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ICLARM MC P.O. Box 1501 Makati Metro Manila Philippines

PN-ABQ-787

ICLARM Technical Reports 40

Household Socioeconomics, Resource Use and Fish Marketing in Two Thanas of Bangladesh

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1993

INTERNATIONAL CENTER FOR LIVING AQUATIC RESOURCES MANAGEMENT
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Printed in Manila, Philippines.

Published by the International Center for Living Aquatic Resources Management, MCPO Box 2631, 0718 Makati, Metro Manila, Philippines with financial assistance from the International Fund for Agricultural Development (IFAD), Rome, and the Danish International Development Agency (DANIDA), Copenhagen.

Citation:
Ahmed, M., M. Abdur Rab and M.P. Bimbao 1993. Household socioeconomics, resource use and fish marketing in two thanas of Bangladesh. ICLARM Tech. Rep. 40, 82 p.

Cover: Fish being sold in a village market in Kapasia, Gazipur, Bangladesh. (Photo by M. Ahmed)

ISSN 0115-5547
ISBN 971-8709-41-X

ICLARM Contribution No. 975

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FOREWORD

Against the background of a decline in the supply of fish from capture fisheries, recent advances in aquaculture technologies have opened up new opportunities of increasing fish production in tropical countries. Bangladesh stands out as a country of exceptional needs and opportunities for research on inland aquatic systems because:

1. it has a very high reliance on freshwater fish for supply of animal protein and micronutrients in human nutrition;
2. it has an unrivalled diversity of inland waterbodies for fish production (floodplains, oxbow lakes, ponds, rice floodwaters, etc.);
3. its millions of small-scale farm families must generate more food and livelihood opportunities from their land and aquatic resources for economic development;
4. fishpond management is an attractive enterprise and can help in the empowerment of women, who traditionally stay close to their farm households; and
5. in addition to governmental extension efforts, there are many NGOs in Bangladesh that are helping to accelerate the adoption of more sustainable farming systems and natural resources management, and they welcome collaboration with researchers in a farmer participatory mode.

Introduction of small-scale aquaculture to farmers is expected to play a vital role in increasing protein supply, income and employment in the rural areas. The role of extension in the adoption of aquaculture technologies and their impact on rural households and communities are critical areas of investigation with important policy implications.

This report is the second in the series of benchmark survey reports under a collaborative project between the Government of Bangladesh (GOB) entitled "Socioeconomic Impact of Fish Culture Extension Program on the Farming Systems of Bangladesh." The Bangladesh Agricultural Research Council (BARC), the Department of Fisheries (DOF) and the Fisheries Research Institute (FRI) were the three collaborating government agencies. The cooperation of these agencies and financial assistance from the International Fund for Agricultural Development (IFAD) and the Danish International Development Agency (DANIDA) are gratefully acknowledged.

This project is a unique effort to study the socioeconomics of aquaculture extension in a poor tropical developing country and to develop methods for future research on this topic. It is the largest and most comprehensive study of the extension of improved inland aquaculture technology in the tropics. The series of benchmark survey reports provide the essential foundation for this study of the impact of aquaculture extension, the results of which are expected to have major significance in Bangladesh and the region.

L.D. Stifel
Director General
ICLARM

Aspects of Household Socioeconomics, Resource Use and Fish Marketing in Kapasia, Gazipur, Bangladesh

Feeding with farm by-products and wastes - a traditional way of raising animals by farm households (photo by E. Worby).

A household member throwing a cast net to catch fish

Vendors carrying fish fry for sale to fish farmers.

Rice straws stacked within the homestead to be used for fuel, animal feed and other household uses (photo by E. Worby).

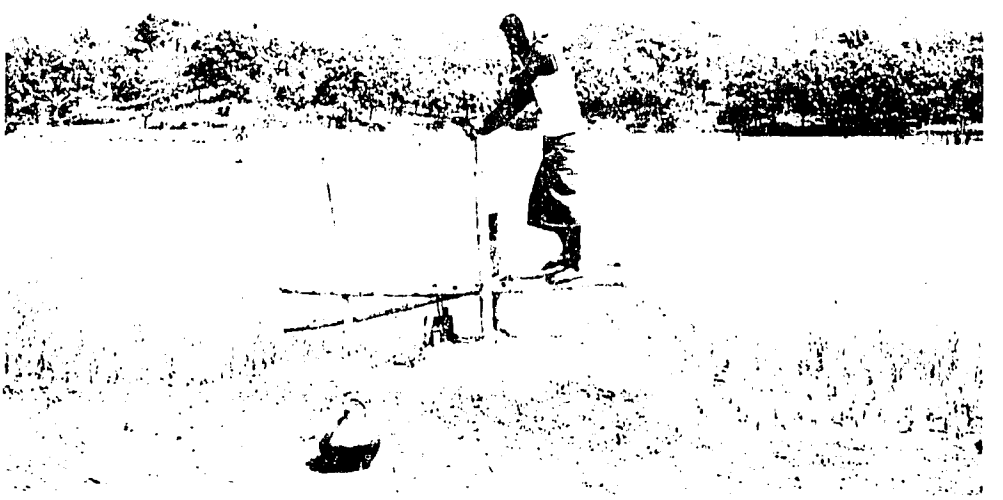
Waterbody surrounded by paddy fields

Fish harvesting from a small homestead pond.

A newly excavated pond to meet the needs of land elevation, water supply and fish production.

Household waste materials dumped at a corner of homestead.

Fish being sold in a villago market.



A farmer using a paddle-pump (a local irrigation technology) for watering ricefield.

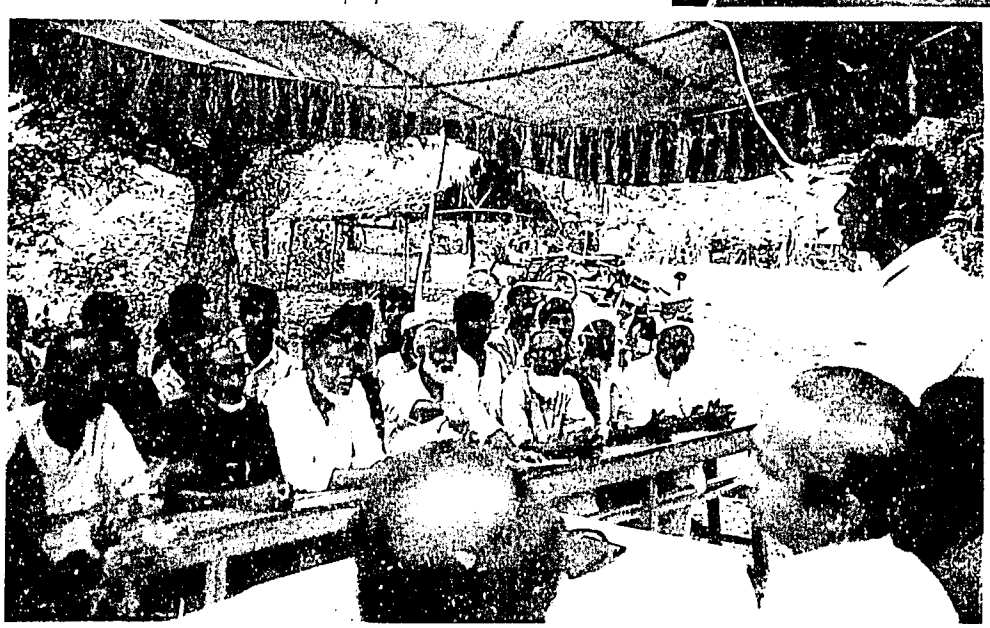
(Photos by M. Ahmed except as marked)

Activities of the Government of Bangladesh-ICLARM Project on Socioeconomic Impact of Fish Culture Extension Program on the Farming Systems of Bangladesh

Extension staff monitoring fish growth.

Discussion between fish farmers and project staff.

Extension staff demonstrating techniques of stocking seed in a farmer's pond.



Department of Fisheries officials addressing a gathering of farmers.

ABSTRACT

A socioeconomic survey was carried out on a sample of 333 households from among the owners and operators of small waterbodies (ponds and ditches) in two subdistricts or thanas: Kapasia (the target area for development of aquaculture) and Sreepur (the control area with no development initiative for aquaculture) in the district of Gazipur, Bangladesh. The report also provides information about fish markets in the two thanas. Fish traders in 21 village markets, 15 from Kapasia and six from Sreepur, were surveyed.

Comparison of land and assets as well as income of the households indicated very little variation between the two thanas as far as the owners and operators of small waterbodies are concerned. Similarly, education, occupation, consumption pattern and resource use pattern of these households differed only slightly. It was also revealed that these persons enjoyed a higher socioeconomic status than the rest of the community.

In both thanas, pond owner and operator households consumed relatively higher amounts of fish and other animal proteins than the national average. On the average, fish represented nearly 70% of the total consumption of animal protein by the respondent households in both the thanas, quite similar to the national average. However, of the total household consumption of fish, on-farm fish represented only 32% in Kapasia and 22% in Sreepur. The log-linear estimate of demand for fish showed that per caput household demand for fish has low income elasticity (0.29). Also, market demand for fish was negatively related to the availability of fish from on-farm sources.

Aside from conventional resources such as land, labor, animal and capital, the respondent households generated a substantial amount of by-products and wastes, such as rice bran, cowdung, poultry manure and kitchen wastes. Apart from poultry manure, most was used for animal feed or crop fertilizer. Virtually none was used in aquaculture.

About 50% of the area under pond dikes in Kapasia and 23% in Sreepur are currently used for gardening, animal grazing, seedbeds and plant nurseries.

Aquaculture techniques, input-use pattern and management were largely unscientific. Overstocking of fingerlings, low levels of both on-farm and off-farm inputs, and irregular stocking and harvesting were the general features of the existing aquaculture in both thanas.

Rural fish markets still receive most supplies from capture fisheries sources. Aquaculture products in the market were mainly Indian major carps, comprising 38% of the total supply. Among the exotic species, Chinese carp (19%) and common carp *(Cyprinus carpio)* (14%) were dominant. Nile tilapia *(Oreochromis niloticus)* and silver barb *(Puntius gonionotus)* were totally absent from the markets. Fish trading is the principal occupation of most of the traders (83% in Kapasia, 93% in Sreepur) in the village markets in both thanas. None of the fish sellers were pond owners or operators selling their produce themselves. Market margins of most of the capture fishery species were generally higher than those of the farmed species.

Introduction of aquaculture in the rural areas will increase on-farm consumption of fish. But the benefits of improved aquaculture technology will accrue mainly to the owners and operators of small waterbodies whose present socioeconomic conditions are better than the rest of the rural population. It might, therefore, be necessary to promote low-cost technologies for aquaculture as well as to provide institutional and policy support to enable poor and landless people to get access to waterbodies and adopt aquaculture.

Chapter 1

BACKGROUND

Fish, an integral part of the diet in Bangladesh, is a major source of animal protein to its rural population. With limited access to other animal protein sources, the contribution of fish is presently 73% of the total protein intake in the rural areas. Traditionally, capture fisheries in the rivers, floodlands and coastal waters supplied most fish, forming an important livelihood activity to fishers and farmers. In view of the degradation and depletion of many natural stocks and in order to meet the growing demand for fish, a lot of emphasis has been given on the development of aquaculture in the country's development plans as an alternative as well to complement the natural supply of fish (MOFL 1990). Since farming is the mainstay of the people, introduction of small-scale aquaculture into farms could be a major step toward sustainable aquaculture.

Current production of fish from aquaculture estimated by the Department of Fisheries is relatively small (21%) and is considered far below its potential. Available aquaculture technologies that have both technical and economic potentials are yet to be adopted by the farmers and there has been a virtual absence of provision of extension and support services for the development of aquaculture countrywide (World Bank 1991). Most of the country's 1.8 million perennial ponds (163,000 ha) that are part of the farm resources of the households still remain unutilized or underutilized as far as aquaculture is concerned. It is expected that if farmers are introduced to modern culture techniques through extension services, it will enable them to grow fish as a routine produce from farms as well as increase yield and availability of animal protein to farm families.

Transfer of appropriate aquaculture technologies and introduction of sustainable farming systems are major challenges to the extension and development agents in Bangladesh. Conventional high input technological approaches may not be suitable for the average Bangladesh farmer, regardless of perceived negative impact of such technologies on environment and ecosystem. Due to high production costs, unavailability of commercial inputs and credit, and high risk factors such as floods, droughts and theft, farmers may find it difficult to adopt intensive aquaculture quickly. Moreover, credit-dependent high input technologies are difficult to disseminate widely and could increase disparity between those who can and those who cannot get access to credit (Lightfoot et al. 1992).

The development and dissemination of aquaculture technologies should also consider the scarcity of resources, which is a general feature of farms in Bangladesh. Within the existing farming systems, an individual household channels its limited resources, e.g., land, labor, capital, by-products and bioresources, to a variety of farm and other activities in order to produce a needed or feasible output and also generate income. Aquaculture will certainly require inputs of these and other resources and may warrant reallocations, including a diversion of farm resources away from the existing enterprises as well as an increase in the dependence of the farms on external commercial inputs.

Farm communities show a wide divergence and heterogeneity in terms of endowments of critical farm resources, particularly land and water. Small-scale and marginal farmers (<1 ha farm size) constitute more than 70% of the total farm households and operate only

29% of the total land holdings, while large-scale farmers (>3 ha farm size), who comprise less than 5% of the total farm households, operate nearly 26% of the total cultivated holdings. The average farm sizes for these two groups are 0.36 and 4.78 ha, respectively (BBS 1993).

Major socioeconomic questions centering around the development of aquaculture on farms are: whether or not i) potential rewards in income and food will be attractive enough to encourage widespread adoption; ii) distribution of benefits from such development will be equitable; and iii) resource-use conflict and competition for scarce farm resources will increase.

ICLARM, in collaboration with the Government of Bangladesh (GOB), designed a project to assess the socioeconomic impact of fish culture extension program on the farming systems of Bangladesh (Fig. 1.1; Ahmed 1992). The main objectives were: i) to identify resource constraints and examine the effects on resource allocation/use pattern at the farm level; ii) to examine the effects on aggregate output and income of the whole farm system as well as of the individual components; and iii) to examine the effects on fish consumption within the farm households.

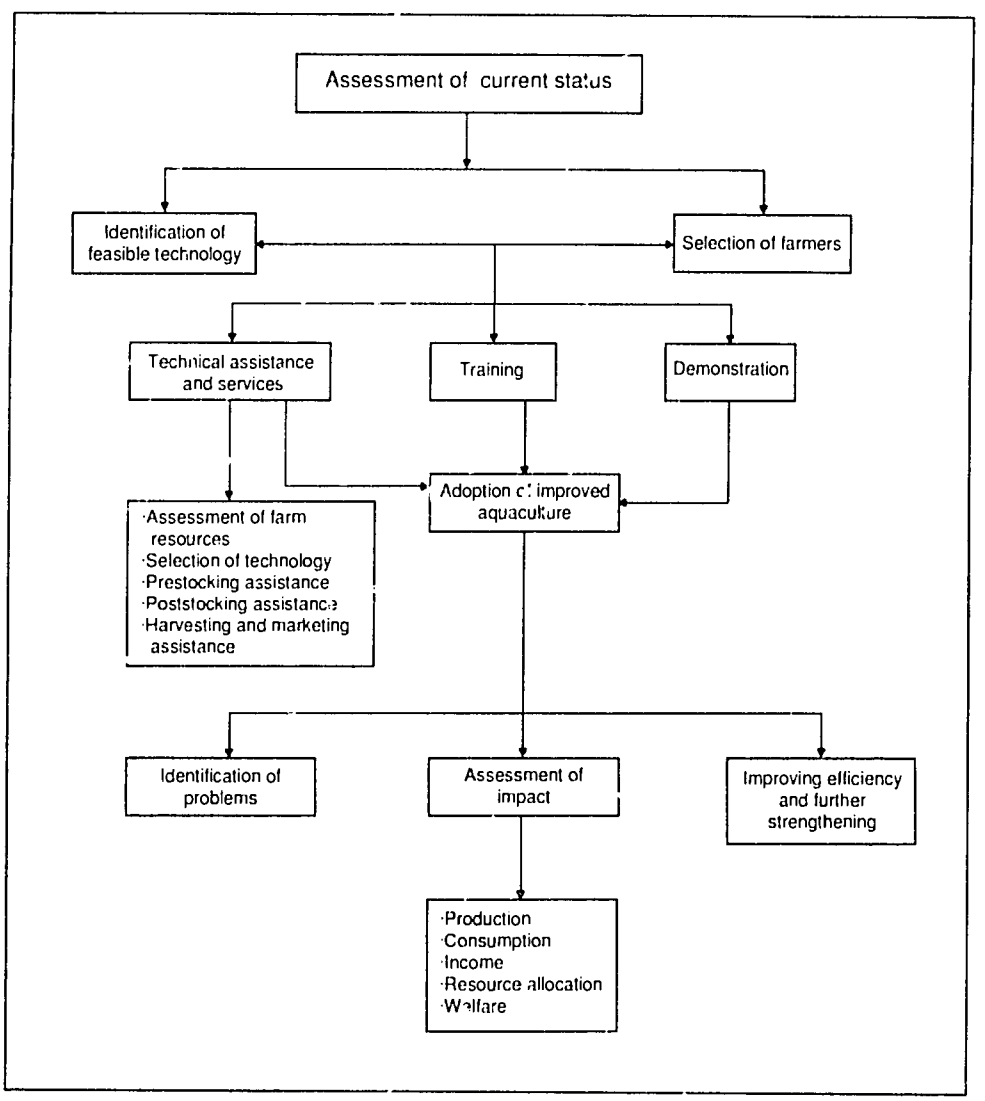


Fig. 1.1. Methodology for aquaculture extension and assessment of its impact under the Project Socioeconomic Impact of Fish Culture Extension Program on the Farming Systems of Bangladesh.

The design of the project included two thanas, namely. Kapasia and Sreepur in Gazipur district of Bangladesh (Fig. 1.2). Kapasia was the target extension area and Sreepur, the control area. The project has undertaken an extension program in Kapasia thana from the middle of 1991 in order to train farmers on techniques of aquaculture and assist the farmers adopt aquaculture (Ahmed 1992). Determination of the effects of the extension program in terms of adoption of aquaculture as well as the analysis of impact of aquaculture on the households and community are being carried out by investigating a set of economic and social variables in both the target and control thanas.

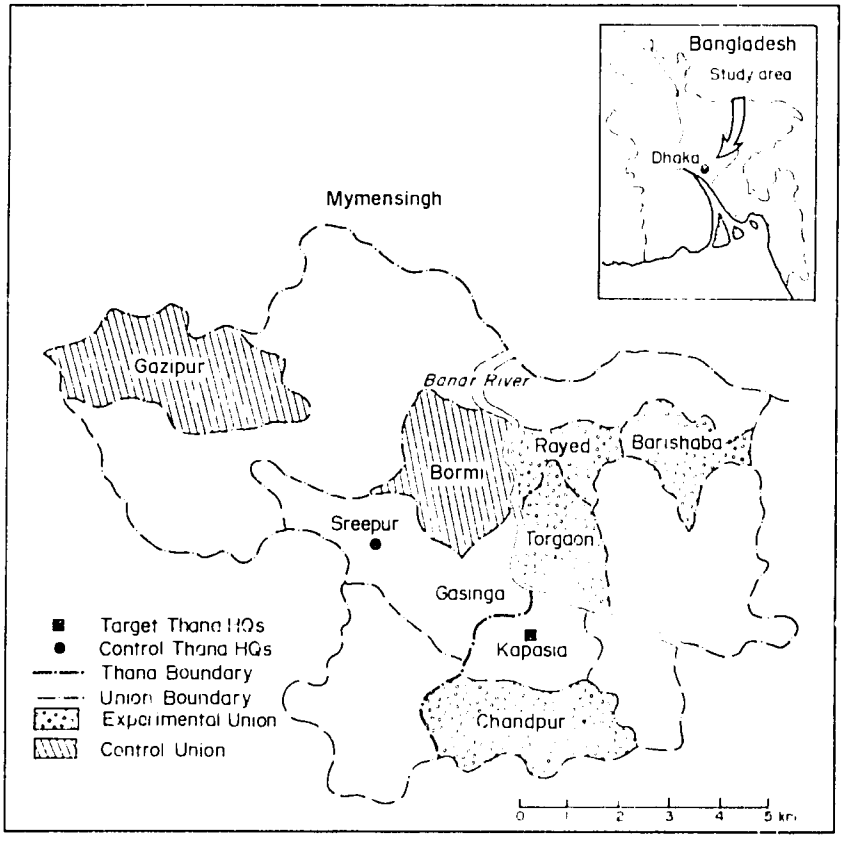


Fig. 1.2 Map of the study area: Kapasia and Sreepur thanas, Gazipur District, Bangladesh.

The emphasis of the extension program has been to design and disseminate low-cost and low external input as well as relatively less intensive technologies that would be affordable to all categories (poor and rich) of farmers. Several hypotheses were made in this regard: i) while adopting aquaculture, no significant diversion of labor and material inputs from the other components of the farm systems will take place; ii) farmers will be able to realize benefits of new aquaculture technologies without any significant increase in dependence on external inputs; iii) the intensity and use of on-farm by-products will increase; iv) income from other components of the farm will remain unaffected and additional income to the farm will accrue due to the adoption of improved aquaculture practices; and v) household consumption of fish will increase as a result of improved aquaculture practices.

The basic framework of analysis was one of examining the socioeconomic conditions of the households and communities prior to the initiation of the program of extension and following-up the same after a certain period. Thus, the project is conducting: i) benchmark studies; ii) regular and periodic monitoring; and iii) post-intervention studies. By comparing results of the studies in both target and control areas, it will be possible to assess the changes that are due to the aquaculture extension program both at the household and community levels and to make some generalized conclusions on the socioeconomic impact of aquaculture in Bangladesh.

This report examines the: i) benchmark situation with respect to the socioeconomic conditions and resource allocation pattern of households having ownership and access to small waterbodies; ii) aquaculture management practices in small waterbodies owned and operated by the households; and iii) structures of fish marketing in the locality.

Chapter 2

INCOME, EXPENDITURE AND RESOURCE ALLOCATION PATTERN OF HOUSEHOLDS

Introduction

The main objective of the household survey was to document the socioeconomic conditions of pond operator/owner households prior to the initiation of extension programs for aquaculture. As already stated, rural households generally engage themselves in various activities related to production and income. Limited farm resources, e.g., land, labor, capital are either used on-farm or rented out to off-farm and nonfarm uses. At the same time, farms draw on resources from outside through purchases, rentals and/or sharing arrangements. Thus, diffusion of aquaculture, like any new commodity or technology, would imply some form of reorganization into the existing patterns. This may come through improving efficiency and/or reallocation of farm resources as well as through supply of additional external inputs. Considering the above, the project included an investigation into current resource allocation patterns by the pond owner or operator households as an important part of benchmark surveys.

The specific objectives of the study were to:

- document the social, educational and demographic characteristics of the farm households;
- assess current ownership of land, animals and other assets of the farm households;
- identify sources of income and assess their current distribution;
- assess current consumption of fish vis-à-vis other food items;
- assess allocation of resources such as land, labor, capital, water resources and other minor indigenous resources;
- assess employment pattern of the farm households over time and space, i.e., over different occupations or activities;
- assess the level of farm products and by-products of the households and their current use; and
- determine the use and management of existing small waterbodies owned or operated by the farm households.

Methodology

Sample Selection

Respondent households were selected from the pond operating households using a stratified random sampling technique. The sampling frame for the socioeconomic survey of

pond operator households were devised using the census data on small waterbodies (ponds/ditches) in Kapasia and Sreepur thanas (Ahmed 1992). The waterbodies were categorized into three groups according to their sizes: small (<600 m^2), medium (600-1,200 m^2) and large (>1,200 m^2). A total of 193 pond operator/owner households from Kapasia and 140 from Sreepur were selected randomly with proportionate samples taken from each pond size group. *Khas* (government-owned) and institutional (e.g., school and mosque) ponds which were not operated by any individual or group as part of household enterprise were excluded from the sample.

Data Collection

A two-part questionnaire was used for the survey (Appendix I). Part I considered questions on the: typology of the household and farm; present holdings of the households; household income from farm and other sources; household consumption, expenditure and indebtedness; social status of the households; and farm production activities and resource use patterns. The Part II questionnaire, the analysis of which is reported separately in Chapter 3, investigated details on the physical characteristics of the ponds/ditches, use of pond dikes/banks, and quantity and value of inputs used. The survey, which covered the production period July 1990 to June 1991, was conducted between July and August 1991.

