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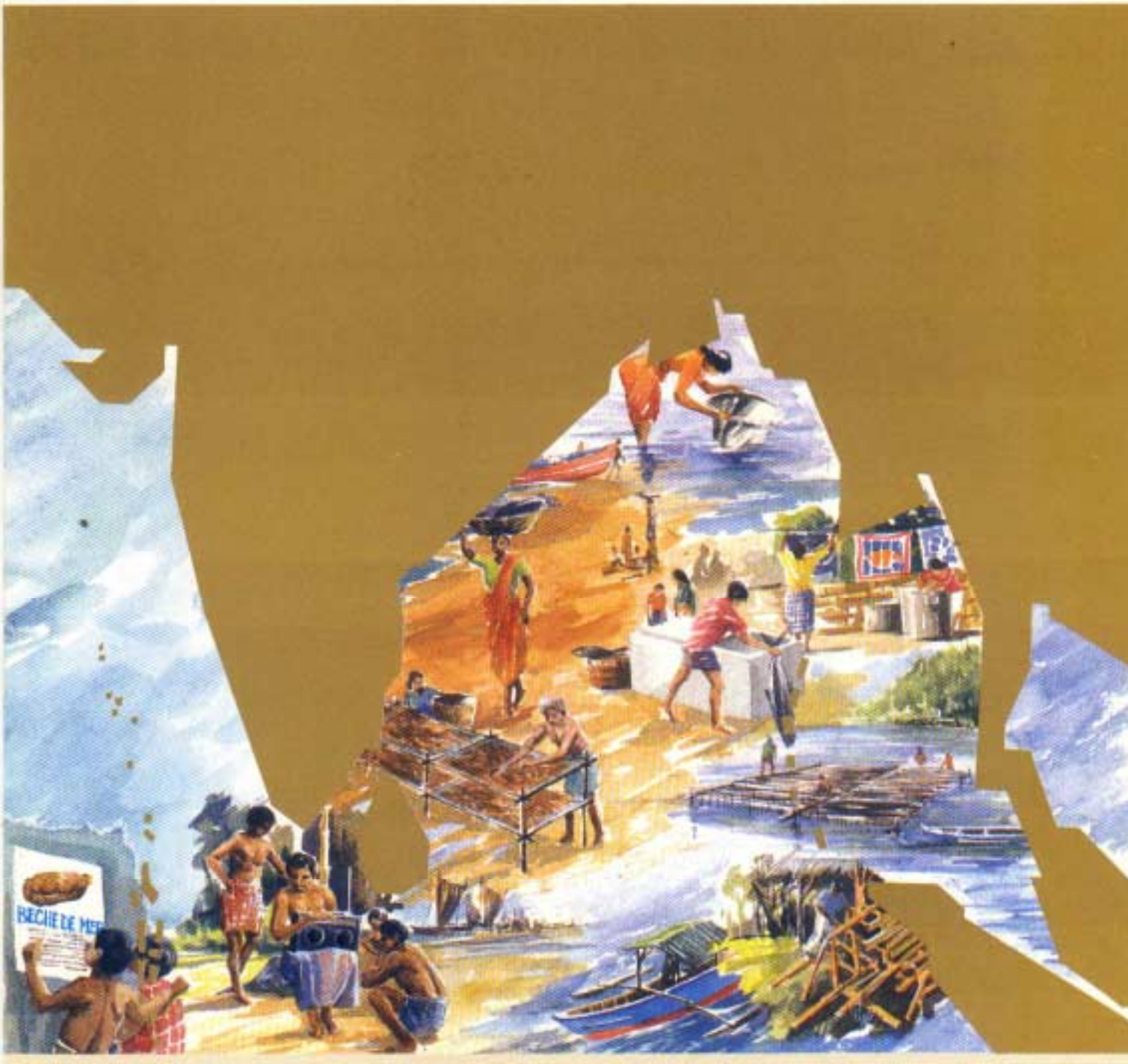
Market study of tiger shrimp fry in West Bengal, India



BOBP For Fisheries Development
BAY OF BENGAL PROGRAMME

BAY OF BENGAL PROGRAMME
Small-Scale Fisherfolk Communities

BOBP/WP/87
GCP/RAS/1 18/MUL

Market study of tiger shrimp fry in West Bengal, India

by

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BAY OF BENGAL PROGRAMME
Madras, India
1993

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Rice-fish polyculture in *bheries* (enclosed paddyfields) has been a tradition in the West Bengal (India) delta. Fish are seeded naturally with the water let into the paddyfields. With the growing shrimp export market, shrimp culture in the *bheries* has proved economically attractive and the supply of tiger shrimp fry to the *bheries* is, now, a burgeoning business is West Bengal.

The Bay of Bengal Programme (BOBP), at the request of the Government of West Bengal, studied the problems connected with the supply of tiger shrimp fry to the *bheries.* The problems were seen as a constraint to the development of the mainly export-oriented shrimp culture industry. BOBP looked into both natural collection and hatchery-reared supply of shrimp fry. It also helped the West Bengal Department of Fisheries to establish a small hatchery at Digha and it worked with some of the fry catchers of Medinipur District through a local NGO. The study of all these activities as well as the marketing process was seen as a step towards a better understanding of the existing tiger shrimp fry market and the fisherfolk involved in it. This, it was hoped, would lead to an elimination of some, if not all, the problems associated with the business. The BOBP study was undertaken under the 'Small-scale Fisherfolk Communities' project (GCP/RAS/l 18/MUL).

The Bay of Bengal Programme (BOBP) is a multiagency regional fisheries programme which covers seven countries around the Bay of Bengal — Bangladesh, India, Indonesia, Malaysia, Maldives, Shri Lanka and Thailand. The Programme plays a catalytic and consultative role: it develops, demonstrates and promotes new technologies, methodologies and ideas to help improve the conditions of small-scale fisherfolk communities in member countries. The BOBP is sponsored by the Governments of Denmark, Sweden and the United Kingdom, and also by UNDP (United Nations Development Programme). The main executing agency is the FAO (Food and Agriculture Organization of the United Nations).

This document is a working paper and has not been cleared by the Governments concernedor the FAO.

July 1993

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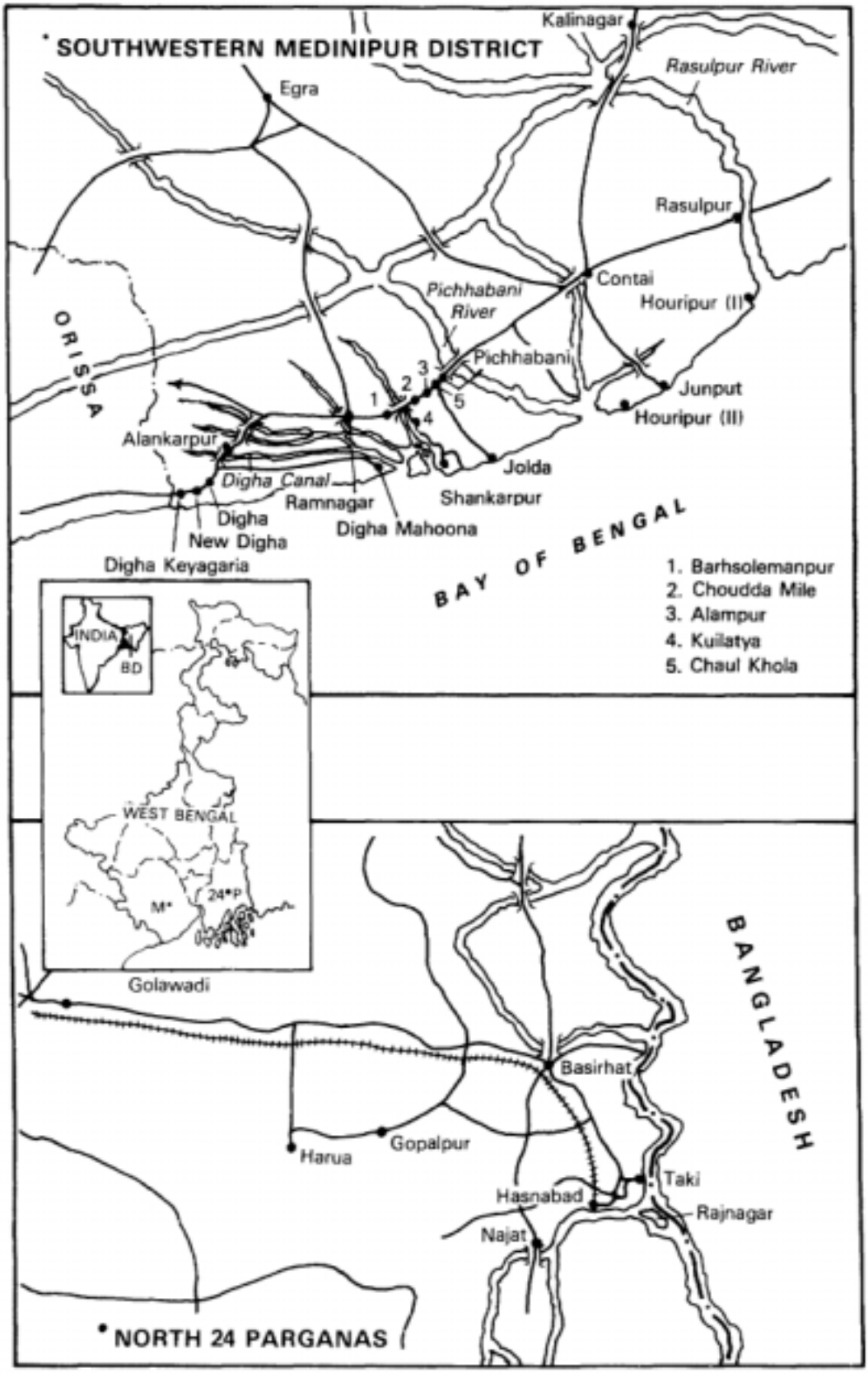

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1. *SUMMARY*

The tiger shrimp fry trade, the life blood of shrimp culture in West Bengal, offers extra earning opportunities to 50,000 families in the state, mainly poor fisherfolk and landless agricultural labour, both young and old, male and female. These fry catchers receive a generous portion of the retail price as their remuneration. What they receive is unusually high for the fisheries or agricultural sector. In most cases, the volatile prices are similar between villages of the same district on the same day, reflecting healthy competition between purchasing agents. Markets in North 24 Parganas also reflect a healthy relationship between buyers and sellers, with concurrent prices uniform and middlemen margins minimal.

2. *INTRODUCTION*

Rice-fish polyculture has been a tradition in the Bengal delta area, very likely since the first construction of a *bheri,* a paddyfield enclosed by a bund. The saline soils permit only an annual crop of salt-tolerant rice known as *aman* paddy. During the rest of the year, the dry season from February to May, the *bheries* are flooded with tidal brackishwater. Fish are seeded naturally with the intake of water to the paddyfield; they had never been stocked as such. In recent decades, shrimp culture in the *bheries* of southern West Bengal has become economically attractive as a result of the growing shrimp export market; there is a much greater demand for tiger shrimp *(Penaeus monodon)* than what nature provides the farmer by chance. For this reason, a new, burgeoning business has evolved in West Bengal: the supply of tiger shrimp fry to the *bheries.*

The Bay of Bengal Programme (BOBP), at the request of the Government of West Bengal, studied the problems connected with this supply. These problems were seen as a constraint to the development of the mainly export-oriented shrimp culture industry.

