



## Emerging Trends and Structural Transformation of Fishery Sector: The Case of Assam

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### Abstract

The study was conducted for the state of Assam using secondary data for the period pertaining to 2002-03 to 2012-13 with the objectives to examine the structural transformation of economic and other activities in the fishery sector of the state. It was observed that India has shared 5.68 % of total fish production and China is the major fish producing country with low annual growth. In India, West Bengal and Andhra Pradesh are the major fish producing states. Share of Assam in country's fish production is marginal. The total fish production in the country was contributed mainly by area followed by productivity and area affect was found to be highly elastic. Area under pond fish and derelict water bodies was found to increase in the state. Nagaon district had the highest number of eco hatcheries in the state with marginal growth. Plan allocation for fishery sector in the state was found to decline with a decline of demand supply gap during the last decade. The fishery sector was found to more promising in contributing to state domestic product and the state needs comprehensive policy for increasing productivity and more area under ponds and derelict water bodies with higher plan allocation in the fishery sector. More Eco hatcheries should be developed in different districts with better extension service for increasing production of fish in the state.

**Keywords:** Trends, structural transformation of economic and other activities in fishery sector of Assam

Fishing is a traditional practice in India as a livelihood for meeting nutritional requirement and it was confined mainly in capture and marine fishing from natural sources with little external inputs (Krishna et al 2000). Rearing of fish in inland fishery was not an ancient practice in India. It was perceived to be an effective instrument for bringing socio economic transformation. The sector has influenced the national economy after independence. During 1950-51 to 2011-12, fish production in the country has increased from 0.75 million tonnes to 8.8 million tonnes with an eleven fold increase in just six decades India is the second largest producer of fish in the world with a global share of 5.68 per cent.

It is the source of livelihood for 14 million people contributing 30213 crores to national economy through export. It accounts for 0.83 per cent of total GDP and 4.75 per cent of the agricultural sector's GDP at the current prices during 2012-13.

Assam is endowed with high surface area of 4.87 lakh hectares of water area in the form of beels, water

bodies and tanks. Beel, tank and pond fisheries alone occupy 1.40 lakh hectares. Besides, it has two major rivers and many tributaries which are potential to scientific fisheries. The sector has emerged with an average growth of 6.40 per cent during Eleventh Plan period. State has witnessed several unfolding pattern in production, resource growth, institutional change and value chains. Over the last two decades, fisheries issues have emerged from being merely an obscure sectoral concern to an important growth sector with an expanding role in economic development and food security. With the improved cultural practices, emerging market forces, increased allocation of resources and technological development, fishery sector in the state has undergone a transformation in the recent decade. As an emerging subsidiary sector of agriculture, it is imperative to examine recent trends and sectoral changes with the following objectives:

- (i) the recent trends and economic transformation in the fishery sector, and

- (ii) the transformation of organisational, institutional and market structures in the fishery sector of Assam.

### Methodology

The analysis was based on secondary data at national and state level pertaining from 2000-01 to 2012-13. Tabular analysis was carried out to examine the parameters and degree of changes. Besides descriptive statistics and trends, decomposition analysis was carried out to assess the relative contribution of area and productivity of fish in the state.

$$\Delta Q = \Delta A * Y_0 + \Delta Y * A_0 + \Delta A * \Delta Y$$

Where,  $\Delta Q = Q_t - Q_0$ ,  $\Delta Y = Y_t - Y_0$ ,  $\Delta A = A_t - A_0$

Here,  $\Delta Q$  = Change in total production ('000 tonnes),

$Q_p$  = Production ('000 tonnes) during 2000-01 and

$Q_t$  = Production ('000 tonnes) in 2011-13.

$\Delta Y$  = Change in total productivity (tonnes/ ha),

$Y_p$  = Productivity (tonnes/ha) in 2000-01 and

$Y_t$  = Productivity (tonnes/ ha) in 2012-13.

$\Delta A$  = Change in total area,

$A_p$  = Area (lakh ha) during 2000-01 and

$A_t$  = Area (lakh ha) in 2012-13.

