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Pilot Study on Impacts of Sustainable Aquaculture Project Extension through Demonstrations

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ICLARM
THE WORLD FISH CENTER

Development of Sustainable Aquaculture Project
International Center for Living Aquatic Resources Management
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Report to the Development of Sustainable Aquaculture Project

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Chapter 1

Introduction and Methods

1.1 Introduction

ICLARM has been providing technical support to the fisheries research and development agencies of Bangladesh since the late 1980s. A major program has been on technology development and transfer for sustainable aquaculture practices supported by USAID. The most recent phase started in 1999 with an emphasis on extending low cost environment friendly aquatic technologies in different regions in Bangladesh. It is implemented by ICLARM, Bangladesh Fisheries Research Institute, universities and several NGOs in 1999. The project provided inputs and training to NGO beneficiaries involved in aquaculture covering 38 districts and 67 upazilas throughout the country. Nine aquaculture technologies were recommended for on-farm demonstration in seasonal and perennial ponds and rice-fish plots. A total of 6,408 households (men and women) were directly involved in the project (40% women). This project has continued in 2000. In December 2000, the project team leader requested the PRIAP team in Bangladesh to undertake a pilot study for this project to develop methodologies for undertaking a bigger scale impact study. The in-house PRIAP team carried out this survey.

1.2 Methodology

Through discussions with the RSDA team leader and among the PRIAP team, it was decided that the pilot study should take place in one upazila where two or more NGOs of different sizes had been active for the project in 1999, and to test both formal interview methods and focus group discussions. The aim was to understand the actual practices of aquaculture in 1999 with project support and to determine the extent these practices continued in 2000 and spread to neighbors compared with control farmers. Narail Sadar Upazila was chosen as Proshika (a national NGO), Banchte Shekha (a regional NGO) and RRC (a local NGO) had all operated demonstrations. Banchte Shekha had 103 demonstrations while Proshika had 45 and RRC had only 4 participants of the project in 1999.

One structured questionnaire was used for interview with the pond operators supported by NGOs, for other neighboring pond operators, and for a control group in a union (area covered by a local council, there are several within each upazila) without NGO supported aquaculture. A simple random sample was drawn from NGO supported pond operators for interview. Pond operators not directly supported by any NGOs were selected from the same village as neighbors who might have influenced them by the demonstration. For each NGO five demonstration farmers were randomly selected from different unions and five neighboring farmers were selected from the same area for interview (except that all four RRC participants were interviewed).

A checklist was used to guide Focus Group Discussions (FGD) to get an insight of the farmers experiences and problems in aquaculture. Eight FGDs held with NGO group members: two demonstration groups supported by the project and two groups not supported by the project from each of the NGOs (Proshika and Banchte Shekha). Farmers interviewed in the sample survey were not included in FGD. Focus group discussion was not held with the RRC as all had been interviewed. Note that the sample sizes were not intended to be statistically valid but were designed to test the method. As the study took place in December 2000 ponds stocked in 2000 had not been harvested.

1.3 Pond Operator Survey in the Control Village in Narail Sadar Thana

A control site was selected for sample interviews with pond operators for comparison with the project participants. After discussion with local NGOs and DOF staff, it was decided to take a village from Kolora Union as a control site for interview.

Part of Kolora Union is under Narail Municipality and a number of NGO's are working in this union: National NGOs: (Grameen Bank, BRAC, ASA, Proshika) and local NGOs: (RISDO, ASG, AKK, KD, BAS, BAUL, Peach Dev., etc). From discussion with NGOs like BRAC and GB we found that aquaculture activities are not supported by any NGOs in some villages. Nirali and Bahirgram are villages where no NGOs have activities for aquaculture. In other villages BRAC has some pond aquaculture activities. First we visited Nirali village and found that only a few households have ponds and the people are very poor. Then we went to Bahirgram village and found a mix of people (both Hindu and Muslim) live there and have ponds. Then we discussed with a few knowledgeable people and got the names of households having ponds with fish culture, however, we did not include households only having ditches in the beel.

In Bahirgram village, there are about 400 households and the ratio of Muslims to Hindus is 55:45. Of these 44 were reported to own ponds. From the list in Table 1.1 we took 10 households at random for the questionnaire survey on their aquaculture practices.

Table 1.1 List of pond owners in Bahirgram village

1	Rahman Fakir	23	Saroj Kundu
2	Ayub Fakir	24	Montu Kundu
3	Ranga Mia	25	Bimal Nandi
4	Ali Mia	26	Johur Mollah
5	Rasamoy Nandi	27	Shaharul Mollah
6	Bimol Adhikary	28	Bhutto Mollah
7	Nirapada Kundu	29	Ali Mollah/Thakur
8	Dukhar Kundu	30	Kaosar Shelkh
9	Montu Kundu	31	Jakir Mollah
10	Arunandi Kundu	32	Ibrahim Mollah
11	Nitai Kundu	33	Enamul Mollah
12	Narayan Kundu	34	Abdul Fakir
13	Dulal Kundu	35	Shariful Mollah
14	Monimohon Kundu	36	Baccu Mollah
15	Narayan Ch. Kundu	37	Monsur Mollah
16	Potit Kundu	38	Nazrul Mollah
17	Bhojan Biswas	39	Altaf Mollah
18	Asar Mollah	40	Mujibar Mollah
19	Kashem Ali	41	Shafi Sikder
20	Abdul Aziz Mollah	42	Momrej Mollah
21	Habibur Mollah	43	Pachu Mollah
22	Rashid Master	44	Golam Asar Mollah

This confirmed that nobody got any support either financial or technical from any NGO. They mainly cultivate fish for their own consumption. But there are a few farmers doing fish culture commercially. There are a few "golda" (*Machrobrachium rosenbergii*) farms operated by individuals, they got involved in fish culture by seeing fish farms in other areas and through encouragement from their relatives and friends, etc.

Chapter 2

Focus Group Discussions

2.1 Strategy

The target size for each focus group was around 10-15 NGO members. Two demonstration and two without demonstration focus groups from each NGO were selected with the NGO's help from different unions for discussion. In fact it was only possible to bring together 4-8 participants and the discussion was held for more than one hour per group.

2.2 Banchte Shekha Participants - Chachra (South) Village, Tularampur Union

2.2.1 Participant characteristics

Eight participants attended the discussion. They were from two women groups of BS: Golap Mohila Samity and Avilash Mohila Samity. On average these group members have been with BS about 6 years. Among the participants, 2 were illiterate, 5 educated up to secondary level and one was a higher secondary student. They are all women and ranged from 19 to 40 years old.

Their ponds have been under cultivation for the last three years. Six participants out of eight could give their approximate pond size (Table 2.1).

Table 2.1 Areas of BS participant ponds in village Chachra

Area (ha)	No. of ponds
0.02 – 0.05	1
0.06 – 0.12	3
0.13+	2

2.2.2 Information sources

- ☐ male household members are actually involved in operating pond aquaculture
- ☐ participants have been cultivating fish commercially for the last 5 - 6 years in their ponds (one has a nursery business)
- ☐ two women are knowledgeable about aquaculture practices for their own ponds, they have some ideas and experience, the others do not have experience of fish culture and practices in their own ponds
- ☐ their main source of aquaculture related information was from Banchte Shekha
- ☐ other important sources for aquaculture information are from their neighbours
- ☐ they received one-day training on fish culture from BS in 1999, training content was about pond preparation, feeding and stocking
- ☐ out of eight, one participant with a poultry rearing project got knowledge about fertilising using chicken manure and she used it from her own farm in her ponds
- ☐ they could not use inputs as prescribed by BS due to lack of capital/credit last year.

2.2.3 Aquaculture practices

- ☐ the husband of one participant having a nursery business cleans his ponds every year by poisoning, liming, etc.
- ☐ others clean their ponds once in a year but do not apply any poison to kill wild fish
- ☐ there has been no change in their pond preparation practice in the last 3 years
- ☐ some of them have changed the amount of fingerlings stocking in their ponds between 1999 and 2000. Some of them overstocked, some under stocked and some stocked the same as last year
- ☐ stocking is done on the basis of availability of money to purchase quality fingerlings and choosing species that have grown better in the previous year
- ☐ they did not use cowdung in their ponds in 1998, but they used rice bran, oil cake, etc.
- ☐ they used rice bran, oil cake, chicken manure, urea, TSP, and cow dung in their ponds in 1999
- ☐ only three participants (farming commercially) used the same inputs in their ponds this year 2000 as in 1999, the others only used cow dung and rice bran this year. Also they stocked cheaper species like silver carp more because they will use it for their own consumption.

2.2.4 Production

- ☐ out of eight participants two said that they consume 90% of fish from their ponds
- ☐ the other two participants said they consume 50% of fish and sell the rest
- ☐ two participants said they sell 90% of fish from their ponds, the other two participants could not say the amount of their consumption
- ☐ they could estimate the amount of consumption over the year: they consume fish for about 6 months from their own pond, they buy wild fish for consumption during the monsoon and about 2.2 mt of fish are produced per hectare of pond
- ☐ they said that they got 25% more fish in 1999 compared to 1998 and they think production will increase this year

2.2.5 Marketing

- ☐ all fish they sell are sold at their pond side except that sometimes they sell small quantities directly in local markets
- ☐ fish prices are high this year (2000) compared to the last 2 years (20-25% increase)
- ☐ the price of fingerlings is also high in 2000 (10-15% increase)
- ☐ they have no problem for fish marketing.

2.2.6 *Problems*

- ☐ their ponds are low-lying and are flood affected almost every year: most of them lost their fish due to flood in 1999
- ☐ fish escaped from some ponds this year but fish production will increase because their growth rate is better
- ☐ water pollution
- ☐ pond area is small
- ☐ Golda production is profitable but it is difficult to protect them from poaching, there is also poaching of other fish
- ☐ most of their ponds dry-up completely during the dry season but fish are left in the ditches or low lying part of the ponds
- ☐ sometimes they have to move fish from their pond to other ponds

They suggested some solutions to overcome these problems:

- ☐ fish ponds should be flood protected with dykes and re-excavation of ponds
- ☐ increase supply of quality fingerlings from hatcheries and nurseries
- ☐ training is needed in fish culture technology, disease control and selection of good fingerlings
- ☐ increase awareness to control poaching
- ☐ increase supply of credit at low interest rate for fish culture activities.

2.2.7 *Comments on the USAID project from participants*

- ☐ good points are: some women gained knowledge in aquaculture; financial support helped them very much for aquaculture in 1999.

The bad points are:

- ☐ women got training for only one day
- ☐ training was not fully useful because fish culture decisions are taken by male members.
- ☐ they got inputs from BS very late
- ☐ BS supplied fingerlings by truck and many fingerlings died immediately after being released into their ponds
- ☐ delivery of fingerlings should be improved. Fry traders are better for delivery of fingerlings.

2.3 Banchte Shekha Participants of Tularampur Village

2.3.1 Participant characteristics

The focus group (FG) discussion was organised at Tularampur village of Tularampur union. Six pond owners comprised the focus group; these women were from two different groups of Banchte Shekha. Among the participants 50% have education up to class 14 the rest have primary literacy. Before they joined BS groups aquaculture work was mainly done by men in their households. The male members of the household still play a vital role for fish culture but these women now have an important part to play by giving technical support.

