8

Aquaculture

8.1 Introduction

Fish forms an important part of the Bengali diet. The waters of the Sundarbans are a commons producing livelihoods and food for any household with labour to harvest fish. These waters host about four hundred species of fish. Threats to Sundarbans ecology present a clear but largely unknown danger to local livelihoods and nutrition (Richards & Flint, 1990). Fishing in the Sundarbans[1] is primarily a collective activity but there are aspects of individual or household action in it, particularly after the introduction of commercial brackish water aquaculture. Before describing the current scenario especially of brackish water aquaculture in the Sundarbans, I will provide a brief historical overview of fishing in the eco-region.

Between the thirteenth and eighteenth centuries, the spread of Islam and wet rice agriculture in hitherto forest areas of the Sundarbans went hand in hand (see Chapter 3, Sub-section 3.1). The Hindu Bengali castes living in the Sundarbans prior to the Muslims were literally and figuratively at the margins of mainstream society. The *Pods* in the west and the *Chandals* in the east were fisher folk. According to James Wise, the emphasis of Muslim leaders upon cultivation resulted in conversion of the fishing castes into agricultural ones, and for the Muslims

[1]For an ethnographic account of fishing in the Sundarbans and the fishing community of Jambudwip, see Raychaudhuri (1980). The ethnographic study was carried out in the late 1960s and remains one of the most comprehensive till date (see Annexure IV). Jambudwip Island has been cleared of settlement in 2004 and is currently out of bounds for most. This was necessitated because the Fisheries Department and the Forest Department were at loggerheads in 2003 on the issue of the use of the island, southwest of Mousuni for commercial drying of fish. The commercial dry fish sector had turned part of the island into a permanent base with a settled population. The Forest Department claimed Jambudwip Island to be part of a reserve forest. After much altercation in public between the two departments and amid deteriorating law and order situation on the island, settlements were removed.

fishing is a lowly occupation because of its association with non-Muslim and outcast tribes who never became integrated into the Muslim society around them (Wise, 1883). Additionally, lagoons previously laden with fish dried up due to silt deposition by the major rivers draining through the region. Hindu fishing castes are still considered low in the caste hierarchy but fishing as an activity, though not the most favoured, is an important occupation with fishing boats locally known as *trawlers* providing employment opportunities, and for the economically weakest the option of tiger shrimp seed collection remains open. In fact, due to increase in population and subsequent pressure on land as well as loss of land due to erosion, a counter-conversion of occupation is underway. Cultivator families with practically no agricultural land are taking to fishing, especially collection of tiger shrimp seeds.

The right to fish in the watercourses of the Sundarbans during the colonial period as now (except within the Protected Area) was in the realm of the commons, and no revenue for it was collected on behalf of the Government. In 1866, however, the Government put up to auction the rights of the fisheries in all the Sundarbans rivers for a term of five years. The Port Canning Company purchased the fishing rights, but as already stated they were withdrawn in October 1868 in consequence of the claims of the Company being disputed by fishermen and others who had prescriptive rights; it was decided that the Government had no right to farm out the fisheries in tidal waters to private persons.

The following sections describe shrimp farming in the Sundarbans (8.2), the practice of shrimp seed collection from the wild (8.3) and the role collective action plays in it, and how the various actors operate within the sector (8.4). Section 8.5 analyses the prevailing practices in light of the concepts presented in Chapter 2, and assesses the prospects of attaining sustainable development goals in the context of aquaculture in the Sundarbans.

8.2 Brackish water aquaculture in the Sundarbans

Bengal has had a long tradition of shrimp culture in paddy fields; traditional farming is mainly based on tidal flow, auto stocking, no supplementary feeding, and in farms alternating paddy and shrimp, this is also known as the “trapping and holding” method.

Policies and programmes for commercial shrimp farming were initiated during the Fifth Plan period (1974-1979) by the Government of India focussing on technology development. It was during the Sixth Plan period (1980-1985) that the Fisheries Department, Government of West Bengal, intensified its efforts to develop coastal aquaculture. This was driven by not only high export value of shrimp but also on higher returns on investment, almost twice as high compared to agriculture and livestock (Krishnan and Birthal, 2002). During the Seventh Plan period (1985-1992), technical assistance through international organisations like the UNDP and the World Bank were brought in, until then traditional farming was the predominant mode of shrimp production. With the introduction of scientific farming of tiger shrimp, an exponential growth took place during early 1990s due to attractive monetary returns, high export demand and liberalised economic policies of the Government. This favourable environment prompted farmers, entrepreneurs, corporate entities and others to enter into shrimp farming. West Bengal became the

