



# Study on Present Status and Future Prospects of Fisheries Development in South Tripura: Strategic Options

Biswajit Debnath<sup>1\*</sup>, D. Sharmah<sup>1</sup>, Basant K. Kandpal<sup>2</sup> and Bidyut Chandan Deka<sup>3</sup>

Krishi Vigyan Kendra (ICAR for NEH Region), South Tripura  
Birchandra Manu, P.O. Manpathar, South Tripura – 799 144(Tripura)

## ABSTRACT

Fisheries sector in north eastern State, Tripura is in a transitional phase to establish the sector into an ‘income-generating enterprise’ due to high demand of fish. This paper aimed at analysing present status and future prospects of fisheries in the southern district of the State with an objective to originate out some strategic options for overall development. Study found that culture fisheries practiced in small sized pond and mini-barrages across the district is the mainstay of fisheries development and area under culture fisheries is 3436 ha (97.75 % of total district water resources) which contributing more than 99 per cent (35,152 MT) to the total fish production in the district during 2017–18. Compounding Annual Growth Rate (CAGR) for culture fisheries resources, fish production from culture fisheries and fish productivity of culture fisheries was observed to be 2.420, 4.528 and 1.802 respectively. Projections using the linear pattern of logarithmic time series data showed that the district would able to produce 11696 MT fish with a fish productivity of 2893 kg per ha per year, while availing 118 MT fish from outside the district by 2025 indicating a deficit of 4000 MT from present (2017-18) level of fish production. Present per capita annual fish consumption is higher than the ICMR recommendations. Study also attempted to discuss multiple technical and managerial aspects which are required to be considered while formulating strategic options for fisheries development in South Tripura district.

**Key Words:** Annual growth rate, Fisheries, Production, Tripura

## INTRODUCTION

The economy of North East Indian State, Tripura is an agrarian state with more than half of the population dependent on agriculture and allied activities. Fisheries sector is considered to be one of the vital sectors for economic development in this State, due to the fact that State has large fish eating population accounting approximately 95 per cent (Debnath *et al*, 2020). Freshwater fishes forms an important food item as it is a cheap source nutrition for human beings, and a reliable source of income and livelihoods to a large section of people of Tripura. The per capita consumption of fish in the State with 18.91kg is reported to be highest 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

\* Corresponding Author's Email: [debnath\\_biswajit@rediffmail.com](mailto:debnath_biswajit@rediffmail.com)

<sup>1</sup>Krishi Vigyan Kendra (ICAR), South Tripura

<sup>2</sup>Director, ICAR Research Complex for NEH Region

<sup>3</sup>Director, Agricultural Technology Application Research Institute (ATARI), Zone - VII

the end of 2018-19 (Anon, 2018). Tripura has made considerable achievement with regard to fish seed production and present production of fish seed in the State is 4350 lakhs which is second highest in North East after Assam (as per data from Government of India, 2019). The technology for breeding and hatching of *Pabda* (the state fish) has been adopted and few hatcheries have been developed. The state also produces freshwater prawn seed using artificial sea water, which is very prevalent and important demanding variety by consumers in the State. Capture fisheries resources is meagre, aquaculture remains the mainstay of its fish production. People of the state, in general, have come to believe that fish culture is the most profitable of all activities under agriculture and allied sectors. Among the eight districts, south Tripura district occupies an important position contributing 13 per cent to the total fish production during 2017-18 with total water resources of nearly 3690 ha (capture and culture fisheries together); the maximum potential for fish production in the district yet to be realized. But this is confronted with many constraints that are needed to be considered on priority basis while preparing district fisheries developmental plans. Therefore, an effort has been made in this document to analyze the present status, future prospects in fisheries while considering the nutritional and food security aspects in mind. Finally, we tried to work out some important strategic options for fisheries development in the district.

