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SHRIMP CULTURE AND MARKET INCORPORATION: A STUDY OF SHRIMP CULTURE IN PADDY FIELDS IN SOUTHWEST BANGLADESH

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INTRODUCTION

The growing incorporation in regional, national or international markets of rural areas previously characterised by the predominance of subsistence production is an important aspect of rural change in developing countries. Despite the rarity of pure subsistence production, in many rural areas of developing countries production is still primarily geared towards consumption by the household, with marketed produce consisting largely of food and raw materials which households forgo to obtain cash. Under such conditions, the penetration of market relations, particularly in the form of a shift towards the production of cash crops or to commercial agriculture, normally has a profound impact.

In response to sustained international demand and favourable prices, the culture of shrimp for export, carried out in paddy fields with very simple techniques and low capital intensity, has experienced fast growth in south-west Bangladesh over the past several years. As a result, areas where subsistence agricultural production had previously predominated are now undergoing a process of international market incorporation. The purpose of this paper is to describe and analyse some of the concrete processes and changes associated with this development.

The paper adopts a 'meso' perspective, rooted in the premise that a satisfactory understanding of market incorporation is unlikely to be reached at the micro or macro levels alone. Market incorporation is characterized by the existence of strong interactions between the international market and local productive and social structures, which implies that a purely local analysis would miss an important part of the total picture. On the other hand, unless the processes and mechanisms associated with change at the

micro level are clearly understood, the sweeping statements of macro-theory are as likely to obscure as to illuminate and, what is worse, it is then very difficult to judge whether they do one or the other. Besides, an exclusive concentration on the macro also tends to lead to perspectives in which changes at the local level are seen almost exclusively as consequences of externally initiated impulses. As Long (1977:187) puts it, this 'centralist view of development' does not pay enough attention

> to the ways in which local groups and processes can contribute [towards] and indeed modify the patterns of national and regional development. Hence, they tend to take too deterministic a view of socio-economic change and do not allow sufficiently for the interplay of local and national forces.

Coburn (1982: 443) echoes the prescription implied in this criticism when, in relation to the penetration of market and government in areas of peasant agriculture, he affirms that 'it is the terms of penetration rather than the penetration itself that should be at issue'.

I. Background information

The semi-saline zone of the southwest delta of Bangladesh roughly coincides with the part of the Khulna district that is not covered by the Sundarbans mangrove swamp forest (see map). The land is flat and criss-crossed by meandering tidal creeks and most of it has an elevation below the high-water level of spring tides. The area has a typical monsoon climate, with over ninety per cent of annual rainfall (which is about 1900 litres per square metre) occurring between May and October. Largely because of the rainfall, the tidal rivers experience considerable fluctuations in salinity: from July to November river water is suitable for irrigation, while in the remaining part of the year it is too saline. Groundwater is too saline to

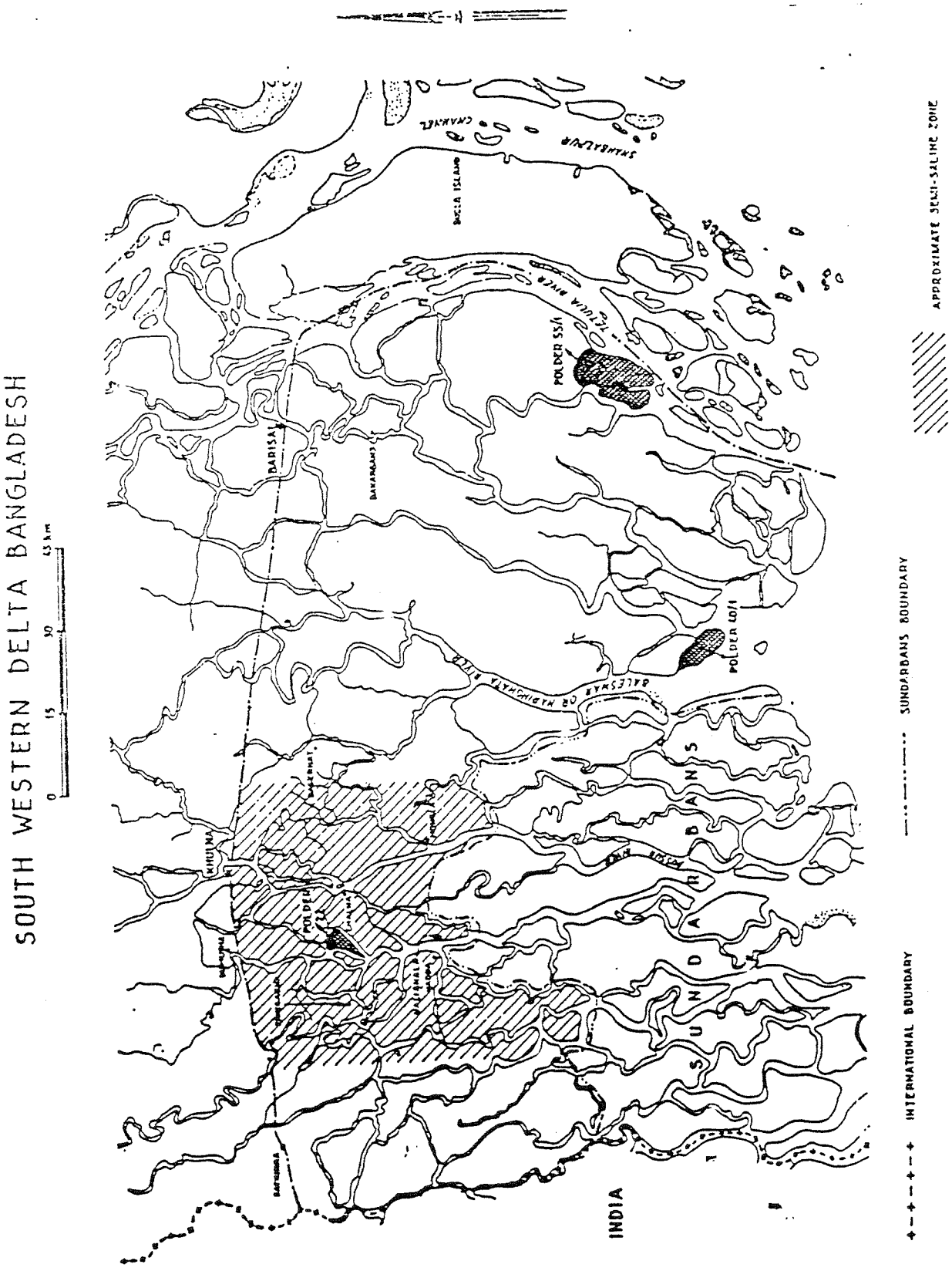
be used for irrigation and in the dry season the salt carried to the topsoil by capillary rise and evaporation of the groundwater makes agriculture impossible in a large part of the area.

To protect their fields against flooding and saline intrusion, farmers normally surrounded them with low earth dikes or 'bunds' which they had to repair or rebuild every year. In the 1960s, however, a large number of higher and longer embankments were constructed to provide safer and more permanent protection for agricultural land. By excluding saline water, the polders thus created significantly improved agricultural production and living conditions in the area.

Agriculture has characteristics typical of peasant agriculture, e.g. the use of a substantial part of the produce for direct consumption by the producers, the generalized use of paddy rather than cash in loans and wages, and the integration of farm and household in resource allocation decisions (van Roosmalen and Guimarães, 1982: 30-1). The main crop is transplanted 'aman' rice, cultivated from the end of June to early January; this is primarily rainfed, but around October some supplementary irrigation is normally required, which farmers carry out by cutting the embankments. Before shrimp culture became widely practiced, most of the land used to lie fallow outside the aman season, when it was used mainly for grazing cattle. Despite low cropping intensity and little use of chemical fertilizers, outputs are high: rice yields of 2000 to 2500 kg/ha are common in the area.

