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## Fishery based livelihood approaches and management of fishery resources in Assam, India

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### Abstract

In India fishery sector provide livelihood to an estimated 10 million people and in Assam fishery sector contribute more than 2% of Gross State Domestic Product (GSDP) to the state economy and plays an important role in providing livelihood to a significant population of the state. The state of Assam has an excellent sub-tropical climate for the development of fresh water fish culture in 3.91 lakh ha of water area an addition of 1.58 lakh hactres of paddy field area. The two major river systems (Brahmaputra and Barak), several beels, lakes, tanks/ ponds and swamps are endowed with valuable fishery resources. Sustainable utilization of available resources with appropriate farming system approaches will increase fish production and also will generate employment opportunities. This paper aimed to focus the potentialities and possibilities of resource utilization as fishery based livelihood through diversified farming systems.

**Keywords:** Livelihood, Fishery, IFS, Rivers, Beels, Rice field,

### 1. Introduction

Fishery plays an important role in supporting livelihoods worldwide and also forms an important source of diet for over one billion people. The Inland fisheries are of particular importance to the rural poor accounting for about 15% of total global employment [7]. It is recognized as a powerful income source and employment generator as it stimulates growth of a number of subsidiary industries and is a source of cheap and nutritious food besides being a foreign exchange earner. In India it is estimated that 12 million people are directly engaged in fishing and about 60 million are exclusively dependent on it for a living [9].

The state of Assam located between 21.57° N – 29.30° N latitude and 89.46° E – 97.30° E longitude with an area of 78 438 km<sup>2</sup>. The state has total 5.49 lakh hectares of fishery resources in the form of river, beels, ponds, low laying areas and paddy field. The state has a total population of 3, 11, 69, 272 as per 2011 census and majority of the population depends on agriculture and allied activities for their livelihood. Despite the vast aquatic resources, Assam yet to reach self-sufficiency in fish production in respect of economic as well as minimum nutritional requirement of 11kg/person because scientific fish farming/fishing is carried out only in 5% of the total water resource area [6].

The production of fishes mainly based on capture fisheries rather than culture fisheries so there is a large gap between demand for fish and production of fish. There is a lack of people's active participation and lack of farming system approach (FSA) for fish production. The excellent sub-tropical climate, vast aquatic resources, rich piscine biodiversity, high demand in market with 95% fish eater population and export potential to neighbouring states provides a congenial background for fishery development to provide employment thousands of people.

### 2. Status of fishery

**2.1 Fishery resources and production trend:** The total water spread area for fishery development is about 5.49 lakh hectares. The state has 3.44 lakh ha of static water resources in the form of beels, ponds and tanks, community tanks, swamps/ low lying areas, reservoirs besides riverine resources of about 2.05 lakh hectres (Table 1). Assam has 216 fin fish species belonging to 104 genera under 37 families and 10 orders [1]. Out of 216 species reported so far, 210 species have food value, 12 species have importance as sport fish and around 150 species have ornamental value. However previous studies from this region reported a wide variation in number of fish species 267 [16] and 266 [15].

**Table 1:** Fishery resources and resource wise productivity (2011-12).

Resources	Area (ha)	Productivity (kgs/ha)	Production (tons)	% Share
Ponds/Tanks - Traditional	19,430	1,800	34,970	14.34
Ponds/Tanks - Improved	21,150	3,000	63,460	26.02
Beels- Traditional	84,900	300	25,470	10.44
Beels-improved	15,915	1,508	24,000	10
Riverine Source	205,000	190	38,950	16
Low-lying/Derelict/Swamps - Traditional	36,000	300	10,800	4
Low-lying/Derelict/Swamps - Developed	4,050	1,500	6,075	2
Forest Fisheries	5,017	501	2,514	1
Other - Paddy Fields etc	158,000	238	37,630	15
Grand Total	5,49,462	444	2,43,869	100

(Source: Department of Fisheries, Government of Assam)

The state stands 6<sup>th</sup> in inland fish production in the country and contributes around 73% of fish production to the regions total fish production. The pond and tanks contributed 40.36% in total fish production followed by beels (20%), River (15.97%) and paddy field 15.43% (Table, 1). The state fish production enhances 28% in last five years with a growth rate of 7.14% in 2012-13. In 2007-08 the production was 190.32 thousand MT and in 2011-12 it is 244 thousands MT (Table 2). The current fish production of fish is not sufficient to meet the demand of 95% fish eater of the state, so around 0.25 lakh tons of fish is annually imported from other states.

