

Institute of Aquaculture  
Stirling, Scotland

CARE – Bangladesh

Cage Aquaculture for Greater Economic Security  
(CAGES)



Research Project R7100

Social surveys



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## 1. Introduction

Social surveys are an integral part of the DfID-funded research project R7100 “Improved management of small scale tropical cage culture systems in Asia”, as indicated in the project logframe. Topics for the surveys were selected by CARE/CAGES staff through interaction with their participants. The design of the surveys and the participatory methods to be used for their implementation were defined and discussed by the both the Institute of Aquaculture and CARE/CAGES members of staff. It was decided that the surveys would be carried out in the five main regions in which the CAGES project is on-going, that is Dhaka, Sylhet, Jessore, Barishal and Comilla areas. The first field visit in the Dhaka area (village 1) was used to test the methodologies chosen for the data collection and check the relevance of research hypotheses and objectives. Survey methods were adjusted afterwards to ensure the full participation of villagers and the relevant and targeted qualitative data collection and match the ‘practicalities’ involved in each village visit.

The three surveys and their objectives are presented below. Their aim is to assess the impact of cage aquaculture on communities and on the lives of those involved in the activity were carried out in the 5 regions of Bangladesh where the CAGES project is implemented (Dhaka, Sylhet, Comilla, Barishal and Jessore). The justification for the issues to be investigated was to gain a broad picture, qualitative in nature, of the environmental and social impacts of cage culture on target groups. Survey 1 aimed at identifying the reasons for household cage operators’ dropout (difficulties) or continuation (success) of cage culture. Survey 2 assessed the roles, opportunity costs and benefits of cage culture to households, and survey 3 the impact of cage aquaculture at the community level. Every survey put a particular emphasis on gender issues and on the role of women in terms of difficulties faced and benefits gained from carrying out this activity. Methodology related to the practical implementation of the surveys, the selection of target villages and respondents and the analysis of the results is presented in the second part of the report. Results and analysis for each region visited are presented in part 3, followed by a synthesis of the findings and a discussion of the methodology and problems related to its use in the context of Bangladesh. Finally, a new survey format is suggested to improve the efficiency of the data collection and facilitate the analysis of follow-up surveys.

### **Survey 1: Reasons for HH cage operators’ dropout or continuation of cage aquaculture.**

Objective 1: To identify the factors responsible for the cage operator’s dropout or continuation, and see if these reasons are similar for both men and women cage operators.

Objective 2: To highlight the cage operator’s perception of success or failure in cage aquaculture and the impact of the activity on his/her HH (or personal) status.

Objective 3: To compare the cage operators’ expectations in terms of support from the local NGO/TO/APO staff with what they have been doing to support cage aquaculture and/or remedy to the problem of dropout.

### **Survey 2: Roles, perceived opportunity costs and benefits of cage aquaculture to HH, with particular emphasis on the role of women.**

Objective 1: To identify the role of women HH decision making regarding cage aquaculture (decision to start cage culture, daily management, post-harvest decision – expectations from cage culture – expectations from cage culture).

Objective 2: To determine the amount of time dedicated to fish culture by all HH members, the division of labour and the opportunity costs, both in terms of time and money, of cage culture.

Objective 3: To determine the various factors that may influence the role of women in cage culture (ex. social status, wealth, distance from water body, access, education, others?).

Objective 4: To determine whether the involvement of women in cage culture (as cage operator or wife of a cage operator) contributes changes to their social status.

**Survey 3: The impact of cage aquaculture at the community level.**

Objective 1: To identify if community members (incl. cage operators and non-cage operators) feel some changes have occurred in their daily activities since the implementation of cage culture.

Objective 2: To identify conflicts that may have emerged since the implementation of cage culture.

Objective 3: If relevant, to identify which regulation mechanisms have been implemented by the community to mitigate any possible negative impacts or problems/difficulties due to cage culture.

## 2. Methodology

The methodology was designed to collect qualitative information. It used a mixture of semi-structured interviews carried out in selected households, along with community meetings and mapping exercises carried out by groups of stakeholders (women, children, cage operators, other water users). Three villages were selected in each area and represented different levels of experience in cage culture. Within each of the selected villages, three households involved in cage culture were targeted, representing various levels of 'success' (high, medium and low success), and within which two respondents (male and female, usually husband and wife) were interviewed. It was decided that Survey 1 and 2 would be carried out through the use of individual interviews for household case studies (both surveys combined in the same questionnaire format made of targeted open question to 'answer' the fixed objectives). Information collection for Survey 3 would be carried out through a brief introductory community meeting and a mapping exercise carried out by different interest groups of the village.

All 5 geographical areas where CAGES staff operate will be investigated. These are:

- ?? Dhaka
- ?? Barisal
- ?? Jessore
- ?? Comilla
- ?? Sylhet

### 2.1 Pre-survey arrangements

TO/APO/NGO pre-survey arrangements included:

- Arranging a time to meet with local NGO staff to finalise the plan for the day and clarify methodological points when necessary.
- Arranging a time with the villagers to meet in the morning for the community meeting.
- Arranging a time with members (husband and wife) of the HHs selected to be interviewed in the afternoon.

In each region, a total of 3 villages are selected:

- 1 village new to cage culture (started in 1998).
- 1 village which started cage culture in 1997 and successful.
- 1 village which started cage culture in 1997 and less successful.

In each village, three households are selected for in-depth case studies:

- 1 HH very successful in cage culture
- 1 HH medium successful in cage culture
- 1 HH less successful in cage culture (facing difficulties).

Whenever possible, the households of women cage operators are selected for the case study.

### 2.2 Daily Timetable of Work

A day was spent in each village. The day was divided approximately as follows:

- ≪≪ Community Meeting: 2 hours.
- ≪≪ Household interview 1. 30 minutes per person max.
- ≪≪ Household interview 2. 30 minutes per person max.
- ≪≪ Household interview 3. 30 minutes per person max.

However, a total of 3 hours for the 3 interviews was allowed to enable respondents to fully develop their answers.

- ≪≪ NGO field staff interview-discussion. 30 minutes, in the field or at the NGO office to complete and cross-check the data.

### 2.3 Community meeting and mapping exercise

The combination of both a short community meeting to gather villagers, inform them about our survey objectives and discuss their feelings about cage culture, followed by a mapping exercise with key groups, appeared to be the most appropriate to identify the impacts of cage culture on the selected community. Cage operators and non-cage operators, including representatives from fishermen and other water users from both rich and poor groups, woman and children were invited to join the group. TO/APO/NGO decided on whether it was appropriate to have mixed or separate genders during the group meetings and informed us of any contentious issues to be wary of during the surveying.

Details of the methodology followed for the running of the community meeting and the mapping exercises are provided as guidelines for TO/APO staff.

### *2.3.1 Introductory session*

These are key questions to be discussed, 5-10 minutes. All group together.

Yesmin introduces herself (and Cecile) and explains shortly what we are here for. This is to avoid lengthy introductions and the creation of a 'hierarchical' gap between CAGES and NGO staff and the rest of the villagers. Moreover, villagers already know the NGO staff and TOs and APOs.

Start of the discussion:

1. Perceptions of cage aquaculture. Has anyone done very well/ poorly? Why is this? (Ask directly to one person from each interest group for views if needed).
2. Changes in how you use water resource due to cage aquaculture.
3. If there are changes, what are they and for whom

TO takes notes during the introduction of the community meeting.

### *2.3.2 Splitting of People of Meeting in to Sub-Groups*

Co-facilitator needs to help at point of separation. Advice from TO/ NGO/ APO for on splitting in to groups. Split in to no more than 4 sub groups. Hence Yesmin, TO, APO and NGO will all be available to facilitate discussions in each of the groups.

Groups could be split into Cage operators, fishermen, kids, woman, other water users.

### *2.3.3 Mapping the Effects of Cage Aquaculture*

Pens and a large piece of paper will be given out to each group. Mapping the effects of cages will then take place. If possible and relevant: 4 groups for resource mapping: women, children, fishermen, cage operators, other water users. 1 facilitator per group. Use of NGO staff as facilitators. Ask people to map places where they carry out their daily activities both before and after cage culture was started in the village to show possible changes and impacts.

### *2.3.4 Checklist to facilitate discussions:*

Possible issues that might be raised by the groups. Some or all of the issues may be raised. Use the list to prompt questions if group is struggling or has missed some issues. Questions are not forced and answers not demanded.

What effect cage aquaculture have on:

- fishing
- washing
- access
- navigation
- irrigation
- jute retting
- pollution
- eutrophication of water body
- any measures to limit conflict

Effects on cage operators, and for other groups what changes have occurred in these peoples lives:

- status change
- money, knowledge, contacts, networks, mobility, new roles

Effect of cage culture on local economy:

- employment for farmer
- input suppliers
- traders
- credit sources

Getting the group together was not practically possible at the end of the mapping exercise as groups were working at different speeds and in different locations. The facilitator thanked his/her group of participants at the end of the mapping exercise.

#### 2.4 Household case studies for Surveys 1 & 2

In each village, three households are selected for in-depth case studies:

- 1 HH very successful in cage culture
- 1 HH medium successful in cage culture
- 1 HH less successful in cage culture (facing difficulties).

Whenever possible, the households of women cage operators are selected for the case study.

The selection is based on the household success in cage aquaculture (low performance, medium and high performance/experienced from the year before) and made prior arrival to the village by the CARE Technical Officer (TO) and Assistant Project Officer (APO) responsible for the area. Household interviews included 2 interviews carried out separately (whenever possible) of a male and female, usually husband and wife. However, in the case of single or unavailable respondent, a relative of the opposite sex was interviewed.

Interviews aimed to obtain mostly qualitative data, and were made up principally of open-ended questions. A questionnaire format is attached in Appendix 1.

The interviewing was carried out by Yesmin, while the TO took notes of the respondent's answers and comments. During this time Cecile observed village cages and discussed issues with ATO and NGO.

In the case of problems arising during the interview process, it was decided the following:

1. The husband does not want his wife to be interviewed separately
  - ? interview him first and let him sit during his wife's interview, asking him not to interfere with her answers. Please use a new questionnaire, writing on the top of the page what was the interview situation (this may explain similarities with the male's answers).
2. Either the husband or his wife from the chosen HH is not available for interview:
  - ? either choose a different HH in which you will be able to interview both husband and wife,
  - ? or interview a relative female or male living in the same HH or in a different HH but which has had a similar success in cage culture.

Whenever possible, female cage operators were interviewed for the case studies.

#### 2.5 NGO, TO, APO Interviews for cross-checking and verifying information

For the triangulation of data, short interviews were carried out with the NGO staff.

These were first left very open to leave scope for the NGO to add any comments and clarifications on what has happen during the village visit. However, when the Dhaka data started to be analysed, it was felt that this method was too slack and that the de-briefing would be more informative if a set of open questions were used to cross-check the results and carry out the analysis, in particular regarding the evaluation of the NGO support in comparison to the farmers' requests (see NGO de-briefing guidelines below). This method was tested by Cecile in the Sylhet region and was used by Yesmin and TO in the remaining regions.

Also required to further substantiate data were views of regional TO / APO's. de-briefing with them was carried out at the end of each day.

##### *2.5.1 NGO de-briefing guidelines:*

Informal discussion with NGO staff with open questions about what they think of cage culture in the **village visited** (not in general), for clarifications (information cross-check), and for details of the aquaculture technical support they are providing to communities.

The following questions can be asked:

- How do you think cage culture is performing in this particular village?
- What are the problems farmers are facing?
- Has there been any conflicts between water users since cage culture has been implemented? If yes, what types of conflicts? Have they been resolved? Etc.
- What is the involvement of women in cage culture like? Are there any cultural constraints to their involvement in cage culture? If yes, which ones?
- How often do you visit this particular village for cage culture support?

- What is the “technical support” you provide? Please give details.
- Are farmers involved in the selection of fingerlings? Who pays for them? (NGO, farmer?) Is there a particular credit system for cage culture?
- Where does the feed come from: NGO, farmer, other? Who pays for it? Which types of feed can be provided by the NGO? What types of feed are collected by the farmer and his family?
- Do you think cage culture has a future in this community? Why?
- Any other comments to add?

#### *2.5.2 Feed information from TO:*

For each type of feed used, please indicate:

- Their availability in the area.
- If feed is collected by farmers or if it is a household by-products
- If it is bought on the market, price of 1kg.
- Quality in terms of protein content, good for fish growth etc.

#### 2.6 Pre-analysis check-list

The following check-list was made to check the presence of all the information required to start the analysis and to facilitate the sorting of all questionnaire formats:

1. For each village visit:
  - village name and district:
  - number of HH (approx.):
  - number of people at the community meeting (approx.):
  - status of the water body (leased, owned, etc.):
  - general indication on the wealth level of the village:
2. Number of individual interviews carried out:  
(number of men and female interviewed; if less than 6 interviews have been carried out, please state the reasons why).
3. Check that the community meeting notes and the NGO de-briefing notes are also present in the folder.
4. Group the questionnaires by HH for the analysis and indicate who is the cage operator in the HH (female or male).

#### 2.7 Reporting and Analysis

Data from questionnaires and resource maps was collected on day of fieldwork and taken back to Care Bangladesh Headquarters or local CARE headquarters for translation by Yesmin and TO. Dhaka data analysis was started in Dhaka by Cecile, with the assistance of Yesmin and TO for clarifications and further information on the context of cage culture in each village.

For the analysis of qualitative information provided by the questionnaires, each survey and its specific objectives were used as a framework to analyse the questionnaires. In each of these, the relevant questions matching the various survey objectives were picked up and put together village by village and with a distinction between male and female answers. Interviewees’ answers were copied directly from the original questionnaire format to avoid bias at this very early stage of analysis. Original questionnaires were only referred to occasionally to check information afterwards.

### 3. Data collected and analysis per region

#### 3.1 DHAKA REGION

Villages visited and people interviewed in the selected household included:

“Village 1”:	Moshurikhola Union: Hemayetpur Thana: Savar	“Household 1”:	Ms. Rabeya Khatun
		“Household 2”:	Mr. Khalil
		“Household 3”:	Mr. Badshah Mia
“Village 2”:	Shanmania Union: Thana:	“Household 1”:	Mr. A. Kadir and his wife Asma
		“Household 2”:	Mr. Ukil and his wife Shahida
		“Household 3”:	Mr. Momtazuddin and his wife Ajufa Begum.
“Village 3”:	Tarabari Union: Shaturia Thana:	“Household 1”:	Ms. Hazera
		“Household 2”:	Mr. Alam Mia
		“Household 3”:	Mr. Buddu Mia

Fieldwork was carried out between the 21 and 24 November 1998.

#### **Survey 1: Reasons for HH cage operators’ dropout or continuation of cage aquaculture.**

Objective 1: To identify the factors responsible for the cage operator’s dropout or continuation, and see if these reasons are similar for both men and women cage operators.

##### *Village 1*

According to the NGO and CAGES staff:

- HH1: very successful
- HH2: medium successful
- HH3: less successful

Table D1: Perception of performance in cage aquaculture, reasons for success and difficulties perceived by cage operators and their household members in Village 1, Dhaka region.

	<i>Perception of Success/failure</i>	<i>Reasons for success</i>	<i>Reasons for difficulties</i>
HH1 Female (c.o.) <u>Rabeya</u>	She does not have any family conflicts.	Proper management and hard labour	Flood this year reduced production (some big fish were stolen).
HH2 Male (c.o.)	Rabeya’s fish is good	more feed = more production	No reason given
HH3 Male (c.o.)	Rabeya is the most successful farmer among the cage operators	Rabeya is experienced and gives much labour to get good production	Mishap (cage cut open and all fish lost)

##### *Village 2*

According to the NGO and CAGES staff:

- HH1: less successful
- HH2: medium successful
- HH3: very successful



Table D2: Perception of performance in cage aquaculture, reasons for success and difficulties perceived by cage operators and their household members in Village 2, Dhaka region.

	<i>Perception of Success/failure</i>	<i>Reasons for success</i>	<i>Reasons for difficulties</i>
HH1			
Female (c. o.)	Azfa is the most successful, good size of fingerlings, good effort.	Try hard (when it's for the 1 <sup>st</sup> time) and give good effort	Small fingerlings
Male (c. o.)	Montaz and Ukil because good fish size and good quality fingerlings.	good feed from a shop	?
HH2			
Female (c.o.)	?	more effort = more success	?
Male (c.o.)	Mr. Montazuddin most succesful because large and healthy fingerlings so no mortality.	Feeling good, no mortality.	No difficulties
HH3			
Female (c.o.)	Successful, getting ideas	more effort = more success	No problem with cages
Male (c.o.) <i>Mr. Montazuddin</i>	?	?	?

### *Village 3*

According to the NGO and CAGES staff:

HH1: less successful

HH2: medium successful

HH3: very successful

Table D3: Perception of performance in cage aquaculture, reasons for success and difficulties perceived by cage operators and their household members in Village 3, Dhaka region.

	<i>Perception of Success/failure</i>	<i>Reasons for success</i>	<i>Reasons for difficulties</i>
HH1			
Female	Buddu is the most successful, with snail fed fish. Doesn't know how successful her HH is.	Fish fed snails	Lack of interest (dropout)
HH2			
Male (c.o.)	Buddu: he manages his cages regularly.	Loss	Fish death (does not know the cause). Salt bathing was done for treatment but no result. Proper time not given to the fish. Wife cannot get involved because the water body is in a distant place (ferry crossing).
HH3			
Male (c.o.) <i>Buddu</i>	He is the most successful	?	Cage fish not fed properly + lack of proper care

A change in circumstances was never mentioned as a cause of difficulty or dropout of cage culture.

Women tend to think that the main reason for success is the time and labour spent looking after the fish, whereas according to male cage operators, good quality feed and good quality fingerlings are the reasons behind good production and success. Reasons for failure and difficulties are varied (small fingerlings, disease, mishap, poaching, 1998 floods, distant water body, lack of interest – and therefore care) and no particular distinctive trend seems to emerge between male and female cage operators. However, these 'external factors' are blamed for the difficulties faced (it is never the c. operator's own fault), and people are able to recognise easily who in the village is truly dedicated to cage culture.

Would the difference observed between men and women mean that men seem to rely on technology (good feed, good fingerlings) and external help (from their wives, NGOs etc.) and women, being more

conscientious and hard working, on their own labour and skills? The only woman mentioning feed as a factor of success (village 3) feeds her fish with snails, which are not available on the market but hard work and time consuming to collect.

Or, is it that men, through their access to knowledge with talking to CAGES/NGO staff know that there are better fish (e.g. GIFT) and feeds (e.g. fish meal) available, and so if they fail, they can blame it on this? This may indeed be a demotivating factor, with less effort going into cage farming, as “it can’t be their bad management to blame, but must be the lack of a better system”.

Distance as a constraint to sustain the effort and labour for cage culture, especially when women are concerned, was mentioned once in village 3 and confirmed by the NGO involved with this village. This suggests that:

1. The proximity of cages or their easy access is important for labour and interest to be sustained.

2. The proximity of cages factor is particularly determinant if women are to be involved more systematically in cage culture.

What do farmers consider as a ‘good feed’?

In classical terms, it is ‘fish meal’ or *shudki* (literally, dried fish), but the appreciation of a ‘good feed’ will depend on the species (e.g. grass carp only require duckweed), the knowledge and advice farmers get from CAGES and NGO staff, and on what they draw from their own experiments.

Hierarchy of feeds (from lower to higher):

- rice bran, wheat bran, grass: cheapest and most available feeds. All are HH by-products.
- broken rice: by-product of husking rice. Not eaten by people, used for ducks, chickens etc. Widely available.
- snails, mussels: cheap but require time for collection (usually collected once a day or for a few days) and therefore have an opportunity cost. Availability depends on water quality, soil etc. They are far better and higher protein feed than mustard oil cake.
- duck weed: not available in all regions (availability depends on water quality, soil etc.) Its high protein content has made it a commonly used plant for pond culture. This use has then been transferred to cage culture.
- mustard oil cake: 6/8 Tk./kg. By-product of mustard oil. Needs to be bought from the market. Also used to feed cattle.
- molasses: by-product of sugar production from sugar cane. 8/10 Tk./kg. Obtained from the market. Also fed to cattle.
- fish meal: ? 20Tk./kg, provided by NGOs, as part of their credit scheme to the farmers.

*Relationship between success through good feed and HH wealth:*

(underlined are the feed bought on the market)

Rich:	<i>unsuccessful</i>	- rice/wheat bran, broken rice, snails, <u>m. oil cake</u> , <u>fish meal</u>
Medium:	<i>med. success</i> <i>successful</i> <i>successful</i>	- rice/wheat bran, grass, rice, snails, <u>fish meal</u> - wheat/rice bran, snails, duckweed, aquatic grass, <u>m. oil cake</u> - rice/wheat bran, rice, snails
Poor:	<i>successful</i> <i>successful</i> <i>med. success</i> <i>med. success</i> <i>unsuccessful</i>	- wheat/rice bran, grass, <u>fish meal</u> - grass, snails, wheat bran, <u>molasses</u> , <u>m. oil cake</u> , <u>fish meal</u> - wheat/rice bran, snails, <u>m. oil cake</u> - rice/wheat bran, broken rice, <u>molasses</u> - rice/wheat bran, snails, <u>molasses</u> , <u>fish meal</u>

It can be observed that, in general, farmers are able to afford at least one higher quality feed purchased on the market, with no consideration of their wealth rank. The case studies do not suggest any relationship between wealth and success through an improved feeding regime. As successful fish culture does not only depend on good quality feed, there is no clear trend showing that richer farmers who can afford to pay for higher feed are more successful than poorer farmers with more basic feed. The adequacy of feed to fish culture needs to be studied further in relation to the species farmed.

Further investigations in the existence of a link between the success of women cage operators and the feed they can get at the market (higher feeds) could be made. Are women culturally able to get feed from the market place, or are they limited to a supply from their HH only, and does this have an effect on their success in cage culture?

Objective 2: To highlight the cage operator's perception of success or failure in cage aquaculture and the impact of the activity on his/her HH (or personal) status.

*Personal perception of success and failure:*

Cage operators interviewed recognise easily who is the most successful, whether themselves or not, but also who is the worst of them, preferably when it is not themselves.... Failure is acknowledged by other members of the village, as seen in village 3 (see Objective 1, Table D3).

*Impact of cage aquaculture on personal status within the community:*

*Village 1*

*Women:*

- No change: no change in social identity, but some makes fun of her (although not seriously) as she is the most successful cage operator of the village.
- Personal gain/recognition: she's recognised by the other farmers as being the most successful.

*Men:*

- No change: 1<sup>st</sup> year of cage culture so no change in status yet.
- Personal gain/ recognition: accepted as more knowledgeable

*Village 2*

*Women:*

- No change: no social problem
- Personal gain/ recognition: developed knowledge (?3) and more respected by the rest of the community members (?1).

*Men:*

- No change: -
- Personal gain/ recognition: knowledge about cage culture (?2)

*Village 3*

*Women:*

- No change: - (no answer)
- Personal gain/ recognition: people know she's doing cage culture, but as she's not very successful, people don't understand why she persists giving so much labour to cage culture.

*Men:*

- No change: no change of status
- Personal gain/recognition: support from the rest of the community

Development of knowledge is the main personal benefit obtained from cage culture. This gain of knowledge seems to be the main reason for a change in personal social status in the community as it leads to better recognition and respect from the other members of the village. Change of status personally or within the community due to financial gains from cage culture was never mentioned.

This may mean that if a negative impact of cage culture were to divide people in the same community, this division would not be based on financial grounds (rich/poor gap), but rather between those who *know* and those who *don't*, the latter paying more respect to the former. The gap between knowledgeable and less knowledgeable fish farmers is probably easier to fill than the gap between rich and poor farmers. The social recognition derived from development of knowledge is probably a strong incentive to start cage culture, in particular for women, as examples show.

Debriefing with the NGO in village 2 confirmed that status had increased due to the increase of knowledge.

Objective 3: To compare the cage operators' expectations in terms of support from the local NGO/TO/APO staff with what they have been doing to support cage aquaculture and/or remedy to the problem of dropout.

*Village 1*

Table D4: Respondents' opinion about NGO/CARE support for cage aquaculture and suggestions for improvement in Village 1, Dhaka region.

	Opinion about NGO support	Suggestions for improvements:
Women	Good	Need more on technical issues like disease
Men	(no answer)	More feed would help a lot

*Village 2*

Table D5: Respondents' opinion about NGO/CARE support for cage aquaculture and suggestions for improvement in Village 2, Dhaka region.

	Opinion about NGO support	Suggestions for improvements:
Women	Ok, fingerling check	- timely fingerling supply, - more technical support (? 2).
Men	Good	- more visits - fingerlings and provided at the right time (? 2), - more learning - more technical support (to prevent fish death).

*Village 3*

Table D6: Respondents' opinion about NGO/CARE support for cage aquaculture and suggestions for improvement in Village 3, Dhaka region.

	Opinion about NGO support	Suggestions for improvements:
Women	No answer	- need more help: feed supply and money because she doesn't have the capacity.
Men	Ok, good	- the more support the better - more regular visits (? 2) - give more time - need for more help - good quality fingerlings

As could have been expected, farmers are happy with the support provided by the NGO and CAGES staff (who are asking the questions). The improvements they nevertheless suggest can be indexed as follows (Table D7).

Table D7: Summary of the frequency of the respondents' answers regarding their suggestions to improve the NGO support in the Dhaka region.

Women				Men			
Techn. support	fingerlings	feed	others	Techn. support	fingerlings	feed	others
3	1	1	Money: 1	3	3	1	Training: 1 Visits: 3 Time: 1

Technical support is obviously the most needed input from the NGOs and CAGES staff by both male and female cage operators. However, the type of technical support required by the cage operators was not specified.

Maybe again the emphasis is put by women on the development of knowledge through technical support, whereas men are more preoccupied by the timely supply of quality fingerlings.

Interesting that 'money' was mentioned only once, when the majority of the HH interviewed were marginal in terms of wealth: success and continuation in cage aquaculture would therefore not necessarily depend on financial situation of the cage operator. However, financial support was mentioned by a *female* cage operator facing difficulties (her husband was in the field and doesn't

operate cages). This may mean that she hasn't got much control over the HH financial resources, which, if it is common practice, can be a serious hindrance for women to continue cage culture.

*Actions of NGOs and CAGES staff to help farmers and prevent difficulties arising:*

CAGES staff visit NGOs twice a month minimum, NGO's visit farmers 2 to 3 times a week.

Fish meal is the feeding ingredient provided by the NGO. It is the most costly ingredient (other feeds come from the HH). NGO also provide credit to the HH and fish meal (when requested) is part of the credit scheme.

