Impact of Fish Farming on Employment and Household Income
Evidence from a Village Study in West Bengal

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Prawn and fish farming is an important source of income and employment for the local populace in the Sunderban region in West Bengal. These have led to a dynamism in the local economy in these areas. The results of this study suggest that the impact of this development has been skewed, whereby a small section of the population with access to capital has enjoyed substantial benefits and a large majority of the population was left out of the development trajectory. This paper analyses the impact of prawn farming on employment and income on different sections of the population in the Sunderban estuarine region.

1 Introduction

West Bengal is one of the largest producers of prawn in India with an impressive growth rate in prawn production between 2000-01 and 2006-07. The growth rate of prawn production in West Bengal between 2000-01 and 2006-07 was 13.8%; the corresponding figure for India as a whole was 0.08%. The state has the highest potential area for prawn farming among the maritime states in India (Bhattacharya 2009). The total potential culturable area for brackish water prawn farming is 5,25,000 acres. By 2007-08, about 27.6% of the total potential area (1,45,000 acres) was under brackish water prawn farming. The share of West Bengal in total prawn production in India was 14.6% in 2006-07. Brackish water prawn farming in West Bengal is done in three districts: North 24 Parganas, South 24 Parganas and East Medinipur. This paper discusses the impact of prawn farming on employment and incomes of different sections of the population. The core of the study is based on primary data collected from a survey in May-June 2006.

Prawn farming is an important source of income and employment in the Sunderban estuarine region in West Bengal. These have led to the development of capitalist production relations in these areas where subsistence single-cropping of paddy was widely prevalent. An important aspect of the development of capitalism is the nature of classes that arise on the basis of the former. Capitalism and market forces, when superimposed on backward pre-capitalist relations that prevailed in these parts, prior to the introduction of prawn farming, have a profound unequalising impact. Prawn farming has made the local economy in these areas more dynamic. However, the impact of the development of prawn farming has been skewed, whereby a small section of the population that had access to capital cornered the benefits and a large majority of the population was left out of the development trajectory.

Studies on fish and prawn farming in West Bengal have mainly discussed the viability of integrated culture of fish-prawn and paddy, particularly in the Sunderban estuarine region (for example, Central Soil Salinity Research Institute 1988; Chakraborti et al 2002; Chattopadhyay et al 1983; Das et al 1996; Ghosh 2001; Natarajan 1983). It is argued in these studies that prior to the introduction of prawn farming, land in these areas was used for agriculture, for paddy cultivation during the monsoon, when salinity of the soil decreased.

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These studies put forth the argument that land in the Sunderban estuarine region of West Bengal was profitably utilised through the introduction of prawn farming. According to Natarajan (1983: 29):

Paddy cultivation in coastal saline regions being dependent almost entirely on the availability of monsoon precipitation, getting a good crop every year is absolutely uncertain. In that context, brackish water paddy-cum-fish culture not only provides a substantial subsidiary income to the farmers by increasing not only the biological production per unit land area but also generates a year-wise employment opportunity to the local people which is about 3 times higher to those in seasonal paddy cultivation.

Naskar (1985) argued that prawn farming in the Sunderban estuarine region had led to the economic growth of the region. He argued that the introduction of prawn farming had led to the establishment of wholesale markets and gave a boost to the transport industry. These had resulted in increase in demand for labour whereby the daily labourers received employment for the whole year. He argued that landowners who had leased out land to fish farmers had received rent that had enhanced their livelihood security.

Few studies discuss the impact of prawn farming on the livelihood of the local population in Sunderban region in detail, and all of these are descriptive. None have analysed, on the basis of statistical data, the impact of growth in prawn and fish farming on household incomes, its distribution among the different sections of the population and employment in the Sunderban estuarine region.3

Since this paper is based mainly on primary data, a village was selected in which prawn farming was done extensively. Tentultala, located in the medium saline region of the Sunderbans, was the chosen study area since it satisfied this criterion perfectly.4 The location of the village facilitated the production of rohu, parsia and tilapia along with giant tiger prawn (*Penaeus Monodon*). Ghosh (2001) has argued that giant tiger prawn, parsia and tilapia were the most important varieties of prawn and fish cultured in the medium and low saline fish farms. He argued that in these regions carp culture was taken up after the monsoon to make use of freshwater conditions. I have used prawn farming and fish farming synonymously in this paper, and prawn farmers have been termed fish farmers.