Analytical Framework

Pond operator or owner households were taken as the unit of analysis. Simple statistical techniques such as frequency distribution, means and percentages were used to analyze the data. Most of the analyses were done by categorizing the respondent households into three land ownership groups: small (<1.0 ha), medium (1.0-2.4 ha) and large (>2.4 ha). Although sample households were drawn on the basis of pond size groups, the analysis was done by land ownership groups, as socioeconomic status is more directly linked to size of total land. Table 2.1 shows the distribution of sample households by land ownership and farm size group. There was a positive association

Table 2.1. Distribution of sample households (no.) by pond size, and by land ownership and farm size groups in Kapasia and Sreepur thanas, Gazipur district, Bangladesh, July 1990 - June 1991.

	Pond size							
	Kapasia				Sreepur			
Land ownership/ farm size	Small (<600 m^2)	Medium (600-1,200 m^2)	Large (>1,200 m^2)	All	Small (<600 m^2)	Medium (600-1,200 m^2)	Large (>1,200 m^2)	All
Land ownership								
Small (<1.0 ha)	31	13	13	57	26	9	7	42
Medium (1.0-2.4 ha)	41	21	14	76	18	12	17	47
Large (>2.4 ha)	22	13	25	60	20	15	16	51
All	94	47	52	193	64	36	40	140
Chi-square				10.40*				7.19
Farm size								
Small (<1.0 ha)	40	39	15	94	31	20	13	64
Medium (1.0-2.4 ha)	15	23	9	47	15	11	10	36
Large (>2.4 ha)	15	16	21	52	12	18	10	40
All	70	78	45	193	58	49	33	140
Chi-square				13.15*				4.21

*Significant at 1%.

between pond size groups and land ownership or farm size groups of the households. In both Kapasia and Sreepur, more than 47% of the sample households belonged to the small farm size groups. In addition, in Kapasia, the positive association between pond size and land ownership/farm size was statistically highly significant.

Measurement of Variables

Land ownership, farm size, income and asset holdings were considered important indicators of social and economic status of Bangladesh's rural households. Although standard definitions of measurement of these and other variables were followed (BBS 1991) in the present study, the following conceptual definitions and measurements of income and assets were used.

DEFINITION OF INCOME

Household or family income was defined as the return to family labor and assets owned after deducting current costs (excluding family labor and rent for own land and assets) from gross value of production, which was estimated using average prices of products recorded for individual household. Current cost was the cost incurred by individual households in purchasing inputs, hiring labor and renting services (Hossain 1990). The analysis of household income included both farm and nonfarm income. Farm income included returns from crops (e.g., cereals, cash crops, vegetables and condiments), orchards, forests, livestock, poultry, fish, by-products and bioresources (cowdung, poultry manure and compost), and plant nurseries. Sources of nonfarm income included lease income, wages/salaries, business/petty trading and other miscellaneous occupations.

DEFINITION OF ASSETS

Household assets included both material possessions such as land, livestock, furniture, consumer durables, transport vehicles, farm equipment and liquid assets (e.g., ornaments, bonds/securities and financial savings).

Results

Demographic Profile of Households

Only four women out of the 333 respondents from both thanas were found to be heading their households (Table 2.2). Age distribution of the household heads was similar in both thanas. More than 80% of the household heads were in the working age (≤60 years). Twenty-five per cent of the members in the sample households were below 10 years of age. Forty-nine per cent of the household members in both thanas were 20 years old and below. On average, 45% in Kapasia and 47% in Sreepur were within the 21-60 years age bracket. In both thanas, around 5% of the household members were above the working age. These results imply that in the coming years, the size of labor force will increase tremendously. There were slight variations in the age distribution of male and female household members between the two thanas. However, in both thanas, the proportion of females to males was higher in the less than 10 years age bracket.

Table 2.2. Age distribution of heads and members in years, by gender, of the sample pond owner/operator households in Kapasia and Sreepur thanas, Gazipur district, Bangladesh, July 1990 - June 1991.

	Kapasia (n=193)						Sreepur (n=140)					
	Male		Female		Total		Male		Female		Total	
Age group	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Household heads												
<30 years	22	12	1	50	23	12	14	10	1	50	15	11
30-45 years	67	35	0	0	67	67	47	34	1	50	48	34
46-60 years	71	37	1	50	72	37	52	38	0	0	52	37
>60 years	31	16	0	0	31	16	25	18	0	0	25	18
Total	191	99	2	1	193	100	138	99	2	1	140	100
Entire household												
<10 years	192	20	212	30	404	25	135	22	155	28	290	25
10-20 years	237	25	139	19	376	24	166	27	113	21	279	24
21-60 years	388	47	329	46	717	45	277	46	270	49	547	47
>60 years	55	8	37	5	92	6	30	5	12	2	42	4
Total	872	55	717	45	1,589	100	608	53	550	47	1,158	100

The average family size of the respondent households of Kapasia (8.23) was similar to that of Sreepur (8.27) (Table 2.3). In both thanas, family size was higher for larger land ownership groups.

A very high rate of literacy was evident amongst the pond owner and operator households in both Kapasia and Sreepur (Table 2.4) as compared to the rate for the entire cross-section of population in the two thanas, which was slightly above 20% during the early 1980s (BBS 1985). Female literacy was relatively lower in both thanas.

Household Occupational Profile

The overwhelming majority (>80%) of the household heads had farming as principal occupation in both Kapasia and Sreepur (Table 2.5). About 16% of the household heads in Kapasia and 4% in Sreepur were principally occupied with business and salaried jobs. In Kapasia, one of the two female family heads was engaged in farming, the other in housekeeping, which are the usual occupations of rural women in Bangladesh. In Sreepur, both women were engaged in petty trading which is a departure from women's traditional role.

In both thanas, around 40% of the male household heads had secondary occupations (Figs. 2.1 and 2.2) mainly farming, business, salaried jobs and petty trading. Daily labor and rickshaw pulling were also reported for a few of the male household heads. Farming and salaried jobs as secondary occupations was more common in Kapasia (28%) than in Sreepur (18%).

Table 2.3. Average size (no. of members) of the sample pond owner/operator households in Kapasia and Sreepur thanas, Gazipur district, Bangladesh, July 1990 - June 1991.

Land ownership group	Kapasia n=193	Sreepur n=140
Small (<1.0 ha)	6.77	5.74
Medium (1.0-2.4 ha)	8.09	7.66
Large (>2.4 ha)	9.80	10.92
All	8.23	8.27

Occupational distribution of the members of the sample households give some important variations between the two thanas (Table 2.5). More male members worked in agriculture in Sreepur (41%) than Kapasia (34%). There were more students in Kapasia (male 33%; female 20%) than in Sreepur (male 23%; female 17%). Business and salaried jobs were also important among some male household members in

Table 2.4. Educational status of heads and members (above 6 years), by gender, of the sample pond owner/operator households in Kapasia and Sreepur thanas, Gazipur district, Bangladesh, July 1990 - June 1991

	Kapasia				Sreepur			
Educational level	Male		Female		Male		Female	
Household heads	n=191	%	n=2	%	n=138	%	n=2	%
No education	30	16	0	0	36	26	2	100
Can read only	16	8	0	0	8	6	0	0
Primary	54	28	0	0	51	37	0	0
Secondary	44	23	2	100	19	14	0	0
Higher secondary	31	16	0	0	14	10	0	0
Bachelor	16	8.5	0	0	10	7	0	0
Entire household	n=744	%	n=557	%	n=507	%	n=434	%
No education	96	13	135	24	146	29	159	37
Can read only	51	7	53	10	43	8	43	10
Primary	247	33	220	39	181	36	181	42
Secondary	204	27	116	21	61	12	36	8
Higher secondary	130	18	33	6	76	15	15	3
Bachelor	16	2	0	0	0	0	0	0
Literacy rate (%)								
Household heads		84		100		74		0
Entire household		87		76		72		63

Table 2.5 Distribution of principal occupation of heads and members, by gender, of the sample pond owner/operator households in Kapasia and Sreepur thanas, Gazipur district, Bangladesh, July 1990 - June 1991

	Kapasia				Sreepur			
Occupation	Male		Female		Male		Female	
Household heads	n=191	%	n=2	%	n=138	%	n=2	%
Farming	158	83	1	50	123	89	0	0
Housekeeping	0	0	1	50	2	1	0	0
Petty trading	1	<1	0	0	0	0	2	100
Business	14	7	0	0	1	<1	0	0
Salaried job	17	9	0	0	6	4	0	0
Driving	1	<1	0	0	6	4	0	0
Entire household	n=872	%[a]	n=717	%[a]	n=608	%[a]	n=550	%[a]
Farming	300	34	9	1	249	41	14	3
Daily labor	0	0	0	0	21	3	9	2
Housekeeping	2	<1	325	45	0	0	274	50
Bamboo/cane works	5	1	5	1	6	1	1	<1
Student	288	33	146	20	142	23	91	17
Petty trading	3	0	0	0	4	1	0	0
Business	29	3	0	0	22	4	9	2
Salaried job	62	7	13	2	23	4	4	1
Driving	1	<1	0	0	0	0	0	0
Others[b]	2	<1	0	0	4	1	0	0

[a]The sum of percentages may not equal to 100.
[b]Include rickshaw/cart pulling and boat driving.

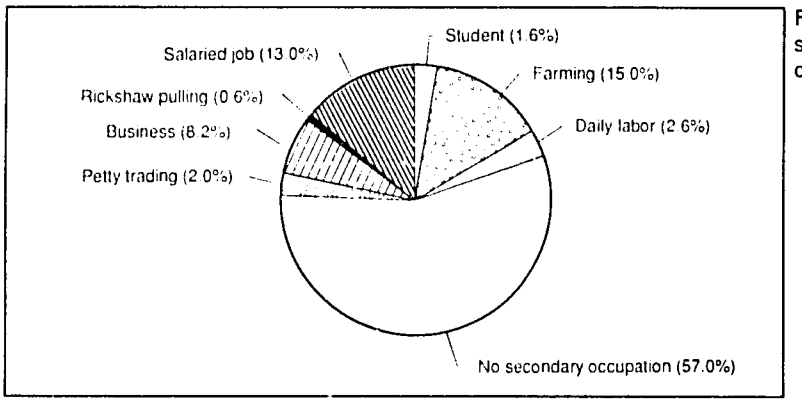


Fig. 2.1. Distribution of male household heads by secondary occupation in Kapasia thana, Gazipur district, Bangladesh, July 1990 - June 1991.

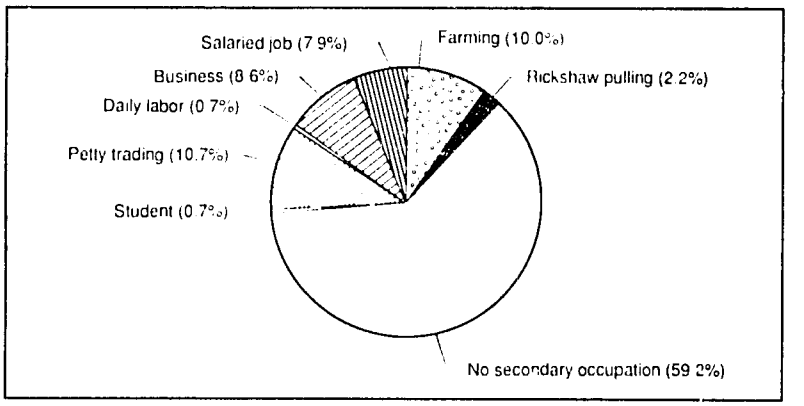


Fig. 2.2. Distribution of male household heads by secondary occupation in Sreepur thana, Gazipur district, Bangladesh, July 1990 - June 1991.

Kapasia (10%) and Sreepur (8%). Almost 45% of the female members in Kapasia and 50% in Sreepur were engaged in housekeeping activities. Overall, including the students, the percentage of economically and professionally active members in the household was 75% in both the thanas.

Household Assets: A Descriptive Profile

LAND OWNERSHIP AND FARM SIZE

Land is the most important asset in the portfolio of the rural households. On average, each pond operating/owning household in the two thanas owned more than 2 ha of land (Table 2.6). While crop land, fallow land and land under ponds and ditches were dominant in Sreepur, orchard/forest land and homestead land dominated in Kapasia.

Average land under crop cultivation was about 50% higher in Sreepur (1.38 ha) than in Kapasia (0.92 ha) (Table 2.7). More than 90% of the total cropped land in both thanas were owned by the households. However, total cropped land represented less than 70% of the total cultivable land owned by the household. Thus, the pond owner or operator households were net lessors in both thanas.

In general, pond owner/operator households are better endowed with land resources than other households (Tables 2.8 and 2.9). While 31 and 41% of all households in Kapasia and Sreepur, respectively, were landless, none in Kapasia and only 3% in Sreepur among the pond owner/operator households were landless. Among the pond owner/operator households, more than 70% owned above 1 ha of land (Table 2.8), while more than 62% of the farms were above 1 ha (Table 2.9). On the other hand, for the entire cross-section of households in the two thanas, owners of more than 1 ha land

Table 2.6. Average ownership of various types of land (ha) of the sample pond owner/operator households in Kapasia and Sreepur thanas, Gazipur district, Bangladesh, July 1990 - June 1991.

Land type	Land ownership group: Small (<1.0 ha)	Medium (1.0-2.4 ha)	Large (>2.4 ha)	All
Kapasia, n=193				
Homestead	0.063	0.094	0.144	0.100
Crop land	0.374	1.034	2.576	1.319
Orchard/forest	0.168	0.328	1.426	0.622
Fallow land	0	0.023	0.146	0.054
Pond/ditch	0.051	0.052	0.131	0.077
Total	0.656	1.531	4.423	2.172
Sreepur, n=140				
Homestead	0.067	0.083	0.114	0.089
Crop land	0.474	1.311	4.048	2.057
Orchard/forest	0.006	0.073	0.323	0.144
Fallow land	0.015	0.103	0.288	0.144
Pond/ditch	0.066	0.093	0.145	0.104
Total	0.628	1.663	4.916	2.538

Table 2.7. Average cropped land (ha) for various land ownership groups of the sample pond owner/operator households in Kapasia and Sreepur thanas, Gazipur district, Bangladesh, July 1990 - June 1991.

Ownership type	Land ownership group: Small (<1.0 ha)	Medium (1.0-2.4 ha)	Large (>2.4 ha)	All
Kapasia, n=193				
Own cultivable land	0.373	1.033	2.576	1.318
Own land cultivated	0.319	0.782	1.475	0.861
Share/leased in	0.164	0.013	0.027	0.062
Share/leased out	0.054	0.251	1.101	0.457
Total cropped land	0.483	0.795	1.502	0.923
Sreepur, n=140				
Own cultivable land	0.474	1.311	4.048	2.056
Own land cultivated	0.389	1.011	2.288	1.289
Share/leased in	0.158	0.127	0.005	0.092
Share/leased out	0.085	0.300	1.760	0.767
Total cropped land	0.547	1.138	2.293	1.381

Table 2.8. Distribution of households (%) by land ownership groups in Kapasia and Sreepur thanas, Gazipur district, Bangladesh, July 1990 - June 1991.

Land ownership	Kapasia: All households[a] (N=43,690)	Kapasia: Pond owner/ operator households[b] (n=193)	Sreepur: All households[a] (N=41,044)	Sreepur: Pond owner/ operator households[b] (n=140)
≤ 0.20 ha (landless)	31	0	36	3
0.21 - 0.40 ha	15	4	12	6
0.41 - 0.60 ha	14	9	11	4
0.61 - 1.00 ha	17	16	14	16
1.01 - 3.00 ha	21	51	23	44
≥ 3.01 ha	2	20	4	27

[a]BBS 1988a.
[b]Field survey.

Table 2.9. Distribution of households (%) by farm size (area under operation) in Kapasia and Sreepur thanas, Gazipur district, Bangladesh, July 1990 - June 1991.

Farm size	Kapasia: All households[a] (N=43,690)		Kapasia: Pond owner/operator households[b] (n=193)		Sreepur: All households[a] (N=41,044)		Sreepur: Pond owner/operator households[b] (n=140)	
	% of house-holds	Average farm size (ha)	% of house-holds	Average farm size (ha)	% of house-holds	Average farm size (ha)	% of house-holds	Average farm size (ha)
Nonfarm[c]	16.6	0	0	0	20.5	0	0	0
Small (0.02-1.00 ha)	60.4	0.43	34.7	0.65	52.6	0.42	37.9	0.62
Medium (1.01-3.00 ha)	20.7	1.60	50.3	1.74	22.9	1.68	45.0	1.88
Large (>3.00 ha)	2.3	4.45	15.0	4.52	3.9	4.56	17.1	4.56
Total	100.0	0.83	100.0	1.78	100.0	0.98	100.0	1.86

[a]BBS 1988a.
[b]Field survey.
[c]Nonfarm is defined as households cultivating an area up to 0.02 ha under various crops excluding homestead land.

constitute 25% or less of the total households (Table 2.8). Similarly, less than 27% of the entire households in the two thanas had farm holdings above 1 ha (Table 2.9).

LIVESTOCK HOLDING

Livestock is regarded as the second (next to land) most important asset of the rural households in Bangladesh. It generates income, protein and nutrition, and provides draft power to cultivate land. Ownership of livestock determines the economic position of the households as well. Table 2.10 presents the size of livestock holding and its value for the respondent households. A positive relationship was observed between ownership of livestock holding and ownership of land in both thanas.

Table 2.10. Average livestock holding and value, by land ownership groups, of the sample pond owner/operator households in Kapasia and Sreepur thanas, Gazipur district, Bangladesh, July 1990 - June 1991. (BDT37 = US$1 in 1991).

	Small (<1.0 ha)		Medium (1.0-2.4 ha)		Large (>2.4 ha)		All	
Type of livestock	No.	Value (BDT)	No.	Value (BDT)	No.	Value (BDT)	No.	Value (BDT)
Kapasia	n=57		n=76		n=60		n=193	
Bullock/buffalo	0.99	2,845	1.46	5,983	2.54	9,566	1.67	6,204
Cow	0.86	1,757	0.84	2,872	1.35	4,601	1.01	3,100
Calves/sheep/goats	1.27	1,325	1.47	1,007	2.39	1,893	1.71	1,393
Chicken/ducks	8.22	993	12.09	375	19.74	537	13.42	622
Sreepur	n=42		n=47		n=51		n=140	
Bullock/buffalo	1.34	2,943	1.57	6,298	2.65	8,565	1.88	6,037
Cow	0.90	1,309	0.69	2,340	1.29	3,963	0.96	2,584
Calves/sheep/goats	1.50	2,327	1.83	1,111	2.08	1,437	1.81	1,607
Chicken/ducks	9.36	1,909	14.82	368	21.24	508	15.36	901

DURABLE ASSETS AND FARM EQUIPMENT

Table 2.11 depicts ownership of durable assets such as electronics, transport vehicles, furniture and fixtures as well as farm equipment of the households. On average, in Sreepur 94% of the households and in Kapasia 61% of the households had at least one of the following electronic goods: radio, television and fan. A few households (3%) in both Kapasia and Sreepur owned agroprocessing equipment such as oil mills and paddy husking mills. Transport vehicles, mainly rickshaws and boats (manual) were owned by more than 55% of the households in both thanas. Wooden furniture and farm equipment (mechanized and traditional) were owned by the households in greater numbers and their values were higher in Sreepur than in Kapasia.

The average amount of fishing equipment, both in terms of number and value, was higher in Sreepur than in Kapasia (Table 2.11). In both thanas, most of the households owned only low-cost fishing equipment such as push net, baskets, fenced trap and lift net (Table 2.12). Only a few of the households owned a castnet (*Jhanki Jal*) and/or gillnet.

TREES AND PLANTS

Households of Kapasia were found richer than their counterparts in Sreepur in terms of ownership of trees and plants (Table 2.13). The average number of trees such as mango and jackfruit in Kapasia was more than double that in Sreepur. A positive relationship was also observed between ownership of trees and ownership of land in both thanas.

Table 2.11. Average ownership of durable assets of the sample pond owner/operator households in Kapasia and Sreepur thanas, Gazipur district, Bangladesh, July 1990 - June 1991. (BDT37 = US$1 in 1991).

	Small (<1.0 ha)		Medium (1.0-2.4 ha)		Large (>2.4 ha)		All	
Type of durable assets	No.	Value (BDT)	No.	Value (BDT)	No.	Value (BDT)	No.	Value (BDT)
Kapasia	n=57		n=76		n=60		n=193	
Electronics	0.28	539	0.50	801	1.05	2,522	0.61	1,258
Agroprocessors	0	0	0.04	571	0.03	1,117	0.03	572
Transport vehicles								
manual	0.23	445	0.57	998	0.95	1,975	0.58	1,109
mechanized	0.02	21	0.01	32	0.07	542	0.03	187
Furniture and fixtures	4.53	2,646	9.44	5,995	14.90	13,067	9.69	7,204
Farm equipment								
traditional	9.63	194	11.64	241	16.27	338	12.49	257
modern[a]		1,221		4,663		8,102		4,716
Fishing equipment	1.81	100	2.58	201	3.32	213	2.58	175
Others[b]		256		4,322		2,970		2,701
Sreepur	n=42		n=47		n=51		n=140	
Electronics	0.41	220	0.98	3,189	1.39	4,459	0.94	2,700
Agroprocessors	0	0	0	0	0.08	6,018	0.03	2,106
Transport vehicles								
manual	0.32	5,475	0.49	921	0.82	1,198	0.55	877
mechanized	0	0	0.06	1,766	0.06	692	0.04	835
Furniture and fixtures	3.18	1,452	9.79	7,317	17.24	15,618	10.32	8,379
Farm equipment								
traditional	9.55	197	13.98	319	15.35	351	13.06	292
modern[a]		1,080		4,851		12,159		6,224
Fishing equipment	2.14	125	3.11	187	3.47	249	2.93	189
Others[b]		227		2,714		963		9,511

[a]Data recorded in value terms only.
[b]Include traditional farm equipment whose quantities are not uniform, hence their numbers were not reported.

Table 2.12. Average number of fishing equipment owned by the sample pond owner/operator households and number of owning households in Kapasia and Sreepur thanas, Gazipur district, Bangladesh, July 1990 - June 1991.

	Kapasia (n=193)		Sreepur (n=140)	
Type of fishing equipment	Average no. of equipment	No. of owning households	Average no. of equipment	No. of owning households
Castnet (*Jhanki Jal*)	0.166	29	0.179	25
Gillnet	0.135	24	0.200	24
Push net	0.648	115	0.329	43
Fishing hook	0.104	8	0.607	20
Baskets	0.648	87	0.536	49
Fenced trap	0.301	40	0.714	66
Lift net	0.451	66	0.271	36
Bamboo trap (*Ucha*)	0.130	18	0.093	8

OWNERSHIP OF LIQUID ASSETS

Households of Sreepur owned more liquid assets than those in Kapasia (Table 2.14). Current average household savings was also higher in Sreepur. Savings by the large-scale farmers were higher in Kapasia than those of Sreepur, while farmers of Sreepur lent out higher amounts of money than their counterparts in Kapasia.

Table 2.13. Average ownership and value of trees and plants by land ownership groups of the sample pond owner/operator households in Kapasia and Sreepur thanas, Gazipur district, Bangladesh, July 1990 - June 1991. (BDT37 = US$1 in 1991).

Type of trees and plants	Small (<1.0 ha) No.	Small Value (BDT)	Medium (1.0-2.4 ha) No	Medium Value (BDT)	Large (>2.4 ha) No.	Large Value (BDT)	All No.	All Value (BDT)
Kapasia	n=57		n=76		n=60		n=193	
Mango	8	4,407	13	6,855	25	15,283	15	8,752
Jackfruit	13	9,723	23	21,708	50	43,720	29	25,011
Coconut	2	347	3	487	5	1,600	3	792
Betelnut	2	172	5	349	6	905	4	469
Bamboo	41	2,433	43	2,496	63	5,373	49	3,372
Others[a]		1,232		4,725		24,700		9,903
Total	66	18,314	87	36,620	149	91,581	100	48,299
Sreepur	n=42		n=47		n=51		n=140	
Mango	3	843	6	2,115	13	4,339	8	2,544
Jackfruit	4	2,498	10	5,106	25	13,861	14	7,513
Coconut	1	88	2	285	5	775	3	391
Betelnut	1	19	3	121	5	285	3	146
Bamboo	42	1,367	55	3,038	65	5,875	55	3,570
Others[a]		4,373		14,681		6,582		8,639
Total	51	9,188	76	25,346	113	31,717	83	22,803

[a]Include indigenous local trees and plants whose quantities are not uniform, hence their numbers were not reported.