largest shrimp culture centre in the country (Banerjee and Singh, 1993).[2] High international market demand has maintained interest in shrimp farming for export despite production being affected by viral diseases and tightening of regulatory norms to safeguard the environment. However, a level of diversification of cultured species has remained low, the most popular being *Peneas monodon* (tiger shrimp). This has had two ecological fallouts, (i) initial loss of mangroves and (ii) depletion of wild shrimp and other fauna stocks. It is reported that in the Sundarbans about 3 percent or 5,000 ha of the total loss of mangrove forest is accounted for by shrimp farming (Silas, 1987 and Sinha, 1999). In the face of an increasing production of shrimp through brackish water aquaculture, the demand for shrimp seeds has been on the rise for over two decades now, and the demand is being met from the wild since West Bengal does not have hatcheries. According to SDMBRI (1996), and Sarkar and Bhattacharya (2003), hatcheries have not been possible in West Bengal, due to a lack of favourable physico-chemical conditions, salinity in particular.

According to aquafarm owners interviewed, two in Sandeshkhali II Development Block (North 24-Parganas) in February 2002 and three in Gosaba Development Block in February 2005, procurement of shrimp seeds from other maritime States of India is not feasible due to seasonality of supply, high mortality, and difference in salinity in different coastal states. However, since 2003-04, Tiger Shrimp Seeds from hatcheries in the southern Indian States have become available in North 24-Parganas District at competitive price. Aquafarmers of Haroa and Minakhan Development Blocks are using hatchery seeds but aquafarm owners in other areas prefer the wild variety from the Sundarbans due to very high mortality reported in case of shrimp seeds from hatcheries. Officials of West Bengal Fisheries Department attribute this high mortality to poor quality of hatchery seeds. A hatchery technician from Andhra Pradesh interviewed on 14 May 2007 confessed that hatchery seeds that fail quality tests are directed towards Kolkata since aquafarmers in the southern States refuse to accept seed consignments without quality certification. Tiger shrimp seed collection (TSSC) therefore, has become an important occupation in the Sundarbans[3]. While travelling in the Sundarbans it is common to come across individuals, especially women and children straining the water in rivers and creeks for tiger shrimp (*P. monodon*) PLs (post-larvae) and juveniles. According to an estimate, 50,000 households in the Sundarbans engage themselves in wild tiger shrimp seed collection (Raj and Hall, 1993); more recent estimates put the figure of collectors to about 400,000 (Environment Department, GoWB, 1997 and ADB Report, 2003b). There are a number of socio-economic factors, which motivate a sizeable population

[2] By 1992, West Bengal was already a major exporter of shrimp, and to maintain its position it sought World Bank assistance vide Project ID P009921 (Shrimp and Fish Culture Project) along with Orissa and Andhra Pradesh which started on January 14, 1992 and closed on December 31, 2000. The project had a budget of US$ 3,200,000/- for the shrimp culture component in the three States. Currently, the State of Andhra Pradesh is the largest producer and exporter of shrimps in India. India is the 4th largest shrimp producer after China, Thailand and Indonesia in the Asia-Pacific region.

[3] Mr. Bhattacharya, a retired school headmaster at Bagdanga on Mousuni Island, in May 2003, introduced me to about 20 households who are better off than earlier by way of being able to feed themselves twice a day. This has been possible due to their involvement in TSSC. Mr Bhattacharya also stated that severity and extent of poverty has reduced because of TSSC.

of the Sundarbans to engage in TSSC[4]. Low level of investment in terms of material and training has been reported as the most significant motivator. The other motivations are ready cash, availability of shrimp seeds throughout the year albeit with seasonal variations (lowest during winter months and highest during monsoon months) as well as variation within a month (higher catch during Full Moon and New Moon), assured market for the catch, facility of advance sale (*daadon*), and barrier-free occupation, meaning, anybody can engage in TSSC irrespective of gender, age, caste, or religion.

Apart from first generation migrants[5], tiger shrimp seed collectors represent households that have fallen on hard times due to any or many of the following reasons: loss of land to river erosion, repeated crop failure due to repeated salt water incursion, loss of employment as boatman of mechanised ferry or deckhand of fishing trawler, death of bread-winner, or desertion by husband. Tiger shrimp seed collection may be viewed as the last "safety net"; any family that falls through the upper layers resorts to TSSC. These are the families, which no longer have access or did not have access to begin with, to other means of livelihood.