BOBP looked into both natural collection and hatchery-reared supply of shrimp fry. With the assistance of BOBP, the West Bengal State Department of Fisheries established a small hatchery at Digha. At the same time, BOBP began work with some of the fry catchers of Medinipur District through a local NGO, SANLAAP. The study of these activities is seen as a step towards a better understanding of the existing tiger shrimp fry market and the fisherfolk involved in it.

2.1 *Geographic limitations of study*

The West Bengal tiger shrimp fry industry is concentrated within the Hugli-Matla estuarine zones and nearby culture areas in three districts, Medinipur (collection), South 24 Parganas (collection) and North 24 Parganas (markets and culture). This study, due to time limitations and BOBP's specific involvement in Medinipur, has restricted itself to field data collection in Medinipur and North 24 Parganas districts only (see maps on facing page). References made to South 24 Parganas are drawn from secondary sources.

Medinipur District covers the area between the lower portion of the Hugli estuary and the Orissa border and is responsible for 15-20 per cent of the state's fry trade. The landscape is extremely flat and near sea-level. Canals for transportation and water drainage criss-cross the district, which is also characterized by flood protection dykes near the coast. Rice production is the mainstay of the economy.

South 24 Parganas is often referred to as the Sundarbans due to the deltaic islands that constitute much of the area between the Hugli-Matla estuary and the Bangladesh border. Mangrove forests, Bengal Tigers and saltwater crocodiles combine to protect an important tiger shrimp fry habitat. Tiger shrimp fry are much more abundant in South 24 Parganas than in Medinipur District.

Fry collection is not carried out on the remote islands where there are no permanent human settlement or transportation links. Bydyadhari, Roy Mangah Matla, Ichavathi, Kalini (Neyat) Dhasa, Saraswati, Gotihara and Goureswar are rich sources of shrimp fry.

To the north, the district of North 24 Parganas forms a transition between the island-dotted Sundarbans delta and the mainland. The district is crossed by several major rivers flowing southward into the delta and is bordered by Bangladesh to the east and Calcutta (and the Hugli River) to the west. The district is the main tiger shrimp production area in the state and has the chief centres for tiger shrimp fry marketing. Some fry collection is also carried out.

2.2 *Methodology*

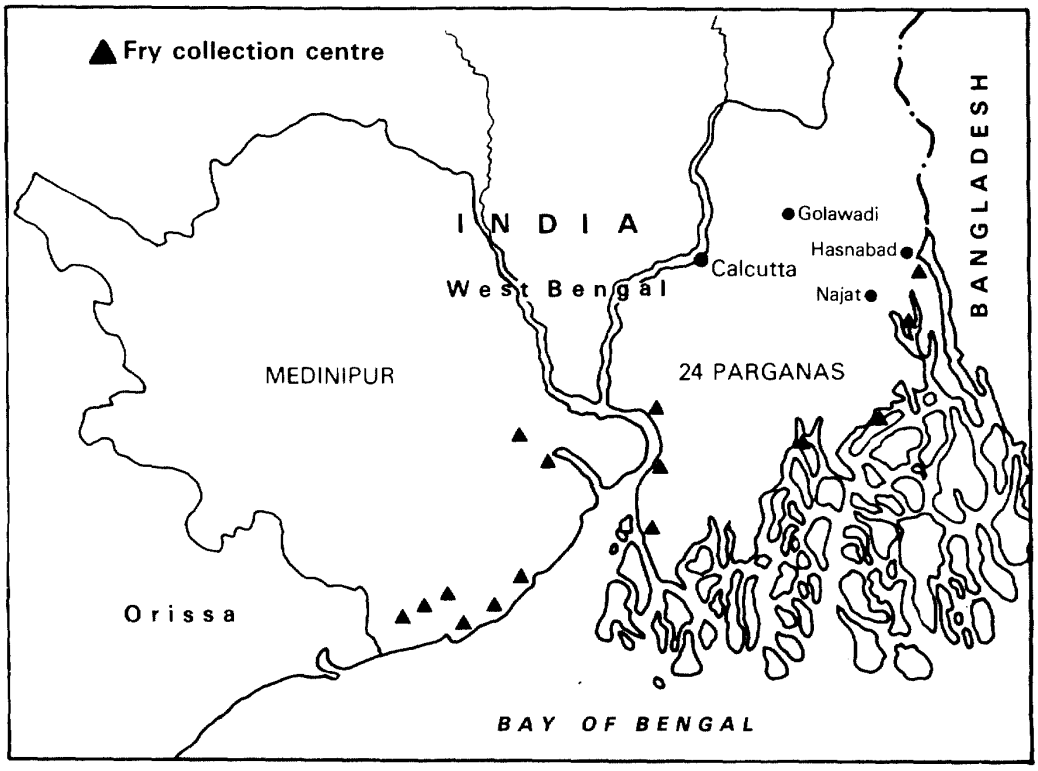
This study is based to a great extent on the information collected from the fisherfolk, traders and farmers involved in the business. The information was collected during an intensive ten-day mission (8-18.3.92) when informal interviews were conducted in the field with the aid of two field workers from SANLAAP familiar with the market. Further information was collected on a visit (23-27.3.92) to Medinipur District in conjunction with the monitoring of BOBP's tiger shrimp fry nursery rearing trials. The collected data was subsequently analyzed and compared with secondary sources.

3. *SUPPLY*

An estimated 90 million fry are being collected from the Sundarbans and Medinipur District every year. There is, however, a potential for 400 million fry, as, currently, only about a third of the Sundarbans area is fished (see figure 2), the rest being out of bounds due to conservation measures and the presence of the Bengal Tiger (R C Sengupta, DOF, personal communication).

Production in Medinipur District depends both on the status of the natural supply and the demand for fry in North 24 Parganas. Though the fry catchers are not very sensitive to price, as they have

Fig 2 Main tiger shrimp fry collection centres in West Bengal.



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few alternative employment opportunities, it is the middlemen or 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.

Supply from nature is dependent on numerous variables, of which, the more important are discussed in the pages that follow.

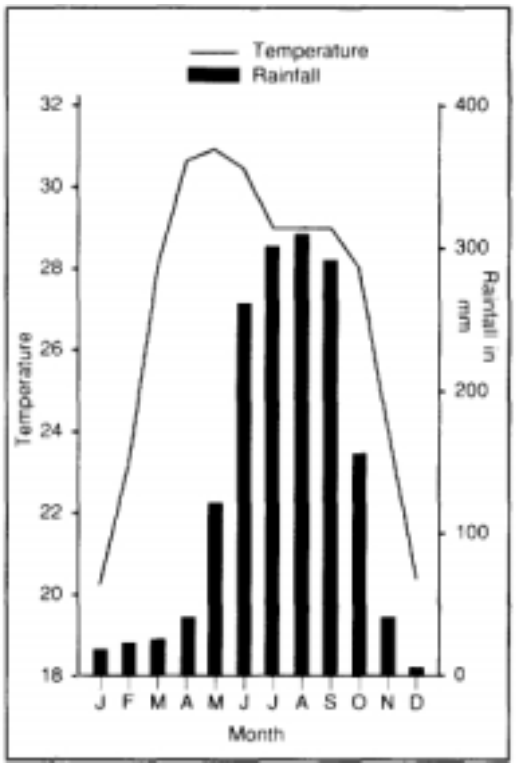
3.1 *Temporal variables*

Season : Tiger shrimp fry can be found at any time of the year in Medinipur, but the catch per unit effort varies greatly. April to June are the peak months for fry availability in the canals and estuaries where they are mostly collected. With the arrival of the monsoon in mid-June and into July, the canals and estuaries drop in salinity to the point where few fry survive. The natural supply recuperates by September. From October, the natural supply builds up to the April peak.

Temperature The low temperatures of water during the Bengal winter inhibit fry growth and may keep fry closer to the warmer Bay of Bengal. Shallow canals, ditches and backwaters experience both low winter temperatures as well as greater daily temperature variations that hinder a steady year-round supply of fry. November to February is the cold period in West Bengal.

Timings : Fry catching can be carried out as long as there is light enough to identify the fry. Collection is carried out during different times of the day, depending on the gear used. *Chakni* catchers (see Section 3.3) normally collect fry early in the mornings (low tide), while shootnet operators work mainly during the late morning, high tide or *bhonna,* and early afternoon ebb tide.

Fig. 3 Average monthly rainfall and temperature



Lunar phases : Spring tides associated with the New and Full Moon periods attract and concentrate fry in the estuaries. Thus, approximately five days around New Moon and five days around Full Moon allow for ten days of good collection every month.

3.2 *Spatial variables*

Adult penaeid shrimp are known to spawn in the sandheads region of the Bay of Bengal at 20-40 m depths. The larvae then drift towards the shallow coastal backwaters and estuarine areas, including river mouths and mangrove areas, which are their nursery grounds.

The fry when collected are about 25-30 days old. Tiger shrimp fry differ from other shrimp fry by the conspicuous brownish red stripe found on their dorsal sides.

Waterbodies : Collection can take place in river estuaries, canals, ditches and on the open sea coast. Medinipur offers them all. Current and tidal activity can be utilized, especially by shootnets (see Section 3.3), for efficient collection.

Habitat : Tiger shrimp fry, unlike other shrimp fry, are attracted to substrate which they cling to. This serves to protect them against cannibalism and predators. While the habitat in the Sundarbans has considerable debris and mangrove roots, the fry habitat in Medinipur is more exposed, with an open coast in parts. Locations with good fry habitats are more 'productive' for collectors, but gear selection is limited to the use of the *chakni* (see Section 3.3).