As in the rest of Bangladesh, there is a significant concentration of land in the hands of the larger landowners. In one of the polders in the area, surveyed in detail in 1981, the top 15% of households controlled 57% of cultivated land, while 47% of households controlled only 6% of the land (van

Map: Semi-saline zone of the south-western delta of Bangladesh



Roosmalen and Guimarães, 1982: 19). Many households have either no land at all or not enough to make a living (locally a farm of 1.2 ha is considered necessary for subsistence; in the polder mentioned above, about 73 percent of households fell short of this norm). In certain areas a significant proportion of the land is in the hands of absentee landowners, who usually give out all or most of their land in sharecropping.

Sharecropping is widely practiced, with landowners taking 50 per cent of gross output while tenants bear all cultivation costs. Competition for access to land by tenancy or sharecropping contracts is very strong, and conditions have become progressively less favourable over time, effectively leading to an increase of the landowners' share of total output. Landowners usually prefer to rent land to people who have some land, draft animals or agricultural tools of their own (although sometimes a condition for renting the land is that the tenant will hire a pair of bullocks from the landowner, who in this way increases his share even more). This means that many landless are almost automatically excluded from sharecropping arrangements and forced onto the labour market as wage earners. Many small and some middle farmers also sell labour. Labour productivity and wages are very low (van Roosmalen and Guimarães, 1982: 48-53).

The skewed land ownership, prevailing sharecropping arrangements and the strongly hierarchical structure of rural Bangladesh are mutually reinforcing. In the patron-client relationship between large landowners and their tenants the poor pay a very high price for access to land, employment and credit, expressed in terms of exploitative sharecropping arrangements, low wages and usurious rates of interest. As a World Bank report on rural employment puts it,

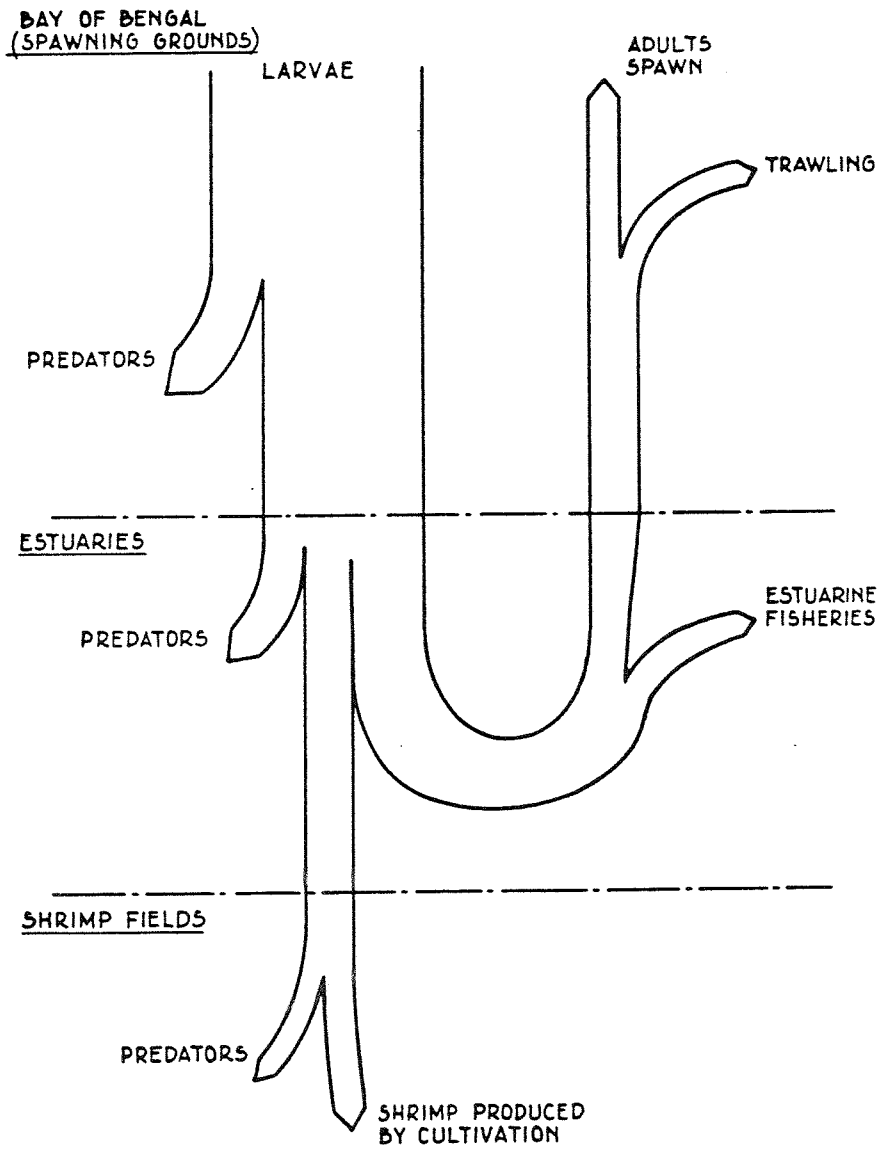
> The patron-client relationship and the system of social stratification reinforce each other. These relationships are difficult to break, as those dependent upon rented land and agricultural labour do not have alternative opportunities to settle on new land or to enter into alternative productive non-farm opportunities. In fact, as unemployment has increased and real wages have declined, the position of the landless and marginal farmers has become more vulnerable; the big landowners on the other hand have continued to extend their influence and domain by acquiring more land through direct purchases and money-lending operations (IBRD, 1983: 18).

Through their control of land and money wealth, large landowners effectively control not only the rural society but also, to a significant degree, the state. The main beneficiaries of government rural development programmes thus turn out to be, not the landless and small farmers for whom they were originally intended, but the rural rich (BRAC, 1983 a and b; de Vylder, 1982).

In recent years shrimp culture has grown rapidly and is now second only to rice culture in economic importance. The main species cultivated are marine shrimp of the genus Penaeus (particularly P. monodon, the black tiger shrimp, and P. indicus, or white shrimp), but other species are also found in smaller quantities, including giant freshwater prawns of the genus Macrobrachium.

The life cycle of penaeid shrimp is characterised by offshore spawning, migration of the post larval and juvenile shrimp to the estuaries, juvenile growth in the brackish water of estuarine areas inshore and, finally, return of the young adults to the spawning grounds (see Figure 1). Shrimp culture consists of trapping the juveniles in ponds or paddy fields specially prepared for the purpose and catching them when they have grown to commercial sizes. The shrimp are then sold to local traders who carry or send them to the district capital, Khulna; there they are again sold to larger, urban

Figure 1: Life-cycle of penaeid shrimp and their exploitation



based traders who are the packing companies' formally appointed suppliers or agents. Finally, the agents sell the shrimp to the packers/exporters.

II. The organization of shrimp culture

In the semi-saline zone, salt water shrimp are principally cultivated in paddy fields during the dry season, when the salinity of soil and water makes rice culture impossible. Shrimp fields need to be close to the tidal rivers, because of the need for frequent water exchange during the period of growth of the shrimp; they are mainly located along the embankments, inside or outside the polders. Work begins in December or January, often before the rice harvest, with the preparation of the fields. This involves building or repairing the bunds surrounding the fields and installing or repairing at least one culvert per field, for water exchange. Sometimes, weirs are also installed at the top of the embankments, to help water exchange at high tide. Of all the activities associated with shrimp culture, building or repairing the bunds is the most difficult and strenuous; for that reason, and also because the bunds must be ready as soon as possible after the rice harvest, this is a task for which shrimp cultivators often engage additional labour.

Once the rice crop is harvested and the bunds and water-exchange structures are ready, water is taken in from the rivers at high tide, flooding the fields; it carries into them post-larval and juvenile shrimp, and also fin fish. The first intake of water usually takes place before the end of February. The shrimp are then left to grow and mature; normally no special food for the shrimp is thrown into the fields and they feed on naturally occurring food only. Shrimp cultivators often stock the fields with additional shrimp fry, which they purchase or catch in the rivers. While the

shrimp grow, the main activity of the cultivators consists of maintaining the structures for retaining and exchanging water, guarding the fields against theft, and renewing the water in them, which is done principally during spring tides (i.e. roughly every two weeks).

