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Full Length Research Paper

Research on South Tripura's Fisheries Development: Current Situation and Prospects: Strategic Choices

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Because of the increasing demand for fish, the northeastern state of Tripura's fishing industry is currently undergoing a shift to become a "income-generating enterprise." In order to identify some strategic choices for overall growth, this article sought to analyze the current state and prospects of the fisheries in the southern area of the state. Culture fisheries, which are conducted in small ponds and mini-barrages throughout the district, are the mainstay of fisheries development, according to the study. The area under culture fisheries is 3436 ha, or 97.75% of the district's total water resources, and they contributed more than 99 percent (35,152 MT) of the district's total fish production in 2017–18.Fish production from culture fisheries, fish productivity of culture fisheries, and the compound annual growth rate (CAGR) for culture fisheries resources were found to be 2.420, 4.528, and 1.802, respectively. By 2025, the district would be able to produce 11696 MT of fish with an annual fish productivity of 2893 kg per hectare, according to projections made using the linear pattern of logarithmic time series data. However, by that time, 118 MT of fish would need to be obtained from outside the district, indicating a 4000 MT shortfall from the current level of fish production (2017–18). The amount of fish consumed annually per person exceeds the ICMR guidelines. The study also made an effort to address a number of managerial and technical factors that must be taken into account when developing strategic choices for the development of fisheries in the South Tripu district.

Key words: Annual growth rate, Fisheries, Production, Tripura.

INTRODUCTION

Over half of the people of North East Indian State, Tripura, are employed in agriculture and related fields, making the state an agrarian economy. Due to the state's vast population of around 95% fish eaters, the fishing industry is regarded as one of the most important areas for economic development in this state (Debnathet al, 2020). Since freshwater fish are an inexpensive source of sustenance for humans and a dependable source of money and livelihood for a sizable portion of the Tripuran population, they constitute an important food item. The State's 18.91 kg per capita fish consumption is said to be the greatest among the inland States of the country. Tripura achieved a fish production of 72,273 MT in 2017-18. Despite such spectacular growth, the demand for fish in the state was higher than its supply and fish are being sourced from outside the State. Unlike other part of NE India, fish is preferable food item for the people of Tripura where rice and fish form the basic diet. Thus it is imperative to enhance the fish production in the State so as to mitigate the area specific problem of food security. However, though there is tremendous potential of available aqua resources in the state, the local production of fish is expected to meet only 20.00 kg against actual per capita fish consumption demand of 23.48 kg at the nation's inland states. In 2017–2018, Tripura produced 72,273 MT of fish. Despite this remarkable expansion, the state's demand for fish exceeded its supply, thus fish are now being imported. For the people of Tripura, where rice and fish make up the majority of the diet, fish is a preferred food item in contrast to other parts of Northeast India. Therefore, increasing the state's fish production is essential to reducing the region-specific food security issue. Even though the state's aqua resources have enormous potential, local fish production is only anticipated to reach 20.00 kg by the end of 2018–19, compared to the actual per capita requirement of 23.48 kg for fish consumption (Anon, 2018). Tripura has made significant progress in producing fish seeds; according to data from the Government of India (2019), the state currently produces 4350 lakhs of fish seeds, second only to Assam in the Northeast. Few hatcheries have been established, and the technology for breeding and hatching the state fish, the pabda, has been implemented. Additionally, the state uses

artificial sea water to create freshwater prawn seed, which is a highly popular and significant kind that the state's consumers seek. Resources from capture fisheries are scarce, and aquaculture continues to be the primary supply of fish. The general public in the state now thinks that fish culture is the most lucrative activity in agriculture and related fields. With total water resources of almost 3690 hectares (capture and culture fisheries combined), the south Tripura district holds a significant position among the eight districts, contributing 13% to the total fish production in 2017–18. However, the district has not yet reached its full potential for fish production. Nevertheless, there are numerous limitations that must be prioritized while creating district fisheries development plans. Thus, an attempt has been made in this document to examine the current state and potential future of fisheries while keeping food security and nutrition in mind. Lastly, we made an effort to determine some crucial strategic possibilities for the district's fisheries development.