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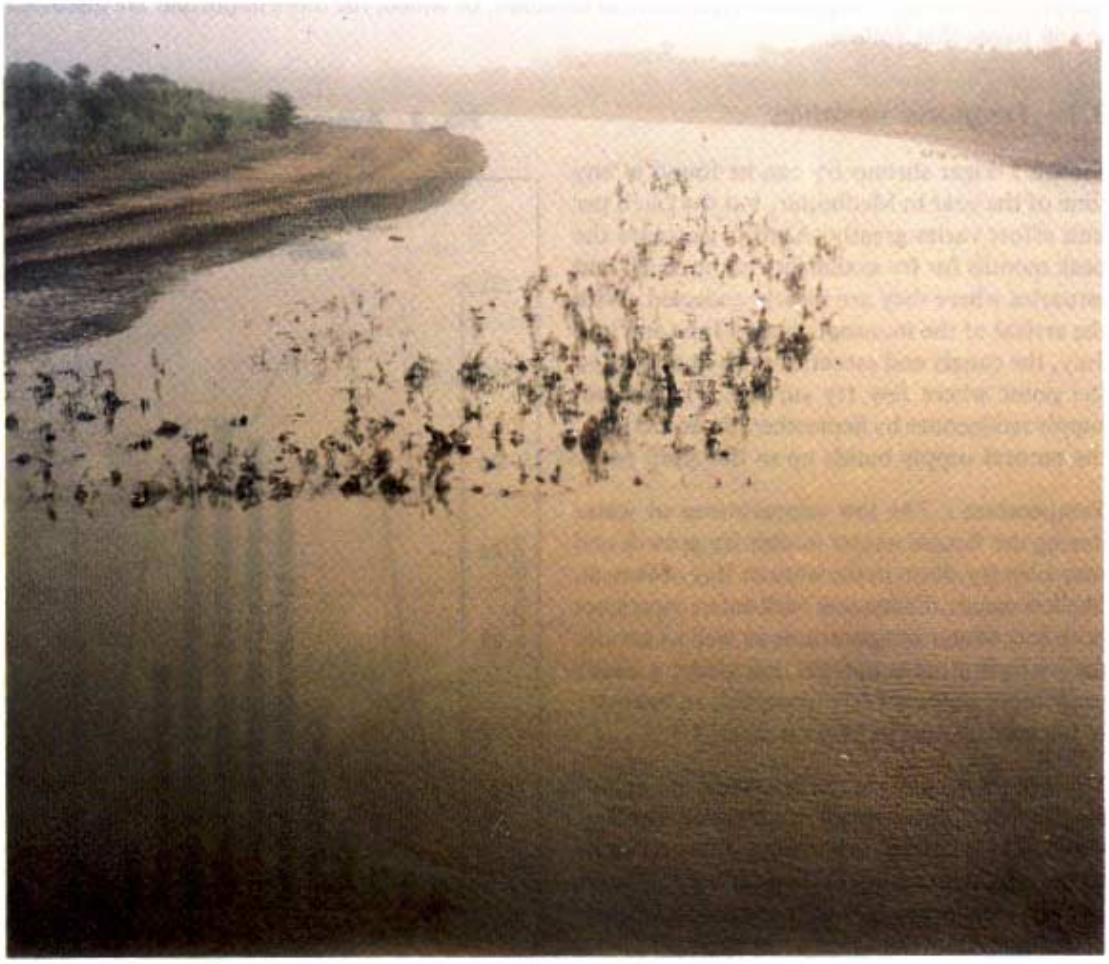
Fry—catchers create artificial environments with branches and brush to attract the fry. Likewise, BOBP has worked with 'lurelines', which are merely an attempt to create a more congenial habitat by introducing substrate tied to a line between two poles.



Salinity: Salinity in the fry collecting areas changes according to rainfall and to the proximity to the saline seawater and the freshwater runoff. Even the tidal flux will change salinity in some locations, as the high tide flows inland and riverwater pushes the saltwater out at low tide.

While tiger shrimp fry can be found alive in any salinity of water of 0-30 parts/1000 (ppt), their number and mortality rate due to stress is sensitive to salinity. For this reason, fry congregate where they find an appropriate salinity, swimming against the salinity gradient to reach such areas. A salinity of 8-25 ppt is what is normally required for fry, but 12-15 seems to be ideal to ensure growth and low mortality. During the Monsoon, salinity in the collection areas gets too low and, consequently, affects natural supply and farmer demand.

Light: As previously mentioned, tiger shrimp fry are attracted to light (phototaxis). Thus, there is a tendency to move to the surface of the water in whatever waterbody they are in. This is especially so during the lunar phase that produces the most light. Sunlight is the main attraction, but the moonlight keeps them at the surface. For this reason, most gear used is meant for surface collection.

3.3 *Modes of collection*

Fry collection, cutting across all social categories, backgrounds, castes and professions, involves around 50,000 families in the state. Poverty and lack of alternative employment are characteristics shared by most fry-catchers, be they traditional fisherfolk or landless agricultural labourers. Some are seasonally full-time collectors, but most are seasonally part-time collectors.

Few depend solely on fry collection for the family income. Within the family, collecting is not restricted to one sex or age but is done by all. The three main collection gear are described below. Brief descriptions of the gear operators are given as well.

Woman catching fry at Dubda levy gate

CHAKNI OR SCOOPNET

The *chakni* is the main gear used in the smaller canals and ditches of Medinipur. It is a gear used almost entirely by women and girls, who operate it for a few hours every morning. The equipment comprises of an 80 cm diameter wooden ring with 1 mm synthetic mesh netting loosely stitched on with cord. An aluminium pot, or *hundi,* floating next to the point of collection serves as a storage container for the captured fry.

This is the experience of a typical young fry collector who uses a *chakni:*

Samonto poses with her chakni *in Dubda Canal*

Name: *Shakuntala Samonto*
Age: *12 years*
Place: *Dubda Canal, Ramnagar*

She operates the chakni *for about 2 to 3 hours/day. She says she collects 100-200 fry a day during thepeak season (March-May). We observed her collect 20 fry 4during 30 minutes. She had a collection of 36 fry on the previous day (9.3.92).*

SHOOTNET

The shootnet, or *beenjal,* whose origins are said to be in Bangladesh, is similar to a stownet or set bagnet. It is a 5 rn-long, fine mesh sock with a 3 m wide opening. The opening of the net is held afloat by a 3 m long pole. Smaller stakes are used to hold the pole and net in place.

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In deeper waters, a barrel or drum is used in place of one of the stakes and the net pivots with the current.

The net is emptied every 10-15 minutes during the roughly three hours of ***bhonna.*** The fry are removed from the 'cod end'. The gear is not selective, capturing large amounts of other post-larvae **and fingerlings. The cost of each shootnet is Rs. 300-350.**

Shootnets and fry-catchers awaiting the fry at Junput

The shootnets are a men's domain, whether the men are 15 or 60 years old. Normally, one family will own more than one shootnet. These can be set up one after the other and operated simultaneously. The fry are sorted immediately they are collected from the net and retained in small tanks built of clay. They are also retained in 40 l aluminium vessels. The water is frequently changed (once every 1-2 hrs) depending on the number of fry. Sampling indicated the presence of juveniles (about 5-10 per cent of the catch) as well as post-larvae, measuring 14 mm on an average.

Debankar Maithi returning home with his catch

Seven agents purchase fry from the collectors in Junput. The **collectors are paid less than the actual market price; they attribute this to the fact that most of them are indebted to the agents. Indebted collectors are,** on an average, paid Rs. 10 **less than the market** price **for their fry. Agents collectively gather about 50,000** fry/day from the Junput area during the lean season and about 200,000 **fry/day each during peak season.**

The experiences of a few fry collectors using shootnets are narrated below.

Name: ***Debankar Maithi***

Age : ***65 years***

Place : *Dubda* ***Canal, Ramnagar***

He operates shootnets and has been collecting tiger shrimp fry for the past 5-6 years. He states that more than 100 shootnets are in operation in the Dubda Canal. The lowest catch/net/day is 300-500 fry and the highest 8,000-10,000.

Maithi sells his fry to a middleman and currently (as on 9.3.92) gets 100 IRs[1]/thousand. He gets only 20-30 Rs/thousand during peak season and 200 Rs/thousand when the catch is low.

He says that out of the 100 net operators in Dubda Canal, at least 60 of them are 'commercially' tied to agents or middlemen, having borrowed money from them (locally known as dadun).

Name: *Chakradhar Sahoo*

Place: *Shankarpur*

Sahoo is an agent and fry collector. He along with three brothers as partners, also operates seven shootnets. They operate the nets for about three hours/day, the timing depending on the tide. They generally operate when the high tide sets in. Their maximum catch per shootnet is 10,000-12,000 and the minimum is 200-500.

He buys fry from over 100 collectors. His current purchase price from the fry collectors is 100 Rs/thousand (as on 10.3.92) and he sells to a middleman at Alampur, Shankardas, at (see Section 5.2) about Rs 120. As an agent he collects between 70,000 and 100,000 fry a day. Nearly 40 fry collectors are commercially bound to him as he has loaned them money (dadun). *He says most of them fail to repay the* dadun *and, hence, payment for purchase is made after deducting part of the loan.*

Name: *Nanigopal Dingal*

Age: *15 years*

Place : *Rasulpur on 11.3.92*

Dingal's family consists of seven members (five children) and owns two shootnets. He has been collecting fry for the past three years. On 11.3.92 he had set his net at 6.30 a.m. and caught 30 fry by 9.30 a.m. Catches per net can be as low as 25 fry, but can also reach 1000 in his area of operation.

Agents bought fry from him on 1.3.92 at 200 Rs/thousand. The rate on 11.3.92 was 120 Rs/thousand.

Name: *Sajjak Ali Shah and Shaik Manjur*

Place : *Junput on 11.3.92*

Junput fry collection is on a mud flat about 3 km² in extent. Over 300 shootnets were seen in operation. Shaik Manjur claims to have pioneered fry collection activity here after seeing it in Bangladesh. He has been operating in this area for the past 7-8 years. He owns six shootnets.

The fry-collectors of Junput devote about four months in a year to this activity; the rest of the year they work as crew on fishing vessels or as labour in dry fish processing. During the lean season, each beenjal is said to land around 100 fry/day, whereas during peak season each lands between 15,000 and 20,000 fry a day. During peak season, the fry generally sell at 70-80 Rs. /thousand, but at times prices can drop to as low as 10 Rs/thousand.

PUSHNETS AND DRAGNETS

These two gear are basically quite similar, the pushnet being pushed by its handle across the bottom in shallow waters and the dragnet being drawn by ropes.

Pushnets are, however, normally smaller than dragnets and can be used even by children. Dragnets are mainly used by older boys or men. Both gear were not seen during the field visit in Medinipur and are said to be relatively rarer than the chakni and shootnet.

US $1 = IRs 29 appx.

4. DEMAND

4.1 *Distribution of demand*

Demand for tiger shrimp fry varies seasonally and by location. Tiger shrimp fry compete against comparable aquatic species for selection by ***bheri*** farmers. These issues are discussed below.

Inspecting a fry shipment at a Gopalpur bheri

TEMPORAL ASPECTS

Demand for fry exists year-round, except just prior to and during the monsoon period. ***Bheri*** farmers would like to stock tiger shrimp fry as much **as** possible, but most farmers are unable to get as many fry as they would like. For this reason, some are willing to pay advances to ensure delivery. Others do the opposite, getting their fry on credit and repaying upon harvest. There is no premium for occasionally caught larger juvenile tiger shrimp, which have a higher stress tolerance.

Demand, in reality, is limited by two factors:

- High fry mortality during the Monsoon, and
- The low productivity of the ***bheries***

High fry mortality and low productivity can be related to three factors

- Initial high stress due to transport and salinity/temperature shock on entering the ***bheri;***
- Low salinity due to heavy rainfall; and
- Cannibalism and predation in the ***bheri.***

The initial stress problem affects the price somewhat (see Section 7 on quality), but it is not a major concern of the buyer. Low salinity, however, is a concern and farmers will refrain from purchasing fry from late May until the rains ease in October. During this period of the Southwest Monsoon, ***bheri*** salinity is virtually zero and post-larvae, though not juveniles, are normally not able to survive in such conditions.