To examine the factors affecting the total production of fish in the state over years, a log linear Cobb-Douglas production function was tried with the following form

$$Q_F = \int (X_1, X_2, X_3, X_4)$$

$$= \alpha X_1^{\beta_1} X_2^{\beta_2} X_3^{\beta_3} X_4^{\beta_4}$$

Where,  $Q_F$  = Total production of Inland fish in Assam (lakh tonnes)

$X_1$  = Total water area of Assam from 2000-01 to 2012-13 (lakh ha)

$X_2$  = Total Fish seed production in Assam during 2000-01 to 2012-13 (million numbers)

$X_3$  = Productivity (tonnes/ ha)

$X_4$  = time (proxy variable for technology)

$\alpha$  is the intercept and  $\beta$  is are the elasticities of influential variables.

### Results and Discussion

#### Shift in share of important countries in global fish production

The important fish producing countries are China, India, Indonesia, Peru and USA with a total global production of 127830 thousand tonnes during 2001-02 which increased to 156195 thousand tones during 2011-12 at an annual change of 2.02 per cent (Table 1).

During this period the production share of China and India was found to shift while it was found to decline in case of Peru and USA. These countries shared 50.02 per cent in 2001-02 to 54.78 per cent in 2011-12 of world fish production.

India's share was found to increase during this period. However, annual percentage change was higher in India and Indonesia and it declined in Peru.

**Table 1: Shift in share of important countries in global fish production**

Leading Fish producing countries	2001-02 Total Production ( '000 tonnes)	Percentage Share (%)	2011-12 Total production ( '000 tonnes)	Percentage Share (%)	Annual PC Change (%)
1. China	38315	29.97	54393	34.82	3.81
2. India	5925	4.63	8875	5.68	4.52
3. Indonesia	5235	4.09	8426	5.39	5.54
4. Peru	8777	6.87	8341	5.34	(-) 0.45
5. USA	5436	4.25	5550	3.55	0.19
6. World	127830	50.02	156195	54.78	2.02

\*Source: Handbook of Fisheries and Aquaculture, Government of Assam.

**Table 2: Share of fish production across major states and its growth**

Particulars State	Total fish (%)		Inland fish (%)		CGR% of production	
	2000-01	2012-13	2000-01	2012-13	Total fish	Inland fish
Andhra Pradesh	10.23	20.00	14.31	24.37	9.00	9.92
Gujarat	11.68	8.72	....	....	1.37	....
Kerala	11.52	7.52	...	....	0.32	....
Tamil Nadu	8.51	6.82	4.00	3.36	1.97	4.12
Maharashtra	9.30	6.48	4.33	2.40	0.83	0.84
West Bengal	18.75	16.48	30.91	23.40	2.65	3.28
Uttar Pradesh	3.68	4.97	7.32	7.86	6.10	6.10
Bihar	3.93	4.43	7.81	7.00	4.63	4.63
Chatisgarh	—	—	5.04	4.47	—	4.54
Karnataka	5.89	5.81	4.48	2.94	3.56	2.16
Odisha	4.59	4.54	4.87	5.09	3.58	5.88
Assam	2.80	2.82	5.57	4.44	3.70	3.69
All India ('000 tones)	5655.34	9040.34	2844.85	5719.56	3.67	5.52

Source: Handbook of Fisheries and Aquaculture, Government of Assam

### Shift in share of major fish producing states of India

Share of India's fish producing states to total and inland fish production in the country indicated that Andhra Pradesh shared the highest of total fish production in the country followed by West Bengal, Gujarat, Kerala, Maharashtra and Tamilnadu (Table 2). It was low in other states of India. The decadal growth of total fish production was higher in Andhra Pradesh and Uttar Pradesh while it was low in Maharashtra, Kerala, Gujarat and Tamilnadu because of low growth of inland fisheries in the coastal region. The national growth was 3.67 per cent during this period.

The share of production of inland fish indicated that the states like Andhra Pradesh and West Bengal followed by Odisha and Bihar shared more of inland fish production in the country. The decadal shift of inland fish production was the highest in Andhra Pradesh followed by Uttar Pradesh and Odisha. It was the lowest in Maharashtra and Karnataka. Assam witnessed a low growth of inland fish production in the country during the last decade. It is clear that the states like Andhra Pradesh and Uttar Pradesh grew more in total and inland fish production while states like Tamilnadu, Chatisgarh, Odisha and Bihar grew faster in inland fish production in the country.