Shrimp catching usually lasts from May through August. This takes place primarily during spring tides, at the same time as the water exchanges. With the onset of sexual maturity the shrimp try to begin their return migration to the spawning grounds and are then caught in nets placed or thrown near the inlets used for water exchange. Peak catches occur in June/July. Towards the middle of August the water in the tidal rivers loses most of its salinity; this, together with the abundant rain that accompanies the onset of the monsoon season, results in a more or less complete removal of saline water from the top layer of the soil by the time shrimp culture ends. After the last catch (which normally also yields significant quantities of fin fish), the fields are ploughed - which is made easier by the softness of the soil kept under water for a long period - and transplanting of aman rice begins immediately.

To obtain a reliable characterization of shrimp culture in the semi-saline zone, 49 randomly selected fields,[1] spread over the whole area, were surveyed using semi-structured interviews. Because of the scarcity of available resources, some fields could be visited only once or twice. In addition, a smaller number of shrimp fields was studied in greater depth, to check the data obtained in the survey. In order to get a good characterization of the whole sector the activities of traders, agents and packers were also examined in detail.

The organizational arrangements found during the survey were classified into types, taking into account (i) whether the people who control shrimp culture are landowners, other local people or outsiders, (ii) whether household or hired labour is primarily used and (iii) the distribution of costs and profits. The main types of arrangement identified are as follows:

1. Single or household control, using own or domestic labour.
2. Single control, using hired labour.
3. Control by landowners (plus possibly a few non-owners), who cultivate shrimp on their land, primarily with their family labour. Subtypes can be defined according to whether non-owners take part in shrimp culture and to the way in which cost and revenue are shared:

   3A. Cultivation done only by landowners, who share equally in the profits, regardless of the area of land owned.

   3B. Cultivation done only by landowners, with profits shared proportionally to the land owned (and other input costs shared on the same basis).

   3C. Cultivation open also to some people who do not own land, and profits shared based on the value of inputs (capital, land, labour) contributed by each participant.
4. Shrimp culture controlled by several people and carried out with hired labour:

   4A. By local people, on land which is partly theirs and partly rented.

4B. By outsiders who rent land and hire labour, with the possible participation of some local landowners.

This classification is not exhaustive; some cases fall outside or between the categories identified, or could be classified into more than one category. It is in fact more appropriate to speak of a continuum of possible arrangements, grouped for convenience into a few classes.

Types 1 and 2 are very different from each other, as are types 3 and 4; the use of household labour is one of the main characteristics of (small-scale) peasant production, while the predominant or exclusive use of hired labour is normally associated with (larger scale) capitalist production. Type 3 is characterized by most of the owners of the land retaining control over, and working in, shrimp culture. In cases 3A and 3B only landowners participate, while arrangements type 3C include some people who do not own land. In case 3B, land ownership determines the way in which sharing of both costs and proceeds is done; in case 3C, on the other hand, since some people own no land in the field, a different criterion is needed.

Table 1 presents, for each type of arrangement, the number of fields where it was found, the approximate area of those fields (in ha and as a percentage of the total) and the average field area (in ha).
Although care should be taken not to conclude too much from a rather small sample, there is a clear association between organizational form and average size of field. The average area of fields where Type 1 arrangements prevail is predictably very small, since the area that can be cultivated - for shrimp as for rice - using household labour only is quite small. Type 2 fields are larger, but much smaller than fields where other types of

Table 1: Frequency and Areas for Each Type of Arrangement (49 shrimp fields, semi-saline zone)

Type	No. of fields	Area (ha)	Area as % of total	Average area per field (ha)
1	3	5.7	0.17	1.9
2	2	28.2	0.84	14.1
3A	8	110.9	3.31	13.9
3B	13	766.5	22.87	59.0
3C	4	265.1	7.91	66.3
4A	9	736.5	21.97	81.8
4B	10	1439.0	42.93	143.9
Total	49	3351.9	100.00	68.4

arrangements prevail. They are also not very large by the standards of large landowners in the area, who in several cases own more than 100 ha. The small number of fields in this category is probably related to the predominant behaviour of the class of people who own large areas of land; traditionally, these people tend to behave as landlords, giving out their land in sharecropping rather than cultivating it themselves. It is not surprising that they continue to behave in a similar way in relation to shrimp culture, although of course this may change with time, especially if shrimp culture remains profitable.

Type 3A fields are also quite small; this type of egalitarian arrangement seems to occur where there are no large landowners and where the land is well distributed. Even in these fields, however, there are people with more land than others, who would benefit from a transition to an arrangement of the type 3B or 3C - and in fact cases have been detected where such a transition took place, under pressure from the owners of larger areas (DDP, 1985a, 2: 100).

Perhaps the most significant characteristic revealed by Table 1 is the high proportion of the total area cultivated with hired labour: over 65 per cent, in roughly 45 per cent of the fields surveyed. The amount of cash that field operators must disburse in these cases (until the shrimp are big enough for selling, at which time the operation quickly becomes self-financing) is considerable, since it has to pay for the earthwork, water exchange structures, possibly a first installment of rent, guardhouses, equipment (nets, boats, flashlights, tools, etc.) and wages for the people who guard and work in the field. It is frequent, because of this considerable financial outlay, for shrimp culture using hired labour to be co-financed by several people, although the management of the field is usually under the direct control of one person, commonly described as the 'owner' of the field. Large landowners often take part in the financing of shrimp fields where they own land, either by forgoing rent or by contributing cash towards the common fund. Small landowners are normally excluded from shrimp culture and are at best persuaded to accept a rent for their land; they may be forced to rent their land and, in some extreme situations, may even be altogether deprived of the rent. In any case, they lose control over their own land, at least for the shrimp season and sometimes for the whole year. This, together with some other negative effects, (see Section 5, below), may help explain the frequency and the vehemence with which small landowners oppose the introduction of shrimp culture.

Table 1 shows that approximately 43 per cent of the total area of the fields surveyed is controlled by outsiders. The importance of outsider control justifies some attention to its analysis. Of the 49 fields surveyed, 10 were controlled by people with no land in the fields and no house in the

village. These were the fields with the largest average size. Outsiders normally rent the fields for the whole year - i.e. for both the shrimp and the paddy seasons - but sometimes only for the shrimp season. The rent is normally expressed in paddy terms but usually paid in cash, in two or three instalments, one of which is at the beginning of the period.[2]

In several of the outsider-controlled fields surveyed, the land was rented for both the shrimp and the rice seasons (usually for periods of 3 to 5 years). The outsiders do not normally cultivate rice themselves, but give the land in sharecropping back to its owners or to other tenants. Some rental agreements explicitly recognise the owners' right to sharecrop, while in others it is left rather vague. Where land used to be given out in sharecropping before the introduction of shrimp culture, the usual practice is for the shrimp cultivators to retain the same sharecroppers.

Outsider control of shrimp culture in the semi-saline zone does not seem to lead to conflicts between the use of the land for shrimp and for rice culture, probably because the change in environmental conditions - especially salinity - effectively separates the two seasons: in January the water is too saline for rice culture, in July/August the salinity becomes too low for the proper development of salt-water shrimp. There are, however, two areas where it does create some problems, namely the engagement of outside labourers to work in the shrimp fields and the erosion of the network of obligations and rights that normally exist in rural areas (see below).

To understand the socio-economic organization of shrimp culture and its impact it is necessary to discuss briefly what factors constrain the choices open to the shrimp cultivators. Technical knowledge does not

restrict entry into shrimp culture for most rural people. The main activities involved in shrimp culture: earthwork, water exchange, guarding the fields and catching the shrimp, are familiar to most rice farmers and agricultural labourers of the delta, many of whom are also part-time fishermen. Access to land with low elevation and near to one of the tidal rivers is, on the other hand, a prerequisite. Access to land is ensured by ownership or, if enough money is available, by renting land. Labour is abundantly available in the area, particularly during the dry season when shrimp culture takes place.

