



SPECIES DIVERSITY AND SOCIOECONOMIC DEPENDENCY ON THE SRI RAM SAGAR PROJECT: STRATEGIES FOR ENHANCING FISH FARMERS' INCOME AMID RISING OPERATIONAL COSTS.

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ABSTRACT :

The SRSP Reservoir, located at Pochampad, Telangana, India, forms a very important source of revenue for local communities, most of whom derive their principal income related to fishing. The present study deals with the species diversity of the reservoir and identifies fifteen economically valuable fish species, considered important for ensuring the socioeconomic stability of fish farmers dependent on SRSP. Despite this reservoir's potentials, over the years, these fishermen have been faced with high financial challenges; this has prevented them from expanding their revenues and sustaining their financial stability as operational costs continue to go up, due to increased prices for gear such as fishing nets and changing rates in markets where fish are sold.

This study analyses focused interventions that could improve the income of fish farmers while ensuring resource management that is sustainable within the SRSP ecosystem. A suggested strategy is the promotion of sustainable aquaculture practices, this would, in turn, enhance market access to provide fairer prices and a broader consumer market, in addition to greater yields and environmental health. Financial incentive programs that also include access to low-interest loans and subsidies for key inputs also help alleviate some of the operational costs. This paper further explores other income-generating activities in the form of ecotourism projects, such as interpretive programs and catch-and-release fishing tours, within this community.

The strategic measures in this study will, therefore, support fish producers to overcome financial constraints and improve income stability as a way of promoting a more resilient and sustainable fisheries sector around the SRSP. Findings with practical implications for policy makers, resource managers, and local stakeholders contribute to the larger discourse on freshwater fishing management and rural socio-economic development

INTRODUCTION :



Image showing aerial [Sriram Sagar Project]

The SRSP is a major water resource for the newly formed state of Telangana, India, constructed over the Godavari River. Except as a source of irrigation and drinking water, SRSP plays a very important part in the fish farming activities of the region. The reservoir has emerged as a significant economic activity for the rural communities surrounding the reservoir, contributing not only to food security but also to the livelihood of so many households. With SRSP fish farming contributing considerably to the local income, its socio-economic importance will go on growing with more families depending on it for their primary source of earnings.

Despite this dependence on it, fish farming by SRSP is confronted with numerous economic issues which pose a threat to the sustainability of farmers' incomes. The fluctuations in the market prices of fish, along with an increase in operational costs, especially of fishing gear like nets and their maintenance tools, have squeezed the margins. In fact, such challenges give a signal for sustainability in practice and alternative livelihoods to ensure financial sustainability of SRSP fish farmers.

These are some of the questions which this study tries to answer, with a focus on



THREE MAIN OBJECTIVES:

- It attempts to document species diversity in the SRSP reservoir as one of the means of recognizing economically important species of fish and contributors to local trade;
- secondly, it analyses the relationship between increasing operating costs and the dependency on SRSP resources. how those factors would influence annual revenues for a fish farmer; and concludes by making some suggestions of how revenue could be diversified in ways which would stabilize, if not raise, regional fish producers' profits through possible projects such as better aquaculture, market access.
- The present study will undertake an in-depth analysis with a view to providing practical insights that may help local stakeholders, legislators, and resource managers build a sustainable and economically resilient fishery industry around the SRSP. The study provides ways through which livelihood outcomes may be improved for communities depending on reservoirs by addressing ecological and economic aspects of fishing farmers in the SRSP.

2. LITERATURE REVIEW :

Freshwater reservoirs are one of the most important resources for rural livelihood due to their potential that contributes to economic development through fisheries and food security. As noted by M. Kumar et al. 2020, freshwater aquaculture is among the main sources of income for millions of people in India, primarily in rural areas where few job opportunities exist. Further, the large structural and financial challenges constrain the sector, such as limited access to sustainable practices, lack of training, and really inadequate infrastructure. Such obstacles are normally discussed not only in relation to the limitation of the overall productivity and income opportunities for fish farmers but also in relation to how they feed into poverty cycles in many rural areas.