MATERIALS AND METHODS

Using only secondary data and information mostly gathered from the Department of Fisheries, Directorate of Economics and Statistics, Government of Tripura, and other pertinent departments, the study was carried out in the southernmost district of Tripura State. Additionally, a few noteworthy facts and the conclusions of pertinent research papers were also included in the analysis. The study made use of both cross-sectional and time series data and information. Understanding the past trend and generating short-term future estimates based on Compounding Annual Growth Rate (CAGR) were the primary uses of time series data. Since 2011–12, time series data on fisheries resources, fish and seed production, etc., have been gathered. Prior to that time, data was compiled and kept for undivided South Tripura, from which the current district administration of South Tripura was separated. Since the data for 2018–19 were not formally released until the analysis period, cross-sectional data primarily represented the data for 2017–18. The South Tripura district's eight blocks, which are divided into three subdivisions, were all examined, and data at the block level was analyzed to determine the current state of the fishing industry. Data analysis at the village level was outside the purview of this paper.

To highlight important aspects of the data, tabulation, percentage analysis, and trend analysis were performed utilizing the slope of the linear relationship between the components under research and their corresponding years. The most methodical approach to displaying numerical data in an understandable format is tabulation. In descriptive analysis, tabulation provides a straightforward way to explain the implications and makes comparing related numerical data simple and convenient. To make the material easier to read, percentages were utilized while addressing the study's parameters. To compare trends and relationship situations, as well as to highlight noteworthy data elements, a graphical representation of the data was created. Exponential functions of the following kind were used to characterize trends in resources under culture fisheries, total fish output, fish productivity under culture fisheries, fish seed production, and the number of fish outsourced.

If x is the year and Y is the dependent variable, such as productivity or resource, etc. "A" and "B" are constants. The logarithmic transformation has been used to convert the equation to linear form.

RESULTS AND DISCUSSION

Present status

Study on Present Status and Future Prospects of Fisheries

The district-level fisheries status scenario and pattern did not differ much from the state-level situation. South Tripura's water resources were 3515 hectares and included small ponds, micro barrages built between hillocks, rivulets, and a few small lakes or wetlands used for catch and culture fishing. Three to four water bodies were as large as two to seven hectares, while there was not a single body of water larger than ten hectares. Capture fisheries had few resources and were mostly centered on culture fisheries, which raised fish in tiny ponds and mini-barrages spread across the region. 3436 hectares (97.75% of the district's total water resources) were dedicated to cultural fisheries, which contributed more than 99% (35,152MT) of the district's total fish production in 2017–18. The fishing industry in South Tripura was mostly centered on culture fisheries, which were mainly focused on backyard-sized ponds and mini-barrages built between hillocks. As a result, attention was focused on water resources such as mini-barrages and ponds in various blocks (Table 1). The district's greatest contribution to fish and fish seed production, and consequently to the productivity attained from culture fisheries, came from the Belonia subdivision, which was made up of Hrishyamukh, Bharatchandra Nagar, and Rajnagar Block. When comparing the blocks, the Hrishyamukh block had the largest fish production and the highest fish productivity per hectare annually; in 2017–18, these figures were 1309 MT and 2951 kg/ha/year, respectively. Rupaichari block had the lowest fish productivity (2143.66 kg/ha/yr during 2017–18) under culture fisheries, which might be because there were more tribal fish farmers there than in other blocks of the districts. Data on carp seed production differed greatly amongst the blocks. There were just 139 fish seed producers in the district, according to a report from the Government of Tripura's Department of Fisheries. This can be because farmers don't know enough about or aren't interested in managing carp nurseries and rearing to produce fingerlings and fry. There were 28846 fish farmers in the South Tripura district, making up around 15.61 percent of the state's total fish farmer population. Table 2 provides a summary of additional infrastructure and pertinent data pertaining to the fisheries of the South Tripura area.