Cannibalism among shrimps and predation by carnivorous/omnivorous finfish radically increase.. fry mortality in the waters of the ***bheri.*** While this may be the main reason why, despite artificial introduction of fry, productivity is so low, no general effort to screen intake water has yet been made. Some predators, like sea bass or ***bhekti (Lates calcarifer),*** are also cultivated by some farmers. These farmers reduce large losses of shrimp fry by stocking the fry while the finfish are still fingerlings.

Demand fluctuates seasonally. During the prime stocking period (Feb.-Mar.), farmers are willing to pay high prices to acquire fry (highly elastic demand), but during the Monsoon, no farmer is willing to buy at any price (highly inelastic demand).

In the cold but dry winter (Nov.-Feb.), fry are available in small quantities and their growth is slow. But as salinity is not a problem, there is farmer demand. However, due to low supply, high prices are normal throughout the winter.

SPATIAL ASPECTS

Brackishwater shrimp culture is practised in about 65,000 ha. in India. About *52,000* ha of this culture is of a traditional nature (that is, less intense than 'extensive' culture) and is practised in West Bengal, Kerala, Karnataka and Goa[2] More than 60 per cent of the traditional culture is in West Bengal.[3] Thus, there is only limited demand for wild tiger shrimp fry out-of-state and most fry are sold within the state. It should, however, be noted that with the level of aquaculture development in Bangladesh, the demand for tiger shrimp fry in Bangladesh is clearly being felt in West Bengal.

There is brackishwater culture of shrimp throughout southern West Bengal, but, with a few exceptions, shrimp culture is mainly in North 24 Parganas. Culture outside North 24 Parganas would have to rely on local collection or, in the case of some modern projects, on hatchery-supplied fry. Future expansion of brackishwater culture of tiger shrimp is likely to take place where rice culture is found to be less profitable (with only a single annual crop due to high soil salinity) and where there is access to saline water. This would ensure that brackishwater aquaculture development does not spread beyond Medinipur and 24 Parganas Districts, where alone rice productivity is less than a tonne per hectare.[4]

4.2 *Substitute and alternative species*

FINFISH

As tiger shrimp fry supply is not reliable, many farmers must turn to finfish species as an alternative, or substitute, income-generating activity. The most common finfish fry sought are tilapia *(Oreochromis* spp.), sea bass *(Lates calcarifer),* milkfish *(Chanos chanos),* catla catla, mullet *(Mugil* spp.) and pearl spot *(Etroplus* sp.). Whereas shrimp have a 100-120 day culture cycle, finfish take up to one year to reach marketable size. The carnivorous nature, low unit price, slow growth and intolerance to high salinity of these finfish, coupled with the high unit price realized by tiger shrimp, are among the reasons why tiger shrimp are the preferred crop.

FRESHWATER PRAWN

Prawns *(Macrobrachium* spp.) are often selected as an alternative to tiger shrimp or they are even cultured together. Prawn fry are available from hatchery stock, although most are caught as juveniles in rivers. The giant freshwater prawn *(Macrobrachium rosenbergii)* fetches good prices and is exported. However, its growth is slower and stocking densities must be kept low to avoid cannibalism, especially during moulting. As a polyculture with tiger shrimp it serves as insurance. While tiger shrimp have high mortalities in very low salinity, freshwater prawns suffer fewer mortalities.

OTHER CRUSTACEANS

Other penaeid shrimp, such as Indian white shrimp *(P. indicus),* banana shrimp *(P. merguensis,),* Japanese kuruma shrimp *(P. japonicus),* king prawn *(P. latisulcatus),* redtail shrimp *(P. penicillatus),* greasy back shrimp *(Metapenaeus dobsoni)* and ginger shrimp *(M. kutchensis),* can be cultured in brackishwater. The first three alternative penaeids mentioned have now been recognized in order to diversify the present tiger shrimp orientation of the shrimp farm sector. The Indian white is already a commercially important cultured species for export. Many of the difficulties of hatching tiger shrimp fry in hatcheries can be avoided with these species, while market prices are similar.

[2] K Alagarswami (1991). Ensuring Sustainable Growth. IN *The Hindu Survey of Indian Agriculture 1991. PP.* 222-225

[3] K Alagarswami (1991). Brackishwater Aquaculture in India An appraisal of present status and future prospects. IN: ***Aquaculture Productivity.*** V R P Sinha, Oxford New Delhi, 1991. pp. 119-132.

[4] Social and Economic Atlas of India, 1987, Oxford, New Delhi.

These are the experiences of a couple of farmers practising polyculture

Name: Shiraf-ul-Haque Mullah
Place : Harua

Mullah owns a bheri of 40 bighas extent (3 bighas = 1 acre). He has been practising extensive systems of mixed fish-cum-shrimp culture for the past twenty years. Apart from tiger shrimp, other species cultivated include freshwater fish like catla, rohu (Labeo rohita), tilapia and freshwater ***prawn.***

Stocking of tiger shrimp fry is done once in three months. Shrimp are harvested after three months, while fish are harvested 8-10 months after stocking. He claims that he is able to harvest 25,000 tiger shrimp if he stocks 40,000 fry (62.6per cent survival). The harvested shrimps sell in the Harua market at 90-160 Rs/kg, depending on the count. His annual revenue out of shrimp culture alone ***is Rs.*** *500,000.*

Name: Abdul Hamid
Place : Korapada, Gopalpur

Abdul Hamid owns 1,500 bighas of bheries. He has been operating his farm on an extensive basis for fish-cum-shrimp culture. The species include tilapia, catla, rohu, bhekti and freshwaterprawn. He has been operating as a fish farmer for about twenty years.

He requires about 9 million tiger shrimp fry annually. He started stocking tiger shrimp fry in his bheries from 1979. His expense on procuring fry is estimated to be Rs. 1.8-2.0 million.

He has begun fertilizing with potash and supplementary feeding with mustard oil cake on a trial basis from this year. The exchange of water in his bheries is tidal. He says shrimp farming has been becoming less profitable of late. He attributes this to decreasing land fertility, greater competition, reducedfry availability, increasing numbers ofpartners in the activity, difficulty in obtaining loans from banks and abnormally high interest rates charged by local moneylenders etc.

5. *MARKET*

5.1 Transport and marketing gear

The following gear are used for transport and marketing:

Hundi: This 40-litre rounded aluminium container with a large lip, to enable carrying on the hip, has been standardized. Small aluminium, ceramic or plastic (cooking) pots may be used at points of collection but, eventually, all fry are transported onwards to the *bheries* in aluminium ***hundis.*** A thin cloth is usually used to cover the opening to reduce sunlight and prevent fry from jumping out or being spilt.

The container's form is ideal for a sloshing effect that aerates the water when shaken. Hundis are normally owned by each level in the market chain and contents are transferred at point of transaction to the new owner's hundi. Hundis are marked so as to avoid mix-ups.

Hundi* Yoke:** On arrival in the culture area, the fully-laden *hundis* are carried to the appropriate ***bheri on footpaths. For this a wooden shoulder yoke is used with two or four *hundis,* one or two on each side, suspended from the yoke by ropes.

Hundis *of fry arrive in Gopalpur*

Bivalve shell: As the dark fry are difficult to see without strong light and a light-coloured background, mussel shells are used throughout the market chain, from catcher to farmer, to count fry. The outer layer (mother of pearl) of the inner surface of the shell collects and reflects available sunlight and this light silver background allows fry to easily be seen.

Catchers separating tiger shrimp fry with mussel shells

White enamel plates: When large numbers of fry are to be counted at numerous points in the market chain, high-rim metal plates coated with white enamel are used to estimate numbers. A number of plates are normally used simultaneously *i.e* the contents of one *hundi* are equally spread in ten plates and one or two plates randomly selected for counting.

Long distance packaging: Fry sold to distant locations are generally sent as airfreight. These are specially packaged in polythene bags filled with water and oxygen and the bags are placed in tins or styrofoam boxes. The packaging (worth about Rs 30) is not returnable by the customer.

The experience of a large unit despatching fry to distant destinations is reported below

Name: *Sambunath Ghosh*
Place : *Ichamati Prawn Seed Bank, Hasnabad*

Thisprivate tiger shrimp seed bank was started by Sambunath Ghosh in 1987, with technical and financial assistance from the Marine Products Exports Development Authority (MPEDA). The seed bank has three tanks, two of which can hold one million fry each. The third tank is used as the reservoir for filtered water supplied to the fry-holding tanks. At the time we visited, the seed bank was not operating due to lack of orders. Since its completion, only 2 million fry had beensuppliedbythebank to Bombay, in April/May1991.

When fry were supplied to Bombay they were packed in polythenebags which were,inturn,packed in tins or ther mocoleboxes. A dequate oxygen was pumped into the bags before they were sealed. Each tin or box accommodated 1500fry. Crushed ice was also packed around the polythene bags. The tins/boxes were transported to Calcutta airport by truck, each truck carrying around 200 tins. The hire charge for, transport between Hasnabad and Calcutta was Rs.500. From Calcutta, the fry were airlifted to Bombay and other airlinked destinations.

Ghosh's margin on sales was about10per cent when buyers personally visited the seed bank for purchase. He kept a margin of 20 per cent when he despatched the fry at his own risk. Transit and handling mortality was assumed at15-20 per cent. He collected fry fromfry-collectors of the Sundarbans area. His maximum collection during peak season was up to 2million fry a day. He employed four or five people when the seed bank was fully operational. The fry were fed with paste made out of rice bran, shrimp meat and trash fish. Poor survival of fry in the nurser ytanks was a major constraint in his business.

VEHICLES FOR TRANSPORT

While hundis may be transported by foot, bicycle, motorbike, bus or bullock-cart,Matadors(diesel vans) and launches are mainly used for transport over longer distances.

Matador : This two-ton diesel van with a long metal cargo bed safely holds 36 *hundis* stacked two high. While the number involved in the trade fluctuates, it is estimated that around 100 Matadors are in use on any one day during peak season. Most are hired with a driver on an individual job basis.

Backwater launches : Fry are transported along the backwaters from South 24 Parganas to the markets of North 24 Parganas by motorized launches which carry both cargo and passengers. Transportation costs are paid according to the number of *hundis* carried. The launches leave their southern bases at night and reach the markets early next morning.

OTHER TRANSPORT FACILITIES

Holding tanks : Throughout the market chain there are holding tanks which allow more water to be held, thus ensuring fewer water changes and less mortality. The simplest tank is a temporary mud tub of a half metre diameter and 10 cm depth built above the surface of the ground. The riverside tanks are lined with net mesh to prevent loss and are used by collectors, mainly those using shootnets.

Agents and middlemen have even larger tanks *(2.5* m^3). These too are clay lined, but they are sunk into the ground. Net lining is used with these tanks too. As the tanks are used to hold fry for several days, they require occasional water changes.

Seed banks require even more advanced tanks, similar to those of a hatchery. Normally made of brick and mortar or cement, these tanks of several tonnes capacity have artificial aeration systems.

The three types of tanks are shown on the facing page.

5.2 Professions in fry marketing

Numerous professions have been created by the tiger shrimp fry business. The majority of people involved are fry-catchers. The other professions, which are the mainstay of the marketing chain, are described below.