Prawn farming was introduced in Tentultala in 1990 and it was done in brackish water. Fish farmers in the village practised the traditional method of farming.5 It was traditional in the sense that fish farms were tidally fed; fish farmers were mainly dependent on natural food for farmed fish and prawns; water intake and draining of water was managed through sluice gates, attached to each fish farm, depending on local tidal effect; there was no specific stocking density and periodic harvesting during full moon and new moon periods. However, there was selective stocking of the giant tiger prawn in the fish farms which was not in consonance with the traditional method, as noted by Alagarswamy (1995). Prior to 2002, land was used for paddy cultivation for four months during the monsoon (July-October); for the remaining eight months (November-June), fish and prawn farming was done. Since 2002, land in Tentultala was used entirely for prawn farming and it was almost a perennial activity in the village.6

The paper is organised as follows. Section 2 discusses the location of the study village, Tentultala. Section 3 discusses the fieldwork methodology. Section 4 discusses the basic features of Tentultala. Section 5 identifies the different classes in Tentultala. Section 6 discusses the importance of fish farming as sources of employment and income in the study village. Section 7 analyses the impact of fish farming on patterns of landholding, distribution of incomes and work participation rates in the study village. Section 8 concludes the paper.

2 Location

Tentultala is located in Minakhan block of North 24 Parganas, West Bengal (Figures 1, 2 and 3). It is located adjacent to Kumarjole Khal that starts from the river Sakha Bidyadhari, an offshoot from the Raimangal River. The nearest town, Ghusighata, is about two kilometres away. Ghusighata is situated on the Basanti Road, a state highway.
Tentultala is about 34 kilometres from Kolkata and frequent buses to Kolkata are available from Ghusighata. It has an all-weather road passing through it. The means of transport within the village are manually-driven van rickshaws or motor van rickshaws.

3 Fieldwork Methodology
The core of this study is based on primary data. The data was collected from a census survey of households in May-June 2006. Data on costs on hired labour, fish and prawn fries, chemicals, fertilisers, fish and prawn fees, rent paid for leased land, and land revenues and licence fees paid was collected from each of the households involved in the production of prawns and fish. Farmers were issued licences to operate fish farms under the West Bengal Fish Producers’ Licensing Order, 1994.\(^7\) Cost of production of fish farming households resembled Cost A2 as defined by the Commission for Agricultural Costs and Prices (CACP).\(^8\)

Data was collected for month-wise production, sale and price of fish and prawns from each prawn farming household, and from this the gross value of output of fish and prawns that were sold in the market was computed. Net income in fish and prawn farming was derived by deducting the paid-out costs from the gross value of output.

Data on employment in fish farming was collected for different members of the household. For each member of a household, the number of calendar days worked, daily hours of work and daily wages was collected for each month and operation. Data on days of employment in a year, daily wage earnings and daily hours of work in other non-agricultural occupations was collected for each member of the household who were employed in different occupations.

Data on employment and wage earnings in agriculture was collected for every member of the household employed in agricultural tasks, crop by crop and for each operation. Fish farming was the main source of employment in Tentultala. Agricultural employment and non-agricultural employment other than fish farming was rarer as compared to the employment in fish farms and so household members recalled employment in these occupations clearly.

Data on incomes from businesses and salaried government and private jobs was collected for different members of the household who participated in these occupations. Rental incomes of each of the households that had leased out land were collected in the survey.

Net incomes from crop production for each of the households are computed for individual crops over paid-out costs. As in fish farming, I have used the Cost A2 concept of the CACP. Data on costs on inputs like seeds, fertilisers, pesticides, irrigation, land revenues paid, rent paid for leased land and hired labour was taken from each cultivating household.