Farmers are dependent on NGOs for fingerling supply.

The support policy is to provide technical knowledge and support but let the farmers experiment themselves ("action research"). To avoid the dependency on NGOs for fingerlings, NGOs are trying to involve farmers in all stages of the cage culture process (ex. take them to the fingerling trader, they choose the fish) so that they progressively become self-reliant.

The overall policy regarding help provided to the farmers from both CAGES staff and NGOs is to *support* but not assist farmers in cage culture.

If the meaning of 'technical support' is limited to technical information, knowledge and training about cage construction, nets, feeding regimes, various species etc., then the request of more technical support on the behalf of the farmers suggests that their dependency on feed and fingerlings is not that great, and that they are willing to experiment further with cage culture, provided that they get the appropriate guidance and technical knowledge from CAGES and NGO staff. However, results form another survey carried out by another researcher of the Institute of Aquaculture suggested that good feed and fingerlings were the most common reasons why farmers did less well than they might have otherwise. This issue would therefore have to be investigated further to check results.

## **Survey 2: Roles, perceived opportunity costs and benefits of cage aquaculture to HH, with particular emphasis on the role of women.**

Objective 1: To identify the role of women HH decision making regarding cage aquaculture (decision to start cage culture, daily management, post-harvest decision – expectations from cage culture)

### *Village 1*

Table D8: Respondents' answers regarding the role of household members in the decision-making process for cage aquaculture and its related tasks in Village 1, Dhaka region.

Households	Decision to start cage culture	Decision on distribution of daily tasks	Decision post harvest
HH1 Female (c.o.) <u>Rabeya</u>	Willingly started herself, her family is not a barrier	?	Will harvest during Ramadan when prices are higher. Expects to make Tk. 10,000. Small fish will be eaten in the family
HH2 Male (c.o.)	No-one imposed to do cage culture , he decided himself	?	?
HH3 Male (c.o.)	His niece Rabeya shared with him about cage culture. After getting information from her, he was interested in starting cage culture, but shared with his wife and family first.	Children mainly are involved but these activities are considered as part of HH activities, so whoever has time feeds the fish	Due to fish loss, he has nothing in his hand.

*Village 2*

Table D9: Respondents' answers regarding the role of household members in the decision-making process for cage aquaculture and its related tasks in Village 2, Dhaka region.

Households	Decision to start cage culture	Decision on distribution of daily tasks	Decision post harvest
HH1			
Female (c.o.)	NGO ? husband + wife ? Zia (CAGES) ? jointly decided to do cage culture	Based on necessity	All fish will be sold, harvest during Ramadan, Tk. 3,000 – 4,000 expected, increase the number of cages
Male (c.o.)	NGO ? culture	Based on necessity	Harvest after Ramadan
HH2			
Female (c.o.)	?	?	?
Male (c.o.)	NGO provided information. self interest along with his wife	He decided along with his wife	Fish marketed when market is good. All fish will be sold, Tk. 5,000 expected, used to increase the number of fish
HH3			
Female (c.o.)	She decides to do c. culture first, then with NGO, Zia (CAGES) and family members	Initiatives based on necessity	Expected money from harvest: Tk. 7,000 but not decided yet what to do with it. Small fish (amount unknown) will be consumed during harvest
Male (c. o.)	HH decided number of cages.	?	?

*Village 3*

Table D10: Respondents' answers regarding the role of household members in the decision-making process for cage aquaculture and its related tasks in Village 3, Dhaka region.

Households	Decision to start cage culture	Decision on distribution of daily tasks	Decision post harvest
HH1			
Female	NGO suggested. Husband supported, they live near the river	She gives maximum time, if no time, then husband and children	NGO will decide to sell, she doesn't know what she'll do with the money, she doesn't want to eat mussel-fed fish
HH2			
Male (c.o.)	Idea from NGO chairman, decided by his mother mainly	He prepares feed on his own and applies feed himself regularly	All fish will be sold, 400 Tk expected
HH3			
Male (c.o.)	Idea from CARE and NGO, talked with his wife: she supported	Through understanding	Fish sold when money is needed to buy rice and food, fish won't be consumed by the family

*Decision to start cage culture:*

The importance of the role of the NGO in initiating cage culture either through suggestion and provision of information is highlighted by both men and women in 2 of the villages. In village 1 however, where all villagers are relatives, NGO suggestion or support to start cage culture was not mentioned: information first entered the village through NGO/CAGES staff, and is then passed on from one relative to the other. Apart from the case of Rabeya (village 1) who is single and made the decision completely on her own, along with another woman in village 2, other wives tend to refer to their husbands, in some instance to the NGO and CAGES staff, to make a joint decision. Reciprocally, wives (occasionally along with other family members) are *consulted* by their husbands prior to starting cage culture. Although answers suggest that decisions are taken jointly by both husband and wife, they do not reflect completely the real weight or impact of women's opinion in the final decision to start or

not cage culture. It will be interesting to compare this point with other areas, in particular Sylhet which is much more conservative. It may confirm that women in the Dhaka area are indeed relatively more 'emancipated' compared to other areas of the country and able to make decisions themselves, or to be listened to.

The proximity of the water body, although mentioned only once (in village 3), is certainly an important factor in convincing people to take up cage culture, in particular women. Indeed in village 3, a household is about to abandon cage culture because a ferry crossing is required to access its site and consequently, the housewife cannot spend as much time and effort as required.

*Decision on distribution of daily tasks:*

Decision based on necessity has been the most frequently cited, by both men and women, although more often by men. This may suggest that the problem of repartition of tasks is not discussed and decided depending on everyone's activities, but also that the traditional cultural division of labour between genders may be prevalent in this case and determines roles and responsibilities. Extra comments on the involvement of HH members in these activities show that women and children are involved more often as helping hands, possibly because they stay in the village during the day, when males are more often outside working in the field. Similarly, daily cage management activities are considered as HH activities, which suggest that, as such, they "naturally" devolve on housewives. Thus, except when cages are managed jointly and where a 'fair' division of tasks exists between husband and wife or when the male is himself responsible for the daily feed preparation and application, women do not have much of a say, or influence, in the decision-making process regarding the daily management of cages.

In this case also it will be interesting to compare the results between the different regions studied.

*Decision post harvest:*

Important religious events such as the holy month of Ramadan influence the local economy as prices go up and this is when farmers are planning to harvest and sell their fish.

Data is not reliable enough to draw comparisons between male and female's monetary expectations from the sale of farmed fish, and therefore no conclusions can be formulated regarding any gender issues related to the dissemination of information.

It seems to come out from the interviews, in general, that very little fish will be consumed by the family. Small and less marketable fish will be kept, but farmers are willing to sell as much as possible of their production. Thus cage culture is seen as a business venture, rather than a subsistence one. Indeed, expected amounts of money from cage culture are relatively high, and will be reinvested in cage culture in most cases (increase the number of cages or the number of fish). It was mentioned only once and by a man that the money earned from the sale would be used to buy rice and food. In comparison, women mentioned twice that a certain amount of small fish would be eaten by the family. This may suggest that cage culture, when carried out by female operators, could serve both HH consumption and entrepreneurial ventures, whereas male cage operators tend to consider it as an income generating activity only.

An interesting point was the fact that one woman does not want to eat fish fed on snails. It is possible that some people fear eating aquatic organisms without scales, so indirectly it may be considered as wrong to eat something fed a diet of scale-less organisms. Although this comment was thought as a rare superstition by CAGES staff, it nevertheless suggests that it could be an important issue in the development of appropriate fish feeds and that religious beliefs can be extremely strong and take precedence over food needs.

Objective 2: To determine the amount of time dedicated to fish culture by all HH members, the division of labour and the opportunity costs, both in terms of time and money, of cage culture.

*Village 1*

*Time:*

*Women:*

Time dedicated: ½ hr/day, everyday at the same time (if she goes to work she applies feed earlier).

*Men:*

Time dedicated: 1hr/day; 2hr/day (2? 1hr.): 2 feedings a day is not troublesome.

Division of labour:

Table D11: Respondents' answers regarding the distribution of the tasks related the management of cage aquaculture to household members in Village 1, Dhaka region.

Tasks: ? Answers by:?	Buy the seed	Prepare feed	Feed the fish	Harvest fish	Sell fish
HH1					
Female (cage operator)	- From NGO	- Feed supplied from NGO + herself. Her sister helps her to prepare feed	- herself and sister	- her elder brother (brother also helps to shift cages)	- her elder brother (her income contributed to her family)
HH2					
Male (cage operators)	From NGO @ Tk. 700 for 100 f'lings.	Wife and children.	Wife and children.	n/a	n/a
HH3					
Male (cage operators)	From NGO or from his own.	Children and wife (wife doesn't feel bad)	Children	n/a (wife supports to do cage culture)	n/a

Opportunity costs and effects on other HH activities:

Table D12: Respondents' answers regarding their appreciation of cage aquaculture and the effects, time and financial opportunity costs they feel the activity bears on their usual household activities in Village 1, Dhaka region.

Households	Appreciation of cage culture	Effect on other HH activities	Time opportunity cost	Financial opportunity cost
HH1				
Female (c.o.)	Does not want to compare cage culture to cattle farming or poultry rearing ("cage culture is cage culture").	Her mode of life has changed a bit: she used to bath in tube well, now in the river	She gets up early for the daily management of cages.	No answer
HH2				
Male (c.o.)	No answer	No effect on normal HH activities	No answer	None
HH3				
Male (c.o.)	He is satisfied with cage culture. He's doing it as a hobby, and is earning money.	Does not hamper his other works, nor other HH members.	F cage culture did not take place they would do their other activities as usual (i.e. crops, poultry, cattle, HH activities)	He received financial support from NGO and contributed very little financially, no financial opportunity cost (he only gives his labour).

#### Village 2

##### Women:

Time dedicated: 1hr./day (2? 1/2 hr.). 1hr./day (2? 1/2 hr. at 8.00am and 4.00pm). 2hr./day during the rainy season. 1hr./day (2? 1/2 hr.): cages are now far from the bank.

##### Men:

Time dedicated: 1hr./day (2? 1/2 hr.). 1hr./day (2? 1/2 hr. at 8.00am and 4.00pm). 2hr./day during the rainy season. 1hr./day (2? 1/2 hr.): cages are now far from the bank.



Division of labour:

Table D13: Respondents' answers regarding the distribution of the tasks related the management of cage aquaculture to household members in Village 2, Dhaka region.

Tasks: ? Answers by:?	Buy the seed	Prepare feed	Feed fish	Harvest fish	Sell fish
HH1					
Female (c.o.)	NGO supplied fish, money given by NGO then from traders	Herself, with help of husband	Husband and herself	n/a (1 <sup>st</sup> year)	n/a (1 <sup>st</sup> year)
Male (c.o.)	From traders: 1.5Tk/piece	Wife, sometimes children	Himself and children	n/a (1 <sup>st</sup> year)	n/a (1 <sup>st</sup> year)
HH2					
Female (c.o.)	Money given by NGO. Husband bought f'lings from traders (1.5Tk/piece).	Partly by herself.	?	n/a (1 <sup>st</sup> year)	n/a (1 <sup>st</sup> year)
Male (c.o.)	NGO gave money. He bought f'lings from traders (1.5Tk/piece).	Wife helps occasionally	Himself	n/a (1 <sup>st</sup> year)	n/a (1 <sup>st</sup> year)
HH3					
Female (c.o.)	NGO helps. Husband collected fingerlings from traders (1,800 tk/1,000 f'lings).	Herself	Husband, sometimes her and son.	n/a (1 <sup>st</sup> year)	n/a (1 <sup>st</sup> year)
Male (c. o.)	Office helps. He collected fingerlings from traders (1,800 tk/1,000 f'lings).	Wife	Himself, sometimes wife and son	n/a (1 <sup>st</sup> year)	n/a (1 <sup>st</sup> year)

Number of cages per household:

	male	female
HH1	1	2
HH2	6	2
HH3	4	2

Opportunity costs and effects on other HH activities:

Table D14: Respondents' answers regarding their appreciation of cage aquaculture and the effects, time and financial opportunity costs they feel the activity bears on their usual household activities in Village 2, Dhaka region.

Households	Appreciation of cage culture	Effect on other HH activities	Time opportunity cost	Financial opportunity cost
HH1				
Female (c.o.)	Leisure time spent for cage management (i.e. opportunity cost)		Time spent on other works. Leisure time spent for cage management	Cattle farming, goat farming, poultry rearing
Male (c.o.)	?	No problem, no harm to other works	Time spent on other works	?
HH2				
Female (c.o.)	?	No effect on HH activities	Leisure	Cattle farming and poultry rearing
Male (c.o.)	Good, no difficulties. The objective is to earn money.	No effect	Cage culture using up leisure time	NGO gave maximum support,
HH3				
Female (c.o.)	Cage culture needs work and is as important as other IGA (income generating activity).	No harm to other activities. Morning feeding at 8.00am to cage fish is not a problem.	Other works, leisure (time consuming collection of snails)	Duck and goat farming,.

Male (c. o.)	?	No effect.	No use of time to spend for other HH purposes, so using this time for cage culture	?
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*Village 3*

*Women:*

Time dedicated: 1hr./day (2? 1/2 hr.).

*Men:*

Time dedicated: 20 min/day. 1hr./day (2? 1/2 hr.), when snail feed: 2hr/day.

Division of labour:

Table D15: Respondents' answers regarding the distribution of the tasks related the management of cage aquaculture to household members in Village 3, Dhaka region.

Tasks: ? Answers by:?	Buy the seed	Prepare feed	Feed fish	Harvest fish	Sell fish
HH1					
Female	NGO supplies f' lings. Also traders.	Herself	Herself	n/a (1 <sup>st</sup> year)	n/a (1 <sup>st</sup> year)
HH2					
Male (c.o.)	NGO provides cage, then he bought f' lings from traders	?	Daughter and son.	?	? (122 fish sold for 400 Tk.)
HH3					
Male (c.o.)	NGO supplied fish	Himself	Himself (wife doesn't help because water body is distant (ferry))	n/a (1 <sup>st</sup> year)	n/a (1 <sup>st</sup> year)

Opportunity costs and effects on other HH activities:

Table D16: Respondents' answers regarding their appreciation of cage aquaculture and the effects, time and financial opportunity costs they feel the activity bears on their usual household activities in Village 3, Dhaka region.

Households	Appreciation of cage culture	Effect on other HH activities	Time opportunity cost	Financial opportunity cost
HH1				
Female	The more labour provided, the better the results so she gives maximum labour to get profits	No detrimental effects on other HH activities	Other HH works, leisure time	Money could be used for other purposes
HH2				
Male (c.o.)	At present, not very good feeling because of poor results. If better results, then better feeling.	Yes, it has a detrimental effects on HH activities.	He could give more time to other works	Money used for own consumption
HH3				
Male (c.o.)	Good, useful use of time, money and energy.	No effect, not that much labour required for cage culture	Engaged with boating. Good income helps him to survive.	Use it for other purposes.

*Amount of time dedicated to fish culture by HH members and distribution of tasks:*

Quantitatively, the time spent on cage culture is more or less equal for both male and female cage operators. On average, cage operators (both male and female) spend approximately 1 hour on cage culture daily, with 2 feedings of ½ hour each. However, qualitatively, the repartition of tasks vary between males and females. In general, to prepare feed and apply it to the cages are the most important and time consuming operations in cage culture. When answers are looked at in global terms, without distinction between villages and of who is the cage operator in the HH, buying seed from traders is a male task, preparing the feed is a female task (with occasional help from children and husband),

feeding the fish is carried out by men, women and children, and harvesting and selling the fish (only 1HH in village 1) is carried out by the males of the family. It seems nevertheless that the children are involved on a regular basis on the preparation and application of feed, which indirectly, is a good way to train them to cage culture. It is however interesting to relate the distribution of preparing and feeding tasks to cage ownership and operating as it may reveal both gender issues over the control of the management of this technology and the degree of autonomy of female cage operators.

In village 1, the female cage operator interviewed (and only one to have started aquaculture the first year of the project) prepares feed and feeds her fish herself, whereas she leaves the harvesting and the selling of fish to her elder brother. This puts into question the final control over the money earned from her work. Although the decision regarding the time to harvest is hers (see Objective 1), it is unclear whether the choice of what to do with the money earned does indeed belong to her. In the same village, although the 2 new male cage operators have not harvested or sold their fish yet, it can be expected that they may reserve these operations to themselves, leaving all the intensive labour of preparing the feed and applying it to their family members. Unfortunately, it was not possible to interview these two operators' wives to cross-check the information and opinions given.

In all the HH interviewed of village 2, both husbands and wives were owners and operators of their own cages. Husband and wife's answers of HH1 regarding the preparation and application of feed are completely different, the husband mentioning his children's help twice for his cages, whereas only the wife and her husband are involved in these tasks for her cages. It looks as if the HH male is somehow 'supervising' his wife's production by being involved in the daily labour required by her cages. The involvement of his children in the management of his cages may reveal the paternalistic role of transmitting this information to his descendants since it is understood that knowledge is a male attribute. He only uses his wife for the 'lower' task of feed preparation. Similarly for HH3, the female cage operator seems much compelled to feed preparation only. The answers given also refer to the problem of decision making regarding the distribution of the daily cage management tasks to each HH member and to the reasons explaining the present repartition of these roles (see Objective 1).

In village 3, no precision was given regarding the ownership of the cages within the HH interviewed. One male cage operator highlighted the problem of distance of the cages from the village, impeding his wife's involvement in the management of the cages, as was already mentioned in Survey 1, Objective 1.

*Cage culture opportunity costs (time and money) and effects on other activities:*

In every village, answers often appear quite contradictory. Respondents generally agree that cage culture is a good use of their time and money and has no effect on other HH activities, but find that, on the other hand, aquaculture has indeed an opportunity cost, encroaching on their leisure time and other HH activities. This either reveals a bias induced in the questionnaire with respondents approving the project to please us, or may have been induced through a language difficulty (translation subtlety). It is probably more reasonable to consider the first option and to consider that the answers to the questions related to the time and financial opportunity costs of cage culture correspond best to the cage operator's opinion. Indeed, they are an indirect formulation of question 22 related to the direct effects of cage culture on the HH activities.

A summary of the answers provided by respondents of each sex is provided in Table D17.

Table D17: Ranking, by frequency of occurrence in the respondents' answers, of the time and financial opportunity costs of cage culture felt by male and female respondents in the Dhaka region.

Time opportunity cost		Financial opportunity cost	
Men	Women	Men	Women
Leisure 2 (incl. "but good use of time": 1) Crops: 1 Poultry: 1 Cattle: 1 HH activities (but cage culture done as a hobby): 1 None: 1 Boating activity: 1 Other works: 1	Other works:3 Leisure: 3 (incl. "but no problem with morning feed": 1).	None:2 Other purposes: 1 Own consumption: 1	Goat farming: 2 Poultry: 2 Does not want to compare c. culture with other activities: 1 Cattle: 1 Other purposes.

The most commonly cited opportunity cost is cage culture taking up time dedicated to leisure and other work ('leisure' mentioned 6 times, 'leisure and other works' mentioned 3 times and other 'activities' once, out of 12 answers). This suggests that, although people involved in cage culture are considering it as an important income generating activity and are willing to devote much time and effort to it, it indeed encroaches upon their time for leisure and other HH activities, and, to some extent, has a negative impact on the daily organisation of their lives. Only one clear negative feeling about cage culture was expressed by an unsuccessful cage operator (village 3) for whom cage culture created both a time and a financial opportunity cost. Interesting to notice that the two men who appreciate cage culture the most are those for whom this activity does not require much effort (feeding is carried out by other HH members).

Financially speaking, cage culture has an opportunity cost as it is often mentioned that if this activity was not carried out, investment efforts would be focussed on goat and cattle farming, duck and poultry rearing, with money also spent on personal consumption. However, as financial support has been provided to farmers to start cage culture (mentioned in two instances), it is considered that cage culture has therefore a limited financial opportunity cost.

So indeed, cage culture has a non-negligible opportunity cost for cage operators and their families, and it seems that this cost is heavier on women than on men cage operators. However, to be more precise, the total opportunity cost of cage culture should be measured against the expected returns from this activity and compared to those that may be obtained from other activities such as poultry rearing and goat and cattle farming for the same amount of time dedicated.

*Plans for next year:*

*Village 1*

Table D18: Respondents' answers regarding their cage aquaculture plans for the next season in Village 1, Dhaka region.

Households	Current number of cages and species	Plans for next year	+/- cages
HH1			
Female (c.o.)	4 cages of 8m3: 1 with pangas, 3 with <i>Catla catla</i> , puntius and grass carp.	Cage culture with floating cages.	?
HH2			
Male (c.o.)	1 cage of 8m3 with <i>Catla catla</i> , grass carp, Anabas and <i>Labeo rohita</i> .	Cage culture with species that performed well	?
HH3			
Male (c.o.)	1 cage of 8m3 with tilapia, catla and silver barb	His HH will be involved in cage culture again next year	?

*Village 2*

Table D19: Respondents' answers regarding their cage aquaculture plans for the next season in Village 2, Dhaka region.

Households	Current number of cages and species	Plans for next year	+/- cages
HH1			
Female (c.o.)	2 cages of 1m3 Species (hers and her husband): silver carp, catla, tilapia	8 cages total, timely stocking and good size fingerlings	+ 5
Male (c.o.)	1 cage of 1m3	Same as above	same
HH2			
Female (c.o.)	2 cages of 1m3 with tilapia only	This year knowledge gain so more cages .next year,	+ 4
Male (c.o.)	6 cages of 1m3: 2 with tilapia, 2 with grass carp, 2 with pantii.	More cages: 16 in total. Good fingerlings and good feed. If no support from NGO then will carry on his own.	+ 8

continued

HH3			
Female (c.o.)	2 cages of 1m <sup>3</sup> Species (HH): silver barb, silver carp, catla, rui, mrigal, tilapia,	Will carry on next year with silver barb, grass carp, silver carp, rui and catla.	?
Male (c. o.)	4 cages of 1m <sup>3</sup>	?	?

### Village 3

Table D19: Respondents' answers regarding their cage aquaculture plans for the next season in Village 3, Dhaka region.

Households	Current number of cages and species	Plans for next year	+/- cages
HH1			
Female (c.o.)	2 cages of 1m <sup>3</sup> with silver barb and tilapia	2 cages again. She needs more support (economic support for feed and seed 50-50)	+ 0
HH2			
Male (c.o.)	3 cages of 1m <sup>3</sup> : 2 with tilapia, 1 with sharputi	Cage culture will be done with more labour to look after the cages ( <i>said by the farmer whose cages are in a distant water body</i> ).	?
HH3			
Male (c. o.)	2 cages with tilapia and sharputi	2 cages again, big nets for pangas and needs help.	+ 0

As can be seen, cage operators are definitely interested in and motivated to carry on investing their time, energy and money in cage culture, which may suggest that the opportunity cost expressed by cage operators would not be that great compared to the benefits drawn from the activity. However, the way the work load is distributed over HH members will have to be monitored carefully since multiplying the number of cages by 2 or 3 will not be without social consequences and personal trade-offs.

Objective 3: To determine the various factors that may influence the role of women in cage culture (ex. social status, wealth, distance from water body, access, education, religion, others?)

No information was collected regarding the women's level of education. Their social status was also a variable difficult to measure, although it often goes de par with HH wealth. In the Dhaka area, I personally felt that women were more accessible and open and relatively freer in their movement and behaviour than in the Sylhet region, much more religiously conservative. Consequently, this facilitates their involvement in cage aquaculture, since they can at least get out of their houses and go to the cages to feed the fish. There seems to be still a long way to go before women can go to the market themselves (i.e. leave the village on their own) to sell their production.

### Village 1

The village is at the edge of the water body, and the cages are relatively close to the edge of the river. The water body belongs to the community and is leased to fishermen, and access to the water by villagers is not limited. Distance and access are therefore not a problem and were not mentioned by any of the interviewees (male and female) as a constraint for women's involvement in cage culture. As all village members are related in this village, there are not any significant differences in the villagers' social status. Rabeya, female cage operator, is from a marginal HH and contributes to her family with the earnings made from cage culture, but the fact that she is single and relatively freer in her decision-making over the management of the cages contributes to her full involvement and success in the activity.

Of the two other interviewees (males), one was wealthy (TV and stereo, one son studying in Kuwait) and the other marginal (i.e. 0.2 to 0.5 acres of land, no TV, tin-roofed house, bamboo fence). The involvement of their wives is though exactly the same and limited, for the moment (cage culture started this year), to the feed preparation and occasional application to the cages, gender issue probably deriving from the traditional and 'cultural' (marked with religion) division of labour (see Objective 1).

### *Village 2*

Cages are located on a government-owned river with open access to all water users. The river and cages managed by villagers are close to the village, accessible by a narrow path. Distance and access difficulties were never mentioned by females or their husbands as a hindrance to the involvement of women. All HH interviewed are of similar wealth: poor or marginal, tin-roofed house with bamboo or straw fences. As in village 1, and probably for the same reasons as in village 1, the wives' tasks are limited to feed preparation mainly, with occasional feed application to the cages. The number of young children to look after does not seem to make any difference either to the amount of time dedicated by women to prepare and apply feed to the cages.

### *Village 3*

A number of cages are in the river that runs by the village and are easily accessible from an embankment created in the river. The water body is owned by the government and leased by the ex-chairman of the community who leaves free use of the water to the villagers. Some cages are however located further along the river and a ferry-crossing is required to access them. This is causing problems to the owner of these cages who mentioned that his wife could not be involved in cage culture because of the distant location of the cages and the ferry crossing. Distance of and complex physical access to the cages site, combined with the fact that women still do not go out of their village much and the number of other HH activities in which they are already involved, are a major constraint to their full participation. Indeed, the only female cage operator interviewed mentioned that the proximity of their house to the river was an important factor in deciding to start cage culture and she is responsible for both the preparation and the application of feed to her cages.

There did not seem to be any connections between the wealth status of the HH and the role of females in cage culture.

Objective 4: To determine whether the involvement of women in cage culture (as cage operator or wife of a cage operator) contributes changes to their social status.

The question of the impact of cage culture on the cage operator's personal status was already approached in Objective 2, Study 1, which suggested that knowledge gained through cage culture was the main factor behind an increase in the cage operator's social recognition within the community. Indeed, developed knowledge and increased social recognition and respect on the behalf of other villagers was cited by female cage operators in each of the three villages, whereas a change in social status due to financial gains did not get any mention. This is very important in a country like Bangladesh where women are only receiving limited and sieved information. This knowledge gain is their own propriety since, contrarily to financial gains made from cage culture, it cannot be appropriated by their husband. From this respect, the introduction of cage culture to women has a very positive impact.