In the FG 50% of the ponds were jointly owned, 33% are seasonal ponds. Homestead ponds were typically used for household washing and bathing and had a few Indian carps stocked. This trend has changed considerably during the last decade, pond owners now stock exotic species as well as Indian carps. Before feeding and fertilizing of the ponds was irregular. They do not use pond water for irrigation. Now their ponds are used for aquaculture production rather than other household uses. Ponds are mostly small (Table 2.2).

Table 2.2 Area of BS ponds in Tularampur

Area (ha)	Number of respondents
0.02-0.05	3
0.06-0.12	1
0.13 & above	2

2.3.2 Information on aquaculture

Apart from NGO training on aquaculture, extension messages reached them from different non-formal sources: neighboring fish farmers, radio, television, fry traders and newspaper. Among NGO participants 50% were active members of Village Defense Party (VDP) of government. When they were in VDP they received training on farming activities like agriculture, livestock, poultry and aquaculture. The FG said that a large number of pond owners received extension from neighboring pond owners who culture fish.

The FG gained aquaculture knowledge mainly from project-supported training. From Banchte Shekha it was a 1-day training on basic aquaculture methods. After that some BS workers came to their pond side to give them advice but it was very irregular.

2.3.3 Aquaculture practice

Fish stocking was very irregular a decade ago, then fry were not available and people stocked mainly Indian arps. The main suppliers of fry were local traditional fishers. During the last decade the fish stocking pattern has changed a lot, in this period pond owners stocked silver carp, rajputi (rajputi) and common carp as well as Indian carps. Overstocking of fingerlings and low use of off-farm and on-farm inputs were common. After receiving project training and support (i.e., in 1999) they tried to follow these prescriptions. This year (2000) they have deviated from the trained method, they stocked more fish and used less input. They have a deep-rooted belief that overstocking brings more production. As a result in 2000 they stocked more, but the positive finding is that stocking density was less than in 1998. They reported that average stocking density before 1998 was 100-150 per decimal (24,700-37,000 per ha) whereas it stands at 80-100 per decimal (19,800-24,700 per ha) in 2000.

These participants did not follow any pond preparation method. They neither used poison nor dried their ponds to clear unwanted aquatic fauna and wild fish. The participants said they learnt about this in 1999 but did not practice it.

The pond operators do not use any fertilizer before stocking their pond; they use fertilizer only after stocking. Before 1999 they did not use inputs according to the prescribed doses, but in 1999 they followed the dose recommended by the NGO. In 2000 fertilizer and lime use has been reduced a little. They could not mention the exact amount of fertilizer and other inputs used but could say whether it was less or more.

On-farm inputs (bran and cowdung) were the main inputs for fish culture before 1999 but use of purchased inputs has been increasing. Very little chicken manure was used in 1998. Among these people, 50% used oil cake, chemical fertilizer and compost last year, i.e., with USAID project intervention. They also used some duckweed in their ponds. Eighty-three percent of them used poultry litter.

2.3.4 Production of ponds

Due to some technical problems (late stocking and fewer fingerlings), they said that production in 1999 with extension was less than in 1998 (before extension), but this year (2000) they are expecting about 10% more production than in the last two years. During the last 4-5 years they reported pond production has increased about 40-50%. Production was 5-6 kg/dec (1240-1480 kg/ha) before 1995, whereas now it stands around 10 kg/dec (2470 kg/ha). The main reasons for more production are regular stocking, increased use of different inputs, and improved knowledge about aquaculture.

2.3.5 Marketing arrangements

About five years ago they used to consume all their fish. But now they sell about 25% of their production. Fish marketing is very easy for them, fishers purchase fish from the pond side and also harvest fish. Harvesting cost is normally included in the purchase price. Fish farmers need not go to market to sell fish. There was no notable change in fish price during the last three years but it was less around 1995 (Table 2.3).

Table 2.3 Changes in farm-gate fish price in Tularampur

Species	Price (Tk/kg) in 1999	Price (Tk/kg) in 1995	% increase
Rui	30-40	28-35	7-14
Catta	28-38	25-33	12-15
Mrigal	33-40	28-33	18-21
Silver carp	20-25	18-23	9-11
Common carp	30-40	25-33	20-21
Rajputi	23-25	20-23	9-15

2.3.6 Assessment of problems

1. Inundation of pond by floodwater was a common problem. During the last 10 years ponds suffered flooding in about 50% of years.
2. These Banchte Shekha group members are too poor to pay for all the aquaculture inputs they think they need. Due to this they think pond production is lower than possible. They have been suffering this problem for a long time but still it limits adopting new aquaculture practices.
3. Fish diseases are also a notable problem, although they have learnt something about disease prevention, lack of money prevents them using their knowledge.
4. Fish poaching is a common problem for a long time.

They reported the following good and bad points about their experience with the project.

Good points of the project

1. They have learned about modern aquaculture through training, for example: stocking ratio, pond preparation, pre and post stocking fertilization, feed preparation and application, disease prevention.

Bad points of the project

1. They did not receive fry in time for stocking.
2. Amount of fish received was less than project stated amount.
3. They did not receive any follow up training.
4. Little monitoring by the NGO.

2.4 Banchte Shekha Non-Participants of Tularampur Village

2.4.1 Group characteristics

A group discussion was held in Tularampur village. All participants were women. They came from one Banchte Shekha group. They are all illiterate. They had belonged to the Banchte Shekha group for about 6 years. They have no cultivable land (Table 2.4). Their ponds were under cultivation for the last 5 years. Some ponds are cultivated jointly.

Table 2.4 Characteristics of Banchte Shekha non-participants in Tularampur

Sl	Name	Village	Gender	Age	Homestead (dec)	Pond (dec)	Cultivable (dec)
1	Monowara	Tularampur	F	20	7.5	17	0
2	Hasina	Tularampur	F	26	7.5	48	0
3	Shapna	Tularampur	F	20	40	10	0
4	Shabina	Tularampur	F	36	40	17	0

Their ponds were used for bathing, washing clothes, cow bathing, and kitchen purposes both before and after 1999.

2.4.2 Information sources

- ☐ Male household members are actually involved in fish culture.
- ☐ All participants said that they have no formal knowledge about fish culture. They have not received any technical support for aquaculture from any organization.

2.4.3 Aquaculture practices

They reported:

- ☐ No changes in their fish culture practice.
- ☐ No changes in their pond preparation. They do not use any poison.
- ☐ They use rui, grass carp, silver carp, mirror carp, rajputi and catla. They have no idea how many fingerlings were used in the last 3 years ("many").
- ☐ No changes in fertilization of ponds in last 3 years. They did not use any fertilizer before stocking. They used urea, TSP and cowdung after stocking.
- ☐ No change in feeding in last 3 years: they used rice bran and oil cake.

- ☐ In 1998 average production was 18 kg/dec (4,400 kg/ha), in 1999 it was the same. This year production will be worse due to heavy rainfall.
- ☐ They said that they consume 20% of fish from their ponds and sell 80%.
- ☐ They sell fish at their pond side. Fishers come to their ponds and harvest then.
- ☐ There have been changes in the last 3 years in marketing. Fish prices were higher in 1999 (Table 2.5) than in 1998

Table 2.5 Prices of fish at farm gate in Tularampur

Species	price (Tk/kg) in 1999
Rui	40
Rajputi	40
Mirror carp	30
Silver carp	30
Catla	30
Grass carp	22

2.4.4 Problems and opinions

- ☐ Before 1999 rajputi was affected by disease. Also in 1999 and this year rajputi has been affected by the same disease.
- ☐ Most of their ponds dry up during the dry season.
- ☐ They have no training on fish culture.
- ☐ Lack of money.

They have some suggestions:

- ☐ To provide loan for fish culture.
- ☐ To provide training for fish culture.

Opinion on USAID project

They did not get any support from BS under the USAID project for fish culture. They said some BS group members got some fingerlings from BS. If they got some fingerlings it would be better. They have had no training for fish culture.

2.5 Banchte Shekha Non-Participants of Char Tularampur Village

2.5.1 General pond use

- ☐ Eight participants were present in the FGD. They were from one BS group. They are all women and aged 16 to 40 years.
- ☐ Their ponds were cultivated for the last 3-4 years.
- ☐ Before 1999 they used their pond water for bathing, washing clothes, cooking, fish culture, irrigation and sometimes bathing their livestock. When the water level falls in the pond they stop using the pond water.

- ☐ In 1999 they used their pond water for bathing, washing clothes, fish culture, and sometimes for irrigation. In this year ponds were flooded and the water was polluted. Because of this they did not use the water for cooking. NGO staff and family planning workers advised them not to use the polluted water.
- ☐ In 2000 they used their pond water as in previous years. But now women are not using pond water for cooking after training by NGO workers. They use their ponds for traditional fish culture.

Table 2.6 Area ponds of BS non-participants in Char Tularampur village

Pond size (ha.)	No. of ponds
0.02 – 0.05	1
0.06 – 0.12	7
0.13 and above	0

2.5.2 Background

- ☐ Male household members are actually involved in operating pond aquaculture.
- ☐ They did not receive any technical support from any NGOs for aquaculture.
- ☐ They have traditional knowledge of fish culture.
- ☐ No women got any training in aquaculture from Banchte Shekha and they did not receive any credit for fish culture.

2.5.3 Aquaculture practice

- ☐ Their ponds are seasonal. In the dry season it is not possible to keep fish alive in their ponds.
- ☐ Most of the farmers cultivated fish for household consumption.
- ☐ They usually depend on fry traders for fingerlings.
- ☐ They purchase most fingerlings by weight (rui, catla, mrigel) but buy rajputi and silver carp by numbers.
- ☐ They stocked many fingerlings in their ponds, an example was give by the FG for a 20 decimal (0.08 ha) pond (Table 2.7).

Table 2.7 Example of typical stocking density for a 20 decimal (0.08 ha) pond.

Species	Weight/fish
Rajputi	1000 fish (2", 5 cm length)
Rui, Catla and Mirgal	5 kg (3-4", 7.5-10 cm) length
Silver carp	1000 fish

- ☐ Assuming 15g/fingerling, this probably amounts to 117 fingerlings/decimal or 4,700 fingerlings/ha.
- ☐ They stocked fingerlings for the last three years in this way.
- ☐ Most of the ponds dry up, but they do not clear out fish from ponds that do not dry up. In the last three years they did not do any maintenance of their ponds.

- ☐ The pond owners follow tradition and do not follow any rules for input use. After stocking they put urea, TSP and cowdung in their ponds. Those pond owners who do not use the pond water for bathing and cooking purpose used chicken manure.
- ☐ Feeding was on the pond owner's own assumption. They mainly use oil cake and rice bran, some of them use rice in the pond.

2.5.4 Production

- ☐ They do not know the level of production in their ponds, because most of the pond owners do not sell fish, they only consume fish. Some pond owners sell the rest of the fish when the pond dries up.
- ☐ Three of them said they got about 4 maunds (160 kg) of fish from their ponds (15 decimals or 0.06 ha) last year amounting to about 11 kg/decimal or 2,600 kg/ha.
- ☐ In the previous year rajputi did not grow well and was affected by disease, so they caught their rajputi before winter.
- ☐ Production is expected to increase this year because fish growth is better.
- ☐ They do not know how to identify good quality fingerlings and depend fully on what fry traders supply. They think they get poor quality fingerlings from traders.