### Relative contribution and sources of growth in fish production

An attempt was made to examine the relative contribution of changes in area, productivity and their interactions by applying decomposition analysis in bringing the changes in fish production in the state

between 2002-03 to 2012-13. It was observed that Contribution of area and productivity were 56.53 and 33.18 per cent respectively while the joint effect of these variables were 10.27 per cent in increasing inland fish in Assam. Thus, it was clear that the additional production of fish in the state was contributed more by area expansion followed by increase in productivity of fish and their interaction in the state. It can be concluded that the increase of fish production in the state was observed mainly due to expansion in area under inland fishery. The change in productivity of inland fish was less effective than the effect of increased area and needs policy intervention for increased productivity of inland fish. The interaction effect of area and productivity was quite low.

### Factors affecting fish production

The factors contributing to the total production of inland fish in the state were examined with effect from 2001-02 to 2012-13,

$$Q_F = 0.88 X_1^{1.0804 (0.0514)} X_2^{-0.0169(0.0204)} X_3^{1.0394(0.0564)} X_4^{0.00406 (0.0068)}$$

(Figures in parenthesis indicate standard error of the coefficients.)

$$R^2 = 0.9984$$

Area elasticity = 1.0804, fish seed elasticity = -0.0169, fish productivity elasticity = 1.0394, technology elasticity = 0.00406

It was observed that production of inland fish in the state was elastic to area and productivity and the inelastic nature of fish seed and time as a proxy for

technology used in the fish sector could not increase relatively the total production of fish in the state. Fish seed was over used. The policy makers should put attention on effectiveness on these two factors to increase fish production in the state.

### Growth of fish production in different districts

The growth of fish production in different districts of Assam was found quite erratic with higher variations. The major districts with high growth of fish production were Kamrup (5.36%), Jorhat (5.25%), Karimganj (5.20%) and Hailakandi (5.36%) followed by Nagaon (4.71%), Golaghat (4.21%), Sivasagar (4.26%), Kokrajhar (3.08%), Barpeta (3.42%), Cachar (3.59%) and N.C Hills (3.15%) (APPENDIX-I). The low growth districts were Morigaon and Lakhimpur in the state.

The shares of fish production in the districts were higher in Dhubri, Barpeta, Kamrup, Darrang, Lakhimpur, Jorhat, Cachar and Karimganj. Out of these districts the trend of fish production was almost stagnant in Dhubri, Darrang and in Lakhimpur districts. Growth of fish production during 2000-01 to 2012-13 was negative in Karbi Anglong and Sonitpur districts. During this period, Dhubri, Barpeta, Kamrup, Nagaon, Lakhimpur, Karimganj and Cachar districts accounted

for 53.44 per cent of total fish production in the state.

### Decadal changes in fishery resources

The major types of resources for fish culture in Assam are beels, ponds, derelict water bodies and forest fishery. It was observed from Table 3 that except ponds and derelict water bodies area under beels and forest fishery resources remained unchanged in Assam during 2002-03 to 2012-13. Area under ponds increased annually by 8.28 per cent while derelict water bodies it increased annually by 2.37 per cent.

Total resources for fish culture in the state increased by 2.80 per cent. It indicated that pond fish culture in the state gained momentum in the last decade.

### Growth of eco fish hatcheries

During 2002-03 to 2012-13, the total number of eco fish hatcheries were 121 which increased to 391 at an annual growth rate of 20.28 per cent. Nagaon district witnessed the highest increase of eco hatcheries from 52 in 2002-03 to 126 in 2012-13 followed by Barpeta (7 to 43), Marigaon (7 to 31) and Karimganj (8 to 25). Other emerging districts were Kamrup (2 to 13), Lakhimpur (0 to 10), Tinsukia (1 to 13), Cachar (2 to 13), Dhemaji (2 to 9), Karbi Anglong (0 to 6), and Baksa (0 to 6) districts.