## MATERIALS AND METHODS

The study was conducted in the southern most district of Tripura State using only secondary data and information mostly collected from Department of Fisheries, Directorate of Economics and Statistics, Government of Tripura and other relevant department. Besides, few significant information and findings of relevant research articles were also incorporated while carrying out the analysis. Both cross section and time series data and information were used for the study. Time series data were mostly used for understanding the previous trend

and making short term future projections based on Compounding Annual Growth Rate (CAGR). Time series data related to fisheries resources, fish and seed production etc. were collected since 2011-12, as data available before that period was aggregated and maintained for undivided south Tripura, from which present south Tripura district administration was separated. Cross section data mostly represented the information for the year 2017-18, as the data of 2018-19 were not officially published till the period of analysis. All the eight Blocks under three subdivisions of South Tripura district were covered and block level data analysis was done to understand the status of fisheries sector at present horizon. Village level data analysis was out of the scope of this paper.

Tabulation, percentage analysis and trend analysis using slope of linear relationship between factors under study with its respective years were carried out to bring out salient feature of data. Tabulation is the most systematic way of presenting numerical data in an easily understandable form. Tabulation in descriptive analysis has clear expression of the implication and easy and convenient to compare related numeric data. Percentage form was used while discussing the parameters of the study to make the document more convenient for the reader. Graphical representation of data was made to highlight outstanding features of data and make comparison of trends and relationship cases. Trend in resources under culture fisheries, total fish production, fish productivity under culture fisheries, fish seed production, quantity of fish outsourced were described by exponential functions of the following form

Where,  $Y$  is dependent variable say resource or production etc. and  $x$  is the year. 'a' and 'b' are constants. The equation has been transformed to linear form using logarithmic transformation.

## RESULTS AND DISCUSSION

### Present status

Fisheries status scenario and pattern was not showing much discrepancy in the district than

## Study on Present Status and Future Prospects of Fisheries

**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*

that prevailing at State level. Fisheries resources of South Tripura was comprised of small ponds, mini barrages created in between hillocks, rivulets, and few small lakes or wetlands under culture and capture fisheries adding to the total of 3515 ha water resources. No single water body existed with a water area of more than 10 ha, whereas three to four water bodies were as large as 2 to 7 ha. Resources under capture fisheries were meagre and it was mainly based on culture fisheries, where fish farming was carried out in small sized pond and mini-barrages across the district. Total area under culture fisheries was 3436 ha (97.75% of total district water resources) contributing more than 99% (35,152MT) to the total fish production in the district during 2017 – 18. South Tripura fisheries sector was mainly based on culture fisheries that primarily engrossed to small ponds at backyard condition and mini-barrages created in between hillocks. So, focus was given on the water resources like ponds and mini-barrages across different blocks (Table 1). Belonia sub-division comprising of Hrishyamukh, Bharatchandra Nagar, and Rajnagar Block was contributing maximum to the district in terms of production of fish and fish seed and hence the productivity achieved from culture fisheries. Comparing the blocks, fish production from Hrishyamukh block and the fish productivity

per ha per year was highest and during 2017-18 the same was found as 1309 MT and 2951 kg/ha/yr, respectively. Lowest fish productivity (2143.66 kg/ha/yr during 2017-18) under culture fisheries was observed in Rupaichari block, which may be due to the fact that percentage of tribal fish farmers was more in that block as compared to other blocks of the districts. Carp seed production data across the blocks varied widely. As per the report by Department of Fisheries, Government of Tripura, the district was having only 139 numbers of fish seed producers. This may be due to the lack of knowledge or interest of farmers to venture into carp nursery and rearing management to produce fry and fingerlings. South Tripura district was having a fish farming population of 28846 numbers, which was approximately 15.61 per cent of State's fish farmer's population. Other infrastructure and related information regarding the fisheries of south Tripura district has been summarized in Table 2.

### Future projections

Time series pattern of culture fisheries water resources, fish and fish seed production from culture fisheries resources, fish productivity and fish sourced from outside-state has been depicted in Table 3. The trend in data showed that there was an exponential pattern of growth in resources, fish production and

**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*

quantity of fish outsourced. Considering so, data were analyzed through linear regression after taking the natural log of variables. Time series data on production of fish seed doesn't follow any regular pattern. Compounding Annual Growth Rate (CAGR) for culture fisheries resources, fish production from culture fisheries and fish productivity of culture fisheries was observed to be 2.420, 4.528 and 1.802 respectively. Interestingly, the quantity of fish outsourced has shown a negative growth over time, which considered to be positive indicator for fish farming development within the district. Using the linear pattern of logarithmic data and the regression in time series data, culture fisheries water resources, fish production and outsourced fish quantity were projected for 2025 (Table 3). Projection showed that the district would be able to produce 11696 MT fish with a fish productivity of 2893 kg per ha per year, while availing 118 MT fish from outside the district.