2.5.5 Marketing arrangements

- ☐ Most of the pond owners produce fish for their own consumption and not for sale but some of them also sell fish at the pond side.
- ☐ Women are not involved in marketing of fish because men mainly operate the ponds. The men do everything for fish marketing.
- ☐ They think that fish prices are higher this year compared to the previous year.

2.5.6 Assessment and problems

Always they face these problems:

- ☐ Fish disease (particularly for rajputi) each year.
- ☐ Fry traders could not supply enough fingerlings to meet the demand of pond owner.
- ☐ Pond owners could not maintain their pond properly (feed, fingerlings, etc.) due to financial problems.
- ☐ Their ponds are small and shallow.
- ☐ They lack knowledge for better aquaculture.
- ☐ Ponds dry-up during the dry season.

They suggested some solutions to overcome these problems:

- ☐ Training in fish culture technology, disease control and selection of good fingerlings.

- ☐ Increase supply of quality fingerlings (from NGOs and nurseries).
- ☐ Credit with low interest rate (from NGOs or any donor agency)
- ☐ Inputs from donor agencies or NGOs
- ☐ To arrange the re-excavation of ponds by NGOs

2.6 Proshika Participants of Three Villages under Chandbarpur Union

2.6.1 General pond characteristics

- ☐ Five participants were present for the focus group discussion. They were from one male and one female Proshika group. Their age range was 25 to 45 years.
- ☐ Their ponds were cultivated for the last 4 to 5 years. Men and women are directly involved in fish culture.
- ☐ Before 1999 they used their pond water mainly for: bathing, cooking, drinking water (one), fish culture, washing clothes, and washing cooking materials.
- ☐ In 1999 they used their pond water mainly for: fish culture, cooking (two) bathing (three), washing cooking materials and washing clothes. This year (2000) they mainly use their ponds for fish culture.
- ☐ In 2000 their use of pond water was the same as in 1998. Note that all of the pond owners use their pond water for washing their clothes. Only in 1999 did these pond owners prepare their ponds. They applied rotenone powder, lime, and cowdung in their ponds as advised by the NGO worker. They did not use the pond water for three months. But this year they did not apply anything to their ponds, so they could use the pond water the whole year for various purposes.

Two households have ponds in the 5-15 decimal (0.02-0.06 ha) range and three have ponds of 15-30 decimals (0.06-0.12 ha).

2.6.2 Information sources

- ☐ They received aquaculture related information from Proshika. They did not get any technical support from other NGOs.
- ☐ They received 1-day training from Proshika in 1999 on pond preparation, collecting fingerlings, use of the pond for various purpose, stocking of 40-50 fingerlings of different species per decimal, feeding rules, pond management and fish marketing.
- ☐ Two participants have been cultivating fish commercially for the last 4 to 5 years in their pond and gher.

Other sources of aquaculture information:

- ☐ They received aquaculture information from TV, radio, booklet, and neighbors (three persons). Two Proshika participants attended two 6-day courses on fish culture (Shrimp and Polyculture). Their only benefits from Proshika have been training.

2.6.3 Aquaculture practice

Stocking:

- ☐ Before 1999 they stocked fingerlings on their own assumption. They did not follow any rules and guidelines for stocking.
- ☐ They usually depended on fry traders for fingerlings.
- ☐ They purchased fingerlings by weight (rui, catla, mirgal), but rajputi and silver carp were bought by number of fingerlings.
- ☐ In 1999 they said that they followed the stocking rules given in training. They stocked fingerlings according to the area of pond. They gave an example for stocking one decimal:
- ☐ In 2000 the pond owners did not follow the rules given in training in 1999. This time they said that they stocked more because there was no NGO support or supervision.

Species	Fish
Catla	3
Rui	3
Grass carp	3
Mirgal	3
Mirror carp	4
Silver carp	12
Rajputi	12
Total	40

Other inputs:

- ☐ Before 1999 these pond owners had no outside knowledge about pond preparation before stocking. But before stocking they used urea, TSP and cowdung in quantities according to their own assumption. After stocking they used urea, TSP, cowdung and sometimes lime, bran and oilcake.
- ☐ In 1999 the pond owners prepared their ponds properly. Before stocking they said they cleaned vegetation from the pond sides, repaired the pond sides, cleaned waterweeds (*kalmi* and water hyacinth), used rotenone powder and cowdung, and agitated before stocking. After stocking they used cowdung, compost, chicken manure, bran and oil cake as recommended.
- ☐ They did not use any chemical fertilizer in their ponds before stocking. Also after stocking they only used cowdung and compost, and sometimes they used lime.
- ☐ This year 2000 nobody prepared their ponds. They assumed that 1999 preparation was good enough, or had fish left over. They sometimes applied cowdung, urea, TSP and lime as they used before 1999. They could not use the amount of inputs recommended by Proshika in 2000 due to lack of money.

2.6.4 Pond Production

- ☐ Two participants said that they consumed 70% of fish and sold 30% from their pond before 1999, the rest consumed all their fish.
- ☐ Before 1999 production averaged 10 kg/decimal (2,470 kg/ha), but fish growth was not good.
- ☐ In 1999 all five participants said that they consumed about 10% of fish and sold about 90% from their ponds.

- ☐ In 1999 production was only 7 kg/decimal (1,730 kg/ha). They said production was less than in the previous years because they stocked fewer fingerlings (as per training rule), but the fish growth was good.
- ☐ In 2000 they stocked more fingerlings so they hope this year fish production will be better than the previous year.

2.6.5 Change in Marketing Arrangement

- ☐ Before 1999 the pond owners mostly produced fish for their own consumption.
- ☐ In 1999 they produced fish mainly for sale. They mostly sold fish at their pond side.
- ☐ In 1999 fish prices (Table 2.8) were higher than the previous year, because they produced larger fish. They sold their fish in 1999.

Table 2.8 Farmer prices of fish in 1999 from five ponds.

Species	Total production (kg)	Price (Tk/kg)
Rui	1400	40
Catla	1200	35
Mrigel	1400	40
Silver	600	25
Rajputi	1000	30
Common carp	1400	40

- ☐ In 2000 they did not yet sell any fish. But they are consuming 10-15% of fish.

2.6.6 Assessment and problems

Before 1999 they said their problems were:

- ☐ Shortage of quality fingerlings,
- ☐ Fish disease (particularly rajputi) each year,
- ☐ They did not know about fish culture,
- ☐ Snakes and other predators ate their fish,
- ☐ Three of them could not maintain their ponds properly due to financial problems.

Every year they face the same problems for fish culture, they suggested some solutions to overcome these problems:

- ☐ NGOs should provide quality fingerlings,
- ☐ Longer training is needed for fish culture technology, disease control, and on how to select quality fingerlings.
- ☐ They need credit (3 persons) with low interest rate from NGOs for fish culture.
- ☐ They want some inputs as grant from donor agency or NGOs.
- ☐ They need a fishery worker (NGO) to follow up on their ponds from time to time.

2.6.7 Assessment of USAID support

The advantages of USAID project were:

- Financially benefited (some part)
- They received 1-day training on preparation of pond, feeding, stocking, etc.

The disadvantages of USAID project were:

- Proshika suggested a low stocking density but they did not benefit financially in 1999, although their fish growth was better.
- Proshika did not provide the pond owners with their last installment of funds.

Additional suggestions were to:

- ☐ Provide financial support in time.
- ☐ Consider recommending the earlier stocking rate.
- ☐ Arrange training for pond owners from time to time and improve communication between the pond owners and fisheries worker (NGOs).

2.7 Proshika Participants of Five Villages under Shahabad Union.

2.7.1 Household characteristics

Eight participants attended the discussion, all from Proshika groups. Three participants were from women's groups. On average they had been in groups with Proshika for about 6 years. Among the participants 5 were illiterate, 3 had education to class 5. The respondent characteristics are shown in Table 2.9.

Table 2.9 Characteristics of Proshika participants from Shahabad union.

Sl.	Name	Village	Gender	Age	Homestead (dec)	Pond (dec)	Cultivable land (dec)
1	Bulu	Dolditpur	F	33	52	12	350
2	Jobeda	Mahajon	F	40	40	26	416
3	Aklima	Joralia	F	29	24	22	200
4	Imran	Mahajon	M	30	16	13	0
5	Abu Taleb	Joralia	M	40	116	26	416
6	Mashud Rana	Narayanpur	M	19	75	20	180
7	Abban Ali	Peruli	M	36	150	40	350
8	Moharin Ali	Peruli	M	40	61	14	150

Six out of 8 participants informed that their ponds were under cultivation for the last 3 years. Two participants said that their ponds were under cultivation for 5 years. Six participants informed that before 1999 they did know how to cultivate fish, but they had no guidance on pond cultivation. They released some fingerlings in the months of Jasitha-Ashar for their own consumption. In 1999 they got some training from Proshika. The same ponds are being used this year (2000).

Table 2.10 Pond areas of Proshika participants from Shahabad union

Pond area (decimal)	Pond area (ha)	Number
2-5	0.008-0.02	0
5-15	0.02-0.06	3
15-30	0.06-0.12	4
above 30	+ 0.12	1

There were no very small ponds represented in the FGD (Table 2.10)

2.7.2 Information sources

All of the FG participants informed that they have received technical support for aquaculture from only Proshika. The first time they received 5 days training and the second time they received one day training on aquaculture. They have received Tk 55/day and Tk 5/day for conveyance. Three male participants informed that they received some aquaculture information from fingerling traders. Two male participants said that they have received some aquaculture information from neighbors.

The three female participants informed that they have received aquaculture information only from Proshika.

2.7.3 Aquaculture practice

- ☐ The participants changed the amount of fingerlings stocked in their ponds after training (1999).
- ☐ Before 1999 they stocked more fingerlings, as a result growth was very slow.
- ☐ In 1999 one participants said that he stocked 35 fingerlings per decimal: 15 were upper level (silver carp 10 and catla 5), 10 were middle level (rajputi 5 and rui 5) and 10 were lower level (mrigal 5 and minor carps 5) species.
- ☐ Three participants informed that in 1999 they stocked 42 fingerlings/decimals: rui 15, mrigal 12, rajputi 5 and silver carp 10.
- ☐ Two participants informed that they have some books on aquaculture. They followed these books in 1999.
- ☐ One male and one female participant said that they don't know what stocking composition and density they followed in 1999.
- ☐ Four participants informed that this year (2000) they have followed the same rules as in 1999. Two participants followed their books and two participants did not follow any rules.
- ☐ They changed their pond preparation. Only 3 participants said that before 1999 they cleaned their pond and used lime, five participants didn't clean/dewater/poison before stocking. In 1999 all eight participants informed that they cleaned their pond, but they did not use any poison. This year is the same as in 1999.
- ☐ They didn't use any chemical fertilizer before 1999. They used only lime. In 1999 and this year they also didn't use any chemical fertilizer.
- ☐ Four participants said they didn't use any feed in their ponds in 1998. Four participants said they used cowdung, rice bran, oil cake etc. After training (1999) everybody said they used rice bran, oil cake, cowdung etc. But they didn't use any chemical fertilizer like urea or TSP. In 2000 they used the same feed as in 1999.
- ☐ They said that their average production was 20 kg/dec (4,900 kg/ha) before 1999. In 1999 their average production was reportedly 25 kg/dec (6,100 kg/ha). In this year they expect that their production will be the same as last year.