**Table 2:** Fish production trend.

Year	Fish seed production (Million fry)	Fish production (ton)
2006-07	2062.61	181479
2007-08	3206.86	190320
2008-09	3428.69	206700
2009-10	3326.23	218822
2010-11	4263.96	232340
2011-12	4490	243869

(Source: Department of Fisheries, Government of Assam)

**2.2 People's Involvement:** People involves in fishing are categorized in three groups: 1. People those catch fishes for daily uses. 2. People belonging to the fishing community and dependent on fishing for their livelihood. 3. Rural entrepreneur (Leaseholders). The floodplains of Brahmaputra and Barak river basins are the important habitat resources of fish and fishery remain as the traditional livelihood activity with tremendous impact on the rural economy. Furthermore fishing during the monsoon is a common economic activity for the people living adjacent to the flood plains <sup>[10]</sup>.

**Fig 1:** Fishing activities in low laying areas of Assam.**Fig 2:** Sun drying of SIFS in Assam.

### 3. Discussion

The available resources of water and land provide excellent opportunities for development of fishery. These are: 1. *Ornamental fish farming:* Assam is the repository of 265 species of indigenous ornamental fishes which have greater demand in international market. Presently, the turnover of export trade of ornamental fish in India is about Rs. 10 million where the north-eastern states alone contributed 85% to the total export trade. Therefore, the sector has great potential for supporting livelihood through breeding and culture of indigenous ornamental fish species. 2. *Culture of small indigenous fish species (SIFS):* The price of small indigenous fishes such as Mola (*Amblypharyngodon mola*), Puthi (*Puntius spp.*), Bata (*Labeo gonius*), Singara (*Mystus spp.*), Singi (*Heteropneustes fossilis*), Kawai (*Anabas testudineus*) etc. has high demand with high price in local market. These species are also cultivable in small ponds (200-400 m<sup>2</sup>) and attain table full grown size within 3-6 months <sup>[3]</sup>. The culture of SIFS does not require much labor and cost, so culture of SIFS can improve livelihood of small farmers with less farming input. 3. *Beel fisheries:* The flood plain wetlands have productivity potential to yield 2.0 to 2.5 t/h/yr in semi intensive culture system <sup>[11]</sup>. The fish production from beel was estimated around 49,470 tons in 2011-12 which contributes 20.29% of fish production of the state. The productivity from beel fisheries can be enhanced through culture based capture fisheries with community participation in 3513 nos. of beels of varied sizes. 4. *Diversification of aquaculture:* The adoption of various non-conventional aquaculture techniques will enhance productivity manifolds. These are: a) *Integrated Fish farming:* Integrated fish farming offers a great scope for generating rural employment in Assam. The integrated fish farming can be in

terms of rice cum fish culture, poultry cum fish culture, dairy cum fish culture and pig cum fish culture<sup>[12]</sup>. Fish farmers can maximize their farm output using plant and animal residues of agriculture and animal husbandry as the major component of feeds and fertilizer in fish culture<sup>[14]</sup>. The ricefish integration is believed to be the most appropriate for livelihood security and also for optimum utilization of available land water resources. The integrated rice fish gives the provision for greater income to the farmers<sup>[8, 2]</sup>. The fish production achieved up to 1.0 t/ha/yr by stocking fish in the flooded rice fields<sup>[13, 4]</sup>. The rice fish integration possess great potentials in 2.3 million hectares of seasonally flooded rice land of Assam.

*b) Cage culture:* Cages are enclosure made of metal rods, bamboos, mosquito cloths or nylon net with capacity to hold definite volume of water permitting free circulation of water through the mesh of cages. Cages used for fish culture may be fixed or floating and allows high stocking density and better maintenance. Cage culture of potential species of fish ensure more of harvested produce per unit area in rivers and beels with greater depth and also will provide quality fingerlings to stock in beels and in rivers.