Subagents : These field personnel of the purchasing agent are located at the village level and are, usually, merely local representatives of the agent. They pay the collectors directly. There can be numerous subagents in a fry catcher village competing for the collected fry. Despite the competition, some villages feel there are market imperfections and that local prices are being held down by cartels.

The fry is transported to the agent once a day. Some agents send out their own collection vehicle once a day. Subagents have to maintain a high volume of despatches if they are to retain the favour of the agent. They are paid a commission on the number of fry rounded up for despatch. The tool of the subagent is the *dadun;* the agent allots his subagent some funds for this purpose and the latter, in turn, lends up to a few thousand rupees to each fry catcher. The fry catchers often receive these loans interest-free, but are obliged to sell all fry, often at less attractive prices, to the subagent making the loan.

Agents : Purchasing agents have anywhere from 5 to 30 subagents located in collection villages. They arrange for block-level collection from these subagents, whose *daduns* they refinance to ensure their market share.

Most agents have one or more holding tanks, which enable them to store a full load of fry. A critical mass must be collected within a certain time to avoid a loss, as mortality in the holding tanks greatly increases if the fry are held more than two days. If the number of fry collected in two or three days is not sufficient, the agent will be forced to sell his fry to another agent or middleman. On the other hand, if sufficient fry are collected, a truck can be hired and a good profit made.

2

1. *Small catcher tank at Rasulpur*
2. *Shootnet collectors use plastic sheeting in tank (Shankarpur)*
3. *An agent/middleman's tank made of clay, at Kalinagar*

3

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Additional information from some agents is presented below.

Name: Siddiq Biswas (interview with his representative).

Place: Choudda Mile, Ramnagar

He has been operating as an agent for the past five years and has six subagents working for him. He gets his fry from Digha, Ramnagar, Rasulpur and Junput, besides places like Talsari, Rankuta, Jyarampur etc, in Orissa. The maximum fry he gets is from Ramnagar and the Dubda Canal.

His cement holding tank measures 2.5 x 1.5 x 0.25m appx. Fry are brought in 40 l hundis *and transferred to the holding tanks after counting, The collection on 9.3.92 was 2,400 fry and on 10.3.92 it was 4,100.*

Name: *Subroto Pradhan*

Place: *Rasulpur*

He has been operating as an agent for four years, and buys fry from 250 people. He also gets fry from Junput and Khejri. Around March, he is able to collect about 40,000 fry/day but during the peak season he can get 100,000-200,000 fry/day. His buying price on 11.3.92 was 120 Rs/thousand. He got about Rs. 180 for this in North 24 Parganas (Najat).

Normally he sends fry to Najat on alternate days or when he has about 80,000 fry for a truck. Hire charges for the vehicle works out to Rs. 2,200 per run. During the peak season, his buying price may be as low as 30 Rs/thousand and selling price Rs 60, whereas the maximum buying price during the scarce season is 240 Rs/thousand and the selling price Rs. 280.

Mortality in clay-lined holding tanks is about 10 per cent and mortality in transit is 10-20 per cent. A van carries about 30 or 40 l hundis, each with about 5,000 fry.

About half the water in the vessels is changed after 4-5 hours, usually at Kolaghat or Haora on the way to North 24 Parganas. Between May and November he markets adult tiger shrimp harvested from the local farms.

He has given dadun *to about 50 collectors who are, thus, obliged to sell him their fry. The loan amount normally does not exceed Rs 200 a person and he pays them five rupees less than the day's price when buying fry from them.*

Name : *Balram Manna*

Place : *Junput*

His collection for the first 15 days in March was about 50,000 fry. He sells his fry to Banu Patra, the local middleman, at a profit of 10 Rs/thousand. He despatches the collected fry once every 2 or 3 days. He lends money to the collectors, about Rs.300 or 400 at most, for purchase of new nets, vessels etc.

Middlemen : They are basically the ones with a contact network in both the collection and cultivation regions. They are located at key points on main transportation routes and are, thus, able to collect from whole districts.

Middlemen normally do not have the village-level contacts and do not provide *daduns* to collectors. They function more as businessmen with a commodity to trade.

Middlemen too have holding tanks, but not all fry needs to be held, as the quantity they deal with is quite high. Middlemen arrange transport and have staff both where the collection is made and where it is sold.

Here is what a couple of middlemen had to say.

Name: *Shankardas*

Place: *Alampore Balishahi*

A leading middleman, he has his own transport and 12 agents working for him. He sells his fry outside as well as uses them in his bheries.

His buying price on 10.3.92 was 100 Rs/thousand and selling price Rs 160. He sent 10,000 fry to Bashirhat on 10.3.92.

He sends his fry to Najat wholesale market or sells to farmers directly if they place orders with him. Transportation of fry from Alampur to North 24 Parganas normally costs him Rs. 2,200 if he uses his own vehicle or about Rs. 2,500 if he hires outside trucks. On an average, from October to January, he sends one vanload every three or four days with an average of 60,000 fry a load. Between February and March, he sends a load once every five or six days, with 10,000-30,000 fry and between March and May he despatches 100,000-200,000 fry every day.

His holding tanks are clay-lined and have a thatched roof. He maintains fry in these tanks for a maximum of six or seven days. Maximum mortality encountered is about 30 per cent, mostly during peak season.

During peak season he buys fry for 30-40 Rs/thousand. His costing at the time we met him was as follows:

Cost of 100,000 fry @ 100 Rs/thousand	=	*Rs. 10,000*
Transportation charges	=	*Rs. 2,500*
Miscellaneous, labour etc.	=	*Rs. 250*
Mortality @ 10%	=	*Rs. 1,000*
		Rs.. 13,750
Selling price at 160 Rs/thousand	=	*Rs. 16,000*
Net profit:		*2,250 Rs/trip*

Middlemen at their Kalinagar office

Emptying a middleman's tank at Kailnagar prior to despatch of fry

Name: *Mohammed Hyder Ali Gazi*

Place: *Hasnabad*

Around 25-30 middlemen operate in this market. They buy up all the fry arrivals from the Sundarbans area and resell them to bheri *owners in North 24 Parganas.*

Gaziis one of these middlemen and had collected between 20,000 and 30,000 fry in March. During peak season, he is able to collect 200,000 to a million fry a day. The selling price at Hasnabad between 10.3.92 and 15.3.92 was 200-210 Rs/thousand.

The highest price recorded in this market during the lean season is said to be 350 Rs/thousand and the lowest price 50 Rs/thousand during peak season.

Transporters : While larger agents or middlemen, generally hire the Matador trucks **with** drivers on a trip basis, some trucks are hired on a long-term basis by transporters who take the truck to the collection areas, buy directly from agents and middlemen there and sell at the main markets on the other side of the state. Transporters need no holding facilities and do not necessarily have networks at each end. They compete with the collection agents, middlemen or buy the fry of smaller middlemen.

Retailing agents : Not all consignments go to the major markets; some of them go directly to the farmer through a retailing agent. These retailing agents are in touch with farmers and know who are willing to pay top prices. They work on a commission basis and do not normally involve themselves in buying and selling of fry. However, some retailers accept advances from farmers who are desperate to receive fry, while, in other cases, some retailers (middlemen) deliver fry and wait until harvest time to collect payment.

Here is one retailing agents's experience.

Name: Mohammed Ashrab Ali

Place: *Golawadi*

Mohammed Ashrab Ali is the leading agent in Golawadi, dealing with 10-12 trucks a day. He arranges distribution to subagents and farmers. He also claims to send fry to Gujarat, Bombay and Bangladesh. He has been in this trade for ten years. He says the price depends on the season and demand. Around twenty subagents work for him. Farmers usually pay advances while booking orders for fry from him. Transport cost is borne by the original supplier. He charges 5-10 per cent of the total value of the fry as commission towards arranging the final sale of the fry. He also gets fry from collection points in Orissa, Namkhana, Kakdwip, Haldia etc. Harwood Point near Kakdwip is, he says, an important shrimp seed collection centre.

Auctioneers: In the major markets of North 24 Parganas, freelance auctioneers await consignments of fry to be sold by auction. The auctioneers supervise the counting, then auction the product to the gathered farmers. The auctioneers, whose major incomes are generally from other sources, work in the markets early in the morning, collect a small commission for their services and then move on to their routine Work.

Counters: With prices being more or less the same throughout a market, the fry count is the most hotly disputed point of a sale. Counting, thus, becomes a very important part of the sale. This service is offered by specialist fry counters. As already mentioned, a random *hundi* is poured into ten white-enamel plates and at least one random plate is counted, fry-by-fry, with a mussel shell. The resulting number times ten and times the number of *hundis* is accepted as the total number of fry in the consignment.

Rathan Rai counting fry collected by local youth at Hasnabad

The randomness of the ***hundi*** and plate selected is not always so random, if the buyer is not astute and the seller is able to select a special ***hundi.***

Counters, like auctioneers, are paid a small fee for their services. These two professions are sometimes combined in one person.

This is the experience of one counter whom we met.

Name: Ratan Rai

Place: Hasnabad

He** has **been operating as a counter at Hasnabad fry market for the past ten years and** has **been earning 50-60 Rs./day. He charges 5-10 Rs/ thousand fry counted (not extrapolated). This is his part-time job, his main business is running a sweet stall.

Carriers: ***Hundi*** carriers are required at two points in the market chain – at the marketplace and in the *bheri.* Marketplace carriers unload launches and Matadors and bring each individual *hundi* to the location of the auction. One *hundi* laden with water and fry is carried at a time on the head with the traditional cloth cushion. Empty ***hundis*** must be carried back to the launches/Matadors. After the sale, the *hundis* are tied together and head-loaded up to four on top of each other. Some are carried to the marketplace by *hundi* yoke, two on either side.

Bheri carriers use ***hundi*** shoulder yokes and carry up to four ***hundis*** from the delivery trucks to the particular ***bheri*** for release. This can sometimes be a long distance, depending on the accessibility of the *bheri.* These carriers are recruited at the market place or arranged by the retailing agent for each consignment.

Both types of carriers are paid according to the number of *hundis* carried and the distance involved.

A carrier using a yoke brings four hundis *to a* bheri *near Gopalpur*

Adulterating fry-collectors: This group, of unknown size, collects fry of other species to mix with tiger shrimp fry just prior to the point of sale. While Medinipur tiger shrimp fry is carefully collected to prevent mixing with non-tiger shrimp fry, a considerable quantity of fry marketed in North 24 Parganas is adulterated with non-tiger shrimp fry. Some species, particularly the Yellow Shrimp ***(Metapeneaus brevicornis),*** are added to deceive farmers who do not know the difference and are fooled by the obvious vitality of the newly captured yellow shrimp fry. These non-tiger shrimp fry can be collected with a simple net cloth drawn along the surface of a canal. Catch rates

are incredibly high compared with that of tiger shrimp fry. These collectors are paid, or rather sell their fry, at extremely attractive rates, partly indicative of the high profitability of such adulteration as well as of the need for discretion.