2.7.4 Marketing

All participants said that they consume 20% of fish from their ponds, 80% is sold. In 1999 seven participants said that they sold fish at their pond side. Fishers came to their ponds and harvested and bought all the fish. Only one participant said he sold fish to an *arot* (wholesaler) because he got a higher price than at the pond side. Before 1999 their marketing pattern was the same.

Prices in 1999 (Table 2.11) were the same as in 1998. They have no problem for fish marketing.

Table 2.11 Average price of fish to farmers in 1999 in Shahabad union.

Species	Tk/ Kg
Rui, Mrigal	48
Silver carp	28
Rajputi	40
Grass carp	43
Katla	45

2.7.5 Problems and suggestions

Problems:

- ☐ Three participants said that their ponds were flood affected in 1998.
- ☐ All kinds of fish are affected by diseases almost every year.
- ☐ Most of their ponds dry-up completely during the dry season.
- ☐ Lack of training.
- ☐ They have no money for fish culture.

They suggested some solutions to overcome problems:

- ☐ Fishponds should be flood protected and they need financial support for this.
- ☐ Ponds should be re-excavated.
- ☐ Training should be arranged for fish culture.
- ☐ Increase supply of credit at low interest.
- ☐ Should control fertilizer and pesticide use to prevent fish diseases.

Good impacts for USAID participants were reported to be:

- ☐ They got some financial support.
- ☐ They got training for aquaculture.
- ☐ Some women gained knowledge and involved in fish culture.

The bad impact for USAID participants was reported to be that last year Proshika arranged a rally about fish culture. Women were involved in this rally. The men in the FG said this caused social problems, the woman did not say anything.

2.8 Proshika Non-Participants from Daljitpur Village, Shahabad Union.

2.8.1 Group characteristics.

Meeting with Daljitpur Jhorna Mohila Samity, this women's group has 14 members and has existed for 6 years

- ☐ 7 participants were present at the session
- ☐ discussion was held for about 2 hours
- ☐ age of members 30-45 years
- ☐ education of the members is primary level

- ☐ women are not directly involved in decision making for fish culture.
- ☐ pond size: under 15 decimals - 2 ponds, 15 - 30 decimals - 5 ponds
- ☐ they have been cultivating fish in their ponds for the last 3 years
- ☐ no change in their pond size between 1999 and 2000
- ☐ use pattern of ponds is traditional.

2.8.2 Information sources

- ☐ nobody received any support from any NGO for fish production
- ☐ they usually get information on fingerlings and feeding from fry traders
- ☐ they have traditional knowledge of fish culture
- ☐ their relatives and neighbors are involved in fish culture and women sometimes got information from them
- ☐ women did not get any training and did not receive any credit from Proshika for fish culture.

2.8.3 Aquaculture practice

- ☐ their ponds are seasonal - they pump water by low-lift pump from the adjacent Chitra River during the dry season to keep the fish alive in their ponds
- ☐ out of 7 participants, 2 said that they stocked more fingerlings this year compared to the last 2 years
- ☐ those who had enough money to purchase fingerlings and bear other costs stocked more fingerlings
- ☐ the poorer farmers preferred fingerlings of cheaper species that they use mainly for household consumption
- ☐ their species composition is different this year because they each stocked more of species that grew better in the last year: some of them stocked more rajputi and less catla; some stocked more silver carp and less rui and rajputi
- ☐ rajputi is very profitable but it is risky to produce: it did not grow well in 1999 and was affected by disease
- ☐ they would like to stock more fingerlings of costly carps if they get credit from NGOs
- ☐ they clean their ponds once a year after the monsoon
- ☐ 50% of the respondents said that they re-excavated their ponds in 1999
- ☐ all ponds are flood protected
- ☐ feed is irregularly used into their ponds, they mainly use rice bran and oil cake.

2.8.4 Production

- ☐ they don't know the level of production in their ponds, because nobody sold fish. One of the participants stocked more fingerlings this year and plans to sell fish

- ☐ one of them said she got about 3 maunds of fish from her pond (15 dec) last year, that means production was about 8 kg/decimal (1,980 kg/ha)
- ☐ production should increase this year because fish growth is better and there was enough rain
- ☐ they did not get a good yield in 1998 because quality of fingerlings was low
- ☐ they also pointed out that everybody takes more care for fish culture now because they need earnings from fish culture
- ☐ fingerlings are supplied by fry traders, they depend on them for fingerlings because they can get them on credit
- ☐ fry traders charge a higher rate for fingerlings sold on credit.

2.8.5 Marketing

- ☐ they produce fish for their own consumption
- ☐ other farmers (not in FGD) sell fish at their pond side
- ☐ fish prices are higher this year compared to 1998 and 1999 (10-25% increase).

2.8.6 Problems and suggestions

Problems

- ☐ ponds dry-up during the dry season (every year)
- ☐ water pollution (every year)
- ☐ fish disease (particularly for rajputi) in 1999
- ☐ lack of fingerlings in 1999 from fry traders
- ☐ lack of credit facilities.

What they do to overcome these problems and possible suggestions for the future:

- ☐ they use LLP for pumping water from the Chitra River into their ponds for fish. Re-excavation of ponds or sinking tubewell are other ways to overcome this problem
- ☐ to counter water pollution, they use plantains (banana tree stems) in their ponds, sometimes they apply lime. They don't know how else they can overcome water pollution. They want training in this regard.
- ☐ since their ponds are completely flood protected, they say they get problems of disease in cultured fish. They don't know why rajputi was affected most by disease in 1999. Sometimes they applied lime but they could not overcome this problem

- ☐ fingerling sources are few, they depend on fry traders so they are not sure whether they get quality fingerlings or not. They need fingerlings from reliable sources
- ☐ lack of credit hampers release of fingerlings in time and adequate stocking. They want credit at low interest rate.

2.9 Proshika Non-Participants of Chakulia Village, Chandibarpur Union.

2.9.1 Group characteristics

The focus group discussion was conducted at Chakulia village, Chandibarpur union of Narail Sadar Upazila. Representatives from 11 pond owning households participated in the group discussion. These participants were from six Proshika groups. Most of them are solvent people. This region is comparatively high and free from flood. The FG participants were connected with Proshika for 3-11 years. It would appear that the Proshika group members tend to have larger ponds and be better off (Table 2.12).

Table 2.12 Distribution of respondents in Chakulia village by pond size.

Pond area (ha.)	Number of respondents
0.02-0.05	0
0.06-0.12	3
0.13 and above	8

Realization of the potential of fish culture has come within the last decade. Before that everyone used ponds for bathing and household purposes. Pond water use for household purposes (washing) has reduced a lot, but 82% of them now-a-days use their pond simultaneously for fish culture and bathing, none of them use pond water for irrigation. Only 9% of pond owners use pond water for cattle washing. All their ponds are perennial.

2.9.2 Information sources

Traditionally they stocked some local Indian carps. Aquaculture information reached them from different non-formal sources, e.g., fry traders, newspapers, radio, television and advice from Proshika group members. In each Proshika group one or two members received training on aquaculture. These people act as extension agents for the rest. Among eleven households only one household received direct training from Proshika, as he received credit on aquaculture from Proshika.

2.9.3 Aquaculture practice

These people are not direct recipients of any aquaculture project benefit and they have not changed their aquaculture practices in terms of stocking composition during the last three years (1998-2000). However, they have changed their stocking composition during the last decade.

Before 1990 they only stocked Indian carps, but now silver carp, common carp and rajputi play a dominant role in aquaculture production. The use of exotic species arose due to information from different non-formal sources. They also stock grass carp and a few pangas as well as Indian carps. According to the group 55% of them stocked pangas this year while 18% stocked it last year.

Their only fry source is vendors: all the pond owners purchase fry at their pond side, nobody had bought fry from any recognized hatchery. Over-stocking is their common practice; they

reported usual stocking densities of 100-150 fingerlings/decimal (about 25,000-37,000 fingerlings/ha).

According to the FG, none of them followed any method of pond preparation before stocking, and 90% have not heard about pond cleaning by de-watering, poisoning or netting. Most of them (90%) do not know any recommendations on stocking ratio and composition. Only 9% of them dried their pond during the last five years for re-excavation.

This FG use fertilizer only after stocking. They do not know what dose of feed and fertilizer they use. Since 1998 there was no notable change in pond fertilization and feeding. Homestead by-products (bran, cowdung and oil cake) are the main inputs. Only one person used lime last year.

2.9.4 Pond production

Fish production has gradually increased due to information from non-formal sources and demonstration effect by Proshika group members. During the last three years pond production has not changed. Production was 2-3 kg/decimal (490-740 kg/ha) before 1998, and now is 3-4 kg/decimal (740-990 kg/ha).

2.9.5 Marketing arrangements

Only one of the FG households consumes all of its production. The rest consume on average only 25%. Fishers purchase fish from these pond owners by species at prices that allow for their harvesting cost. None of the FG carry fish to the market themselves. Prices have risen between 1995 and 1998, silver carp and rajputi were reported to be the lowest priced (Table 2.13).

Table 2.13 Prices by species received by Proshika farmers in Chakulla village.

Name of species	Price (Tk/kg) in 1995	Price (Tk/kg) in 1999	% increase
Rui	28-38	38-50	32-36
Catla	25-30	33-35	17-32
Mrigal	28-38	38-50	32-36
Rajputi	23-28	28-30	7-22
Silver carp	23-28	25-30	7-9
Common carp	30-38	38-40	5-27
Pangas	not available.	60-80	-

2.9.6 Problems and suggestions

They reported the following problems:

- Most of them have inadequate knowledge of aquaculture, they have not received any formal training from any organization on fish culture.
- They realize that fish culture is a profitable business but financial crisis is a common problem for them.
- Fish disease is a regular problem, which hampers their production each year.
- Their main problem is the non-availability of quality fingerlings. Pond owners purchase fingerlings at their pond side from vendors, however they cannot measure the quality due to lack of aquaculture knowledge.

Suggestions from the FG:

- ☐ To improve aquaculture knowledge they want training on aquaculture by any NGO or DOF.

- ☐ Fish production mainly depends on the smooth supply of quality fingerlings, the pond owners expect organizational support in this sector.
- ☐ Most of their pond owners would expect low interest credit from NGO or formal banks for aquaculture.

Chapter 3

Formal Interview Survey

3.1 Survey Design and Sample

As noted in Section 1.2, the formal survey was designed to test the survey method and give indicative results, but was not intended to give statistically rigorous results. Therefore to fit within the time available random samples of only five participants and the same number of paired non-participant neighboring pond operators were taken from each of the three NGOs. Thus for each sample NGO-supported pond a nearby pond within 500 m on a random compass direction was sampled, these need not and generally were not under any other NGO program. The exceptions are that RRC had only four participants in the surveyed Upazila, and two neighbors were surveyed for one of these participants, and only four Banchte Sheka neighbors were interviewed. A further 10 pond operators from the control group were interviewed. The questionnaire was designed to be brief and was based on formats developed earlier in assessments of aquaculture practices after extension undertaken by another IFAD-funded project of ICLARM: Fisheries Extension Evaluation Project (FEEP).

3.2 Findings

Most of the ponds surveyed were stocked in 1998 as well as in 1999, but a few, notably the Proshika participants, lacked production in 1998. Stocking has continued in 2000 but by December 2000 many ponds had not yet been harvested. All of the BS and Proshika participants were women but none of the other pond operators were women. These women pond operators were reported to be about 10 years younger than male pond operators, while the RRC rice-fish participants were the oldest participants. Both BS participants and neighbors were better educated than other pond operators except for the control group (Table 3.1).