Shrimp culture (which requires very little equipment) can thus be practised by anybody who can ensure access to suitable land. This may be an owner or group of owners who, if they use their own labour, need very little cash to cultivate shrimp (and, as will be discussed below, can borrow even that little on very favourable terms), or it may be a person or group of people who do not own land but have enough money to rent it (and possibly also to pay wages to hired labourers).

Table 1 raises two interesting questions, namely (i) are all the different types of arrangement equally stable or are some of them likely to become predominant while others disappear? and (ii) why do production units (i.e. fields) have areas so much larger for shrimp culture than for rice culture?

The available empirical evidence seems to suggest a certain stability of organizational forms, with some interesting exceptions. Two type 3A arrangements were replaced, one year later, by type 3B. Predictably, this was done at the insistence of the people who owned most land in the fields, with the argument that they felt entitled to benefit more from the common activity, given the amount of land they owned. In another case, conflicts

among the shrimp cultivators in a field with a type 3 arrangement led to their field being forcibly taken over by an outsider, brought in by one of the factions. It must be pointed out that the empirical information available covers only a rather short period of time - at best 4 or 5 years - and it is possible that in the long run other changes may take place. If shrimp culture remains lucrative it is conceivable that more large landowners - or their children - will decide to cultivate shrimp themselves, rather than simply renting out their land.

As to the second question, production units in shrimp culture are indeed larger than in rice culture: a shrimp field will normally, in the rice season, be turned into several rice fields, separately cultivated. This difference follows from the technical requirements of water management for shrimp culture, especially the need for exchanging water regularly and for keeping a reasonable depth of water (of between 0.6 m and 1 m) in the fields, to ensure good growing conditions for the shrimp. Given these requirements, the construction of bunds to separate the plots belonging to various owners would entail such costs and would create such problems for controlling the flow of water into and out of individual plots as to render shrimp culture practically unfeasible inside the polders, except perhaps on a narrow strip of land along the embankments. Given, on the other hand, the ability of the shrimp to move about inside the fields, (a characteristic which is obviously not shared by rice), it is easy to understand that joint water management must entail joint cultivation.[3]

The larger scale of cultivation of shrimp and the absence of the traditional control mechanisms and relationships that persist in paddy culture (which include sharecropping arrangements) create situations where the costly

nature and the asymmetric distribution of information cause incentive problems and make it difficult to enforce contracts and property rights (Binswanger and Rosenzweig, 1986: 507-8). The term 'moral hazard' is used to describe the problems of opportunistic behaviour that appear in these circumstances, which range from failing to divulge information to deliberately distorting it, and from failing to work as hard as possible in unsupervised conditions to stealing when the identity of the thief is easily hidden (Williamson, 1975: 84; Platteau, 1987: 8 - 10).

Problems of moral hazard are common in shrimp culture in southwest Bangladesh. Shrimp theft is a serious problem, both because it is easy if intense vigilance is not maintained and because the temptation is great, especially for the local poor. With some luck, a thief could in a few minutes catch shrimp worth several days' wages. Thus it is necessary to guard the fields. This entails considerable costs, since it requires the constant presence of significant numbers of people. In fields where shrimp culture is carried out by outsiders, with hired labour, an obvious problem arises: if the labourers who guard the field were local people, the likelihood of their tolerating a certain amount of stealing by their fellow villagers, or even engaging in some stealing themselves, would be very high. For this reason, outsiders engage only workers who are also from outside the area; when this happens, the local poor (landless and small farmers) do not benefit from the jobs created by shrimp culture, at least in their own area. This is a frequent source of complaints, as is the suspiciousness of the outsiders vis-à-vis the local people and their perceived 'aggressiveness' in the protection of the shrimp fields.

In order to minimize the risk of theft and of other conflicts, groups of farmers who cultivate shrimp on their land with their own labour occasionally coopt some local landless people as associates, even when they do not consider their contribution necessary or especially useful. Although at first people explained this behaviour as a form of charity, additional probing showed that considerations related to the minimization of risks of theft and conflict - in other words, enlightened self-interest - were paramount in the minds of the cultivators.

Moral hazard is also related to problems of individual incentive and collective action. As Olson (1965) has shown, the mere existence of a large group with a common interest does not automatically lead to collective action, and the larger the group the greater the need for either compulsion or individual incentives in order to achieve full participation in collective action. Because of their specific nature, problems of collective action especially affect groups of farmers who cultivate shrimp on a more or less cooperative basis, i.e. those organized according to type 3 arrangements. In these cases, large group size may - and sometimes does - lead to free riding and to the suspicion that some group members are trying to take unfair advantage of the group. This in turn leads to conflicts. In the previously noted case in which one faction brought in outsiders against the wishes of members of other factions, the outsiders resorted to violence to occupy the shrimp field. Following what is unfortunately a common pattern, the police then helped the (rich) outsiders by harrassing several of the (poorer) farmers involved. The farmers who tried (unsuccessfully) to resist the taking over of shrimp culture by the outsiders then ended up not even being paid the rent due to them by the shrimp cultivators.[4]

III. Traders, agents and packers: roles and profits

There are normally two tiers of middlemen between the shrimp cultivators and the freezing and packing companies: local traders who buy the shrimp in the fields and transport them to the city, and urban based agents, who buy from traders and sell to packers, who in turn process and freeze the shrimp for export.

Local traders have depots dispersed throughout the area. They act both as middlemen and as suppliers of credit for the cultivators. Often they also initiate and participate in shrimp culture. Local traders buy shrimp from cultivators and from fishermen, pack them in ice, take or send them to Khulna and sell them to an agent or, in the name of an agent, directly to a packer. The shrimp are normally carried by the cultivators or fishermen to the traders' depots, although some traders, or their employees, also collect shrimp from fields or fishermen who are not located in the immediate vicinity of the depots. Traders bring ice from Khulna in large blocks that they flake as necessary for preserving the shrimp.

Traders play a useful role as middlemen. Without them it would be difficult even for large shrimp cultivators (and practically impossible for the smaller ones or for individual fishermen) to send their catch in good condition to the city. At the same time, traders' profit margins per unit weight of product are quite modest. This is no doubt partly a consequence of the conditions of free entry and intense competition that prevail in the sector. The physical dispersion of producers also makes it difficult for traders to collude against producers, since such collusion would be practically impossible to monitor. Traders also do not have a monopoly over the commercialization of the shrimp cultivated in any particular field, since each field is normally within easy reach of several traders' depots.

As often happens in similar situations, traders try to increase the quantity of shrimp traded, so as to increase total profits. A common strategy to increase turnover is to lend money to shrimp cultivators, to help finance the initial stages of cultivation, against a guarantee that all their shrimp will be sold to the trader who lends the money. The money is usually lent without interest and repaid at the end of the shrimp season. Normally the shrimp are sold at current prices, i.e. at the same prices the cultivators would get by selling to any other trader. Occasionally, shrimp cultivators borrow money from more than one trader; in such cases, they sell their shrimp to the traders in proportion to the money borrowed from each. Because of the difficulties of monitoring agreements of this type, however, traders tend to avoid them.

To be able to lend money to the shrimp cultivators, traders often have to borrow it themselves. They often borrow from agents, usually against a similar obligation of selling all their shrimp to the agent involved. Again, this money is normally lent at zero interest. Sometimes a trader borrows money from one or more rich persons in his village. When this happens he normally either pays interest or gives each creditor a share in the profits. In addition to the money lent to cultivators, traders also need money to pay for certain investment expenditures (e.g. the depot) and a revolving fund with which to pay the shrimp cultivators. The quantity of cash needed for this fund is a function of turnover, of the delays in the payments received from the agents and of whatever delay the trader can convince cultivators to accept in his own payments to them.

In 1984 there were about 50 agents in Khulna. Agents are in general large merchants who operate in fixed locations in the city, mainly in the bazaars.