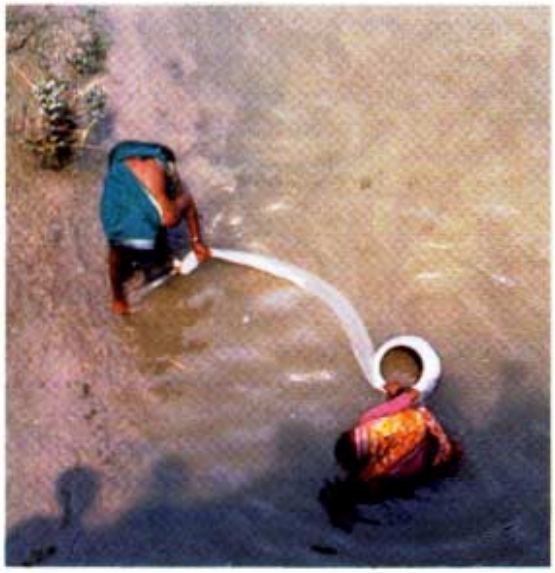
One experience of adulteration is recorded below.

Name: Anonymous

Place: Haldia-Najat Road

On the way to Gopalpur to inspect a bheri, *we met a truck from Haldia carrying 32* hundis *in two layers. The driver and the fry agent accompanying the truck stated that they were carrying 95,000 fry to be delivered to a* bheri *at Harua, near Gopalpur. It had taken them five hours to get to Gopalpur from Haldia.*

Following the truck to witness the transactions between the agent and the farmer, we noticed a startling practice: mixing, or adulteration, of tiger shrimp fry with that of yellow shrimp. Metapenaeus brevicornis *(locally called* 'chamni') *are collected from canals near Gopalpur. The post-larvae of* Metapenaeus brevicornis *bear a striking resemblance to* **P.** monodon *post-larvae. The only difference is in the colour of the dorsal stripe which is orange in the case of yellow shrimp and needs very careful observation to distinguish from* **P.** monodon's *red colour.*



Women collecting yellow shrimp fry in North 24 Parganas

The agent confessed that he had been regularly adulterating tiger shrimp fry with yellow shrimp fry, even upto a ratio of 50:50, and making huge profits.

This practice, common amongst many middlemen, is a boon to women living near these canals. They make a livelihood collecting yellow shrimp fry, which are so abundant in these canals that a collector can gather over 100,000 fry in just about an hour. The women normally use fine mesh nylon nets.

Two women involved in the collection of yellow shrimp fry stated that they could earn as much as 200-250 Rs/day during peak season. They had been involved in this business for the past ten years. During peak season, 20-25 trucks stop by for mixing, whereas during the lean season 7 or 8 trucks stop. They charge Rs. 20-25 to replenish a truck.

This particular consignment was delivered to the unsuspecting bheri *owner, Shiraj-ul-Haque Mullah,* ***in Harua. The consignment*** *was sold at 250 Rs/thousand (the buying price at Haldia was* ***130 Rs/thousand).***

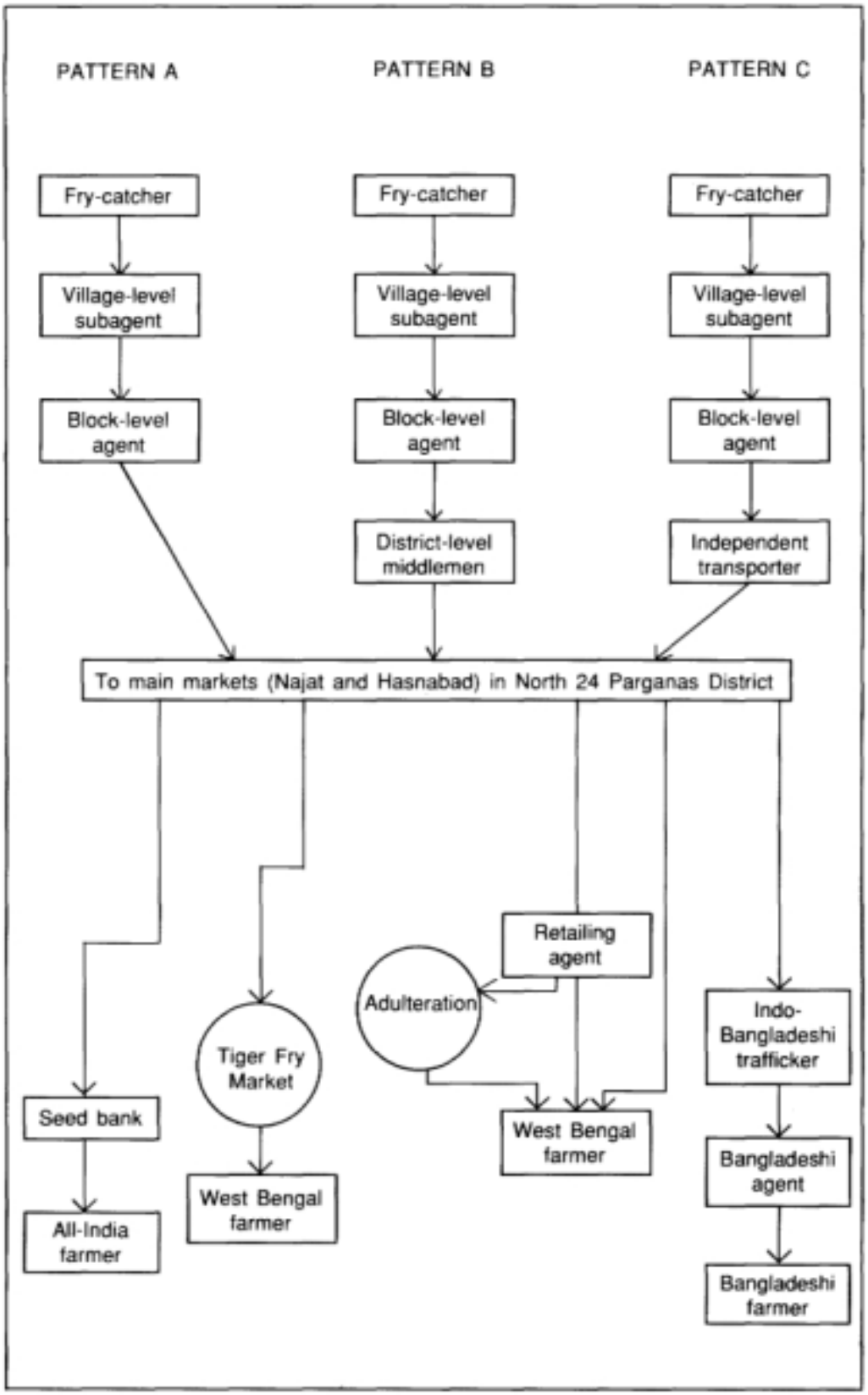
Cross-border traffickers: As fry prices are higher in Bangladesh, where aquaculture is more extensive, there is a considerable movement of fry across the long border. Indian smugglers send a variety of goods to Bangladesh, including tiger shrimp fry, diesel, sugar, rice, salt, and fish. They illicitly 'import' gold, pens, watches, electronic goods and clothing.

It is difficult to estimate the amount of fry exported illicitly. The border at Hasnabad, which we visited, is a river, and is less desirable as a crossing point than the dense forest along the border at other points.

5.3 Market patterns

All the professions mentioned in the preceding section are involved in the marketing of tiger shrimp fry in West Bengal. But there is no single distinct pattern linking them in the frymarketing operations. Some of the collection and distribution patterns are depicted on the facing page (Figure 4).

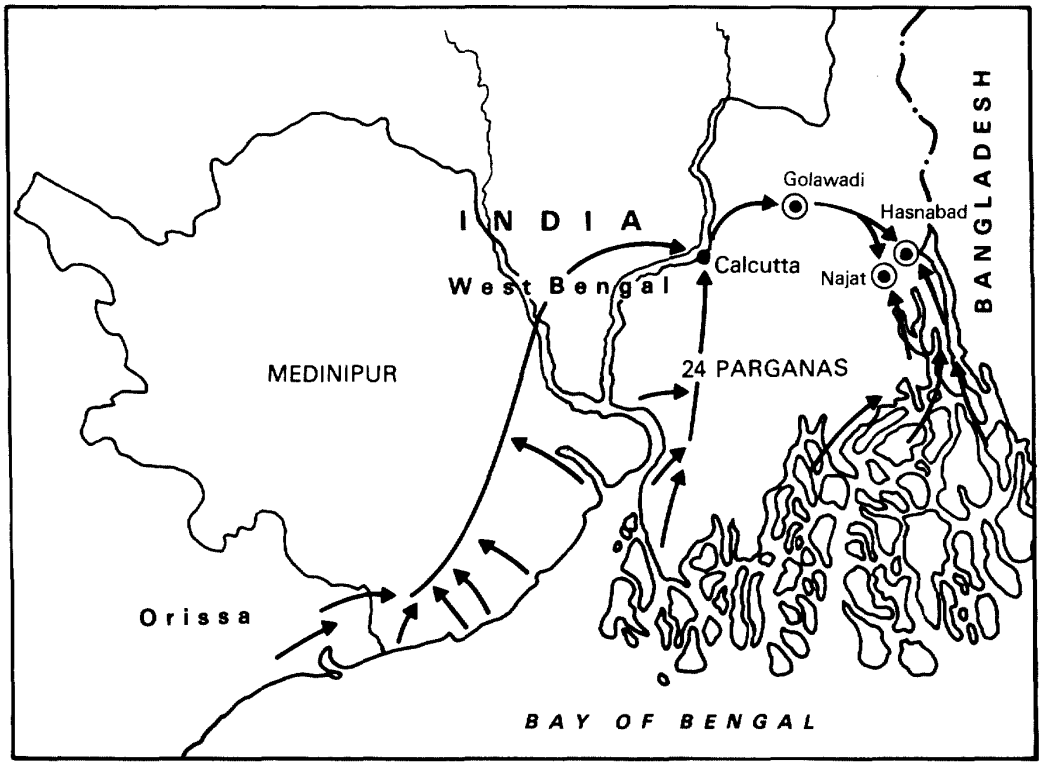
Fig 4. Distribution channels for tiger shrimp fry in West Bengal.



5.4 Marketplace locations

The key markets of North 24 Parganas are only a few, all at road or river junctions (Figure *5).*

Fig 5: Flow of fry to tiger shrimp fry markets.



Golawadi : This town near Basirhat is on the main road leading to the cultivation area. It is not a true auction market but is more of a wholesale/retail transfer point. All trucks originating in Medinipur or the east bank of the Hugli pass by this transit point on their way to North 24 Parganas. Numerous retailing agents, as well as *hundi* carriers, are based here.

Four agents based in Golawadi fix the final sale of the fry and their destinations in North 24 Parganas. In other words, these agents have prior bookings with farmers and the fry-laden trucks are sent to the respective destinations according to requirements.

Around 20-30 trucks stop here every day for further instructions on their destinations. The trucks usually start arriving at about 6.00 a.m. When we were there, two trucks arrived from Kalinagar and Khejura with, we were told, 70,000 and 92,000 fry respectively.