West Bengal, mainly the Sundarbans[6], accounts for 30.27 percent of total cultured shrimp area in the country producing about 26 percent of the total produce, second only to Andhra Pradesh on both counts (see Table 8.1). Most of the production

Table 8.1: State-wise details of shrimp culture and productivity

State	Area under culture (ha)	Production (MT)	Productivity (MT/ha/Yr)
Andhra Pradesh	79,600	51,230	0.64
West Bengal	46,750	26,800	0.57
Kerala	14,700	5,540	0.38
Orissa	8,120	8,960	1.10
Karnataka	3,080	3,500	1.14
Tamil Nadu	2,480	4,710	1.90
Goa	930	1,200	1.29
Gujarat	540	680	1.26
Maharashtra	300	320	1.07
Total	**1,56,500**	**1,02,940**	**0.66**

Source: Cyriac (2002; p. 37)

[4] About 20 percent of the households as per this study based on random sampling of 243 households (123 on Mollakhali and 120 on Mousuni) engage themselves in TSSC, 38 households reported it as their primary occupation while for other 9 households it was their secondary occupation.

[5] In fact, the prospect of making a living through TSSC lured 15 of the respondent families to the Sundarbans (six from East Midnapore District), having migrated not more than 20 years ago.

[6] Most (about 70-80 percent) of the shrimp farming in the Sundarbans takes place in North 24-Parganas District.

comes from small farms with less than 2 ha of water-spread area. In fact, 90 percent of the farms are less than 2 ha, 8 percent between 2 and 10 ha, and 2 percent with water spread of over 10 ha (Cyriac, 2002; p. 4).

A description of different types of shrimp farming practised follows. Among the different farming systems practised in the maritime States of India, *semi-intensive*, and *intensive* methods were developed with the introduction of scientific farming and the establishment of commercial hatcheries (not in West Bengal[7]) through imported technology. The *traditional* system of shrimp farming makes use of tidal flow, auto stocking with no supplementary feeding. In the *semi-intensive* system, the farm size usually varies between 0.25-4 ha, ponds are manured and fertilised, water is exchanged using pumps, aerators are used, and high nutritive feeds, drugs and chemicals are applied. Selective stocking of shrimp seeds between 6 and 25 post-larvae (PL)/m^2 is carried out. The *intensive* method is similar to *semi-intensive* farming but with higher stocking density of 25-35 PL/m^2, frequent water exchange, and removal of sludge (Vasudevappa & Seenappa, 2002). Productivity improved dramatically from about 50 kg/ha/yr under *traditional* to 4-5 ton/ha/crop in *semi-intensive* and 10-20 ton/ha/crop in *intensive* farming (Chennubothla and Rao 1998; p. 6).

With the outbreak of viral diseases and tightening of regulatory norms, the shrimp farming shifted to the *extensive* method wherein the stocking density is maintained at 5 PL/m^2 and water is exchanged through tidal flow. Various modifications of the *extensive* system are in practice with up to 10 PL/m^2 of stocking density along with as many as 15-18 finfish species and crabs, and providing indigenously prepared feed.

Due to the high demand of tiger shrimp PL, the absence of hatchery in West Bengal, and the abundance of such PL during the initial years in water courses of the Sundarbans, shrimp seed/fry collection became a significant occupation for the people of the eco-region, especially the asset-less. An entire sector servicing shrimp farms developed involving collectors, agents, traders, transporters and auctioneers. The entire chain, except for shrimp seed collectors of the Sundarbans, is well documented in a working paper of the Bay of Bengal Programme titled “Market study of tiger shrimp fry in West Bengal, India” (1993). Therefore, the following section describes shrimp seed/fry collection and the collectors of the Sundarbans. This is also the activity in the value chain that is carried out in the commons and allows space for examining collective action.

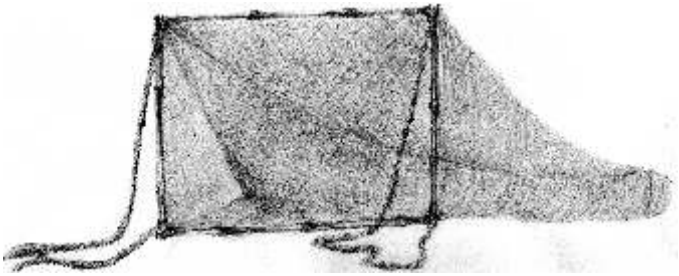
8.3 Collection of tiger shrimp seed from the wild

Individuals engaged in tiger shrimp seed collection (TSSC) are a heterogeneous lot; the only commonality is their poverty in varying degrees and lack of access to other resources. They can be broadly divided into three categories based on their gear, and location along the creeks and rivers.

[7] A small hatchery was established by the West Bengal Fisheries Department with the help from the Bay of Bengal Programme (FAO) in the coastal town of Digha in Midnapore District but it did not attain commercial proportions.

The poorest group, usually women and children use drag-nets (see Figure 8.1) along the banks. Only one family operates in a particular stretch along the embankment at a particular time. Each stretch is about 12 metres long, unless population pressure is very severe. In case of a split in a family, the new family is allotted a stretch of similar length along the embankment. If necessary, all the families reduce the length of their stretches proportionately to accommodate the new family. This is a form of *spontaneous* collective action.