**Table 3: Decadal changes in fishery resources of Assam**

Resource type	Resources(2002-03)		Resources(20012-013)		Annual percentage change(%)
	Area(ha)	Pc share	Area(ha)	Pc share	
Rivers	20500	55.00	205000	42.10	0
Beels or open water bodies	100815	27.08	100815	20.70	0
Registered	60215	16.18	60215	12.36	0
Unregistered	40600	10.90	40600	8.34	0
Forest fishery	5017	1.34	5017	1.03	0
Derelict water bodies	30124	8.09	11644	23.90	2.37
Ponds	31232	8.39	59707	12.20	8.28
<b>Total</b>	372188		486983		2.80

**Table 4: Plan achievement of Fish Farmers' Development Agencies**

Year	No. of FFDA's	Water area covered (Ha)	Fish farmers trained (Nos)	Beneficiaries (Nos)	Average productivity (kg/ha/yr)
10th plan period	23 (5.36)	4953 (0.66)	27204 (3.02)	17887 (1.39)	1900 (95.00)
All India	429	745515	900002	1279538	2000
11th plan period	23 (5.36)	5292 (0.65)	27871 (2.90)	109221 (7.88)	2200 (75.86)
All India	429	804450	959388	1384914	2900

The figures in parentheses indicate the pc share of India.

Development of eco hatcheries in other districts was marginal with low shift in total number of eco hatcheries.

### Plan shift of institutions and productivity of fish

Table 4 indicates that number of Fish Farmers' Development Agencies remained stagnant during Tenth and Eleventh plan periods in the state and shared 5.36 per cent of the country. Water area in the state for fish rearing was less than 1.00 per cent of the country. FFDA trained 3.02 and 2.90 per cent in the Tenth and Eleventh plans respectively with marginal decline. However, number of beneficiaries increased in Eleventh plan to 7.88 per cent from 1.39 per cent of country's total beneficiaries. The shift in productivity of fish as a result of activities of FFDA shared 95.00 per cent of the productivity of fish in the country during tenth plan and was found to decline to 75.86 per cent in the Eleventh plan while the national productivity of fish increased from 2000 to 2900 kg/ha/yr. during these two plan periods.

### Shift in contribution of fishery to net state domestic product

It was observed from Table 5 that the contribution of the fishery sector in Assam to NSDP varied from 1.91 per cent in 2002-03 to 2.21 per cent in 2012-13 with an annual change of 1.43 per cent. The sector is found to be more promising in contributing to net state domestic income of the state. In comparison to agriculture proper.

### Shift in plan allocation in fishery sector

Out of total fund allotted in the country, Assam received 3.44 per cent in Tenth plan which declined to 2.05 per cent in the Eleventh plan (Table 6). It was also observed that during these two plan periods total fund allotted to fishery sector of Assam increased by 9.85 per cent and could spend about 59.72 and 55.40 per cent of total outlay respectively.

### Shift in demand-supply gap

Intra and inter year demand supply gap of fish in the state indicated that during 2002-03 this gap was

**Table 5: Shift in contribution of fishery to Net State Domestic Product (NSDP)**

Category	(2002-03) Contribution to NSDP (%)	(2012-13) Contribution to NSDP (%)	Annual percentage change (%)
Fishery	1.91	2.21	1.43
Agriculture	30.34	26.72	(-) 1.08
Net State Domestic Product (crores)	₹ 31720.80	₹ 112126.32	32.13

**Table 6: Plan allocation of funds to the fishery sector of Assam**

Plan	Total Fund Released		Percentage (%) spent
	Funds (In Lakhs)		
	Outlay	Expenditure	
10th Plan	6838.50 (3.44%)	4084.39	59.72
11th plan	14251.00 (2.05%)	7896.32 (Upto 2010-11)	55.40
Percentage Change	9.85	8.67 (Upto 2010-11)	

\*Figures in parentheses indicate percentage share of Assam from the total fund allotted