The economic challenges are particularly ominous in the context of India's aquaculture industry. As R. Sharma et al. (2018) explain in their study, increasing costs of operations have resulted in the undue increase in critical equipment and tools such as nets that are used to catch fish. stress among fish farmers regarding finances. Inflation, interruption of supply chains, and input costs have made things challenging for farmers to upgrade their operations and invest in better practices. Due to this, aquaculture practices are often kept at very low levels concerning productivity and quality, which reduces the earning potential still further for those dependent on the industry.

These are further aggravated by deficiencies in the infrastructure in which cold storage and transportation are considerably lacking. Fish farmers cannot benefit better from urban markets because they must sell their commodities locally and cheaply since there are no good storage and transportation facilities

available. These binding constraints highlight the need to develop the appropriate infrastructure that could support the fish farmers, more so at SRSP where post-harvest losses are very high and transportation is usually erratic.

Furthermore, aquaculture within reservoirs should be made as environmentally sustainable as possible. According to researchers such as Tiwari et al. (2021), unsustainable methods of fishing degrade ecosystems and reduce the yield of fish, with a threat to biodiversity. The knowledge and training on methods considered sustainable aquaculture-which would protect freshwater ecosystems and ensure long-term productivity-are found to be too inadequate to enable farmers to pursue its complete adoptions. These latter two, polyculture farming and controlled feeding programs, have been tried with some success elsewhere but so far remain uncommon in the SRSP area.

Increasing operation costs and lack of access to even more sustainable practices have also eroded the economic stability of fish farmers. This paper discusses economic issues affecting SRSP fish farmers, with a focus on the specific conditions of SRSP fish farmers, providing a strategic outlook.

This review has tried to provide a comprehensive framework through which aquaculture practices in SRSP can be upgraded based on its interaction with interrelated factors of financial stress, infrastructural deficits, and environmental issues. Therefore, targeted interventions such as investment in infrastructure, training for sustainable practices, and subsidies for equipment necessary to raise their level would increase SRSP fish farmers' productivity and incomes manifold.

3. METHODOLOGY :

3.1 STUDY AREA

In Telangana, India, the SRSP is one of the biggest bodies of fresh water located on the Godavari River, and with a reservoir area estimated at 5,000 hectares. The local peoples' livelihoods depend on the most important water resources of the reservoir for drinking, fishing, and irrigation. The diverse fish fauna of the aquatic ecosystem of SRSP provides double benefits to the local fish farmers and biodiversity. Hence, the study area was selected to represent a variety of fishing sites constituting SRSP so that a fair assessment of species diversity and socioeconomic dependency can be achieved among different fishing communities. Sites for sampling were selected in such a way as to include those areas of the reservoir that are heavily fished, as well as areas of less frequent harvesting, so as not to miss the diversity of fish within the entire community of fish.

3.2 SPECIES IDENTIFICATION

Fish samples were collected systematically over a three-month period that comprised both peak and off-peak fishing seasons in order to capture the seasonality of fish species diversity in the SRSP. Standardized netting, comprising cast and gill nets, was used to capture fish from different habitat zones and depths. Identification was based on accepted taxonomic keys, focusing primarily on morphological characteristics of body shape, fin structure, coloration, and scale patterns. Identification procedures were also cross-checked with expert local fishermen regarding the commonly caught species and seasonal occurrence of fish. Identification of commercially important fish species at SRSP was cross-checked for each species with the help of reference materials and databases for their correct identification.

| Fish Species | Scientific Name | Identification Characteristics |
|-------------------|------------------------------------|--|
| Rohu | <i>Labeo rohita</i> | Deep-bodied, elongated, silver scales, forked tail |
| Catla | <i>Catla catla</i> | Large head, wide mouth, silver body |
| Mrigal | <i>Cirrhinus cirrhosus</i> | Streamlined, small scales, deep forked tail |
| Common Carp | <i>Cyprinus carpio</i> | Deep-bodied, barbel on upper jaw |
| Tilapia | <i>Oreochromis niloticus</i> | Rounded body, dark vertical stripes on body |
| Grass Carp | <i>Ctenopharyngodon idella</i> | Elongated body, cylindrical, no barbels |
| Silver Carp | <i>Hypophthalmichthys molitrix</i> | Flattened body, upturned mouth |
| Bighead Carp | <i>Hypophthalmichthys nobilis</i> | Large head, spotted body, fleshy lips |
| Snakehead | <i>Channa striata</i> | Long body, dark bands on side, snake-like head |
| Indian Major Carp | <i>Cirrhinus reba</i> | Elongated body, silver with dark fins |