## **Survey 3: The impact of cage aquaculture at the community level.**

Objective 1: To identify if community members (incl. cage operators and non-cage operators) feel some changes have occurred in their daily activities since the implementation of cage culture.

### *Village 1:*

NB: no children attended the meeting.

No mapping exercise was carried out in this village because it was felt that no difficulties had risen since the implementation of cage culture in the community. Both women and cage operators expressed their good feelings about cage culture. Moreover, all village inhabitants are related, making it difficult for conflicts to emerge openly. About using the water body where cages are located, it emerged from the community meeting that:

- general users have no problem using the water body for their daily activities,
- bathing nearby cages is not a problem as it was thought that soapy water does not harm fish,
- other water users like cattle farmers, duck rearers and boat men, do not cause any trouble to cage operators.
- Women use the water body for bathing and are now using the village tube well to wash vegetables (vegetables washed in the winter season only before going to the market), but they do not have a problem with this as they belong to the same family.
- Local subsistence fishermen are not facing any problems with the presence of cages as they belong to the same community.

? Cage aquaculture in this village has not brought any significantly incommoding changes to the traditional patterns of water use by local villagers.

*Village 2:*

Approximately 30 participants attended the meeting (9 cage operators, 4 fishermen, many women and kids). During the introductory discussion, participants did not feel there were any ongoing problems or difficulties in the community due to cage culture. Women said they do not feel shy while using the water body for bathing, and when other people appear, they “take it easy” as they are used to this situation (dixit). Cattle bathing near the cages is not seen as a problem either.

Fishermen said they catch their fish in this water body all year round. They do not consider the presence of cages as a problem as cage culture requires a small area and does not encroach on their fishing grounds.

During the mapping exercise, the group was divided into four sub-groups: fishermen, women, children and cage operators.

Cage operators and women’s maps show best where each water use takes place in the water body. A “summary” map reproducing all maps drawn is presented next page (Figure D1).

Uses mentioned include:

- boating and river traffic
- wash utensils and cleaning
- bathing
- cattle bathing
- fishing
- cage culture
- jute retting
- irrigation

Women did not mention jute retting and irrigation as uses of the water body, but added interesting comments on why cage aquaculture does not generate difficulties. According to them, cages are not a problem for fishermen because they are located in a corner of the water body, and their number could even be increased because the river is very wide. Similarly, maps show that boat traffic from one bank of the river to the other is not impeded by the siting of cages. Children indicated that no poaching had occurred, complementing women’s comment that cages were guarded by cage operators.

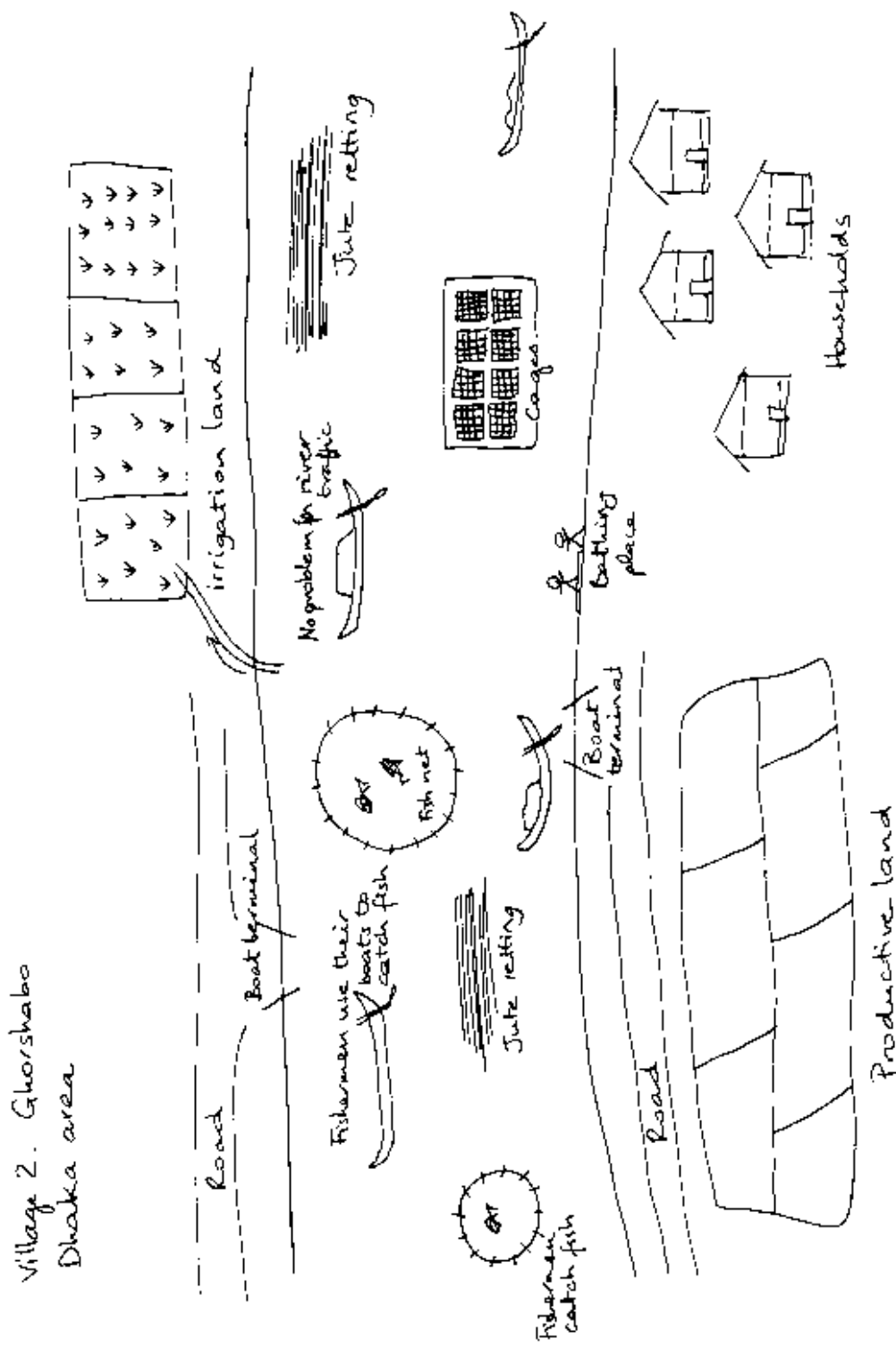


Figure D1: Mapping exercise in Village 2 (Ghorshabo), Dhaka District.



*Village 3:*

Cage aquaculture has only been implemented earlier this year (1998) in this village. The community meeting was attended by 30 participants approximately, including 10 cage operators, 4 fishermen, 10 kids, only one woman sat down.

The general impression of participants about cage culture is positive, although due to this year's flood, a huge number of fish died and they are currently only observing losses. They nevertheless believe that with good labour, cage culture can be a profitable IGA.

No specific changes and problems were highlighted by the participants during the introductory discussion of the meeting.

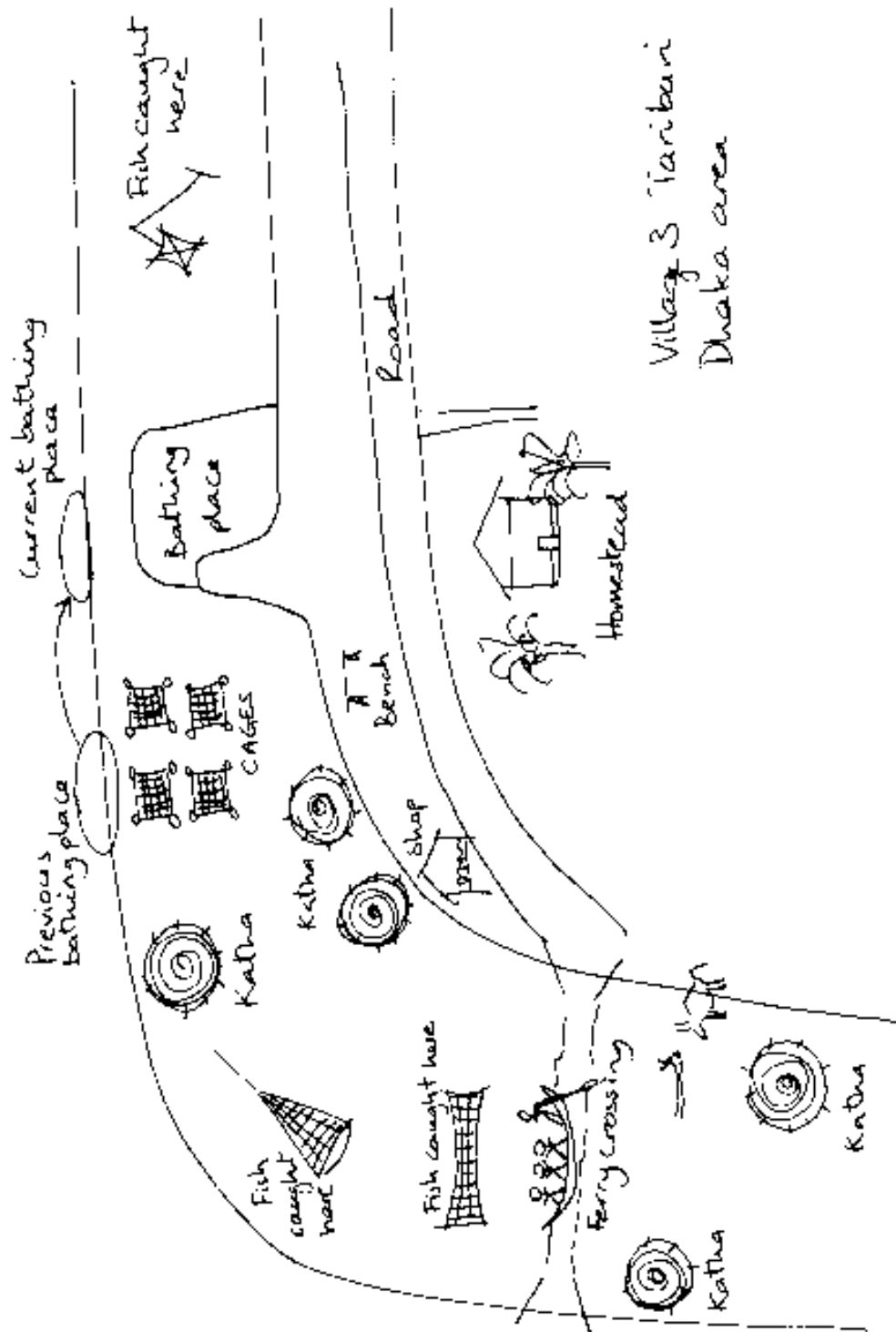
However, the map prepared by the other water users' group reveals that their bathing place had to be shifted a bit further due to the presence of cages close to the shore. In addition, children mentioned that jute retting was responsible for fish death and had to be moved away to a different location. They also reckon that more cages are likely to bring more problems. Women indicated that they wash clothes at the place where people bathe, in the pond (we don't know however where they used to do it before). They wash their utensils and sometimes bathe in the tube well.

The cage operators' perspective is rather different since, according to them, cage culture does not cause any problem, and they highlight only positive aspects and benefits of cage culture (i.e. knowledge development, network development, new work, new IGA, feed rice bran and broken rice from their HH, and encourage everybody to try cage culture again next year).

It is also mentioned by the other users' group that boats usually do not enter the water body, except during the rainy season, thereby limiting the risks of interference with the cages.

Figure D2, presented next page, is the result of the mapping exercise carried out in this village.

Figure D2: Mapping exercise, Village 3 (Tarabari), Dhaka region.



Objective 2: To identify conflicts that may have emerged since the implementation of cage culture.

*Village 1:*

No fishermen were present at the community meeting because there aren't any in this particular village, and none from the neighbouring community were able to attend the meeting.

However, it was mentioned by the rest of the community that cage culture sometimes create conflicts with outside 'professional' fishermen when cages are shifted to the parts of the water body used as fishing ground by these fishermen. As an additional factor to increase the potential for conflicts, the water body where cages are set has been leased out to these fishermen this year (and for one year) to catch fish. Consequently, some mishaps have occurred, cages nets cut, some fish stolen from the cages, and these were blamed on the outside fishermen. It was thought however that other people from the neighbouring community were not troubled by cage culture.

Other water users from village 1 felt that they did not have any problem with cage operators, and the cage operators told the same about the other water users. As all villagers are relatives, they do not have (or perhaps do not *want* to have) any conflicting situation with the cage operators. Similarly, female participants said: "we have no difficulties in using the water body because we all are relatives and belong to the same community".

*Village 2:*

No particular conflicts were mentioned during the community meeting discussion.

The maps show the location of the various water uses and activities occurring relatively close to the cages location and discussions over the drawing of the maps did not reveal any particular conflicts between water users and cage operators.

The present ownership situation of the water body, governmentally-owned with open access to water users, does not pose any problem to the community members.

*Village 3:*

No particular conflicts were mentioned during the community meeting discussion.

However, maps suggest a potential for conflicts since some activities such as bathing and jute retting have to take place on different locations because of the presence of cages. It is interesting though to see that they do not seem to be considered as 'conflicts', and certainly not treated as such.

Many *katlas* (set for fish catching activities) are represented on the maps, and if too close to the cages, it may be possible that some interference could occur with cage culture.

The present system of ownership of the water body, i.e. government-owned and leased to the ex-chairman of the community who leaves free access and use to the villagers, does not create any conflicts among the various water users.

It will be interesting to compare this 'non-conflict' or 'avoidance of open conflict' situation in the other regions of study as surveys in villages 1, 2 and 3 seem to suggest a big resilience to changes from the villagers. Is this a trait of character typical of Bangladeshi people?

Objective 3: If relevant, to identify which regulation mechanisms have been implemented by the community to mitigate any possible negative impacts or problems/difficulties due to cage culture

*Village 1:*

No particular mechanisms of self-regulation have been implemented to solve the conflict between cage operators and outside fishermen. However, it was mentioned during the community meeting that outside fishermen raised the issue of the nuisance of the sitting of cages with cage operators. In addition, one suggested during the interview that the local NGO could intervene and help resolve the conflict by setting a 'physical barrier' of some kind around the cages to limit interference with fishermen.

*Village 2:*

No regulation mechanisms as no difficulties or conflicts are occurring over the use of the water body.

*Village 3:*

No mitigation measures have been considered by the villagers, who seem to just accept the changes imposed by cage culture.

### 3.2 SYLHET REGION

Villages visited and people interviewed in the selected household included:

<p>“Village 1”:</p> <p>Mathargram Union: Manikpur Thana: Zukigais District: Sylhet</p>	<p>“Household 1”:</p> <p>Mr. Jalal Uddin and his wife Sharifa Khatun “Household 2”:</p> <p>Mr. Belal Miah and his wife Minara Begum “Household 3”:</p> <p>Mr. Shabbir Ahmed and his sister Monowara Begum</p>
<p>“Village 2”:</p> <p>Dharon Union: Syder Gaon Thana: Chhatak District: Sanamgauj</p>	<p>“Household 1”:</p> <p>Mr. Md. Khoshru Miah and his wife Salma Ali “Household 2”:</p> <p>Mr. Nurul Huda Pir (‘Uncle’) and his wife Syeda Rabeya Khatun “Household 3”:</p> <p>Mr. Md. Sazzadur Rahman and his mother Mrs. Hayatun Nesa.</p>
<p>“Village 3”:</p> <p>Sheotorpara Union: Uttar Khurma Thana: Chhatak District: Sanamgauj</p>	<p>“Household 1”:</p> <p>Ms. Md. Shahidul Islam and his mother Mrs. Rashedun Nesa. “Household 2”:</p> <p>Mr. Md. Rafiqal Islam and his cousin Mr. Md. Jakaria Hossain “Household 3”:</p> <p>Mrs. Noor Johan</p>

Field work was carried out on the 7, 8 and 9 December 1998.

In this region, cages are managed co-operatively. For this reason, there is no household more “successful” than another.

The symbol (\*) indicates non-cage operator interviewees.

### **Survey 1: Reasons for HH cage operators’ dropout or continuation of cage aquaculture.**

Objective 1: To identify the factors responsible for the cage operator’s dropout or continuation, and see if these reasons are similar for both men and women cage operators.

#### *Village 1*

Table S1: Perception of performance in cage aquaculture, reasons for success and difficulties perceived by cage operators and their household members in Village 1, Sylhet region.

	<i>Perception of Success/failure</i>	<i>Reasons for success</i>	<i>Reasons for difficulties</i>
HH1			
Female (c.o.)	Fish has grown to expected size. They are happy and hope they will get much money.	?	No problem: everybody is thinking to do it next year.
Male <i>Jalal</i>	Good, encouraging. Next year people will be more involved.	More awareness growing among group members. His house is near to the water body, so his wife and kids can help with the culture.	Some people have other works which are also important. So misunderstanding because all people cannot work the same
HH2			
Female	Good as they are comparing with other businesses and it seems to be more profitable than others. Jalal and Shabbir contributed a lot.	No conflicts, good understanding. It is good to give more of the share to Jalal and Shabbir as they are working hard.	No difficulties faced

Continued (HH2)

Male (c.o.)	Great, more profitable than other businesses, happy with the performance.	More contribution from Jalal as his home is nearest and his kids working	No problem, no misunderstanding, everybody is brothers
HH3			
Female	Good, we are thinking it could be a good and profitable thing for next year.	Shabbir and Jalal are working more, al together	No difficulties, cage work considered as normal family work.
Male (c.o.) <i>Shabbir</i>	Good. Jalal and himself are working hard though other people are working well as a group.	As new thing and 1 <sup>st</sup> year, they can maintain properly, try to develop techniques, feed, species stocking size, management, need to develop more.	No problem. However, apart from 2 people (Jalal and himself), others can't contribute properly as they are poor and need to work in other places or fields.

Village 2

Table S2: Perception of performance in cage aquaculture, reasons for success and difficulties perceived by cage operators and their household members in Village 2, Sylhet region.

	<i>Perception of Success/failure</i>	<i>Reasons for success</i>	<i>Reasons for difficulties</i>
HH1			
Female (c.o.)	Good. Expectation is to do more. Better performance than last year as her husband was working last year.	Mr. Nurul Huda Pir contributes more as he is free and working around. Scope to work with different people, can share ideas and apply. They shifted cages from canal to the pond.	Last year: her husband was working, floods, mortality, lack of experience. In addition problem in the water body which is a water way and boats always pass randomly, so they shifted cages from the canal to pond.
Male (c.o.)	Not satisfied.	Nurul Huda Pir contributes more: he does not have any other works, he is old, near the house and getting support.	If more time and energy deployed then results must be better. Need more intensive care.
HH2			
Female (c.o.)	Not satisfied. If feed and management were increased, the production must be increased	Nurul Huda Pir does a lot, some other people are helping.	Feed and management difficulties
Male (c.o.) <i>Nurul Huda Pir</i>	Not satisfied but feed and management is done so no major losses. He contributes the most and is the most successful as other group members are close relatives and depend on him for cage culture as he is free.	More successful this year because manage according to his plan, more feed ingredients and fish properly fed, take care as much as possible	No problem
HH3			
Female	Nurul Huda Pir and Sazzadar Rahman are the most successful and contributing the most.	?	No difficulties faced
Male (c.o.) <i>Sazzadar Rahman</i>	'Uncle' is the most successful and involved.	?	Can't contribute fully as he has his exams ahead ( <i>student</i> ). It would be more profitable if everybody worked uniformly.

Village 3

Table S3: Perception of performance in cage aquaculture, reasons for success and difficulties perceived by cage operators and their household members in Village 3, Sylhet region.

	<i>Perception of Success/failure</i>	<i>Reasons for success</i>	<i>Reasons for difficulties</i>
HH1			
Female	Good. Mr. Rafiqal Islam and Mr. Shahidul Islam are the most successful.	If more feed provided, then more production. Discuss among all members to solve problems.	No difficulties.
Male (c.o.) <i>Shahidul Islam</i>	Positive. Rafiqal Islam and himself are the most successful.	We are very close, Rafiqal Islam is experienced for 2 years.	There is no problem.
HH2			
Male (c.o.) <i>Rafiqal Islam</i>	Successful, no problem, 1 <sup>st</sup> year for experience, now 2 <sup>nd</sup> year. He thinks he's the most successful this year, last year: Jakaria Hossain.	Gained experience the 1 <sup>st</sup> year. No problem among group members.	Last year, feeding quality was not clear as new thing and feed and feeding techniques were unknown. This year little problem with feeding costs as all are poor
Male (c.o.) <i>Jakaria Hossain</i>	Last year he did not have technical experience and got poor results. Rafiqal Islam is the most successful this year.	No group conflict.	This year, he is not doing cage culture (but he can still gain experience by observing the others). He drop out because he got a skin disease on his legs and could not continue culture this year. No group conflicts even though someone has an outside job and cannot contribute properly, but OK
HH3			
Female	Very good as a IGA. Rafiqal Islam is most successful, he gained experience over the last 2 years.	Need to nurse closely. Experience.	No problem

For women, co-operative work between the group members (good understanding, no conflicts) as well as care and help from husband (mentioned once) are important factors for their success in cage aquaculture. However, whether cage operator or not, they also realise that feed is an important component of successful fish farming.

Regarding the difficulties faced, there is a noticeable difference in the answers of female cage operators and female non-cage operators. Indeed, none of the female non-cage operators (involved in cage culture indirectly as a hand, at the same level of children) see any difficulties in the management of cages that could lead to difficulties or dropout. However, for women involved a bit closer in cage culture, technical aspects of cage culture such as cage siting, net cutting by crabs, fish mortality, flood, feed and management, lack of experience can be factors of difficulties and need to be dealt with to avoid dropout. The cultural background of the Sylhet region (religiously conservative) has to be taken into account to explain the current condition and status of women in this part of Bangladesh. *Parda* ("curtain", i.e. women's physical covering and spatial enclosure), which is "a fundamental precept of Islam, ordained in the Koran, and is a universal hallmark of the true Muslim way of life" (Mandelbaum 1988)<sup>1</sup>, restricts women's physical movement and indirectly their access to knowledge. This explains the little of involvement of housewives in cage culture and their misconceptions about the real difficulties of managing cages. Females 'officially' involved in cage culture as members of the group, however restricted they may be in their movement and contribution to the activity, have a better grasp of the reality and of the technical requirements of cage culture. However, the real impact of various

<sup>1</sup> Mandelbaum, D. G. (1988) *Women's Seclusion and Men's Honor. Sex Roles in North India, Bangladesh and Pakistan*. The University of Arizona Press, Tucson.

degrees of technical knowledge on the capability of cage operators, both male and female, to carry out cage culture is difficult to measure for cages are managed in group.

One woman cage operator suggested by her answer that male help is useful for the heavy work involved in cage management, for instance shifting cages. This reminds us that cage culture is not only a technical activity, but also relies on heavy physical manipulations for which male ‘muscles’ can be welcome to help reducing the physical strain women are already bearing from other activities. If exclusively female groups were to be formed, or female were targeted as individual cage operators, this point (heavy weight, size, difficulty of manipulation of cages) should be borne in mind for the design of adapted cages (e.g. light - bamboo - frame, easily accessible location etc.).

For men, time dedicated to cage culture, co-operative work between group members as well as care and experience and development of technical knowledge are the main factors thought to be a guarantee of success. The lack of uniformity in the share of workload between group members is seen as the main problem in dealing with co-operative cage culture. Lack of knowledge and experience on feeding techniques was also cited as reasons for difficulties and poor results in the first year of culture, emphasising the importance of training support in the first year/cycle of culture. Interestingly, poverty as a constraint to cage culture in terms of feed affordability and time availability (need to work outside to earn extra money) was mentioned twice. Personal circumstances (disease and education) also appeared twice as a reason for dropout and difficulties encountered respectively.

It appears therefore that the difference between men and women is mainly a difference of judgement and appreciation of the real constraints to cage culture which is almost certainly the result of the different levels of technical knowledge of women and involvement in the activity. Group management is seen as a positive asset in terms of understanding, problem solving and sharing of technical knowledge and experience. However, it is also considered as a constraint when the workload is not shared equitably between members and when external constraints to participation such as poverty or personal circumstances are added up to the technical difficulties commonly faced.

Feeds available in this region:

- Banana leaves: freely available everywhere, all year round.
- Mussels: widely available, but time consuming to collect.
- Duckweed: moderately available. Collected in ponds. Difficult to collect during monsoon season.
- Grass: not available during pre-winter and winter season.
- Rice/wheat bran: available from town market or smaller market places but a little costly. Rice = 6-8 Tk/kg. Wheat = 3-4 Tk/kg.
- Molasses: available from market: 9-10 Tk/kg.
- Oil cake: available from market: 9-10 Tk/kg.
- Fish meal: not available. Protein feed is purchased from poultry traders but costly: 20 Tk/kg.

Table S4: Relationship between success through ‘good feed’ and group wealth in Villages 1, 2 and 3, Sylhet region.

Village	Wealth (av. in village)	Success	Feed collected	Feed purchased	Species
Village 1	poorest	Medium	Banana leaves, grass, duckweed, soft leaves, bamboo, mussels, dry fish (can also be bought)	Rice and wheat bran, oil cake	Sarputi (5 cages) Grass carp (3 cages) Tilapia (1 cage) Catla
Village 2	medium	Poor performance	Leaves, grass, mussels, dry fish (can also be bought).	Rice and wheat bran, oil cake	Tilapia Sarputi Grass carp Common carp
Village 3	richest	Successful.	Mussels, dry fish (can also be bought), duckweed.	Oil cake, rice and wheat bran, molasses	Sarputi Tilapia Common carp Grass carp Rui

This table seems to suggest that wealthy Village 3 group can afford a wider range of higher feeds (i.e. with higher protein content) than the other two villages, which in turn, results in better fish growth than for fish fed mainly on vegetal HH by-products.

Data collected for Objective 2, Survey 2 shows that the total daily time dedicated to fish culture by the respondents in villages 1, 2 and 3 adds up to 15 hrs., 10hrs30min., and 12hrs30min. respectively. This therefore may explain why Village 1, being the poorest of all, still manages a reasonable level of success.

As cages are managed co-operatively by mixed groups (both male and female), it is difficult to establish any possible relationship between female's success and the type of feed they are using (see Dhaka results).

In addition, the adequacy of feed to fish culture needs to be studied further in relation to the species farmed.