4 Basic Features of Tentultala
In 2005-06, the total population of Tentultala was 1,336 and the total number of households 244. Of the total number of households, about 44.7% were scheduled castes (SCs) and the rest (55.3%) were Muslims. There were 698 males (52%) and 638 females (48%) in the village. Muslims (781 out of 1,336) constituted 58.5% of the total population. Hindus comprised the rest, about 41.5% of the total population, and they belonged to the Paudra Kshatriya caste. All Hindus in the village were scs. The average household size in 2005-06 was 5.5. The female literacy rate in the village is 53.3%; the corresponding figure for males is 70.3%. In 2005-06, there was a middle school (up to the 10th standard) and a primary school (up to the fifth standard) in the village. There were higher secondary schools in Ghusighata (two kilometres away), Chandipur (three kilometres away) and Ghatakpuruk (seven kilometres away). In 2005-06, the nearest government-sponsored college was in Bhangar (about 10 kilometres away). In 2005-06, almost 96.4% of the total extent of operational holdings, of resident households in Tentultala, was used for prawn farming; the rest was used for agriculture.

5 Classification of Households in Tentultala
Since crop production was only of marginal importance in the economy of Tentultala, conventional criteria used for analysing agrarian class structure could not be applied to the village. In the thesis, socio-economic classes in Tentultala were identified on the basis of source of income, their role in the process of fish and prawn farming, the pattern of labour deployment and participation in labour market, and the extent of their operational holdings (that is, of fish farms and agricultural land). The precise criteria used for identifying each of these classes were as follows:

(1) Big Farmers of Fish: Households which derived their incomes mainly from prawn farming, did not use family labour for agriculture and fish farming, did not participate in wage labour and operated fish farms that were more than 10 acres were classified as big farmers of fish. In 2005-06, this class comprised seven households (Table 1). Of these, five households were also engaged in other businesses or had small extent of agricultural land. In this class, six households also leased out plots of land (that were not contiguous to their fish farms) to other prawn farmers.

(2) Medium Farmers of Fish: Among the households for which prawn farming was the main source of income, those that operated fish farms of at least three acres but not more than 10 acres...
were classified as medium farmers of fish. In 2005-06, five households belonged to this class (Table 1). Among them, two households were engaged in self-employment/business occupations and agriculture and three households participated in wage labour. About four households also leased out some plots of land (which were not contiguous with their fish farms) to other fish farmers and earned rental income.

(3) Small Farmers of Fish: Among the households for which prawn farming was the main source of income, those who farmed fish and prawns on less than three acres of land were classified as small farmers of fish. In 2005-06, there were 10 such households in Tentultala; these comprised 4.1% of all resident households in the village (Table 1). This class also included a number of small landowners who were able to produce fish and prawns on their own land or were able to lease in a small amount of land. Some of these households had the advantage of owning land close to the main channel so they could directly get access to brackish water. As a result, they were able to do prawn farming on relatively small extent of land. Typically, incomes of these households from prawn and fish production were small. As a result, four among them also participated in wage labour and two among them were engaged in other activities. About six households leased out some plots of land (that were not contiguous to their fish farms) to other prawn farmers and earned rental income.

(4) Households Primarily Dependent on Rental Income from Land: Many households in Tentultala, small landowners in particular, leased out their land to the prawn farmers. Also, bargadars sub-leased barga land to the prawn farmers. In 2005-06, for 70 households, which included many relatively income- and asset-poor households, rent from the land leased out to fish farmers was the main source of income. These have been classified as households dependent primarily on rental income from land. Among these households, 39 were also involved in other activities like prawn farming, self-employment/business occupations, agriculture and hiring out labour. In the reference year, 31 households belonging to this class were not involved in any other economic activity and depended totally on rental income from leasing out land.

(5) Hired Manual Labourers: In 2005-06, wage labour was the primary source of income for 114 households out of 244 households that were residents in Tentultala (Table 1). These households were classified as hired manual labourers. Among them, 51 households were solely dependent on hiring out labour, 23 households had small plots of land which was either leased out to other prawn farmers or used by the households for prawn farming. There were 17 households that had small incomes from petty businesses. There were five households that were involved in cultivation of agricultural crops.