Table 2.14. Ownership of liquid assets by land ownership groups of the sample pond owner/operator households in Kapasia and Sreepur thanas, Gazipur district, Bangladesh, July 1990 - June 1991. (BDT37 = US$1 in 1991).

Liquid assets	Kapasia Small (<1.0 ha) n=57	Kapasia Medium (1.0-2.4 ha) n=76	Kapasia Large (>2.4 ha) n=60	Kapasia All n=193	Sreepur Small (<1.0 ha) n=42	Sreepur Medium (1.0-2.4 ha) n=47	Sreepur Large (>2.4 ha) n=51	Sreepur All n=140
Current average savings (BDT)	144	1,161	2,217	1,189	68	2,960	1,102	1,416
Amount of money lent out (BDT)	35	82	1,933	643	647	2,289	3,071	2,081

Household Income: A Descriptive Profile

FARM INCOME

The average farm incomes for pond owner/operating households are shown in Table 2.15. Average farm income per household was about 39% higher in Kapasia than Sreepur. The share of cereals (rice and wheat) in the farm income in Sreepur (82%) was more than double that in Kapasia (39%). Orchards and forests contributed a large amount of income (32%) to the total farm income in Kapasia. In both thanas, the income from poultry and livestock (<3%) and fish (6%) relative to crops, orchards and forests was very small under the current farming systems.

Disaggregating household farm income by land ownership groups provided further insights. The distribution of income by land ownership groups showed that small-scale farmers obtain a relatively larger share of income from cereals in both thanas (Table

Table 2.15. Average annual farm income (BDT) by land ownership groups of the sample pond owner/operator households in Kapasia and Sreepur thanas, Gazipur district, Bangladesh, July 1990 - June 1991. (BDT37 = US$1 in 1991).

	Kapasia								Sreepur							
	Small (<1.0 ha) n=57		Medium (1.0-2.4 ha) n=76		Large (>2.4 ha) n=60		All n=193		Small (>1.0 ha) n=42		Medium (1.0-2.4 ha) n=47		Large (>2.4 ha) n=51		All n=140	
Source of farm income	Value (BDT)	%	Value (BDT)	%	Value (BDT)	%	Value (BDT)	%	Value (BDT)	%	Value (BDT)	%	Value (BDT)	%	Value (BDT)	%
Income per household	12,692	100	24,004	100	53,506	100	29,834	100	9,850	100	16,619	100	35,372	100	21,422	100
Cereals	5,572	44	10,105	43	19,055	36	11,549	39	7,516	76	12,999	78	28,869	82	17,136	80
Cash crops	675	5	2,273	9	4,962	9	2,637	9	-14[a]	-<1[a]	636	4	972	3	564	3
Vegetables	371	3	746	3	1,792	4	960	3	463	5	450	3	560	1	494	2
Other crops	23	<1	351	1	1,175	2	510	2	7	<1	279	1	422	1	250	2
Orchard and forest	3,679	29	7,500	31	18,137	34	9,678	32	185	2	660	4	1,755	5	917	4
Poultry and livestock	435	3	529	2	1,798	4	896	3	349	3	439	3	724	2	516	2
Fish	1,279	10	1,220	5	2,747	5	1,712	6	1,162	12	1,037	6	1,636	5	1,292	6
Plant nursery	377	4	836	4	1,733	3	979	3	0	0	0	0	0	0	0	0
By-products	281	2	444	2	2,107	4	913	3	182	2	119	1	434	1	253	1
Income per caput	1,875		2,956		5,460		3,625		1,716		2,169		3,240		2,590	
Cereals	823		1,249		1,944		1,403		1,309		1,697		2,644		2,072	
Cash crops	100		281		506		320		-2[a]		83		89		68	
Vegetables	55		92		183		117		81		59		51		60	
Other crops	3		43		120		62		1		36		39		30	
Orchard and forest	543		927		1,851		1,176		32		86		161		111	
Poultry and livestock	64		65		184		109		61		57		66		62	
Fish	189		151		280		208		202		135		150		156	
Plant nursery	56		103		177		119		0		0		0		0	
By-products	42		55		215		111		32		16		40		31	

[a]Negative values were attributed to low prices of jute which is gradually losing its market, as reported by jute-growing farmers.

2.15). In both Kapasia and Sreepur, medium- and large-scale farmers accrued larger shares of farm income from orchard and forest than did the small-scale farmers.

NONFARM INCOME

Unlike farm income, the average nonfarm income was higher in Sreepur than Kapasia by 12% (Table 2.16). Most important components of nonfarm income were lease income, wages and salaries from nonagricultural sources and business income. In Kapasia, wages and salaries from nonagricultural sources were found more important, followed by lease income and business. But in Sreepur, lease income came first, followed by business income and wages from nonagricultural sources.

The disaggregated picture of nonfarm income revealed that small- and medium-scale farmers derive higher average nonfarm income in Kapasia than their counterparts in Sreepur (Table 2.16). However, this was opposite in the case of large-scale farmers. Large-scale farmers in both Kapasia and Sreepur obtained larger shares of nonfarm income from leasing out of assets such as land, farm and nonfarm equipment. Share of nonfarm income maintained a positive relationship with land size groups. Although the share of business income in Kapasia showed a negative relationship with land holding, in Sreepur no such pattern followed.

TOTAL HOUSEHOLD INCOME

The average family income in 1991 for the households was estimated to be Bangladesh Taka (BDT) 56,639 (US$1,531) in Kapasia and BDT51,440 (US$1,390) in Sreepur (Table 2.17). In per caput annual income, these translate to BDT6,882 (US$186) for Kapasia and BDT6,264 (US$169) for Sreepur.

Comparison of farm and nonfarm income by land size groups gives an interesting picture. In Kapasia, the contribution of farm income to total income increases as farm ownership of land increases unlike in Sreepur (Table 2.17). In Sreepur, the contribution of nonfarm income were higher for medium (60%) and large (59%) land owning households than for the small (50%) land owning households.

The overall socioeconomic status of the pond owner/operator households appeared to be much higher than the rest of the community. This was also supported by data from Table 2.18 which shows the distribution of households by amount of annual tax levied by the local union parishads. More than 70% of the pond owner/operator households in Kapasia were levied above the mean amount of tax (BDT10), the average being BDT22. Size of farm, land ownership and level of income were the major criteria of tax assessment by the local union parishads (GOB-ICLARM 1991).

Consumption Pattern of Households

Level and composition of different food and nonfood items in the consumption bundle of households are functionally dependent on the level of disposable income. Generally, there is a positive relationship between consumption and disposable income. Consumption increases as income increases but it may not increase as much as income increases. At higher levels of income, there may be a change in the composition of consumption bundles as the consumers will substitute superior commodities to inferior ones. Integration of improved aquaculture within the existing farming systems, it is believed, will enhance income of the households through efficient allocation of on-farm resources both technically and economically and thereby increase whole farm productivity along with higher fish

Table 2.16. Average annual nonfarm income (BDT) by land ownership groups of the sample pond owner/operator households in Kapasia and Sreepur thanas, Gazipur district, Bangladesh, July 1990 - June 1991 (BDT37 = US$1 in 1991)

	Kapasia								Sreepur							
	Small (<1.0 ha) n=57		Medium (1.0-2.4 ha) n=76		Large (>2.4 ha) n=60		All n=193		Small (<1.0 ha) n=42		Medium (1.0-2.4) n=47		Large (>2.4 ha) n=51		All n=140	
Source of nonfarm income	Value (BDT)	%	Value (BDT)	%	Value (BDT)	%	Value (BDT)	%	Value (BDT)	%	Value (BDT)	%	Value (BDT)	%	Value (BDT)	%
Income per household	15,703	100	26,666	100	37,521	100	26,804	100	9,739	100	24,954	100	51,387	100	30,018	100
Lease income	2,582	16	4,239	16	14,895	40	7,063	26	905	9	3,570	14	20,135	39	8,805	29
Wages from agriculture	422	3	72	<1	0	0	153	1	700	7	149	<1	127	<1	306	1
Wages and salaries from nonagriculture[a]	6,852	44	13,526	51	11,410	30	10,897	41	4,309	44	1,987	8	10,210	20	5,679	19
Petty trading	526	3	421	2	233	1	394	1	2,511	26	2,659	11	1,607	3	2,232	8
Business	3,363	22	3,842	14	2,258	6	3,210	12	71	1	8,672	35	12,800	25	7,595	25
Others[b]	1,953	12	4,566	17	8,725	23	5,087	19	1,243	13	7,917	32	6,508	13	5,401	18
Income per caput	2,318		3,296		3,828		3,257		1,697		3,257		4,706		3,630	
Lease income	381		524		1,520		858		158		456		1,844		1,065	
Wages from agriculture	62		9		0		19		122		19		12		37	
Wages and salaries from nonagriculture[a]	1,012		1,672		1,164		1,324		751		259		935		687	
Petty trading	78		52		24		48		437		347		147		270	
Business	497		475		230		390		12		1,132		1,172		918	
Others[b]	288		564		890		618		217		1,034		596		653	

[a]Nonagricultural wages also include remittances by household members who are employed in salaried jobs, or engaged in petty jobs, away from home or outside the country.
[b]Include handicrafts, cart pulling, boat plying, etc.

Table 2.17. Summary of total income (BDT) by land ownership groups of the sample pond owner/operator households in Kapasia and Sreepur thanas, Gazipur district, Bangladesh, July 1990 - June 1991. (BDT37 = US$1 in 1991).

Land ownership group	Farm income		Nonfarm income		Total income
	Value (BDT)	% to total income	Value (BDT)	% to total income	Value (BDT)
Income per household					
Kapasia, n=193	29,835	53	26,804	47	56,639
Small (<1.0 ha), n=57	12,693	45	15,705	55	28,398
Medium (1.0-2.4 ha), n=76	24,000	47	26,667	53	50,667
Large (>2.4 ha), n=60	53,504	59	37,522	41	91,026
Sreepur, n=140	21,420	42	30,020	58	51,440
Small (<1.0 ha), n=42	9,850	50	9,740	50	19,590
Medium (1.0-2.4 ha), n=47	16,619	40	24,955	60	41,574
Large (>2.4 ha), n=51	35,373	41	51,388	59	86,761
Income per caput					
Kapasia, n=193	3,625		3,257		6,882
Small (<1.0 ha), n=57	1,875		2,320		4,195
Medium (1.0-2.4 ha), n=76	2,967		3,296		6,263
Large (>2.4 ha), n=60	5,460		3,829		9,289
Sreepur, n=140	2,634		3,630		6,264
Small (<1.0 ha), n=42	1,716		1,697		3,413
Medium (1.0-2.4 ha), n=47	2,170		3,258		5,428
Large (>2.4 ha), n=51	3,331		4,706		8,037

Table 2.18. Distribution of households by amount of tax levied by union parishad in Kapasia thana, Gazipur district, Bangladesh, July 1990 - June 1991. (BDT37 = US$1 in 1991).

Tax group	Number of household (%)	
	All households[a] (n=13,067)	Pond owner/operator households (n=193)
<BDT10	68	29
BDT11-20	20	35
BDT21-30	7	14
>BDT30	5	23
Mean tax	10	22
Standard deviation of mean tax	12	15

[a]Based on tax assessment list from union parishads in four selected unions in Kapasia thana.

production. Thus, consumption patterns of the households are expected to be changed due to increases in farm productivity and income: particularly per caput fish consumption might increase due to increased availability of fish from farm and at the market. This section of the report describes the existing consumption behavior of the pond owner/ operator households before introducing aquaculture extension activities. This can be compared in the post-intervention situation to measure the impacts on consumption.

CONSUMPTION OF MAJOR FOOD ITEMS

Table 2.19 presents per household and per caput consumption of different food items in the two thanas. It shows that per household and per caput consumption of most food items was higher in Sreepur than in Kapasia. Fish, dry fish, meat (poultry, beef and mutton) and eggs were the main sources of animal protein to the members of household. Excluding the consumption of eggs, per caput annual consumption of animal protein was 18.3 kg in Kapasia and 24.8 kg in Sreepur, of which fresh and dry fish contributed nearly 70%.

Annual consumption of fish (fresh and dried) per household was higher in Sreepur (142 kg) than in Kapasia (107 kg) by 33% (Table 2.19). The consumption of fish (fresh and dried) against the consumption of meat is higher by 143% in Kapasia and 125% in

Table 2.19. Average per household and per caput consumption (kg) of different food items, by land ownership groups, of the sample pond owner/operator households in Kapasia and Sreepur thanas, Gazipur district, Bangladesh, July 1990 - June 1991.

	Kapasia				Sreepur			
Food items	Small (<1.0 ha) n=57	Medium (1.0-2.4 ha) n=76	Large (>2.4 ha) n=60	All n=193	Small (<1.0 ha) n=42	Medium (1.0-2.4 ha) n=47	Large (>2.4 ha) n=51	All n=140
Consumption (kg) per household								
Rice	1,335	1,776	2,417	1,845	1,248	1,949	3,178	2,186
Wheat	31	16	49	31	25	16	26	23
Pulse	27	37	61	41	33	54	83	58
Vegetables	303	369	541	403	447	538	807	609
Fish	77	97	140	105	76	138	191	139
Meat	23	39	69	44	28	63	91	63
Salt	39	53	70	54	49	63	88	68
Soyabean	19	27	43	30	14	28	38	28
Dry fish	2	2	3	2	2	3	5	3
Sugar	51	79	123	84	38	79	81	67
Milk (liter)	109	127	248	159	74	179	249	173
Egg (no.)	93	167	245	169	111	205	235	188
Consumption (kg) per caput								
Rice	197.2	219.5	246.6	224.2	217.4	254.4	291.0	264.3
Wheat	4.6	2.0	5.0	3.8	4.4	2.1	2.4	2.8
Pulse	4.0	4.6	6.2	5.0	5.7	7.0	7.6	7.0
Vegetables	44.8	45.6	55.2	49.0	77.9	70.2	73.9	73.6
Fish	11.4	12.0	14.3	12.8	13.2	18.0	17.5	16.8
Meat	3.4	4.8	7.0	5.3	4.9	8.2	8.3	7.6
Salt	5.8	6.6	7.1	6.6	8.5	8.2	8.1	8.2
Soyabean	2.8	3.3	4.4	3.6	2.4	3.7	3.5	3.4
Dry fish	0.3	0.2	0.3	0.2	0.3	0.4	0.4	0.4
Sugar	7.5	9.8	12.6	10.2	6.6	10.3	7.4	8.1
Milk (liter)	16.1	15.7	25.3	19.3	12.0	23.4	22.8	20.9
Egg (no.)	13.7	20.9	25.0	20.5	19.0	27.0	22.0	22.7

Sreepur. Per caput annual consumption of fresh fish was estimated at 12.8 and 16.8 kg, respectively, in Kapasia and Sreepur. In addition, households under study consumed 2-3 kg of dry fish annually: a per caput of 0.2 kg in Kapasia and 0.4 kg in Sreepur.

Average annual consumption of fruits was higher in Kapasia than Sreepur (Table 2.20). This was due to a higher on-farm availability of fruits among the households of Kapasia. Average consumption of food items and fruits increased as farm size increased. This relationship between consumption of food items and farm size remained valid in terms of consumption per caput also (Table 2.19).

Table 2.20. Average per household consumption of fruits by land size groups of the sample pond owner/operator households in Kapasia and Sreepur thanas, Gazipur district, Bangladesh, July 1990 - June 1991.

	Kapasia				Sreepur			
Type of fruits	Small (<1.0 ha) n=57	Medium (1.0-2.4 ha) n=76	Large (>2.4 ha) n=60	All n=193	Small (<1.0 ha) n=42	Medium (1.0-2.4 ha) n=47	Large (>2.4 ha) n=51	All n=140
Jackfruit (no.)	94	148	260	167	66	146	183	135
Banana (bunch)	8	12	18	13	5	15	18	13
Mango (kg)	29	53	83	55	26	53	76	53
Watermelon (no.)	2	3	5	4	3	7	9	6
Litchi (no.)	2,065	863	1,293	1,352	273	917	782	675
Pineapple (no.)	33	56	93	61	18	29	33	27
Papaya (kg)	12	22	22	19	13	27	35	26
Guava (no.)	1,577	1,319	1,927	1,584	1,134	743	931	929
Coconut (no.)	28	45	78	50	13	38	47	34

CONSUMPTION EXPENDITURE PATTERN

Per household consumption expenditure on food and other items showed that the average consumption expenditure was 10% higher in Sreepur than in Kapasia (Table 2.21). Consumption expenditure pattern of the households by farm size showed as expected: small farm households had higher share of expenditure incurred for food items, particularly for cereals. In wealthier households, this pattern reverses so that the higher land owning households tend to allocate proportionately more for nonfood and less for food, particularly cereals.

Most of the food items in the consumption bundle of the households were on-farm agricultural products (Table 2.22). This was expected as farms were diversified in choice of crops. The table also shows distribution of expenditure on different food items by sources (on-farm and purchased) by farm size. Generally, expenditure share for on-farm consumption goods increased as farm size increased in both thanas. On-farm shares of cereals and fruits, which were produced in abundance by most of the households in both thanas, were higher irrespective of farm size.

Fish Consumption Behavior

Average per caput fish consumption of the sample households in both thanas (shown in Table 2.19) was much higher than the average national consumption per caput, reported by the Food and Agriculture Organization (FAO 1991) as 7.5 kg during the 1980s. However, there are sources (such as household expenditure surveys by the Bangladesh Bureau of Statistics and nutrition surveys of the Institute of Nutrition and Food Sciences) that suggested a steady increase of per caput consumption of fish from 9.84 to

Table 2.21. Average per household consumption expenditures (BDT) on food and nonfood items, by land ownership groups, of the sample pond owner/operator households in Kapasia and Sreepur thanas, Gazipur district, Bangladesh, July 1990 - June 1991. (BDT37 = US$1 in 1991).

Consumption items	Kapasia				Sreepur			
	Small (<1.0 ha) n=57	Medium (1.0-2.4 ha) n=76	Large (>2.4 ha) n=60	All n=193	Small (<1.0 ha) n=42	Medium (1.0-2.4 ha) n=47	Large (>2.4 ha) n=51	All n=140
Food	30,625	40,649	58,856	43,350	27,507	46,541	67,068	48,307
Cereals[a]	15,738	20,739	27,847	21,472	14,118	22,439	35,184	24,586
Pulse	698	970	1,536	1,066	901	1,459	2,242	1,577
Vegetables	2,337	2,772	4,163	3,076	2,780	3,999	4,999	3,998
Oils and fats	2,029	2,533	4,554	3,012	1,395	3,086	4,229	2,995
Fruits	3,682	4,913	7,516	5,359	2,326	4,497	5,288	4,133
Meat	1,270	2,068	3,728	2,348	1,382	3,103	4,595	3,130
Fish	3,441	4,462	6,219	4,707	3,215	5,440	7,608	5,562
Sugar/molasses	958	1,475	2,293	1,577	711	1,466	1,649	1,306
Others[b]	472	717	1,000	733	679	1,052	1,274	1,020
% to total expenditures	77	72	74	74	79	76	73	75
Nonfood	8,962	15,836	20,740	15,330	7,354	14,986	24,657	16,219
Energy and fuels	910	2,475	1,233	1,627	695	1,251	1,780	1,277
Clothing	3,407	5,333	7,228	5,353	2,619	5,462	9,190	5,967
Education	2,053	4,277	6,182	4,212	552	4,045	6,576	3,919
Services[c]	2,342	3,183	4,682	3,400	3,031	3,243	6,302	4,294
Others[d]	250	568	1,415	738	457	985	808	762
% to total expenditures	23	28	26	26	21	24	27	25
Total food and nonfood	39,587	56,485	79,596	58,680	34,861	61,527	91,725	64,526

[a]Include rice, wheat, etc.
[b]Include salt, milk, eggs, etc.
[c]Include medicare and recreation.
[d]Include recreation, festivals, maintenance of assets, etc.

13.18 kg between 1973-74 and 1985-86. As for the rural households, it has increased from 9.84 to 12.67 kg during this period (World Bank 1991). Nevertheless, higher per caput consumption of fish among pond owner/operator households were expected, as they represent a higher economic class in terms of income and wealth than the rest of the community.

The share of average household expenditure on fish (Table 2.21) did not vary significantly among different land size groups in both thanas. Fish ranked first in terms of cash expenditure and accounted for 22 and 24% of the total cash expenditure on food items in Kapasia and Sreepur, respectively (Table 2.22). However, as shown in Table 2.23, proportion of cash expenditure devoted to purchase of fish is higher for higher land size groups. This implies that a positive relationship exists between market demand for fish and income of the households.

Sample households, despite being owners or operators of ponds, still relied mostly on purchased fish for household consumption in both thanas. Of the total per caput household consumption of fish, 68% in Kapasia and 78% in Sreepur came from purchased sources (Table 2.22).

DEMAND FOR FISH

The above analyses of fish consumption behavior can be explained by a demand model where quantity of fish consumption is the dependent variable, while price, per caput

Table 2.22. Average per household consumption expenditures (BDT) on food items, by source, by land ownership groups, of the sample pond owner/operator households in Kapasia and Sreepur thanas, Gazipur district, Bangladesh, July 1990 - June 1991. (BDT37 = US$1 in 1991).

	Small (<1.0 ha)				Medium (1.0-2.4 ha)				Large (>2.4 ha)				All			
Consumption items	On-farm	%	Bought	%	On-farm	%	Bought	%	On-farm	%	Bought	%	On-farm	%	Bought	%
Kapasia			n=57				n=76				n=60				n=193	
Cereals	10,005	61	5,733	40	17,891	66	2,847	21	26,715	64	1,131	7	18,305	64	3,166	21
Pulse	45	<1	653	5	183	1	787	6	253	1	1,284	8	164	1	902	6
Vegetables	699	4	1,537	12	953	4	1,819	13	1,717	4	2,446	14	1,115	4	1,960	13
Oils and fats	631	4	1,398	10	711	3	1,823	13	1,698	4	2,856	17	994	3	2,019	14
Fruits	3,104	19	577	4	4,262	16	651	5	6,780	16	735	4	4,703	17	656	4
Meat	259	2	1,011	7	383	1	1,684	12	1,031	2	2,697	16	548	2	1,800	12
Fish	1,217	7	2,224	16	1,447	5	3,015	22	1,836	4	4,383	26	1,500	5	3,207	22
Sugar/molasses	418	2	540	4	952	3	523	4	1,598	4	695	4	995	3	582	4
Others[a]	117	1	355	2	159	1	558	4	321	1	680	4	197	1	536	4
Total	16,495	100	14,128	100	26,941	100	13,707	100	41,949	100	16,908	100	28,521	100	14,828	100
Sreepur			n=42				n=47				n=51				n=140	
Cereals	10,011	74	4,106	30	20,164	69	2,275	13	34,042	77	1,142	5	22,174	74	2,412	13
Pulse	0	0	901	6	108	<1	1,351	8	142	<1	2,099	9	88	<1	1,489	8
Vegetables	745	6	2,034	15	1,476	5	2,524	15	1,366	3	3,634	16	1,216	4	2,782	15
Oils and fats	251	2	1,143	8	1,131	4	1,955	11	1,358	3	2,872	13	950	3	2,046	11
Fruits	1,413	10	912	6	3,388	12	1,109	6	4,040	9	1,248	6	3,033	10	1,100	6
Meat	155	1	1,228	9	476	2	2,627	15	723	2	3,872	17	470	2	2,660	15
Fish	675	5	2,540	18	1,253	4	4,187	24	1,639	4	5,969	26	1,220	4	4,342	24
Sugar/molasses	164	1	547	4	741	3	725	4	644	1	1,005	4	533	2	773	4
Others[a]	186	1	493	4	390	1	662	4	439	1	835	4	347	1	674	4
Total	13,600	100	13,904	100	29,127	100	17,415	100	44,393	100	22,676	100	30,031	100	18,278	100

[a]Include salt, milk, eggs, etc.

Table 2.23. Proportion of expenditure on fish to total expenditure on food items (%) and per caput annual consumption of fish (kg), by land size groups, of the sample pond owner/operator households in Kapasia and Sreepur thanas, Gazipur district, Bangladesh, July 1990 - June 1991.