Future projections

Table 3 shows the time series pattern of water resources used in culture fisheries, fish productivity, fish and fish seed generation from culture fisheries resources, and fish sourced from outside the state.

The data trend indicated that resources, fish productivity, and the number of fish that were outsourced all grew exponentially. In light of this, the natural log of the variables was taken before the data were subjected to linear regression analysis.There is no consistent pattern in the time series data on fish seed production. Fish production from culture fisheries, fish productivity of culture fisheries, and the compound annual growth rate (CAGR) for culture fisheries resources were found to be 2.420, 4.528, and 1.802, respectively. Curiously, the amount of fish that is outsourced has decreased with time, which is thought to be a good sign for the growth of fish farming in the district. Culture fisheries water resources, fish output, and the quantity of fish that are outsourced were anticipated for 2025 using the linear pattern of logarithmic data and regression in time series data (Table 3). With a fish production of 2893 kg per hectare annually, the district was projected to be able to produce

11696 MT of fish while obtaining 118 MT of fish from outside the district.

*No regular pattern was observed and no CAGR was calculated.

Fish demand vis-à-vis local supply pivot

Estimates of South Tripura's fish production by 2025 were given in the previous section, coupled with estimates of the availability of fish from outside sources. This shows that fish will be available by 2025. However, estimates may be based on a number of factors when taking the demand side into account. In order to estimate demand, we made numerous assumptions.

Scenario1 (Food security)

Here, the demand for fish is estimated considering the impact of rising fish consumer income in South Tripura, assuming that all other parameters stay the same. Here, the income elasticity of demand that exists in Tripura was estimated using a basic method. An income elasticity of demand for Tripura was determined to be 0.375 using primary data from the National Sample Survey Organization's (NSSO) 61st round, 2004-05 (NSSO, 2007) and 68th round, 2011-12 (NSSO, 2014) surveys. Table 4 displays the anticipated demand using this elasticity and the base year of 2017–18 fish production. The study's imprecise estimate of the demand for fish by 2025 was 12682 MT, indicating a 4000 MT shortfall from the current level of fish output in 2017–18. In other words, given Tripura's growing population and affluence, the current development in fish output may not be enough to meet the demand for fish by 2025.

Scenario 2 (Nutritional security)

Fish Global food and nutritional security is significantly influenced by fish and fisheries products. Eating fish has special health and nutritional advantages and is regarded as an essential part of a balanced diet. The Indian Council of Medical Research's 2011 National Institute of Nutrition, Hyderabad, produced Dietary Guidelines for Indians, which included suggestions for balanced meals. Our primary topic of discussion is fish, which is a popular and readily digested source of animal protein. Because it contains certain vitamins (A, D, and B12), minerals (zinc, iron, iodine, selenium, phosphorus, and calcium), and—most importantly—long-chain omega-3 fatty acids, it is also recognized for having beneficial health effects.

(Sabine and Sarvenaz, 2018). According to Dey et al. (2017), small indigenous fishes (SIFs) have a well-balanced diet that is primarily composed of protein.

According to dietary standards, a vegetarian Indian should consume 32.76 kg of pulses annually; non-vegetarians can substitute animal protein, such as meat or fish, for these pulses. In Tripura, the average person currently consumes 5.800 kg of pulses, 4.90 kg of beef, and 15.28 kg of fish. In Tripura, the average person consumes 25.98 kg of these three food types—pulses, meat, and fish—and the average annual deficiency for non-vegetarians is approximately 4.78 kg of animal protein. Therefore, there is room for fish, meat, and pulses as sources of protein to satisfy the state's nutritional needs. The severe and hypothetical scenario of substituting fish alone for the entire pulse demand was shown in Table 4. According to Barik (2016), around 44% of the non-vegetarian protein came from fish. Taking this assessment into account, the annual per capita consumption of fish in Tripura was significantly greater than the national non-vegetarian consumption of fish-based protein. Furthermore, as fish is regarded as a special source of vitamins and minerals, it undoubtedly holds a premium position for development if the current analysis of nutritional elements extends beyond the issue of protein.

