices, and ultimately the efficiency of trout farming operations. The distribution of seminar attendance among trout farmers indicates moderate but uneven engagement with capacity-building activities. About 32% of farmers attended three seminars, 22% attended four, and 19% attended two. Smaller percentages

attended one (15%) or five seminars (11%), while 1% never participated. The average attendance was approximately three seminars (mean = 2.91, SD = 1.25), reflecting reasonable involvement in training essential for farm management, technology adoption, and productivity improvement. However, the low or absent participation of some farmers highlights the need for more inclusive outreach to ensure all benefit from knowledge dissemination.



Source: Authors Compilation

Figure 1. Distributions of Non-Metric Variables

The gender composition of trout farm owners shows a highly skewed distribution, with 87% of farms owned by males and only 13% owned by females. This imbalance highlights the male-dominated nature of trout farming, which is consistent with broader trends in fisheries (Adewuyi, 2010; Ayelaja, 2021; Babatounde, 2024; Kundu, 2016). While access to financial services plays a crucial role in enabling farmers to adopt improved technologies, purchase quality inputs, and expand their operations. The results indicate that 64% of trout farmers have access to credit through the KCC (Kisan Credit Card) scheme, while the remaining 36% rely on alternative sources, such as relatives, friends, informal borrowings systems. The high share of KCC beneficiaries suggests that farmers have relatively good access to formal financial channels, which may facilitate timely purchase of inputs. However, the fact that more than one-third of farmers still depend on alternative sources highlights gaps in coverage and financial inclusion, possible due to documentation constraints, limited awareness, or perceptions about banking procedures. The distribution of trout farm types indicates that 66% operate as single farms, while 34% function within cluster arrangements. Single farms typically rely on household labor and individual decision making, which may limit economies of scale. In contrast, cluster farms benefit from shared resources, collective procurement, group marketing, and knowledge exchange. The higher proportion of single farms suggests that trout farming in the region is largely individual-driven and small-scale.

Conclusion and Recommendations

This study examined the socio-economic, institutional, and farm-level characteristics of trout farmers in Jammu and Kashmir, a region with substantial potential for cold-water aquaculture development. The results reveal marked heterogeneity across farmers in terms of age, education, experience, family structure, household income, access to credit, training exposure, and distance to extension services. The age distribution indicates that trout farming is concentrated among individuals in their productive years, supported by moderate levels of education and mid-range farming experience. These characteristics reflect a farming population capable of engaging with new technologies and management practices, aligning with trends observed in previous studies across Africa and Asia. Household income patterns suggest that trout farming contributes to diversified livelihoods, particularly among lower-income households. However, significant variation in economic status points to uneven access to resources and opportunities. Institutional access also shows disparities: while a majority of farmers benefit from the KCC credit scheme, nearly one-third continue to rely on informal sources. Similarly, although many farmers participate in training seminars, a non-negligible proportion remains outside institutional extension networks. The physical distance to extension offices further limits timely access to advisory support for many farmers. Farm type

distribution shows that trout farming in the region is predominantly conducted on single-farm units, which tend to operate individually with limited economies of scale. Cluster-based farms—though fewer—offer advantages such as shared learning, group marketing, and collective resource use. Overall, the findings demonstrate that the performance and sustainability of trout farming are shaped not only by technical inputs but also by farmers' socio-economic attributes, institutional connections, and access to support services. Strengthening these factors can enhance the economic viability and long-term resilience of the sector. Drawing on the empirical findings and the broader literature, the following recommendations are proposed to strengthen trout farming in Jammu and Kashmir:

Strengthen Extension Delivery and Improve Accessibility: Given the considerable distance many farmers face in reaching extension offices, mobile extension units, satellite service centers, and ICT-based advisory platforms (SMS, WhatsApp groups, and helplines) should be introduced. Locating village-level extension agents within major production clusters would further enhance responsiveness and reduce information gaps.

Expand Capacity-Building and Training Coverage: Although many farmers have attended training seminars, uneven participation persists. Extension agencies and the Department of Fisheries should increase the frequency of location-specific training programmes, focusing on feed management, disease control, water quality monitoring, and biosecurity. Priority should be given to farmers with low or no previous training exposure to ensure inclusiveness.

Enhance Access to Affordable and Timely Credit: While KCC coverage is significant, barriers remain for nearly one-third of farmers. Simplifying documentation, improving awareness, and offering aquaculture-specific loan products—such as credit for feed, fingerlings, and raceway repair—would strengthen financial access. Collaboration between banks, cooperatives, and farmer producer organizations (FPOs) can further expand formal credit outreach.