(6) Households Primarily Dependent on Businesses Other Than Agriculture and Fish Farming: In 2005-06, 37 households in Tentultala obtained their income primarily from self-employment/business occupations other than agriculture or prawn farming (Table 1). Of these, incomes from self-employment occupations/businesses were the only source of income for 23 households. Members of the working age group participated in various kinds of petty businesses, motor van/rickshaw driving and tuitions. Of households in this class, 16 had some earnings from wage labour, 18 had rental income from leasing out land for prawn farming, and 10 were themselves engaged in prawn farming.

(7) Salaried Employees: In 2005-06, the main income of one household was from salaried regular employment outside fish farming (Table 1). This household did not perform manual wage labour in fish farming or agriculture and did not have own businesses. This household earned rental income from land leased out to prawn farmers.

6 Fish Farming as a Source of Income and Employment in Tentultala

Fish farming was the most important source of income and employment in Tentultala. This is shown in Tables 2 and 3. Table 2 shows composition of household income in Tentultala.
In 2005-06, households in Tentultala derived incomes from the following sources:

1. (1) Income from fish and prawn production.
2. (2) Wage income from hiring out labour in fish farming (casual, regular).
3. (3) Rental income from leasing out land for fish farming.
4. (4) Income from cultivation of agricultural crops.
5. (5) Wage income from hiring out labour in agriculture.
6. (6) Own businesses.
7. (7) Wage income from hiring out labour in other occupations (casual, regular).
8. (8) Salaried non-manual work (government and private).

Table 2 shows that in 2005-06 almost three-fourths (74.1%) of total household income was received from the primary sector. Almost the entire income in the primary sector was from fish farming. Agriculture, as a source of income, was of lesser importance as compared to fish farming. Share of income from cultivation of agricultural crops and wage from hiring out labour in agricultural work in total household income was 0.8%.

Of the sources of income in secondary and tertiary sectors, share of income from self-employment and business occupations was highest. Almost 13% of the total household income was from self-employment/business occupations. Wages from other occupations and salaries from non-manual work were other sources of income in the secondary and tertiary sectors.

In 2005-06, there were 57 female workers and 302 male workers in the age group 18-60. Table 3 shows the proportion of male and female workers in this age group in Tentultala, engaged in different economic activities in 2005-06. Table 3 shows that in 2005-06, fish farming was the most important source of employment in Tentultala. About 74.7% of the male workforce (226 workers) was employed in occupations in fish farming; the corresponding figure for females was 83.1% (47 workers). Of the various tasks in fish farming, women were involved in removal of algae in the farms. Businesses in fish farming were also run exclusively by men. In all, about 23.5% of the male workforce was engaged in some businesses in fish farming.

In 2005-06, among self-employment and business occupations related to fish farms, almost 21% of the male workforce in Tentultala constituted fish farmers involved in producing fish and prawns. In comparison, the proportion of male workforce who worked as commission agents and sellers of fish and prawn fries was lower. While 0.9% of male workers were commission agents, 2.1% of the total workers were sellers of fish and prawn fries. Commission agents are involved in marketing of fish and prawns. Sellers of fish and prawn fries are involved in selling and marketing of these products.

No land within Tentultala mouza was used for crop production in 2005-06. Only a few households in Tentultala cultivated, owned or leased land in neighbouring villages. In comparison to fish farming, very few workers were engaged in agriculture-based activities. About 4.2% male workers cultivated crops on land under their operational holding while about 2.1% male workers had participated in agricultural wage employment.

### 7 Impact of Fish Farming in Tentultala

#### 7.1 Impact on Patterns of Landholding

Fish farming led to the consolidation of land in Tentultala. The Gini coefficient of distribution of operational holdings was 0.93. Land plots were consolidated to reap the benefits of economies of scale in the construction of channels through which water was supplied in fish farms. Channels were not built to supply water to individual plots of land in Tentultala, which were, as is the feature in West Bengal, of very small size, in which there were no households that had owned more than 3.7 acres of land in 2005-06. Consolidation of land in Tentultala was done through large-scale leasing of land by big farmers of fish who had access to capital. These households accounted for 71.6% of the total land leased in for fish farming in Tentultala in 2005-06. Table 4 shows distribution of operational holdings across classes in Tentultala.