	% of household expenditures on fish to total expenditure on food items			Per caput annual consumption of fish (kg)		
	Category of expenditure			Category of expenditure		
Land size	In-kind (on-farm)	Cash (bought)	Total	In-kind (on-farm)	Cash (bought)	Total
Kapasia, n=193	5	22	11	4.06	8.94	13.00
Small (<1.0 ha), n=57	7	16	11	4.02	7.68	11.70
Medium (1.0-2.4 ha), n=76	5	22	11	3.82	8.38	12.20
Large (>2.4 ha), n=60	4	26	11	4.22	10.38	14.60
Sreepur, n=140	4	24	12	3.68	13.12	17.20
Small (<1.0 ha), n=42	5	18	12	2.77	10.43	13.50
Medium (1.0-2.4 ha), n=47	4	26	12	4.14	13.86	18.40
Large (>2.4 ha), n=51	4	26	11	3.76	13.84	17.90

expenditure or income and other related variables are explanatory variables. The model in log-linear form provides expenditure elasticities or income elasticities which measure the percentage change in the demand for fish in response to a percentage change in total expenditure or income. In other words, Engel elasticities for fish are estimated. Fish consumption by households may also depend on the number of household members. Larger-sized households may have less per caput consumption of fish. The price of fish and substitute products such as chicken and beef is expected to have independent effects on demand for fish. As price data on chicken and beef are not available, cash expenditure on meat has been used as a proxy for chicken and beef prices. Another factor which seems vital in the model is on-farm availability of fish. Per caput consumption of fish will be less if on-farm availability of fish is higher. Since per caput relationships are found to be more meaningful and stable, the model used the variables on a per caput basis. The specific log-linear form of the fish consumption demand is as follows:

$$\log FE = a + b_1 \log TE + b_2 \log PF + b_3 \log PM + b_4 \log FS + b_5 \log FA$$

where FE = per caput consumption of fish
TE = per caput total expenditure
PF = price of fish
PM = per caput cash expenditure on meat
FS = family size
FA = per caput on-farm availability of fish

and the estimated parameters (b_i) measure elasticities with respect to i^{th} variable.

REGRESSION RESULTS AND COEFFICIENTS OF ELASTICITY

The results of Ordinary Least Squares (OLS) estimates for the above model are shown in Table 2.24. Explanatory power of the regression equation was low (adjusted R^2=0.22) but the F value was highly significant. The coefficients for expenditure elasticities, cross elasticities (expenditure on meat) and family size were all statistically significant at the 1%

Table 2.24. Factors determining fish demand in the study thanas: regression estimates.

Independent variables	Regression coefficients	T-values	Mean	Standard deviation
Price of fish (PF)	-0.56*	-2.06	39.24	5.26
Per caput cash expenditure on meat (PM)	0.28**	4.93	303.62	302.57
Per caput on-farm availability of fish (FA)	-0.02	-1.23	5.08	5.50
Family size (FS)	-0.21**	-2.80	7.93	4.26
Per caput total cash expenditure (TE)	0.29**	2.94	10,521.22	8,640.54
Constant	0.55	0.42		
Adjusted R^2 = 0.22				
F = 19.81**				

*Significant at 5%.
**Significant at 1%.

level. The coefficient for own price elasticity was also significant at 5%. The sign of the coefficient of per caput on-farm availability of fish was negative as expected, though not significant. This implies that per caput consumption of purchased fish will be less if on-farm availability of fish increases. Fish consumption needs of the household could then be met from the supply coming from family farms. The coefficient for own price elasticity was also less than one. It implies that if price of fish would decrease by 1%, fish consumption would increase by only 0.56%. Similarly, expenditure elasticity (0.29) was also quite low, although expenditure elasticity of fish for rural households in general is reported to be above one (BBS 1991). The general low value of elasticities of price and expenditure could be due to the presence of significant on-farm consumption of fish as substitutes for purchased fish.

Given the very low value of estimates of own price elasticity of demand, any efforts to increase on-farm supply of fish have the following implications: aquaculture in small waterbodies will certainly increase fish supply in the rural markets and consequently price of fish will decline. But this decrease in price may not be sufficient enough to absorb the entire supply by the market since the demand for fish is price inelastic (<1.0, i.e., 0.56). Moreover, the low value for expenditure elasticity implies that demand for fish is also not very much responsive to income changes. Hence, there is a chance of overproduction and farmers may face price uncertainty if they have to depend only on the local village markets to sell their fish products. On the other hand, the demand for fish in the urban markets is evidently higher. Urban consumers have higher purchasing power. Some recent surveys (e.g., BBS 1988b, 1991; INFS 1977, 1983) have reported an increasing trend in urban fish consumption (World Bank 1991). Therefore, an increased flow of fish from rural to urban markets can be foreseen. However, this will require a better marketing infrastructure which includes development of a sound marketing network, better transport and storage facilities.

Farm Production Activities

Farms in Bangladesh are generally rice-based, although a wide range of crops is grown on the farms, based on crop suitability and on the type and quality of land. In addition, irrigation facilities, subsistence needs of the farmers and risk of crop failure may also determine crop choices by the farmers. It was hypothesized that the introduction of

improved aquaculture into the existing farming systems will not have any significant negative effect on the current cropping pattern and productivity of the farms.

CROPPING PATTERN

Pond operating households of both Kapasia and Sreepur were found to cultivate varieties of crops including horticulture products. Cropping patterns as well as land allocation patterns to different crops and orchard/forest products are shown in Tables 2.25 and 2.26, respectively. As shown in Table 2.25, farm households in Kapasia and Sreepur were cultivating similar crops with some variations with regard to land allocation among crops. The major differences were that households of Kapasia grew more *boro* rice, while households of Sreepur grew wheat in addition to smaller *boro* rice during the dry season.

In both thanas, most cultivated land was allocated for *aman* rice grown during August-December. This share was 90% in Sreepur and 71% in Kapasia (Table 2.25). Cultivated

Table 2.25. Allocation of cultivated lands to different crops (%) in the sample pond owner/operator households in Kapasia and Sreepur thanas, Gazipur district, Bangladesh, July 1990 - June 1991.

	Kapasia				Sreepur			
Type of crops	Small (<1.0 ha) n=57	Medium (1.0-2.4 ha) n=76	Large (>2.4 ha) n=60	All n=193	Small (<1.0 ha) n=42	Medium (1.0-2.4 ha) n=47	Large (>2.4 ha) n=51	All n=140
Aus (rice)	52.8	47.9	40.2	44.7	61.4	51.6	44.0	48.1
Aman (rice)	68.7	69.8	73.0	71.1	95.5	91.1	88.8	90.3
Boro (rice)	46.9	43.8	47.4	46.1	17.0	16.4	15.5	15.8
Wheat	0	0	0	0	1.5	0.4	1.8	1.2
Sugarcane	5.0	10.7	11.9	10.5	0	3.9	2.6	2.6
Jute	4.2	6.6	6.2	6.1	1.5	2.1	2.3	2.3
Vegetables	2.3	3.1	3.3	3.2	0.5	1.2	1.1	1.1
Other minor crops[a]	3.6	5.3	5.7	5.1	0	3.0	1.5	1.8
Total	183.5	187.2	187.7	186.8	177.4	169.7	157.6	163.2
Total cultivated land (ha)	0.656	1.531	4.423	2.172	0.628	1.663	4.918	2.538

[a]Include oil seeds, pulses, condiments, grain, etc.

Table 2.26. Allocation of orchard/forest lands (%) to fruits and trees in the sample pond owner/operator households in Kapasia and Sreepur thanas, Gazipur district, Bangladesh, July 1990 - June 1991.

	Kapasia				Sreepur			
Type of fruits and trees	Small (<1.0 ha) n=57	Medium (1.0-2.4 ha) n=76	Large (>2.4 ha) n=60	All n=193	Small (<1.0 ha) n=42	Medium (1.0-2.4 ha) n=47	Large (>2.4 ha) n=51	All n=140
Papaya	0.4	0.1	0	0.1	0	2.1	0	0.4
Banana	7.9	3.9	1.3	2.2	0	0	0.8	1.0
Pineapple	3.3	5.2	2.2	2.9	0	0	0.2	0
Mango	1.6	4.6	4.7	4.4	12.8	4.3	3.1	3.4
Jackfruit	4.3	6.4	11.2	9.7	29.0	21.6	15.8	17.0
Litchi	0	0.6	0.4	0.4	0	0.2	0.0	0.1
Guava	18.6	13.2	6.2	8.7	0	0.3	0.4	0.3
Forest/trees	44.1	47.6	50.2	49.1	37.1	50.4	67.7	64.4
Bamboo	5.8	7.6	4.7	5.4	17.5	4.0	3.1	3.4
Total	86.0	89.2	80.9	82.9	96.4	82.9	91.1	90.0
Total land (ha)	0.168	0.328	1.426	0.622	0.006	0.073	0.323	0.144

land allocated for *aus* rice grown during April-August was slightly higher by 3% in Sreepur than Kapasia. As for *boro* rice grown during January-May, allocation of land was significantly higher in Kapasia (46%) than Sreepur (16%). Variation in the land allocation and cropping pattern between the two thanas was due to differences in land type and water supply. In Kapasia, lands were moist and had better irrigation facilities. Cropping intensity, measured by total cropped land as a percentage of cultivated land (Hossain 1977), was higher in Kapasia (187%) than Sreepur (163%).

Different patterns of land allocation to fruits and trees between the two thanas (Table 2.26) were also due to different land types. Sloping lands at higher elevations in Kapasia were generally suitable for cultivation of perennial crops like fruits, woods and forest. Total available land to households for orchard/forest was more than four times higher in Kapasia (0.62 ha) than in Sreepur (0.14 ha). Fruit crops were much less important in Sreepur than in Kapasia.

CROP PRODUCTION

Table 2.27 shows the number of farm households that cultivate each of the major crops and average productivity (kg/ha) of crops for different land ownership groups in Kapasia and Sreepur. More farm households cultivated *aus* and *aman* crops in Sreepur,

Table 2.27. Average productivity (kg/ha) of different crops cultivated by the sample pond owner/operator households in Kapasia and Sreepur thanas, Gazipur district, Bangladesh, July 1990 - June 1991.

	Kapasia				Sreepur			
Type of crops	Small (<1.0 ha) n=57	Medium (1.0-2.4 ha) n=76	Large (>2.4 ha) n=60	All n=193	Small (<1.0 ha) n=42	Medium (1.0-2.4 ha) n=47	Large (>2.4 ha) n=51	All n=140
Average productivity (kg/ha)								
Aus (rice)	1,305	1,167	1,177	1,212	1,828	1,648	1,631	1,695
Aman (rice)	2,306	2,280	2,412	2,331	2,565	2,805	2,674	2,687
Boro (rice)	4,314	4,269	4,492	4,361	4,431	3,279	4,259	3,946
Wheat	0	0	0	0	619	653	760	719
Jute	1,385	1,164	1,143	1,202	1,099	912	1,112	1,040
Oil seeds	741	1,044	706	781	0	112	282	180
Pulses	511	588	611	585	0	557	487	522
Potato	7,410	6,117	9,139	7,165	0	5,222	7,849	6,536
Condiments	5,629	5,234	6,889	5,940	3,108	6,182	5,402	5,527
Arum	5,534	6,199	10,474	8,363	7,513	10,453	19,680	15,306
Sugarcane	3,921	3,208	3,812	3,647	0	3,596	3,264	3,443
Vegetables[a]	57	125	247	147	97	104	232	149
% of households engaged in crop production								
Aus (rice)	70	70	68	69	76	77	78	77
Aman (rice)	82	80	90	84	88	91	88	89
Boro (rice)	61	70	83	72	29	43	47	40
Wheat	0	0	0	0	5	4	16	12
Jute	28	41	50	40	21	34	41	33
Oil seeds	2	1	5	3	0	6	4	9
Pulses	11	21	25	19	0	11	10	7
Potato	2	5	3	4	0	2	2	1
Condiments	30	59	65	52	7	28	20	19
Arum	4	17	27	16	5	9	16	10
Sugarcane	19	42	47	39	0	15	12	9
Vegetables	100	100	100	100	100	100	100	100

[a]Kilogram per household.

while more *boro* crops were cultivated in Kapasia. Around 40 and 33% of farm households were found to cultivate jute in Kapasia and Sreepur, respectively. Sugarcane and condiments were cultivated by 39 and 52% of the farmers in Kapasia, 9 and 19% of the farmers in Sreepur, respectively. The productivity of these crops was higher in Kapasia. Vegetables were cultivated by all the farmers in both thanas and not much difference in average production per household was observed. Oil seeds, pulses, potatoes were cultivated by few farmers in both thanas and productivity of these crops was higher in Kapasia.

FISH AND POULTRY PRODUCTION

Fish and poultry were the two main animal protein products of the households in both thanas (Table 2.28). Fish was produced by 73% of the households in Kapasia and 72% of the households in Sreepur with an average annual production of 82 and 71 kg, respectively. Eighty per cent of the households reported an annual average poultry production of 20 and 15 kg per household in Kapasia and Sreepur, respectively. Of the total on-farm production of animal protein (fish and poultry) by the reporting households, fish comprised 80% (82 kg) in Kapasia and 83% (71 kg) in Sreepur (Table 2.28).

PRODUCTION OF FRUITS AND FOREST PRODUCTS

Average production of various types of fruits produced by the households was much higher in Kapasia than their counterparts in Sreepur (Table 2.28). Similarly, number of households that reported cultivation of different fruits was also higher in Kapasia.

Table 2.28. Average per household production of fish, poultry, fruits and forest products of the sample pond owner/operator households in Kapasia and Sreepur thanas, Gazipur district, Bangladesh, July 1990 - June 1991

	Kapasia				Sreepur			
Production items	Small (<1.0 ha) n=57	Medium (1.0-2.4) n=76	Large (>2.4 ha) n=60	All n=193	Small (1.0 ha) n=42	Medium (1.0-2.4 ha) n=47	Large (>2.4 ha) n=51	All n=140
Average production per household								
Fish (kg)	51	53	140	82	61	95	52	71
Poultry (kg)	12	14	33	20	8	18	16	15
Pineapple (no.)	197	646	933	674	175	1,000	0	587
Banana (bunch)	47	45	44	45	5	20	49	25
Papaya (kg)	30	55	76	57	21	103	96	85
Guava (no. x 100)	65	117	132	105	9	8	15	11
Litchi (no. x 100)	44	228	170	160	35	40	15	23
Jackfruit (no.)	275	477	1,195	696	67	167	400	240
Firewood (kg x 100)	24	21	42	31	19	18	30	22
Trees for timber (no.)	21	14	78	8	4	14	18	14
% of household engaged in crop/animal production								
Fish (kg)	70	70	78	73	60	83	73	72
Poultry (kg)	74	76	90	80	57	89	88	80
Pineapple (no.)	30	38	45	38	2	2	0	1
Banana (bunch)	51	57	58	55	17	[illegible]	16	19
Papaya (kg)	21	37	37	32	7	17	8	11
Guava (no. x 100)	56	41	57	50	19	17	27	21
Litchi (no. x 100)	40	46	55	47	2	6	16	9
Jackfruit (no.)	56	66	82	68	38	32	47	39
Firewood (kg x 100)	33	54	83	57	5	17	14	12
Trees for timber (no.)	4	13	30	53	5	4	10	6

Many (57%) households in Kapasia had their own sources of firewood production as compared to only 12% of the households in Sreepur. All households in both thanas produced timber trees. In Kapasia, each household produced eight such trees, while in Sreepur only one tree was produced per household on average.

Resource Availability and Uses

The conventional resource base of a Bangladesh farm household consists of land, labor and capital. It is common for a farm to make use of these resources to produce a wide range of food crops, cash crops, horticultural products, animals and fish and to use many outputs and by-products of one subsystem as inputs to other subsystems of the farm. Farm households allocate resources like land, labor and capital over different farm enterprises on the basis of their existing knowledge and in order to generate as much as possible the needed output and income. It is widely believed that farm-generated bioresources and by-products are important complementary resources and can make a significant contribution to farm productivities. Because of their abundant production on farms, these bioresources and by-products are generally underutilized. It is hypothesized that integration of improved aquaculture into the farming systems will create additional demand for these and other resources and may warrant a reallocation leading to improvement of efficiency in their use as well as increase in farm productivity and income.

AVAILABILITY AND USE OF LAND

Table 2.29 presents the use of various types of lands in Kapasia and Sreepur. Of the total operated lands, 57% in Kapasia and 81% in Sreepur were used in crop cultivation. About 32% of operated lands in Kapasia were under orchard/forest as compared to only

Table 2.29. Land availability (ha) of the sample pond owner/operator households in Kapasia and Sreepur thanas, Gazipur district, Bangladesh, July 1990 - June 1991.

	Homestead	Orchard/ forest	Crop land	Pond/ ditch	Fallow	Total
Kapasia, n=193						
Own available	0.100	0.622	1.319	0.077	0.054	2.172
Operated	0.100	0.515	0.923	0.075	0	1.613
Leased out	0	0	0.457	0.002	0	0.457
Leased in	0	0	0.062	0	0	0.062
Unused	0	0.107	0	0	0.054	0.162
Sreepur, n=140						
Own available	0.089	0.144	2.057	0.104	0.144	2.538
Operated	0.089	0.129	1.382	0.099	0	1.699
Leased out	0	0	0.767	0.005	0	0.772
Leased in	0	0	0.092	0	0	0.092
Unused	0	0.015	0	0	0.144	0.159

8% in Sreepur. Of the total operated lands, ponds and ditches accounted for only 5% in Kapasia and 6% in Sreepur. Total amount of unused land per household was almost equal (0.16 ha) in both Kapasia and Sreepur. In short, crops occupied most of the lands operated by the farmers and very small amounts of land were classifiable as ponds/ ditches.

LABOR AVAILABILITY AND USE

Labor force participation rate. This section provides a broad overview of the supply of and demand for labor at the household level in the two thanas. For the purpose of this study, a worker was defined as a person who reported to be engaged in an income-earning activity during the survey period. On this basis, the proportion of the household members participating in the labor force was estimated. The estimation included members who are above 10 years of age which is a deviation from the conventional estimation. There are two reasons to follow this estimation method: first, farm households in Bangladesh utilize their children for labor activities; and second, chances are higher that these types of child labor will be useful for aquaculture purposes. Another issue which needed to be addressed was whether the services of the women should be treated as gainful employment or not. The estimation method also took this into consideration and separately estimated labor force participation rate which included the role of female household members.

The rate of labor force participation in Kapasia and Sreepur can be seen in Table 2.30. There was a marked difference in labor force participation among the land owning groups. For all households, the rate of participation in the labor force, excluding the activities of women in housekeeping, was 30 and 42% in Kapasia and Sreepur, respectively. Including the activities of women in the household, the labor force participation rate stood at 60% in Kapasia and 75% in Sreepur. No relationship was found between the rate of labor force participation (excluding women's housekeeping activities) and land ownership. If the women's activities in housekeeping are included, a positive relationship was found between the labor force participation rate and land ownership in Kapasia, while it was negative in Sreepur.

Table 2.30 Labor force participation rate (%)[a] in income-earning activities of the sample pond owner/operator households in Kapasia and Sreepur thanas, Gazipur district, Bangladesh, July 1990 - June 1991.

Land size group	Kapasia	Sreepur
Excluding housekeeping activities		
Small (<1.0 ha), n=57	25.60	50.00
Medium (1.0-2.4 ha), n=76	34.20	36.20
Large (>2.4 ha), n=60	29.95	41.16
All, n=193	30.34	42.15
Including housekeeping activities		
Small (<1.0 ha), n=42	58.40	85.50
Medium (1.0-2.4 ha), n=47	59.10	72.00
Large (>2.4 ha), n=51	63.30	68.80
All, n=140	60.20	74.88

[a]Defined as the proportion of household members engaged in income-earning activities.

Labor utilization. The information obtained from farm households on the use of labor in different farm enterprises is shown in Table 2.31. It shows that crops accounted for almost 68% of total labor per farm in both Kapasia and Sreepur. Livestock was the next major enterprise in terms of labor using 27% in Kapasia and 31% in Sreepur, of the total labor. In Sreepur, no labor was required for orchard/forest but in Kapasia, this comprised 3% of total labor demand. Orchard/forest being a major enterprise generating a large cash income for the households in Kapasia, separate allocation of labor was warranted. Aquaculture took very little labor: only 2% in Kapasia and 1% in Sreepur.

The relative proportion of labor used for different farm enterprises did not vary with the land ownership groups in the two thanas. However, the proportion of own labor requirements in all enterprises was lower for higher land sizes in both Kapasia and Sreepur.

Table 2.32 shows that labor use in the crop sector was 37% higher in Kapasia than in Sreepur. Similarly, labor use was 144% higher for aquaculture in Kapasia than in Sreepur.

Table 2.31. Utilization of labor (person-days) per household in different farm enterprises, by land ownership groups, of the sample pond owner/operator households in Kapasia and Sreepur thanas, Gazipur district, Bangladesh, July 1990 - June 1991.

Labor use by enterprise	Kapasia[a]								Sreepur[a]							
	Small (<1.0 ha) n=57		Medium (1.0-2.4 ha) n=76		Large (>2.4 ha) n=60		All n=193		Small (<1.0 ha) n=42		Medium (1.0-2.4 ha) n=47		Large (>2.4 ha) n=51		All n=140	
Crops	121	(65)	203	(69)	361	(69)	228	(68)	116	(58)	197	(66)	418	(72)	248	(68)
Own[b]	70		91		147		102		41		55		60		52	
Hired	51		112		214		126		75		142		388		196	
Orchard/forest	10	(5)	9	(3)	12	(2)	10	(3)	0	(0)	0	(0)	0	(0)	0	(0)
Own[b]	7		5		7		6		0		0		0		0	
Hired	3		4		5		4		0		0		0		0	
Livestock	52	(28)	80	(27)	142	(27)	91	(27)	83	(41)	96	(32)	161	(28)	115	(31)
Own[b]	49		64		107		73		74		81		96		84	
Hired	3		16		35		18		9		15		65		31	
Aquaculture	4	(2)	4	(1)	11	(2)	6	(2)	2	(1)	4	(1)	2	(<1)	3	(1)
Own[b]	3		3		6		4		1		3		2		2	
Hired	1		1		5		2		1		1		0		0	
All enterprises	187	(100)	296	(100)	526	(100)	335	(100)	201	(100)	297	(100)	581	(100)	365	(100)
Own[b]	129	(69)	163	(55)	267	(51)	185	(55)	116	(58)	139	(47)	158	(27)	138	(38)
Hired	58	(31)	133	(45)	259	(49)	150	(45)	85	(42)	158	(53)	423	(73)	227	(62)

[a]Numbers in parentheses are percentages to total labor utilization by enterprise.
[b]Includes owner and family labor.

Table 2.32. Utilization of labor (person-days) per hectare and per animal, in different farm enterprises, by land ownership groups, of the sample pond owner/operator households in Kapasia and Sreepur thanas, Gazipur district, Bangladesh, July 1990 - June 1991.

	Kapasia				Sreepur			
Labor use by enterprise	Small (<1.0 ha) n=57	Medium (1.0-2.4 ha) n=76	Large (>2.4 ha) n=60	All n=193	Small (<1.0 ha) n=42	Medium (1.0-2.4 ha) n=47	Large (>2.4 ha) n=51	All n=140
Crops (per ha)	251	255	240	247	212	173	182	180
Own[a]	145	114	98	111	75	48	26	38
Hired	106	141	42	137	137	125	156	142
Orchard/forest (per ha)	60	27	9	16	0	0	0	0
Own[a]	42	15	5	10	0	0	0	0
Hired	18	12	4	6	0	0	0	0
Livestock (per animal)	17	21	23	21	22	24	27	25
Own[a]	16	17	17	17	20	20	16	18
Hired	1	4	6	4	2	4	11	7
Aquaculture (per ha)	79	79	84	78	30	47	14	32
Own[a]	59	59	46	52	15	32	14	26
Hired	20	20	38	26	15	15	0	6

[a]Includes owner and family labor.

Only in the case of livestock was labor use higher (by 19%) in Sreepur than Kapasia. Moreover, the intensity of labor use in orchard/forest and aquaculture was much less than that in crops in both thanas. For example, labor use in aquaculture represents only 32% in Kapasia and 18% in Sreepur, of labor use in crops.

ON-FARM BY-PRODUCTS AND WASTES

Availability. Farmers usually generate by-products and wastes which are recycled as inputs into subsystems of the farm. Rice bran, cowdung, poultry manure and kitchen wastes were generated on most farms. Table 2.33 presents on-farm availability of these resources. On the average, each farm generated 1.0 t of rice bran, 3.0 t of cowdung and 0.7 t of kitchen wastes in Kapasia. In Sreepur, these resources in order were 1.1 t, 3.8 t and 1.1 t, respectively. Poultry manure was scarcely available due to the free-range nature of rearing. Availability of compost was also minimal as the farm households were not

Table 2.33. Average production of on-farm bioresources and by-products (kg/household) of the sample pond owner/operator households in Kapasia and Sreepur thanas, Gazipur district, Bangladesh, July 1990 - June 1991.