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

#### **Fish demand vis-à-vis local supply pivot**

Previous section provided projections of fish

production of south Tripura by 2025 along with the projections of availing fish from outside source. This indicates the availability of fish by 2025. But while considering the demand side, projections may be based on various factors. We have assumed different situation for demand estimation.

#### **Scenario 1 (Food security)**

It is herewith projected the demand of fish using the effect of income growth of fish consumer's demand of fish in South Tripura with an assumption that other factors remained unchanged. Here, a crude method was used to estimate the income elasticity of demand prevailing in Tripura. Using primary data of survey, 61st round, 2004-05 (NSSO, 2007) and 68th round, 2011-12 (NSSO, 2014) reported by National Sample Survey Organization (NSSO) an income elasticity of demand for Tripura was found as 0.375. Using this elasticity and fish production of 2017-18 as base year, the projected demand has been shown in Table 4. This crude estimation made in this study claimed a demand of 12682 MT fish by 2025 which indicated a deficit of 4000 MT from present (2017-18) level of fish production. In other words, the present fish production growth might not

## Study on Present Status and Future Prospects of Fisheries

**Table 3: Time series data and projections of different variables related to fisheries in South Tripura district.**

Year	Culture fisheries resources (ha)	Production from culture fisheries (in MT)	Productivity of culture fisheries (kg/ha/year)	Carp seed production (lakhs)*	Fish availed in district from outside State (MT)
2011-12	2992	6570	2282	237.25	NA
2012-13	3059	6968	2379	413.8	1500
2013-14	3145	7223	2390	248.84	1504
2014-15	3138	7547	2309	250	1045
2015-16	3297	7744	2466	167.51	1005
2016-17	3393	8368	2561	205.96	473
2017-18	3436	8590	2540	213.74	554
CAGR	2.42 %	4.528 %	1.802 %		-21.523 %
Projections:					
2018-19	3530	8982	2597	-	505
2019-20	3616	9386	2644	-	397
2020-21	3703	9808	2692	-	311
2021-22	3793	10250	2741	-	244
2022-23	3885	10711	2791	-	192
2023-24	3980	11193	2841	-	151
2024-25	4077	11696	2893	-	118

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

compensate the demand of fish by 2025, considering the income growth population in Tripura.

### Scenario 2 (Nutritional security)

Fish and fishery products play an important role in food and nutritional security around the world. Consumption of fish offers unique nutritional and health benefits and is considered a key element in a healthy diet. Dietary Guidelines for Indians prepared by National Institute of Nutrition, Hyderabad (2011) under Indian Council of Medical Research provided the recommendations for Balance diets. Fish is our main object for discussion which is widely preferred and easily digestible source of animal protein. It is also known for having positive health effects due to availability of certain vitamins (A, D, B<sub>12</sub>) and minerals as Zinc, Iron, Iodine, selenium, phosphorus, and calcium and most importantly, long chain omega-3 fatty acids

(Sarvenaz and Sabine, 2018). Small Indigenous Fishes (SIFs) reported to have protein based well balanced nutrition composition (Dey *et al*, 2017).

Dietary guidelines recommended an annual per capita nutritional requirement of 32.76 kg pulses for a vegetarian Indian which can be replaced with Animal protein like meat or fish by a non-vegetarian consumer. Present per capita consumption of pulses in Tripura is about 5.800 kg and per capita meat consumption is about 4.90 kg, and the same for fish is 15.28 kg. Per capita consumption of these three type of food items i.e. pulses, meat and fish is 25.98 kg in Tripura, and it was found that per capita per annum deficit is nearly 4.78 kg animal protein for non-vegetarian. So, Scope exists for pulses, meat as well for fish as a source of protein to meet the nutritional requirement in the state. Table 4 indicated the hypothetical and extreme case