They buy shrimp from local traders and sub-agents (an intermediate tier of middlemen, usually operating from very accessible locations in the delta which constitute intermediate collection points) and also directly from cultivators and fishermen. The shrimp packing companies will only buy shrimp directly from their appointed agents. Agents usually lend money on a large scale to traders, sub-agents and cultivators. The money is lent free of interest, against the exclusive right to buy the borrowers' shrimp.

Besides supplying shrimp to packers and credit to other economic actors, agents also help to smooth the flow of cash from packers to traders and cultivators. Normally they receive from the packers, each morning, payment for the shrimp they supplied (having previously bought and paid for them) in the preceding day. Thus they need to have a sizable revolving fund. For instance, an agent supplying 40 maunds (1 maund = 37.324 kg) per day in the peak season would need to have, at 1983 prices, a revolving fund of about Tk 400 000/-. Sometimes cash shortages force the packers to delay payments by several days; on such occasions agents draw on what additional financial resources they have and also resort to short-term borrowing. They also pass some of the delay on to traders and cultivators, sometimes compensating them by charging smaller commissions. Given the preference of traders and shrimp cultivators for immediate payment and the role of interest-free credit in capturing a share of the market, the more cash an agent has the more business will come his way. Agents thus need large amounts of cash to operate effectively. For example, two agents interviewed operated with a capital of Tk 500 000/- each (200 000 their own, the rest borrowed). These two agents, who were considered small, had lent respectively Tk 100 000/- and Tk 267 000/-, directly or through traders, to shrimp cultivators. Their throughput in one season was between

3000 and 4000 maunds of shrimp each, worth an average of between 4000 and 6000 Tk/maund.

Most agents supply several packers, and each packer normally has a few agents. This, and the continuous flow of information among agents - both directly and through traders - helps spread information about prices. If, for example, a packer needs to fill an order and raises his purchase prices to increase his supply, the information quickly spreads through the market and the other packers are forced either to follow the price increase or to see their own supplies cut until that particular order is filled. In this way agents function as an informal but efficient 'shrimp exchange', adjusting prices to supply and demand conditions.

All the shrimp exported from Khulna are frozen. Packers make contracts for exporting the shrimp either directly with buyers abroad or with buyers' agents in Bangladesh. Exporters benefit from special credit facilities and export incentives.

In 1984 most of the 12 freezing and packing plants working in Khulna had been in operation for only one or two years, and several more were either planned or already under construction. This has led to what most packers, as well as the officials concerned with the sector, consider a problem of excess installed capacity in the freezing industry. Capacity utilization in the packing industry in Khulna during the 1982-83 season was about 35 percent.[5] Excess installed capacity lowers the profit margins of packers and pushes up factory gate prices. Between 1977 and 1982 these are estimated to have more than doubled; in the same period, world prices rose by only around 20 percent (ADB/FAO INFOFISH, 1983: 37).

Because of the intense competition that follows from the existence of excess capacity, most packers work with very small or even slightly negative profit margins in the shrimp business itself. For example, in July 1983 - which was not an exceptional period - several packers reported FOB prices, for the largest size category of tiger prawns, of around US $ 12.00, or Tk 291, per kg. At approximately the same time, prices at the factory gates were about Tk 10,500 per maund which, taking wastage into account, is equivalent to Tk 300 per kg. In addition, packing costs (including labour, energy, materials and overheads) were about Tk 17 - 29 per kg of raw material. These figures suggest that, without government intervention, the profits of packers would be negligible or even negative. Packers remain financially viable largely thanks to export incentives granted to them by the government, which push overall profit margins to acceptable values.[6]

As for packers, the middlemen's profits per unit weight also seem small.[7] For local traders, average profits are in the region of Tk 200 to Tk 400 per maund of shrimp, although they can vary quite substantially from case to case, depending on the particular circumstances of each transaction. A typical trader will pay shrimp cultivators around Tk 700 per maund less than the price quoted to him by the agent. Out of this margin he will have to pay a commission of Tk 100 per maund to the agent and at least another Tk 100 per maund to pack the shrimp in ice and transported to Khulna. He also has fixed costs, and may have to pay short term credit costs when there are delays in payments, or to support occasional losses when, because of transport delays or other reasons, the shrimp lose value or even become too deteriorated to be saleable. Besides, competition among traders may, in certain transactions, push margins to as little as Tk 100 or Tk 200 per maund.

Agents' margins vary substantially from one transaction to another, but their profits per maund are in general also low. Packers tell agents - and only them - the price they are willing to pay for the shrimp (related to the FOB price they get from foreign buyers), and the agents in turn quote a price to their suppliers, usually Tk 100 per maund below the gate price. Agents also charge commissions to their suppliers, especially those who have borrowed money from them, and receive commissions from the packers for delivering large quantities of shrimp. With all these, agents' profits probably fall between Tk 200 and Tk 500 per maund in normal circumstances, although they may be as high as Tk 1000 per maund in exceptional cases. Large agents are likely to have higher unit profits than smaller ones.

Table 2 combines information from various sources into a general view of the prices for tiger prawns of a particular grade in July 1983. The table also gives summary information on the approximate unit profits of the various economic actors involved in commercialization of the shrimp at that time.

The four main groups of economic actors directly involved in the commercialization and export of shrimp are thus cultivators, traders, agents and packers. An interesting question, especially considering the modest profit margins of the latter three groups, is whether they endeavour to acquire greater control over the activities of the other groups, and particularly over shrimp culture itself, to increase profits. A satisfactory answer to this question entails both reference to empirical information and an analysis of the strategies of the different economic actors.

Table 2.- Price Formation and Profits in 1983: Tiger Prawns, Grade 20

Export price FOB	US$ 12.50	per kg
	or	
	Tk 305	per kg
Price per maund (35 kg/md due to wastage)	= Tk 10 675	per md
- Packing costs and grade loss allowance	- Tk 1 100	per md
= Price given to agent	= Tk 9 575	per md
Price quoted by agent	Tk 9 450	per md
- Agent's commission (=~ 1%)	- Tk 100	per md
= Price paid to traders	= Tk 9 350	per md
- Trader's expenses (ice, transport, labour...)	- Tk 300	per md
- Trader's profit	- Tk 250	per md
= Field price	= Tk 8 800	per md

PROFITS

Packers:

a) Without Import Entitlement Certificates (see note 8):

Tk 0 to Tk 200 per md

b) After selling IECs:

Tk 600 to Tk 1 000 per md

Agents: Tk 200 to Tk 400 per md

Traders: Tk 200 to Tk 400 per md

In July 1983:

Export Prices: US$ 12 to 12.50 per kg

Field Prices: Tk 8 000 to 10 000 per md

As was mentioned above, in a few cases traders take part in shrimp culture themselves and are, in fact, often its instigators and animators in and around their villages. Their control over shrimp culture is, however, rather limited, in terms both of the area covered by the fields in which they have a share and of the conditions which they can impose on their associates. Of all the cases of traders observed, only one succeeded in imposing on his associates a price lower than current market prices, and even then only by between 5 and 10 percent.[8] The prevailing strategy of traders seems to be to assure themselves of supplies by linking interest-free loans to the cultivators with the right to buy all the shrimp they catch, at market prices.

Although they often buy shrimp directly from cultivators (to whom they also occasionally lend money), agents normally adopt towards traders a similar strategy of providing them with interest-free loans; they also endeavour to develop personal links with traders, in order to maximize the amount of shrimp traders sell through them.

One way in which agents (and the larger traders) could ensure access to a reliable supply of raw material would be by going into shrimp culture themselves, on a suitable field, as outsiders. Evidence of this happening is, however, scarce. In only one of the fields surveyed was the shrimp culture carried out by a trader (not an agent) from outside the area. When agents interact with shrimp cultivators, it is normally through interlinked contracts of interest-free credit and commercialization, or to buy shrimp directly from them.