Figure 8.1: Drag-net



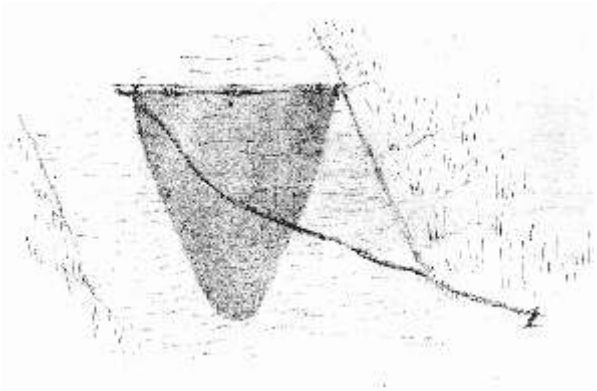
The gear of drag-net operators consists of a net attached to a bamboo frame and some rope to drag the net along the bank. The net is made up of fine mesh nylon fabric of 25 m (maximum) and costs between $ 0.12 and $ 0.14 per metre. It costs $ 0.03 per metre to stitch the nylon fabric into a drag-net ($ 0.7 maximum for stitching the net). The bamboo frame is made of a pole costing about $ 0.8-1.10. The drag-net operators usually use 4-6 m of nylon rope of 8 mm thickness which is sold at $ 1.80 per kg. Most drag-net operators cannot afford to buy the equipment on their own and resort to advance sale (*daadon*) of their catch. The *byapaari* (agent) buys the gear for them and has the right to buy the shrimp seeds at a price lower than the prevalent market price varying between $ 3.30 and $ 15.40 per thousand seeds. With fluctuating availability and price of seeds, it is difficult to arrive at a figure for earning per day without observing the transaction for about a week in each of the seasons. To get over the problem I sought information from *byapaaris* who buy seeds every day. According to *byapaaris*, a family with two drag-nets earns about $ 0.90 per day while those with three nets earn about $ 1.50 per day through the year on an average.

The second group uses a shoot-net (see Figure 8.2) fixed to a horizontal bamboo pole. One end of the bamboo pole is embedded in the mud bank while the other end is tied to a long nylon rope, which in turn is pegged on the mud bank a little distance away either upstream or downstream depending on tidal direction so that the pole is held perpendicular to the flow of water. Material requirement for their gear is nylon fabric of 25-50 metres, up to 2 kg nylon rope of 8-9 mm thickness (each kg of rope is about 32 metres long) and two bamboo poles. Per unit cost of material is the same as that of the drag-net operators, just that initial investment is higher due to greater material requirement. Some of the operators are able to procure material on credit from nylon

net and rope traders while others resort to *daadon. Byapaaris* are of the opinion that on an average, river bank shoot-net operators earn about $ 1.10-1.30 per day.

The third group has a relatively more sophisticated gear (see Figure 8.3) as well as a small country boat. This group collects tiger shrimp seeds away from the banks. The shoot-net is fixed to a bamboo pole as in the case of the second group but the pole and the net are held in place using anchors or heavy wooden angles to which plastic (HDPE) barrels are tied as floats. The pole is tied between the two barrels. Mid-stream collectors usually use 50-70 metres of nylon fabric. Two kg of nylon rope of 10 mm thickness is used but some collectors use more rope due to greater depth in the river. Each kg of rope has 20 metres length. They also use anchors weighing up to 10 kg costing $ 0.7 per kg. Boats used by the mid-stream collectors are called *salti* or *chot-salti* and costs $ 132/- for a new one and between $ 66 and $ 88 for

Figure 8.2: Shoot-net

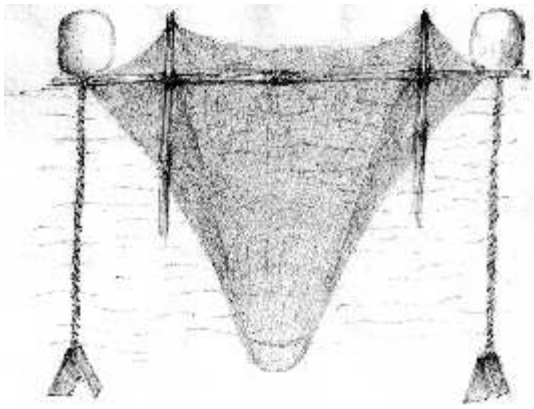


older ones. Mid-stream collectors work in pairs, usually father-son, brother-brother, as well as husband-wife. After setting up the gear the younger person stays back on the boat (husband, in case of husband-wife pair) to empty the net periodically. *Byapaaris* estimate that mid-stream collectors earn about $ 2.20 per day on an average. In all the three cases, the tapering end of the net is emptied every half an hour or so into a white enamelled flat metal bowl. Collectors use a shell of bivalve to pick up tiger shrimp seeds and store it in an earthen or aluminium pot (*handi*) half filled with creek water; mid-stream collectors usually use plastic containers with lid.