**Table 4: Fish Demand vis-à-vis local supply pivot.**

Year	Population (as per census, 2011 and projected with growth rate of 1.475)	Total Fish production (in MT) with projections based on ACGR as estimated in table 3	Scenario 1 (in MT) (Food Security)		Scenario 2 (in MT) (Nutrition Security)	
			Requirement with present consumption rate (using an income elasticity of 0.375 <sup>s</sup> )	Gap# (Deficit or Surplus)	Requirement by complete replacement of pulses in diet ( <i>hypothetical</i> )	Gap# (Deficit or Surplus)
2017-18	480551	8669	9223	(-) 554	14956	(-) 6287
Projections						
2018-19	487640	9082	9652	(-) 864	15176	(-)6507
2019-20	494832	9490	10102	(-) 1433	15400	(-) 6731
2020-21	502131	9917	10572	(-) 1903	15627	(-) 6958
2021-22	509537	10363	11064	(-) 2395	15858	(-) 7189
2022-23	517053	10829	11579	(-) 2910	16092	(-) 7423
2023-24	524680	11316	12118	(-) 3449	16329	(-) 7660
2024-25	532419	11825	12682	(-) 4013	16570	(-) 7901

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

<sup>s</sup>A crude estimation using NSSO, 2007 and NSSO, 2014, Projection Base year is 2017-18.

<sup>#</sup>It was estimated in reference to present fish production i.e. 2017-18 fish production

of replacing total pulse requirement by fish only. Barik(2016) reported that fish contributed about 44 % of the non-vegetarian protein. Considering this assessment, annual per capita fish consumption in Tripura was much higher than the national non-vegetarian's protein consumption in the form of fish. Further, if the present analysis on nutritional aspects goes beyond the issue of protein, then definitely fish occupies a premium place for development as it is considered as unique source of vitamins and minerals,

### Crafting strategic options

Present fish consumption status in South Tripura doesn't necessitate an alarming situation for nutritional security. Fish consumption is high (20.20 kg per capita annually), even more than the nutritional requirement as recommended by

ICMR. But nutritional elements and significance of different fish varieties are diverse. Small Indigenous fish variety have diverse form of micro-nutrients (Dey *et al*,2017) and similarly, fishes like *Singhi* and *Koi* are recommended in the diet of sick and the convalescents. It is high time in Tripura to make research studies to work out the production requirement of different fish varieties separately. Fish variety wise requirement and effective strategies should be prepared. A sound economic study on fish variety wise demand estimation is an urgent need. Management strategies on input demand for fish farming were not being given much of importance till date. Market availability and demand for fish farming based input materials such as fish seed, fish feed, lime and other manures and fertilizers must assessed properly. Farmers of the

## Study on Present Status and Future Prospects of Fisheries

district face the problem of non-availability of good quality fish seed and fish feed. Quality fish seed certification may be introduced. Good potential exists to incorporate improved fish varieties like Amur carp, Jayanti Rohu etc. in pond fish farming could be another strategy to boost up production level. IFS approach integrating fisheries as central component is also a good option for south Tripura considering its availability of resources. Women in fish farming and family approach need to be promoted. There is an urgent need to sensitize fisheries cooperatives and SHGs. Knowledge up-gradation of field level functionaries is an important concern. Coming to Credit issues, availability of credit to the farmers in time is essential to take up timely aquaculture activity. Presently, Kisan Credit Card (KCC) support has been extended to fisheries activities also. Awareness to the farmers must be made in this regard. Credit support system from financial organizations need to be strengthened. Government support regarding the fish storage facility and market infrastructure should be ensured to reach the fish to consumer's hand in fresh quality. Market infrastructure along with low cost fish storage facilities need to be strengthened.

### CONCLUSION

A holistic approach through prioritizing the strategic options and defining the role of different stakeholders is required at present to achieve the targeted fish production in the district. Fish as a farm product in the district is more important for business or enterprise development to generate employment solution among rural youths of the district. Nutritional security from fish is not a major concern in the district as annual per capita fish consumption is quite high, beside the fact that it is also supplemented by pulses, meat, eggs. But beyond protein, fish has much to do in diet chart as it is good in micro-nutrient and few varieties have medicinal properties too. The population and income growth of consumer and the increasing trend of demand of fish in the district indicated an urgent need of strategic intervention.

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