Table 3.1. Pond and operator characteristics, Narail.

Characteristic	BS participant N=5	BS neighbor N=4	Proshika participant N=5	Proshika neighbor N=5	RRC participant N=4	RRC neighbor N=5	Control N=10
No stocked in 1998	5	3	4	4	4	5	10
No stocked in 1999	5	4	5	5	4	4	9
No stocked in 2000	5	4	5	4	4	6	10
No with production in 1998	4	3	1	5	4	4	9
No with production in 1999	5	4	4	5	4	3	9
No with production in 2000	4	3	1	3	4	3	4
Male (No.)	0	4	0	5	4	5	10
Female (No.)	5	0	5	0	0	0	0
Age (years)	32.6	45	34.2	49	55.25	47.8	45.4
Education (year)	8.4	7.25	4.6	5.8	4.5	3.2	11
No education (No.)	0	0	2	2	2	2	0

Pond operators are not usually the poorest people in rural Bangladesh because most own a pond. However, the NGO participants tended to have less land than their neighbors, and the BS and RRC participants had least land but still averaged over 1.3 ha per household. Interestingly the NGO participants share-crop out significant areas of land (the control group share-crop out even more land). The Proshika participants had relatively small ponds, while the BS and RRC participants had larger than average ponds (Table 3.2). Hence targeting at

women appears to have been good but targeting at resource poor pond owners and small pond owners appears to have been less good.

Table 3.2 Landholding (average in ha) of pond owning households, Narail.

	BS - participant N=5	BS - neighbor N=4	Proshika - participant N=5	Proshika - neighbor N=5	RRC - participant N=4	RRC - neighbor N=5	Control N=10
Sample size							
Homestead land	0.09	0.10	0.08	0.08	0.11	0.21	0.28
Ponds	0.26	0.19	0.08	0.18	0.37	0.06	0.15
Own cultivated land	0.78	1.80	1.34	1.02	0.39	0.73	0.87
Own other land	0.22	0.29	0.26	0.03	0.02	0.12	0.00
Share crop/rented in	0.00	0.27	0.00	1.15	0.29	0.53	0.16
Share crop/rented out	0.25	0.30	0.51	0.32	0.31	1.17	2.10
Total operated land	0.78	2.07	1.34	2.17	0.68	1.25	1.03
Total own land	1.38	2.66	2.00	2.75	1.47	2.69	3.56

The BS and Proshika participants adopted carp polyculture packages offered by the NGOs under ICLARM training and supervision, the RRC participants adopted rice-fish culture (but had already been doing this in 1998), some of their neighbors and one control pond also apparently received some extension. Ponds were either owner operated or leased and operated by the respondent, only two were group operated. All respondents had in 2000 retained access to the pond/field they operated in 1999, with two participants, one neighbor and one control farmer adding ponds/plots for fish culture in 2000 (Table 3.3).

Table 3.3. Aquaculture area and technology adopted in 1999 and 2000, Narail.

	Sample size	BS - participant N=5	BS - neighbor N=4	Proshika - participant N=5	Proshika - neighbor N=5	RRC - participant N=4	RRC - neighbor N=5	Control N=10
Technology adopted	Rice fish							
	Polyculture	5		5		4		
Area in 1999	(decimals)	50.2	40	16.8	26.4	85.5	12.8	37.9
	(ha)	0.20	0.16	0.07	0.11	0.35	0.05	0.15
Ownership	single	3	1	4	4	4	4	8
	leased	2	2	1	1			1
	multi		1					1
Operation	self	4	3	4	5	4	5	10
	group	1	1					
No. not cultivated same pond in 2000		0	0	0	1	0	0	0
No. cultivated additional/different pond/plot in 2000		0	1	1	0	1	0	1
Area in 2000	(decimals)		8	30		3		200
	(ha)		0.03	0.12		0.01		0.81
Ownership	single		1	1		1		
	leased							1
Operation	self		1	1		1		1

On average all NGO participants reported stocking fewer fingerlings per ha than did neighbors and control farmers (Table 3.4). However, the ICLARM support of 1999 apparently resulted in reduced stocking density for BS participants and increased stocking density for Proshika and RRC participants, BS and RRC participants continued similar practice in 2000. The neighbors of Proshika participants reportedly reduced stocking density in 2000 but this is unlikely to be linked with a diffusion impact of the project because both they and the participants next to them reduced from the same stocking density in 1999. For comparison the recommended stocking densities given by ICLARM to partner NGOs were 6,180-8,400 fingerlings per ha for carp polyculture in ponds (lower figure for seasonal ponds and higher figure for perennial ponds), and 12,350 for rice-fish culture of which 64% were to be golda chingri (*Machrobrachium rosenbergii*). Thus the RRC participants stocked almost exactly the prescribed number in 1999, but both BS and Proshika participants reported that they followed much higher stocking densities in 1999 than had been recommended. It should also be noted that the ICLARM recommendations under this project are for lower stocking

densities than those recommended by various DOF projects studied in 1998-1999 by ICLARM (Thompson et al. 2000). However, satisfaction with stocking practice in 1999 (or subsequent actions on 2000) seemed to be quite high among participants, whereas non-participants tended to rate their stocking in 1998 as best (on average these were among their lower stocking densities).

Table 3.4. Stocking density and ranking of its effectiveness during 1998-2000.

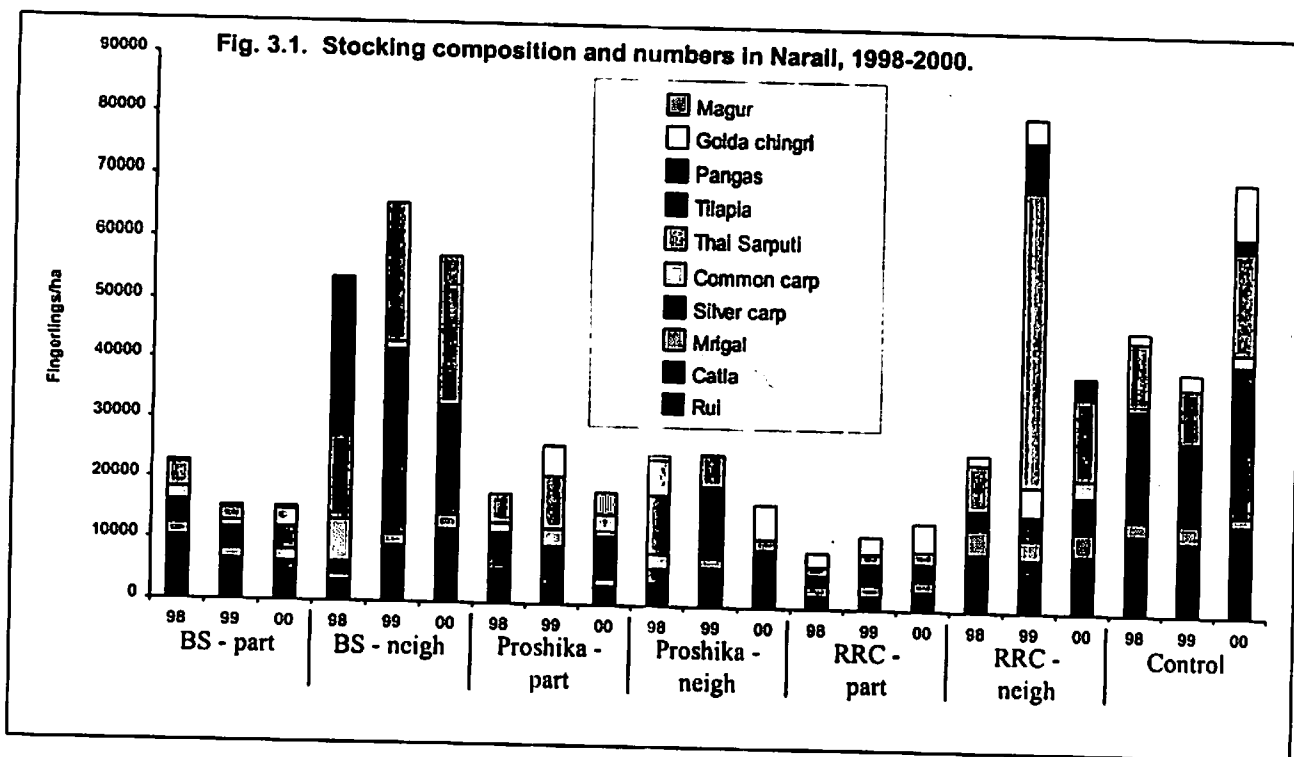
Attribute		BS – participant N=5	BS - neighbor N=4	Proshika – participant N=5	Proshika - neighbor N=5	RRC – participant N=4	RRC - neighbor N=5	Control N=10
Stocking density (fingerling/ha)	1998	23,127	53,624	17,900	24,951	9,092	26,013	46,947
	1999	15,406	65,471	26,275	25,289	12,099	79,780	39,871
	2000	15,373	57,254	18,728	16,847	14,290	39,366	72,179
Stocking assessment – 1998	1 st	1	2	0	2	0	2	3
	2 nd	1	0	2	1	3	0	4
	3 rd	3	2	3	1	1	3	3
Stocking assessment – 1999	1 st	3	2	4	2	2	2	4
	2 nd	2	2	1	3	1	2	3
	3 rd	0	0	0	0	1	0	2
Stocking assessment – 2000	1 st	1	0	1	1	2	1	3
	2 nd	2	2	2	1	1	3	7
	3 rd	2	2	2	2	1	1	0

The ICLARM recommendations for stocking composition are shown in Table 3.5. Overall respondents reported few changes between 1998, 1999 and 2000 in their stocking compositions, but there were substantial differences between categories of respondent (Fig. 3.1). NGO participants and neighbors tended to have different stocking compositions except for Proshika participants and neighbors (who also had the most similar stocking densities) who all concentrated on silver carp and Thai Sharputi (52-67% of fish stocked). By comparison BS participants used more major carps while neighbors stocked more exotic fishes and these trends were not affected by any project support in 1999. RRC participants differed in that golda chingri comprised 25-33% of their stocking – again this was not affected by support from the project in 1999, when they were actually recommended to substantially increase the proportion of golda chingri in their stocking. Proshika participants also experimented with golda chingri in 1999 but did not continue, and some non-participants have also tried it.

Table 3.5. Stocking densities (fingerlings/ha) recommended by ICLARM in 1999.

Species	Seasonal polyculture	Perennial polyculture	Rice-fish
Catla	494	1,482	988
Silver carp	494	1,482	1,976
Thai Sharputi	2,470	2,470	0
Rui	494	988	988
Grass carp	494	494	494
Mrigal/Kalibaush/Gainna	1,482	1,235	0
Mirror carp	247	247	0
Golda chingri	0	0	7,904
Total	6,175	8,398	12,350

It was apparent in the interviews that actually stocking practice differed greatly from recommended practice. Thus the project recommended use of limited numbers of large fingerlings, and participants tried to follow this to some extent. However, some of the very high stocking densities recorded (for example for RRC neighbors) are because they reported that they stocked Thai Sharputi fry by weight with examples of 1,000 fry per kg, implying fry of not more than 1 g weight, compared with more usual weights of 3 g per fish stocked (according to the interviews). This typical practice clearly differs greatly from the fingerlings of 7.5-10.0 cm that the project recommended. If larger fingerlings are so difficult to obtain it may be that alternative recommendations for different sizes and/or by weight of fry/fingerlings are needed.