	Kapasia				Sreepur			
Bioresources/ by-products	Small (<1.0 ha) n=57	Medium (1.0-2.4) n=76	Large (>2.4 ha) n=60	All n=193	Small (<1.0 ha) n=42	Medium (1.0-2.4 ha) n=47	Large (>2.4 ha) n=51	All n=140
Rice bran	536	904	1,501	981	535	985	1,673	1,086
Cowdung[a]	1,450	2,850	4,750	3,025	1,700	3,325	6,050	3,825
Poultry manure	40	28	79	47	3	13	7	8
Kitchen wastes	539	653	1,066	748	535	861	1,684	1,063
Compost	3	2	0	2	0	0	3	1

[a]Computed from reported basket units where one basket approximately equals 25 kg.

familiar with this technology and also not aware of its importance in agriculture and aquaculture. All the by-products and wastes mentioned above are important inputs for aquaculture.

Utilization. Table 2.34 presents current uses of these resources in different enterprises. It shows that almost 72% of total rice bran and 91% of kitchen wastes in Kapasia and 64% of rice bran and 81% of kitchen wastes in Sreepur, were used as animal feed. About 85% of total available cowdung in Kapasia and 83% in Sreepur were used as crop fertilizer. Another major use of rice bran was evidenced in generating bio-energy (22% in Kapasia and 31% in Sreepur). Use of these on-farm resources for aquaculture was negligible. Only 2% of total rice bran in Kapasia and 1% in Sreepur were used for

Table 2.34. Utilization of on-farm bioresources and by-products (%) by land ownership groups of the sample pond owner/operator households in Kapasia and Sreepur thanas, Gazipur district, Bangladesh, July 1990 - June 1991.

	Kapasia				Sreepur			
Bioresources/ by-products	Small (<1.0 ha) n=57	Medium (1.0-2.4 ha) n=76	Large (>2.4 ha) n=60	All n=193	Small (<1.0 ha) n=42	Medium (1.0-2.4 ha) n=47	Large (>2.4 ha) n=51	All n=140
Cowdung								
Crop fertilizer	95	71	89	85	86	84	81	83
Pond (fish) fertilizer	5	4	4	4	1	5	2	3
Others[a]	0	25	7	11	13	11	17	14
Rice bran								
Animal feed	77	78	66	72	77	63	61	64
Fuel	17	15	29	22	16	32	35	31
Fish feed	2	2	1	2	1	1	1	1
House maintenance	4	5	4	4	7	4	4	4
Poultry manure								
Crop fertilizer	6	8	3	6	0	0	0	0
Pond (fish) fertilizer	0	0	0	0	0	0	0	0
Unused	94	92	97	94	100	100	100	100
Kitchen waste								
Animal feed	90	89	92	91	91	75	81	81
Fish feed	0	0	0	0	0	0	0	0
Unused	10	11	8	9	9	25	19	19

[a]Include fuel and maintenance of mud walls and floors of house.

aquaculture purposes. Similarly, the proportion of cowdung used for aquaculture was only 4% in Kapasia and 3% in Sreepur. Only 6% of total available poultry manure was used, solely as crop fertilizer in Kapasia, while no use of poultry manure was reported in Sreepur.

Discussion

While in general, households in both Kapasia and Sreepur have similar socioeconomic status, the survey results revealed that existing socioeconomic conditions of pond owner/ operator households are higher than the rest of the households in the two thanas. This was reflected in the ownership pattern of land and other assets of the households. Members of the pond owner/operator households also have better advantage in terms of occupational diversity, education and skills. The same is true for their income. In general,

the average income (expressed in terms of value of total products as well as cash earnings) of pond owner/operator households, were higher than other households in the community.

As regard to per caput food consumption, pond owner/operator households have higher intake of food than that of the rest of the community and the country as a whole (BBS 1991). In terms of fish consumption as well, pond owner/operator households had a higher intake than the rest of the households in the community. Per caput consumption of fish including dry fish by the pond owner/operator households (13.0 and 17.2 kg in Kapasia and Sreepur, respectively) was higher than the national per caput consumption.

Although sample households were owner/operators of ponds, most of their fish requirements (68-78%) were purchased. Fish demand of the sample households was determined by a number of factors, such as income, price of fish and price of meat. Demand for fish was found price and income inelastic which implies that rural fish markets will not be able to absorb all the incremental produce expected to come as a result of introduction of improved aquaculture. However, a sizable portion of the incremental fish production by the households is expected to substitute the fish products currently purchased from the market to satisfy household consumption needs. As for the general rural consumers, the implication of increased fish supply will be a certain amount of lowering of market price and hence cheaper fish protein. If market infrastructure, transport and storage facilities become available, some export to urban markets may also occur.

Land, as the most scarce resource in Bangladesh, poses a serious limitation to physical expansion of farm enterprises. Intensification of land use by increasing soil fertility, transferring lands from lower to higher productive enterprises and utilization of unused/fallow lands are some of the remaining options to increase farm production. Although the current allocation of farm land to waterbodies (ponds/ditches) is very small, returns from such land can become high if improved aquaculture is adopted on the farms. Land allocation for aquaculture might even expand in the future by including fallow and unused lands as a result of adoption of improved aquaculture technologies that are currently being disseminated.

On the other hand, aquaculture at present utilizes very little household labor compared to the crop and livestock sectors. It is expected that demand for labor will increase significantly with the introduction of improved aquaculture and this would enable labor to obtain a higher marginal productivity than at present (Ahmed and Rab 1992). The additional labor under improved aquaculture will still be small as compared to the size of labor demand in the entire farm. Farm households will be able to allocate labor time from its surplus/unused labor force without hampering other enterprises. Most household labor time is currently used to meet the requirements of crops whose demand is seasonal. Demand for labor reaches a peak during planting and harvesting times of major crops (e.g., rice). Aquaculture as such has no peak or lean season. Fish can be stocked and harvested any time. Hence, the farmers can adjust their time with regard to fingerling stocking and fish harvesting to suit their conditions.

Like labor, crops absorb most of the on-farm by-products and waste materials. Crops are also the main source of on-farm resources like rice bran, household wastes and some of the ingredients of compost preparation. However, a sizable proportion of rice bran and cowdung which can potentially be used for aquaculture was found to be used either to generate bio-energy and maintain houses or to be sold as surplus. The cost effectiveness of these resources in generating bio-energy and in maintaining houses should be subject of future investigation. Yet, there remains the possibility of redirecting these resources into aquaculture, if alternative sources of fuel and house materials can be found to substitute for existing uses.

Production of rice bran is directly linked with the crop yield and rice processing technology. It can be augmented through the use of modern husking techniques (milling), which is already popular in rural areas. Farm households usually sell surplus paddy without processing. If the opportunity cost of rice bran increases, households will be induced to sell processed rice in the markets and thereby increase the on-farm supply/ production of rice bran.

Production of compost can be increased several fold through the dissemination of knowledge relevant to its preparation. Important ingredients of compost preparation such as straw, cowdung and waste materials are available within the farm. Farm households make little use of compost and poultry manure. Under the current free-range strategy of poultry/duck rearing, there are no feasible techniques for collection or recycling of manure. This might, however, be increased by adopting the rearing practices of poultry birds in closed environments such as poultry-fish culture.

It is expected that through introduction of improved aquaculture, a large quantity of resources previously unemployed and underemployed in various enterprises will now be shifted to aquaculture. This can increase the overall productivity of farming systems in Bangladesh.

Chapter 3

FISH PRODUCTION AND MANAGEMENT OF SMALL WATERBODIES (PONDS AND DITCHES)

Introduction

From a census of ponds and ditches (Ahmed 1992) in Kapasia and Sreepur thanas, it was revealed that nearly 1% of total land area was occupied by ponds and ditches. Production from these waterbodies was typically low (about 550 $kg \cdot ha^{-1}$) due to the poor status of aquaculture in these waterbodies. Many waterbodies (34%) were not used for aquaculture at all. Among the cultured waterbodies, less than 1% was found to follow the scientific approach to aquaculture, i.e., regular stocking, feeding, fertilizing and harvesting. The remaining waterbodies were practising mainly irregular stocking with no feeding nor fertilizing. The water resources are put to various competitive economic and social uses, such as bathing, washing, drinking, irrigation, jute retting and growing aquatic vegetation (see Ahmed 1992 for details). This section of the report provides information on the physical condition of waterbodies, including use of pond dikes, and analyses the management aspects of aquaculture, i.e., stocking density and species, input use pattern and productivity.

Ownership and Share of Joint Owner Operators

Pond ownership, number of owners and operator status of ponds are presented in Table 3.1. The proportion of ponds owned by households is greater than institutional and *khas* ponds in Kapasia and Sreepur. Ninety-seven per cent of the waterbodies in Kapasia and 98% in Sreepur are privately owned, while the rest are institutional and *khas* ponds. More than 50% of the ponds in both thanas are under single ownership. On average, two households own one pond in the study thanas. Four operator status of the ponds, namely, single owner operator, joint owner operator, single lease operator and joint lease operator, were reported. Operator in the study is defined as the person under whose control the pond/ditch was held during the survey period irrespective of ownership. More than 55 and 40% of the waterbodies are single and joint owner operated, respectively, in Kapasia and Sreepur. The proportion of lease operators is very small. A higher proportion of the jointly owned ponds are under sharing arrangements of 21-40% (36% for both thanas) and greater than 40% (32% for both thanas) (Table 3.2).

Physical Condition of the Waterbodies

For typical small waterbodies, particularly homestead ponds, some land is devoted to dikes which are put to many beneficial uses by the households. The size of the dikes was 10-20% of the water area depending on the purposes of creation of the waterbodies and their intended future uses. Table 3.3 describes the use of the dikes of the waterbodies

Table 3.1. Ownership, number of owners and operator status of ponds under study in Kapasia and Sreepur thanas, Gazipur district, Bangladesh, July 1990 - June 1991.

	Kapasia		Sreepur		All	
	No.	%	No.	%	No.	%
Ownership type						
Owned by households	187	96.9	137	97.9	324	97.3
Institutional	1	0.5	2	1.4	3	0.9
Khas	5	2.6	1	0.7	6	1.8
Total	193	100.0	140	100.0	333	100.0
No. of owners						
Single ownership	100	53.5	76	55.5	176	54.3
2-5 owners	69	36.9	48	35.0	117	36.1
6-10 owners	14	7.5	11	8.0	25	7.7
11-18 owners	4	2.1	2	1.5	6	1.9
Mean	2.64		2.39		2.53	
Standard deviation	2.86		2.43		2.69	
Operator status						
Single owner operator	108	56.0	78	55.7	186	55.9
Joint owner operator	79	40.9	59	42.2	138	41.4
Single lease operator	3	1.6	1	0.7	4	1.2
Joint lease operator	3	1.6	2	1.4	5	1.5

Table 3.2. Percentage share of the respondent operators in jointly owned ponds in Kapasia and Sreepur thanas, Gazipur district, Bangladesh, July 1990 - June 1991.

	Kapasia n=193		Sreepur n=140		All n=333	
Percentage share	No.	%	No.	%	No.	%
≤10	6	7.6	3	5.0	9	6.5
11-20	19	24.1	16	26.7	35	25.2
21-40	30	37.9	21	35.0	51	36.7
≥41	24	30.4	20	33.3	44	31.6
Total	79	100.0	60	100.0	139	100.0
Average % share						
Operators		31.0		32.7		31.7
Standard deviation		15.3		15.1		15.2
Other owners		69.0		67.3		68.3
Standard deviation		15.3		15.1		15.2

owned/operated by the respondent households in Kapasia and Sreepur. It shows that, on average, there were five big trees in Kapasia and 10 big trees in Sreepur on the dikes. In addition, pond dikes were used as kitchen gardens, grazing land for animals, stacks of straws, and sites for piling animal dung and animal shades. In Kapasia, the above uses of the waterbodies were higher than in Sreepur. Seventeen per cent of the dikes were used for gardening and 14% for animal grazing in Kapasia as compared to 6 and 8%, respectively, in Sreepur. All of the above uses comprise only about 50% in Kapasia and 23% in Sreepur of the total dike area.

Almost equal proportions of the waterbodies in Kapasia and Sreepur had sunken trees/ branches (32%) (Table 3.3). Trellises/shades for vines were found in 7% of the waterbodies in Kapasia and 13% of waterbodies in Sreepur. Surface water plants were also found in some of the waterbodies in both thanas.

Table 3.3. Utilization of pond dikes and condition of waterbodies in Kapasia and Sreepur thanas, Gazipur district, Bangladesh, July 1990 - June 1991

	Kapasia (n=193)	Sreepur (n=140)
Big trees (no. per pond)	5.25	10.19
Use of pond dikes (% of total dike area)		
Gardening (includes trees)	16.69	5.69
Animal shed	0.72	0.71
Grazing land	13.75	7.50
Storage for straw/dung	2.09	1.10
Graveyard	0.49	0.97
Others[a]	15.82	6.76
Idle/unused	50.44	77.27
Condition of waterbodies (% of waterbodies)		
Has trellises/shades for vines	6.7	12.9
Has sunken trees/branches	31.6	32.1
Presence of surface plants (% of waterbodies)		
Water hyacinth	18.7	10.7
Water spinach		
Kalmilata	19.7	15.0
Hilancha	6.7	7.9
Others[b]	4.1	16.4

[a]Include seedbed preparation, plant nurseries and bamboo bushes.
[b]Include indigenous aquatic vegetations.

The diverse nature of services and benefits derived by households from the use of dikes and water spaces reinforces the multiple-use character of small waterbodies. The opportunity cost of these and other social and economic uses of waterbodies will vary among individual households. In adopting improved aquaculture, households will probably set their own limits on input-use and management intensity in order to avoid competition with loss of benefits from other uses.

Management of the Waterbodies

Fingerling Stocking: Composition and Density

Although the release of seed fish (fry/fingerlings) into waterbodies to create an initial stock of biomass for nursery or growout operations is a basic step in aquaculture, most existing small waterbodies are not stocked on a regular basis, especially those in the two thanas under study (Ahmed 1992). In Kapasia, only 33% (64 farmers out of 193) and in Sreepur 51% (71 farmers out of 140) stocked fingerlings into their ponds during the reporting year. Table 3.4 presents data on fingerling stocking and species composition in the ponds by the reporting farmers. It can be seen from the table that the farmers were mainly practising polyculture of Indian major carps (rohu [*Labeo rohita*], catla [*Catla catla*] and mrigal [*Cirrhinus mrigala*]). Almost 94 and 83% of total fingerlings stocked accounted for Indian major carps in Kapasia and Sreepur, respectively. Stocking rates of exotic species like silver carp (*Hypophthalmichthys molitrix*), common carp (*Cyprinus carpio*), tilapia (*Oreochromis mossambicus* and hybrids) and Nile tilapia (*O. niloticus*) though higher in Sreepur than Kapasia, were negligible. Stocking of silver barb (*Puntius gonionotus*) that has recently been introduced in the country was absent in both thanas.

Table 3.4 depicts that overstocking was a common tendency among the households in both thanas, particularly in Sreepur, where stocking density was twice as high (17,399 ha^{-1}) as in Kapasia (8,656 ha^{-1}). Under existing farming conditions where artificial feeding and fertilizing are expected to be quite modest, a lower rate of stocking (6,500-7,000 fingerlings ha^{-1}) is considered ideal (Ahmed 1992).

Source of Fingerlings

Growth of fish and productivity depend on the quality of fingerlings as well. Fingerlings collected from rivers and other open waters had been the traditional sources of supply of stocking materials. But the supply from the above source is inadequate, limited to only few species, and the season of availability is very short. In recent times, fingerlings produced at government, private and NGO hatcheries have become a complementary and alternative source of supply of seed fish to pond operators. Professional vendors usually

Table 3.4. Average number of fingerlings stocked per pond and rate of stocking per hectare, by species, in Kapasia and Sreepur thanas, Gazipur district, Bangladesh, July 1990 - June 1991.

	Kapasia (n=64)			Sreepur (n=71)		
Species	Average no. per pond	%	Stocking rate per ha	Average no. per pond	%	Stocking rate per ha
Rohu (*Labeo rohita*)	418	34	3,800	743	32	5,586
Catla (*Catla catla*)	440	36	4,000	704	30	5,293
Mrigal (*Cirrhinus mrigala*)	293	24	264	489	21	3,677
Silver carp (*Hypophthalmichthys molitrix*)	6	1	55	111	5	835
Common carp (*Cyprinus carpio*)	30	2	273	92	4	692
Tilapia (*Oreochromis mossambicus* and hybrids)	0	0	0	71	3	534
Nile tilapia (*O. niloticus*)	23	2	209	24	1	180
Others[a]	6	1	55	80	4	602
Total	1,216	100	8,656	2,314	100	17,399
Standard deviation	1,053			8,283		

[a]Include indigenous small fish and airbreathing fish.

deliver, at pond sites of farmers, fingerlings of various species that are either caught from open waters or produced in the hatcheries. The qualities of fingerlings of such deliveries are not reliable, as they usually suffer from stress due to long distances of travel and hence have poor rate of survival after stocking into rearing ponds.

Table 3.5 shows the distribution of households by principal sources of fingerlings stocked in their waterbodies. Eighty-nine per cent of the farmers in Kapasia and 36% in Sreepur stocked fingerlings collected from rivers and open waters, mainly sold by the vendors. Moreover, vendors sold fingerlings purchased from hatcheries to 61% of the farmers in Sreepur and only to 3% in Kapasia. Direct purchases from hatcheries were not a common practice of the households in the two thanas.

Harvesting Methods

Netting, draining and angling were the common methods of fish harvesting (Table 3.6). Among these methods, netting was found as the single most important method of harvesting (85% in Kapasia, 87% in Sreepur).

Engaging professional harvesters (fishers) is the usual practice in the case of bulk harvesting from household operated waterbodies. They are usually paid in kind, ranging from 25 to 50% of the total catch. However, in both thanas a large part of the harvest (54% in Kapasia, 78% in Sreepur) was made by the households themselves (Table 3.6).

Table 3.5. Principal sources of fingerling supply in Kapasia and Sreepur thanas, Gazipur district, Bangladesh, July 1990 - June 1991.[a]

	Kapasia (n=140)		Sreepur (n=101)	
Sources	No.	%	No.	%
Direct purchase from				
Private hatcheries	2	1	2	2
Government/NGO hatcheries	10	7	1	1
Vendors selling from				
Private hatcheries	3	2	60	59
Government/NGO hatcheries	1	1	2	2
Rivers/open waters				
Self collection	16	12	5	5
Purchased	108	77	31	31

[a]Based on the farmers who were engaged in aquaculture.

Table 3.6. Percentage distribution (%) of total fish harvest by harvesting methods in Kapasia and Sreepur thanas, Gazipur district, Bangladesh, July 1990 - June 1991 [a]

Harvesting method	Kapasia (n=158)			Sreepur (n=85)		
	Own[b]	Fishers	All	Own[b]	Fishers	All
Netting	41	44	85	65	22	87
Draining	7	2	9	4	0	4
Angling	6	0	6	9	0	9
Total	54	46	100	78	22	100

[a]Based on farmers who harvested fish during the reporting period.
[b]Includes operator and family labor.

Input Use Pattern

Small quantities of feed and fertilizers were used in some of the small waterbodies. Table 3.7 shows average use of inputs by the reporting farmers. Among the organic components of fertilizers, the use of cowdung was relatively higher (1,181 kg·ha^{-1} in Kapasia, 704 kg·ha^{-1} in Sreepur). The use of poultry manure was negligible in both Kapasia and Sreepur. Compost was used only in Sreepur, and only at 16 kg·ha^{-1}.

Inorganic fertilizers (urea and TSP) and lime were used in both Kapasia and Sreepur. Use of these fertilizers was much more common in Kapasia than in Sreepur. Rice bran and oil cake were also used as supplementary feeds by the farmers but the average application rate was low. Rice bran was applied at 165 kg·ha^{-1} in Kapasia and 84 kg·ha^{-1} in Sreepur. The average amount used of oil cake was much higher in Sreepur (30 kg·ha^{-1}) than in Kapasia (0.81 kg·ha^{-1}).

Table 3.7. Average input use by pond operators/owners of farmed waterbodies in Kapasia and Sreepur thanas, Gazipur district, Bangladesh, July 1990 - June 1991.

Inputs	Kapasia (n=140)			Sreepur (n=101)		
	No. of users	% of user households to total households engaged in aquaculture	Amount used per ha	No. of users	% of user households to total households engaged in aquaculture	Amount used per ha
Labor (person-days)[a]	76	54	58	39	39	22
Organic fertilizer (kg)						
Cowdung	93	66	1,181	43	43	704
Compost	0	0	0	1	1	16
Poultry manure	4	3	0.65	1	1	0.32
Inorganic fertilizer (kg)						
Urea	41	29	46	13	13	8
TSP	26	9	32	11	11	9
Lime (kg)	24	17	35	6	16	4
Feed (kg)						
Rice bran	67	48	165	49	49	84
Oil cake	2	1	0.81	10	10	30

[a]Excluding harvesting labor.

Production and Disposal Pattern

As shown in Table 2.6, small waterbodies (ponds and ditches) represent only 3.5 and 4.1% of total land owned by the respondent households in Kapasia and Sreepur, respectively. These waterbodies are generally put to various uses including farming and/or harvesting of fish. Among these waterbodies, almost 70% in Sreepur and 61% in Kapasia reported aquaculture (Ahmed 1992). Average per hectare production in the cultured ponds

during the reporting period (1990-91) was found higher in Kapasia (618 kg·ha^{-1}) than Sreepur (455 kg·ha^{-1}) (Table 3.8). Some 64% of total fish production in Kapasia and 55% in Sreepur were sold (Fig. 3.1). About 33% in Kapasia and 42% in Sreepur were consumed by the farmers themselves, while the remaining fish were given to neighbors and relatives.

Table 3.8. Average production of fish (kg/ha) for various land ownership groups in Kapasia and Sreepur thanas, Gazipur district, Bangladesh, July 1990 - June 1991.[a]

Land size group	Production (kg/ha)
Kapasia, n=140	618
Small (<1.0 ha), n=40	573
Medium (1.0-2.4 ha), n=53	565
Large (>2.4 ha), n=47	659
Sreepur, n=101	455
Small (<1.0 ha), n=25	462
Medium (1.0-2.4 ha), n=39	879
Large (>2.4 ha), n=37	234

[a]Based on ponds that were stocked during the reporting year.

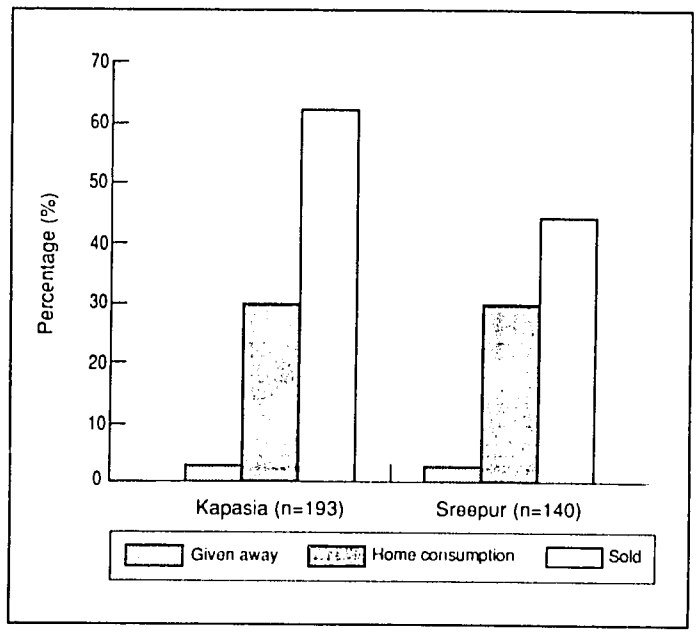


Fig. 3.1. Disposal pattern of fish harvests (%) in Kapasia and Sreepur thanas, Gazipur district, Bangladesh, July 1990 - June 1991.

Discussion

Although a large percentage of farmers was practising aquaculture in their ponds, it is evident from the above analysis that culture techniques, input use pattern and management were suboptimal. Overstocking of fingerlings, low doses of both on-farm and off-farm inputs, irregular stocking and harvesting were the general features of the existing aquaculture in small waterbodies owned and operated by farm households. Polyculture technology was practised by most farmers, mainly Indian major carps. Exotic species like silver carp, common carp and tilapia were rare in the species mix. Farmers mainly relied on natural sources (rivers and other open waters) for supply of stocking materials, particularly in Kapasia.