**Objective 2: To highlight the cage operator's perception of success or failure in cage aquaculture and the impact of the activity on his/her HH (or personal) status.**

*Personal perception of cage culture and success and failure:*

Respondents' answers are presented in Objective 1. There is no question of personal perception of success or failure as such since the cages are managed jointly. However, it appears through the questionnaire's answers and extra comments that farmers acknowledge that some members of their group put more effort into cage culture than others who are constrained by other necessities. In village 1 for instance, Mr. Jalal and Mr. Shabbir are unanimously recognised by the other cage operators and their wives (non cage operators) as the most actively involved in the management of the cages. According to Mr. Jalal, people decided to set the cages in front of his house since it is located near the water body and would make guarding easier. He also thought that given the assistance provided by his wife and the proximity of the cages to his house, people were considering him as the "best worker". Proximity of cages and assistance by family members was also cited by another farmer as a reason for his good contribution to the group. It was also interestingly mentioned by another member of the group that Mr. Jalal and Mr. Shabbir should get a bigger share of fish and money since they are contributing more than others. It seems therefore that everyone's contribution to cage culture is perceived rightly by group members, both directly and indirectly (i.e. women non cage operator) involved in the activity, and that the communal management of the cages does not create animosity or competition between cage operators since it is accepted that some are working more than others and that these would deserve a bigger share of the harvest.

In village 2, unanimity also goes to a single cage operator, Mr. Nurul Hada Pir, said to have no other work, to be "old, near the house, getting support" and to be "free, working around, can give ideas and apply them" by other group members. Himself recognises that other group members depend on him for the daily management as he is free. This is confirmed by every respondent's answers about the division of tasks related to the daily management of cages. All named Mr. Nurul Hada Pir as the person to go and get the fish seed with the NGO, feed, harvest and sell the fish. A hierarchy of roles seems to be much more marked here than in village 1. This may however be explained by the fact that Mr. Nurul Hada Pir is the most experienced farmer (he's been doing cage culture for the past two years), able to give advice, but also organise according to his plans (*dixit*) the work of the other group members who are only in their first year of fish culture. It may be expected that this organisation of labour within the group will facilitate and accelerate the learning process of its participants, but may, in the longer run, create frictions between members if a leadership position is maintained and no longer justified as farmers will become themselves more experienced and willing to manage cages their own way. The situation in village 2 underlines the fact that the availability of time is of major importance in cage culture and the attention and care requirements of this activity imply the full dedication of those who start it.

The situation is somewhat similar in village 3 where Mr. Rafiqal Islam, with a two-year experience in cage culture, is seen as the most successful and involved farmer in the group. However, the respondents' answers do not suggest any strong leadership appears between the group members.

*Impact of cage aquaculture on personal status within the community:*

*Village 1*

*Women:*

- They got new idea and knowledge, other people come to know it. It is socially uplifting.
- New option for earning, people are coming to know how to do cage culture (\*).
- Everybody is coming to us to know about cage culture (\*).



*Men:*

- People coming to him, getting experience and knowledge, people talk about him and are getting interest.
- Community people are impressed, getting new idea and knowledge and will try cage culture next year.
- Now people think I know cage culture very well though it is very new. People are coming to know cage culture, to discuss about it, to develop awareness.

*Village 2*

*Women:*

- Local people are coming to know, visit showing their interest to work next year. Relatives are coming to know, interested.
- Getting honour, people coming to know, showing interest to culture, visiting cages.
- Getting interest, people think that cage culture can be profitable, visiting (\*).

*Men:*

- He's getting honour as a resource person. People coming to know and feel interested to culture next year. People visiting.
- People are thinking of him as a resource person, getting honour, people visiting.
- Friends are coming asking questions, interested.

*Village 3*

*Women:*

- Everybody is asking about cages, waiting for result, people coming and visiting (\*).
- People come out to join them (\*).

*Men:*

- No answer.
- People think of him as a resource person, people come to him, he's involved in a good thing.
- Everybody thinks of him a resource person who knows well about cage culture.

As mentioned by all respondents, whether male or female, cage operator or not, cage culture definitely brings changes, globally positive, to their personal lives and personal status as well as their status within the community. These changes are nevertheless qualitatively different between men and women. The most important impact seen by women is the fact that the activity attracts people to their village, their family and themselves directly (cited 8 times). Second in importance, but cited only twice, is the increase in personal importance and honour derived from the activity. The males' answers ranked almost equally (mentioned 6 and 5 times respectively) the attraction and interest of outsiders to their activity and the gain in personal honour. They also mentioned twice the gain of new ideas and knowledge. Although formulated in a slightly different manner, all answers suggest that cage operators and their relatives' personal status within the community is increased through the interest they get from neighbouring villagers who regard them as more knowledgeable than through financial benefits brought by the activity. This cultural influence of *parda* on women's lives may explain why visits from outside villagers to their community and/or family were mentioned more by women and are considered as a special event. It is likely that these visits and interest expressed by neighbours contribute to a certain extent to an 'opening' of their restricted world, and indirectly contribute to a better recognition of their status and work since some women are cage operator themselves. Since there is a cultural gender 'advantage' for men, it is not surprising that cage culture improves their personal status and recognition among other men more directly. However limited the actual role and contribution of women in cage aquaculture may be in this very conservative area of Bangladesh, and however lengthy the process of involving them more directly in this activity may be, it seems that cage culture can already bring them an opening on the outside world which will hopefully lead to a better recognition of their status and allow their gradual emancipation.

Objective 3: To compare the cage operators' expectations in terms of support from the local NGO/TO/APO staff with what they have been doing to support cage aquaculture and/or remedy to the problem of dropout.

*Village 1*

Table S5: Respondents' opinion about NGO/CARE support for cage aquaculture and suggestions for improvement in Village 1, Sylhet region.

	Opinion about NGO support	Suggestions for improvements:
Women	- Now getting optimum support, NGO staff always with us, no problem - ? (? 2 (*))	- If more support, it is welcome - More visits by NGO/CARE, work share with other members, more involvement of group members. If individual cage, try to work without help from each other (*). - Need support from NGO, need money, fingerlings, need help, work with other people closely, need feed and management (*).

Men	<ul style="list-style-type: none"> <li>- Very happy, good support, NGO staff and CARE always help.</li> <li>- OK.</li> <li>- Sufficient enough. Help and co-operation from NGO and CARE appreciated.</li> </ul>	<ul style="list-style-type: none"> <li>- After this culture, plan to cultivate more cages, need help from NGO for money, suggestions, and group where all people will work together.</li> <li>- If financial and other support like seed, feed were given by NGO, then it will be more helpful. Also need more money, suggestions, work together to guard the cages, sale fish timely.</li> <li>- Need to ensure net materials. Financial and other support is important. Some group members need to develop an awareness and group approach, need to work more closely.</li> </ul>
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*Village 2*

Table S6: Respondents' opinion about NGO/CARE support for cage aquaculture and suggestions for improvement in Village 2, Sylhet region.

	Opinion about NGO support	Suggestions for improvements:
Women	<ul style="list-style-type: none"> <li>- Good support but expectation is more than feed and support, advice.</li> <li>- OK.</li> <li>- OK (*)</li> </ul>	<ul style="list-style-type: none"> <li>- Need feed ingredients, advice, financial support, more involvement of group members.</li> <li>- Need more support from NGO for feed and financial support. Need to work together in the family.</li> <li>- Need support (but cannot say what exactly) (*).</li> </ul>
Men	<ul style="list-style-type: none"> <li>- Satisfied.</li> <li>- OK.</li> <li>- OK.</li> </ul>	<ul style="list-style-type: none"> <li>- Feed and financial support, more technical support (cage construction, cage size), cross-visits and cross-sharing among groups.</li> <li>- Need loan from NGO to provide more support to cage culture. Need to check transportation mortality.</li> <li>- Need more intensive work together.</li> </ul>

*Village 3*

Table S7: Respondents' opinion about NGO/CARE support for cage aquaculture and suggestions for improvement in Village 3, Sylhet region.

	Opinion about NGO support	Suggestions for improvements:
Women	<ul style="list-style-type: none"> <li>- Good, happy with support (*).</li> <li>- Sufficient (*).</li> </ul>	<ul style="list-style-type: none"> <li>- Need feed, technical support, financial support, suggestions (*).</li> <li>- Need more feed, more formula and technical assistance, financial support, loan.</li> </ul>
Men	<ul style="list-style-type: none"> <li>- Good, no problem.</li> <li>- Got considerable knowledge on technical points.</li> <li>- OK, last year NGO staff and CARE people contributed a lot.</li> </ul>	<ul style="list-style-type: none"> <li>- Feed and feeding, technical support.</li> <li>- Need more technical knowledge for indigenous species, need fingerlings timely, there was a shortage of feeding ingredients in the last part of the culture period.</li> <li>- Need feed and financial support.</li> </ul>

A summary of the improvements suggested is presented in Table S8 hereafter.

Table J8: Summary of the frequency of the respondents' answers regarding their suggestions to improve the NGO support in the Sylhet region.

Women				Men			
Techn. support	fingerlings	feed	others	Techn. support	fingerlings	feed	others
4	1	5	∅	5 ∅ ∅	2	5	∅ ∅ ∅

☞ includes:	money:	5
	better co-operation between group members:	4
	advice and suggestions:	2
	visits (by NGO and CARE):	1
	management:	1
☞☞ includes:	general technical support:	1
	net materials:	1
	cage construction and size:	1
	transportation:	1
	indigenous species:	1
☞☞☞ includes:	money:	6
	better co-operation between group members:	4
	suggestions:	2
	sale fish timely:	1
	cross-visits and cross-sharing:	1

Village 1 is visited twice a week by the local NGO (Shimanti). The 'technical support' provided includes training for cage construction, site selection, fingerling collection and selection of species, transportation, stocking, feed and feeding options, daily management, marketing. Fingerling supply is problematic due to the lack of hatcheries. Fingerlings are given free of charge to the farmers. Their costs (including transport) are borne by the NGO. Shimanti staff is aware that farmers would like to be visited more often and need a lot of encouragement from them and CARE. No financial support schemes (loans etc.) are provided. Interviewees are globally satisfied with the support provided by the NGO. A recurrent suggestion for improvement is the provision of financial support to the cage operators. Given the apparent demand for such help, this may be an issue worth considering by the NGO. In addition, group members are aware of the need to work together better. The NGO may also have to role to play as a facilitator in raising awareness over the importance of group work and in improving co-operation between group members.

Cages TO and APO visit each of the 7 groups involved in cage culture twice a month in the whole Sylhet area. The same NGO is responsible for villages 2 and 3. Occasional workshop training and meetings are held at this NGO office. Cage operators (women included) attend and are also encouraged to come by themselves when they are facing problems. Fingerlings are provided by the NGO. Their supply is organised as follows:

- Meeting with farmers in the community to choose the fish species to be grown.
- The NGO pays for the fingerlings, but it is agreed that if profits are made by farmers at the end of the cycle, the NGO will take 20% of these profits. They will however wait until harvest and see how things are going at this time to confirm this decision. If farmers are facing losses, they do not have to give this contribution to the NGO. This is only meant to raise the farmers' awareness over the cost of fingerlings. A workshop with farmers will be organised by the NGO after harvest to discuss the results of the cycle, potential improvements to cage culture etc.
- The NGO also provided cages free of charge to the farmers. Some training was organised about feeding practices, but it is the cage operators' responsibility to collect and prepare their own feed in the aim of sharing responsibilities and sense of ownership.
- The 'technical support' provided by the NGO includes:
  - selection of farmers' group and formation
  - selection of site
  - construction of cages
  - feed and feeding formulation and feeding techniques
  - selection of species
  - collection, transportation, stocking, handling
  - harvest
  - marketing
  - daily management of cages
  - fish disease advice

No credit facilities are provided for cage culture specifically yet. An interest-free loan is planned to start in January 1999 to help farmers start cage culture.

In these two villages, the respondents' opinion is also positive about the NGO support. All the points mentioned for improvements are already covered by the NGO's work. However, since most participants are still in their first year of culture, this may explain why they require more assistance from the NGO. More training seems needed on the technical aspects of aquaculture such as knowledge of indigenous species, disease, transport methods, feed formulation to develop the farmer's knowledge and understanding of the activity and responsabilise them further.

In village 2, the NGO recognises the need to provide more cages and fingerlings to the group because its members rely completely on Mr. Nurul Hada Pir (the eldest, most experienced etc.) for the management of cages. To increase the number of cages would give more independence to the group's members. If the NGO feels that the overall group management of the cages has improved (guarding, feeding, etc.), there is nevertheless still a need to improve members' awareness about their responsibilities as part of a group. Indeed, improvement of the co-operation between group members was an improvement often mentioned by the participants themselves.

It is interesting to observe that the ranking of improvements (suggested by the number of times an improvement has been mentioned) is similar for both men and women: money, better co-operation between group members, provision of suggestions. Selling fish timely and cross-visits are typical male suggestions, in particular in the area of Sylhet where culture restricts the movement of women outside their house (and *a fortiori* village, as these activities involve). This reinforces the fact that the training of women in cage aquaculture requires more regular presence and visits by the NGO to their *house* (not only village) to transmit any technical knowledge as they do not get any opportunity to access outside information.

## Survey 2: Roles, perceived opportunity costs and benefits of cage aquaculture to HH, with particular emphasis on the role of women.

Objective 1: To identify the role of women HH decision making regarding cage aquaculture (decision to start cage culture, daily management, post-harvest decision – expectations from cage culture)

### Village 1

Table S9: Respondents' answers regarding the role of household members in the decision-making process for cage aquaculture and its related tasks in Village 1, Sylhet region.

Households	Decision to start cage culture	Decision on distribution of daily tasks	Decision post harvest
HH1			
Female (c.o.)	Husband informed about it first and then discussed with her about possibilities and decided it all together	Mr. Jalal	Doesn't know how much fish can be sold and how much money can be made. Not decided what to do with fish culture yet.
Male <i>Jalal</i>	Was interested in fishing activities but does not have the money. Shimantik (NGO) suggested that it may be profitable and formed group. As it provided financial and other inputs, it was easy to get involved.	He decided who would do which works	Expects to sell at 80 Tk/kg min. and make about 8,000-9,000 Tk total. All money earned will be invested in cage culture next year (increase the number of cages). Thus most of the fish will be sold. For kids, more or less very few fish will be eaten or will be bought from the group during harvest.
HH2			
Female	No answer	Cage operator with his family and other group members, cyclic order	No answer (she has not visited the cages for the last 2 months)
Male (c.o.)	Sometimes works in fishing. Firstly Shimantik people came and spoke about cage culture. Then prepared a group, after discussed with wife and family members:	Normally, decide upon the cyclic duty of original members. Duty person decides and distributes work, other	Total expected: 8,000-9,000 Tk (Sarputi: 80 Tk/kg; Catla: 80 Tk/kg; grass carp: 70-80 Tk/kg; tilapia may be more: 80-90 Tk/kg). Money used to increase

	everybody agreed	people help	the number of cages, create a good group and start it in a good spirit.
HH3			
Female	Shabbir ( <i>her brother</i> ) decides to do cage culture as he knows well	Shabbir and group members	Doesn't know exactly how much money can be made. Little fish will be for the family as it is a new thing

Continued (HH3)

Male (c.o.) <i>Shabbir</i>	He discussed with Shimantik and chairman, and thought it could be profitable. Encouraged by Jalal.	In cyclic order.	Total expected: 8,000-9,000 Tk (70-80 Tk/kg). Money will be used for next year as more cages will be cultured and some money will be invested in other small business. A little will be eaten at the end of harvest, just to taste.
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Village 2

Table S10: Respondents' answers regarding the role of household members in the decision-making process for cage aquaculture and its related tasks in Village 2, Sylhet region.

Households	Decision to start cage culture	Decision on distribution of daily tasks	Decision post harvest
HH1			
Female (c.o.)	Herself as husband was involved last year. So she was interested to join to work together for little earning sources ( <i>she wasn't a group member last year</i> ).	As her socio-cultural condition doesn't permit to go outside, so husband does outside work and herself conducts house-based work initiated by herself	Total expected: 4,000-5,000 Tk (Sarputi, grass carp and tilapia sold @ 60-70 Tk/kg). Plan to increase cage and fish in next year, plan to work more closely and intensively
Male (c.o.)	Was involved last year as an outside observer and shown the technical things to manage cages. Try to form a group within family and working together as his thought was that it could be profitable	Himself	Total expected: 4,000-5,000 Tk. (60-70 Tk/kg sold, fingerlings: 4 Tk/piece). Money will be used for next year's culture: more cages and fish. Little will be eaten in the family.
HH2			
Female (c.o.)	Husband made little money from last year's cage, and asked/discussed with her and decided to join the group	Mr. Nurul Hada Pir ( <i>her husband</i> ) for outside work and he asked women to perform work inside house.	Does not know. Money will be used for i) household activities, ii) poultry (mainly duck). If fish is eaten, then there will be no money so try not to eat at harvest
Male (c.o.) <i>Nurul Huda Pir</i>	Founder member of SRDS (NGO). Closely related to all activities. He informed him. As it is new and think it may be interesting, as SRDS intervention, it will be a demonstration	Himself and discussion with other group members	Total expected: 2,000-3,000 Tk. (2-3 Tk per fingerling ? seed for pond culture). He plans to stock his own pond with his own fingerlings. No fish eaten by family.
HH3			
Female	Her uncle, Mr. Nurul Hada Pir, encouraged her son to start cage culture by informing him it was profitable, and discussed with family and he decided to start	Can't think	Does not know
Male (c.o.) <i>Sazzadar Rahman</i>	His uncle, Mr. Nurul Hudapir, as it is a new thing that can be profitable	Uncle	Can't assess, maybe 2-3 Tk/piece

Village 3

Table S11: Respondents' answers regarding the role of household members in the decision-making process for cage aquaculture and its related tasks in Village 3, Sylhet region.

	Decision to start cage culture	Decision on distribution of daily tasks	Decision post harvest
<b>HH1</b>			
Female	Mr. Rafiqal Islam (2-year culture experience). informed her about cage culture. Discussed among us and decided	Group meeting and group decision	Total expected: 12,000-14,000 Tk (6-7 Tk/fish). Money will be used for family work, sharing more cage culture. A small amount of fish will be eaten within the family
Male (c.o.) <i>Shahidul Islam</i>	Mr. Rafiqal Islam (2-year culture experience).	Group discussion	Total expected: 10,000-12,000 Tk. (6-7 Tk/fish. NB: kg is not used there). Money used to start other business, expand cages, and family maintenance. Little will be eaten by family, eat fish bought from group
<b>HH2</b>			
Male (c.o.) <i>Rafiqal Islam</i>	Himself. SRDS informed him, discussed with SRDS and CARE people and lastly decided himself.	Group decision as all members sit once a week for their subscription for cage management, then they delegate their vote on the basis of an agreement. Weekly contribution /subscription only used for cage purpose like feed, bamboo, repairing etc	Total expected: 15,000 Tk (large ones: 10 Tk/fish; small ones: 3 Tk/fish, average: 7.5 Tk/fish). Some for family but eat fish bought from group.
Male (c.o.) <i>Jakaria Hossain</i>	Mr. Rafiqal Islam and SRDS people discussed first. Then discussed among family members and decided to start cage culture	Mr. Rafiqal Islam initiated to distribute work and group agreed.	Not culturing this year (disease on his legs).
<b>HH3</b>			
Female	NGO	Male cage operators decide most activities	Doesn't know how much to expect as she doesn't visit cage site. Maybe 10 Tk/fish (200? 10 Tk). Very little fish will be eaten by family: just to taste and for family interest

*Decision to start cage culture:*

Answers between men and women are completely different and are an indicator of the strong gender discrimination women are facing in the Sylhet region. Indeed, none of the females interviewed (whether cage operator or not) mentioned receiving information directly from the NGO about cage culture. They were informed about it through their husbands or relatives who discussed about possibilities to start cage culture with them or through their own observation of aquaculture being carried out by their husbands. However, the decision to start the activity does not belong to them. They are either not consulted by their husbands (in particular when they do not belong to the group of cage operators), or have to discuss it with their husbands - or group leader - and get their approval, before becoming cage operators themselves.

Unlike women, all men interviewed were directly approached by the NGO's about the possibility to start cage culture, or by another male villager with some experience in cage culture, and only then, some of them discussed the possibility to start culturing with the rest of their household. It is already known that the region of Sylhet can be considered as one of the most difficult regions of Bangladesh to work with women due to religious barriers, but one may question the efficiency of the NGO's work in



achieving the particular aim of the project related to women's participation and empowerment. Although it could be suggested that a female-staffed NGO may reach women more easily and efficiently, NGO's work in this area is already considered by fundamentalists as against Koranic law and this could make the NGO's tasks even more difficult.

*Decision on distribution of daily tasks:*

The gender separation appears even more flagrant in the decision on the distribution of daily tasks than in the decision to start cage culture. The group leader and women's "socio-cultural condition" determine the tasks to be performed by female cage operators, which does not leave them with much of a choice, *a fortiori* when they are not cage operators. Male group members mentioned group discussion to decide about the division of tasks which are then carried out in a cyclic order. However, decisions also seem to be taken by the group leader, person with either more experience or successful operator. Is this person chosen by the NGO? by himself? elected? Is there a real need for a group leader? If the leader was named by the NGO, could it then be a woman? It is interesting that within the same village (e.g. villages 2 and 3), respondents mentioned both group decision and one-man decision, which may question the perception of leadership between group members.

In village 1, the NGO mentioned the need to re-organise the group because some of the problems are caused by the presence within the group of various castes and would recommend groups based on caste or profession. It may be expected that leaders belong to a higher caste or social group. The advantage is that knowledge may be transmitted faster to the other group members, skills are shared etc., but it considerably reduces the scope of experimentation initiative and farmer's research encouraged by the project. One must make sure (the NGO's role?) that if there is a leader in place, decisions are discussed among all members, and that the female cage operators' input (voice!) is heard.

*Decision post harvest:*

Not surprisingly, women non cage operators are not very aware of the sort of price they can hope to sell their fish for, and find it difficult to estimate the earnings they can make of cage culture since a few of them - non-cage operators in majority - have not visited the cage site for a while. However, not all female cage operators have a clear idea either. They are aware that little fish will be eaten in the family because it is a new thing or to keep the money earned. Only three women have a clear idea of how the money earned will be used, two of them are willing to reinvest in cage culture.

The situation is again significantly different for male cage operators: 7 out of 8 who are culturing this year have a clear idea of market prices for the various species and are able to evaluate very precisely the amount they can expect to make. This emphasise again the limited access to external information women have. Information about prices they get is almost certainly provided by their husbands: both husband and wives provided similar answers on two separate occasions (see village 2 and 3). In all cases, most of the fish will be sold and money reinvested in cage culture (increase the number of cages and fish, start a good group). Only one mentioned family maintenance and other 'business' as a use of the money. It can be observed from the scale of expectations that village 3 is definitely the most successful of the three villages visited in the Sylhet district. Little fish will therefore be consumed within the family as most of the money earned from the sale will be reinvested. One may suspect that group ownership and management of the cages does not encourage personal consumption of fish since fish has to be bought from the group. However, men have expressed a will to keep/buy some fish for their family, kids in particular. In village 1, a potential for conflict between group members at the division of profits was mentioned by the NGO, although the less active members recognise that a bigger share of the profits should be given to the two most active members. In village 2, all group members are related and this should reduce the likeliness of conflicts occurring at the sharing of the profits.

The advantages and disadvantages of group cage culture in the Sylhet cultural context should be discussed once all villages have harvested and shared the profits to measure concretely who will, in the longer run, benefit the most from cage culture. There are obvious advantages, such as sharing of work and skills, building of a knowledge pool, strengthening of cohesion between farmers group as they are working towards the same goals, sharing of the tasks, with a particular advantage for guarding the cages etc. Another advantage, which hopefully will be verified after harvest, should be that women, in spite of their limited contribution to the group, should get their share of the profits made from the sale of fish. As long as the whole group is benefiting from it and conflicts are avoided, it should be pursued. However, one has to consider the context in which this is happening. In the very specific context of Sylhet, men seem to be benefiting considerably more than their female counter-parts from this management technique. What practical recommendations could be formulated to increase and improve

women's REAL participation in cage culture? The cultural and religious constraints may be overcome if women's groups (exclusively) were formed and trained by WOMEN NGO staff. However, as it was noted briefly before, the strict religious and sexist environment of the Sylhet area may put in question the work and credibility of a women only NGO.

Objective 2: To determine the amount of time dedicated to fish culture by all HH members, the division of labour and the opportunity costs, both in terms of time and money, of cage culture

*Village 1*

Time dedicated:

*Women:*

- Morning and afternoon, at least 1 hr. each (i.e. 2hr./day). Hard to prepare feed.
- Sometimes visit and nurse cages during market day (*when all men are out of the village and they can leave their houses*), but hasn't visited the cages for the last 2 months (\*).
- 2 hrs/day (\*).

*Men:*

- Collection: 1 hr. Preparation: 2 hrs. Application: 1 hr. Total = 4hrs.
- Total: 4 hrs, 2 hrs morning and 2 hrs afternoon.
- Collection: 1hr. Preparation: 1 hr. Application: 1 hr. Total = 3 hrs.

Division of labour:

Table S12: Respondents' answers regarding the distribution of the tasks related to the management of cage aquaculture to household members in Village 1, Sylhet region.

Tasks: ? Answers by:?	Buy the seed	Prepare feed	Feed the fish	Harvest fish	Sell fish
HH1					
Female (c.o.)	NGO	No answer.	Husband and kids	n/a (1 <sup>st</sup> year)	n/a (1 <sup>st</sup> year)
Male <i>Jalal</i>	NGO (Shimantik) @1.5 Tk/piece.	Women (wife) in house	Himself and kids. Kids very much involved in cage culture.	Himself and other members	Himself and other members
HH2					
Female	No answer	Collect and prepare in house	No answer	No answer	No answer
Male (c.o.)	NGO	No answer	Cyclic way, maybe weekly, if anybody fails, other people come out to do it	Himself and other members	Himself and other members
HH3					
Female	NGO @1.5 to 2 Tk/fish.	Shabbir ( <i>her brother</i> ) and group members.	Shabbir ( <i>her brother</i> ) and group members.	Shabbir ( <i>her brother</i> ) and group members.	Shabbir ( <i>her brother</i> ) and group members.
Male (c.o.) <i>Shabbir</i>	Himself	Himself and group members	Himself and group members	Himself and group members	Himself and group members

Opportunity costs and effects on other HH activities:

Table S13: Respondents' answers regarding their appreciation of cage aquaculture and the effects, time and financial opportunity costs they feel the activity bears on their usual household activities in Village 1, Sylhet region.