<table>
<thead>
<tr>
<th>Socio-economic Categories</th>
<th>Number of Households</th>
<th>Proportion of the Total (%)</th>
<th>Extent of Operational Holdings (Acre)</th>
<th>Share of Operational Holdings (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hired manual labourers</td>
<td>114</td>
<td>46.7</td>
<td>4.3</td>
<td>1.3</td>
</tr>
<tr>
<td>Households primarily dependent on rental income from land</td>
<td>70</td>
<td>28.7</td>
<td>45.7</td>
<td>13.9</td>
</tr>
<tr>
<td>Small farmers of fish</td>
<td>10</td>
<td>4.1</td>
<td>16.1</td>
<td>4.9</td>
</tr>
<tr>
<td>Medium farmers of fish</td>
<td>5</td>
<td>2.1</td>
<td>29.6</td>
<td>9.0</td>
</tr>
<tr>
<td>Big farmers of fish</td>
<td>7</td>
<td>2.9</td>
<td>228.7</td>
<td>69.6</td>
</tr>
<tr>
<td>Households primarily dependent on businesses other than agriculture and fish farming</td>
<td>37</td>
<td>15.2</td>
<td>4.3</td>
<td>1.3</td>
</tr>
<tr>
<td>Salaried employees</td>
<td>1</td>
<td>0.4</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Total</td>
<td>244</td>
<td>100.0</td>
<td>328.6</td>
<td>100.0</td>
</tr>
</tbody>
</table>

Table 4 shows that the big farmers of fish had the largest share in total area operated in 2005-06. About 2.9% of these households had about 69.6% of the total operational area. Of the economic classes, the share in area operated was least for the hired manual labourers and the households dependent primarily on businesses other than agriculture and fish farming. In 2005-06, the shares in area operated by each of these classes were 1.3%.

7.2 Impact on Income Distribution

Distribution of household income in Tentultala was extremely unequal. The Gini coefficient of distribution of annual household income for all households in Tentultala was 0.58. The Gini coefficient of per capita income was 0.59. To put this in perspective, Table 5 (p 72) presents estimates of the Gini coefficient of household and per capita income from various recent village-level and large-scale surveys. Table 5 shows that the Gini coefficients of household and per capita income in Tentultala were comparable to Gini coefficients of most unequal villages and were higher than Gini coefficients reported in most studies.

Fish farming was the main source of income in Tentultala in 2005-06 (Table 2). However, there were wide disparities in incomes across classes. This is shown in Table 6.

Table 6 shows that fish farming as a source of income benefited a small section of the population in Tentultala. In 2005-06, about 46.7% of households belonging to the class of hired manual labourers received only about 18.7% of total household income. Households in this class had lowest levels of income. In contrast, 3.3% of households that were big farmers of fish and salaried employees received about 37% of total household income.

7.3 Impact on Work Participation

Fish farming led to a decline in employment opportunities for male and female workers in Tentultala; however, the impact was more adverse for female workers than their male counterparts (Tables 7 and 8). Table 7 shows Census of India data on work participation rates in Tentultala and rural West Bengal in 1991 and 2001. The period between 1991 and 2001 saw a shift in land use in Tentultala from agriculture to fish farming. Table 7 shows a steep decline of over 3 percentage points in work participation rates of both men and women in Tentultala between 1991 and 2001. This was in sharp contrast with rural West Bengal as a whole where work participation rates of rural women increased by about 5 percentage points and those of rural men increased by about 2 percentage points. Work participation rates were low among women because mainly male workers were employed in fish farms, which were the most important source of employment in Tentultala.

Data on occupational structure of the workforce presented in Table 8 shows that there was a steep decline in the proportion of cultivators and agricultural workers (particularly women) in the population in Tentultala between 1991 and 2001. It is particularly noteworthy that low female labour absorption in fish farms was the primary reason why very few women in Tentultala were workers. This is likely to have been a result of change in the pattern of land use from agriculture to fish farming over this period.

Table 8 shows decline in work participation rates in Tentultala between 1991 and 2001, mainly on account of loss of employment for women in agriculture. This was in sharp contrast with rural West Bengal as a whole where an increase in the proportion in total female population employed in “household industry” and “other” activities was seen between 1991 and 2001.