An important part of the recommendations offered by ICLARM was to prepare ponds before stocking including to remove unwanted fish. Many of the ponds dry out seasonally and so do not require any further action, but the incidence of deliberate removal (netting) did increase for participants in 1999, and probably fell back in 2000 (Table 3.6).

Table 3.6. Treatment of wild fish (No. of ponds) in Narail.

		BS - participant N=5	BS - neighbor N=4	Proshika - participant N=5	Proshika - neighbor N=5	RRC - participant N=4	RRC - neighbor N=5	Control N=10
1998	removed	1	1	2	1	1	2	3
	poisoned	1				1		
	left in pond/dried out	1	3	3	3	2	3	4
	deliberately released	2			1			1
1999	removed	3	1	3	1	1	1	2
	poisoned					1		1
	left in pond/dried out	1	3	2	3	2	4	6
	deliberately released	1			1			1
2000	removed	2	1	2	1	1	2	3
	poisoned					1		
	left in pond/dried out	1	3	3	3	2	3	6
	deliberately released	2			1			1

Use of other inputs was not distinguished between preparation and during culture because responses might have been unreliable given that they depended on recall. Instead simple information was asked of the respondents on whether each input type was used in a pond in 1999 and how 1998 and 2000 compared (Table 3.7). This was easier to answer and should give reliable but not quantitative results. All participants and over 50% of non-participants applied cow dung to fertilise their ponds/fields in 1999, most had used less in 1998 but practice varied in 2000 with some using more again and others less than in 1999. Chicken manure is apparently less widely used, although three Proshika participants seemed to use some. Compost was only used by some participants in 1999, most of them continued to use it in 2000, no neighbors reported adopting it. Green fodder was only used in one of the

control ponds. Azolla was used by some participants and neighbors in 1999, some was new from the previous year but its use dropped to being insignificant in the respondent's ponds in 2000.

Table 3.7a. Input use by number of ponds for organic manures and green feeds (for those using each input in 1999, comparisons with 1998 and 2000 are shown).

Sample size		BS - participant N=5	BS - neighbor N=4	Proshika - participant N=5	Proshika - neighbor N=5	RRC - participant N=4	RRC - neighbor N=5	Control N=10
Cowdung 1999	No of ponds	5	2	5	3	4	3	7
More or less in 1998	same	3			1		1	3
	more			1		1	1	
	less	1	2	2	2	1	1	3
	not at all	1		1		2		1
More or less in 2000	same	2			1			2
	more	1	1	3	1	2	2	3
	less	1	1	2	1	1	1	1
	not at all	1				1		1
Chicken manure 1999	No of ponds	1	0	3	1	1	0	0
More or less in 1998	less			1	1			
	not at all	1		1		1		
More or less in 2000	same	1		1		1		
	more			1				
	less			1	1			
Compost 1999	No of ponds	2	0	3	0	2	0	0
More or less in 1998	same	1				1		
	not at all	1		2		1		
More or less in 2000	same	1				1		
	more	1						
	less			1				
	not at all			2		1		
Weeds/leaves 1999	No of ponds	0	0	0	0	0	0	1
More or less in 1998	same							1
More or less in 2000	same							1
Azolla 1999	No of ponds	2	2	2	1	1	0	0
More or less in 1998	more		1			1		
	less		1	1	1			
	not at all	2		1				
More or less in 2000	more					1		
	less		2		1			
	not at all	2		2				

Lime was used in their ponds by 70% of participants in 1999 compared with 17% of neighbors and control farmers (Table 3.7b). This was a new input for several of the BS and Proshika participants, but use generally dropped in 2000 suggesting that the farmers did not think it had been worthwhile. The pattern of use of urea is almost identical except that more RRC neighbors use it, but TSP was added to the input use of Proshika and RRC participants in 1999 and dropped out of their use in 2000.

Bran was reported to be used as a feed by most participants and non-participants except Banchte Sheka and RRC neighbors. The amounts and incidence of use among participants rose in 1999 but there was a similar pattern among the control group so differences are not attributable to the project. There is a similar pattern for use of oilcake.

Table 3.7b. Input use by number of ponds for inorganic manures and other feeds etc. (for those using each input in 1999, comparisons with 1998 and 2000 are shown).

Sample size		BS - participant N=5	BS - neighbor N=4	Proshika - participant N=5	Proshika - neighbor N=5	RRC - participant N=4	RRC - neighbor N=5	Control N=10
Lime 1999	No of ponds	5	1	3	1	2	0	2
More or less in 1998	same					1		2
	more	1						
	less	1	1	1	1	1		
More or less in 2000	not at all	3		2				
	same	1			1	2		2
	more	1						
Urea 1999	less	1	1					
	not at all	3		2		1		1
	same	1	1			1		1
More or less in 2000	more	1		1	1		1	1
	less	1		1			1	
	not at all	2		1		2		1
TSP 1999	No of ponds	1	1	3	1	4	1	0
More or less in 1998	same					1	1	
	more				1			
	less		1	2		2		
More or less in 2000	not at all	1		2		1		
	same	1	1		1	2		
	more			1				
Bran 1999	less			2			1	
	not at all			1				
	same					2		
More or less in 2000	more			2			1	
	less			1				
	not at all					2		
Bran 1999	No of ponds	4	1	5	4	4	2	7
More or less in 1998	same	1			2	2		3
	more	1		1	1		1	
	less	2	1	2	1	1	1	4
	not at all			1		1		
More or less in 2000	same	2			1	1		3
	more	1	1	1	2	2	1	2
	less	1		3			1	2
	not at all			1		1		
Oilcake 99	No of ponds	5	1	3	3	3	2	6
More or less in 1998	same	2			1	2	1	4
	more	1			1			
	less	2	1	2	1		1	2
	not at all					1		
More or less in 2000	same	3			1	1		3
	more	1		1	2	1	1	2
	less	1	1	2			1	
	not at all					1		1
Piscicide 99	No of ponds	1	0	0	0	0	0	0
More or less in 1998	same	1						
More or less in 2000	same	1						

Considering all forms of feed and fertilizer together there was no difference in the number of households using some between 1998, 1999 and 2000 (Table 3.8). Proshika participants clearly thought that their practice was better in 1999 and worse in 1998, but Banchte Sheka participants thought their practice was better in 1998 and 1999 than in 2000 while RRC participants appear to think that they have improved feed and fertilizer practice each year. This compares with recommendations from the project: cowdung, chicken manure, compost, lime, urea and TSP were all recommended (urea in small amount), TSP and chicken manure were the least used but recommended inputs.

Table 3.8. Assessment of feed and fertilizer practice (No of ponds) in Narail.

	BS - participant	BS - neighbor	Proshika - participant	Proshika - neighbor	RRC - participant	RRC - neighbor	Control
Sample size	N=5	N=4	N=5	N=5	N=4	N=5	N=10
No. pond used in 1999	5	3	5	4	4	4	8
best	3	2	4	1	1	2	3
2nd best	1	1	1	2	3	2	5
3rd best/worst	1	0	0	1	0	0	0
No. pond used in 1998	5	3	4	4	4	3	8
best	2	0	0	2	1	1	1
2nd best	1	1	1	1	1	0	4
3rd best/worst	2	2	3	1	1	2	3
No. pond used in 2000	5	3	5	3	4	3	8
best	0	1	1	2	2	1	3
2nd best	3	1	4	1	1	1	4
3rd best/worst	2	1	0	1	1	1	1

Ultimately pond operators are interested in their returns from cultivating fish, the survey indicated that yields of participants and non-participants (but not the control group) increased between 1998 and 1999, with pond operators averaging 800-3,000 kg/ha (Table 3.9). The exception is for Proshika participants who claimed they had no production in 1998 although most said they had stocked fish (Table 3.1). Rice-fish culture by RRC members averaged 470-660 kg/ha. Sadly in terms of yield none of the participants in 1999 were able to match their neighbors (although the RRC neighbors are not comparable since they are pond operators).

Household fish production also reflects pond size and can be compared with an average annual consumption for a typical household of six people of 50 kg (23 g/person/day). Because most of the sample (participants and non-participants) produce around 200 kg/year of fish and consume over 50%, most have higher than national average fish consumption. The low percentage sold by Proshika participants and RRC neighbors is consistent with their low production per household, but BS neighbors would be expected to sell more fish. For BS and RRC participants aquaculture contributes a substantial amount to household income, but this is no different from the control sample of pond operators. Unfortunately the survey could not assess any diffusion effects in 2000 because most ponds had not yet been fully harvested.

Table 3.9. Production and use of fish in Narail in 1998 and 1999.

	BS - participant	BS - neighbor	Proshika - participant	Proshika - neighbor	RRC - participant	RRC - neighbor	Control
Sample size	N=5	N=4	N=5	N=5	N=4	N=5	N=10
Total production (kg/ha) - 1998	1233	846	18	1091	471	1801	1634
1999	1604	2939	890	1742	661	2038	1275
Total production (kg/hh) - 1998	180	186	1	124	141	60	240
1999	287	239	54	200	190	85	203
Sale (kg/ha) - 1998	543	117	0	247	211	0	823
1999	722	57	107	553	329	51	451
% sold - 1998	32	16	0	16	57	0	40
1999	41	9	18	38	60	2	28
Cash income (Tk/ha) - 1998	22823	7890	0	10498	22680	0	36911
1999	25838	2093	5248	28552	23102	20362	27101
Cash income (Tk/hh) -1998	4160	2750	0	1500	10275	0	6670
1999	5400	625	420	6140	9525	1494	9340

By their own overall assessments more of the Banchte Sheka and Proshika participants tended to rate 1999 (the year of project extension support) as the best among the last three

years with regards to costs and benefits from aquaculture (Table 3.10). RRC participants rated 2000 better on average. Neighbors and control farmers were divided in opinions but tended to regard 1999 and 2000 as their best recent years. There is no evidence from the surveys of any change in prices obtained for fish between 1998, 1999 and 2000 although the 2000 data is incomplete. As might be expected the scattered impact of improved pond yields for some farmers in the Upazila did not greatly change fish supply.

Table 3.10. Overall assessment of aquaculture in Narail.

Attribute and year	Ranking of years	BS - participant N=5	BS - neighbor N=4	Proshika - participant N=5	Proshika - neighbor N=5	RRC - participant N=4	RRC - neighbor N=5	Control N=10
Cost - 1998	best	1	2		3	1	2	1
	2nd best	1		1		2		3
	3rd best/worst	3	2	3	1	1	3	5
Cost - 1999	best	2	2	4		1	3	4
	2nd best	3	1	1	5	2	1	5
	3rd best/worst		1			1		
Cost - 2000	best	2		1	2	2		5
	2nd best	1	3	2			3	2
	3rd best/worst	2	1		1	2	1	3
Benefit - 1998	best	1	2		2		2	5
	2nd best	1		1	1	2		3
	3rd best/worst	3	2	3	2	2	3	1
Benefit - 1999	best	2	2	3	1	1	3	2
	2nd best	3	1	2	4	2	1	6
	3rd best/worst		1			1		1
Benefit - 2000	best	2		2	2	3		3
	2nd best	1	3	1			3	1
	3rd best/worst	2	1		1	1	1	6

Respondents were asked to rank the problems they faced in aquaculture for the three years considered. Although they could report up to three problems in the survey there were few additional problems to those reported in Table 3.11. There were only minor differences between years. Although the Proshika participants and neighbors reported flooding in 1998 to be the main problem, this did not affect most other farmers surveyed in the Upazila (Table 3.11). There was no change in the perceived significance of lack of knowledge (not volunteered as a problem), but 2000 appears to have been generally a year with fewer problems for fish culture.