*c) Pen culture:* Pens are bamboo or nylon made enclosure in shallow margin of water bodies. It can be erected in seasonal water bodies which receives high volume of water for 4-6 months during flood. It may be effectively utilized for raising fry and fingerlings.

*d) Fish-prawn culture:* Rearing of prawn having high market values with fishes can ensure better economic returns to farmers.

*e) Substrate based aquaculture:* The use of substrate likes plants twigs, dried stems, banana leaves, bamboo etc., promote growth of periphyton which are the important live fish food. Thus xeng fishery possesses great potential for good harvest of fish from rivers and beels.

The state endowed with copious fishery resources but lack of infrastructure and facilities hinder the production to a great extent. So, some of the recommendations are:

*a) Establishment of hatcheries:* To provide quality seed in desired quantities at the time stocking of fish in different water bodies.

*b) Fish feed manufacturing plant:* Nutritionally balanced diets or feeds can be supplied to farmers if fish feeds are made available.

*c) Soil and water testing laboratories:* To determine the quality of soil and water favourable for fish growth.

*d) Diseases diagnosis/health centre:* Diseases not only causes mortality and also lower production of fishes in terms of size and quantity. Diagnosis and fish health investigation will ensure better production.

*e) Information centers:* Information center facilitates the information's and training to farmers about available new technologies and input to increase production.

*f) Research facilities:* Research centers with adequate facilities should established to conduct research on fishery development through dietary (feed) intervention, curing of diseases, genetic improvement, improvement of gears and standardization of breeding.

*g) Reclamation of water bodies:* Water bodies which are weed infested or have become shallow have to be reclaimed in order to retain their productivity.

*h) Dissemination of advanced technology:* Farmers should be given training and awareness through TV presentation, Newspapers, on farm and off farm demonstrations for proper dissemination

Of technology.

*i) Post harvest facilities:* Fishermen do not have any access to cold storage facilities, forcing them to sell the fish at lower prices. So, post-harvest facilities such as vehicles for transportation, ice and ice box should be provided to farmers in adequate amount.

*j) Loan and People's participation:* Increase of government allocation to provide

financial assistance to cover a large number of people. The existing Self Help Groups (SHG) should be encouraged taking fishery as one of the key income by providing financial support.

*k) Women empowerment through Fisheries:* Income generating activities has great potential to empower women by involving them in aquaculture. They should get required training and provide with input to rear fingerlings in the backyard ponds as part time employment.

*l) Establishing market linkages:* It is to ensure that the benefits accrue to the fishermen directly, providing adequate access to finances and liberating them from middlemen.

#### 4. Conclusion

The vast fishery resources existing in the state need to be exploited properly and carefully adopting scientific fish farming to enhance productivity. However, the fisheries potential of these resources is still underutilized. Hence, aquaculture reforms should address issues in the area for enhancing fish production to ensure sustainable livelihood to the rural farmers from both capture and culture fisheries. The capture fishery shares 36% of total fish production of the state and plays a pivotal role in it socioeconomic development and livelihood security but the productivity from capture fisheries undergone declining over the past few years. The involvements of large numbers of farmer in culture fisheries can only cater the demand of fish production in the state. The fish production of about 1800 kg/ha/yr could be achieved from small seasonal homestead ponds through integrated use of locally available biological resources<sup>[5]</sup>. This implies an excellent opportunity for improving the rural economy through the development of small-scale fish culture enterprises. The poorly explored native ornamental fish resources have tremendous potential towards development of ornamental fish trade which will create new avenues for employment generation<sup>[14]</sup>. The integrated fish farming particularly the rice fish culture in 2.3 million ha seasonally flooded low laying areas will give the provision for farmer's better livelihood. The state and central government should intervene in bringing improvised technologies to the farmers and other stakeholders for holistic development of the fishery sector. The sustainable utilization of available land and water resources by mass participation of farmers in aquaculture would be able to improve the socioeconomic condition of the farmers of the state.

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