8 Conclusions

No studies have analysed the impact of prawn farming on household incomes and employment in West Bengal, across socio-economic classes and on the basis of statistical data. This is despite West Bengal being one of the largest producers of prawn in India, having registered an impressive growth rate in prawn farming between 2000-01 and 2006-07. This study is a contribution in filling this gap in the existing literature.

The development of capitalist relations of production is clearly the major trend in fish farming. This study shows that capitalist development has led to differentiation of the peasantry into seven distinct classes. While on the one hand there were the big farmers of fish that had leased in large tracts of land and had a major share in the total operated area, at the other end were the hired manual labourers dependent
primarily on working for others. Fish farming had led to concentration of land among the big farmers of fish in Tentultala. These households had almost 70% of the total operated area in Tentultala.

Fish farming was the main source of income and employment in the study area. Analysis of primary data shows that almost three-fourths of total household income was from fish farming. Also, 74.7% of the male workforce (in the age group 18-60) was employed in the fish farms; the corresponding figure for women workers (in the same age group) was 83.1%. Of all the tasks in fish farming, women workers were employed only in removal of algae in fish farms.

Inequality in distribution of income was very high in Tentultala. The Gini coefficient of per capita income distribution for all households was 0.59, higher than those reported in most village studies. Almost 47% of households were hired manual labourers in 2005-06; the share of income of these households was only 18.7%. In contrast, big farmers of fish, who comprised 2.9% of the households, accounted for 33.5% of the income. The big farmers of fish had clearly benefited from the development of prawn farming, while the others were left out.

Introduction of fish farming resulted in decline of employment opportunities for men and women workers in Tentultala. This was seen from the decline in work participation rates between 1991 and 2001 when there was a shift in land use from agriculture to fish farming. Women workers were more adversely affected than their male counterparts. This was due to loss of employment for women in agriculture and also due to the fact that it was men workers who were primarily employed in fisheries. This was in contrast with rural West Bengal as a whole where there was an increase in proportion in the total female population of those employed in “household industry” and “other” activities between 1991 and 2001.

NOTES


2. The West Bengal Human Development Report 2004 (UNDP 2004) identified the Sundarban region as one of the backward areas in the state.

3. Bhattacharya (2009) had analysed net incomes from prawn production for different classes of farmers. The study is based on primary data. However, it does not analyse the impact of prawn farming in household incomes or employment in the study areas.

4. See, for instance, Alagarswamy (1995) and Ghosh (2001) for the classification of fish farms in the Sunderban region of West Bengal on the basis of salinity level.

5. See, for instance, Alagarswamy (1995) for a discussion of the classification of techniques in prawn farming. Alagarswamy listed the characteristics of the traditional method of prawn farming as, “Fully tidally-fed; salinity variation according to monsoon regime; seed source of mixed species from the adjoining creeks and canals by auto-stocking; dependent on natural food; water intake and draining managed through sluice gates depending on local tidal effect; no feeding; periodic harvest during full and new moon periods; collection at sluice gates by traps and by bag nets; seasonal fields alternating paddo (monsoon) crop with shrimp/fish crop (inter monsoon); fields called locally as bheries, pokkali fields and khazan lands”.

6. Resident households in Tentultala had 328.6 acres of land. This was the total extent of operational holdings of all residents in the village in 2005-06. Of these, about 46.4% was used for fish and prawn farming, and the rest for agriculture.

7. Fish farmers had to submit a form of applica-
tion to the department of fisheries, Government of West Bengal to get a licence.

8. According to the CACP, Cost A2 includes, (i) value of hired human labour, (ii) value of hired bullock labour, (iii) value of owned bullock labour, (iv) value of owned machinery labour, (v) hired machinery charges, (vi) value of seed, (vii) value of insecticides and pesticides, (viii) value of manure, (ix) value of fertilisers, (x) irrigation charges, (xi) depreciation on implements and farm buildings, (xii) land revenue and other taxes, (xiii) imputed value of interest on working capital, (xiv) miscellaneous expenses and (xv) rent paid for leased in land.

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