Hatchery and nursery operations at the household level were not undertaken by farmers. Nursery operations have, however, become popular in the southwestern district Jessore in recent times, and their introduction to other areas of the country could be a major contributory factor to make seed fish available locally. It should be mentioned here that there was no hatchery in Kapasia, while one small hatchery with a capacity to produce 25 kg of fertilized eggs per annum has recently been established in Sreepur by the Department of Fisheries.

To ensure regular stocking of desired species at required densities for growout operations, availability of seed fish (fry/fingerlings) within the locality is crucial. Extension assistance should also be directed to introduce nursery operations at the farm household level. Local supply, if available, can also avoid the problem of quality deterioration of fingerlings during transport. Despite poor overall knowledge of aquaculture and little

investment made in inputs, most small waterbodies within the households are suitable for aquaculture (Ahmed 1992). There is, therefore, an enormous potential for transfer of appropriate aquaculture technologies to these farmers through extension services. Increase of area of waterbodies under aquaculture and adoption of improved culture techniques are likely to result due to extension intervention, if done properly.

Chapter 4

FISH MARKETING IN THE TWO THANAS

Introduction

Inland fisheries will continue to be the main source of fish supply although their contribution, especially from inland capture fisheries, has shown a decline in recent years. Production from coastal fisheries have reached maximum sustainable yield (MSY) and further increases may not be feasible. Thus, any effort to increase production has to concentrate on aquaculture. It was envisaged that aquaculture in small waterbodies would entail supplies from small but large number of producers. This in effect will require a sound marketing infrastructure which can ensure fair price to the producers. Marketing is an important aspect where fish production is meant for sale. The profitability and income from aquaculture will, to a significant extent, depend on the availability of marketing outlets, their structure and conduct. The present marketing system is not well integrated and the marketing infrastructure such as cold storage, transport facilities, landing centers and wholesale markets are inadequate and are not designed to market production from aquaculture. It is assumed that the immediate outlet for marketing of surplus fish produced by farm communities will be the rural village markets. The supply situation in the rural markets, the price and absorption capacity of the markets against existing demand will determine the profitability of aquaculture operations by the households.

Objectives

The broad objective of the marketing study was to investigate the current structure of fish marketing in the project area. Specific objectives of the study were to: i) determine fish marketing channels; ii) determine types of fish available in the market; and iii) determine the major sources of supply of fish in the rural markets and gather data on fish prices.

Methodology

Area Selection

The marketing survey was also a part of the benchmark surveys under the project entitled "Socioeconomic Impact of Fish Culture Extension Program on the Farming Systems of Bangladesh". In line with the project design, the survey was conducted in six selected unions: four unions from Kapasia thana and two unions from Sreepur thana.

Data Collection

The survey was designed in two phases. In the first phase, an inventory of all the markets regarding their size, number of sellers/buyers and number of sitting days in a

week was undertaken by using a predesigned guideline (Appendix II). On the basis of the information collected through the preliminary survey, the markets were stratified into three groups according to number of sellers and sitting days. From each group, one market was selected randomly for a more comprehensive survey. Accordingly, 21 markets (15 from Kapasia and six from Sreepur) were surveyed (Table 4.1).

Listing of all markets in the study unions was completed during July and August 1991. The comprehensive survey (second phase) of the sample markets started during the first week of November 1991 and continued up to December 1991. Data were collected through a questionnaire (Appendix III) by the project field investigators under the supervision of the research officers. Field observation and field notes were also maintained regarding market mechanisms and marketing channels. Fish traders were interviewed in one of the weekly sitting days in each of the selected markets.

Table 4.1. Distribution of sample markets by sitting days per week in Kapasia and Sreepur thanas, Gazipur district, Bangladesh, November - December 1991.

	Sample markets by sitting days per week			
	Once	Twice	Daily	Total
Kapasia, n=15	4	10	1	15
Barishaba	0	3	0	3
Chandpur	2	2	0	4
Rayed	1	2	0	3
Torgaon	1	3	0	4
Thana market	0	0	1	1
Sreepur, n=6	1	4	1	6
Bormi	0	2	0	2
Gazipur	1	2	0	3
Thana market	0	0	1	1
Total	5	14	2	21

Review of Fish Marketing Systems in Bangladesh

Fish marketing in Bangladesh is mainly a private sector operation run by a set of intermediaries. Harvested fish transfer through many hands, as an old practice, especially those caught in the open waters, before they reach the consumers (Fig. 4.1). Intermediary agents in the marketing system may be broadly categorized as fish collectors, wholesalers and fish retailers. Collectors obtain their supplies of fish directly from fishers. The wholesalers, who usually operate in principal markets, usually obtain their supplies from collectors. Fish retailers in turn obtain their supplies either from wholesalers or from collectors or directly from the producers at the landing point. Auction and contractual arrangements are the usual methods of fish buying on the part of collectors who buy at the landing sites. Auction is the dominant sales method for fish such as carps, hilsa, catfish, airbreathing fish, indigenous wild fishes and small shrimps, sold in the interior markets of the country. Contractual arrangements (mutually predetermined prices) are used for higher-priced export varieties such as shrimp and marine fish. Subsistence and part-time fishers who catch small amounts of fish from nearby open waters also sell some, usually directly to the consumers.

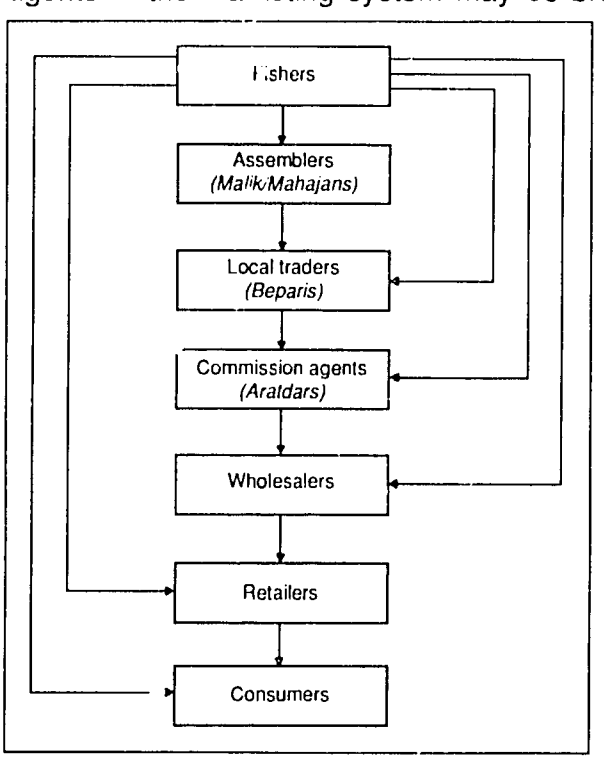


Fig. 4.1. Marketing channels of openwater capture fisheries harvest. (Source: Ahmed 1991).

Marketing mechanisms for inland culture fisheries are not fully developed yet. Only a

fraction of total harvested fish from small waterbodies (ponds and ditches) that are regarded as aquaculture production enters the formal market. There are two categories of channels that are used in case of marketing of fish from small waterbodies operated by rural households: i) operators sell their own harvests to market intermediaries and consumers; and ii) professional harvesters assist the operators in harvesting as well as in marketing (Fig. 4.2). The Bangladesh Fisheries Development Corporation plays a major role in the marketing of the aquaculture products from oxbow lakes and other government owned/managed waterbodies.

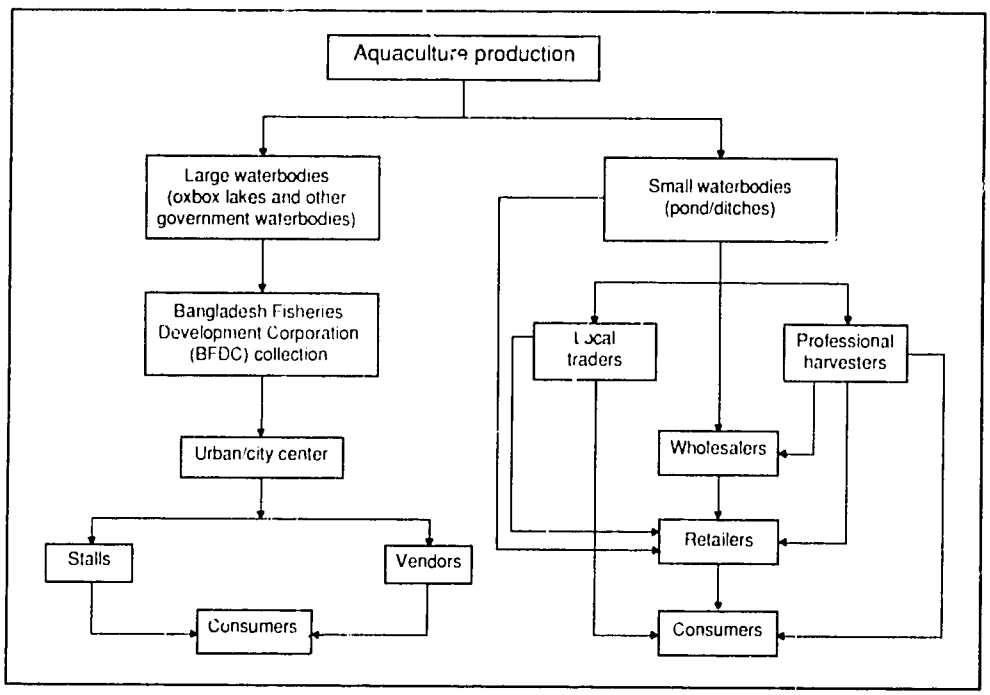


Fig. 4.2. Existing marketing channels of aquaculture production.

Physical Characteristics of Markets

Rural fish markets are part of the traditional village markets that usually sit twice in a week where people of the surrounding areas gather to sell their produce and purchase household necessities. Most of the sellers sell their own produce in these markets. In addition, there are small traders who bring products from different areas to sell in these markets. There are also a few permanent shops in such markets, mainly grocery and tea stalls. The size of markets in terms of land area is usually a few thousand square meters. Table 4.2 shows that 47% of the sampled markets in Kapasia and 33% in Sreepur occupy more than 5,000 m^2 of land area. In both thanas, 33% of the markets occupy 801-1,600 m^2 of land area. Most of the markets (67%) sit twice in a week.

Profile of the Fish Traders/Sellers

Table 4.3 presents the socioeconomic profiles of fish traders. Fish traders were functionally landless, having land ownership around 0.16 ha in both the thanas studied. Their average family size is almost six which is slightly higher than the national average. About 25% of the fish traders in Kapasia and 32% in Sreepur were literate, most of whom have read up to primary level. Only one trader in Kapasia thana has secondary level

Table 4.2. Distribution of sample markets by physical area (m^2) and number of sitting days per week in Kapasia and Sreepur thanas, Gazipur district, Bangladesh, November - December 1991.

Size of markets	Number of sitting days per week				
	Once	Twice	Daily	Total	%
Kapasia, n=15	4	10	1	15	100
≤800	1	1	0	2	13
801-1,600	2	3	0	5	33
1,601-5,000	0	1	0	1	7
>5,000	1	5	1	7	47
Sreepur, n=6	1	4	1	6	100
≤800	0	0	0	0	0
801-1,600	0	2	0	2	33.3
1,601-5,000	0	2	0	2	33.3
>5,000	1	0	1	2	33.3

Table 4.3. Socioeconomic profile of fish sellers/traders in the sample markets in Kapasia and Sreepur thanas, Gazipur district, Bangladesh, November - December 1991.

	Kapasia n=134	Sreepur n=68
Average land owned (ha)	0.17	0.16
Average household size (no.)	5.98	5.92
Educational status (%)		
No education	75.4	67.6
Primary	23.9	30.9
Secondary	0.7	0
Higher secondary and above	0	1.5
Principal occupation (%)		
Agriculture	9.7	5.9
Daily labor	6.0	1.5
Fish trading	82.8	92.6
Rickshaw pulling	0.7	0
Others[a]	0.7	0
Average annual income per seller (BDT x 1,000)		
Principal occupation as fish trading	17.57	19.87
Secondary occupation as fish trading	1.57	0.53
Residential location (%)		
Within union of the market place	42	53
Within thana but different union	34	29
Different thana	24	18

[a]Include cart pulling and boat driving.

education. Most of the fish traders (79%) were inhabitants of the same thana, 46% within the same union as the market place and another 32% from the other unions. The number of fish traders coming from within the union of the market places is higher (53%) in Sreepur than in Kapasia (42%).

Fish trading is the main occupation of the great majority of the sellers (83% in Kapasia, 93% in Sreepur) (Table 4.3). Average annual income from fish trading as a principal occupation was BDT17,570 in Kapasia and BDT19,870 in Sreepur. Average annual income from fish trading as a secondary occupation was only BDT1,570 in Kapasia and BDT530 in Sreepur.

Structure of Rural Fish Markets

Pricing of fish and competition among buyers and sellers in rural fish markets are largely governed by the degree of concentration of sellers and buyers in the market, source of supply and marketing channels, and volume of fish by species available in the market.

CONCENTRATION OF SELLERS AND BUYERS

Table 4.4 presents the distribution of markets by number of potential buyers and fish sellers present in the markets during sitting times. Forty per cent of the markets in Kapasia and 33% in Sreepur were attended by less than 501 potential buyers during sitting days. On the other hand, more than 10 fish sellers/traders were found in 40% of the markets in Kapasia and 67% in Sreepur. A direct relationship was observed between number of potential buyers and sellers in the markets, i.e., numbers of fish sellers were higher in markets that had higher number of potential buyers (Table 4.5). Buyer-seller ratio was as high as 188 in both thanas. This ratio was higher in the sample markets of Sreepur (212) than that of Kapasia (189).

Table 4.4. Distribution of sample markets by number of potential buyers and fish sellers on a market day in Kapasia and Sreepur thanas, Gazipur district, Bangladesh, November - December 1991.

	Number of fish sellers				
Number of buyers	<5	5-10	11-15	>15	All
Kapasia, n=15	3	6	5	1	15
≤500	3	3	0	0	6
501-2,000	0	2	2	0	4
2,001-4,000	0	1	2	0	3
>4,000	0	0	1	1	2
Sreepur, n=6	2	0	2	2	6
≤500	2	0	0	0	2
501-2,000	0	0	1	0	1
2,001-4,000	0	0	0	1	1
>4,000	0	0	1	1	2

Table 4.5. Average number of buyers, fish sellers and availability of fish in the sample markets on a market day in Kapasia and Sreepur thanas, Gazipur district, Bangladesh, November - December 1991.

	Kapasia n=15	Sreepur n=6	All n=21
Average no. of buyers	1,700	2,333	1,881
Average no. of fish sellers	9	11	10
Average volume of fish in the market on a sitting day (kg)	91	218	128
Thana market	654	814	734
Union market	52	99	64
Buyer/seller ratio	189	212	188
Availability of fish in the market (g/buyer)	54	93	70

VOLUME OF FISH AND VARIETIES OF SPECIES IN THE MARKETS

The average volume of fish supplied in each of the markets of both Kapasia and Sreepur was 128 kg per market on the date of survey (Table 4.5). It was more than double (218 kg) in Sreepur than in Kapasia (91 kg). The availability of fish in the markets was only 70 g per buyer overall, but was nearly twice as high in Sreepur as in Kapasia.

Table 4.6 shows the distribution of markets by species observed during the survey date. Small indigenous fish, airbreathing fish, small shrimps, prawns and other wild fish were available in almost all the markets. Indian major carps and hilsa were found in 38 and 24% of the markets, respectively. Chinese carps and common carp (*Cyprinus carpio*) were on sale in a few (19% and 14%, respectively) of the markets. Marine fish and tilapia (*Oreochromis mossambicus* and hybrids) were on sale in only one market in Kapasia. Nile tilapia (*O. niloticus*) and silver barb (*Puntius gonionotus*) were totally absent from the markets.

Table 4.7 presents average supply of fish by species in the markets. Supplies were dominated by Indian major carps, airbreathing fish and small indigenous fish in both thanas. Of the total supply of fish on a market day, these three species groups constituted nearly 72% in Kapasia and 70% in Sreepur.

Table 4.6. Distribution of fish species sold in the sample markets in Kapasia and Sreepur thanas, Gazipur district, Bangladesh, November - December 1991.

	Kapasia n=15		Sreepur n=6		All n=21	
Species	No.	%	No.	%	No.	%
Indian major carps	4	27	4	67	8	38
Chinese carps	3	20	1	17	4	19
Common carp	2	13	1	17	3	14
Tilapia[a]	1	7	0	0	1	5
Airbreathers	12	80	6	100	18	86
Hilsa	2	13	3	50	5	24
Marine fish	1	7	0	0	1	5
Indigenous small fish	15	100	6	100	21	100
Shrimp/prawn (small)	12	80	6	100	18	86
Other wild fish	6	40	4	67	10	48

[a]*Oreochromis mossambicus* and hybrids.

A comparison of average supply of fish between the two thanas shows a higher average supply for markets in Sreepur than Kapasia (Table 4.7). Species-wise, average figures were also higher in Sreepur. Among the exotic species, Chinese carps and common carp were relatively popular. Considerable amounts of these species were supplied to the markets.

Supplies of fish in the small union (village) markets were significantly lower than in

Table 4.7. Average supply of fish (kg) per market day by species in the thana and union sample markets in Kapasia and Sreepur thanas, Gazipur district, Bangladesh, November - December 1991.

	Kapasia			Sreepur		
Species	Thana market n=1	Union market n=14	All n=15	Thana market n=1	Union market n=5	All n=6
Indian major carps	275	9	27	292	22	67
Chinese carps	28	2	4	50	0	8
Common carp	66	1	5	0	2	2
Tilapia	3	0	<1	0	0	0
Airbreathers	31	7	9	218	13	47
Hilsa	0	7	7	0	23	19
Marine fish	0	1	<1	0	0	0
Indigencus small fish	181	19	30	106	24	38
Shrimp/prawn (small)	15	4	5	4	10	9
Other wild fish	55	2	5	144	5	28
Total	654	52	92	814	99	218

[a]*Oreochromis mossambicus* and hybrids.

the big thana central markets (Table 4.7). Thana markets in Sreepur and Kapasia represented almost 62 and 47% of the total supply of fish, respectively, on the sitting days of market. Again, the average supply of fish in the union markets of Sreepur is higher than those of Kapasia.

SOURCES OF SUPPLY AND MARKETING CHANNELS

Fish supplies in the markets in both thanas came from openwater capture fisheries and small waterbodies (ponds and ditches) operated by farm households (Table 4.8). Direct marketing between producer and consumer was practised by those fishers who sell their harvests from open waters such as beels, haors, rivers, etc. Operators of small waterbodies usually sold their produce to professional fish harvesters or to fish traders.

Table 4.8. Occupational background of sellers/traders and origin of fish supply in the sample markets in Kapasia and Sreepur thanas, Gazipur district, Bangladesh, November - December 1991.

	Kapasia (n=134)		Sreepur (n=168)	
Occupation and origin	No. of sellers/ traders	%	No. of sellers/ traders	%
Fish farmers				
Selling harvests from own pond/ditch	0	0	0	0
Fishers				
Professional fishers selling harvests from others' pond	5	4	0	0
Professional fishers selling own harvest from openwater beels/haors/rivers	65	48	23	34
Retail traders				
Selling local harvests and harvests from outside the thana	64	48	45	66
All	134	100	68	100

Table 4.8 shows the occupational background of the fish sellers/traders and origin of supply of fish in the markets, which gives some indication of marketing channels. It shows that among the sellers/traders interviewed in the sample markets, none were pond owners/operators selling their produce themselves. A few of the sellers sold harvest from others' ponds within the thana. Overall, in both thanas, 41% of the fish sellers were the fishers who sold their own catch from local beels, haors and

rivers. Almost 57% of the sellers were retail traders who sold local supplies as well as supplies from distant places (outside the thana).

Considering sources of fish supply by species, some interesting conclusions can be drawn. Ponds/ditches are the only source of supply of Chinese carps, common carp, tilapia and most of the Indian major carps (77%) in both thanas (Table 4.9). The sources of supply of most airbreathing fish are beels/haors. Indigenous small fish and prawn/shrimp came mainly from beels/haors and rivers. Interestingly, beels and haors supplied the largest fraction of total marketed fish in both thanas. Small waterbodies accounted for 33% of the total fish supplies in Kapasia and 31% in Sreepur.

Table 4.9. Percentage distribution of total fish supply by sources of harvest in the sample markets in Kapasia and Sreepur thanas, Gazipur district, Bangladesh, November - December 1991.

	Kapasia (n=15)				Sreepur (n=6)			
Species	Small waterbodies[a]	Beels/ haors	Rivers	Total	Small waterbodies[a]	Beels/ haors	Rivers	Total
Total fish supply (kg)	448	546	373	1,367	402	616	295	1,313
Indian major carps	306	0	90	396	317	50	35	402
Chinese carps	61	0	0	61	50	0	0	50
Common carp	76	0	0	76	10	0	0	10
Tilapia[b]	3	0	0	3	0	0	0	0
Airbreathers	0	130	0	130	0	278	3	281
Hilsa	0	0	101	101	0	0	115	115
Marine fish	0	5	2	7	0	4	0	4
Indigenous small fish	0	288	152	440	20	107	102	229
Shrimp/prawn (small)	0	65	10	75	0	47	8	55
Other wild fish	2	58	18	78	5	130	32	167
% distribution to total supply	33	40	27	100	31	47	22	100
Indian major carps	77	0	23	100	79	12	9	100
Chinese carps	100	0	0	100	100	0	0	100
Common carp	100	0	0	100	100	0	0	100
Tilapia[b]	100	0	0	100	0	0	0	0
Airbreathers	0	100	0	100	0	99	1	100
Hilsa	0	0	100	100	0	0	100	100
Marine fish	0	71	29	100	0	100	0	100
Indigenous small fish	0	65	35	100	9	47	44	100
Shrimp/prawn (small)	0	87	13	100	0	85	15	100
Other wild fish	3	74	23	100	3	78	19	100

[a]Include ponds and ditches.
[b]*Oreochromis mossambicus* and hybrids.

MARKET MARGINS

Table 4.10 presents average purchase and selling prices, and seller's margins and rates of margin by species. It shows that the average purchase and selling prices of carps were generally higher than those of the other fishes available in the markets. Among the carps, the Indian major carps were sold at higher prices. On average, fish prices were higher in Sreepur than in Kapasia. However, the seller's margins were higher in Kapasia (ranging from 22 to 281%) than in Sreepur (ranging from 13 to 141%). The seller's margin was observed to be lower for the cultured fishes such as carps and exotic fishes than for wild fishes, airbreathers, shrimp/prawn and indigenous small fishes.

Table 4.10. Purchase and selling prices, and market margins (BDT/kg) of fish sold by species in the sample markets in Kapasia and Sreepur thanas, Gazipur district, Bangladesh, November - December 1991. (BDT37 = US$1 in 1991).

	Kapasia (n=15)				Sreepur (n=6)			
Species	Purchase price	Selling price	Price margin	Rate of margin (%)	Purchase price	Selling price	Price margin	Rate of margin (%)
Indian major carps	47.11	59.41	12.30	26	41.80	50.16	8.36	20
Chinese carps	22.50	30.00	7.50	33	40.00	45.00	5.00	13
Common carp	30.00	38.00	8.00	27	35.00	45.00	10.00	29
Tilapia[a]	45.00	55.00	10.00	22	0	0	0	0
Airbreathers	21.00	53.06	32.06	153	34.51	53.44	18.93	55
Hilsa	31.50	51.25	19.75	63	38.33	46.66	8.33	22
Marine fish	22.50	30.00	7.50	33	0	0	0	0
Indigenous small fish	10.70	26.88	16.18	151	10.43	25.16	14.73	141
Shrimp/prawn (small)	7.24	27.56	20.32	281	12.10	26.31	14.21	117
Other wild fish	34.38	49.61	15.23	44	25.14	44.42	19.28	77

[a]*Oreochromis mossambicus* and hybrids.

Discussion

The survey of fish markets in the two thanas revealed that rural fish markets still receive the bulk of their supplies (more than two thirds) from capture fisheries sources (e.g., rivers, beels and haors). Market margins for most of the capture fisheries species are higher than those of the cultured species. The lower margins for aquaculture species relative to capture species can be interpreted to represent lower marketing costs and profits to traders dealing with aquacultural products.

It is alleged that due to lack of competition at the assembly stage and involvement of a large chain of intermediaries and transportation between the points of production and retail trade, the share of producers (fishers) of the total value of fish originating from capture fisheries is typically low. As fishers lack access to credit, means of fish preservation and market information, thus, they have poor bargaining power. Hence, widespread exploitation of fishers and extraction of rent by traders and middle agents are evident (World Bank 1991). In the case of marketing of aquacultural products, such chains of intermediaries may also emerge in the future, because the potential producers are small farmers lacking bargaining power against organized marketing agents. It will be difficult to reduce exploitation unless competition is facilitated through improved infrastructure, means of storage and better communications networks.

