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Reservoir to livelihood: A socio-economic perspective on fisher's of Sarodha Reservoir, Chhattisgarh

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Abstract

The fisheries sector plays a vital role in shaping the socio-economic development of Chhattisgarh state, with reservoirs serving as significant hubs for fish production, irrigation, industrial growth, and livelihood opportunities. This study focuses on Sarodha reservoir, situated in Kabirdham district of Chhattisgarh, with the aim of comprehending the socio-economic perspectives of the fisher communities engaged in fisheries activities within the reservoir. Data were collected using pre-structured interview questionnaires and Participatory Rural Appraisal (PRA) tools to assess the available resources. Additionally, secondary data from the annual reports of state fisheries departments, journals were incorporated. Multistage random sampling was employed for the sampling process. The findings of the study highlight that a majority of fishers fall within the age group of 21-40 years (69%), and the occupation is predominantly male-dominated, with 59% of the respondents being married. Educational attainment indicates that only 10% of the samples were illiterate, while the maximum number had completed primary education (34%). Furthermore, approximately 52% of fishers earned a monthly income of Rs. 10,001 to 15,000, which proved inadequate to sustain their livelihoods, often leading to indebtedness. The study also delves into the species commonly caught in the reservoir. Among the challenges faced by the fisher communities, marketing issues and insufficient knowledge regarding fish handling emerged, along with the lack of access to credit facilities. Based on the findings, it is concluded that providing basic infrastructure facilities to the fisher communities can significantly improve their livelihoods. This study aims to inform the formulation of policy frameworks that address the specific needs and challenges faced by fisherfolk in Sarodha reservoir, thereby contributing to the enhancement of their overall socio-economic well-being.

Keywords: Fisheries, livelihood, infrastructure, reservoir

Introduction

India boasts a commendable fish production of 14.73 million tonnes during 2019-2020, establishing its position as the world's 3rd largest fish-producing nation and the 2nd largest in aquaculture, closely following China. The fisheries sector plays a pivotal role in the socio-economic well-being of numerous individuals, providing affordable and nutritious food to the population (Ayappan and Krishnan, 2004; Chourey *et al*., 2014) [1, 2]. Reservoir fisheries hold significant importance in inland fisheries production, ensuring nutritional and livelihood security for the most vulnerable sections of society, particularly in developing nations. India has a vast array of reservoirs, with 19,134 small, 180 medium, and 56 large reservoirs serving diverse purposes, including irrigation, soil conservation, hydro power generation, and domestic water supply These reservoirs are categorized based on size into large (>5000 ha), medium (1000-5000 ha), and small (<1000 ha) reservoirs (FAO, 2022; Sugunan, 1995) [3, 5].

The fisheries sector plays a crucial role in the socio-economic development of rural communities in Chhattisgarh. The state's fish production for 2019-20 is estimated at 572 tonnes. Out of the total 1770 reservoirs in Chhattisgarh, more than 42 reservoirs are utilized for fisheries purposes and play a significant role in various aspects, including fish production and providing livelihood opportunities. These reservoirs serves as vital role to the region's socio-economic development, playing a crucial role in meeting the nutritional needs of the population, supporting agricultural activities through irrigation, fostering industrial growth, and offering livelihood opportunities to communities dependent on fishing-related activities. One such reservoir is Sarodha, located approximately 12 kilometers from Kawardha, Chhattisgarh. Built in June 1963 across the river Uthani Nala, the reservoir is surrounded by the Maikal mountain range. It spans 470 meters in length and has a considerable water storage capacity of 30 million cubic meters (DoF Chhattisgarh, 2019-20). Sarodha reservoir is considered 'The lifeline of Kawardha". Details on Saroda reservoir are mentioned in Table 1.

Table 1: Saroda reservoir

Particulars	Sarodha Sagar Jalasay/Reservoir
Location of dam	12 km from Kawardha
River	Uthani nala river Mahanadi basin
Year of construction	1963
Total surface area (ha)	409 ha
Effective area	232 ha
Height of dam (in m)	36.61m
Length of the dam (km)	469 km
Catchment area (km2)	223 km2
Type of reservoir (size)	232 ha
Type of reservoir	Small
Purpose of construction	Irrigation, Electricity purpose
Reservoir capacity (million metric cubes)	8mmt
Main catch	342 kg
By-catch	44.9kg
Total catch	386.9 kg
Ownership	Irrigation department
Seasonality	Perennial
Water Retention Month	12
Aquatic weed	No
Under a fish culture	Yes