Households	Appreciation of cage culture	Effect on other HH activities	Time opportunity cost	Financial opportunity cost
HH1				
Female (c.o.)	Cage culture is almost the same as other work, it is new, interesting. Mr. Jalal is doing the work, so women have less work	No effect. Little work load, but interesting.	If no cage culture, they would visit here and there (relatives), Mr. Jalal would work with wood shop at next village	They would involve in rice husking and save the money they have invested in cage culture.
Male <i>Jalal</i>	Good use of time: creative, interesting, profitable.	He spends more time on cage culture.	He has adjusted all his work with cage work. He adjusted time of his own.	Other works like agricultural labourer, wood work in next village or in Sylhet or other

			His wife and his kids are considering it as regular and important work.	little business.
HH2				
Female	Cage culture good use of time and energy	No detrimental effect on HH activities as all together they just adjust work with mutual understanding with other group members and other family members	Cattle, goat fathering, family work, daily chicken raising, gardening.	Cattle, goat, chicken, fishing, gardening, work with other houses/fields
Male (c.o.)	Good use of time and energy	He just thinks it is more important than other work of family and adjusts with time and importance, re-arrange work with household activities.	He arranges with other operator/group members considering his family work (therefore no opp. cost).	He would involve in normal family work, look after goats, cows for fattening
HH3				
Female	Good use of time and energy as fish is growing very well, could be a good thing for next year, must be profitable.	She does not know	For common work, homestead gardening	She does not know
Male (c.o.) <i>Shabbir</i>	Yes, it seems profitable	It does not have any detrimental effects. They have re-arranged and adjusted with the other family work. Made a routine for work so no harm.	Now cage culture is the most time consuming and he can't give more time to other activities. Also fisheries, pond, cattle, market small business and some HH affairs, development of other entrepreneurship.	He would have invested in other fish ponds, canal leasing, small business at market and some agricultural farming.

### Village 2

Time dedicated:

*Women:*

- 2.30 hrs total (1.15 hr ? 2 per day). She would like to get involved more but culture does not permit.
- 2 hrs per day.
- 2 hrs per day.

*Men:*

- 2 hr. per day.
- 2 hrs per day.
- 2 hrs per day.

Division of labour:

Table S14: Respondents' answers regarding the distribution of the tasks related to the management of cage aquaculture to household members in Village 2, Sylhet region.

Tasks: ?	Buy the seed	Prepare feed	Feed the fish	Harvest fish	Sell fish
Answers by:?					
HH1					
Female (c.o.)	NGO	No precision given	Mr. Naral Huda Pir, husband and kids.	Mr. Naral Huda Pir, husband and kids.	Mr. Naral Huda Pir, husband and kids.
Male (c.o.)	NGO and Mr. Naral Huda Pir	No precision given	Mr. Naral Huda Pir and kids, other group members.	Mr. Naral Huda Pir and kids, other group members	Mr. Naral Huda Pir and kids, other group members

HH2					
Female (c.o.)	NGO	No precision given	Mr. Naral Huda Pir, younger son, daughter	Mr. Naral Huda Pir, younger son, daughter	Mr. Naral Huda Pir, younger son, daughter
Male (c.o.) <i>Nurul Huda Pir</i>	NGO and he was there too	No precision given	Himself with members.	Himself with members	Himself with members
HH3					
Female	NGO	No precision given	'Uncle' ( <i>Mr. Naral Huda Pir</i> ) and herself.	'Uncle' ( <i>Mr. Naral Huda Pir</i> ) and herself.	n/a (1 <sup>st</sup> year)
Male (c.o.) <i>Sazzadar Rahman</i>	NGO	No precision given	'Uncle', sometimes himself maybe twice a week	Himself and other members	Himself and other members

Opportunity costs and effects on other HH activities:

Table S15: Respondents' answers regarding their appreciation of cage aquaculture and the effects, time and financial opportunity costs they feel the activity bears on their usual household activities in Village 2, Sylhet region.

Households	Appreciation of cage culture	Effect on other HH activities	Time opportunity cost	Financial opportunity cost
HH1				
Female (c.o.)	Good investment	No effect as she is thinking that it is a common work of family.	Tree nursery and family work.	Small business, mechanics, nursery
Male (c.o.)	Yes, good investment.	No effect on other HH activities.	Tree nursery, mechanics shop and other house or seasonal activities.	Tree nursery, mechanics shop and other trading
HH2				
Female (c.o.)	Very good: if we need fish, then somehow meeting the purpose and also chance to get some money.	No detrimental effects as although cage culture is dominating other works, it is adjusted with other works.	Seasonal stock business, other family activities.	Money used for family purpose, education, business.
Male (c.o.) <i>Nurul Huda Pir</i>	Good as cages are in the pond so escapees are within the pond so no loss.	No detrimental effects.	Accounting of big businessman, rest, family work, seasonal business.	Money would be used for other family purposes.
HH3				
Female	Yes, good use, although sometime spending for cage operation rather than education.	Her son cannot concentrate on his educational work. Now he has re-organised his work and routine.	Family purpose.	Family purposes, education.
Male (c.o.) <i>Sazzadar Rahman</i>	Cannot assess the usefulness of cage culture	May have detrimental effects on education as it is very close. After that it will be ok and he can contribute more time and energy for cage.	Education	Daily necessities

Village 3

Time dedicated:

Women:

- 3 hrs per day (\*)
- 1-2 hrs per day to prepare feed (\*)

Men:

- Total: 3 hrs per day (2? 1hr30min).

- Preparation: 1 hr (*by women - see his answer in the table below*). Application 1hr15min., twice a day = 4hrs30min per day.
- 2 hrs per day.

Division of labour:

Table S16: Respondents' answers regarding the distribution of the tasks related to the management of cage aquaculture to household members in Village 3, Sylhet region.

Task	Buy the seed	Prepare feed	Feed fish	Harvest fish	Sell fish
HH1					
Female	NGO	Women, collection by male delegate.	Male members	All group members	All group members
Male (c.o.) <i>Shahidul Islam</i>	NGO	Women	Group, mainly male members - Male members	Group, mainly male members - All group members	Group, mainly male members
HH2					
Male (c.o.) <i>Rafiqal Islam</i>	Got them from NGO, he went with NGO staff.	Women, collection by male delegate	Every group member in cyclic order.	Every group member in cyclic order.	All group members
Male (c.o.) <i>Jakaria Hossain</i>	NGO	No precision given	Every group member in cyclic order	Every group member in cyclic order	Every group member in cyclic order
HH3					
Female	NGO	Herself	Male members	Male group members	Male group members

Opportunity costs and effects on other HH activities:

Table S17: Respondents' answers regarding their appreciation of cage aquaculture and the effects, time and financial opportunity costs they feel the activity bears on their usual household activities in Village 3, Sylhet region.

Households	Appreciation of cage culture	Effect on other HH activities	Time opportunity cost	Financial opportunity cost
HH1				
Female	Yes, this is the first year, it is good but will be better next year.	No detrimental effects: her son ( <i>Shahidul Islam</i> ) is now free and cage needs little time to operate so no problem in operation	Family work, small business, farming, share cropping.	Small business, share cropping, farming
Male (c.o.) <i>Shahidul Islam</i>	Yes, as there is scope to work with cages along other family work and allow to remain close to family (avoid working outside).	No problem, adjust with other works.	Family work, share cropping, farming.	Saving for the future, use for future trading
HH2				
Male (c.o.) <i>Rafiqal Islam</i>	Yes, optimistic about the return of cage culture that is more profitable than any other business.	Does not hamper other works.	Work with other fishermen in the <i>haor</i> (open water), stock business, family purpose.	Saving among the group for small stock business.
Male (c.o.) <i>Jakaria Hossain</i>	Yes but need to work together.	No detrimental effects.	Labour, family affairs, little business.	Labour, family affairs, little business.
HH3				
Female	Yes, comparatively it is more profitable than other works	No detrimental effects.	Family dairy activities	Family activities, duck, chicken rearing

Amount of time dedicated to fish culture by HH members and distribution of tasks:

The overall time spent on cages appears to be longer in this area than in Dhaka. Ratios of time female/male in the same HH suggest that, globally, men spend longer managing the cages each day than their female counterparts. This may be easily explained by the socio-cultural condition of women in this area of Bangladesh. This is also supported by the comments made by the female respondents regarding *parda* as implicitly impeding their full participation to cage culture. However, if the time spent on cage culture is looked at in a ‘qualitative’ manner, women dedicate most of the ‘cage culture’ time to the preparation of feed which was qualified as a hard task by one of the female respondents. There are similar trends between the three villages in terms of division of tasks. Globally, buying seed is a male task (NGO and males), preparing is dominated by females and carried out from their house, feeding is mainly carried out by males, with occasional help from kids, and harvesting and selling fish are strictly masculine activities. Once again, *parda* is a major constraint in the involvement of women in any activity outside their house, and apart from feed preparation, aquaculture is not much of an indoor activity.

*Cage culture opportunity costs (time and money) and effects on other activities:*

As for the Dhaka region, there is a noticeable contrast between the respondents’ positive opinion of cage culture being a good investment of their time, money and energy having no detrimental effect on the other HH activities, and their comments about the time and financial opportunity cost of this activity. Apart from the advantage of being considered as more profitable than other activities and as such being able to bring direct financial benefits to the cage operators’ group and to their HHs, another interesting indirect advantage mentioned is that it enables men to stay and work around their village instead of going away looking for outside labour. Another indirect benefit cited is that cage culture, when carried out in a pond, enables pond re-stocking and prevents the loss of escapees, and therefore financial loss for the farmers. Cage culture is considered as having no detrimental effects on the other HH activities since cage culture has been adjusted with the other activities and is seen as a “common work for the family”.

A summary of opportunity costs felt by the each of the HH respondents is provided below (Table S18), without distinction between villages.

Table S18: Ranking, by frequency of occurrence in the respondents’ answers, of the time and financial opportunity costs of cage culture felt by male and female respondents in the Sylhet region.

Time opportunity cost		Financial opportunity cost	
Men	Women	Men	Women
- HH works: 6	- Family activities/ work: 5	- Family purpose/work: 2	- Family purpose/work: 2
- Seasonal business (incl. labour): 3	- Homestead gardening: 2	- Woodwork or other little business: 2	- Small business: 2
- Small business: 3	- Cattle, goats, chicken rearing: 1	- Saving for future and among group for small business: 2	- Poultry: 2
- None: 1	- Common work: 1	- Agricultural labouring: 1	- Education: 2
- Other activities: 1	- Tree nursery: 1	- Goats, cows: 1	- Rice husking: 1
- Fisheries: 1	- Seasonal stack business: 1	- Tree nursery: 1	- Savings: 1
- Pond culture: 1	- Small business: 1	- Mechanics shop: 1	- Cattle, goats: 1
- Cattle: 1	- Farming + share cropping: 1	- Trading: 1	- Fishing: 1
- Tree nursery: 1	- Family dairy activities: 1	- Daily necessities: 1	- Gardening: 1
- Mechanics shop: 1		- Future trading: 1	- Agricultural labouring: 1
- Accounting of businessman: 1		- Homestead gardening, vegetable: 1	- Does not know: 1
- Rest: 1		- Poultry etc.: 1	- Mechanics: 1
- Education: 1			- Nursery: 1
- Share cropping + farming: 1			- Farming + share cropping: 1
- work with fishermen: 1			

It is interesting to observe that, conversely to the Dhaka area, ‘leisure’ is never mentioned, neither by men, nor by women. ‘Family work’ or household affairs are the most frequently cited, both by men and women. Other activities mentioned are all income generating activities, which confirms what was observable in the field: farmers involved in cage culture and the villages in which they live are generally poor. There is a marked distinction between men and women’s answers since most of the activities mentioned by women involve work carried out around the house, reflection of the cultural environment in which they live.

As has already been said, all these activities are income generating activities, and thus cage culture has both a time and financial opportunity cost linked to these activities. However, the fact that a student



was involved in cage culture in one of the village made him and his mother realised how cage culture could encroached on educational time and costs. We saw previously that children are commonly involved in the management of the cages at an early stage. It is therefore likely that teenagers may be confronted to choices regarding their education cursus or starting being involved in cage culture more actively.

In summary, cage culture has an important opportunity cost, and this could be even more crucial where farmers are already resource-poor and need to sell their labour for living. However, there has been good and encouraging results, therefore aquaculture could present in the long term significant advantages in terms of financial assistance and provision of work within the village and close to the family.

*Plans for next year:*

*Village 1*

In this village, the group of cage operators (10) operates a total of 9 cages with Grass carp in 3 cages, Silver barb in 5 cages and tilapia in one cage.

Table S19: Respondents' answers regarding their cage aquaculture plans for the next season of culture in Village 1, Sylhet region.

Households	Plans for next year
HH1	
Female (c.o.)	Increase number of cages, continue the process, involve other people with us.
Male <i>Jalal</i>	8 cages with 500 fish each. Would like his group to have only 4 members (instead of 10). Would also be interested to culture 8-10 cages individually. He may like grass carp, sarputi, catla.
HH2	
Female	Cage will be operated at large scale, with good group, individual cage culture
Male (c.o.)	Increase number of cages, more fish stocked. Ask for more support to Shimantik and CARE, but if no support, the group will try to do something together by contributing
HH3	
Female	We will do it next year
Male (c.o.) <i>Shabbir</i>	He will work with small group of 45 members, maybe manage more cages, all depends on this year's experience. Will try to collect loan for cages and other work. Must expend cage culture, maybe general places/sites, depends on Shimantik and CARE.

*Village 2*

In this village, the group of cage operators (5) operates a total of 5 cages, 2 large ones (8m<sup>3</sup>) and 3 small ones (1m<sup>3</sup>) with common carp, Silver barb and tilapia.

Table S20: Respondents' answers regarding their cage aquaculture plans for the next season of culture in Village 2, Sylhet region.

Households	Plans for next year
HH1	
Female (c.o.)	She has an interest to work individually. 5 cages (small ones) with sarputi, tilapia as depends on this year's experience.
Male (c.o.)	He has his own pond and plan for next year individually with 5 cages within his family, just to test his own competency. Other people may be encouraged and create a competitive environment and spread the culture.
HH2	
Female (c.o.)	Plan to increase the number of cages, better to culture in group.
Male (c.o.) <i>Nurul Huda Pir</i>	15 cages in each group (instead of 5), culture preferably in group. If anybody wish to culture individually, they can. He is able to conduct 3-5 cages as his 2 kids are with him. Fish can also stocked in his own pond.
HH3	
Female	If no harm to education, then it is ok and culture more cages
Male (c.o.) <i>Sazzadar Rahman</i>	Will culture next year after finishing his exams, at least one cage individually, but better in group.

*Village 3*

As in village 2, the group of cage operators (5) operates a total of 5 cages, 2 large ones (8m<sup>3</sup>) and 3 small ones (1m<sup>3</sup>) with common carp, Silver barb and tilapia.

Table S21: Respondents' answers regarding their cage aquaculture plans for the next season of culture in Village 3, Sylhet region.

Households	Plans for next year
HH1	
Female	Number of cages will be increased, depends on this year's experience. Group is better
Male (c.o.) <i>Shahidul Islam</i>	10 cages next year (instead of 5). Group approach is better as sharing, problem solving, guarding is possible. Interest increasing.

continued

HH2	
Male (c.o.) <i>Rafiqal Islam</i>	Increase the number of cages (10-15 planned). Group management because: sharing, delegating work, guarding. Good relationship with the local community people
Male (c.o.) <i>Jakaria Hossain</i>	In the coming year, he will join again with cages, more cages, more intensively. He is already in a farming group
HH3	
Female	Cage number needs to increase, maybe 10-15 cages (instead of 5). Group approach, group size will be increased

Almost all respondents have the desire to increase the number of cages they are cultivating for next year's cycle. Not all of them have decided the exact number of cages yet as they are still in the process of knowledge and experience building and this will determine the number of cages they will be able to manage. Answers are diverging in terms of desire to pursue cage culture co-operatively or individually. In village 1, respondents are still willing to pursue the activity in group, although they are suggesting that the group size should be reduced and limited to only 4 or 5 participants (instead of 10 currently). In village 2, there is a balance between those wishing to try aquaculture individually and those willing to remain within a group in village 2. In village 3, cage operators are definitely for a group approach to cage culture. Relating these answers with answers provided in Survey 1, Objective 2 (suggestions for improvements) and with the general performance of the village in cage culture can explain such wishes. In village 1 (medium performance, poorest of the three villages), better collaboration between group members was cited 3 times by males, twice by females. In village 2 (poor performance), it was cited once by males and twice by females. In village 3 (successful aquaculture and richest of the three villages), it was never mentioned. This explains why the group approach is not contested by farmers in this village, and why it is more contested in village 2 where farmers sound keen to start cage culture on their own. It is important that the farmers' wishes are kept into account by the CAGES and the NGO staff in the planning of future cycles.

Men also seem to have a more precise idea of what and how they want to do next year, resulting their direct experience/involvement in the activity and the knowledge they have gained from it.

Objective 3: To determine the various factors that may influence the role of women in cage culture (ex. social status, wealth, distance from water body, access, education, religion, others?)

No information about the educational level of women was collected. In the Sylhet area, the condition of women is strongly affected by Islam and its strict religious application, as well as by the dominating role of males. Consequently, women's social status within society is very low. This condition is similar in each of the three villages visited in this region.

#### *Village 1*

One of the three women interviewed is a member of the group of cage operators. Cages are located in a section of a river (embanked at one end) that runs through the village. The water body is leased to one person who gives free access to all water users, including fishermen under certain conditions and cage operators, free of conditions. Distance and access *per se* are therefore not a problem to go the cages. However they *are* in the sense that *parda* hinders women from going outside of their houses. It seems therefore that, whether cage operator or not, women have the same limited role in cage culture. In addition, they seem to have a limited knowledge of culture in itself: they do not always know the number of fish per cage, how much money to expect from the current cycle, the market price of one kg. of fish, etc. It may therefore be expected that this limited access to technical information considerably reduces their impact in the group and their contribution to cage culture. As it was mentioned by men during the community meeting, "women are helping the farmer from inside the house preparing feed, discussing issues and on Bazar day, they are visiting the cages". All females interviewed in this village, both cage and non-cage operators, are from poor households (rice straw and bamboo house, tin shed, with a few trees, chickens, occasionally cows), and large families. This may suggest that, in addition to their housework and raising the children, they may be poor enough to have to leave their house and sell their labour outside, leaving very little time for their involvement in cage culture.

### *Village 2*

Two females over the three HH interviewed are members of the cage operators' group. All of them mentioned their inside-the-house work, imposed by their 'social condition' and by male cage operators. Cages are located in a family pond, owned by only seven HH and used only by them. In spite of the proximity and the fact that its users are relatives, the religious condition still dominates women's lives and defines their movements. Apart from one of the female cage operators who was able to answer questions about number of fish in the cages, market price of fish and money expected from her sale, the other two females interviewed were not able to do so, or only partially, which is a sign of their limited involvement with the activity, as in village 1. Village 2 is of 'medium wealth' compared to the other two visited. Although the household size is relatively big (4 to 6 children), households reflect a certain level of comfort with decorated tin-shed houses, books and notebooks, and a seasonal garden. Additionally, household males have extra activities providing extra earnings and therefore better support to their family. A repercussion of this condition is likely to be on the status of women who, since without need to sell their labour to support the HH are more trapped in it than if they had to.

### *Village 3*

Two female non-cage operators were interviewed in this village. One of them was very aware of the number of fish cultured, market prices and money expected from the activity. The other female interviewed provided answers very similar to those obtained in the previous two villages. It was also commented during the community meeting that "females don't come to the water body, they never come out as society doesn't permit it". The contribution of the two female cage operators' is therefore reduced to helping with feed preparation from their house. The water body is a roadside canal, near the village houses and is governmentally-owned with free access. Again, distance and access are therefore not factors influencing the role of women in cage culture. This village is the wealthiest of all, villagers interviewed own small portions of land allowing them to grow their own crops. Family size is still quite big, and the group of cage operators dominated by males, giving little space for women's contribution.

In summary, the involvement and role of women in cage culture in the Sylhet area is determined by cultural factors, i.e. religion. All other factors such as social status, wealth, distance, access and education/access to knowledge, are secondary since all are themselves shaped/moulded by the strict religious culture of this area. In addition, poverty is relatively dominant in the villages studied and is another constraint to the direct participation of women in cage culture in terms of necessity to sell their labour and feed affordability. This means that strategies to approach, train and involve women in aquaculture are likely to be more delicate to develop in this area than in others (to be confirmed with remaining studies) and will require a tactful in-depth and long-term work by CAGES and NGOs extension staff.

#### Objective 4: To determine whether the involvement of women in cage culture (as cage operator or wife of a cage operator) contributes changes to their social status.

Only one female cage operator made a comment on the personal honour she was getting from doing cage culture. All other answers, both from cage operators and non-cage operators, although indicating cage culture as a social uplift, were not about personal changes in the women's social status. It is also hopefully possible that their status, knowledge and social recognition from other community members (men especially) increase as an indirect result of their 'official' - although limited - involvement with the group in cage culture. One could expect that, if women groups were formed and women given more autonomy and the possibility to access a water body in or very close to their homestead, a change in their personal status and recognition may be felt. However, the religious pressure is so intense in this area of Bangladesh that a more 'radical' approach should be suggested to overcome this immense cultural barrier to the involvement of women in this activity. This approach however still has to be defined more precisely and must avoid the risk of going backwards due to its non-acceptance by locals. Although religious tolerance should be advocated in most cases and cultural customs and practices incorporated in development strategies, there are limits when religion deprives beings of their basic rights. It seems that the soft approach used by CAGES is not strong enough to promote the involvement of women in cage culture in this area, and targeting women groups specifically through women only NGOs may be a more efficient strategy to achieve the project's aim (involvement of women).

### Survey 3: The impact of cage aquaculture at the community level.

It was very difficult to approach women in the three villages due to the strict cultural context preventing women to leave their house and be approached by strangers. In village 1, the mapping exercise with the female group was actually carried out in the presence of only 3 women and one of their husbands. As these ladies were too shy to hold the pen, Yesmin took notes of what they were saying regarding changes/impacts that had occurred. Mapping exercises in the other 2 villages were carried out in the house of one of the participants with a limited number of females (4-5) taking an active part in the exercise, the others remaining quite – but interested – observants.

Objective 1: To identify if community members (incl. cage operators and non-cage operators) feel some changes have occurred in their daily activities since the implementation of cage culture

#### *Village 1:*

Various uses of the canal water include:

- bathing
- bathing of cows and buffaloes
- fishing using seine nets
- cleaning and washing of clothes
- irrigation and crops
- drinking (for men, cattle and buffaloes)
- fish culture.

Opportunities created by cage culture in the community along with general comments about cage culture have been cited as follows:

- |                   |   |
|-------------------|---|
| Children          | - Learning a new thing  |
|                   | - Cage fish is now a place of enjoyment, a site for visit and it is interesting to see the movement of fish.                      |
|                   | - The feed lost from the cages is used by the fish in the canal.  |
|                   | - Fish is available for cage culture.   |
| Women             | - They have an interest in cage culture.  |
|                   | - They use a raft made out of banana tree to see and visit the cages on Wednesdays and Saturdays when men are away to the market. |
|                   | - Women normally prepare the feed. The feed ingredients are collected by men, and once prepared, they apply it to the cages.      |
| Cage operators    | - Catla fish grow well.   |
|                   | - They would like to do cage culture next year.   |
|                   | - No problem with cage setting, with using the ghat, with water becoming polluted.  |
| Other water users | - People are expressing their interest for a new option of fish culture.  |
|                   | - More fish will be produced and available for cage culture.  |
|                   | - Unemployment will be mitigated.   |
|                   | - Fish will be available when needed.   |
|                   | - Fish in the canal water will benefit from the feed lost from the cages.   |

All map features drawn by respondents have been reproduced in Figure S1 to illustrate water body uses and location. Maps revealed interesting differences between groups reflecting their general perception of the environment as well as interest and concern priorities. For example, cage operators drew the house from which cages are guarded and gave indications regarding some poaching that had occurred (but “the thief was caught and got punished”) and risks related to the use of this canal for setting the cages (“if water [from the Surma River] overflows the dike, the fish and cages can be damaged”). The cage operators’ map did not show the location of the school which was indicated on both the children’s and the other water users’ map (the ‘other water users’ group included the village school teacher). However, all located the mosque on their maps, suggesting the importance religion has in this area, without regard to any age or group belonging.

From the four maps (cage operators, women, children and other water users), and comments made during the exercise, it can be observed that the only significant change that has occurred is affecting professional fishermen regarding the setting of their fishing nets in the canal (*‘Moroi Khal’*). This point was made by cage operators, who also added that “before cage setting, people used to fish in the canal.

They are still fishing but not coming to the cage site". Indeed, it can be seen from their map as well as from the children's that the nets position in the canal has to take into account the position of the cages. Women did not mention any changes related to their 'household tasks' such as utensil cleaning, washing and bathing. While utensils are normally washed with tube well water, most women use water from the *khal* for bathing and washing. Those who own a pond use it for these activities instead.

The presence of cage culture attracts visitors to the village as mentioned by the cage operators and the women's group, and this almost certainly constitutes a change from the days prior the introduction of cage culture. According to the cage operators, "villagers visit cages, take photographs by boat". Women's response: "it is not a problem when people come from a neighbouring location or area" for "normally women don't come out [their house] in front of strangers".

Cage operators mentioned that the water is not being polluted by cage culture, corroborated by children's and other water users' comments on the fact that the fish in the canal benefit from the feed lost from the cages.

Results from the mapping exercise illustrating the various uses of the water body are presented in Figure S1 at the end of Survey 3.

In summary, although no major changes in the lives and organisation of daily activities seem to have occurred since the introduction of cage culture in the village, there have been a few qualitative changes in the use of the canal water for some of the water users. They are hardly perceptible at the moment, and have not started to create any conflicts, but attention should be paid to these little things to prevent them from developing into more serious conflicts in the longer term, if, for instance, the number of cages is increased significantly.

#### *Village 2:*

Various uses of the water body (pond) include bathing, washing clothes, cleaning of utensils and cage culture.

Opportunities created by cage culture and advantages of the activity were:

According to cage operators:

- pond fish can take the feed,
- people of this area are feeling encouraged by cage culture,
- it is an income source,
- non-cage operators are becoming interested in cage culture,
- it is a new learning experience.

According to non-cage operators (other water users):

- people are getting encouraged,
- unemployment is eliminated by cage culture,
- pond fish take the feed,
- during the floods, some fish came from the outside and stayed in this pond because of the feed lost from the cages.
- The number of fish is increasing in the pond.

According to women:

- neighbours and other villagers feel encouraged to see the cages.

All map features drawn by respondents have been reproduced in Figure S2 at the end of Survey 3 to illustrate water body uses and their location.