Promote Cluster-Based Farming Models: Given the advantages of collective production and marketing, efforts should be made to encourage cluster formation among small-scale trout farmers. Support for shared infrastructure—such as cold storage, transport, input procurement, and processing units—would increase economies of scale, reduce transaction costs, and improve market access.

Develop Targeted Support for Low-Income and New Farmers: The high proportion of low-income households suggests the need for tailored interventions. Subsidized inputs, start-up assistance, and specialized training for new entrants can reduce entry barriers and improve farm stability. Encouraging women's participation through gender-sensitive training and credit programmes can further diversify involvement in the sector.

Integrate Socio-Economic Factors into Aquaculture Policy and Planning: The study shows that socio-economic attributes—such as education, experience, and family labor—significantly influence management practices and institutional engagement. Policies should therefore integrate human-capital development, local livelihood conditions, and social dynamics into aquaculture planning rather than relying solely on technical or infrastructural solutions. By highlighting micro-level socio-economic and institutional determinants, this study contributes to a deeper understanding of trout farming systems in Jammu and Kashmir. Strengthening extension, training, financial services, and collective action can significantly enhance farm performance, reduce inequalities, and promote sustainable cold-water aquaculture in the region.

REFERENCES

- Adewuyi, S. A. 2010. Analysis of Profitability of Fish Farming in Ogun state, Nigeria. *Journal of Human Ecology* 31 (3), 179 – 184.

- Ayeloja, A. A. 2021. Contribution of fish farming to the socio-economic status of fish farmers in Oyo State, Nigeria. *Ghana Journal of Agricultural Science*, 56(2), 75-84.
- Babatoude, C. F. 2024. Socio-economic determinants of the adoption of fish farming technologies in south Benin. *Agronomie Africaine*, 36(2), 121-132.
- Babatoude, C. F. 2024. Socio-economic determinants of the adoption of fish farming technologies in south Benin. *Agronomie Africaine*, 36(2), 121-132.
- Department of Fisheries, G. 2023. Handbook on Fisheries Statistics 2023. New Delhi: Government of India.
- Department of Fisheries, Government of Jammu and Kashmir. 2024. Retrieved from <http://jkfisheries.in/achievements.htm>
- FAO. 2024. The State of World Fisheries and Aquaculture. Rome, Italy: FAO. doi:<https://doi.org/10.4060/cd0683en>
- FAO. 2025. FAO Yearbook of Fishery and Aquaculture Statistics. Rome, Italy: FAO. doi:<https://doi.org/10.4060/cd6788en>
- Kundu, R. M. 2016. Effect of Social and Economic Drivers on Success of Small Scale Fish farming in Western Kenya. *African Journal of Tropical Hydrobiology and Fisheries*, 14(1), 29-44.
- Kundu, R. M. 2016. Effect of Social and Economic Drivers on Success of Small Scale Fish farming in Western Kenya. *African Journal of Tropical Hydrobiology and Fisheries*, 14(1), 29-44.
- Little, D. C. 2013. Socio-economic factors affecting aquaculture site selection and carrying capacity. Site selection and carrying capacities for inland and coastal aquaculture, 103-115.
- Morgan, M. T. 2017. Socio-cultural dynamics shaping the potential of aquaculture to deliver development outcomes. a. *Reviews in Aquaculture*, 9(4), 317-325.
- Nadarajah, S. &. 2017. Global aquaculture growth and institutional quality. *Marine Policy*, 84, 142-151.
- Pemsl, D. E. 2006. Determining high potential aquaculture production areas-analysis of key socio-economic adoption factors.
- Sanon, V. P. 2021. Socio-Economic Perspectives of Transition in Inland Fisheries and Fish Farming in a Least Developed Country. *Sustainability*, 13(5), 2985.
- Slater, M. J. 2013. Effect of social and economic drivers on choosing aquaculture as a coastal livelihood. *Ocean & Coastal Management*, 73, 22-30.
- Sule, A. M. 2002. Factors affecting adoption on fishing innovation among fishing entrepreneurs in Jebba Lake Community. *Journal of Agricultural Extension* 6., 48 – 60.
- Zhang, H. N. 2022. Evaluation of technical efficiency in exotic carp polyculture in Northern India: conventional DEA vs. bootstrapping methods. *Fishes*, 7(4), 168.