There is also no evidence of any involvement of packers in shrimp culture. When questioned on this subject, several packers stated that for them to

engage in shrimp culture on rented land would cost so much effort and trouble that the idea was completely ruled out. Significantly, however, some packers expressed interest in the commercial possibilities of the eventual development of shrimp hatcheries, both for selling the fry and as a first step for engaging in high-intensity, high-yield shrimp culture.[9] This is seen as a totally different type of operation, which packers feel would be suitable for their firms to take up.

The conditions under which shrimp are traded also imply that packers would have little advantage in trying to take over traders or agents; in fact, as the practice of appointing agents suggests, packers actually try to minimize their interface with the rest of the sector by dealing exclusively with the small number of appointed agents.

It may be surmised that the weak infrastructure in the region and the low level of technical development of shrimp culture play a role in maintaining the clear separation between the various groups involved in the culture and commercialization of shrimp and the strong bargaining position of the groups which control the land. Evidence from other countries in Asia suggests that, as the intensity of shrimp culture increases and capital investment comes to play a greater role in production, the situation may change drastically, with the middlemen and the packers acquiring a much greater degree of control over the cultivators than now.

IV. Employment creation and income distribution

Since shrimp are cultivated in rotation with rice in the study area, the employment and income distribution effects associated with the new land use must be analysed taking into account what happens in relation to rice

culture. Let us first consider briefly the matter of employment creation. As was made clear above, shrimp culture in the semi-saline zone does not displace rice culture. There is thus no significant destruction of employment in the cultivation of rice and there is significant creation of employment in shrimp culture between February and August, precisely the months when little alternative agricultural employment is possible, because of the salinity of the soil and groundwater. Considering an average wage of Tk 500 per month, which is the approximate level of wages in shrimp culture in the area, it was estimated that, in six fields which were studied with special care, covering a total area of 446 ha, work amounting to a total of 1420 manmonths was directly created by the introduction of shrimp culture (DDP, 1985a, 2: 37).

If these six fields are representative of the rest of the study area, and if we apply the ratio which obtains in them of 3.18 man-months per hectare to the estimated area under shrimp culture in the semi-saline zone (approximately 23 000 ha; Ali, 1983), shrimp culture may have been directly responsible for the creation of over 5,000 man-years of work in the fields in that zone, in the 1983 shrimp season. Given the uncertainty about the data, this figure must of course be interpreted as no more than an order of magnitude. To this employment must be added all the other work indirectly created by shrimp culture, in catching shrimp fry, trading, transport and packing. Without attempting to estimate these effects, it seems legitimate to conclude that the introduction of shrimp culture in the semi-saline zone has had a significantly positive impact of net employment creation.

Table 3a. Costs and Revenue of Shrimp Cultivators in the Semi-Saline Zones
Tk per hectare

Arrangement type	4A	4B				Weighted
Field No.(polder)	17(23)	14(18/19se)	15(18/19)	54(16n)	55(16s)	Average
Costs						
Rent/year	7595	7743	3616	5928	1400[1]	
Total labour	2962	1790	1495	1316	1080	
Bund labour	370	555	695	326	405	
Other labour	2592	1235	800	990	675	1526
Fry[2]	1667	250	625	410	101	477
Equipment[3]	666	643	416	403	359	461
Total Costs[4]	12890	10426	6152	8057	2940	
Gross Revenue						
Total shrimp/fish	12036	11504	8962	4387	7300	8197
Marine shrimp	11111	9869	7772	3639	5235	6903
FW shrimp/fish	925	1635	1190	748	2065	1295
Rice	6648	4239	4239	5327	-	4748
Total revenue	18684	15743	13201	9714	7300	
Net Revenue[5]	5794	5317	7049	1657	4360	

Notes
1. Rented for the shrimp season only (see also note 5 below).
2. Fry for stocking the fields are caught in the rivers with fine-mesh nylon nets. The most important component in the cost of the fry is the labour of the catcher, since the Tk 100-250 nets are relatively cheap.
3. Including reported cash payments for water exchange structures (culverts, sluice gates, weirs) guardhouses, nets, flashlights and batteries, boats, etc., but excluding labour costs except payments to outsiders for materials or technical expertise.
4. Rice cultivation costs are borne by sharecroppers.
5. Rice revenue for shrimp field operators is a 50 per cent share of the crop. Rice income earned from field 55 does not accrue to shrimp cultivators and has therefore been excluded.

As for the distribution of income, Table 3a gives, for five fields, estimated values for the costs and revenue of shrimp cultivators. One of the five fields is rented for the shrimp season only. Shrimp culture in the sixth field, field 53, is done by sharing net income (i.e. income minus cash expenditure) among landowners, labourers and a moneylender (see Table 3b). Both tables highlight the economic importance of shrimp culture, which appears to entail an approximate doubling of the productivity of the land.

Table 3b. Costs and Revenue of Shrimp Cultivators, Type 3C Sharing Arrangement[1] (Tk per hectare)

	Monetary	In-Kind
Costs		
Total labour		83 manmonths
Fry	0	
Equipment	2174	
Gross Revenue		
Total shrimp/fish	14506	
Marine shrimp	11693	
FW shrimp/fish	2183	
Net Revenue	12332	
Shares		
Land (4/16)	3083	
Labour (7/16)	5395	
Finance (5/16)	3854	

Note
1. This arrangement for the shrimp season only; field 53, polder 20W (area: 11.5 ha).

The information contained in Tables 3a and 3b makes it possible to analyse the distribution of total revenue from both rice and shrimp culture among the various groups involved. Table 4 gives average values for this distribution for the first four fields of Table 3a, i.e. those in which shrimp cultivators rent the land for the whole year. The shrimp cultivators then give out the land in sharecropping during the rice season, on the usual terms of equal shares with all cultivation costs borne by the sharecropper. It is important to note that this table gives the net incomes of landowners, labourers and shrimp field operators, but the gross income of rice sharecroppers.[10]

Table 4 - Income per Hectare from Shrimp and Rice Culture and its Distribution among Participants, 1983 (average for fields 14,15,17 and 54, in Tk/ha)

	Value	%	Remarks
Total Income Shrimp	8 381		
Expenses Shrimp Cult.	1 036		(fry, equipment)
Net Income Shrimp	7 345		
Total Income Rice	9 495		
Shrimp + Rice Income	16 840	100.0	(shrimp: net; rice: total)
Shrimp Field Labour	1 617	9.6	(mainly shrimp season)
Landowners	5 537	32.9	(rent for whole year)
Field Operators	4 938	29.3	(net, from shrimp + rice)
Sharecroppers Gross	4 748	28.2	(50% share in rice crop)
- Costs Rice Cult.	3 750		(estimate)
Sharecroppers Surplus	998	N.A.	(estimate)

Table 4 shows that the income per hectare of landowners qua landowners (i.e. if they engage directly neither in shrimp culture nor in cultivating rice on their own land) is roughly the same as that of the shrimp cultivators. Labourers get on average less than 10 per cent of the total net income or 20 per cent of the income from shrimp culture alone.

Tables 5 and 6 give the distribution of the income generated by both rice and shrimp culture in fields 55 and 53, respectively, assuming that all the land in these fields is under sharecropping during the aman season (but of course here it is the landowners, not the shrimp cultivators, who receive a 50% share). Leaving aside differences in yields, the arrangements portrayed in Table 5 are similar to those in Table 4. Whether a full-year renting agreement is to the advantage of the landowners or the shrimp field operators depends on whether the difference between the two rents is larger or smaller than the landowner's share in the rice. This difference in arrangements does not affect the situation of labourers or sharecroppers, because both wage and rice yields are independent of it. Clearly, in type 4 arrangements the main beneficiaries of shrimp culture are landowners and entrepreneurs. Landless labourers derive some benefits from the creation of additional employment during a normally slack season. The situation of sharecroppers does not change significantly.

The type 3 arrangement summarized in Table 6 shows a much better remuneration than the other two for labour. It must be kept in mind, however, that most of the people who work in this field own land in it and take part in management decisions. This is an example of type 3C arrangement, where the landowners themselves (plus possibly a few outsiders) cultivate shrimp and share in the profits.