Women provided information on the status of the pond in which cage culture is being carried out and on the history of fish farming in the village. The pond is being used by the members of 7 different families only, outsiders are not allowed to use it. Only 3 families (out of the 7) have cages in the pond, but the other 4 do not have any objections to this. Last year, when cage culture was implemented in the village, cage operators selected the adjacent *khal* (canal or dead river) to set their cages as they thought that many people would observe them and that their interest in cage culture would grow. However, cages were poached and cage operators decide to shift their cages to the pond for this year's culture.

Maps are indeed very precise in locating every particularity of the community, but very few changes were mentioned by the participants. It was mentioned during the community meeting that members of the households located around the pond are now the important people as they have started a new activity, implying a change in the village hierarchy has occurred due to the introduction of cage culture in the village. Non-cage operators indicated that before cage culture, the pond was only used for household purposes and that cage culture has not contributed to the water to become polluted. Given

the small size of the pond and its access being restricted to a limited number of community members, it is thus possible that the introduction of cage culture in this village did not cause any changes to the water users' habits.

A positive impact of cage culture was implicitly mentioned by both cage and non-cage operators. As it can be expected that pond users catch fish from the pond when needed, and as it is recognised that cage operators attract wild fish in the pond with their feed, it is likely that cage culture can have a harmonising role in the community and this will strengthen understanding and co-operation between all pond users.

#### *Village 3:*

Typical uses of the canal water include:

- boating during the monsoon season (canal used as a communication medium),
- fishing (although no nets were represented on the maps),
- cattle bathing,
- during the winter, village people sink their boats in the canal (way to conserve wood).

Advantages and comments related to cage culture included:

- cage culture as a source of income,
- when cage culture was first implemented in the village, cage operators were considered as "mad" but now people are interested, in particular women because "they are observing that the fish are growing" (they can observe the cages on their way to work because the cages are located along the road),
- fish will be available when necessary.
- the canal is not used for irrigation purposes.

All map features drawn by respondents have been reproduced in Figure S3, presented at the end of Survey 3, to illustrate water body uses and their location.

Cage operators indicated that prior to cage culture, the canal had no other use. This was corroborated by the women's group who said that they usually use tube well water for their household activities instead of water from the canal. However, according to them, the place that was used by village people prior the introduction of cage culture has changed because of the sitting of cages. Cattle has now to bathe a bit further away. Apart from this change, no other information of this nature was provided by the participants.

#### Objective 2: To identify conflicts that may have emerged since the implementation of cage culture.

##### *Village 1:*

As was indicated in Objective 1, no conflicts have emerged over the use of canal water since the implementation of cage culture in this village. Indeed none of the group mentioned any "problems" due to cage culture and cage setting.

Cage operators wrote that females did not face any problems in using their ghat. Maps show the position of two ghats, one for males, close to the cage site, and one for women, a bit further along the canal bank, closer to the place where fishermen lay their nets. Women, in turn, said they were not disturbed by people from neighbouring communities coming to see the cages. They added that, although they were very interested in cage culture, they would only visit the cage site on Wednesdays and Saturday when men go to the market (weekly bazaar day) as they cannot visit the site in the presence of male cage operators.

Nevertheless, maps may suggest the potential for conflicts rising between water users. The canal is not an immense water body to host so many different activities and uses. Indeed, cages are located at the proximity of a ghat and near the shore. If pollution increases due to an increasing number of cages (as cage operators plan to do for the next cycles), the resulting poorer water quality will affect bathing and cleaning/washing activities of all water users. It may be assumed that the cage site was decided taking into account the location of the ghat women use to carry out their own activities to avoid any embarrassment the proximity of the cages and cage operators may cause to them. However, fishermen had to change the location of their seine nets in the canal and the new setting is now very close to the women's ghat, as shown on the children's and cage operators' maps, resulting in the creation of the same embarrassment for women. It will be unlikely that women openly state their embarrassment and point out the problems resulting from the location of the cages given their social condition. Therefore, if conflicts openly arise, they will be more likely to be between fishermen, cage operators and other

male water users (bathers, cattle owners etc.) and dealt directly by them, leaving considerations over the use females make of the canal outside the debate.

*Village 2:*

As mentioned in Objective 1, very few changes seem to have occurred in the community since the introduction of cage culture in the village. The fact that the pond is under a multi-ownership scheme could suggest that there is a potential for conflicts to appear over the uses of this pond. However, the non-cage operators group indicated that “there is no problem, though there is multi-ownership [of the pond]”. As women suggested, a tacit agreement is likely to exist between the seven families using the pond. Non-cage operators also mentioned that cage culture is not polluting the pond water and that before the implementation of cage culture, the pond was only used for household purposes. The size of the pond is not very extensive compared to water bodies in other villages – a small area of the pond is also covered by water hyacinths and reduce the usable water volume. However, given that the space used by the cages is constraint to a limited part of the pond and that there is no pollution created, there are no apparent hindrances for the other uses of pond water (bathing, washing clothes, cleaning utensils and vegetables). This therefore reduces the likeliness of conflict occurrence between pond users.

The pond is surrounded by trees and located close to the users’ houses. In addition, all the water users know each other, given the proximity in which they live. It may therefore be expected that the combination of these two factors with those cited above will prevent conflicts from developing as well as embarrassments to be caused to women in particular by the presence of unknown men in the water body.

*Village 3:*

As indicated in Objective 1, uses of this canal are limited compared to other water bodies and the only significant change in habit generated by the sitting of the cages related to the place along the canal used for cattle to bathe. As the length of the canal is limited, this change, which so far has not generated a conflict between cage operators and cattle owners, may become problematic if the number of cages increases significantly (as it is planned by cage operators).

What may also become problematic if the number of cages increases is the use of the canal as a transportation route, which is its principal use during the monsoon season. Although cages are in the water for only 5 months of the year, from June to November, CAGES project aims to extend the length of time spent by cages in the water (K. McAndrew, pers. com.) to spread returns over a longer time period. However one of the downsides, in addition to the canal congestion, may be a resulting increase in poaching.

The other potential source of problems may stem from the fact that there are no arrangements of taking lease of the water body (the canal is government khas land) - mentioned by women. If the government or anyone else realises that cage culture can add a considerable value to a water body, there may be conflicts over the right of appropriation of the benefits of the activity.

However, these may only be pessimistic speculations because cage operators stated themselves that “co-operative cage culture has created a unity amongst [them] which did not exist before”.

Objective 3: If relevant, to identify which regulation mechanisms have been implemented by the community to mitigate any possible negative impacts or problems/difficulties due to cage culture.

*Village 1:*

No regulation mechanisms have been implemented since the only acknowledged changes that have occurred have affected fishermen, who shifted their seine nets away from the cage site. Other slight modifications in everyone’s activities that may have occurred have been accepted without further questioning.

*Village 2:*

No conflicts have emerged since the implementation of cage culture in this community. Therefore no mitigation measures to regulate potential conflicts have been implemented.

*Village 3:*

No conflicts were highlighted in this village, therefore no mechanisms to solve them were set up. The problem of the location of the cages where the cattle used to bathe simply resulted in the cattle owner moving his animals a bit further along the canal banks.



Figure S1: Mapping exercise in village 1 (Mathargram), Sylhet area.

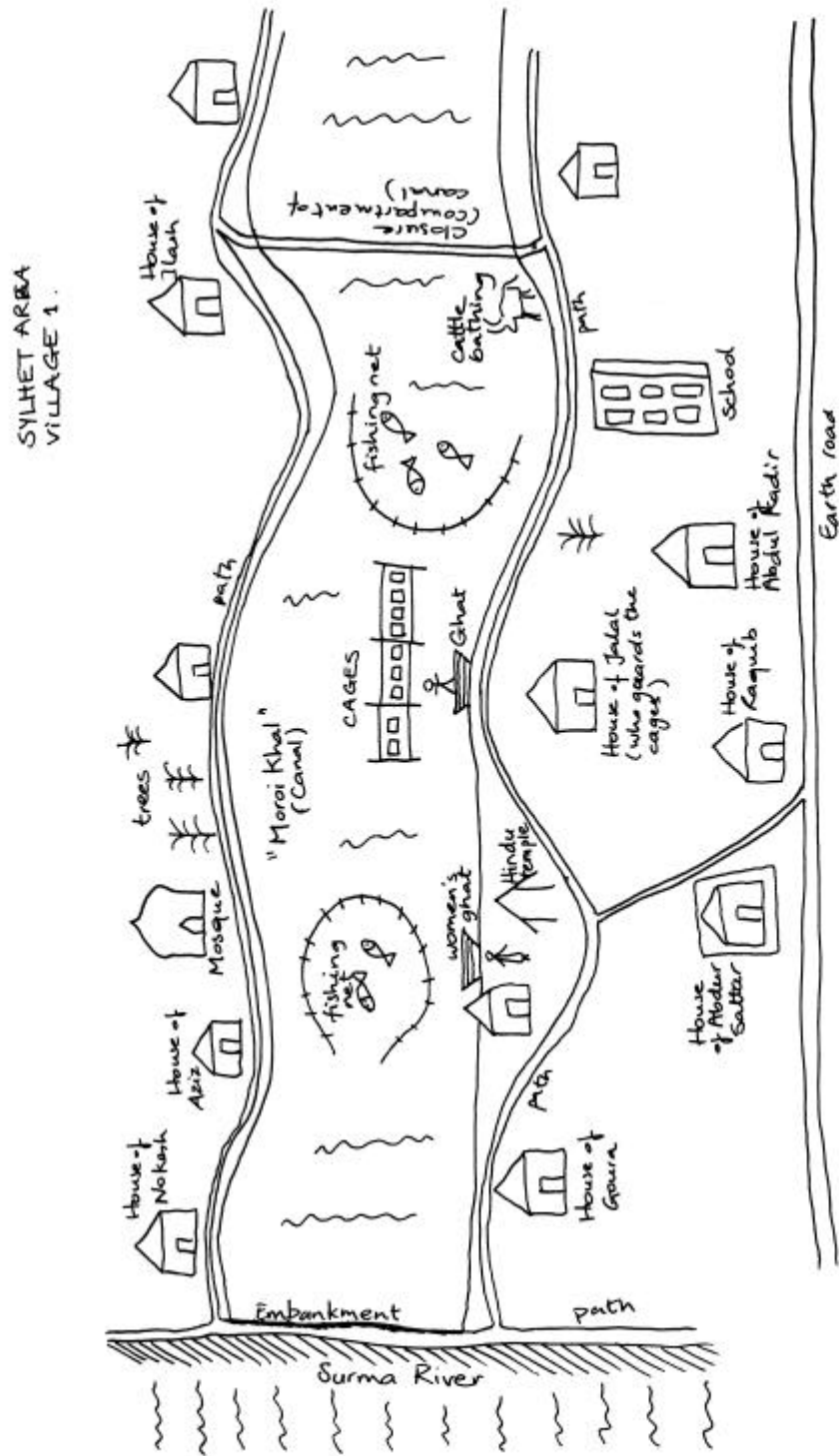


Figure S2: Mapping exercise in village 2 (Dharon), Sylhet area.

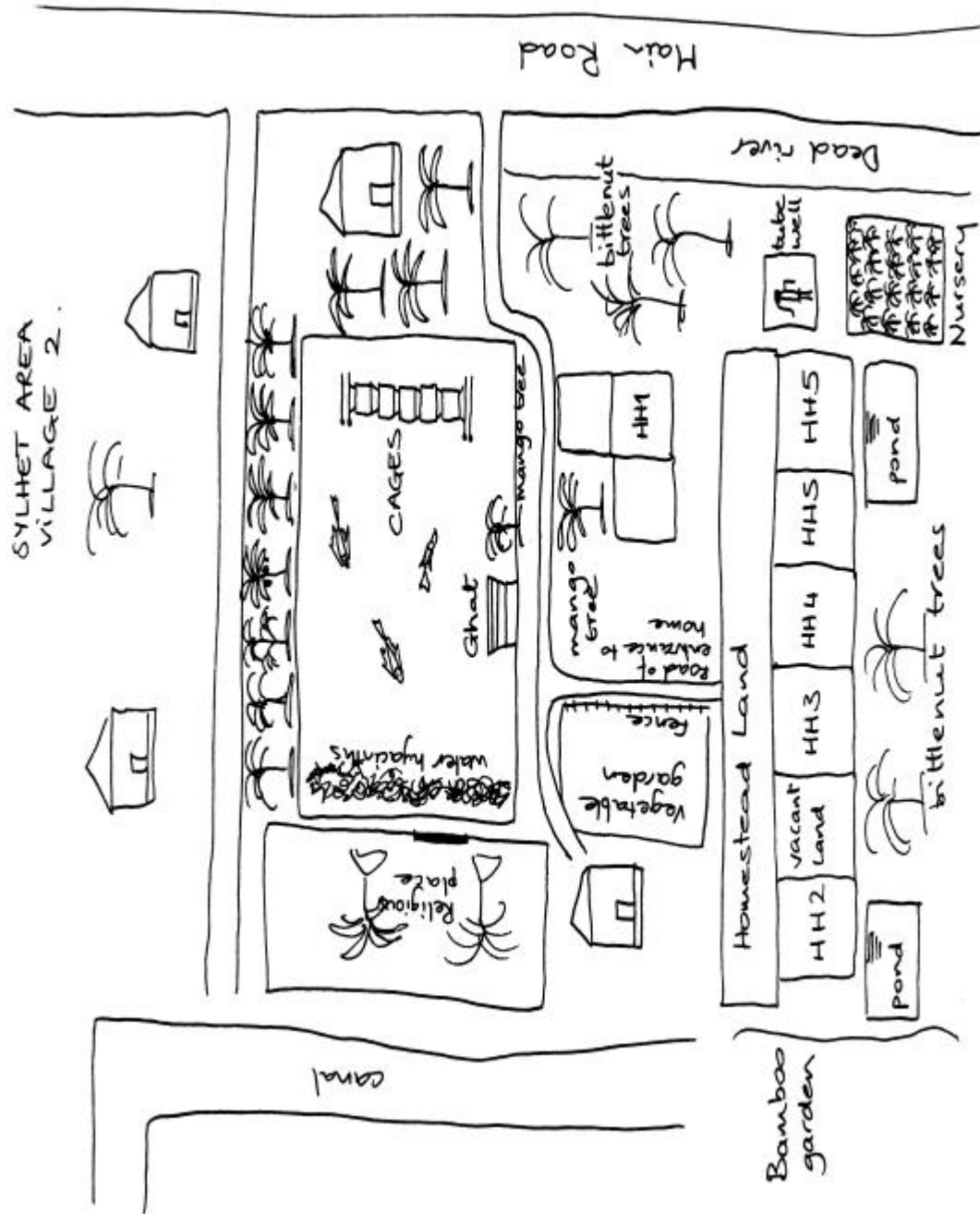
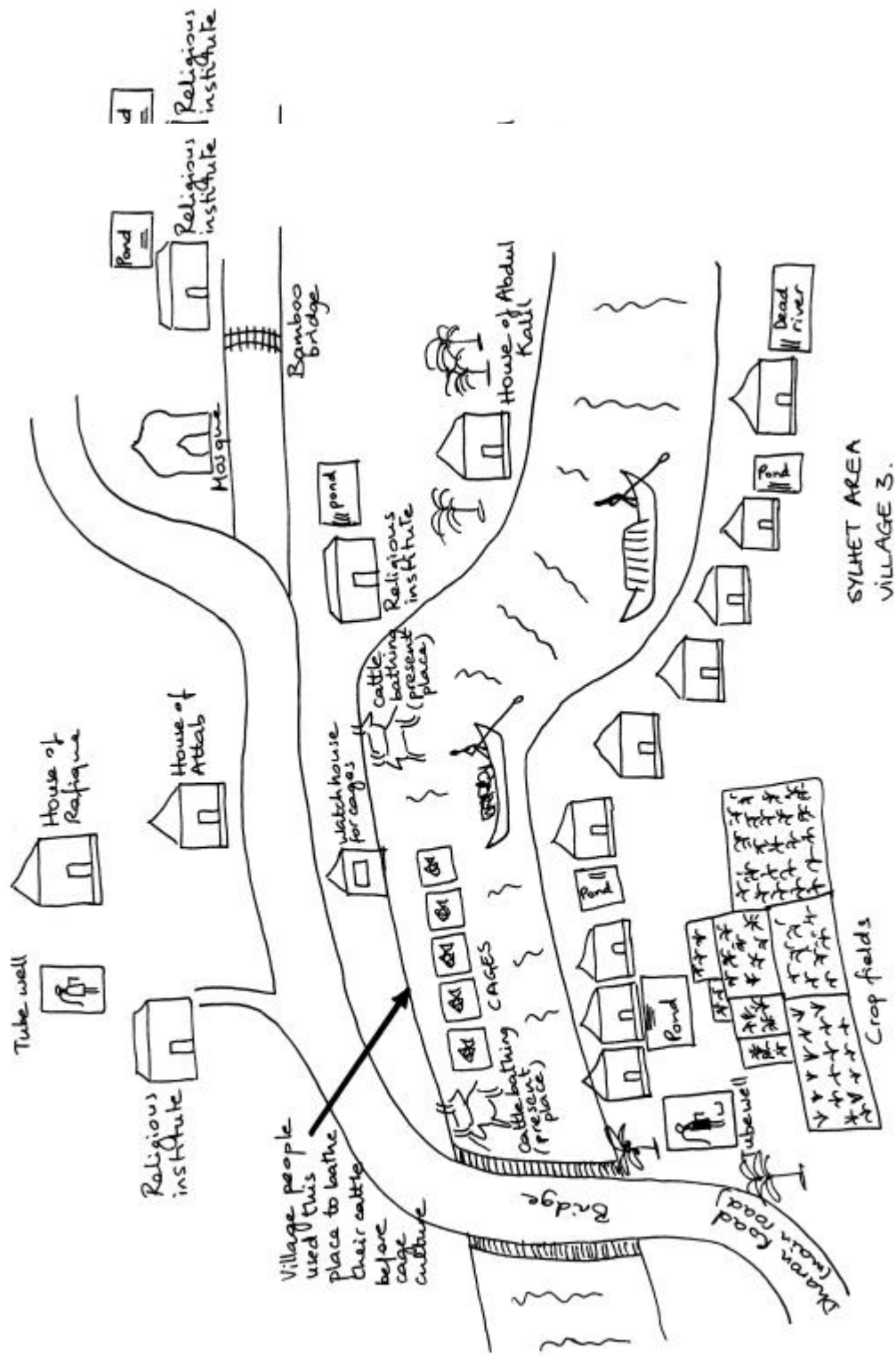


Figure S3: Mapping exercise in village 3 (Sheoterpara), Sylhet area.



### 3.3. COMILLA REGION

Villages visited and people interviewed in the selected household included:

“Village 1”:	Parihall Para	“Household 1”:	Mr. Aledur Akhter and his wife Farida
	Union: Mukam	“Household 2”:	Mrs. Zahura Begum (Khairunnahar) and her son Sumon (separated from her husband and living with her son).
	Thana: Burishong District: Comilla		
“Village 2”:	Durgapur	“Household 1”:	Mr. Md. Mohiuddin (single)
	Union: Mukam	“Household 2”:	Mr. Muzibur Rahman and his daughter Nargis Parven
	Thana: Burishong District: Comilla	“Household 3”:	Mrs. Sahela Rahman and her relative Shahama Sultana.
“Village 3”:	Chandi	“Household 1”:	Mr. Yeahea and his relative Rabeya.
	Union: Kodda	“Household 2”:	Mr. Abdul Quddus and his wife Putul
	Thana: Brahmanbaria District: Comilla	“Household 3”:	Mrs. Maleka Khatum and her son Mannan.

Only four interviews were carried out in Village 1 (two households) because no other cage operators were available considering the sampling criteria (successful, medium and poor performance) in the same village. Thus only households with medium and poor performance were interviewed in this village.

In village 2, only five interviews were carried out because the most successful cage operator of this village suddenly left for another district for work reasons. Although another successful cage operator had been selected, he was not interested in speaking to CAGES staff for both religious and work reasons.

Fieldwork took place on the 3, 4 and 5 January 1999.

### **Survey 1: Reasons for HH cage operators’ dropout or continuation of cage aquaculture.**

Objective 1: To identify the factors responsible for the cage operator’s dropout or continuation, and see if these reasons are similar for both men and women cage operators.

#### *Village 1*

According to the NGO staff, performance of the households selected may be disaggregated as follows:

HH1: poorer performance

HH2: medium performance

Table C1: Perception of performance in cage aquaculture, reasons for success and difficulties perceived by cage operators and their household members in Village 1, Comilla region.

	<i>Perception of Success/failure</i>	<i>Reasons for success</i>	<i>Reasons for difficulties</i>
HH1			
Female (c.o.) <i>Farida</i>	Good success. Khairunnahar is the most successful.	Khairunnahar has her own pond.	Fish escaped after the pond has been given lease, cutting problem. Some people in group have had difficulties but she is not sure about the cause
Male (non c.o. but helps his wife a lot)	He feels that cage culture is a profitable business. Khairunnahar is the most successful	Khairunnahar has her own pond and her stocking density was low.	Loss this year as fish escaped. In addition, he thought some fish were killed by intentional poisoning.

continued

HH2			
Female (c.o.) <i>Khairunnahar</i>	Good success. Farida is the most successful.	She has been more successful than last year due to her experience. Farida has a big pond and good water quality, uses diversified feed.	Poaching, mortality
Male (c.o.)	Low performance. He does not know who is the most successful and why.	He feels more successful than last year: he provided high-quality feed.	Fish mortality, intentional poaching

### Village 2

According to the NGO staff, performance of the households selected may be disaggregated as follows:

HH1: very successful

HH2: medium successful

HH3: less successful

Table C2: Perception of performance in cage aquaculture, reasons for success and difficulties perceived by cage operators and their household members in Village 2, Comilla region.

	<i>Perception of Success/failure</i>	<i>Reasons for success</i>	<i>Reasons for difficulties</i>
HH1			
Male (c.o.)	He feels he is the most successful.	?	No reason given (successful)
HH2			
Female (c.o.)	She feels it is a profitable business	Good management	Net cutting (she found a hole).
Male (c.o.)	Little successful. He thinks he is the most successful.	?	Poor net quality (he found a hole in nets), no co-operation between his group members, water retention period is less.
HH3			
Female (c.o.)	Last year very successful but this year not so good as fish escaped	Provision of secondary protection outside the net.	Fish escaped due to net cutting.
Female (c.o.)	Successful effort but fish escaped from cage so she is demoralised	Shakil's fish did not escape. He marketed them in due time.	Fish escaped due to a hole in the cage.

### Village 3

According to the NGO staff, performance of the households selected may be disaggregated as follows:

HH1: less successful

HH2: medium successful

HH3: very successful

Table C3: Perception of performance in cage aquaculture, reasons for success and difficulties perceived by cage operators and their household members in Village 3, Comilla region.

	<i>Perception of Success/failure</i>	<i>Reasons for success</i>	<i>Reasons for difficulties</i>
HH1			
Female (c.o.) <i>Rabeya</i>	She is successful.	No reason given	Poaching and storm last year, fish stolen this year (guard came to have dinner then the fish were stolen).
Male (c.o.)	He is not so successful.	Mannan is the most successful: he used snails and manages his cage well.	This year he has no cage due to family problem. Last year, storm destroyed the cages.

continued

HH2			
Female (c.o.)	She was the most successful before all fish were stolen	She applied snails as feed.	Poaching by a fundamentalist group.
Male (c.o.)	Not so successful.	Rabeya is the most successful as she stocked fish early.	Intentional poaching by a fundamentalist group.
HH3			
Female (c.o.)	Quite successful	Mannan is the most successful: he feeds fish regularly and manages cages well.	Intentional poaching by a fundamentalist group.
Male (c.o.) <i>Mannan</i>	Quite successful	He is the most successful: fish fed regularly with quality feed.	Intentional poaching by a fundamentalist group.

Differences in the perception of the reasons behind success and failure in cage culture between men and women are summarised in Table C4.

Table C4: Summary of the perceived reasons for success and difficulties and their frequency of occurrence in the respondents' answers in the Comilla region.

Women		Men	
Reasons for success	Reasons for difficulties	Reasons for success	Reasons for difficulties
- own pond: 1	- escapees: 1	- own pond: 1	- escapees: 1
- experience: 1	- pond given lease: 1	- low stocking density: 1	- poisoning: 1
- good water quality: 1	- net cutting: 4	- good quality feed/snails: 3	- poaching: 3
- big pond: 1	- poaching: 4	- good management: 1	- fish mortality: 1
- diversified feed/snails: 3	- fish mortality: 1	- stock early: 1	- poor net quality: 1
- good management: 1	- storm: 1		- lack of co-operation: 1
- secondary net protection: 1			- water retention problem: 1
- market fish in time: 1			- family problem: 1
			- storm: 1

Many factors cited are common to both male and female cage operators. However, there are some quantitative differences in the number of times each of these factors have been mentioned by the respondents. Good quality feed and good management clearly stand out as reasons of success given by women, whereas for men, only feed quality has clear precedence over the other reasons mentioned. In terms of factors responsible for difficulties faced, poaching is the most hindering factor for both men and women. Women also mentioned more frequently than their counterparts poor quality nets (net cut by crabs), and gave more technical reasons for success (e.g. good water quality and big pond, secondary net protection, timely marketing of fish, diversified, high quality feed, etc.) than male cage operators. Since reasons of success and failure are drawn from both personal experience and observation of other cage operators' difficulties or success in raising their fish, this may suggest that women are more observant than males and they derive most of their information from personal observations. Family problems as a reason of - temporary -dropout was mentioned only once.

There has been access problems to the multi-owned water body (pond) in village 1. Indeed, the NGO in charge of this village underlined that "at first, some operators faced difficulties to get access to their shared pond, but later, they solved them and set their cages [in the pond]". During the community meeting, it was also mentioned by the farmers themselves that some of them could not start cage culture because they did not have their own pond, but that other without pond had been able to start cage culture in other people's. One farmer added that the cage farming was a helpful source of income for those who have their own pond. Although village 2 is in the same situation of multi-owned pond and is facing water body scarcity, problems relating to these limitations do not seem as exacerbated as in village 1. Access to the water body is therefore an important issue in the starting of cage culture, and later in its success and has to be discussed and negotiated among farmers to avoid conflicts and friction (poaching etc.) within the community. NGO mentioned the existing jealousy among the community members, reflected in the respondents' mention of "intentional poisoning", "intentional poaching", fish escapees, etc. It will be interesting to check if this is reflected in the mapping exercise, and what are the real causes for these friction between village members.

The main problem cage operators from village 2 are facing is due to weak nets subject to crab cutting, which inevitably results in fish escapees and losses for the farmers.