At this transit point, carriers get into the truck to help with unloading the fry containers at the eventual destination, usually the *bheries.* Each carrier earns 40-100 Rs/day.

Hasnabad : Situated at a river junction near the India-Bangladesh border, Hasnabad receives, by river launch, a large amount of the fry from the Sundarbans area. Hasnabad also receives truck shipments and fry from local collectors. Buyers are local farmers and Bangladesh-bound smuggling agents. Hasnabad's seed bank buys for all-India distribution as well as for legal export.

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Early morning sales at Hasnabad market

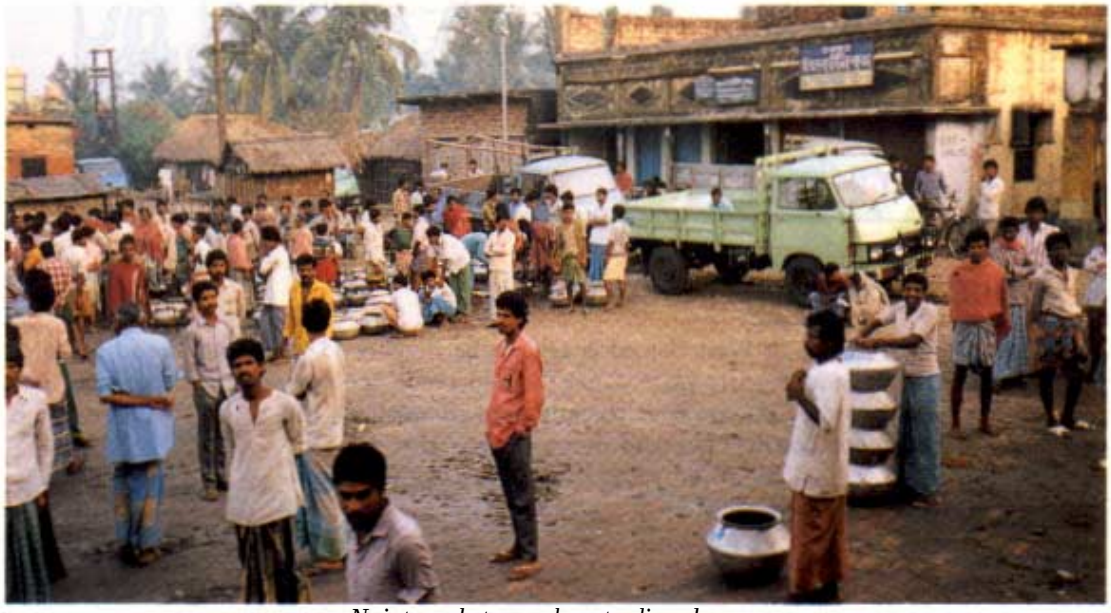
The tiger shrimp fry market at Hasnabad opens around 6.30 a.m every day, with both wholesale and retail sales taking place. It was observed that in the case of small sales, middlemen were not involved; the collectors sold fry directly to the farmers.

Najat: This is the main fry market of the state, and has a full-fledged market square dedicated to the fry trade. The roads to the town are clogged with Matadors and the rivers with launches, reflecting Najat's importance in the trade. Truck deliveries, however, appear to outweigh launch deliveries. Post-auction distribution is by truck.

The volume of the shrimp fry handled in this market is reflected by the presence of over 100 agents. Fry arrive from various centres, mostly from remote areas in the Sundarbans. The collection from the Sundarbans arrives in boats after 3-7 hours travel, reflecting the distances covered. Freight charge per *hundi* is Rs. 8-10.

The daily sales in Najat market ranges from 200,000 - 10,000,000 fry, the former being during the lean season and the latter during the peak season.

The highest prices recorded in this market are said to be 370 Rs/thousand during the lean season and 165 Rs/thousand during the peak season. Agents keep a margin of 50 Rs/thousand.



Najat market on a lean trading day

The fry bought by the agents are sent to *bheri* owners in North and South 24 Parganas by truck. Eleven trucks were noticed on the day we visited the market. The market price is the same for all the fry sold in the market and is jointly decided by the agents on a daily basis. For example, the market price on 14.3.92 was 217 Rs/thousand, on *15.3.92* it was 192 Rs/thousand and on 16.3.92 it was 180 Rs/thousand. During the peak season, around 40-50 trucks leave Najat every day for various destinations.

This is the experience of a person who has long used the Najat Market.

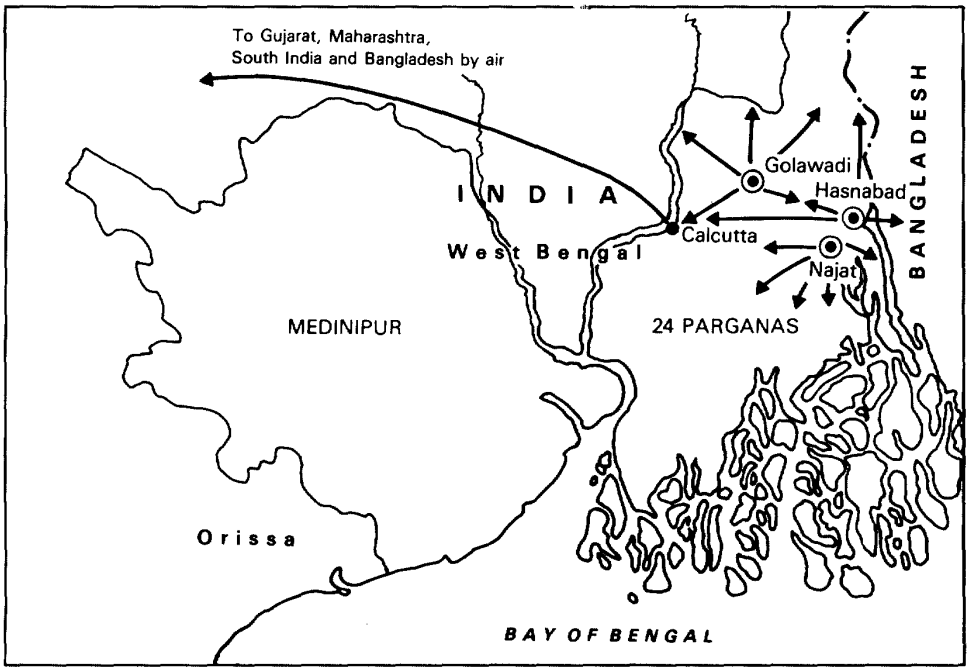
Name: Badsa Mondal

***Place** : Najat Market*

Badsa Mondal is a farmer and shrimp agent. He owns 700 bighas of bheri *land. He gets three crops a year (each of three months' duration). The day we met him, he had sold 70,000 fry at 180 Rs/thousand. He had brought the fry from the Sundarbans where he had purchased the lot at 120 Rs/thousand. According to him, a lot of tiger shrimp fry are being smuggled to Bangladesh, where they fetch about 500 Taka/thousand (about 300 Rs/thousand)* (See Figure 6).

Mortality in transit and handling was highest around June and could be as much as 35 per cent. Mortality was lowest in March (around 10-15 per cent).

Fig. 6 Distribution from tiger shrimp fry markets



6. *PRICE AND QUANTITY*

The tiger shrimp fry trade in West Bengal is said to be roughly 15-20 years old and included Medinipur District even in its early years. Since the mid-l980s, the number of fishing units used by fry catchers has grown. Catchers have recently been complaining that catch per unit effort is decreasing in Medinipur District. Demand, however, has grown.

6.1 *Price*

It is estimated that 90 million fry are traded each year. As already mentioned and shown in Figure 7, price is mainly determined by the demand of the fish farmers and this fluctuates with the Monsoon.

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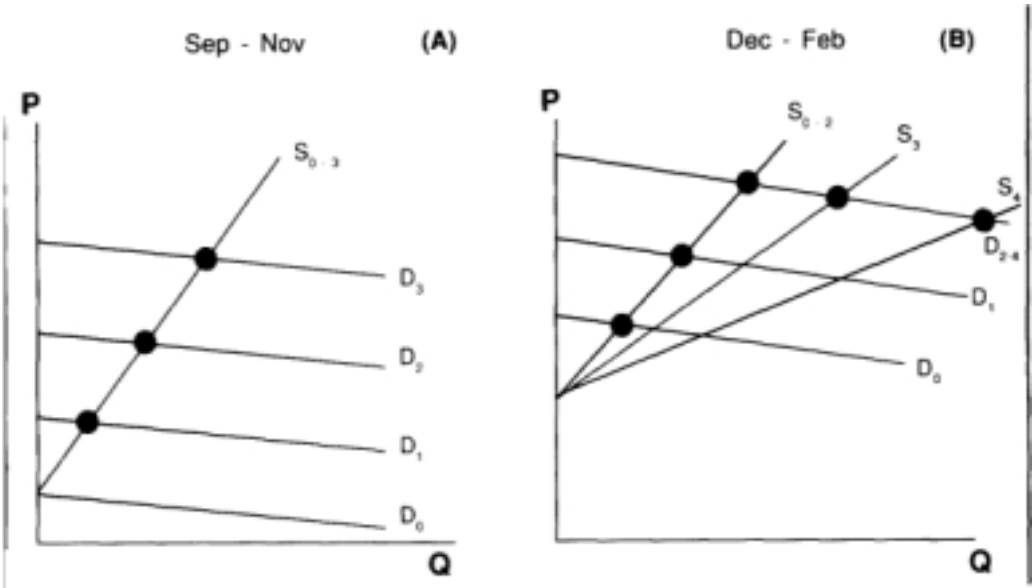
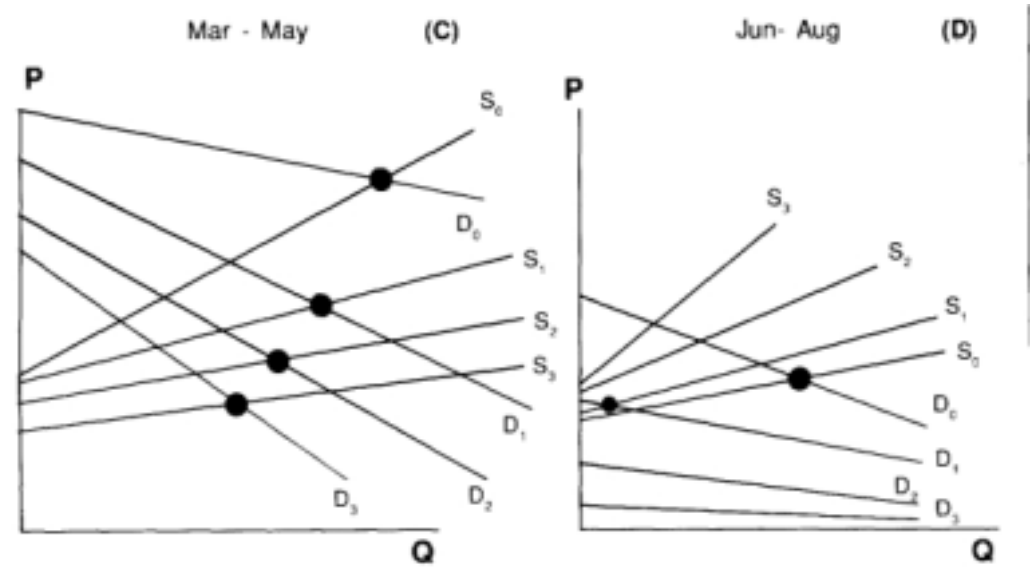
Fig. 7 A-D. Schematic graphs of annual dynamics of fry supply and demand in West Bengal



Monsoon = no trade, low farmer demand and suppliers unwilling to deal (unable) in low volume available. Rains end and demand expands so that supplier's interested. Demand for the small volume available continues to grow, forcing a rapid price rise.