Crafting strategic options

South Tripura's current fish consumption condition does not call for a serious threat to nutritional security. The average person consumes 20.20 kg of fish each year, which is even more than the amount of nutrients advised by

ICMR. However, the nutritional value and importance of various fish species vary. According to Dey et al. (2017), small indigenous fish varieties include a variety of micronutrients. Similarly, fish like Singhi and Koi are advised to be included in the diets of those who are ill or recovering from an illness. Research studies to determine the production needs of several fish kinds independently are long overdue in Tripura. Effective techniques and requirements for different types of fish should be prepared. There is a pressing need for a solid economic analysis of demand estimation for fish varieties. Up until now, management solutions regarding the need for inputs in fish farming have not received much attention. It is necessary to accurately analyze the market availability and demand for input materials used in fish farming, such as fish feed, fish seed, lime, and other manures and fertilizers. The district's farmers struggle with the scarcity of high-quality fish feed and seed. Certification of high-quality fish seed could be implemented. Pond fish farming has a good chance of incorporating enhanced fish types like Amur carp, Jayanti Rohu, etc. as an additional tactic to increase production levels. Given its resource availability, South Tripura would also benefit from the IFS model, which integrates fisheries as a fundamental component. Promoting women in family farming and fish farming is necessary. Sensitization of SHGs and fishing cooperatives is urgently needed. The improvement of field level officials' knowledge is a significant concern. Regarding financing concerns, prompt credit availability to farmers is necessary for them to begin aquaculture activities on time. Currently, fishing operations are also covered by the Kisan Credit Card (KCC). It is necessary to raise farmers' awareness of this. Financial institutions' credit assistance systems need to be reinforced. For the fish to reach consumers in fresh condition, government assistance for the market infrastructure and fish storage facility should be guaranteed. Low-cost fish storage facilities and market infrastructure need to be improved.

CONCLUSION

To reach the district's desired fish production, a comprehensive strategy that prioritizes strategic choices and clearly defines the roles of many stakeholders is now needed. Fish is the district's most significant agricultural product for business or enterprise growth in order to create jobs for the district's rural youth. Because of the district's high yearly per capita consumption of fish and the fact that it is additionally complemented by meat, eggs, and pulses, nutritional security from fish is not a big worry. However, because it is high in micronutrients and some types have therapeutic qualities, fish plays a significant role in diet plans in addition to providing protein. The district's growing demand for fish and the demographic and economic increase of its consumers both pointed to the urgent need for deliberate intervention.

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Table1: Present status of culture water resources, production, productivity and fish seed production across different blocks of South Tripura (2017-18).

Sub-division	Name of the Block	Culture fisheries resources (ha)	Production from culture fisheries (in MT)	Productivity of culture fisheries (kg/ha/year)	Carp seed production (lakh)
Santirbazar	Bokafa	499.92	1296	2592.41	11.8
	Julaibari	578.98	1513	2613.22	32.67
Sabroom	Satchand	512.86	1139	2220.88	30.6
	Rupaichari	357.8	767	2143.66	19.05
	Poyangbari	127.33	331	2599.54	2.7
Belonia	Hrishyamukh	443.53	1309	2951.32	50.21
	BC Nagar	288.3	810	2809.57	6.68
	Rajnagar	521.63	1136	2177.79	27.95

Source: *Department of Fisheries, Government of Tripura, 2017-18*

Table 2: Infrastructure in fisheries (2017-18).

Particular	Nos. in the District	Nos. in State
Fish Breeding Farm	0	9
Fish Seed Centre	2	14
Fishermen Co-operative Societies	21	143
Fish Farmers Development Agency	0	4
Fish Farmers Training Centre	1	8
Fishery Awareness Centre	1	3
M. C. Hatchery (Chinese)	3	18
Prawn Hatchery	1	8
Cat fish Hatchery	1	5
F.R.P Hatchery	4	21
Soil & Water Testing Laboratories	5	27
Nos. of KVK	1	8
Nos. of Fish Market	38	176

Source: *Department of Fisheries, Government of Tripura, 2017-18*