Village 3 was subject to an important storm that devastated the cages last year. As was indicated during the NGO de-briefing, farmers did not have any major problem this year until all the cages were stolen during a fundamentalist riot. Males, to the same extent as females, have suffered from poaching by the fundamentalist group. High quality and protein content (snail) feed was mentioned by both sexes in this village (it did not get any mention in the previous two villages). Contrarily to the Dhaka area where it appeared that men might be more aware of high quality feeds than women, which suggested a failure in the information transmitted to women (indirect consequence of *parda*), it seems that in this area, women are fully aware of all the technical aspects of cage culture (feeds, nets, water quality etc.). Whether they have been told this by the NGO and/or husbands, or they have learned it by themselves through their own observations, is not possible to determine through the analysis of the questionnaires.

In summary, there does not seem to be any major gender differences in the factors affecting male and female cage operators, nor in their awareness of reasons behind successful fish production. In addition to the common difficulties faced every fish farmer, each village is suffering from a particular problem (restricted access to water and ponds, poor net quality, poaching), which should be dealt with the farmers by each NGO to ensure community conflicts are avoided and production is sustained.

Feeds available in villages 1 and 2:

Only dry fish is supplied by the NGO free of charge to the farmers.

Other feeds are either collected or purchased by the farmers themselves:

Collected

rice  
broken rice  
rice bran  
rice water  
*atta* (white flour)  
mussels  
snails  
duckweed  
Neem leaf  
trash fish

Purchased

mustard oil cake  
wheat bran  
wheat  
molasses

NB: no indication of price was given for the purchase of the above feed in these two villages.

Feeds available in village 3:

Collected

snails  
duckweed  
aquatic weed  
Neem leaf  
mussels  
trash fish  
filament algae

Purchased

oil cake: 7 Tk/kg  
rice bran: 1.5 Tk/kg  
wheat bran: 10 Tk/kg  
dry fish: 20 Tk/kg  
molasses: 10 Tk/kg.

Table C5: Relationship between success through 'good feed' and wealth in Village 1, Comilla region.

	<i>Wealth</i>	<i>Level of success</i>	<i>Feed collected</i>	<i>Feed purchased</i>	<i>Species</i>
HH1 (female)	Medium	Low	Broken rice.	Urea, wheat bran, rice bran	Tilapia
HH1 (male)	Medium	Low	None	Urea, wheat bran, oil cake, molasses.	Tilapia
HH2 (female)	Richer	Medium	Mussels, boiled rice, dry fish	Rice bran, oil cake	Pangas
HH2 (male)	Richer	Medium	Mussels, boiled rice, dry fish	Rice bran, oil cake	Pangas

Table C6: Relationship between success through 'good feed' and wealth in Village 2, Comilla region.

	Wealth	Level of success	Feed collected	Feed purchased	Species
HH1 (male)	Medium	High	Dry fish, duckweed, wheat	Rice bran, oil cake	GIFT tilapia, pangas
HH2 (female)	Medium	Medium	Broken rice, wheat	Oil cake, molasses, wheat bran, rice bran	Tilapia
HH2 (male)	Medium	Medium	Dry fish	Rice bran, molasses	Tilapia
HH3 (female)	Richer	Low	Broken rice, dry fish, rice, wheat	Rice bran	Tilapia, pangas
HH3 (female)	Richer	Low	Wheat, rice	Oil cake, wheat bran	Tilapia

Table C7: Relationship between success through 'good feed' and wealth in Village 3, Comilla region.

	Wealth	Level of success	Feed collected	Feed purchased	Species
HH1 (female)	Poor	Low	Dry fish, rice liquid	Rice bran, wheat bran, oil cake, snails	Sarputi, tilapia
HH1 (male) (relative)	Richer	Low	Duckweed, dry fish, Neem leaf	Oil cake, wheat bran	Sarputi
HH2 (female)	Poor	Medium	Dry fish, boiled rice, rice liquid, snails	Wheat bran, oil cake, molasses	Sarputi, Tilapia
HH2 (male)	Poor	Medium	Rice, rice liquid, snails	Rice bran, wheat bran, molasses	Sarputi, tilapia
HH3 (female)	Medium	High	Snails, dry fish, Neem leaf, trash fish	Rice bran, wheat bran, molasses	Sarputi, tilapia
HH3 (male)	Medium	High	Dry fish, snails, duckweed, Neem leaf	Wheat bran, oil cake	Sarputi, tilapia

As suggested by these tables, wealth is not synonymous of success. One would think that a higher level of wealth allows the purchase of higher feeds and therefore a higher success rate. But, as shown in the three tables, fish from wealthier cage operators are fed a diet mainly composed of collected ingredients. Similarly, medium-wealth farmers were able to afford many types of higher feeds, which nevertheless ended in poor results (village 1).

There seems to be thus no cause-to-effect relationship between the cage operators' wealth, the feed they can afford or collect and their success in the activity. External circumstances such as poaching, storm, mortalities etc. as were mentioned by the farmers may be therefore a higher determinant in the potential of success in cage culture than personal circumstances, poverty included.

The relationship between species and feed given and the resulting growth performance has to be investigated further.

*Relationship between females' success and the feed they are using:*

Comilla is not a religiously conservative area (Yesmin, pers. com.). It was mentioned during each NGO de-briefing that there were no holdback for women to do cage aquaculture. However, from the three previous tables, it can be observed that:

Women: success level

Low = 4

Medium = 3

High = 1

Men: success level

Low = 2

Medium = 3

High = 2

However, it can also be observed (by counting the different types of feeds used) that women purchase 6 different types of feeds against 5 for men, and that they collect 10 different types of feeds against 7 for men. There may be several reasons to explain these two contradictory observations. One is the amount of time dedicated to cage culture by each sex (to be determined in Survey 2, objective 2). Another may be related to the amount of technical information women receive: although the feed they provide to their fish is more diversified, it may not be well adapted to the species they grow.



The number of feeding ingredients purchased by women is approximately equal to the number of feeds purchased from the market place by men. This suggests that the religious pressure is indeed less severe in the Comilla region than in other areas of the country (Sylhet for example), allowing females to go out of their houses and go to the market place to buy their own feed.

Objective 2: To highlight the cage operator's perception of success or failure in cage aquaculture and the impact of the activity on his/her HH (or personal) status.

*Personal perception of success and failure:*

In village 1, HH1 (Farida) is not experiencing a very good of production since 350 fish out of 500 escaped (success classified as low by CAGES staff). Although they estimate their success to be "good", they recognise that another lady cage operator is the best cage operator of the village. Interestingly, the lady best cage operator of the village thought to be successful with the culture this year but reckoned that Farida was the most successful.

In village 2, the most successful cage operator could not be interviewed because he had to leave the village for personal circumstances. He was recognised as the most successful cage operator of the village, at the exception of one male cage operator (medium successful) who thought of himself as the most successful one. It appears from the interviews that the personal perception of success is coherent from the external observation of performance by the NGO. Some of the villagers interviewed have been operating cages for the last two years, with variable success, which give them a better and more accurate measurement of their own performance.

There is a similar trend in village 3 with farmers with 2cycle experience able to measure more accurately their own performance in cage culture, although there is one exception to this. Most of the village's fish farmers acknowledge the success of one of them, Mannam (male), indeed the most successful cage operator of the village.

In general, in all villages, it appears through the answers given that villagers (both cage and non-cage operators) are very observant of one another, and notice the reasons why one is indeed more successful than the others. As cage culture is still a new activity and is still in its infancy, cage operators are observing and experimenting by themselves which demonstrates not only their interest in the activity, but their capability to analyse their results and adjust the management of their cages so as to obtain profitable results.

*Impact of cage aquaculture of personal status within the community:*

*Village 1*

*Women:*

- Positive effect (? 2)

*Men:*

- Positive effect.  
- Encouraged him.

*Village 2*

*Women:*

- Positive effect (? 3)

*Men:*

- Positive effect, he feels proud.  
- No change.

*Village 3*

*Women:*

- Positive effect (? 3)

*Men:*

- Positive effect (? 3)

According to the respondents, cage aquaculture has undoubtedly positive effects on the status of their household within the community. However not much precision was given on the type of positive effects felt by the respondent himself or his HH. Two exceptions are the personal encouragement gained from the attention provided by the NGO, and most likely derived motivation. The other is the personal honour drawn from the activity, which will almost certainly affect his personal recognition within the community. The fact that women responded very positively to the question relating to the

change of status confirmed the indirect, positive influence of cage culture upon their personal recognition as important actors within the community, and to a wider extent, society.

Objective 3: To compare the cage operators' expectations in terms of support from the local NGO/TO/APO staff with what they have been doing to support cage aquaculture and/or remedy to the problem of dropout

*Village 1*

Table C8: Respondents' opinion about NGO/CARE support for cage aquaculture and suggestions for improvement in Village 1, Comilla region.

	Opinion about NGO support	Suggestions for improvements:
Women	- She thought staff consultation is enough. - Sufficient support.	- She needs a loan for cage culture. - More technical support will be excellent.
Men	- He is satisfied. - No idea.	- He wants to stock pangas as it is costly fish. - No idea.

*Village 2*

Table C9: Respondents' opinion about NGO/CARE support for cage aquaculture and suggestions for improvement in Village 2, Comilla region.

	Opinion about NGO support	Suggestions for improvements:
Women	- Enough. - Very satisfactory. - She feels enough, during visit she is encouraged.	- Need more visit to encourage her. - High quality net should be provided (? 2)
Men	- He feels enough. - Enough.	- He needs more cages. - Need extra surrounding net to protect from crab.

*Village 3*

Table C10: Respondents' opinion about NGO/CARE support for cage aquaculture and suggestions for improvement in Village 3, Comilla region.

	Opinion about NGO support	Suggestions for improvements:
Women	- Enough. - Not so aware. - Enough.	- She needs a pellet machine. - Not aware. - No answer given.
Men	- Not so enough. - Enough. - Enough: he will be able to culture fish without NGO support	- Should provide more technical advice. - Richer technical information. - No need for support.

A summary of the improvements suggested by male and female respondents is presented below in Table C11.

Table C11: Summary of the frequency of the respondents' answers regarding their suggestions to improve the NGO support in the Comilla region.

Women				Men			
Techn. support	f'lings	feed	others	Techn. support	f'lings	feed	others
3 ☞	-	-	loan: 1 visits for encouragement: 1	4 ☞☞	-	-	pangas: 1

☞ includes high quality nets: 1  
pellet machine: 1

☞☞ includes more cages: 1  
extra surrounding net: 1  
technical advice: 2

Globally, both male and women cage operators think the NGO support is sufficient and are satisfied with it. If some improvements are nevertheless suggested by the respondents, this indicates that the NGO support is meeting the farmers' needs adequately, to the point that a farmer with only one year experience expressed his intention to carry on cage culture next year without the NGO's help.

In village 1, the NGO provided training and assistance with: cages, fingerlings, information on feed, cage management, market prices. The NGO selects the fingerlings (either tilapia or pangas), there are no opportunity for the farmers to do it themselves. Farmers will pay back for the fingerlings after harvest and depending on their success. There is no particular credit system for cage culture, but there is the possibility for those who are interested to delay their payments depending on their results. Only dry fish is purchased and supplied by the NGO, other feeds are purchased by the farmers themselves. A female cage operator expressed the need for loan to carry on cage culture, or the NGO to provide her with free cages. This highlights that the initial investment for cage culture is substantial, especially for resource-poor farmers. One way for the NGO to gradually withdraw its direct assistance could be through the provision of an "aquaculture" credit scheme to enable the cage operators willing to pursue this activity to do so. The comment by a male cage operator who wants to stock pangas, an expensive fish, confirms the potential of cage culture to be an IGA (income generating activity) more than a protein source.

In village 2, the NGO provides assistance to the farmers in terms of net, fingerlings, feed (information shared from different places), information on cage management and market prices. Farmers pay for their fingerlings immediately, and use mostly rice and *atta* (white flour), along with other ingredients, to feed their fish. Although support is judged satisfactory and sufficient, there is the recurrent request for improved quality nets to deal with the crab cutting problem and resulting escaping of fish. The 'encouragement factor' is highlighted in a couple of answers in this village: cage culture is largely technical but not only, and when it comes to the involvement of women in the project, external encouragement and personal enhancement are particularly important given the gender-related difficulties they are likely to be facing.

In village 3, farmers seek the NGO assistance during the fingerling selection. Farmers will pay for these after harvesting, depending on their results. The NGO also provides assistance and training in terms of net sewing, feed selection, feeding techniques, species selection and stocking, fingerling transportation, daily management, cage shifting. The villagers are visited regularly and frequently by the NGO because one member of staff lives in the same village. Farmers are responsible for the feed they give to their fish, the NGO does not provide any. There is no particular credit system for cage culture, but, according to the NGO, farmers have already expressed their interest to receive credit from the NGO for this activity. If the NGO accepts to provide credit, this will represent a great opportunity for the farmers. Interestingly, credit was never mentioned in this village during the farmers' interviews. (although they said they had "no funds" [to start cage culture] during the community meeting). Instead, more technical information is suggested as an improvement, which may be justified by the fact that most farmers are new to the activity.

So, in general, the support provided by the NGO involved with CAGES project seems to be meeting fairly well the farmers' requests, and the improvements that could be brought to cage culture are specific (surrounding nets, technical information) in villages 1 and 2, which makes it easy to target. A greater effort may have to be provided in village 3.

## Survey 2: Roles, perceived opportunity costs and benefits of cage aquaculture to HH, with particular emphasis on the role of women.

Objective 1: To identify the role of women HH decision making regarding cage aquaculture (decision to start cage culture, daily management, post-harvest decision – expectations from cage culture).

### Village 1

Table C12: Respondents' answers regarding the role of household members in the decision-making process for cage aquaculture and its related tasks in Village 1, Comilla region.

Households	Decision to start cage culture	Decision on distribution of daily tasks	Decision post harvest
HH1			
Female (c.o.) <i>Farida</i>	Salma (NGO staff) motivated them to do this. After receiving training, she decided to do it. She consulted with her family members. She set cage to get benefit.	Jointly	Expects 5 Tk/fish, total 750 Tk, market price: 50 Tk/kg. She may sell fish or keep it in pond. If fish is sold, then use for house repairing. 4 fish eaten, if needed they may eat more
Male (non-c.o. but helps his wife a lot)	Hearing from Salma, he decided to set cage. Salma stated it is a good programme to get economic benefits.	Himself.	Expects to sell at 4 Tk/fish and total of 600 Tk. Reinvest in cage culture. Expects 50 Tk/kg. No fish will be eaten by the family.
HH2			
Female (c.o.) <i>Khairunnahar</i>	Learning from NGO staff, she consulted with her family members and decided to set cage for economic benefit.	Mutual understanding	Expects to make 1500 Tk and use it for sewing purpose. Market price: 85 Tk/kg. Very few fish will be eaten within the family.
Male (c.o.)	Hearing from Salma, he and his mother decided to do it for economic benefit.	Mutual understanding	Very few fish will be eaten within the family

### Village 2

Table C13: Respondents' answers regarding the role of household members in the decision-making process for cage aquaculture and its related tasks in Village 2, Comilla region.

House holds	Decision to start cage culture	Decision on distribution of daily tasks	Decision post harvest
HH1			
Male (c.o.)	He first saw some cages in a pond and talked with NGO director. Learning from director, he was inspired to do cage culture for economic benefit.	He decided himself, he has no suitable other relative/person to involve with him.	Expects 13,000 Tk, will re-invest and use for HH purpose. Market price: tilapia: 50 Tk/kg; pangas: 80 Tk/kg. No fish will be eaten within family.
HH2			
Female (c.o.)	Learning from her relative (Sahela), she talked with her father and decided to do it for family consumption ( <i>she is a student</i> )	Mutual understanding.	Expects 4,000-5,000 Tk, will purchase her favourite things. Market price: 50 Tk/kg. Maximum fish will be eaten within the family.
Male (c.o.)	He saw it in Chittagong. Last year he saw in NGO. He talked with NGO and his neighbour Sahela. Do it to use his leisure time and for economic benefit. May also use as reserve stock for HH purpose.	Mutual understanding	Expects 2,000 Tk. Market price: 50 Tk/kg. Continuous consumption within the family.

continued

HH3			
Female (c.o.)	Hearing from NGO staff and decided with her son and husband, for interest and use of her leisure time	Mutual understanding.	Expects 2,100 Tk, will use it for HH purpose, re-investment. Market price: 50 Tk/kg. Very few fish will be eaten.
Female (c.o.)	Learning from her relative (Sahela), she talked with her brother and decided, for family purpose.	Mutual understanding.	100% fish for own consumption, will not sale any fish.

### Village 3

Table C14: Respondents' answers regarding the role of household members in the decision-making process for cage aquaculture and its related tasks in Village 3, Comilla region.

	Decision to start cage culture	Decision on distribution of daily tasks	Decision post harvest
HH1			
Female (c.o.) <i>Rabeya</i>	Learning from NGO staff. She decided to set cage for economic benefit.	Herself.	Expects 700 Tk, will re-invest and for HH purpose. Market price: 35 Tk/kg. No fish will be eaten by family
Male (c.o.)	Learning from NGO staff, he decided to set cage for additional income.	He demonstrated the feeding technique to help family ( <i>last year</i> ).	This year he has no cage due to family problem. Very few fish were eaten last year. Market price: 50 Tk/kg.
HH2			
Female (c.o.)	She decided consulting with her husband, for economic benefit	Mutual understanding.	Expects 4-5,000Tk. Will use the money to purchase her favourite things. Expects to get 50Tk /kgo of fish. Maximum of fish will be eaten within the family.
Male (c.o.)	Mutually decided, for economic benefit.	Mutual understanding	Expects 900 Tk. Use for business. Market price: 45 Tk/kg. No fish eaten within family.
HH3			
Female (c.o.)	Mutual unders tanding. For economic benefit	Mutual understanding.	Expects 1200-1300 Tk. Will use it for small business. Market price: 40 Tk/kg. No fish will be eaten.
Male (c.o.) <i>Mannan</i>	Learning from his father, he decided to do it for additional income.	Himself.	Would have expected 1200-1400 Tk, and use it for small business. Market price: 40 Tk/kg. No fish eaten ( <i>all stolen</i> ).

#### Decision to start cage culture:

All women interviewed apart from one in village 3 consulted their husbands/brothers or relatives before deciding to start cage culture. Although the Comilla region is not religiously conservative (Yesmin, pers. com.), and some of the female respondents seem to have decided by themselves to start cage culture, their decision still depends on the male of the HH's approbation. This is similar to the way decisions are made in the Dhaka area.

In village 1, both male and female cage operators learned about cage culture directly through the NGO. In villages 2 and 3, the situation is slightly different since aquaculture technology seems to have been transmitted through both direct (NGO) and indirect channels (relatives and observations from other areas where cage culture is practised). Both ways present advantages and disadvantages. It is important that the new technology spreads spontaneously from one village to the other, transmitted by those who practice it. However, if this method is usually successful in exciting the curiosity and interest of neighbours, it may not be sufficient in transmitting the appropriate technical information to those willing to start the activity. This is where the NGO's role is crucial. Moreover, given the cultural context in which aquaculture development takes place, it is important that the NGO maintains the focus on women's participation, which may not happen spontaneously as this new technology is practised and transmitted by men.

So in remote areas where cage aquaculture has never been practised, the NGOs have an important role (as demonstrated in Village 1) in convincing farmers, both males and females, about the feasibility and profitability of cage culture. However, in villages close by an area where cage culture is already practised, it is likely that information will spread quickly from mouth to ear, doing the “publicity” for cage culture, saving some of the NGO’s time for the dissemination of information. Since wrong and discriminative information can spread quickly through this informal channel, it is crucial that the NGO’s control over the development of the activity remains strong.

In terms of expectations from cage culture (i.e. reasons why it was decided by the respondent to start cage culture), the motives are different between male and female respondents and to some extent between villages. Globally,

Females gave:

Economic benefit: 5 times

Family use: twice

Interest and use of leisure time: once

Males gave:

Economic benefit: 7 times

Leisure time and family use: once

as reasons for starting cage culture. This seems to suggest that economic benefit is not the only priority for women but that providing food to their family is a prime concern. This would need however to be investigated further.

In village 1 and 3, to get economic benefit is the only motive to do cage culture for both men and women. By contrast, in village 2, women never mentioned cage culture as source of economic benefit, whereas family consumption and other indirect purposes (use of leisure time, personal interest) were the other reasons stated. Males’ answers in this village follow a similar pattern although economic benefit figured in the comments. It may be interesting to relate these answers to the NGO’s approach to cage culture. Indeed, village 2 is the village where it is clearly stated by the respondents that they learned indirectly from relatives and personal observations about cage culture (not all answers in village 3 give precision on where respondents were informed about cage culture). It may be therefore that the first spontaneous appeal in the activity would be to be able to feed one’s family, and if production exceeds HH consumption, obtain additional income from the sale of the production surplus. In village 1 where farmers seem to have been approached more directly by the NGO, answers are more focused on the potential economic benefits of the activity, which is likely to reveal the emphasis put on by the NGO in convincing the farmers to take up the activity.

It is a very positive aspect that the project offers a lot of flexibility to the cage operators to use cage culture as is convenient to them to help meeting their own needs.

#### *Decision on distribution of daily tasks:*

The same pattern seems to follow the one for the decision to start cage culture. For women, the “jointly” decision over the distribution of tasks or through “mutual understanding” dominates. The only exception is with the female cage operator who decided herself (no consultation) to start cage culture. As could be expected, male cage operators’ “mutual understanding” and personal decision were mentioned equally (three times each). However, it does not appear through the results that men made the decision *for* their wives, which may indicate the relative autonomy of women in managing their own cages. One may interpret the “mutual understanding” carefully though, the analysis of results for objective 2 may give a better insight in the real position of women regarding their autonomy and participation in cage culture.

#### *Decision post harvest:*

Answers provide an insight into the respondent’s financial expected returns from cage culture and wish to use his/her fish production, and although they do not tell us who will have the final word in the decision post harvest, they allow to draw some comparisons between HH members and some thoughts on gender issues. Some HH couples’ answers are markedly different, both in terms of knowledge/perception of market prices and decision of what to do with the fish produced (eat or sell). It was expressed on several occasions that fish would be consumed rather than sold. When intra-HH decisions are observed, it may be noticed that intentions differed between men and women: in general terms, women’s answers are more ‘protective’ in the sense that they would either keep the fish for HH consumption or, if sold, use the money for HH purpose. This confirms that male and female interests in the family are not the same (Mosse 1993)<sup>2</sup>, and that the precedence of family concerns and direct support tend to be more specific to women. However, it was also mentioned by women that they would

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<sup>2</sup> Mosse, J. C. (1993) *Half the World, Half a Chance. An Introduction to Gender and Development*. Oxfam publication, Oxford.

use the money for themselves, for a “sewing purpose” (which in turn may be an IGA) or for “purchasing her favourite things”, which is appearing for the first time, mentioned by an unmarried woman (thus without child responsibilities). It indirectly reveals the awareness of women of the potential freedom they could gain from the culture through the gain a certain degree of financial autonomy, and suggests that this motivation must be implicit in their decision to start cage culture.

In addition, it is interesting to compare information relating to the market prices expected for the sale of fish between male and female respondents. Although quantitative comparisons using averages have to be handled with care given the limited number of answers, they can complement and facilitate the analysis of qualitative observations. The following table outlines the expected prices per kg of fish species sold.

Table C15: Estimation of the expected market prices for the different fish species sold, according to men and women in the Comilla region.

Village 1	Women		Men	
	Species	Price/kg	Species	Price/kg
	Tilapia	50	Tilapia	50
	Pangas	85	Pangas	?
<i>Average</i>		<i>N/a</i>		<i>N/a</i>
Village 2	Tilapia	50	Tilapia	50
	Tilapia + pangas	50	Pangas	80
	Tilapia	N/a (all fish eaten)	Tilapia	50
<i>Average</i>	<i>Tilapia (+ pangas)</i>	<i>50</i>	<i>Tilapia</i>	<i>50</i>
Village 3	Sarputi + tilapia	35	Sarputi	50
	Sarputi + tilapia	40	Sarputi + tilapia	45
	Sarputi + tilapia	40	Sarputi + tilapia	40
<i>Average</i>	<i>Sarputi + tilapia</i>	<i>38.3</i>	<i>Sarputi + tilapia</i>	<i>45</i>

If averages are only possible and meaningful in the case of village 3, the above table nevertheless suggests a number of things:

1. The price of one kilo of tilapia in this area is constant and well known by both sexes (village 1 and village 2).
2. Estimates are different between men and women in village 3, women’s estimates for fish market price being lower than for their counterparts. This may suggest that, as was previously encountered in other regions of Bangladesh, women’s access to outside information is restricted by cultural and religious practices (parda).

There is however no obvious explanation to the fact that the price of tilapia and sarputi is lower in village 3 than in villages 1 & 2.

Total expectations are difficult to handle since they depend on the number of cages managed, the species farmed and the level of success or ‘failure’ experienced by the cage operator.

Objective 2: To determine the amount of time dedicated to fish culture by all HH members, the division of labour and the opportunity costs, both in terms of time and money, of cage culture.

*Village 1*

Time:

*Women:*

Time dedicated: 1 hr.; 2hrs.

*Men:*

Time dedicated: 1hr to 1hr15min.; 10min.

Division of labour:

Table C16: Respondents' answers regarding the distribution of the tasks related to the management of cage aquaculture to household members in Village 1, Comilla region.

Tasks: ? Answers by:?	Buy the seed	Prepare feed	Feed the fish	Harvest fish	Sell fish
HH1					
Female (c.o.) <i>Farida</i>	Her son purchased it from NGO at 250 Tk/500 f'lings	No precision given	Her son	Herself with help of her son.	Her son (1000 Tk net profit last year).
Male (non-c.o. but helps his wife a lot)	His wife and son from NGO office, 500 fish @ 250 Tk.	No precision given.	Last year himself, this year his family.	Himself last year (fish escaped this year).	His son (last year)
HH2					
Female (c.o.) <i>Khairunnahar</i>	Her son, from NGO office, 625 Tk / 250 pangas.	No precision given	Herself and her son	Herself (last year)	Brother and son
Male (c.o.)	Himself ( <i>son</i> ), from the NGO, 250 pangas @ 625 Tk.	No precision given	During bathing	He participated	He participated in selling.

Opportunity costs and effects on other HH activities:

Table C17: Respondents' answers regarding their appreciation of cage aquaculture and the effects, time and financial opportunity costs they feel the activity bears on their usual household activities in Village 1, Comilla region.