**Table 7: Population engaged in fishery sector of Assam during 2012-13**

Category	Total members (Nos)			Fulltime (Nos)		Part time (Nos)		Others (Nos)	
	Male	Female	Children	Male	Female	Male	Female	Male	Female
Assam	131312 (2.80)	97986 (2.42)	161082 (2.80)	66120 (81.1)	39568 (33.48)	42764 (4.64)	23676 (15.5)	48814 (4.80)	12282 (3.34)
All India	4696158	4033963	5755233	814951	118173	919776	152031	1017015	367467

\* The figures in parentheses indicates the pc share of Assam

found to decline by (-)1.08 per cent and it further declined to (-)0.46 per cent during 2012-03. It was further observed that demand of fish in the state grew by 9.89 per cent while the demand of fish during this period had grown by 57.04 per cent during the last decade in the state.

### Status of employment in the fishery sector

Table 7 indicates that Assam had about 8.00 per cent of total employment in the country in the fishery sector out of which full time employment of male was more than female. Employment of part timer was less in the fishery sector of Assam.

### Conclusion

It can be concluded that total fish production in the country shared from 4.63 per cent to 5.68 per cent of world production during the last decade with an annual growth of 4.52 per cent. China shared 34.82 per cent of world production during 2012-13 with low annual growth. In India, Andhra Pradesh and West Bengal alone shared more than 46 per cent of total fish production of the country while share of Assam was about 4.00 per cent. The total fish production in the state was influenced more by increased area (56.53 %) followed by productivity (33.18%). The supply elasticity of area was also higher than productivity while fish seed was found overused and the affect of technology was quite low.

The districts like Dhubri, Barpeta, Kamrup, Darrang, Lakhimpur, Jorhat, Cachar and Karimganj produced more than half of total production of fish in the state. During the last decade, area under fish pond was found to increase faster than other resources. Highest number of eco hatcheries was found to increase in Nagaon district and it marginally grew in the state. Number of fish farmers' development agency was almost stagnant and Plan allocation of fund for fishery development was found to decline in the state between tenth and eleventh five year plans. State employment in the fishery sector shared about 8.00 per cent of total employment in the fishery sector of the country.

During the last decade demand supply gap in the state was found to decline with relatively higher production and income from the fishery sector in the state. The state needs comprehensive policy for

increasing productivity with application of improved technology and covering more area under ponds and derelict water bodies with higher plan allocation of fund in this sector.

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## APPENDIX-I

## District wise fish production and its share in state total production (no. in tonnes)

Districts	2000-01	Pc share	2012-13	Pc share	CGR (%)
Dhubri	10802	5.97	13350	5.25	1.63
Kokrajhar	2541	1.40	3761	1.48	3.08
Bongaigaon	5281	2.92	6070	2.38	1.08
Goalpara	5591	3.10	7650	3.01	2.45
Barpeta	10615	5.87	16416	6.46	3.42
Nalbari	8440	4.66	10200	4.01	1.47
Kamrup	10416	5.76	19729	7.76	5.04
Darrang	10156	5.61	11273	4.43	0.81
Sonitpur	7500	4.14	7205	2.83	-0.31
Lakhimpur	8415	4.65	12315	4.84	2.97
Dhemaji	4108	2.27	5100	2.00	1.68
Morigaon	7691	4.25	11250	4.42	2.97
Nagaon	14388	7.95	26184	10.30	4.71
Golaghat	5120	2.82	8750	3.44	4.21
Jorhat	6785	3.75	13200	5.19	5.25
Sibsagar	5697	3.15	9800	3.85	4.26
Dibrugarh	7452	4.12	7860	3.10	0.41
Tinsukia	5316	2.94	6689	2.63	1.78
Karbi Anglong	2500	1.38	2260	0.89	-0.77
N.C. Hills	501	0.03	750	0.30	3.15
Karimganj	9158	5.06	17710	6.96	5.20
Hailakandi	5101	2.82	10053	3.95	5.36
Cachar	11947	6.60	18920	7.44	3.59
Chirang	0	—	1925	0.76	—
Baksa	0	—	4150	1.63	—
Udalguri	0	—	1700	0.67	—
All Assam	180945	100.00	254270	100.00	2.65

Source: Economic Survey of Assam, Directorate of Economics and Statistics, Govt. of Assam.