3.3 SOCIOECONOMIC DATA COLLECTION: INCOME AND COST ANALYSIS

A total of 50 fish farmers residing in the villages surrounding the reservoir were involved in structured interviews to be able to determine their economic dependence on SRSP resources. **The Nizamabad district comprises Nandipet, Navipet, Mendora, Balkonda, and Morthad mandals.** Those who participated actively in fishing within SRSP itself and depended on it for sustenance as their main source of income were some of the selection criteria for participants. Face-to-face interviews were performed because the researchers were in a better position to seek clarification where necessary and encourage elaboration of answers.

The major purposes of the survey instrument were for the capture of annual income, income fluctuations in seasons, and particular cost factors related to fish farming. Questions included:

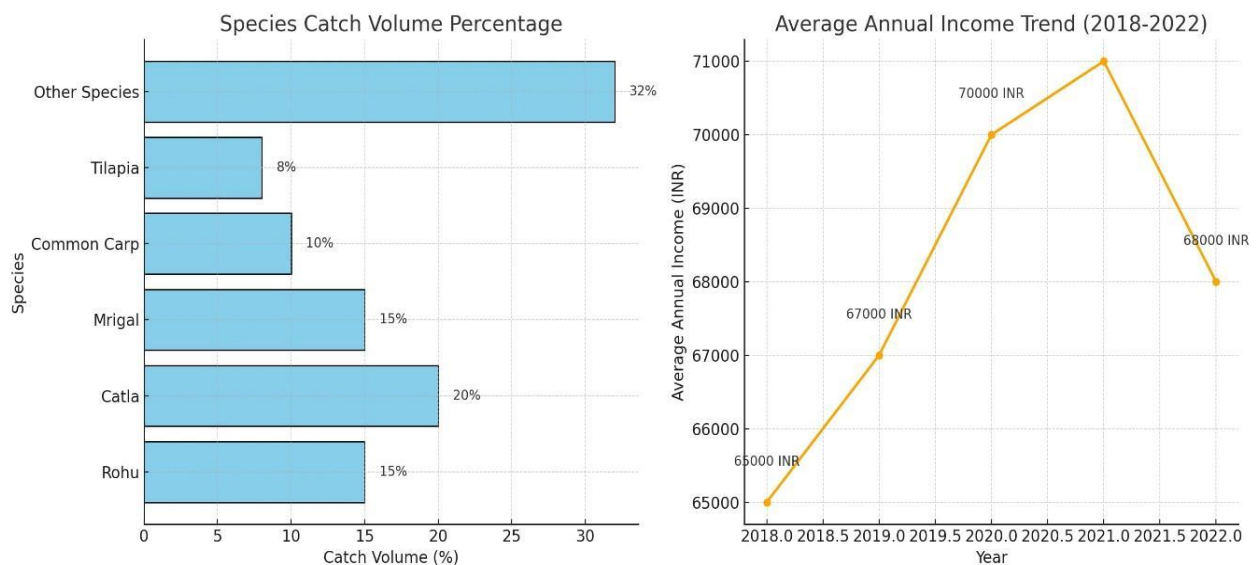
1. Seasonal average catch volume and value.
2. The main issues of fish marketing, including fluctuation in price and availability. Operating costs, where the labour, fuel, and maintenance expenses of the and fishing net are estimated.
3. The presumed impact on profitability and the stability of income due to the rise in material costs.
4. Other sources of income were also inquired into, as was the question of whether they would be interested in diversifying these streams by availing themselves of opportunities like better market access. They were also asked about other sources of income they might have. whether they had an interest in diversifying their streams of revenue through potential opportunities, like increased market access or ecotourism. Although the quantitative data on income and cost were used to deduce the average profit margins and financial constraints affecting livelihood sustainability among fish farmers, the qualitative data helped in capturing the macro socioeconomic dependencies and challenges

4. RESULTS :

4.1 SPECIES DIVERSITY

The SRSP reservoir have fifteen economically important fish species. These are extremely important to the ecosystem balance and for providing a living source to local fishermen. Major species of commercial importance include the most commercially significant species include **Rohu** (*Labeo rohita*), **Catla** (*Catla catla*), and **Mrigal** (*Cirrhinus cirrhosus*) Their combined catch shares were estimated to be about 50% and thus had the highest demand and commercial value in the local markets.