In the district of Kabirdham, there are a total of 43 primary fisheries cooperatives. Among these cooperatives, three societies are currently engaged in fisheries activities in the reservoir. The management actions taken by these cooperatives are intricately linked to the livelihood status of the beneficiaries. As fisheries play a crucial role in the socio-economic development of the region, it becomes imperative to design and implement policies that align with the socio-economic status and demands of the stakeholders involved. The success and effectiveness of their management strategies heavily depend on understanding the socio-economic conditions of the people involved, as well as recognizing the specific needs and aspirations of the stakeholders.

Designing appropriate policies requires a thorough assessment of the socio-economic status of the fisher communities, taking into account factors such as their income levels, educational attainment, access to resources, and existing challenges. By tailoring policies to address the specific demands and requirements of the stakeholders, the authorities can ensure that the fisheries sector remains sustainable, economically viable, and beneficial to the overall well-being of the local population. Moreover, implementing policies that are responsive to the socio-economic conditions of the stakeholders will foster a sense of ownership and active participation among the fishing communities. This, in turn, can lead to better resource management, increased productivity, and the overall growth of the fisheries sector in Kabirdham.

Materials and Methods

The Sarodha reservoir is situated in Kawardha, Chhattisgarh, at coordinates 21°58'43.5"N 81°08'25.6"E. For data collection, a multistage random sampling method was employed. Primary data were gathered from ninety members of three cooperative societies: Kevart Fisheries Cooperative Society, Shri Ram Fisheries Cooperative Society, and Netaji Fisheries Cooperative Society (30 numbers from each society). The study collected data on various socio-economic indicators, including age, gender, education, types of housing, income, expenditure patterns, savings, occupation, employment status, health, and access to basic infrastructure facilities (Kumar *et al*., 2014). Additionally, Participatory Rural Appraisal (PRA) tools were utilized to assess the resources available to the respondents. To analyze the collected data, the statistical software SPSS 18 was employed.

Fig 1: Satellite image of Sarodha reservoir

Results and Discussion

Age structure: The study reveal important insights about the age distribution of the respondents involved in fishing activities. Among the surveyed individuals, the majority, comprising 65% of the respondents, fell within the age group of 21 to 40 years old. This indicates that the fishing community predominantly consists of relatively younger individuals. Furthermore, the graph suggests that the percentage of people engaged in fishing declines significantly after the age of 60. This decline can be attributed to several factors. Firstly, fishing is generally considered a physically demanding and labor-intensive occupation that requires considerable energy and physical strength. As individuals age, they may find it increasingly challenging to cope with the physical demands of fishing, leading to a reduced participation rate in this occupation. The data also imply that younger individuals are more likely to join the fishing workforce, while older individuals tend to transition away from fishing-related activities, possibly seeking alternative livelihoods that are less physically demanding.

Family structure: The study indicates that a significant proportion of the respondents, comprising 59%, were married individuals. Among these married respondents, the prevailing family structure is that of a joint family, consisting of 5 to 15 members. This finding highlights the common family arrangement among the surveyed population. Joint families are characterized by multiple generations living together under one roof and sharing resources and responsibilities. In this context, it is common for family members to be financially dependent on one another and collaborate in various aspects of daily life. The prevalence of joint families with a relatively larger size suggests that the fishing community in the study area values

the sense of togetherness and mutual support. Such family structures can have advantages in terms of social cohesion, pooling of resources, and shared responsibilities.

Gender: The study findings indicate that a majority of the respondents engaged in various activities related to fisheries were male, accounting for 59% of the total respondents. This observation highlights the male-oriented nature of the fisheries sector in the study area. The gender disparity in fisheries activities can be attributed to various social, cultural, and economic factors prevalent in the region. Traditionally, fishing has been considered a male-dominated occupation, where men often take on roles such as fishing, boat operation, and marketing of the catch. On the other hand, women may be more involved in activities related to fish processing and domestic tasks. This gender skew in the fisheries sector can have implications for women's access to income-generating opportunities and decision-making power within the fishing community. Efforts to address the male-oriented nature of the fisheries sector should involve promoting gender equality, providing training and support for women's participation in various fisheries activities, and creating an enabling environment that ensures equal opportunities for both men and women in the sector.