Table 3.11. Problems for aquaculture (number of respondents reporting main problem) in Narail.

		BS - part	BS - neigh	Proshika - part	Proshika - neigh	RRC - part	RRC - neigh	Control
Sample size		N=5	N=4	N=5	N=5	N=4	N=5	N=10
No of household reporting problems	1998	4	3	4	5	3	4	7
	1999	4	3	2	4	3	1	8
	2000	3	3	1	4	4	3	6
1998	Financial, late stocking	1				2		1
	Flooding/sudden rain	1		4	3		1	2
	Lack of shrimp fry					1		
	Lack knowledge		1					
	Fish disease	1			1		2	2
	Low growth of fish							1
	Ponds dried up (sandy soil)	1	1					
	Slow growth due to siltation				1		1	
	Joint management							1
	Water quality		1					
None	1	1	1		1	1	3	
1999	Financial, late stocking	1		1	1	2		1
	Flooding/sudden rain				1			1
	Lack of shrimp fry					1		
	Lack knowledge		1					
	Fish disease	1		1	1			2
	Low growth of fish	1						1
	Ponds dried up (sandy soil)	1	1					2
	Slow growth due to siltation				1		1	
	Lack of sunlight due to trees		1					
	Joint management							1
None	1	1	3	1	1	4	2	
2000	Financial, late stocking	1				2		1
	Flooding/sudden rain				2	1		2
	Lack of shrimp fry					1		
	Lack knowledge		1					
	Fish disease	1		1	1			
	Low growth of fish						1	1
	Ponds dried up (sandy soil)	1	1					2
	Slow growth due to siltation				1		1	
	Lack of sunlight due to trees		1					
	Water quality						1	
None	2	1	4	1		2	4	

It was expected that the participants would have received and made use of information from the partner NGOs, and the survey confirmed that all had received training from the NGOs. There has also been minimal coverage by any extension workers outside of this program (Table 3.12). Over half of participants, neighbors and control farmers have all received aquaculture information from radio, TV and/or other fish farmers. Respondents were asked to rank the usefulness of the information they received and that received from the project partner NGOs ranked highest except that RRC participants rated other fish farmers just as useful a source of information. Non-participants rated other fish farmers, and fish seed traders in the case of the control group, most useful indicating scope for diffusion from the demonstrations.

Table 3.12. Sources of aquaculture information ever received with mean ranking of usefulness.

	BS - participant N=5	BS - neighbor N=4	Proshika - participant N=5	Proshika - neighbor N=5	RRC - participant N=4	RRC - neighbor N=5	Control N=10
No used							
NGO staff contact/training	5	0	5	0	4	0	0
DoF staff contact/training	0	1	0	0	0	1	1
Other extension worker contact	0	0	0	0	0	1	0
Radio	2	3	1	4	4	3	7
TV	2	2	1	3	1	0	8
Newspaper	0	0	0	1	0	0	3
Book/leaflet	0	0	1	0	0	0	2
Fish seed traders	0	0	1	1	1	2	6
Other fish farmer	3	1	2	4	4	1	6
Hatchery/nursery operator	0	0	0	0	0	0	2
Fish trader	0	0	0	0	1	0	0
Friend/relative	0	0	0	0	0	0	2
mean rank							
NGO staff contact/training	1.0		1.3		1.8		
DoF staff contact/training		1.0				1.0	
Other extension worker contact						2.0	
Radio	2.5	1.3	2.0	1.5	2.5	2.0	3.0
TV	2.5	2.0	3.0	2.7			2.0
Newspaper				4.0			
Book/leaflet			4.0				3.0
Fish seed traders			3.0	2.0		2.0	1.0
Other fish farmer	2.0	1.0	1.5	1.5	1.7		1.3
Hatchery/nursery operator							
Fish trader					1.0		
Friend/relative							2.0

Note: ranks: 1 = 1st, 2 = 2nd, etc.

Direct involvement in demonstration activities was limited according to the respondents. The BS participants reported giving advice to a high number of people but this was mainly within their NGO groups. Although RRC participants were sources of advice, their neighbors advised more people (Table 3.13). However, while the Proshika participants reported passing on virtually no advice, one of them did hold a demonstration day with 150 people attending in 1999 (the only demonstration day among the sample households). Similarly three of the Proshika participants were the only ones in the sample to attend a rally in 1999 along with one RRC neighbor, none of the other neighbors attended any rally.

Table 3.13. Number of people to whom respondents have given advice on aquaculture

	BS - part N=5	BS - neigh N=4	Proshika - part N=5	Proshika - neigh N=5	RRC - part N=4	RRC - neigh N=5	Control N=10
Average no advised/farmer (all hh)							
Relative	1.4	0	0	0.4	2	3	1.5
Neighbor	2.8	0	0.8	0.8	4.25	3	3
Other member of NGO group	6	0	0	0	0	0	0
Other person	0	0	0	0	0	4	0
Total	10.2	0	0.8	1.2	6.25	10	4.5

To understand the current knowledge of respondents on aquaculture practices, respondents were asked what they would do if faced with five simple operations/problems. The responses (Table 3.14) indicate that the project participants have no better idea of how to select good fingerlings than do other NGO group members or the control group, but most people look for the appearance of the fingerlings/fry before buying. Apparently all feeding practices have been developed by trial and error (except that some non-participants do not feed). Liming is a popular response of all the farmers if their pond becomes muddy irrespective of extension (note that the RRC participants have rice-fish plots that would be expected normally to have muddy water). There were a diversity of reasonable responses that farmers would adopt if

fish growth was slow, but just as many participants as non-participants had no idea of what to do, and the same applied to a situation where fish were rising at the surface. Overall the participants and their neighbors appear to have a poorer understanding of good practice than the control group (who on average were better off and better educated farmers), only among the women participants of Banchte Sheka was there any overall improvement in reported responses compared with neighbors.

Table 3.14. Aquaculture practice that farmers reported they would adopt in response to different problems or situations (number of responses).

Problem	Response	BS - p	BS - n	Proshika - p	Proshika - n	RRC - p	RRC - n	Control
Sample size		N=5	N=4	N=5	N=5	N=4	N=5	N=10
Select quality of fingerlings	<i>Physical health and appearance (clean scale)</i>	3	1	1	2	1	3	7
	<i>Age of the fingerlings</i>						1	
	Experience gained from old farmer	1			1	2		
	Depend on the vendor's/fry trader's choice		1	1				1
	No idea about quality assessment	1	2	3	2	1	1	2
Feeding fish	<i>Don't apply any feed</i>		3			1	1	2
	Experience gained through - trial and error	4	1	3	5	3	4	5
	Feed according to their ability			2				
	Follow fish culture books and own experience							1
If water become muddy	<i>Use plantains/log</i>	1						1
	<i>Use lime</i>	3		3	3	1	3	6
	Use potash						1	
	Harvest fish from ponds			1	1			
	increase level of water in the pond							1
Slow growth	<i>Do nothing</i>	1	4	1	1	3	1	2
	<i>Increase amount of feed to apply</i>	1		1	1	1		3
	<i>Use fertilizer, urea</i>	1					1	1
	<i>Partial harvest of fish from pond</i>			1	1			1
	<i>Shifting fish to other ponds (clean water)</i>							1
	Don't know	2	3	2	3	1	3	2
	Agitate water through ladder at the bottom/netting	1		1		1	1	1
Fish on the surface	Apply lime, potash and feed		1			1		
	<i>Agitate water by applying ladder</i>	1	1	1	1			
	<i>Pump water into the pond by STW</i>				1			
	<i>Group swimming in the pond</i>			1		1	1	
	<i>Netting and apply lime, potash</i>							3
	Apply lime	1			1		1	2
	Feed with bran/other				1	1		1
	Use plantains/log	1					3	1
Don't know	2	3	3	1	2		3	
Average percentage of respondents giving an appropriate answer		40%	25%	32%	36%	25%	40%	50%

Note: p = participant, n = non-participant.

Responses in italics are among the potentially appropriate ones for each problem.

Note that the project did not advocate feeding fish.

Overall the problems that pond operators regard as the main constraints on them practicing better aquaculture were mainly related to lack of funds and inputs and to physical problems such as floods. Only a few such as disease and death of fish are constraints that information on aquaculture practice provided by the project might relieve (Table 3.15).

Table 3.15. Main constraints (combination of 1st and 2nd) reported for aquaculture (No of responses).

Constraint	BS - participant N=5	BS - Proshika - neighbor participant N=4	Proshika - participant N=5	Proshika - neighbor N=5	RRC - participant N=4	RRC - neighbor N=5	Control N=10
Sample size							
No funds to make pond dyke/ excavate pond	3		2	2	3	3	4
Lack of fishing gear			1				
Floods			2	2	1		2
Sandy soil/ dry up/ poor growth	2	1		2			2
Lack of shrimp fry/ other fry in time	1				2		
Joint ownership		1					1
Poaching					1		
Fish diseases (Golda)	1	1		1			1
Sharputi dies in the winter				1			
Lack of knowledge			1			1	2
Do not have enough time			1				1
None	1	2	1			2	2

Lastly to get a better idea of respondent's perceptions of how well they use their existing knowledge of aquaculture, they were asked directly about this. More non-participants agreed with the statement that they did not know enough about aquaculture (Table 3.16). However, only a majority of the BS participants said they knew what to do and could make best use of that knowledge, several participants said they chose to do differently. Several reasons were given for deviating from what farmers said was best practice known to them: fund constraints, a belief that stocking more would give more production, and personal preferences such as cleaner water for household use, taste and destination of fish. About half of this small sample of participants deviated from recommendations for these various reasons, this highlights the need to understand the motivation of households and their limitations when making recommendations

Table 3.16. Level and use of good aquaculture knowledge (No of responses).

Sample size	BS - p	BS - n	Proshika - p	Proshika - n	RRC - p	RRC - n	Control
	N=5	N=4	N=5	N=5	N=4	N=5	N=10
Know and can make best use	3		1		1	1	2
Know but cannot make best use		1		2	1		1
Know but like to do different	2		2	2	2		
Don't know enough		3	1	1		4	7
Reason for not using knowledge	Cannot use fertilized water for household use						
	Culture fish only for consumption - not for sale						
	Re-excavation is needed for good growth						
	Lack of credit for fish culture						
Reason for choosing to do different	Multiple ownership hampers fish cultivation						
	Could not stock in time due to financial problem						
	Does not like to cultivate exotic fish						
	Can't prepare pond in time due to lack of finance						
	More stocking will give more production						
Like to do on my own choice							
Golda cultivation is labor intensive							

Chapter 4

Comparison of Findings of the Study and Recommendations

4.1 Sources of aquaculture information

It would appear that the better-off control group of farmers have accessed a wider range of information on aquaculture despite having virtually no access to formal extension. Mass media and word-of-mouth from other fish farmers and fish seed traders were widely reported to be useful information sources, but the project participants who had all received extension from the NGOs in 1999 made less reference to other information sources. The participant groups of both Proshika and Banchte Shekha reported that they have started to use modern technologies for the last 5-6 years with NGO support, thus preceding the 1999 project activities.