1. **Rohu** (*Labeo rohita*): This species constitutes 15% of the total catch volume, with an individual fish weighing on average 1.5–2.5 kg, and the price for one fish can reach up to 80–100 INR. If this species weighs more than 3 kg, its price reaches 110–150 INR. The locals value this species highly.
2. **Catla** (*Catla catla*) – Represents 20% of the catch; larger specimens below (2–3 kg) are likely to be sold 80-100 INR per kg. above 3kg often sold for INR 130–180 per kg.
3. **Mrigal** is the third component, *Cirrhinus cirrhosus*, which forms 15% of the catch. This is a demandable species in the local market and fetches INR 90 per kg due to its taste and texture.
4. **The common carp**, *Cyprinus carpio*, constitutes 10% of the total catch and is sold approximately at INR 100 per kilogram.
5. **Tilapia** or *Oreochromis niloticus* accounts for about 8% of the catch, and an average price for it in the market is INR 60/kg.



4.2 FARMER ANNUAL INCOME DEPENDENCY AND RISING COST

The average annual income of SRSP fish farmers was estimated at around INR 60,000–80,000. However, their economic stability is increasingly challenged by:

1. **Unstable Market Rates:** Farmers often lack bargaining power due to limited market access, forcing them to accept low prices set by intermediaries.
2. **Rising Costs of Fishing Materials:** The cost of nets has surged by approximately 20% in recent years, straining farmers' budgets and reducing their profit margins. High-quality, durable nets are essential for sustaining catch volume, but rising costs limit farmers' ability to invest in these resources.

DISCUSSION :

In fact, the biodiversity in the SRSP reservoir acts as a backbone for the fishing economy, wherein different species of fishes support several rural populations. The study has identified fifteen commercially important species in this reservoir, thus proving the capacity of said reservoir to maintain sustainable and lucrative methods of fishing. However, fish farmers' dependence on SRSP also subjects them to a set of operational and financial risks threatening their all-round viability as well as income security.

The other urgent problem that has arisen from our studies is that of the effect of the growth of operating expenses on the profitability of fish farmers. As is well known, the price of basic necessities such as fishing nets and upkeep of s have increased dramatically. These costs reduce profit margins and leave little money for reinvestment with many fishermen. These costs are further enhanced by the increase in the price of petroleum products, especially for cases going for longer fishing expeditions. The tribulations are also worsened by the lack of cold storage and transport means because this makes the markets not easily accessible and forces the farmer to dispose of his products at low prices that the middleman dictates. This is because the fishermen do not have negotiating power, putting them at the mercy of the market prices that may result in volatile and erratic earnings.

The following research gives a set of viable solutions for the aforementioned problems, which shall help enhance the economic viability of fish growers around SRSP. For one, access to infrastructure-such as cold storage-would let fishermen store their catches for longer periods without spoilage, enabling them to sell their produce at more rewarding markets. The aquaculture farmers could be better placed in reducing costs by forming cooperative networks through which they share resources, negotiate better prices, and purchase goods wholesale. The community-led cooperatives may also provide training for more sustainable methods of aquaculture in case the species integrated are hardy to environmental changes and demanded throughout the year as a means of diversifying incomes for fishermen.

Most importantly, SRSP is capable of acting as an ecotourism attraction, drawing in tourists interested in the unique biodiversity of the area and local fishing practices. This could directly create more income through activities based on tourism or indirectly through increased demand and awareness for fish caught locally.

Lastly, the income sustainability for SRSP fish producers may need financial support and government involvement. Such communities may have fewer financial burdens if they can get low-interest loans, subsidies for the needed inputs, or even selective incentives in cases of practicing sustainability methods. Policy reform in terms of giving a fair market access by eliminating the unfair intermediaries together with opportunities for selling directly to the consumers will continue to empower the producers of fish.