Caste: The study's findings emphasize the significant representation of different social groups within the fisheries cooperatives, with the majority of members belonging to Other Backward Classes (OBCs), comprising 75% of the cooperative membership. This high representation reflects the active participation and engagement of fishermen communities such as *Kaivart*, *Malha*, and *Dhivar* in fisheries activities. Moreover, Scheduled Tribes (STs) make up 19% of the cooperative members, indicating their involvement in the fishing sector. The Baiga tribe, which constitutes the ST caste, is among the major communities involved in fisheries activities. Additionally, Scheduled Castes (SCs) account for 6% of the cooperative membership. The diverse representation of different social groups within the fisheries cooperatives demonstrates the inclusive nature of these cooperatives and the fishing community as a whole. This diversity not only enriches the cooperative's dynamics but also enables the incorporation of various perspectives and experiences in decision-making processes.

By ensuring equitable opportunities and benefits for all members, irrespective of their social background, the fisheries cooperatives can promote sustainable development, enhance the socio-economic well-being of the fishing community, and strengthen the overall resilience of the sector.

Literacy: The study reveals interesting insights into the educational background of the fishers surveyed. Among the respondents, the highest proportion, accounting for 50%, had completed their education up to the primary level. This suggests that a significant number of fishers have acquired basic literacy skills, which can have positive implications for their engagement in various livelihood activities and their ability to access information and resources. Having a larger proportion of respondents falling into the "educated" category (34%) reflects a moderate level of educational attainment among the fishing community, indicating that some individuals have pursued secondary or vocational education. Interestingly, only 6% of the fishers had received higher education, which includes individuals who have completed tertiary education such as university degrees or advanced diplomas. This suggests that access to higher education among the fishing community is relatively limited. Encouraging more fishers to pursue higher education can lead to increased knowledge and skills, fostering innovation, and improving overall socio-economic development.

Health facilities: The study provides valuable information regarding the proximity of fishing villages near Sarodha reservoir to the district hospital of Kawardha, indicating a distance of approximately 12 kilometers. This distance plays a significant role in understanding the accessibility of healthcare services for the fishers residing in these villages. According to the findings, 60% of the fishers reported having access to a primary health care center. This suggests that a substantial portion of the fishing community in the area can access basic healthcare services through nearby primary health care facilities. Having access to primary health care is crucial for addressing common health issues, receiving preventive care, and seeking early treatment for illnesses or injuries. However, it is essential to continue monitoring the health status of the fishers and assessing the effectiveness of healthcare interventions to ensure that all members of the fishing community have access to quality healthcare services. Strengthening healthcare infrastructure, promoting health education, and supporting preventive healthcare measures can further enhance livelihood resilience of the fishing community.

Housing Condition: Among the houses surveyed, the majority, accounting for 78% of the total, were classified as semi-pucca houses. Semi-pucca houses are dwellings that have a combination of permanent and temporary materials, offering a balance between cost-effectiveness and durability. The second most common type of houses, comprising 16% of the total, were categorized as pucca houses. Pucca houses are fully permanent structures made of durable and long-lasting materials, providing better resilience against environmental conditions and offering a higher level of permanence. Lastly, 6% of the houses fell under the category of kaccha houses. Kaccha houses are typically constructed using temporary and locally available materials, making them less durable and more susceptible to weather conditions.

According to the study findings, 42% of the respondents constructed their houses under the Pradhan Mantri Awas Yojana (PMAY). This indicates that a significant portion of the surveyed individuals opted for the assistance and support provided by the PMAY program to fulfill their housing needs.

Monthly Income: The study reveals the distribution of monthly income among the fishers surveyed. Among the respondents, the largest proportion, comprising 52%, reported earning a monthly income in the range of Rs. 10,001 to Rs. 15,000. The second most common monthly income range reported by 26% of the respondents is Rs.

5,001 to Rs. 10,000. This suggests that a considerable number of fishers earn a slightly lower income compared to the first group, but still falls within a reasonable range to support their livelihoods. A smaller percentage of fishers, 8%, reported earning more than Rs. 20,001 per month. Lastly, only 4% of the fishers reported earning less than Rs. 5,000 per month. This group represents those with lower incomes, possibly facing financial challenges and requiring greater support to improve their socio-economic conditions.
Efforts to improve the livelihoods of fishers may include providing training and support for alternative income-generating activities, promoting sustainable fishing practices, and ensuring fair market access for fishers to fetch better prices for their catch. By addressing income disparities and fostering economic growth within the fishing community, the overall socio-economic development of the region can be enhanced.