Another finding of the survey was the virtual absence of pond owners and operators in direct selling of fish in the market places. Most sellers are professional vendors/traders. Average annual incomes for them are much higher (more than 10 times) than those who sell fish as a secondary source of income.

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ACKNOWLEDGEMENTS

The authors acknowledge the support received from Dr. M.S.U. Chowdhury, Executive Vice Chairman and Dr. A.K.M. Nuruzzaman, Member-Director (Fisheries), Bangladesh Agricultural Research Council (BARC); Mr. A.K. Ataur Rahman, Director, Department of Fisheries (DOF); and Dr. M.A. Mazid, Director, Fisheries Research Institute (FRI), Bangladesh.

Thanks are due to Messrs. Joti Lal Barua, Eftekharul Alam, Shajahan, Kazi Ataul Kabir and Mohiuddin Ahmed for their efforts in data collection. Special thanks are due to Mr. Muzibur Rahman who provided assistance in computerization and analysis of data; to Messrs. Aynul Islam and Kazi Giasuddin for coding and editing the data, and to Mr. Mahbub Hossain and Ma. Lucia Tungala for typing the report. The report also benefitted from the suggestions and comments by Dr. Clive Lightfoot, Dr. Roger Pullin and Mr. Jay Maclean. Special thanks are due to Ms. Leticia B. Dizon, Ms. Marie Sol M. Sadorra, Ms. Casilda I. Guevara Mr. Christopher M. Bunao and Mr. Albert B. Contemprate of the ICLARM Information Division.

Appendix I

BENCHMARK HOUSEHOLD SOCIOECONOMIC SURVEY QUESTIONNAIRE

PART I

SECTION I

Identification of the households
(Col. 1 union, 2-3 mouza, 4-6 serial no.) 01 [ ][ ][ ][ ][ ][ ] 06
Name of the household head: _____
Father's/husband's name: _____
Village: Mouza: _____
Union: Thana: _____

Name of respondent and relationship with household head:

_____

SECTION II: TYPOLOGY OF HOUSEHOLD AND FARM

Profile of the household head
Age: _____ 07 [ ][ ] 08
Civil status: (married = 1, unmarried = 2) [ ] 09
Sex (male = 1, female = 2) [ ] 10
Education: (Illiterate = 1, Can read = 2, Primary = 3, Secondary = 4, Higher secondary = 5, Bachelor = 6) [ ] 11
Occupation:
Principal occupation: _____
Secondary occupation: _____ 12 [ ][ ] 13
Occupation code: 14 [ ][ ] 15

Farming	01
Daily labor	02
Housekeeping	03
Bamboo and cane works	04
Student	05
Petty trading/shopkeeping	06
Business	07
Service	08
Rickshaw/cart/boat driving	09
Driving	10
Others (specify)	11

Profile of the members of the household

1. Sex and age distribution of the members

Age group	Male	Female			
Up to 10 years			16		17
10 - 20 years			18		19
20 - 60 years			20		21
Above 60 years			22		23

2. Level of education of the eligible members of the household (above 7 years)

Level of education	Male	Female			
No education			24		25
Can read only			26		27
Primary			28		29
Secondary			30		31
Higher secondary and above			32		33

3. Principal occupation of the members of the household (age between 10 - 64 years)

Occupation	Male	Female			
Farming			34		35
Day labor			36		37
Housekeeping			38		39
Bamboo and cane works			40		41
Student			42		43
Petty trading/shopkeeping			44		45
Business			46		47
Service			48		49
Rickshaw/cart/boat driving			50		51
Driving			52		53
Others (specify)			54		55

4. Secondary occupation of the members of the household (age between 10 - 64 years)

Occupation	Male	Female			
None			56		57
Farming			58		59
Day labor			60		61
Housekeeping			62		63
Bamboo and cane works			64		65
Student			66		67
Petty trading/shopkeeping			68		69
Business			70		71
Service			72		73
Rickshaw/cart/boat driving			74		75
Driving			76		77
Others (specify)			78		79

SECTION III: PRESENT ASSET HOLDING OF THE HOUSEHOLDS

1. Landholding of the households (in decimal)

Total land owned		01/01	04
Homestead		05	08
Cultivable (crop)		09	12
Orchard/forest		13	16
Fallow land		17	20
Pond/ditch		21	24
Total cultivated land		25	28
Own land		29	32
Share/leased in		33	36
Share/leased out		37	40

2. Livestock holding (value in '00)

	Number	Value		
Bullock/buffalo			41	45
Cow			46	50
Calves/sheep/goat			51	55
Chicken/duck/pigeon			56	69
Others			61	65

(First two cols. for number)

3. Household durable assets (value in '00 Tk)

	Number	Value		
TV/VCR/VCP/Refrigerator			66	69
Radio/cassette player			70	73
Fan			74	77
Sewing machine			02/01	04
Rice/flour mills			05	08
Bicycle			09	12
Rickshaw/boat/cart			13	16
Van			17	20
Oil mill			21	24
Dhenki			25	28
Others			29	32

(First one col. for number)

4. Trees and plants

	Number	(Value '00 Tk)		
Mango			33	37
Jackfruit			38	42
Coconut			43	47
Betel nut			48	52
Bamboo			53	57
Others (specify)			58	62

(First two cols. for number)

5. House building pattern

	Number	(Value '00 Tk)			
Pacca house			63		67
Semi-pacca			68		72
Tin roofed, tin fenced, pacca floor			73		77
Tin roofed, tin fenced, kancha floor			03/01		05
Tin roofed, kancha fenced, kancha floor			06		10
Kancha			11		15
Others (specify)			16		20

(First one col. for number)

6. Mechanized transport vehicles (value in '00 Tk)

	Number	Value			
Car			21		25
Jeep			26		30
Bus			31		35
Truck			36		40
Power boat			41		45
Others (specify)			46		50

(First one col. for number)

7. Furniture and fixtures (value in '00 Tk)

	Number	Value			
Khat/chouki			51		54
Almirah			55		58
Drawer			59		62
Alna			63		66
Table			67		70
Chair			71		74
Sofa set			75		78
Showcase			04/01		04
Others (specify)			05		08

(First one col. for number)

8. Farm equipment

a. Traditional (purchase and present value in Tk)

	Number	Purchase price	Present value	Age			
Plough					09		16
Yoke					17		24
Weeder					25		32
Sickle					33		40
Spade					41		48
Leveller					49		56
Doon					57		64
Sewing basket					65		72
Khanti					73		80
Axe					05/01		08
Others					09		16

(First col. for number, three cols. each for purchase price and present value, last col. for age)

b. Modern (% share, purcahse and present value)

i) Irrigation equipment (value in '00 Tk)

	% share	Purchase price	Present value	Age			
Power tiller					17		23
DTW					24		30
STW					31		37
LLP					38		44
Tube well					45		51
Paddle pump					52		58

(First two cols. for % share, two cols. each for purchase price and present value, last one col. for age)

ii) Other equipment (value in '00 Tk)

	Number	Purchase price	Present value	Age			
Weeder					59		63
Thresher					64		68
Sprayer					69		73
Others					74		78

(First one col. for number, one col. each for purchase price and present value, last two cols. for age)

c. Fishing equipment

Number			Value		
Jhanki Jal			06/01		04
Gill net			05		08
Push net			09		12
Fishing hook			13		16
Baskets			17		20
Fenched trap			21		24
Lift net			25		28
Ucha			29		32

(First col. for number)

SECTION IV: HOUSEHOLD INCOME FROM NONFARM SOURCES

1. Annual lease/share income ('00 Tk)

Type of property	Amount/year			
Land (lease and share crop)		33		35
Bullock labor		36		38
Farm equipment		39		41
Transport vehicles		42		44
Business establishment		45		47
Livestock sharing		48		50
Others		51		53

2. Annual interest earning from savings ('00 Tk) 54 56

3. Annual income from other sources ('00 Tk)

Type of work	Income					
Wage labor	_____	57				59
Petty trading	_____	60				62
Business	_____	63				65
Service	_____	66				68
Rickshaw pulling	_____	69				71
Cart driving	_____	72				74
Bamboo and cane works	_____	75				77
Driving	_____	78				80
Boat plying	_____	07/01				03
Others (specify)	_____	04				06

4. Current household savings (bank deposit/cash in hand/lent out) ('00 Tk) _____ 07 [ ][ ][ ] 09

5. Amount of money lent out ('00 Tk) _____ 10 [ ][ ][ ] 12

6. Income from plant nursery ('00 Tk) _____ 13 [ ][ ][ ] 15

SECTION V: HOUSEHOLD ANNUAL CONSUMPTION EXPENDITURE

1. Food items (kg)

	Amount consumed					
	Self	Purchased	Price/kg			
Rice ('00 kg)	____	____	____	16		23
Wheat	____	____	____	24		31
Pulse	____	____	____	32		39
Vegetables	____	____	____	40		47
Fish	____	____	____	48		55
Meat	____	____	____	56		63
Salt	____	____	____	64		71
Soyabean/mustard oil	____	____	____	72		79
Dry fish ('00 g)	____	____	____	08/01		08
Sugar/molasses	____	____	____	09		16
Milk	____	____	____	17		24
Egg (nos.)	____	____	____	25		32
Others (total)	____	____	____	33		40

(First six cols. for self and purchased items, three cols. each, and last two cols. for price)

2. Fruits

	Amount consumed					
	Self	Purchased	Price/unit			
Jackfruit	____	____	____	41		47
Banana (bunch)	____	____	____	48		54
Mango	____	____	____	55		61
Watermelon	____	____	____	62		68
Litchi ('000)	____	____	____	69		75
Pineapple	____	____	____	09/01		07

	Self	Purchased	Price/unit			
Papaya	____	____	____	08		14
Guava ('00)	____	____	____	15		21
Coconut	____	____	____	22		28
Others	____	____	____	29		35

(First three cols. for self and next two cols. for purchased items)

3. Nonfood items

Items	Amount spent ('00 Tk)			
Clothing	____	36		40
Schooling	____	41		45
Housing (maintenance)	____	46		50
Medicare	____	51		55
Recreation	____	56		60
Festival and social ceremonies	____	61		65
Maintenance of assets	____	66		70
and equipment	____	71		75
Purchase of durable assets (radio, TV, bicycle, motorcycle, watch, furniture, etc.)	____	76		80
Purchase of land	____	10/01		05
Purchase of ornaments	____	06		10
Others (specify)	____	11		15

SECTION VI: INDEBTEDNESS OF THE HOUSEHOLD

1. Total outstanding loans till date ('00 Tk) 16 17

2. Amount of loan received during the last five years
   a. Institutional ('00 Tk) ____
      - pond fishery ____ 18 20
      - other fishery ____ 21 23
      - nonfishery ____ 24 26

      i) If the loan is for pond fishery state purposes ____ 27
         Capital (reexcavation and equipment) 1
         Production (operating inputs) 2
         Both 3

      ii) What was the area of pond for which loan was taken?
         ____ decimals 28 30
   b. Noninstitutional ('000 Tk) ____ 31 32

SECTION VII: SOCIAL STATUS AND HEALTH PRACTICES OF THE HOUSEHOLD

1. Social status of the respondent
   a. Are you an elected member of the local bodies (union parishad, thana parishad, etc.)? (Yes =1, No = 0) 33
   b. Are you a member of school/madrasha etc. executive committee? (Yes =1, No = 0) 34
   c. Did you ever elect a member of the local bodies? (Yes =1, No = 0) 35

d. Are you an executive committee member of the village cooperatives/clubs? (Yes =1, No = 0) ☐ 36

e. Do you participate in the village salish? (Yes =1, No = 0) ☐ 37

2. Health and sanitation practices of the households

a. Sources of drinking water ☐ 38

Tube wells	1
Pond/ditch	2
River	3
Wells	4

b. Type of latrine owned by the households ☐ 39

No latrine	1
Pacca	2
Semi-pacca	3
Katcha	4

c. Did you immunize your children? (Yes =1, No = 0) ☐ 40

SECTION VIII: FARM PRODUCTION ACTIVITIES

1. Land allocated under different crops (type and area in decimal)

a.	Aus		41					44
b.	Amon		45					48
c.	Boro		49					52
d.	Sugarcane		53					56
e.	Wheat		57					60
f.	Jute		61					64
g.	Oil seeds		65					68
h.	Pulses		69					72
i.	Condiments		73					76
j.	Gram		77					80
k.	Potato		11/01					04
l.	Vegetables		05					08
m.	Papaya		09					12
n.	Banana		13					16
o.	Pineapple		17					20
p.	Mango		21					24
q.	Jackfruit		25					28
r.	Litchi		29					32
s.	Guava		33					36
t.	Forest/trees		37					40
u.	Pond/ditch		41					44
v.	Bamboo		45					48
w.	Others (specify)		49					52

2. Utilization of resources in farm production activities

a. Aus crop

Land allocated (decimal) _____

Inputs	Quantity	Price/wage/unit			
Self inputs					
Seed/seedlings			53		57
Organic fertilizers (kg)					
Cowdung			58		62
Chicken manure			63		67
Compost			68		72
Ash			73		77
Labor (days)			12/01		05
Animal labor (days)			06		10
Purchased inputs					
Seed/seedlings (kg)			11		15
Inorganic fertilizers (kg)			16		20
Organic fertilizers (kg)					
Cowdung			21		25
Chicken manure			26		30
Compost			31		35
Ash			36		40
Pesticides ('00 ml/g)			41		45
Labor (days)			46		50
Animal labor (days)			51		55

(First three cols. for quantity)

Other costs (Tk)					
Power tiller			56		59
Irrigation (modern)			60		63
Rent for land			64		67
Rent for other farm equipment			68		71
Production					
Total production (kg)			72		76
Quantity sold (kg)			13/01		05
Landlord's share (kg)			06		09
Price (Tk/kg)			10		11

b. Amon crop

Land allocated (decimal) _____

Inputs	Quantity	Price/wage/unit			
Self inputs					
Seed/seedlings			12		16
Organic fertilizers (kg)					
Cowdung			17		21
Chicken manure			22		26
Compost			27		31
Ash			32		36
Labor (days)			37		41
Animal labor (days)			42		46

Purchased inputs				
Seed/seedlings (kg)			47	51
Inorganic fertilizers (kg)			52	56
Organic fertilizers (kg)				
Cowdung			57	61
Chicken manure			62	66
Compost			67	71
Ash			72	76
Pesticides (liter/kg)			14/01	05
Labor (days)			06	10
Animal labor (days)			11	15

(First three cols. for quantity)

Other costs (Tk)			
Power tiller		16	19
Irrigation (modern)		20	23
Rent for land		24	27
Rent for other farm equipment		28	31
Production			
Total production (kg)		32	36
Quantity sold (kg)		37	41
Landlord's share (kg)		42	45
Price (Tk/kg)		46	47

c. Boro crop

Land allocated (decimal)

Inputs	Quantity	Price/wage/unit		
Self inputs				
Seed/seedlings			48	52
Organic fertilizers (kg)				
Cowdung			53	57
Chicken manure			58	62
Compost			63	67
Ash			68	72
Labor (days)			73	77
Animal labor (days)			15/01	05
Purchased inputs				
Seed/seedlings (kg)			06	10
Inorganic fertilizers (kg)			11	15
Organic fertilizers (kg)				
Cowdung			16	20
Chicken manure			21	25
Compost			26	30
Ash			31	35
Pesticides (liter/kg)			36	40
Labor (days)			41	45
Animal labor (days)			46	50

(First three cols. for quantity)

Other costs (Tk)

Power tiller	_____	51	54
Irrigation (modern)	_____	55	58
Rent for land		59	62
Rent for other farm equipment	_____	63	66

Production

Total production (kg)	_____	67	71
Quantity sold (kg)	_____	72	76
Landlord's share (kg)	_____	77	80
Price (Tk/kg)	_____	16/01	02

d. Wheat

Land allocated (decimal) _____

Inputs	Quantity	Price/wage/unit		
Self inputs				
Seed/seedlings	_____	_____	03	07
Organic fertilizers (kg)				
Cowdung	_____	_____	08	12
Chicken manure	_____	_____	13	17
Compost	_____	_____	18	22
Ash	_____	_____	23	27
Labor (days)	_____	_____	28	32
Animal labor (days)	_____	_____	33	37
Purchased inputs				
Seed/seedlings (kg)	_____	_____	38	42
Inorganic fertilizers (kg)	_____	_____	43	47
Organic fertilizers (kg)				
Cowdung	_____	_____	48	52
Chicken manure	_____	_____	53	57
Compost	_____	_____	58	62
Ash	_____	_____	63	67
Pesticides (liter/kg)	_____	_____	68	72
Labor (days)	_____	_____	73	77
Animal labor (days)	_____	_____	17/01	05

(First three cols. for quantity)

Other costs (Tk)

Power tiller	_____	06	09
Irrigation (modern)	_____	10	13
Rent for land	_____	14	17
Rent for other farm equipment	_____	18	21

Production

Total production (kg)	_____	22	26
Quantity sold (kg)	_____	27	31
Landlord's share (kg)	_____	32	35
Price (Tk/kg)	_____	36	37

e. Jute

Land allocated (decimal) _____

Inputs	Quantity	Price/wage/unit			
Self inputs					
Seed/seedlings	_____	_____	38		42
Organic fertilizers (kg)					
Cowdung	_____	_____	43		47
Ash	_____	_____	48		52
Labor (days)	_____	_____	53		57
Animal labor (days)	_____	_____	58		62
Purchased inputs					
Seed/seedlings (kg)	_____	_____	63		67
Inorganic fertilizers (kg)	_____	_____	68		72
Organic fertilizers (kg)	_____	_____			
Cowdung	_____	_____	73		77
Pesticides (liter/kg)	_____	_____	18/01		05
Labor (days)	_____	_____	06		10
Animal labor (days)	_____	_____	11		15

(First three cols. for quantity)

Other costs (Tk)				
Power tiller	_____	16		19
Irrigation (modern)	_____	20		23
Rent for land	_____	24		27
Rent for other farm equipment	_____	28		31
Production				
Total production (kg)	_____	32		36
Quantity sold (kg)	_____	37		41
Landlord's share (kg)	_____	42		45
Price (Tk/kg)	_____		46	47

f. Oil seeds

Land allocated (decimal) _____

Inputs	Quantity	Price/wage/unit			
Self inputs					
Seed/seedlings	_____	_____	48		52
Organic fertilizers (kg)					
Cowdung	_____	_____	53		57
Chicken manure	_____	_____	58		62
Compost	_____	_____	63		67
Ash	_____	_____	68		72
Labor (days)	_____	_____	73		77
Animal labor (days)	_____	_____	19/01		05
Purchased inputs					
Seed/seedlings (kg)	_____	_____	06		10
Inorganic fertilizers (kg)	_____	_____	11		15
Organic fertilizers (kg)					

Cowdung	_____	_____	16		20
Chicken manure	_____	_____	21		25
Compost	_____	_____	26		30
Ash	_____	_____	31		35
Pesticides (liter/kg)	_____	_____	36		40
Labor (days)	_____	_____	41		45
Animal labor (days)	_____	_____	46		50

(First three cols. for quantity)

Other costs (Tk)					
Power tiller		_____	51		54
Irrigation (modern)		_____	55		58
Rent for land		_____	59		62
Rent for other farm equipment		_____	63		66
Production					
Total production (kg)		_____	67		71
Quantity sold (kg)		_____	72		76
Landlord's share (kg)		_____	77		80
Price (Tk/kg)		_____		20/01	02

g. Pulses

Land allocated (decimal) _____

Inputs	Quantity	Price/wage/unit			
Self inputs					
Seed/seedlings	_____	_____	03		07
Organic fertilizers (kg)					
Cowdung	_____	_____	08		12
Chicken manure	_____	_____	13		17
Compost	_____	_____	18		22
Ash	_____	_____	23		27
Labor (days)	_____	_____	28		32
Animal labor (days)	_____	_____	33		37
Purchased inputs					
Seed/seedlings (kg)	_____	_____	38		42
Inorganic fertilizers (kg)	_____	_____	43		47
Organic fertilizers (kg)					
Cowdung	_____	_____	48		52
Chicken manure	_____	_____	53		57
Compost	_____	_____	58		62
Ash	_____	_____	63		67
Pesticides (liter/kg)	_____	_____	68		72
Labor (days)	_____	_____	73		77
Animal labor (days)	_____	_____	21/01		05

(First three cols. for quantity)

Other costs (Tk)					
Power tiller			06		09
Irrigation (modern)			10		13

Rent for land			14	17
Rent for other farm equipment			18	21
Production				
Total production (kg)		_____	22	26
Quantity sold (kg)		_____	27	31
Landlord's share (kg)		_____	32	35
Price (Tk/kg)		_____	36	37

h. Potato

Land allocated (decimal) _____

Inputs	Quantity	Price/wage/unit		
Self inputs				
Seed/seedlings	_____	_____	38	42
Organic fertilizers (kg)				
Cowdung	_____	_____	43	47
Chicken manure	_____	_____	48	52
Compost	_____	_____	53	57
Ash	_____	_____	58	62
Labor (days)	_____	_____	63	67
Animal labor (days)	_____	_____	68	72
Purchased inputs				
Seed/seedlings (kg)	_____	_____	73	77
Inorganic fertilizers (kg)	_____	_____	22/01	05
Organic fertilizers (kg)				
Cowdung	_____	_____	06	10
Chicken manure	_____	_____	11	15
Compost	_____	_____	16	20
Pesticides (liter/kg)	_____	_____	21	25
Labor (days)	_____	_____	26	30
Animal labor (days)	_____	_____	31	35

(First three cols. for quantity)

Other costs (Tk)				
Power tiller			36	39
Irrigation (modern)		_____	40	43
Rent for land		_____	44	47
Rent for other farm equipment		_____	48	50
Production				
Total production (kg)		_____	51	55
Quantity sold (kg)		_____	56	60
Landlord's share (kg)		_____	61	64
Price (Tk/kg)		_____	65	66

i. Vegetables

Land allocated (decimal) _____

Inputs	Quantity	Price/wage/unit		
Self inputs				
Seed/seedlings	_____	_____	67	71
Organic fertilizers (kg)				

Cowdung			72	76
Chicken manure			23/01	05
Compost			06	10
Oil cake			11	15
Ash			16	20
Labor (days)			21	25
Animal labor (days)			26	30
Purchased inputs				
Seed/seedlings (kg)			31	35
Inorganic fertilizers (kg)			36	40
Organic fertilizers (kg)				
Cowdung			41	45
Chicken manure			46	50
Compost			51	55
Oil cake			56	60
Ash			61	65
Pesticides (liter/kg)			66	70
Labor (days)			71	75
Animal labor (days)			76	80

(First three cols. for quantity)

Other costs (Tk)				
Power tiller			24/01	04
Irrigation (modern)			05	08
Rent for land			09	12
Rent for other farm equipment			13	16
Production				
Total production (kg)			17	21
Quantity sold (kg)			22	26
Landlord's share (kg)			27	30
Price (Tk/kg)			31	32

j. Condiments

Land allocated (decimal)

Inputs	Quantity	Price/wage/unit		
Self inputs				
Seed/seedlings			33	37
Organic fertilizers (kg)				
Cowdung			38	42
Compost			43	47
Labor (days)			48	52
Animal labor (days)			53	57
Purchased inputs				
Seed/seedlings (kg)			58	62
Inorganic fertilizers (kg)			63	67
Organic fertilizers (kg)				
Cowdung			68	72
Pesticides (liter/kg)			73	77

Labor (days)	_____	_____	25/01		05
Animal labor (days)	_____	_____	06		10

(First three cols. for quantity)

Other costs (Tk)					
Power tiller		_____	11		14
Irrigation (modern)		_____	15		18
Rent for land		_____	19		22
Rent for other farm equipment		_____	23		26
Production					
Total production (kg)		_____	27		31
Quantity sold (kg)		_____	32		36
Landlord's share (kg)		_____		37	40
Price (Tk/kg)		_____		41	42

k. Gram _____

Land allocated (decimal)

Inputs	Quantity	Price/wage/unit			
Self inputs					
Seed/seedlings	_____	_____	43		47
Organic fertilizers (kg)					
Cowdung	_____	_____	48		52
Compost	_____	_____	53		57
Labor (days)	_____	_____	58		62
Animal labor (days)	_____	_____	63		67
Purchased inputs					
Seed/seedlings (kg)	_____	_____	68		72
Inorganic fertilizers (kg)	_____	_____	73		77
Organic fertilizers (kg)					
Cowdung	_____	_____	26/01		05
Compost	_____	_____	06		10
Pesticides (liter/kg)	_____	_____	11		15
Labor (days)	_____	_____	16		20
Animal labor (days)	_____	_____	21		25