While demand continues to rise as the main culture season nears, the supply of fry remains limited, further pushing up the price. As the warmer temperatures come, natural fry supply increases as well as collection. Demand remains high but expanding supply pushes prices down.



Rapidly expanding supply of fry allows suppliers to sell at lower and lower rates due to the high volume traded. Farmers' willingness, to pay whatever price, changes as growing season shrinks. Demand is slowly dropping while suppliers at the same time lower costs. Both price and volume fall.

Suppliers can no longer accept the shrinking margin. Demand continues to fall as Monsoon nears. Trade stops as the Monsoon arrives. No trade for several months.

Key: S = Supply of fry in the market
D = Demand of fry by farmers
P = Price of fry sold
Q = Quantity or volume sold
0-4 = Time sequence

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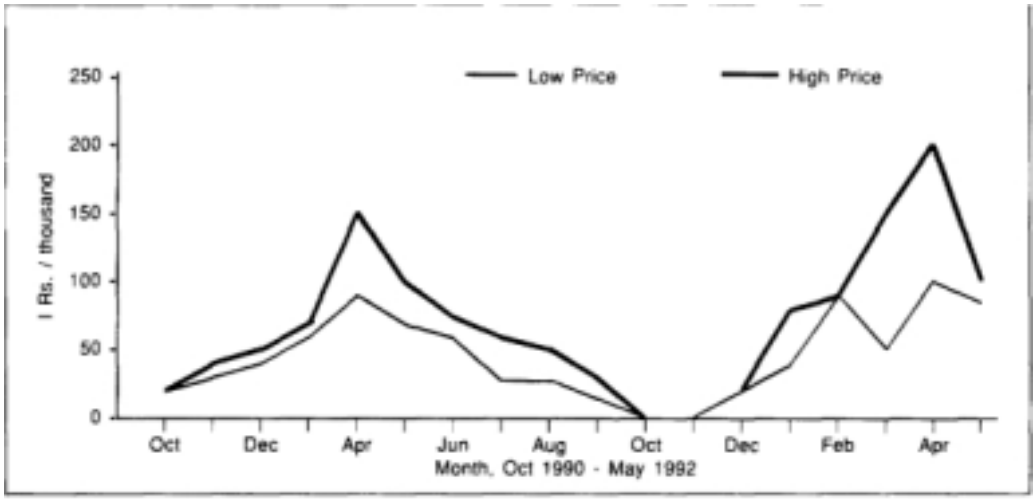
Supply also fluctuates seasonally, increasing as demand falls nearing the Monsoon. The result is a rapid fall in price from February to June. Below (Figure 8) is the actual price fluctuation in Ramnagar, Medinipur.

Fig. 8 Fluctuations of tiger shrimp fry buying prices in Medinipur District.



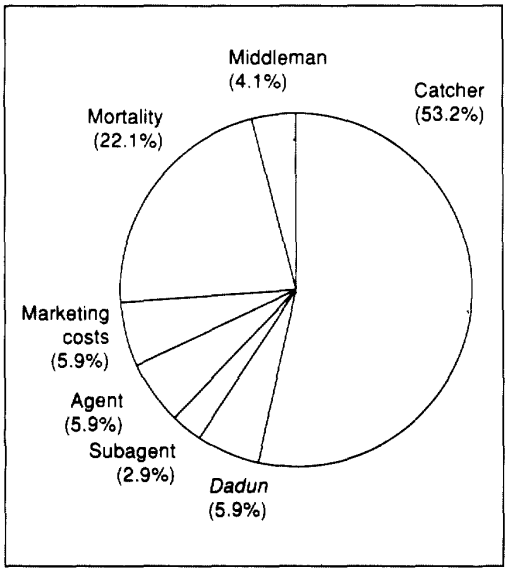
6.2 *Market behaviour*

Combining the price/quantity information about the season cycle of the market with what is known about the actors' sensitivity to the external influences, the fry market's dynamic behaviour can be translated into the four graphs on the facing page.

6.3 *Cost composition of the product*

The main component of the total retail price of tiger shrimp fry is the remuneration to the catcher. As every specific shipment has its own unique path to the consumer (farmer), no exact percentages can be given. Medinipur fry catchers, in general, receive at least a third and up to half the final retail price. Sundarbans catchers may receive more, as their proximity reduces transport costs and extra costs in the market chain. Catchers based in North 24 Parganas can receive more than 90 per cent of the retail price by personally bringing their catch to market.

Fig. 9 Cost composition of tiger shrimp fry



As the focus of this report is Medinipur District, a typical case, if that is at all possible – and reflecting only the producer and consumer prices at the time this study was made – has been graphically shown in Figure 9, alongside. It should be cautioned that these percentages fluctuate, being slightly better for the catcher if the price is higher and worse before the Monsoon, when the low price includes a higher percentage for overheads. If there was an auction market operating, the retailing agent's percentage would have gone to the auctioneers and counters, but perhaps the carrier cost would

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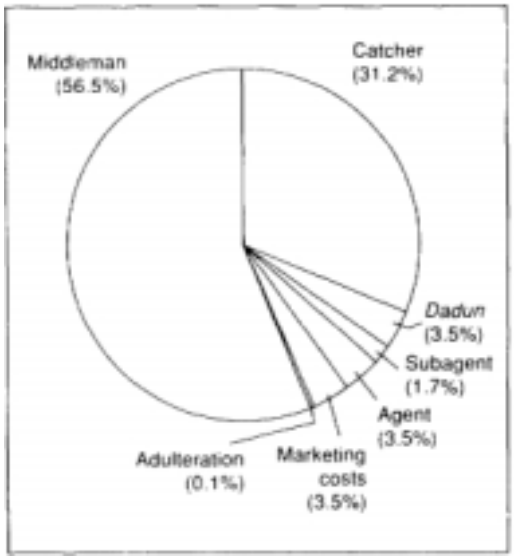
have been borne by the buyer. Mortality of 20-30 per cent is normal, affecting almost entirely the middleman, not the subagent or agents. This is a high cost to bear and constitutes one-fourth of the retail price.

It will be seen from Figure 9 that the catcher receives almost 60 per cent of the final price. But as this catcher took a *dadun*, he/she must sell at Rs.10 below market price. This is, as earlier mentioned, a form of interest payment transferred to the agent (or whoever gave the *dadun).* The middleman receives money for the three pie slices marked 'middleman', 'mortality' and 'marketing costs'. In this case, marketing costs include a percentage to a retailing agent, the hire of truck and driver, sundry costs to officials and carrier wages at the *bheri.*

Fig. 10 Percentage cost composition of adulterated fry.



On the other hand, if all these conditions remained unchanged, except for an addition of 100,000 yellow shrimp fry, there is a radical change in cost composition. All costs are reduced proportionately, while the added cost of adulterating the consignment is insignificant. The middleman's share, after his running costs are deducted, is then more than 50 per cent of the retail price. (See Figure 10).

7. *QUALITY OF PRODUCT*

7.1 *Mortality*

The prime concern of the 'consuming' farmer is the vitality of the purchased fry. This is determined by observing the number dead, number damaged and level of activity. In turn, the vitality at the point of purchase is determined by the amount of stress the fry have been exposed to since capture.

There are several reasons for stress, and include the following

Gear used – shootnets (where fry are only collected out of the net at certain intervals) versus the quick transfer from *chaknis* to *hundis* – makes a difference.

Transport is certainly the main stress factor. No transporter uses oxygen bottles; instead, lie relies on agitation by human hand, or vehicle vibration, and periodic water changes for aeration. To avoid the heat and to reach the market on time, fry are transported at night.

Holding tanks : As fry are generally caught in the morning, they are transported to collection points and held in *hundis* or holding tanks, where due care has to be taken to keep the water cool. Morning marketing and post-sale transport in the mid-day sun cause problems.

Bheri salinity : Fry need to be slowly acclimatized to *bheri* salinity and water temperature in order to avoid stress.

7.2 *Adulteration*

As farmers lack the skills necessary to differentiate between similar species of penaeid shrimp fry, the fry sellers find it extremely lucrative to adulterate the *hundis* with other species that are readily available and similar in colour. This helps the seller in two ways. First, the number of 'tiger shrimp' fry is increased in the count sample which will determine the estimate of the number being sold. Secondly, the species that are introduced are done closer to the point of sale, thereby appearing more vital than the tiger shrimp fry caught the day before. Thus, both quantity and quality appear to be better than they are.

The farmer, on the other hand, loses in two ways. First, he, of course, receives less tiger shrimp fry than expected and earns less at harvest, adulterated species being of low market value at that

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time. Secondly, the non-tiger species can be cannibalistic or carnivorous and prey on the already reduced number of tiger shrimp fry received.

8. *CONCLUSIONS*

- The marketing apparatus for tiger shrimp fry in West Bengal appears to function well, with healthy competition at almost all points in the market chain. The trade is characterized by an eight-month season during which prices peak in February and volume is highest in the March-May period.

- Fry-catchers, young and old, male and female, fisherfolk and farm workers, have poverty in common. All of them also live near brackishwater. Fry-catching gives them good part-time earnings during the peak months. Upto *50* per cent of the fry's retail price goes to the catcher.

- While transportation and handling are simple and well organized, mortality per shipment is normally high, around 30 per cent. This becomes a major component of the retail price.

- Adulteration of shipments of tiger shrimp fry with readily available, inferior-value species is widespread in North 24 Parganas.

9. RECOMMENDATIONS

- Information on proper fry handling, including how to reduce stress and, thus, mortality – from capture to *bheri* release – needs to be disseminated to all participants in the market chain.

- Information on the advantages of purchasing juveniles rather than post-larvae tiger shrimp needs to be given to farmers, so that they begin to differentiate the two in price.

- Extension information on identification of various species of fry needs to be disseminated to the farmers so as to build up the consumer's ability to check the quality and purity of fry purchases.

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The BOBP brings out the following types of publications:

Reports (BOBP/REP/...) which describe and analyze completed activities such as seminars, annual meetings of BOBP's Advisory Committee, and subprojects in member-countries for which BOBP inputs have ended.

Working Papers (BOBP/WP/...) which are progress reports that discuss the findings of ongoing work.

Manuals and Guides (BOBP/MAG/...) which are instructional documents for specific audiences.

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***Newsletters (Bay of Bengal** News)* which are issued quarterly and which contain illustrated articles and features in nontechnical style on BOBP work and related subjects.

Other publications which include books and other miscellaneous reports.

Those marked with an asterisk **(t)** are out of stock but photocopies can be supplied.

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