According to my study, 19 percent of the population of the Sundarbans engage themselves in TSSC (a little less than the government and ADB estimates), of which 32 percent are relatively recent migrants; having migrated to the Sundarbans not more than 20 years ago. In fact, the prospect of making a living through TSSC lured them to the Sundarbans. All the families that have lost land to river erosion have had to change their primary occupation, 36 percent of these opted for TSSC, next only to

wage labour (39 percent)[8]. Changes in the landmass are well within the perception of the inhabitants of the Sundarbans. Ninety-three (38 percent) of the respondent families who were essentially cultivators have had to change their primary occupation due to changes in the landmass. They appear to accept the fact that if humans occupy places like the Sundarbans, changes in location and occupation are inevitable. “If you live on the lap of the river, she will ask you to move some time or the other” is the common perception among the affected families. Shrimp seed collectors simply dismantle their huts and relocate elsewhere. Physical mobility and 'can do' attitude of the collectors is a characteristic of the frontier people (see Footnote 2, Chapter 2).

Figure 8.3: Fixed shoot-net



Becoming a shrimp seed collector for the poor is rather simple. All one has to do is to acquire a very basic gear as described above and take it to the waters. Forty five percent of the shrimp seed collecting families manage to buy their equipment with own resources, the rest depend on moneylenders and *byapaaris* or agents. Agents provide money or gear to collectors on condition that the catch is his[9] for a price determined by him, which is usually $ 0.20-0.30 less per thousand seeds than the prevailing rate. “…Fry catchers are not sensitive to price, as they have few alternative employment opportunities, it is the middlemen and transporters who cannot afford to move small quantities. While supply from the fry catchers is inelastic, the middlemen have a cut-off point at which they cease to trade in fry, making the supply elastic or price sensitive” (Raj & Hall, 1993; p. 3).

[8] Eighty-eight households have lost all or most of their land to river erosion 32 of which have taken to TSSC, and 34 households make a living through wage labour.

[9] *Byapaaris* are overwhelmingly men but I have come across one woman *byapaari* at Baliara on Mousuni Island. She appeared very confident and in control, her clients did not have to quarrel with her over the price of seeds. Only 25 percent of the collectors interviewed do not have to quarrel with their *byapaaris*.

Dependence of tiger shrimp seed collectors on a single ecosystem for subsistence is near total. However, the natural biotic communities are not an integral part of their lives, nor do they behave as integral components of the ecosystem they inhabit. For the collectors, the ecosystem is the great provider. The collectors do not gather seeds for domestic consumption or local level exchange. Rather they have direct linkage with outside markets unlike subsistence farmers. The collectors do not harbour any sense of obligation towards the ecosystem as opposed to traditional fishermen. For example, caste fishermen have scheduled restraints on fishing attributed to events like menstruation of the river goddess (*Ganga mayer masik*). Non-traditional fishermen and shrimp seed collectors appear to be in competition with one another and with the ecosystem. Whether shrimp seed collectors are overriding the productive limits of local animal and plant populations is unascertainable as of now though there are signs of the ecosystem being under severe human pressure (Naylor et al. 2000; Primavera 1998; S.D. Marine Biological Research Institute, 1996) as will be discussed below. The collectors view the ecosystem as being inexhaustible. Their opinions range from "how can anything that comes from the sea ever be exhausted" to "if shrimp seed runs out eventually, there will always be something else of value in the rivers and creeks". Persisting with the issue of damage to the ecosystem due to tiger shrimp seed collection invariably provokes collectors to retort "how are we to make a living" or "are the lives of these creatures more valuable than ours", and at times, "are we to make a living through theft and banditry?"

Marine biologists from the Calcutta University and the Zoological Survey of India interviewed in August 2003 are categorical in their opinion that in the process of shrimp seed collection, the target species (*P. monodon*) accounts for only 0.25-0.27 percent of the total catch, one percent at the most, making the process highly wasteful in terms of loss of other life forms especially juveniles of other edible fish, as almost the entire remaining portion is discarded on beach flats or tidal mudflats. The above mentioned biologists believe that the practice of shrimp seed collection can lead to severe stock depletion and hamper energy transference through marine ecosystem food webs, as well as cause soil erosion by uprooting mangrove saplings and salt marsh vegetation. Marine biologists are in favour of restrictions and enactment of tougher laws. Officials of the Environment Department, Government of West Bengal interviewed in August 2003 are also unanimous in their opinion that shrimp seed collection is detrimental to the ecosystem.