Expenditure pattern: The study analyzed the expenditure patterns of the fishers, focusing on the five most common expenses: food, clothing, medicine, education, and entertainment. The findings revealed that the fishers' income-expenditure ratio was lower, indicating that their monthly expenditure exceeded their earnings. Among the various expenditures, the highest percentage of fishers' income, 55%, was spent on food. This suggests that a significant portion of their earnings is allocated towards meeting basic food needs for themselves and their families. The second most significant expenditure was on clothing, accounting for 18% of their income. This reflects the importance placed on clothing expenses, which are essential for maintaining their livelihood and social well-being. Medical expenses constituted 10% of their income, indicating the significance of healthcare costs for the fishers' overall well-being and the need for financial provisions to manage health-related needs. Education expenses accounted for 8% of their income. This indicates that investing in education is recognized as essential for the fishers and their families, potentially contributing to their socio-economic development and improving future prospects. Lastly, 9% of their income was allocated to entertainment expenses. This highlights the importance of leisure activities and recreational pursuits in the lives of the fishers, contributing to their quality of life and well-being.
The difference in the monthly expenditure patterns among different Co-operative Societies was analyzed in Table 2. This information can provide insights into how the expenditure patterns may vary between different groups of fishers based on their socio-economic backgrounds, geographical locations, and other factors. Understanding these differences can help in formulating tailored strategies and support measures to address the specific needs of different Co-operative Societies and improve their financial stability and well-being.

Table 2: Difference in the monthly expenditure (%) pattern of Co-operative Societies

Expenditure Items	Kevart Coop. Society	Shri Ram Coop. Society	Netaji Coop. society
Food	72.8%(Rs.107700)	71.1% Rs.118200)	71.1%(Rs.125000)
Clothing	10.9% (Rs.16200)	10.8%(Rs.18000)	10.7%(Rs.18900)
Medical	6.9% (Rs.10200)	8.4%(Rs.13900)	5.8%(Rs.10200)
Education	5.4% (Rs.7900)	6.7%(Rs.11000)	6.9%(Rs.12000)
Entertainment	4.0% (Rs.6000)	3.0%(Rs.5000)	5.5% (Rs.9700)
Total	100% (Rs.1,48000)	100%(Rs.166,100)	100%(Rs.175,800)

Occupation: The study indicates that the majority of respondents have fisheries as their primary occupation. This highlights the significance of fishing as the main source of livelihood for a significant portion of the surveyed population. Additionally, the study examined alternative sources of income among the respondents. The findings reveal that livestock and poultry rearing serve as the most common alternative income-generating activity, accounting for 50% of the respondents. This suggests that a substantial number of fishers are also engaged in raising livestock or poultry alongside their fishing activities to supplement their income.
Furthermore, agriculture is identified as another significant alternative source of income, generating 32% of additional earnings for the respondents. This indicates that a considerable proportion of fishers may be involved in agricultural activities, possibly cultivating crops or engaging in other agricultural practices to diversify their income streams. Lastly, the study found that 18% of the respondents earn alternative income through running shops or similar small businesses. This suggests that a portion of fishers may operate small retail establishments or enterprises, providing goods or services to the local community.
Diversifying income sources is essential for enhancing the economic resilience of individuals and communities, particularly in sectors like fishing that can be influenced by factors such as weather conditions and fluctuations in fish stocks. By engaging in alternative income-generating activities, fishers can mitigate risks and create more stable livelihoods.

Species caught from the reservoir
The study recorded the capture of more than 20 different fish species from the reservoir during the survey period. These diverse species demonstrate the rich biodiversity and potential of the reservoir as a fishing ground. After catching the fish, the majority of the fishers sell their catch at the Kawardha Fish Market, which is situated approximately 15 kilometers away from the reservoir. The market acts as a major trading hub for fish, where fishers can access a broader customer base and potentially fetch better prices for their catch. Table 3 presents the various fish species caught from the reservoir, along with their respective rates in the market. These rates can vary depending on factors such as fish size, species popularity, and market demand