(First three cols. for quantity)

Other costs (Tk)					
Power tiller		_____		26	29
Irrigation (modern)		_____		30	33
Rent for land		_____		34	37
Rent for other farm equipment		_____		38	41
Production					
Total production (kg)		_____	42		46
Quantity sold (kg)		_____	47		51
Landlord's share (kg)		_____		52	55
Price (Tk/kg)		_____		56	57

l. Sugarcane

Land allocated (decimal) _____

Inputs	Quantity	Price/wage/unit		
Self inputs				
Seedlings (in '00 nos.)			58	62
Organic fertilizers (kg)				
Cowdung			63	67
Chicken manure			68	72
Compost			73	77
Oil cake			27/01	05
Ash			06	10
Labor (days)			11	15
Animal labor (days)			16	20
Purchased inputs				
Seed/seedlings (kg)			21	25
Inorganic fertilizers (kg)			26	30
Organic fertilizers (kg)				
Cowdung			31	35
Compost			36	40
Oil cake			41	45
Lime			46	50
Ash			51	55
Pesticides ('00 ml/g)			56	60
Labor (days)			61	65
Animal labor (days)			66	70

(First three cols. for quantity)

Other costs (Tk)			
Power tiller		71	74
Irrigation (modern)		75	78
Rent for land		28/01	04
Rent for other farm equipment		05	08
Production			
Total production (kg)		09	13
Quantity sold (kg)		14	18
Landlord's share (kg)		19	22
Price (Tk/kg)		23	24

m. Pineapple

Land allocated (decimal) _____

Inputs	Quantity	Price/wage/unit		
Self inputs				
Seed/seedlings			25	29
Organic fertilizers (kg)			30	34
Labor			35	39

Purchased inputs				
Seed/seedlings (kg)			40	44
Inorganic fertilizers (kg)			45	49
Organic fertilizers (kg)			50	54
Pesticides ('00 ml/g)			55	59
Labor (days)			60	64

(First three cols. for quantity)

Production				
Total production (nos.)			65	69
Quantity sold (nos.)			70	74
Landlord's share (nos.)			75	78
Price (Tk/piece)			79	80

n. Banana

Land allocated (decimal)

Inputs	Quantity	Price/wage/unit		
Self inputs				
Seedlings (nos.)			29/01	05
Organic fertilizers (kg)			06	10
Cowdung			11	15
Chicken manure			16	20
Compost			21	25
Labor			26	30

Purchased inputs				
Seedlings (nos.)			31	35
Inorganic fertilizers (kg)			36	40
Organic fertilizers (kg)				
Cowdung			41	45
Compost			46	50
Labor			51	55

(First three cols. for quantity)

Production (nos. in bunch)				
Total production			56	59
Quantity sold			60	63
Price (Tk/bunch)			64	65

o. Papaya

Land allocated (decimal)

Inputs	Quantity	Price/wage/unit		
Self inputs				
Seed/seedlings			66	70
Organic fertilizers (kg)			71	75
Labor (days)			76	80

Purchased inputs

Seedlings (nos.)	_____	_____	30/01		05
Inorganic fertilizers (kg)	_____	_____	06		10
Organic fertilizers (kg)	_____	_____	11		15
Labor (days)	_____	_____	16		20

(First three cols. for quantity)

Production

Total production (kg)		_____	21		25
Quantity sold (kg)		_____	26		30
Landlord's share (kg)		_____	31		34
Price (Tk/kg)		_____	35		36

p. Guava

Land allocated (decimal) _____

Inputs	Quantity	Price/wage/unit			
Self inputs					
Seedlings	_____	_____	37		41
Organic fertilizers (kg)	_____	_____	42		46
Cowdung	_____	_____	47		51
Chicken manure	_____	_____	52		56
Compost	_____	_____	57		61
Labor (days)	_____	_____	62		66
Purchased inputs	_____	_____			
Seedlings (kg)	_____	_____	67		71
Inorganic fertilizers (kg)			72		76
Organic fertilizers (kg)	_____	_____			
Cowdung	_____	_____	31/01		05
Compost	_____	_____	06		10
Labor (days)			11		15

(First three cols. for quantity)

Production		_____			
Total production		_____	16		20
Quantity sold		_____	21		25
Price (Tk/hundred)			26		27

q. Jackfruit

Land allocated (decimal) _____

Inputs	Quantity	Price/wage/unit			
Self inputs					
Inorganic fertilizers	_____	_____	28		32
Cowdung	_____	_____	33		37
Chicken manure	_____	_____	38		42
Compost	_____	_____	43		47
Labor (days)	_____	_____	48		52
Purchased inputs					
Inorganic fertilizers	_____	_____	53		57
Organic fertilizers (kg)					

Cowdung			58		62
Compost			63		67
Labor (days)			68		72

(First three cols. for quantity)

Production (nos.)					
Total production			73		77
Quantity sold			32/01		05
Price (Tk/piece)				06	07

r. Litchi

Land allocated (decimal)

Inputs	Quantity	Price/wage/unit			
Self inputs					
Seedlings (nos.)			08		12
Cowdung			13		17
Compost			18		22
Labor (days)			23		27
Purchased inputs					
Seedlings (nos.)			28		32
Inorganic fertilizers (kg)			33		37
Cowdung			38		42
Compost			43		47
Labor (days)			48		52

(First three cols. for quantity)

Production					
Total production			53		57
Quantity sold			58		62
Price (Tk/hundred)				63	64

s. Forest

Land allocated (decimal)

Hired labor (days)				65	66
Self labor (days)				67	68
Production					
Firewood ('00 kg)				69	70
Quantity sold				71	72
Price (Tk/hundred kg)				73	74
Timber production (no. of trees)					
Self used (no. of trees)			75		77
Quantity sold (no. of trees)			78		80
Price (Tk/tree)			33/01		04

t. Livestock (cattles and buffaloes)

Number of heads				05	06
Value ('000 Tk)			07		09

Utilization of inputs

Inputs	Quantity	Price/wage/unit			
Self inputs					
Labor days			10		14
Straw ('00 kg)			15		19
Grass ('00 kg)			20		24
Oil cake (kg)			25		29
Rice bran (kg)			30		34
Pulse bran (kg)			35		39
Local medicine			40		44
Others (specify)			45		49
Purchased inputs					
Labor (days)			50		54
Straw (kg)			55		59
Grass (kg)			60		64
Oil cake (kg)			65		69
Rice bran (kg)			70		74
Pulse bran			75		79
Wheat bran (kg)			34/01		05
Medicine			06		10
Others			11		15

(First three cols. for quantity)

u. Livestock (goat/sheep)

Number of heads		16	17
Value ('00 Tk)		19	20

Utilization of inputs

Inputs	Quantity	Price/wage/unit			
Self inputs					
Labor days			21		25
Grass			26		30
Local medicine			31		35
Others (specify)			36		40
Purchased inputs					
Labor (days)			41		45
Grass			46		50
Medicine			51		55
Others			56		60

(First three cols. for quantity)

v. Livestock (poultry/ducks)

Number of heads		61	62
Value ('00 Tk)		63	64

Utilization of inputs

Inputs	Quantity	Price/wage/unit			
Self inputs					
Labor (days)			65		69
Rice bran (kg)			70		74

Waste rice	_____	_____	75		79
Wheat bran (kg)	_____	_____	35/01		05
Local medicine	_____	_____	06		10
Others (specify)	_____	_____	11		15

Purchased inputs

Labor (days)	_____	_____	16		20
Rice bran (kg)	_____	_____	21		25
Wheat bran (kg)	_____	_____	26		30
Medicine	_____	_____	31		35
Others	_____	_____	36		40

(First three cols. for quantity)

Production

Total production (kg)		_____	41		43
Quantity sold (kg)		_____	44		46
Price (Tk/kg)		_____		47	48

w. Miscellaneous production

i. Egg (dozen)

Total production	:	_____	49		53
Quantity sold	:	_____	54		58
Price (Tk/dozen)	:	_____		59	60

ii. Milk ('00 liters)

Total production	:	_____	61		65
Quantity sold	:	_____	66		70
Price (Tk/liter)	:	_____		71	72

iii. Bamboo ('00 nos.)

Total production	:	_____	73		77
Quantity sold	:	_____	36/01		05
Price (Tk/hundred)	:	_____		06	07

iv. Mango ('00 nos.)

Total production	:	_____	08		11
Quantity sold	:	_____	12		15
Price (Tk/hundred)	:	_____		16	18

SECTION IX: BY-PRODUCTS

1. Rice straw ('00 kg)

Total production	:	_____	19		23
Quantity used as					
Animal food	:	_____	24		28
Fuel	:	_____	29		33
Roof fence	:	_____	34		38
Given away	:	_____	39		43
Quantity sold	:	_____	44		48
Price (Tk/piece)	:	_____		49	50

2. Rice bran (kg)
   - Total production : _____ 51 [ ][ ][ ][ ][ ] 55
   - Quantity used as/for
     - Animal/poultry food : _____ 56 [ ][ ][ ][ ][ ] 60
     - Fuel : _____ 61 [ ][ ][ ][ ][ ] 65
     - House maintenance : _____ 66 [ ][ ][ ][ ][ ] 70
     - Fish feed : _____ 71 [ ][ ][ ][ ][ ] 75
   - Quantity sold : _____ 76 [ ][ ][ ][ ][ ] 80
   - Price (Tk/kg) : _____ 37/01 [ ][ ] 02

3. Wheat straw ('00 kg)
   - Total production : _____ 03 [ ][ ][ ][ ][ ] 07
   - Quantity used as
     - Animal food : _____ 08 [ ][ ][ ][ ][ ] 12
     - Fuel : _____ 13 [ ][ ][ ][ ][ ] 17
     - House fence : _____ 18 [ ][ ][ ][ ][ ] 22
   - Quantity sold : _____ 23 [ ][ ][ ][ ][ ] 27
   - Price (Tk/'00 kg) : _____ 28 [ ][ ] 29

4. Jute stick ('00 kg)
   - Total production : _____ 30 [ ][ ][ ][ ][ ] 34
   - Quantity used as/for
     - Fuel : _____ 35 [ ][ ][ ][ ][ ] 39
     - House fence : _____ 40 [ ][ ][ ][ ][ ] 44
     - Vegetable garden : _____ 45 [ ][ ][ ][ ][ ] 49
   - Quantity sold : _____ 50 [ ][ ][ ][ ][ ] 54
   - Price (Tk/'00 kg) : _____ 55 [ ][ ] 56

5. Sugarcane straw ('00 kg)
   - Total production : _____ 57 [ ][ ][ ][ ][ ] 61
   - Quantity used as/for
     - Fuel : _____ 62 [ ][ ][ ][ ][ ] 66
     - Compost making : _____ 67 [ ][ ][ ][ ][ ] 71
   - Quantity sold : _____ 72 [ ][ ][ ][ ][ ] 76
   - Price (Tk/'00 kg) : _____ 77 [ ][ ] 78

6. Cowdung (kg)
   - Total production : _____ 38/01 [ ][ ][ ][ ][ ] 05
   - Quantity used for
     - Farm activities : _____ 06 [ ][ ][ ][ ][ ] 10
     - Pond fish culture : _____ 11 [ ][ ][ ][ ][ ] 15
   - Quantity sold : _____ 16 [ ][ ][ ][ ][ ] 20
   - Price (Tk/kg) : _____ 21 [ ][ ] 22

7. Compost (kg)
   - Total production : _____ 23 [ ][ ][ ][ ][ ] 27
   - Quantity used for
     - Farm activities : _____ 28 [ ][ ][ ][ ][ ] 32
     - Pond fish culture : _____ 33 [ ][ ][ ][ ][ ] 37
   - Quantity sold : _____ 38 [ ][ ][ ][ ][ ] 42
   - Price (Tk/kg) : _____ 43 [ ][ ] 44

8. Chicken/duck manure (kg)
   Total production : _____ 45 [ ][ ][ ][ ][ ] 49
   Quantity used for
   Farm activities : _____ 50 [ ][ ][ ][ ][ ] 54
   Pond fish culture : _____ 55 [ ][ ][ ][ ][ ] 59
   Quantity sold : _____ 60 [ ][ ][ ][ ][ ] 64
   Price (Tk/kg) : _____ 65 [ ][ ] 66

9. Kitchen waste (kg)
   Total production : _____ 67 [ ][ ][ ][ ][ ] 70
   Quantity used for
   Poultry/duck raising : _____ 71 [ ][ ][ ][ ][ ] 74
   Pond fish culture : _____ 75 [ ][ ][ ][ ][ ] 78
   Quantity sold : _____ 39/01 [ ][ ][ ][ ][ ] 04
   Price (Tk/kg) : _____ 05 [ ][ ] 06

PART II

If the respondent is a pond owner or operator, ask him the following questions.

SECTION I: BACKGROUND AND PHYSICAL CHARACTERISTICS OF POND/DITCH

1. Pond/ditch type
   (Pond - 1, ditch - 2) [ ] 07
2. Area of the pond/ditch (in decimal)
   Area including bank 08 [ ][ ][ ] 10
   Area excluding bank 11 [ ][ ][ ] 13
3. No. of years since reexcavation _____ 14 [ ][ ] 15
   [ ] 16
4. Pattern of acquisition
   - Inherited 1
   - Purchased 2
   - Newly excavated 3
5. Distance of pond from the household
   - Adjacent, less than 100 m 1 [ ] 17
   - Between 100-500 m 2
   - Between 500-1,000 m 3
   - More than 1,000 m 4
6. Water quality of pond
   - Turbid 1 [ ] 18
   - Green 2
   - Clear 3
7. Purpose(s) of pond excavation
   (Yes = 1, No = 0)
   - For elevating homestead [ ] 19
   - For fish culture [ ] 20
   - For household use [ ] 21
   - For road construction [ ] 22
   - For irrigation [ ] 23
   - Others (specify) [ ] 24

8. Age of the pond 25 [ ][ ] 26
9. Year of last dewatering of the pond _____ 27 [ ][ ] 28
10. Minimum water retention level
    During dry season(m) _____ [ ] 29
    During rainy season(m) _____ [ ] 30
11. Does the pond get flooded under normal flooding?
    (Yes = 1, No = 0) [ ] 31
12. Was it flooded during the 1988 flood?
    (Yes = 1, No = 0) [ ] 32
13. Ownership type [ ] 33
    - Owned by households 1
    - Institutional 2
    - Khas (Government) 3
14. If owned by households, number of owners 34 [ ][ ] 35
15. Operators' status: [ ] 36
    - Single operator 1
    - Joint operator 2
    - Single lease operator 3
    - Joint lease operator 4
    - Others 5
16. In case the operator is also a joint owner, what is his share (% of area)? 37 [ ][ ] 38

SECTION II: UTILIZATION OF POND DIKES/BANKS

1. Big trees (nos.) _____ 39 [ ][ ][ ] 41
2. Trellises/shades for vines
   (Yes = 1, No = 0) [ ] 42
3. Sunken trees/branches (Yes = 1, No = 0) [ ] 43
4. Presence of surface plants (Yes = 1, No = 0)
   - water hyacinth [ ] 44
   - kalmilata [ ] 45
   - halencha [ ] 46
   - others [ ] 47
5. Presence of chicken/duck house (Yes = 1, No = 0) [ ] 48
6. Area of the pond dike used for (in percent)
   - gardening 49 [ ][ ] 50
   - animal shed 51 [ ][ ] 52
   - grazing 53 [ ][ ] 54
   - storage for straws, dungs, etc. 55 [ ][ ] 56
   - graveyard 57 [ ][ ] 58
   - others 59 [ ][ ] 60

SECTION III: QUANTITY AND VALUE OF INPUTS USED (1990-91)

1. Pond preparation

Inputs	Quantity	Price/wage/unit		
Own resources:				
Labor (days)	_____	_____	61 [ ][ ][ ][ ]	64
Cowdung (kg)	_____	_____	65 [ ][ ][ ][ ]	68
Chicken manure	_____	_____	69 [ ][ ][ ][ ]	72
Compost (kg)	_____	_____	73 [ ][ ][ ][ ]	76

Hired resources:

Lime (kg)	_____	_____	77	80
Urea (kg)	_____	_____	40/01	04
TSP (kg)	_____	_____	05	08
Piscicide	_____	_____	09	12
Cowdung	_____	_____	13	16
Chicken manure	_____	_____	17	20
Compost	_____	_____	21	24
Labor (days)	_____	_____	25	28

(Two cols. each for quantity and price)

2. Stocking and harvesting data

a.Stocking and harvesting during 1988-89

Species		No. stocked	Size (cm)	Price/100	Qty. harvested (kg)	Price/kg	
Rohu	29						46
Catla	47						64
Mrigal	41/01						18
Kalbaos	19						36
Ch. carps	37						54
Com. carp	55						72
Tilapia	42/01						18
Nilotica	19						36
Shorputi	37						54
T. shorputi	55						72
Others	43/01						18

b.Stocking and harvesting during 1989-90

Species		No. stocked	Size (cm)	Price/100	Qty. harvested (kg)	Price/kg	
Rohu	19						36
Catla	37						54
Mrigal	55						72
Kalbaos	44/01						18
Ch. carps	19						36
Com. carp	37						54
Tilapia	55						72
Nilotica	45/1						18
Shorputi	19						36
T. shorputi	37						54
Others	55						72

c.Stocking and harvesting during 1990-91

Species		No. stocked	Size (cm)	Price/100	Qty. harvested (kg)	Price/kg	
Rohu	46/01						18
Catla	19						36
Mrigal	37						54
Kalbaos	55						72
Ch. carps	47/1						18
Com. carp	19						36
Tilapia	37						54
Nilotica	55						72
Shorputi	48/1						18
T. shorputi	19						36
Others	37						54

3. Principal source of fingerling supply
   - directly purchased from private hatchery 1 [ ] 55
   - vendors selling from private hatchery 2
   - directly purchased from government/NGO 3
   - vendors selling from government/NGO hatchery 4
   - directly collected from rivers/open waters 5
   - vendors selling fries collected from rivers/open waters 6

4. Fertilizers/feed applied last year (1990-91)

Fertilizers/feed	Quantity	Price/unit			
Own source (kg)					
Cowdung			56		60
Rice bran			61		65
Oil cake			66		70
Wheat bran			71		75
Waste/cooked rice			76		80
Purchased (kg)					
Lime			49/01		05
Urea			06		10
TSP			11		15
Cowdung			16		20
Rice bran			21		25
Wheat bran			26		30
Oil cake			31		35
Others (specify)			36		40

(First three cols. for quantity)

5. Methods used for harvesting and share by type of harvestor during 1990-91.

Methods	Self	Fisher	Total			
Netting				41		44
Dewatering				45		48
Angling				49		52
Total						

6. Cost of harvesting
   i. Share of fish (kg) 53 [ ] 55
   ii. Cash ('00 Tk) 56 [ ] 57

7. Disposal pattern of harvested fish (kg)
   - self-consumed _____ 58 [ ][ ][ ] 60
   - given away _____ 61 [ ][ ][ ] 63
   - sold _____ 64 [ ][ ][ ] 66
8. Average price per kg _____ 67 [ ][ ] 68
9. Total labor requirements at different stages of pond management (in man-days)

Stages	Labor Self	Labor Hired	Wage rate		
Pond preparation					
Dewatering	_____	_____	_____	69	77
Cleaning	_____	_____	_____	73	80
Interculture management					
Release of fingerling	_____	_____	_____	50/01	06
Supervision	_____	_____	_____	07	12
Feeding and fertilizing	_____	_____	_____	13	18
Harvesting	_____	_____	_____	19	24
Marketing	_____	_____	_____	25	30

(Two cols. for each entry)

SECTION IV: CONSTRAINTS OF ADOPTION OF FISH CULTURE

1. How are fish marketed from your pond? [ ] 31
   - sell harvests in the market 1
   - sell harvests to the fisher 2
   - others 3
2. In case of self-marketing what is the cost? (in Tk): _____ 32 [ ][ ][ ] 34
3. Problems of adoption of fish culture in ponds (Yes = 1, No = 0)
   - pond is used for other purposes [ ] 35
   - lack of manpower to supervise [ ] 36
   - risk of theft [ ] 37
   - lack of agreement among the cosharers [ ] 38
   - lack of capital [ ] 39
   - inadequate supply of fry fingerling [ ] 40
   - heterogeneous supply of fingerlings [ ] 41
   - natural harvest is enough [ ] 42
   - lack of water in the dry season [ ] 43
   - extreme turbidity of water [ ] 44
   - lack of technical knowledge [ ] 45
   - harvesting problem [ ] 46
   - others (specify) [ ] 47
4. If the pond is jointly owned/operated, did all the sharers actively participate in pond fish culture? (Yes = 1, No = 0) [ ] 48
5. If yes, how was the expenses shared? [ ] 49
   - equally 1
   - proportionately to ownership share 2
   - others (specify) 3

Appendix II

FISH MARKET OBSERVATION GUIDELINE

1. Name of market: _____
   Union: _____ Thana: _____ District: _____
   Serial number: _____

   01 [ ][ ][ ] 03

(First col. for union, last two cols. for market serial no.)

2. Number of sitting days in a week: [ ] 04
   - Once 1
   - Twice 2
   - Thrice 3
   - Daily 4

3. Number of buyers and sellers in the market: [ ] 05

Below	500	1
500 -	2,000	2
2,000 -	4,000	3
Above	4,000	4

4. Area of the market (in decimal): 6 [ ][ ][ ][ ] 09

5. Number of fish sellers/traders: 10 [ ][ ][ ] 12

6. Species observed and estimated quantity in the markets:

Species	Quantity		
a. Major carps	_____	13	15
b. Chinese carps	_____	16	18
c. Common carps	_____	19	21
d. Tilapia	_____	22	24
e. Nilotica	_____	25	27
f. Shorputi	_____	28	30
g. Live fish	_____	31	33
h. Hilsha fish	_____	34	36
i. Sea fish	_____	37	39
j. Small fish	_____	40	42
k. Shrimp/prawn	_____	43	45
l. Wild fish	_____	46	48
m. Others	_____	49	51

Appendix III

SURVEY OF FISH TRADERS/SELLERS IN RURAL MARKETS QUESTIONNAIRE

1. Name of the market place:
   Union: Thana: District:

2. Name of the fish trader:
   Village: Union: Thana:

3. Respondent serial number:
   (First col. for union, 2nd and 3rd cols. for market serial number and last three cols. for respondent serial number) 1-6

4. Respondents' residence:
   Same union 1 7
   Different union within thana 2
   Different thana 3

5. Socioeconomic profile of seller/trader
   a. Household size: 8-9
   b. Principal occupation: 10
   c. Secondary occupation: 11
      Occupation code:
      - Agriculture 1
      - Day labor 2
      - Fish trader 3
      - Cart driving 4
      - Petty trading 5
      - Rickshaw pulling 6
      - Service 7
      - Others 8
   d. Educational status:
      Education code: 12

   e. Total annual income (Tk)
      i. from principal occupation 17-21
      ii. from fish trading 22-26

6. Status of the seller/trader: 27
   a. Selling harvests from own pond/ditch 1
   b. Professional harvestor selling harvests from other ponds 2

c. Selling own harvest from open water (beels, rivers) 3
d. Middleman (selling local harvests and harvests from outside the thana) 4
e. Others (specify) 5
(If the seller is selling his own harvests, ask questions 7 and 8)

7. Amount harvested today (in kg): [ ][ ][ ] 28-30

8. Amount kept for self-consumption and/or given away (in kg) [ ][ ] 31-32

9. Quantity of various types of fish brought for sale and source (in kg):

Species	Quantity	Source		
a. Major carps				33-36
b. Chinese carps				37-40
c. Common carps				41-44
d. Tilapia				45-48
e. Nilotica				49-52
f. Shorputi				53-56
g. Live fish				57-60
h. Hilsha				61-64
i. Sea fish				65-68
j. Small fish				69-72
k. Shrimp/prawn				73-76
l. Wild fish				77-80
m. Others				81-84

(First three columns for quantity)

10. Selling and purchase price per kg by variety:

Species	Quantity	Source		
a. Major carps				05-10
b. Chinese carps				11-16
c. Common carps				17-22
d. Tilapia				23-28
e. Nilotica				29-34
f. Shorputi				35-40
g. Live fish				41-46
h. Hilsha				47-52
i. Sea fish				53-58
j. Small fish				59-64
k. Shrimp/prawn				65-70
l. Wild fish				71-76
m. Others				77-80