In attempts to quantify the loss, Naylor et al. (2000) reported that annual wastage in terms of bycatch is estimated at 63 million to 2.6 billion seeds of various species in just three collection centres in West Bengal Sundarbans. Primavera (1998) reported an estimated loss of 47 to 999 (*sic*) juvenile shrimp in India for every single tiger shrimp seed; a Government of India commissioned report (S.D. Marine Biological Research Institute, 1996) projected that about 5100 gm of juveniles of different categories of fish are wasted per net per day for an average collection of 500 tiger shrimp seeds, the approximate number of juveniles species wasted being 76. "For every post-larvae of *P. monodon* collected from the wild, it has been estimated that 18 PL of other species of shrimp and fish are sacrificed. … This is a colossal loss of biodiversity" (Sinha, 1999; p. 27). Despite these warnings, the Fisheries Department (Govt. of West Bengal) is drawing up schemes that are likely to intensify pressure on the ecosystem. To address wastage of bycatch the Department is promoting brackish

water canal fishery and has established demonstration projects so that the bycatch is not wasted and juveniles of other species survive due to commercial value of some of the bycatch species. If successful, collection of fish fry from the watercourses can only intensify. To address the issue of dwindling catches of tiger shrimp seeds and subsequent weakening of economic condition of tiger shrimp seed collecting households, the Department is promoting collection of edible mud crabs and has established crab fattening farms on demonstration project basis. The colossal loss of biodiversity does not seem to be of concern to the Fisheries Department.

Religious or caste scruples do not apply in this trade; just about anybody can take up the occupation. Even tribal people originally from Chotanagpur Plateau (far away from the coast to the southwest) have taken to TSSC. It has been observed and reported earlier by others (SDMBRI, 1996) that women collectors outnumber men by 3 to 1, and children up to the age of 14 years outnumber adults by a proportion of 3:2. Women collectors are greater in number due to their limited mobility for employment; need to augment family income, widowhood, and desertion by husband. Child collectors are brought into the trade by their parents to augment family income. Male children, by the time they are about 10 years old develop a sense of economic freedom. Most male children by that age keep aside a part of their earning for themselves, which they spend on video shows, cigarettes/*bidis* and other addictions. An attempt during 2002-03 by the Haldarchak Chetna Welfare Society, a Sundarbans-based NGO to bring some of these children to educational centres in the hope of putting a few of them back into the mainstream school system failed because of loss of economic freedom experienced by the children as soon as the stipend for attending educational centres ran out.

Most shrimp seed collecting families (80 percent) operate for 5-6 months in a year, for part of the remaining year, males of these families migrate in groups to other districts as agricultural labourers or to other States as wage labourers as far away as Gujarat and Andaman Islands. These workers have a regular schedule and route charted out by labour contractors who are either known in the village or are former residents of the village. The remaining 20 percent of the collecting families carry on for 9 months though the catch dwindles considerably during the winter months and on certain days not a single seed lands in the net. These families are relatively weaker in financial terms than the former, and they try to find work on the island or on one of the adjoining islands since they do not have the means to travel far[10]. The weaker the family, the longer it works, and the lesser it earns as compared to others. Fifteen percent of the families work for 20 days for nine months earning $ 0.40 a day on an average. Another 30 percent work for 7 days for 5 months earning about $ 1.10 a day on an average. These are the mid-stream collectors with boats. Fifty five percent of the shrimp seed collecting families work for 15 days a month for six months, earning bout $ 0.80 per day. Mid-stream collectors from Chotomollakhali

[10] Beginning 2006, the Government of India has launched the National Rural Employment Guarantee Scheme wherein 100 days of employment is guaranteed within the village. The Gram Panchayats are administering the Scheme, mostly for carrying out earthwork for embankments. But, due to limitations of manpower and financial authority, not all eligible households can be provided the guaranteed employment or unemployment benefit within a financial year.

also go fishing in the rivers and creeks as well as collect honey and firewood from forests, mostly without permit from the Sunderban Tiger Reserve (Forest Department). Not that these people are unable to pay for the permit, but getting one is hard, time consuming and involves travelling to another island where the Forest Range Office is located, whereas being caught by forest guards, getting detained and fined happens only a little over half (55 percent) the times they venture into the forests. On rare occasions, the boats are confiscated and members of the group imprisoned which then becomes an expensive and time-consuming affair to deal with[11]. For people of Mousuni finding wage employment is comparatively easier than those of Chotomollakhali because of proximity to the Sandheads where larger vessels offload into smaller vessels capable of moving through the Hugli River to the Kolkata Port. Besides, better road and rail connectivity also contributes to greater employment opportunities, as does recurrent breaches in embankment.