Table 3: Major species caught from the sarodha reservoir

Name	Scientific name	Local Name	Retail / kg
Catla	*Catla catla*	Catla/ Bhakur	150/-
Rohu	*Labeo rohita*	Naini	140/-
Mrigal	*Cirhhinus mrigala*	Mrigal	120/-
Common carp	*Cyprinus carpio*	Petla	120/-
Grass carp	*Ctenophyaryngodon idella*	Ghass carp	120/-
Silver carp	*Hypophthalmicthys molitrix*	Chikni	120/-
Pangus	*Pangasius sp.*	Pangus	80-100/-
Bighead carp	*Hypophthalmicthys nobilis*	Bighead	120-150/-
Climbing perch	*Anabas testudineous*	Keu	120/-
Murrel	*Channa striatus*	Bhunda	150-200/-
Eel	*Mastacembalus armatus*	Bambi	80-100/-
Mola	*Amblypharyngodon mola*	Molal	100/-
Tilapia	*Oreochromis sp.*	Tiger Fish	100/-
Magur	*Clarias batracus*	Mongra	50-80/-
Singhi	*Hetereonoptis fossilis*	Singhi	150-200
Loach	*Lepidocephalus guntea*	Rudwa	250
Feather-back	*Notopterus sp.*	chital	120-150
Tengra	*Mystus sp.*	Tengra	80
Puntius	*Puntius sp.*	Kotri	150
Freshwater Prawn	*Macrobrachium choprai*	Chinghri	50
Freshwater shark	*Wallagu attu*	Padhina	100

Constraints faced by the fishermen

The study identifies several key constraints faced by the fishing community in the studied reservoir area. These constraints can significantly impact the livelihoods and overall well-being of the fishers. Some of the major constraints are as follows:

1. **Lack of Cooperative Marketing Organization:** The absence of a cooperative marketing organization can hinder the fishers' ability to collectively market and sell their catch. Cooperative marketing can provide better bargaining power, access to larger markets, and fair prices for their produce. The fish caught were auction on the site and sell out to the individual fishermen or the intermediaries.
2. **Lack of Crafts and Gears:** The inadequate availability of fishing crafts and gear, particularly the use of tubes, can restrict the fishers' efficiency and effectiveness in catching fish. Access to appropriate and modern fishing equipment can enhance their productivity and catch efficiency.
3. **Inadequate Credit Facilities:** Fishers often require financial support to purchase necessary inputs like fishing equipment, fuel, and other supplies. The lack of adequate credit facilities can limit their ability to invest in their fishing activities and improve their livelihoods.
4. **Lack of Knowledge on Hygienic Handling of Fish:** The absence of proper knowledge on hygienic handling and post-harvest practices can negatively impact the quality and value of the fish catch. Proper handling and storage practices are essential to ensure the freshness and marketability of the fish.
5. **Lack of Transport, Storage, Ice, and Parking Facilities:** Insufficient infrastructure facilities, such as transportation, storage, ice, and parking facilities, can create challenges in preserving the quality of the fish catch and efficiently transporting it to markets.
6. **Inadequate Awareness of Government Schemes:** Limited awareness among the stakeholders, including fishers, about the available schemes and support programs offered by both the central and state governments can lead to missed opportunities to access financial and technical assistance.

Addressing these constraints is crucial for promoting the sustainable development of the fishing community and the fisheries sector. Effective interventions and support measures can include the establishment of cooperative marketing organizations, provision of modern fishing crafts and gear, access to credit facilities, training on hygienic fish handling practices, and the improvement of infrastructure facilities. Additionally,
raising awareness about government schemes can empower the fishing community to take advantage of available support and incentives, leading to enhanced livelihoods and improved socio-economic conditions for the fishers and their families.

Conclusion

The study underscores the significance of the fisheries sector in the socio-economic development of the Sarodha Reservoir region. Fisheries plays a pivotal role as source of income, nutrition, and livelihood for a significant portion of the local population. However, the income expenditure gap analysis found that the income-expenditure ratio of fishers was lower, indicating that their monthly expenditure was higher than their earnings. Furthermore, it has been observed that the fishers face various challenges in their livelihoods. By recognizing these challenges and constraints faced by fishers, policymakers and stakeholders can develop targeted interventions to enhance their livelihoods and overall well-being. Addressing issues related to infrastructure, marketing, access to credit, and skill development can promote sustainable growth and economic empowerment within the fishing community. Ultimately, a holistic approach focusing on the improvement of various aspects of the fisheries sector can contribute to the betterment of the fishers' lives and foster inclusive development in the region

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