In other words, SRSP biodiversity is considerable capital that might contribute to the subsistence strategies of the residents. However, this promise will only be fulfilled through joint efforts, against the market dependence and poor infrastructure with increasing prices. But a more secure and prosperous future of people depending on this crucial reservoir could be fostered through a combined mix of economic resiliency of the fish farmers involved in SRSP, by enhancing cooperation in networks, sustainable practices, policies, and increased infrastructure

SUGGESTED WAYS OF IMPROVING INCOMES AND MATCHING GROWING EXPENSES

1. IMPROVED FISHERIES METHODS

- **Training and Capacity Development:** Engage in various capacity building and training through government agencies on yield improvement; aquaculture production techniques, which have lesser impact on the environment, including habitat enhancement and selective breeding amongst others. The latter type of programs has resulted in a resultant improvement in the productivity and skills of fish farmers; an example is the Aquaculture Skill Development Program of India.
- **Subsidized Equipment:** Farmers could be able to invest in quality equipment with the help of governmental subsidies since the subsidies offset the increased costs for such vital equipment as nets and do not yield lower income.

2. BETTER VALUE ADDITION AND MARKET ACCESS

- **Cold Storage and Processing Facilities:** Construction of neighbourhood cold storage facilities near SRSP would allow farmers to maintain the freshness of fish for longer and sell at a time when demand is particularly strong. The value addition of fish into fillets would have a greater increase in market prices.
- **Co-operatives:** Direct Market Access - Co-operatives empower the SRSP fish farmers by reducing their dependence on middlemen, thus enabling collective bargaining. For example, in Kerala, fish co-operatives have helped the local farmers get much better prices by simply eliminating middlemen.
- **Transparent Market Rates:** The mobile phone application or SMS-based service for SRSP farmers would allow farmers to decide when and where to sell by providing real-time fish prices. A similar model has helped farmers in other agriculture sectors of the country avoid underselling their products.

3. FINANCIAL SUPPORT AND GOVERNMENT ASSISTANCE

- **Microfinance and Low-Interest Loans:** Low-interest loans toward the purchase price of durable nets and equipment mean that farmers are able to make such investments without depleting their savings. This has been where microfinance institutions have been able to succeed in helping rural farmers acquire needed equipment.
- **Grantly Support for Sustainable Practices:** Government grants for providing ecological equipment, such as biodegradable nets, translate into less spending over time and further capture of more ecologically conscious consumers.
- **Income Protection Insurance:** The provision of insurance plans would serve as a safety net for SRSP fish farmers, covering the loss of income due to market price fluctuations or sudden unforeseen expenses. This same sort of system has worked well in the Philippines, cushioning the loss when fishermen have to put off fishing during distress times.

7. CONCLUSION :

Apart from being an important source of irrigation water, this SRSP reservoir is also forming an important economic hub for the aquaculture community in Telangana State. For most fishermen, SRSP would provide a basis to support their families and the community besides being a source of revenue. However, economic issues like low and erratic market prices, soaring costs for vital gear such as nets, and lack of proper access to markets are declining, thus seriously hampering the very sustainability of such livelihoods and perhaps inhibiting further growth. Apart from determining the potentials and vulnerabilities within the ecosystem, this study was also in a position to impress upon the importance of SRSP biodiversity and its economic contribution to aquaculture production.

Targeted interventions have to be instituted in overcoming these problems. Examples of enhanced aquaculture practices which would directly impact production and conservation of fish resources include selective breeding and sustainable management. Programs that can be set up, like cooperatives giving direct market access, would reduce the need for middlemen and allow more equitable pricing for the fish farmers to establish a regional brand for SRSP

fishery products. Besides alleviating short-term economic strains, financial assistance might also engender long-term resilience through low-interest loans and subsidies for sustainable equipment.

Other ecotourism activities around SRSP, such as recreational fisheries, culinary tourism, or educational tours, open up new sources of income for the fish farmers and raise the level of public awareness about the ecological value of the reservoir. These, along with assisting local businesses, would seek partnerships with universities and other academics that could encourage school outings and transfer knowledge among the young researchers and local fishermen.

These remedies concur with the general objective of SRSP, that argues for the utilization of resources in a sustainable manner. The remedies have helped fish growers to become economically resilient while ensuring that the biological balance, which is essential for the long survival of the reservoir is realized. Through consultation with local cooperatives, educational institutions, and government organizations, SRSP has the potential to become model of sustainable fishery management that not only meets the needs of present-day communities but also paves the way for future generations to thrive. By reinforcing SRSP's socioeconomic and environmental framework, we can ensure that this reservoir continues to be a lifeline for the fish farmers and the biodiversity it supports.

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