8.4 Collective action in shrimp seed collection

There have been attempts to check this colossal loss of biodiversity through legislative and administrative means as well as civil society initiatives but in the absence of alternative means of livelihood, success remains elusive. However, collective action, *institutionalised* and *spontaneous* might provide an answer. Glimpses of collective action in shrimp seed collection follow.

The poorest group of collectors, the drag-net operators are not organised formally or informally and operate individually, at most as a family unit but have devised a mechanism by which they avoid collecting shrimp seeds along the same stretch at the same time since the chances of collection for the one behind is drastically reduced. However, there are times when disputes related to collection arise which collectors are unable to resolve by themselves. In such cases, the dispute is referred to the local panchayat member; traditional panchayat members are preferred over Gram Panchayat members on account of perceived fairness of the former. In many places though, the Gram Panchayat (*institutionalised* collective action organisation) has supplanted the traditional panchayat[12] (*spontaneous* collective action organisation). Punishment for the offending collector is in the form of suspension of collection ranging from one to seven days.

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[11] No new permits are issued by the Forest Department to venture into the Sunderban Tiger Reserve; permits are renewed annually for a nominal fee of Rs. 35/- ($ 0.80). On occasion, permits are reassigned due to disuse by earlier assignee. Apart from the permit, each member of the group has to pay a fee of Rs. 20/- ($ 0.45) for each week in the forest for a maximum of four weeks. Since no new permits are issued, permits are traded at a premium of Rs. 3,000/- to Rs. 10,000/- ($ 67.00-222.00) depending on the ability of the group to pay. Fine for venturing into the STR without valid permit ranges between Rs. 250/- and Rs. 1,110/- ($ 5.50-24.50) depending on the location in the forest where the group is apprehended. Imprisonment term depends on material illegally extracted from the forest. Consequently, the amount of bribe to forest guards depends on location and material extracted. The highest bribe amount paid that has come to light is Rs. 60,000/- ($ 1,333.00); the Forest Department official was convicted in this case.

[12] The Gram Panchayat system in India is a modified and democratized version of the traditional panchayat system that existed prior to Independence. Traditional panchayats were mostly caste panchayats overseeing adherence to caste norms. In West Bengal, traditional panchayats were more of local councils governing social life within a locality. In some places, e.g. Dwariknagar in Namkhana Development Block, traditional panchayats with elected *morols* (chief) are still in existence but post 73rd Amendment, local self-governments in the form of Gram Panchayats came into being all over the country (see Annexure I). In West Bengal, the Gram Panchayats in most places have eclipsed the traditional panchayat.

organisation). Punishment for the offending collector is in the form of suspension of collection ranging from one to seven days.

The mid-stream collectors are organised into several *majhi samitis* (*spontaneous* collective action organisation) based on locality of residence rather than location of collection. The *majhi samiti* protects rights of its members in the water courses. In case of disputes arising out of siting of gear among members, the *samiti* convenes a meeting to sort out the problem at the earliest. In case of dispute between members of different *samitis*, office bearers of the concerned *samitis* meet to resolve the issue. If the concerned *samitis* fail to resolve the issue amicably, standpoint of the numerically stronger *samiti* prevails due to the threat of use of physical force. Until disputes are resolved, the disputing collectors have to suspend collection. According to office bearers of *majhi samitis*, the *samiti* though a collective action organisation of mid-stream collectors, does not facilitate procurement of gear, loan or insurance as the members lack single-interest relationships due to varied political affiliations. Since membership of *majhi samiti* is based on location of residence, neighbours might have different political affiliations. In rural West Bengal, it is practically impossible to undertake any activity cutting across political affiliations except for crisis situations and at times of religious festivals. The *samitis* organise Ganga *puja* (religious festival) during the middle of January each year where each member has to contribute about US$ 22.00. After the festival, a new body takes over the affairs of a *samiti* but usually the same office bearers continue in their positions.

Collective action – *institutionalised* as well as *spontaneous* – is also used to suspend shrimp seed collection. During the April 2003 panchayat elections, the leftist grouping was voted out of power in Mousuni. The new Pradhan (headman), during 2004-05, implemented a ban on tiger shrimp seed collection at a particular stretch along the south-eastern periphery of the island. The Pradhan believes that the Gram Panchayat is the implementing agency of the provisions of the Biological Diversity Act, 2002. Rules framed in 2004 under the Act empower Gram Panchayats to form Biodiversity Management Committees (BMCs) to control and regulate adverse impacts on biodiversity. Because the Pradhan at Mousuni is concerned with river bank erosion, he sees mangrove plantation as a solution to the problem, and uses the BMC to protect the mangrove plantation. The particular stretch has been planted with mangrove saplings by the Forest Department, Government of West Bengal and the Pradhan does not want the stretch trampled upon by shrimp seed collectors. For an understanding of how the two forms of collective action come together to achieve something that is not possible by any one form alone, see Chapter 4, Section 4.