Table 5 - Distribution of Income per Hectare from Shrimp and Rhce Culture Among Participants, 1983 (field 55, in Tk/ha)

	Value	%	Remarks
Shrimp + Rice Income	19 340	100.0	(shrimp: net; rice: total)
Shrimp Field Labour	1 080	5.6	(mainly shrimp season)
Landowners	7 650	39.6	(rent for whole year)
Field Operators	4 360	22.5	(net, from shrimp + rice)
Sharecroppers Gross	6 250	32.3	(50% share in rice crop)
Sharecroppers Surplus	2 500	N.A.	(after costs)

Table 6 - Distribution of Income per Hectare from Shrimp and Rice Culture Among Participants, 1983, Arrangement Type 3C (field 53, in Tk/ha)

	Value	%	Remarks
Total Income Shrimp	14 506		
Expenses Shrimp Cult.	2 174		(equipment)
Net Income Shrimp	12 332		
Total Income Rice	10 582		
Shrimp + Rice Income	22 914	100.0	(shrimp: net; rice: total)
Labour Share of Shrimp	5395	23.5	(7/16 of shrimp)
Landowners: Shrimp	3 083	13.5	(4/16 of shrimp)
Landowners: Rice	5 291	23.1	(50% of rice)
Moneylender	3 854	16.9	(5/16 of shrimp)
Sharecroppers Gross	5 291	23.1	(50% share in rice crop)
- Costs Rice Cult.	3 750		(estimate)
Sharecroppers Surplus	1 541	N.A.	

As a tentative conclusion it may be said that the benefits associated with the introduction of shrimp culture are captured primarily by people who own land or have the money necessary to rent it. Given the existing skewness in the distribution of both land and other wealth, shrimp culture is bound to reinforce ongoing processes of income concentration.

V. Other effects of shrimp culture

The fact that in the semi-saline zone, because of its peculiar environmental characteristics, shrimp culture did not displace rice culture seems to have resulted in a situation which could, at first glance, merit to be described as a Paretian improvement, in the sense that some people are made better-off and nobody is made worse-off by the new activity. Unfortunately, this is not true. Shrimp culture has several negative effects, which reflect themselves directly and indirectly in the welfare of many people and go a long way towards explaining the fierce opposition which often meets proposals to introduce shrimp culture. These effects are not easy to quantify, but it is important at least to mention them.

The reduction in the area of land available for grazing and the increased salinity of the water in the canals inside the polders, caused by the flooding of fields inside the polders with saline water, has a negative effect upon the number of livestock, particularly cattle. This in turn may affect the availability of draught power and the income and wealth of some people for whom cattle is an important resource; this is especially true of the poor because, before the introduction of shrimp culture, cattle grazed freely on the rice stubble and grasses that grew on the fallow land, regardless of who owned it.

The practice of taking saline water into the polders also leads to the contamination of the fresh water ponds used by the population during the dry season as sources of drinking water, forcing people to spend more time and energy in carrying water from farther afield. It also destroys trees and bushes which cannot stand the increased salinity; these are wealth, privately or collectively owned and enjoyed, and their destruction means a loss for those who own them or for the public at large.

Another aspect of shrimp culture with negative implications for income distribution and for the welfare of the poor follows from outsider control of significant numbers of fields. Outsiders have, towards the local people - and particularly the local poor - none of the obligations that go together with kinship, patronage and the whole network of social relationships that characterizes rural communities. No one would deny that the rural rich in Bangladesh exploit the poor, but they also provide some protection to them, especially in situations of crisis like famine, sickness or natural disasters. Outsiders, on the other hand, do not belong to this network, and the only relations they establish with the local poor are contractual ones, for earthwork, sharecropping, etc. Outsider control of shrimp fields therefore contributes towards the loss by the poor of the "safety net" that protects them in situations of crisis.

The loss of control over their own land experienced by many small and middle farmers, who are often coerced by the larger landowners into accepting the introduction of shrimp culture, has some negative economic aspects. One of these follows from the need to prepare seedling beds in fields irrigated with fresh water, because of the sensitivity of rice seedlings to salt. This does not pose problems to people who also have land outside the shrimp

field, but may be a source of difficulty and expense for farmers whose land is all inside the field, and who have to rent land for their seedling beds.

All these effects entail real costs, especially for people who live close to the margin of subsistence; although these costs seem to be of a smaller order of magnitude than employment and income creation benefits, they are borne by people who are not the main beneficiaries of the introduction of shrimp culture. This reinforces the tendency towards concentration of income and wealth already mentioned at the end of Section 4. Awareness of this fact may help explain the bitterness with which many people, especially small and middle farmers, oppose the introduction of shrimp culture.

Shrimp culture seems to have some beneficial side effects as well, most notably in controlling weeds and snakes and in helping keep the soil soft and thus simplifying the work of ploughing which takes place before rice transplanting. These benefits are, however, at least partly offset by siltation within shrimp fields, which in the long run creates problems of water management for rice growers.

VI. Concluding remarks

The conditions under which shrimp culture has developed in the semi-saline zone of southwest Bangladesh over the past few years have been such that field cultivators actually receive the major part of the price paid for the shrimp by foreign buyers. Middlemen have played an important role in financing the new activity and in providing an efficient network of collection, linking the dispersed and often very small producers with the necessarily large and more concentrated freezing and packing firms. At the same time, the competition among middlemen and the difficulties that

physical dispersal poses for collusion have prevented them from imposing more unfavourable terms on cultivators.

The distribution of income among the various economic actors directly involved in shrimp culture is, however, heavily biased in favour of landowners and entrepreneurs in the rural areas, i.e. people who either own or can obtain control of land. Given the conditions under which shrimp culture has developed until now, characterized by a primitive technology and low yields per hectare, land appears to be the key resource.

The situation described in this paper supports the argument that when a new and profitable productive activity (e.g. a cash crop) is introduced in a rural context, the distribution of the income it generates is biased in favour of the people or groups who control the scarcest among the resources necessary for the new activity. As technology improves and shrimp culture becomes more intensive, it may be expected that capital investment will play an increasingly crucial role. If the argument above is valid, the balance is then likely to tilt in favour of the groups that control capital, and the middlemen and packers may come to capture a much larger share of the profits. A comparison of Bangladesh with other Asian countries where the capital intensity of shrimp culture is higher would be particularly interesting from this point of view.

Shrimp culture has generated considerable resource flows to southwest Bangladesh and, in particular, to its rural areas. There are, however, not many reasons for optimism about the likely long-term effects of these flows upon the development of the region. If the opportunities to invest either in the development of agriculture or in industrial activities remain as scarce as they have been in the past, the resources generated by the new activity,

which will largely accrue to the traditional rich, may well end up being used in the traditional ways: moneylending, buying of land to give out to sharecroppers, control of the delivery services of the state, control of the local society, etc. Evidence available from other studies (e.g. van Roosmalen and Guimarães, 1985a; Rahman, 1986; Boyce, 1987) indicates that these traditional ways are likely to lead, not to sustained development, but to increased landlessness, exploitation and stagnation.

NOTES

Most of the information used in this paper was collected during field research carried out between 1982 and 1984 in the context of the Delta Development Project (DDP), a project of development cooperation between the governments of the Netherlands and of Bangladesh, carried out under the Bangladesh Water Development Board. The contribution of Md. Helaluddin Morshedi during the data collection stage is gratefully acnowledged. The paper itself is to a significant extent based upon my own contribution to a report on that research, written together with J. R. Colthoff (DDP, 1985a). To avoid burdening the text with references, my own text is freely incorporated in the text of this paper.

(1) The selection procedure adopted combined randomness with the need to save time and fuel, while ensuring the inclusion in the sample of fields of different sizes, spread over the whole area. The procedure consisted of selecting a number of itineraries for the speedboat used in the survey, along the rivers that crisscross the area (because of the need for regular water exchanges, all the shrimp fields are adjacent to rivers), stopping at random intervals along those itineraries and surveying the nearest fields and traders' depots. The 49 fields surveyed in the semi-saline zone have a total area of 3350 ha. The best estimate of the total area under shrimp culture in the southwest, in 1983 (Ali, 1983), gives an area of approximately 23,600 ha, in the semi-saline zone. The sample therefore represents approximately 14.2 % of the total area under shrimp culture. It is likely, however, that the sample selection procedure may have led to a relative over-representation of large fields in the sample.