However, in the FGD, the women from Banchte Shekha said that they have traditional experience in aquaculture but they are not actually involved in aquaculture - the men of their families actually operate the ponds; whereas the Proshika members said both men and women are involved in fish culture.

The participants got information through training from the NGO regarding stocking composition, fertilising, feeding and pond preparation. They all said that informal sources of information were also very useful. They said that neighboring farmers were the most important sources for aquaculture related information, however men said that they have more access to their neighbors compared to the women because women are almost confined to work at home.

The non-participants reported that they did not attend any NGO training so they do not have any formal knowledge in aquaculture rather they have traditional knowledge in fish culture (but they also access new information through personal contacts and the mass media). In addition the interview sample of Banchte Shekha and RRC participants reported giving advice to 6-10 other pond operators per participant, while one Proshika participant's pond was used in a demonstration day attended by some 150 people.

On this subject both methods (sample interview survey and FGD) appeared to give useful information. The simple quantified data from the interviews may be more useful but FGDs helped understand the limited extent that women were actually involved in aquaculture.

4.2 Aquaculture Practice

With these different combinations of information, targeted extension and traditional views of aquaculture, what differences are there in practice? The participant farmers have been experimenting in fish culture for the last 5-6 years with NGO help, but the other respondents have also been cultivating fish.

All respondents apparently follow traditional practices in cleaning their ponds once a year (which also ties in with many ponds drying up seasonally. Most people in the FGDs and interviews said that they do not like to use any pesticides or poison to kill wild fish before stocking because they use water for other household purposes everyday (some from both categories say they deliberately release small fishes). They also follow traditional beliefs in

fingerling stocking, preferring to stock as much as they can afford because they believe that more stocking will give more production. The participants did not follow NGO advice in stocking composition because fingerlings of the recommended species were not available at the right time. Even so the extension participants have lower stocking densities than do other farmers. Also the non-participants pointed out that they do not go outside to purchase fingerlings, fry traders come to their pond side and do not always consider fingerling quality when stocking. They choose species on the basis of those fishes that had grown better in the previous year for stocking. Most of the farmers stock mainly for their own consumption, and this may explain why they choose cheaper species like silver carp for culture. They all have some idea of the best stocking time but they cannot follow it because fingerlings are not available in time.

Stocking density data from farmers are probably very unreliable and the FGD helped to understand the limitations of such data based on recall. Better ways of measuring and comparing what people do are needed given that stocking fry and fingerlings is so complex (with a wide continuum of sizes, several species that may be mixed up, and spread out timings). One-off surveys and discussions that depend on recall cannot quantify this and only very detailed monitoring of participants and control groups may be effective in quantifying practice. On the other hand the FGDs help to understand the perceptions and problems of farmers, and interviews did indicate some plausible differences in stocking numbers.

Actual quantities of other inputs were not investigated in the surveys because recall data were deemed unreliable, but the farmers reported that the quantities used depend on availability, funds and their assumptions about needs. Of the recommended inputs more of the participants reported using cow dung, lime and urea than non-participants, and the amounts were reported to have increased over the previous year (before extension). But also most extension recipients and many non-recipients feed fish with oilcake and bran although the project did not recommend this, and several farmers reported increasing use of feeds again in 2000.

The project participants appear to have no better idea of how to select good fingerlings than do other NGO group members or the control group, but most people look for the appearance of the fingerlings/fry before buying. Apparently all feeding practices have been developed by trial and error (except that some non-participants do not feed). Liming is a popular response of all the farmers if their pond becomes muddy irrespective of extension (note that the RRC participants have rice-fish plots and so this "problem" may not have been regarded by them as a problem). There were a diversity of reasonable responses that farmers would adopt if fish growth was slow, but just as many participants as non-participants had no idea of what to do, and the same applied to a situation where fish were rising at the surface.

Overall the participants and their neighbors appear to have a poorer understanding of good practice than the control group (who on average were better off and better educated farmers), only among the women participants of Banchte Sheka was there any overall improvement in reported responses compared with neighbors. The FGDs did not effectively investigate good practice, and are perhaps more likely to reveal consensus views on what the project/facilitator wants to hear.

4.3 Fish Production

The focus group discussions confirm that farmers can hardly say what their annual fish production is from ponds, this puts into question the recall data from the interview surveys. They can say which species have grown better or worse in the last 3 years and the trends between years in their production. They could also identify reasons for increasing or

decreasing yield. Most of them said the important reasons for lower fish production were poor quality of fingerlings (too few or quality?) and late stocking. Accepting the uncertainties over estimates of production, it was clear from both interview surveys and FGD that people following their own practices did not differ greatly in production per area from those who had advice and support from the project. Typical yields were thought to be in the 2-3 mt/ha range.

Fish production is vulnerable to natural hazards and weather variations. Because of flood, drought, and disease the farmers find that production is always uncertain – this is more apparent from FGD than from interviews that must be restricted in the data collected to specific years.

Most farmers consume fish from their own ponds for around 6 months when floodplain caught fish are scarce and costly. There was quite wide variation in the proportion of pond production consumed and sold – some from all categories of farmer mainly consumed the fish they grew, and others sold more. On average they sold about 20-40% of the total fish from their own ponds.

4.4 Constraints for Aquaculture and Conclusions

Although there has been rapid growth and spread of pond aquaculture in Bangladesh, there are many problems faced by small-scale fish farmers. The FG participants raised some of the vital obstacles to increasing fish production in their ponds. In the floodplain system ponds are generally low lying and pond fish escape when there is flooding or excess rainfall. Flooding and use of pesticides in the crop fields was thought to result in water pollution that damaged fish in the ponds. Fish disease is a problem, sometimes the farmers use plantains (banana stems) and lime to prevent fish disease but they got limited success. Most ponds are small and shallow and dry up in the dry season limiting the growing period. Apart from the financial problems, lack of quality fingerlings and poaching are other common problems.

It is difficult to say how far lack of knowledge is a constraint on aquaculture given that farmers who had NGO support and extension with support from ICLARM (training and reference materials from ICLARM) seemed to perform little better in many ways from those with no direct extension information. From the interview survey, more people who had no formal extension thought they did not know enough about aquaculture. The reasons given for not using knowledge were quite varied and because of the small sample size only give an idea of the issues. They included lack of funds, personal taste preferences, the need to use pond water for household purposes, and for three extension recipients the belief that stocking more would result in higher production. The latter is notable since this misperception is perhaps the main problem in current practice as perceived by aquaculture scientists and extensionists, and therefore the main target of project extension was to reduce stocking numbers and to change to few larger fingerlings.

Farmers would like to improve aquaculture by re-excavation of ponds and raising pond dikes to protect against normal floods, increasing awareness among the villages to control poaching, getting training on how to control fish disease, and having a supply of quality fingerlings in their proximity.

The acceptability of extension/NGO practices was also discussed. The main criticisms related not to information but to supplies and timing of physical inputs from NGOs. Women generally do not go outside their home to work. The NGOs provided training on aquaculture that helped women take a role and they also got financial support that helped to get them involved in aquaculture. Some participants said the training was inadequate, and that men are more involved in fish culture and this discouraged the women (for example husbands

had objected after one partner NGO had held a successful women-only rally on aquaculture).

Overall we believe that formal extension is helping to spread aquaculture information by word of mouth and farmer-farmer information flows, but that the impact (at least in this example) may not be very great. If farmers are simply told what to do rather than themselves taking part in guided experiential learning and comparisons among themselves, then they may be more likely to follow the current "indigenous knowledge" that has evolved. This may result in resistance to trying/continuing new ideas such as stocking few large fingerlings and only using fertilisers and no feed. Traditional practice appears to be expensive considering the risks and variability in aquaculture, but this variability may make it difficult for individual farmers to see the benefits of new ideas.

4.5 Recommendations on methods

Both sample interview surveys and focus group discussions have their merits. To meet the need of assessing project impacts we recommend that both approaches are adopted.

The benefit of FGD is in diagnosis of problems and having farmers reflect with project staff on past experience and how to improve activities. We assume there is some risk that NGOs could orchestrate these discussions if left to themselves, and that ICLARM staff normally have limited daily contact with participants. Therefore FGD should be used by ICLARM staff after harvesting and completion of the first year of NGO support to assess progress and plan follow ups that meet farmers needs. This probably will need more than one round of discussions. Perhaps the first should be just with ICLARM, and then having compiled these outcomes and included with sample data, follow up discussions can be between farmers, NGO and ICLARM.

Formal sample surveys should be able to determine if NGOs gave the planned support and can assess uptake of key practices. If neighbors at different distances and control areas are also surveyed they can be used to quantify impacts including diffusion and demonstration effects. However, they will probably not give very reliable data on input quantities or production. With this qualification, past surveys of a similar type can be used to see the variability in responses when determining appropriate sample size. To assess the post-support impacts, surveys after harvesting is completed would be better as reported production compared with practices can be compared. For example, this suggests dry season interview surveys in March-April 2002 to assess the impacts of the 2000 extension round if comparisons between the extension year and the following year are to be made. Surveys of this type could be contracted out, although ICLARM would have to decide how much control on survey design and analysis it wanted (we suggest that these should both be ICLARM's responsibility). They should be distinguished from research studies/monitoring, and from routine monitoring and participant data recording (record books). This study did not compare reported practice with pond record books, and it may be useful to do this in future, but any contractor should not have access to the record books as they might then be used to fill in the impact survey.

4.6 Outline Terms of Reference for Impact Assessment Studies

Using both formal sample surveys and participatory diagnostic methods you will describe, quantify and give reasons for the patterns found in the uptake and post-extension practices of small scale fish farmers supported by NGOs under the DSAP.

The methods adopted should give an understanding of current practices of the extension recipients after extension and make comparisons with control or non-participant pond operators/fish farmers. The study should also investigate diffusion and demonstration effects from the original demonstrations by surveying practices of pond operators/potential technology users at different distances from demonstrations, and by surveying non-participants who were recorded by the NGOs as having attended open days or other demonstration activities.

The quantitative part of the study will produce statistically representative estimates of key parameters for each of the main NGO partners selected by DSAP for the impact study. Key parameters will include (but will not be restricted to):

- the basic aquaculture knowledge of the farmers;
- the production and returns of participants in the year after extension compared with the year of participation;
- the aquaculture practices followed by farmers; and
- the extent of demonstration and diffusion effects on other non-participants as indicated by their sources of information, practices and achievements.

The diagnostic participatory evaluations will concentrate on:

- the reasons for differences between actual practices and recommendations from the project,
- opinions on the project and NGO partners in the services and information delivered to participants,
- gaps in farmers' aquaculture knowledge,
- farmers' suggested criteria for successful aquaculture demonstrations, and
- suggestions for improvements in the project.

The project will supply for the impact assessors a breakdown of the year's demonstrations by technology, NGO and region. Through consultation a sampling/survey strategy will be developed that will result in representative participatory evaluations and valid estimates of key parameters for the population of demonstrations. For assessment of demonstration effects and comparison with control areas, samples should be sufficient to make comparisons with participants. The project or partner NGOs will provide lists of names of participants in the demonstrations in the selected sample/study areas and of those who attended demonstration activities conducted by those participants selected for study.

The study should take place immediately after harvest of ponds in the year after the demonstrations being studied.