A recent report on human-wildlife conflict (WWF-India, 2006) shows that most victims are shrimp seed collectors and as long as other livelihood opportunities are unavailable, potential for such conflicts remain high. The Forest Department, since 1991, has been channelling funds for local economic development as part of eco-

development to reduce forest dependence of the adjoining human population[13]. Eco-development Committees (EDCs) or Forest Protection Committees (FPCs) depending on adjoining forest classification have been established by the Forest Department but representation of the poor and the neediest like shrimp seed collectors at these committees is negligible. At Chotomollakhali, shrimp seed collectors are not represented in the EDC at all[14], all the members are cultivators who are not exactly dependent on the forest or water courses. Moreover, as part of the ecodevelopment initiative the EDC at Chotomollakhali has desilted and embanked freshwater canals, raised plantations, distributed stand-alone solar lighting systems, and provided funds for self-help groups none of which have accrued to the shrimp seed collectors. These have been cornered by cultivators mostly at the communal level, but also at individual level. WWF followed the same model from 2003-04 through 2005-06 as part of its tiger habitat conservation initiative at Chotomollakhali and the benefits have been taken up by the stronger elements of the community. After this experience, WWF has attempted course correction through collaboration with *institutionalised* collective action organisation (panchayat) and *spontaneous* collective action organisation (*para* 'club') using this form of collective action as a counter balance for the former form thereby trying to ensure that benefits accrue to the neediest as well, e.g. ensuring that the landless have access to land and water during dry winter months to raise at least one paddy crop for subsistence through interdependence of members of the target community in the form of vesting ownership of water in re-excavated freshwater canals with the landless. This arrangement is likely to forge a symbiotic relationship between the landless and the landed.

8.5 Analysis

This is one case where the concept of sustainability is used in its original context of living renewable resources. In this case, lack of sustainability may be indicated by declining productivity but, equally, collapse may come suddenly and without warning (Conway, 1983). Ecologists believe that there are important thresholds of scale, and that human activities can, by stressing ecosystems in ill-advised ways, set in motion large-scale and irreversible losses in the functioning ecological and physical systems (Tisdell, 1988). Here, the dilemma is between meeting basic human needs of the shrimp seed collectors and ecological sustainability. Further, existing contradictory situations such as liberalised economic policies and promotion of shrimp aquaculture *vs*. absence of hatchery in West Bengal; income generation initiatives for the asset-less and ecosystem dependent population *vs*. benefits cornered by the relatively better off and landed; and, existence of collective action organisations *vs*. lack of orientation of such organisations, intensify the basic dilemma.

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[13] The National Forest Policy, 1988, of the Ministry of Environment and Forest, Government of India, incorporated ecodevelopment which was thought of to reduce forest dependence of the people surrounding Protected Areas, and to compensate them in cash and kind as well as through non-farm income generating opportunities for the loss of access to resources in Protected Areas. See Chapter 3, Sub-section 3.2 and Footnote 9.

[14] At Mousuni, EDC/FPC does not exist due to absence of forest in adjoining area.

This case vividly presents what Holdren, Daily and Ehrlich (1995) term as *perverse conditions* (in terms of poverty, impoverishment of environment, and wastage of human potential), *driving forces* (in terms of excessive population growth), and *underlying human frailties* (in terms of short-sightedness, ignorance, and denial), all of which make achieving sustainable development goals difficult.

Shrimp seed collectors of the Sundarbans, especially drag-net operators and shoot-net operators are left with no choice. In fact, it is the only avenue left for these people to subsist and they do not perceive either the basic dilemma in the 'activity' as constructed by academicians, planners and development practitioners. This lack of perception may be attributed to dependence on the benefits received, high discount rates, and lack of information about the sheer number of collectors in the eco-region and extent of damage to the ecosystem, particularly in terms of bycatch. Is this, then, the end of the road or are there conditions that can facilitate reduction or discontinuation of tiger shrimp seed collection? Examples of collective action as enumerated in the preceding section hold the key.

Since traditional panchayat members are able to resolve conflicts among shrimp seed collectors, they most likely are the ones who can exert influence on the collectors provided alternative means of subsistence are available which not only compensate the loss of earning through tiger shrimp seed collection but also address the very short economic cycle of the shrimp seed collectors. As of now the *majhi samitis* organise religious festivals and resolve conflicts but their ambit can be widened to encourage members to take up other means of livelihood and approach institutional lenders for the purpose. Alternative means of livelihood for the shrimp seed collectors can be a possibility if a mechanism of checks and balances is devised through participation on equal terms of *institutionalised* and *spontaneous* collective action organisations.