(2) The importance of the areas controlled by outsiders raises the question

of who these outsiders are and how they obtained control over the shrimp fields. These are not easy questions to answer, especially since several people normally own shares in these fields. The outsiders described as 'owners' of the fields (which may mean that they are the main shareholders) were reported as having a variety of occupations: government servants, farmers, landowners, shop owners, one shrimp cultivator from outside the area and one shrimp trader.

As to the way in which they gained access to and control of the land, generally the initial contact was made with large landowners in the fields, with whom sometimes the outsiders were previously acquainted. Indeed the initiative for these contacts was sometimes the landowners'. Once the agreement of the large landowners to shrimp culture was obtained, smaller landowners were then enlisted by a mixture (in varying proportions) of persuasion, pressure and, in a few cases, actual threats.

(3) This is also why water management in rice cultivation is normally done jointly for all fields that constitute a hydrological unit. A related question is whether economies of scale exist in shrimp culture. The argument for their existence is associated, in the first place, with the indivisibility of certain items of equipment (e.g. water exchange structures) the cost of which is, within certain limits, independent of field size. A second argument in favour of the existence of economies of scale relates to the fact that several of the most important costs of shrimp culture - e.g. building and reparing bunds, guarding the fields, etc - are a function of the perimeter of the fields. For any given shape of field, the larger the field the smaller the perimeter/area ratio and therefore the lower the incidence of these costs per unit area.

At the same time, provided the water exchange structures have enough capacity, field size is unlikely to have the same negative effect upon the yield per hectare. The main factors influencing yield are the environmental conditions in the field - particularly the abundance of predators and the quantity of nutrients present - and the stocking of the field with fry. If water exchange is sufficient to ensure the same availability of nutrients and if similar stocking policies are adopted (with similar costs per unit of area), the only factor through which field size might affect yields negatively is the control of predators, which may be less effective in larger fields. Empirical information available is, unfortunately, inconclusive about the existence of significant economies of scale, because of the difficulty of obtaining reliable data on costs per hectare for a large enough number of fields.

(4) In another, large shrimp field close to where all this took place, the farmers were acutely aware of the relationship between field size and the potential for conflict. This field was divided into four smaller ones by three parallel bunds. Each of the four fields was organized according to an arrangement type 3B. When questioned about the reason for what was clearly a more costly solution - both because of the bunds and because each of the smaller fields required its own water intake - the shrimp cultivators stated that their primary reason was to decrease the sizes of the groups involved in shrimp culture in each field, to avoid serious conflicts which might lead to their losing control over shrimp culture and their land.

(5) The concepts of excess capacity and of capacity utilization were developed for industries which can in principle work continuously, without depending on seasonal supplies of inputs, and it is difficult to adapt them

meaningfully to the situation which prevails in shrimp packing, where the supply of shrimp is doubly seasonal, with a bi-weekly and an annual cycle, related respectively to the occurrence of spring tides and to the annual life cycle of the shrimp. These two cycles mean that, to be able to cope with peak supply conditions, the processing capacity of the industry must exceed average supply. Given the seasonal nature of the supply, excess capacity would have to measured in relation to some normatively defined optimal capacity, defined as the capacity which would strike an optimum balance (in terms of profits) between the costs of investment and the opportunity costs associated with having to turn away supplies at certain peak periods. A less rigorous but more practical approach is to compare the industry as a whole with the most efficient packer, used as a standard. This will probably lead to underestimating the excess installed capacity. Using this criterion, capacity utilization has been estimated at 35 percent (DDP, 1985a: 20-5).

(6) To stimulate exports, the Government of Bangladesh had in place, in 1983-84, a system whereby exporters were given the right to import certain categories of goods manufactured abroad, with a value which is a fixed percentage of the values of the exports. This is the system of Import Entitlement Certificates (IECs). The percentage mentioned above was fixed, during that period, at 80%. IECs are negotiable, which means that an importer can sell all the IECs that he does not need to use himself, for a fraction of the value of goods that the IEC entitles its owner to import. This fraction fluctuates according to the types of goods that can be imported and with market conditions; at the time of the fieldwork upon which this paper is based, it was about 10%. This means that a shrimp exporter would be able, by selling his IECs, to make an additional profit

of 8% (= 80% x 10%) of the total value of the shrimp he exported.

(7) The low profits per maund of shrimp realized by middlemen cannot be interpreted as meaning that shrimp trading is unprofitable; indeed if that were the case fewer people would enter the sector and there would probably be much less competition. Profitability could only be properly assessed after taking into account the capital invested, the total amount of money borrowed by the traders and the respective rates of interest, the money lent to other intermediaries and to cultivators, fixed costs, total turnover, etc.

(8) This particular trader is also the son of the richest and most powerful man in the village, which no doubt helps explain his having been able to impose unfavourable terms on the other villagers.

(9) Intensive shrimp culture as practiced in Japan has yields of up to 6 000 kg/ha, and values of 800 to 1 500 kg/ha are found in shrimp culture in East and Southeast Asia. Under the rather primitive conditions which prevail in Bangladesh, yields average less than 100 kg/ha.

(10) Cultivation costs for rice have been estimated, for this area, at around Tk 3750/ha (DDP, 1985b); these include the costs of all inputs (labour, seeds, etc) required for the local varieties currently cultivated.

REFERENCES

ADB/FAO INFOFISH, 1983, International Market for Shrimp. Kuala Lumpur.

Ali, Md.L., 1983, 'Shrimp Farm Survey in Coastal Area of Bangladesh', Dhaka, mimeo, December.

BRAC, 1983a, Who Gets What and Why. Bangladesh Rural Advancement Committee, Dhaka.

BRAC, 1983b, The Net: Power Structure in Ten Villages. Bangladesh Rural Advancement Committee, Dhaka.

Binswanger, H.P. and M.R. Rosenzweig, 1986, "Behavioural and Material Determinants of Production Relations in Agriculture", Journal of Development Studies, 22: 503 - 539.

Boyce, J.K., 1987, Agrarian Impasse in Bengal: Agricultural Growth in Bangladesh and West Bengal 1949-1980. Oxford: Oxford University Press.

Coburn, J.,1982, "Current Studies of Peasants and Rural Development: Applications of the Political Economy Approach", World Politics, 34: 437 - 49.

DDP (Delta Development Project), 1985a, "Shrimp Culture in the Semi-Saline Zone of the Delta", Technical Report No. 13, Arnhem and The Hague, mimeo.

DDP (Delta Development Project), 1985b, "Agriculture: Final Report on Aman Cultivation", Technical Report No. 15, Arnhem, mimeo.

IBRD, 1983, "Bangladesh: Selected Issues in Rural Employment", Report No. 4292-BD, Washington, DC.

Long, N., 1977, An Introduction to the Sociology of Rural Development. London: Tavistock Publications.

Olson, M., 1965, The Logic of Collective Action. Cambridge, Ma., Harvard University Press.

Platteau, J.-P., 1987, "La Nouvelle Economie Institutionelle et la Problématique Cooperative", Cahiers de la Faculte' des Sciences Economiques et Sociales, Série "Recherche", Namur.

Rahman, A., 1986, Peasants and Classes: A Study in Differentiation in Bangladesh. Delhi: Oxford University Press.

van Roosmalen, H.P.A. and J. Guimarães, 1982, "Notes on the Socio- Economic Situation in Polder 22", Delta Development Project, Technical Report No. 1, The Hague, mimeo.

de Vylder, S., 1982, Agriculture in Chains. Bombay: Vikas.

Williamson, O., 1975, Markets and Hierarchies: Analysis and Antitrust Implications. New-York: The Free Press.