Households	Appreciation of cage culture	Effect on other HH activities	Time opportunity cost	Financial opportunity cost
HH1				
Female (c.o.) <i>Farida</i>	Good use of time, money energy.	No detrimental effects on other HH activities	Leisure time	Would use the money for HH purposes
Male (non-c.o. but helps his wife a lot)	Good use of time, money energy.	No detrimental effects on other HH activities	Agriculture work and HH work.	Would use the money for HH purposes
HH2				
Female (c.o.) <i>Khairunnahar</i>	Good use of time, money energy.	No detrimental effects on other HH activities	Sewing and leisure time	Would use the money for house hotel purpose.
Male (c.o.)	Good use of time, money energy.	No detrimental effects on other HH activities ( <i>son who is studying</i> ).	Studies	Studies

Village 2

Women:

Time dedicated: 10-15 min.; 15 min.; 10-15 min.

Men:

Time dedicated: 5 min.; 5-10 min.



Division of labour:

Table C18: Respondents' answers regarding the distribution of the tasks related to the management of cage aquaculture to household members in Village 2, Comilla region.

Tasks: ? Answers by:?	Buy the seed	Prepare feed	Feed the fish	Harvest fish	Sell fish
HH1					
Male (c.o.)	Collected seed himself from NGO (GIFT tilapia and pangas @ 8,000 Tk.).	No precision given	Himself and his lodging teacher.	N/A (1st year, not harvested yet).	N/A
HH2					
Female (c.o.)	Her father, from NGO, 1000 tilapia @ 600 Tk.	No precision given	All family members but specially her and her young sisters.	Her father (continuous consumption).	Her father (if some fish is sold).
Male (c.o.)	Himself, from NGO (1000 tilapia @ 600 Tk.).	No precision given	His daughters	Himself (continuous consumption)	Himself (if some fish is sold)
HH3					
Female (c.o.)	Herself and her son, from NGO office, 1000 Tk for pangas and tilapia.	No precision given	Herself and her son.	Herself and her son.	Hired people.
Female (c.o.)	Her father, from NGO, 1000 tilapia @ 600 Tk.	No precision given	Herself.	N/A (no harvest: will eat 100% of fish)	N/A

Opportunity costs and effects on other HH activities:

Table C19: Respondents' answers regarding their appreciation of cage aquaculture and the effects, time and financial opportunity costs they feel the activity bears on their usual household activities in Village 2, Comilla region.

Households	Appreciation of cage culture	Effect on other HH activities	Time opportunity cost	Financial opportunity cost
HH1				
Male (c.o.)	Good use of time, money, energy.	No effect on other HH activities.	Business purpose	Would use the money for business purposes
HH2				
Female (c.o.)	Obviously good use of time, money, energy.	No effect on other HH activities ( <i>student</i> ).	Studies, HH work	Would use the money to purchase chickens.
Male (c.o.)	Positive use of time, money, energy: additional work ( <i>started cage culture to use up his leisure time</i> ).	No effect on other HH activities.	Studies, leisure time, other HH works.	Would use the money for HH purposes, fish culture in pond.
HH3				
Female (c.o.)	Good use of time, money, energy.	No effect on other HH activities.	HH work	Would use the money for HH purpose
Female (c.o.)	Good use of time, money, energy	No effect on other HH activities.	HH work.	business and other works

Village 3

Women:

Time dedicated: 1hr30min; 1hr30min; 2hrs (\*).

Men:

Time dedicated: 1hr30min; 2hrs; 1hr.

Division of labour:

Table C20: Respondents' answers regarding the distribution of the tasks related to the management of cage aquaculture to household members in Village 3, Comilla region.

Tasks: ? Answers by:?	Buy the seed	Prepare feed	Feed the fish	Harvest fish	Sell fish
HH1					
Female (c.o.) <i>Rabeya</i>	Her relative, from a village, 400 fish @ 200 Tk. (sarputi + tilapia).	No precision given	Herself.	N/A (all fish stolen).	N/A (all fish stolen).
Male (c.o.)	Seed collected from his own pond.	No precision given	Himself and his wife.	Himself.	N/A (all fish stolen).
HH2					
Female (c.o.)	Her husband, from NGO, 400 fish @ 200 Tk. (sarputi + tilapia).	No precision given.	Herself and her relatives.	N/A (all fish stolen).	N/A (all fish stolen).
Male (c.o.)	His relative, from NGO, 400 fish (tilapia + sarputi) @ 400 Tk	No precision given	Himself and his wife.	N/A (all fish stolen).	N/A (all fish stolen).
HH3					
Female (c.o.)	Her son, from NGO, 400 fish @ 400 Tk. (sarputi + tilapia)	No precision given.	Her son	N/A (all fish stolen).	N/A (all fish stolen).
Male (c.o.) <i>Mannan</i>	Himself, from NGO, 400 fish (tilapia + sarputi) @ 400 Tk.	No precision given.	Himself	N/A (all fish stolen).	N/A (all fish stolen).

Opportunity costs and effects on other HH activities:

Table C21: Respondents' answers regarding their appreciation of cage aquaculture and the effects, time and financial opportunity costs they feel the activity bears on their usual household activities in Village 3, Comilla region.

Households	Appreciation of cage culture	Effect on other HH activities	Time opportunity cost	Financial opportunity cost
HH1				
Female (c.o.) <i>Rabeya</i>	Good use of time, money, energy	No effect on other HH activities.	HH works	Would use the money for poultry, goat rearing.
Male (c.o.)	Good use of time, money, energy	No effect on other HH activities.	Leisure time	HH purpose
HH2				
Female (c.o.)	Good use of time, money, energy.	No effect on other HH activities.	HH purpose	HH purpose
Male (c.o.)	Good use of time, money, energy	No effect on other HH activities.	Leisure time	Would have a small business.
HH3				
Female (c.o.)	Good use of time, money, energy.	No effect on other HH activities.	Poultry, HH work.	Would use the money for poultry purposes
Male (c.o.) <i>Mannan</i>	Good use of time, money, energy	No effect on other HH activities.	Business purpose	Small business

Amount of time dedicated to fish culture by HH members and distribution of tasks:

If the average time spent feeding the fish by men and women in the three villages is virtually equal (52 min. and 53 min. per day respectively), these figures hide large discrepancies between villages and, to

some extent, between men and women. Whilst the amount of time spent managing the cages daily is usually counted in hours, it amounts to a maximum of a quarter of hour in village 2. According to the NGO, most people from this village are service holders and out of the village during the day for professional reasons, leaving them little time to spend on cage culture. This explains such short feeding times in this village and why women tend to spend longer each day looking after the cages than men. The NGO estimates that, for this reason, combined with others such as water body scarcity and multi-ownership, “cage culture is negligible here”. However, in this village as in the other two, women spend on average longer feeding the fish and looking after the cages than their male counterparts:

	Man	Woman
Village 1	42 min/day	1hr30min/day
Village 2	5 min/day	15 min/day
Village 3	1hr30min/day	1hr40min/day

Regarding the division of labour, similar patterns to those observable in the Dhaka and Sylhet areas are observable here. Seeds are collected by males (husband, son), feed is prepared by women, with the help of their husbands (when these are cage operators) and children occasionally, and the marketing of fish is carried out by males (brother, son) or hired people for a female cage operator. It seems however that the harvesting task is shared more equitably between men and women in this area than in the other areas previously studied. Unfortunately, no information was provided by the respondents on the feed preparation and/or collection. However, given that the overall pattern of distribution of tasks is broadly similar to the ones found in the Dhaka and Sylhet areas, it may be expected that this task would be carried out by women and children predominantly.

*Cage culture opportunity costs (time and money) and effects on other activities:*

As in the other villages visited, all participants judged cage aquaculture as a positive use of their time, money and energy, and as not having any detrimental effects on HH activities, but also never failed to mention some of its time and financial opportunity costs.

A summary of opportunity costs felt by the each of the HH respondents is provided below (Table C22), without distinction between villages.

Table C22: Ranking, by frequency of occurrence in the respondents’ answers, of the time and financial opportunity costs of cage culture felt by male and female respondents in the Comilla region.

Time opportunity cost		Financial opportunity cost	
Men	Women	Men	Women
Leisure time: 3	HH work: 6	HH purpose: 3	HH purpose: 3
Business purpose: 2	Leisure time: 2	Small business: 3	Purchase chickens (poultry): 3
Studies: 2	Sewing: 1	Study: 1	House hotel purpose: 1
HH work: 2	Study: 1	Fish culture in pond: 1	Business: 1
Agriculture: 1	Poultry rearing: 1		Other works: 1
			Goat rearing: 1

The major time opportunity cost for women bears on their HH works and maintenance. Male answers however show the importance of the current involvement of some of them in other professional activities (business activities of all sorts). But interestingly and quite unexpectedly, if women had the money invested in cage culture in hand, most of them would also carry out “business” activities, indirectly referred to as “house hotel”, poultry rearing activities. This may suggest that women in this area are more in control of their lives and finances, hence more able and independent in their choices of activities. This may also mean that cage aquaculture may be considered by them as a transitional activity used to achieve their personal aims, which, in a way, would go beyond the defined purpose of the introduction of cage farming to deprived groups.

Leisure time as well as educational time were cited to be encroached upon more frequently by males than females, reflecting the social and cultural roles of both sexes.

So it is found that cage aquaculture bears opportunity costs on other HH or professional activities, but these are different in nature for men and women. Information collected does not give any estimates of the scale of the opportunity costs (both time and financial) on the activities mentioned. It will be interesting to monitor the financial results brought to cage operators in the longer to verify the

importance of cage culture compared to other income generating activities, in particular for women, and to check if the activity is maintained or simply used as short term IGA.

*Plans for next year:*

*Village 1*

Table C23: Respondents' answers regarding their cage aquaculture plans for the next season in Village 1, Comilla region.

Households	Current number of cages and species	Plans for next year	+/- cages
HH1			
Female (c.o.) <i>Farida</i>	1 cage of 8m <sup>3</sup> with tilapia.	Plans to set another 2 cages if they are provided free of charge by the NGO, otherwise only 1.	+ 2 (or +1)
Male (non-c.o. but helps his wife a lot)	(Same)	Plans to set two more cages if difficulties do not arise.	Same
HH2			
Female (c.o.) <i>Khairunnahar</i>	1 cage of 8m <sup>3</sup> with tilapia and pangas. Due to winter, she released the pangas in the pond.	She will set one cage with tilapia or pangas. She will not increase the number of cages because it is a small pond	+ 0
Male (c.o.)	1 cage of 8m <sup>3</sup> with pangas.	Keep one cage with pangas.	+ 0

*Village 2*

Table C24: Respondents' answers regarding their cage aquaculture plans for the next season in Village 2, Comilla region.

Households	Current number of cages and species	Plans for next year	+/- cages
HH1			
Male (c.o.)	1 cage of 1m <sup>3</sup> and 1 cage of 8m <sup>3</sup> with tilapia (GIFT) and pangas	He has a plan to set 20 cages	+ 18
HH2			
Female (c.o.)	1 cage of 8m <sup>3</sup> with tilapia	Plans to keep one cage with tilapia.	+ 0
Male (c.o.)	1 cage of 8m <sup>3</sup> with tilapia	He will expend or not depending on the situation	?
HH3			
Female (c.o.)	1 cage of 1m <sup>3</sup> and 1 cage of 8m <sup>3</sup> with tilapia and pangas	Hope to set three cages with pangas and tilapia.	+ 1
Female (c.o.)	1 cage of 8m <sup>3</sup> with tilapia	Two more cages will be set if good quality net is provided	+ 2

*Village 3*

Table C25: Respondents' answers regarding their cage aquaculture plans for the next season in Village 3, Comilla region.

Households	Current number of cages and species	Plans for next year	+/- cages
HH1			
Female (c.o.) <i>Rabeya</i>	2 cages of 1m <sup>3</sup> with sarputi and tilapia	Plans to set 3 cages with tilapia and sarputi	+ 1
Male (c.o.)	He had 1 cage of 8m <sup>3</sup> with sarputi last year ( <i>he is not cultivating this year</i> ).	He'll plan to have 2 cages	+ 1
HH2			
Female (c.o.)	2 cages of 1m <sup>3</sup> with sarputi and tilapia	Plans to set 4 cages with tilapia and sarputi	+ 2
Male (c.o.)	2 cages of 1m <sup>3</sup> with sarputi and tilapia	Same	+ 2

HH3			
Female (c.o.)	2 cages of 1m <sup>3</sup> with sarputi and tilapia	Plans 4 cages of 1m <sup>3</sup> with sarputi and tilapia	+ 2
Male (c.o.) <i>Mannan</i>	2 cages of 1m <sup>3</sup> with sarputi and tilapia	Same	+ 2

Most of the cage operators are modest in the increase of number cages they are willing to operate. If approximately two cages is the number by which cage operators intend their current number of cages, some of them expressed reserves regarding the conditions in which this would happen (e.g. cage provided by the NGO free of charge) and reflecting disappointments that may have happened to them during the previous (or present) culture cycle (e.g. crab cutting). External conditions such as pond size, more than performance in cage culture, are also determining the number of cages to be farmed. However, it is interesting to point out that the cage operator willing to increase his number of cages by 18 for the growth cycle used GIFT tilapia. If GIFT tilapia would perform just as well Nile tilapia, *Oreochromis niloticus*, the most dominant and widespread tilapia species in Bangladesh is Mozambique tilapia, *Oreochromis mozambicus*, weaker in nature than *O. niloticus* (K. McAndrew, pers.com. 1998). Apart from independent and external factors affecting negatively cage operators production in this area, there is little doubt that a strong strain of fish will contribute to a better performance, which explains the high enthusiasm and motivation of this cage operator. There may be two potential reasons behind the fact that the species to be farmed from one cycle to the other tend to remain the same for cage operators. One may be that cage operators feel more confident carrying on cultivating species for which they have a bit of experience, and, as this activity is still risky in nature, they do not want (or financially cannot afford) to take inconsiderate risks. The second factor may be related to the availability of certain species in certain areas.

Objective 3: To determine the various factors that may influence the role of women in cage culture (ex. social status, wealth, distance from water body, access, education, religion, others?).

#### *Village 1*

There are 2 ponds used for cage culture in this village. The larger one has 5 owners and is shared between them and some outsiders. Among the 5 owners, 2 have cages. The smaller is individually owned by one of the female cage operators. The NGO staff mentioned that “at first, operators faced difficulties to get access to the shared pond, but later, they solved [this problem] and set their cages [in the pond]”. Therefore access to the water body has been a problem for some cage operators, *a fortiori* female cage operators. It was also thought that individual ownership of pond was an advantage for succeeding in cage culture. According to the maps drawn by the interest groups, ponds are located in the centre of the village and distance from the water body was never mentioned (neither by male nor by female cage operators) as a hindrance to do cage culture. In addition, the NGO staff indicated that women are involved in cage culture in this area and are used to doing field work. Indeed, the Comilla region is not religiously conservative and women are allowed to go out of their houses to carry out outside activities. The cultural context in which they live is therefore less strict than, for example, in the Sylhet area and enable women to participate more actively in aquaculture activities. However, as in the Dhaka area, they will not go out to the market place to sell their fish (this remains a male task – Survey 2, Objective 2). It was found in Survey 1, Objective 1 that women are very aware of the technical aspects of cage culture and thus do not lack access to this type of information which, in turn, enables them to take initiatives in the farming of fish. The two females interviewed were from different socio-economic backgrounds and both well involved in cage culture. This may suggest that wealth is not a factor determining the involvement of women in cage culture.

#### *Village 2*

22 persons have the ownership of the pond used for cage culture in this village. Among them, 4 are cage operators and 7 cages in total are sitting in the pond. No outsiders are allowed to use this pond, which is a holdback for individuals (both males and females) willing to start cage culture. The pond is surrounded by houses, in the centre of the village, and of easy physical access to every cage operators. NGO staff mentioned that women were not facing any holdbacks for their involvement in cage culture. As in village 1, female cage operators are from various socio-economic backgrounds which may suggest again that wealth and status are not factors conditioning their involvement in cage culture. Interestingly however, 2 female cage operators out of the 3 interviewed are currently studying (one of them is from a relatively modest background: no particular sign of wealth in the house, many brothers and sisters etc.). This may suggest that, to some extent, education, by triggering interest and curiosity,

may be an inciting factor to start cage culture. As was already mentioned for village 1, religion and its practice are not as dominant as in the Sylhet area and therefore, are not a major hindrance to the involvement of women in cage culture. However, there seems to be still a long way to go before women go and sell their fish to the market place themselves.

### *Village 3*

Cages are located in a government-owned river with free access to any water users. There are several women doing cage culture in this village. As shown on the maps, there are houses along the bank at the proximity of the cages location. However, as the village was not visited, it is unclear whether cage operators live in these houses or further, in the centre of the village. However, distance from the water body was not mentioned by women as a problem to do cage culture. All women involved appear to be of marginal wealth judging from the brief description of items encountered in the household, which seems to indicate that wealth or status are not conditioning the involvement and success of females in doing cage culture. As seen in Survey 1, Objective 1, women are well informed and aware of the technical aspects of cage culture, and are able to indicate coherent market prices for their fish. Access to technical knowledge is not hindering factor either as gender differences in accessing information do seem to occur in this area.

A problem occurred in this village with a fundamentalist group poached fish. Although only the NGO's cages were targeted, they were located near the farmers' cages, and stolen all together. By targeting development organisations because of their opposition to the values promoted by them, fundamentalist groups may render the positive outcomes of cage culture more aleatory. Many participants whose cages were poached felt very "demoralised".

### Objective 4: To determine whether the involvement of women in cage culture (as cage operator or wife of a cage operator) contributes changes to their social status.

It is difficult to draw conclusions for this objective as the only answer obtained for the question "how has cage aquaculture affected the status of your household within the community?" is "positive" (for both men and women). One may nevertheless expect that, given the degree of autonomy women have in this area, their involvement as cage operators would, in the longer run, contribute to the recognition of their entrepreneurial and managerial skills. As cage operators' wives, they may indirectly obtain the knowledge necessary, incentives, and eventually confidence to start cage culture on their own.

## **Survey 3: The impact of cage aquaculture at the community level.**

### Objective 1: To identify if community members (incl. cage operators and non-cage operators) feel some changes have occurred in their daily activities since the implementation of cage culture.

#### *Village 1:*

The pond under multiple ownership is used for:

- irrigating the nearby vegetable garden,
- washing clothes and utensils,
- bathing (human and cattle)
- culture of fish in pond and in cage.

Children observed that "previously, [pond] owners cultured fish in the pond. Now, in addition, they also do cage culture". However, the male group (non-cage operators) commented that it has become difficult to "catch fish by nets due to the presence of cages in the pond. It is easy to poach cage fish. Due to the high density of fish in cages, fish mortality occurred". It is therefore likely that non-cage operators willing to carry on rearing fish in the pond had to adapt their catching methods. However, women non-cage operators also said that "fish in the pond are getting feed from the cage". Women non-cage operators indicated the place where cattle bathe, in the opposite corner of the cage location. Whether cage siting was decided according to the cattle bathing point or vice-versa remains unknown. Male on-cage operators also indicated that there were "no changes of the daily use of the pond".

The individually owned pond was left empty before being used for cage culture. Now it is also used for washing the dishes and irrigation purposes.

Other comments from women non-cage operators included: "many of the villagers are interested to do cage culture but they have no pond" (which corroborates the fact that access to a water body is the main constraint to cage culture in this village) and "some are not interested to start cage culture because they observed that lots of fish died".

All map features drawn by respondents have been reproduced in Figure C1 presented at the end of Survey 3 to illustrate water body uses and location.

#### *Village 2:*

The pond in which cage culture is practised is owned and used by 25 families. Among these 4 are operating cages. Before the introduction of cage culture, the pond was used for pond fish culture. These 25 family members constitute the Mosque Committee who carries out pond culture. Money earned from pond fish culture is therefore used for repairing and maintaining the mosque. If some of the cage operators' fish escape into the pond, they will then need permission from the Mosque Committee to catch them and use them for their own profit. No outsiders (i.e. non-pond owners) are allowed to use the pond.

Its various uses include:

- washing utensils, "wash hand and mouth"
- culture of fish in pond and cages
- occasionally irrigation
- cattle bathing

According to the cage operators group, the place which is presently occupied by cages was vacant and unused before and there have been no changes in the water quality due to the presence of the cages in the pond. In contrary, the feed lost from the cages is "an extra source of feed for pond fish" and, because of the feed, "fish from the pond gather near the cage and it is easy to catch them".

Female non-cage operators group observed that a few years ago, cattle used to bathe in the pond all the time "but now it is reduced due to the caution of health", which implies that the presence of cages in the pond has certainly contributed to the fact that cattle do not bathe as much as it used to in the pond. They added that they use tube well water for most of their household works and that they sometimes use tube well water for bathing purposes, which complements the cage operators comment that washing and bathing take place less frequently in the pond now than before. Women also explained that once or twice a year, they catch fish from the pond. During this time, they shift the cages in a corner of the pond to enable the fishing to take place. The presence of the cages adds therefore an extra operation, but this did not seem to be considered as a nuisance.

Other comments on the advantages of cage culture included:

- "at the first time of starting cage culture, some neighbours teased cage operators, but they started cage culture later".
- "cage culture is a profitable business and extra source of income". Its advantages are "it is easy to entertain the guests, easy to catch and sell the fish".

All map features drawn by respondents have been reproduced in Figure C2 at the end of Survey 3 to illustrate water body uses and location.

#### *Village 3:*

The river is government-owned and there is open access to water users.

Various uses include:

- fish catching using different sorts of traps (*kathas* are made from October to January). Sometimes the government uses the river for fishing, especially at the end of the monsoon period,
- navigation and boating,
- washing, cleaning,
- bathing,
- duck farming,
- irrigation for paddy, mustard, wheat, jute and pulse,
- collection of cattle feed,
- cage culture (4 cage operators have 10 cages in the river).

Water is widely available in the river from May to September. Cage culture takes place from June to September. According to the children, before cage culture was implemented in the river, the place was unused, and this is why cage culture is not creating any changes nor problems. However, women (both cage and non-cage operators) commented that "before starting cage culture, the river was used for boating, but now boatmen row their boat in a different way". Cages are located behind a 'channel' of water hyacinths dumped here to protect them from tidal waves which last year destroyed the cages and because "the fish can feel disturbed [by the waves]" (women's comment). Beyond water hyacinths are fishermen's *kathas* and the navigation channel (see map). This suggests that the river space occupied by the cages is doubly encroaching on the river width due to the water hyacinths protection, and this

considerably reduces the navigation and fishing channels. The presence of cages in the river has however not brought any changes in the women's lives since they affirmed that they usually use tube well and pond water instead of river water for household use.

Other positive comments on cage culture included:

- "At first, we thought that cage culture was a non-profitable project" (from fishermen's group).
- "Most of the time, women feed the fish but we do not face any problem. A bamboo bridge is used for feeding purpose" (from women's group).
- "It looks beautiful with the cages. People feel encouragement when they cross the river to see the cages and also show interest in a new thing like cage culture" (from children's group).
- "People who have cages, they catch fish from the river and put them in empty cages. After one month of rearing, they sell their fish for any special occasion like marriage or religious festival" (from children's group).

All map features drawn by respondents have been reproduced in Figure C3 found at the end of Survey 3 to illustrate water body uses and location.

#### Objective 2: To identify conflicts that may have emerged since the implementation of cage culture.

##### *Village 1:*

No conflicts as such have emerged due to cage culture and male non-cage operators said that "no difficulties arise due to cage culture", confirmed by the children group and the female non-cage operators group ("the water body users did not face any problem due to cage culture". However, NGO staff indicated that the multi-ownership of the pond had created frictions between owners when cage culture was first implemented in the village. They also added that: "the community people feel jealous among themselves". The reason for this jealousy was not stated but cross information from the community meeting, the mapping exercises and individual interviews suggest that it may be between those who have access to a water body and those who don't, in particular now that people have realised the potential of cage culture. This is likely to explain the fears of poaching and the devices set around the pond to prevent theft.

In addition, as the male group of non-cage operators noted, it has become difficult to catch pond fish because of the presence of cages in the pond. If the number of cages was to increase, thereby reducing the available volume for pond culture, conflicts between cage operators and pond farmers may start to emerge. However, cage operators were aware of the lack of water body space and modest in their ambitions for next year (Survey 2, Objective 2). Thus if the number of cages in the pond remains the same, the potential for conflicts arising between cage operators, pond farmers and cattle owners may remain limited.

##### *Village 2:*

Information related to the existence of conflicts is contradictory. On one hand the NGO stated there were no conflicts in spite of cage operators facing water scarcity problems and multiple ownership of the water body they are using. Cage operators also mentioned that "there is no jealousy between the cage owners and the pond owners". On the other hand, the group of male non-cage operators said that some people had cut the cages nets as revenge. Women non-cage operators also underlined the existing tensions: "if all the owners want to install cages in their pond, they can, but due to the lack of security, they do not want to do it". In addition, non-cage operators complained about the difficulty to catch fish with their nets because of the cages in the pond.

These 'conflicting' comments suggest that conflicts are underlying but have not broken out yet because some stakeholders are more aware of them than others. The other reason may be that the changes observed are still at the stage of 'bearable nuisances' and are not strong enough to be denounced openly.

##### *Village 3:*

All cages were poached and/or stolen by a fundamentalist group who targeted one of the NGO staff's cages which were in the same location as the villagers' cages. However, CARE/CAGES staff indicated that this was an incident and was not the reflection of open conflicts existing between water users (Yesmin, pers. com.). If abstraction is made of this unfortunate event, Objective 1 suggested that the main change that has occurred relates to the river space occupation by all activities. No boatmen participated in the community meeting, therefore the picture of possible conflicts arising over the use of the water body is incomplete. NGO staff mentioned that "there was no conflict between the water body users". Children nevertheless mentioned that "if in the future more cages are installed in this



water body, there will be no problem because the water body is not captured by an individual person. It is government property. But the poaching possibility will be increased because of the benefits [of cage culture]”. However, women also added that those whose houses are located along the river bank are mainly those who have cages and that, if they face difficulties due to the overcrowding of the river, they will shift them into ponds as most of them have also ponds. These comments suggest that, in comparison to the other 2 villages of the Comilla district using ponds, the use of a wide, open access and public water body has the potential to reduce the likeliness of conflict occurrence. The fact that cage operators also own ponds and have the option to shift their cages in them if difficulties arise is an additional factor to avoid conflicts between water users.

Objective 3: If relevant, to identify which regulation mechanisms have been implemented by the community to mitigate any possible negative impacts or problems/difficulties due to cage culture.

*Village 1:*

The first type of conflict (between pond owners over shared access to the pond) was openly debated and solved to enable cage operators set their cages in the pond. However, the second type of conflict faced in this village (jealousy between community members over pond ownership) is still underlying and nothing has been done to discuss the problem. However, given the nature of the issue, it may be optimistic to hope that changes are brought to the ownership status of the pond.

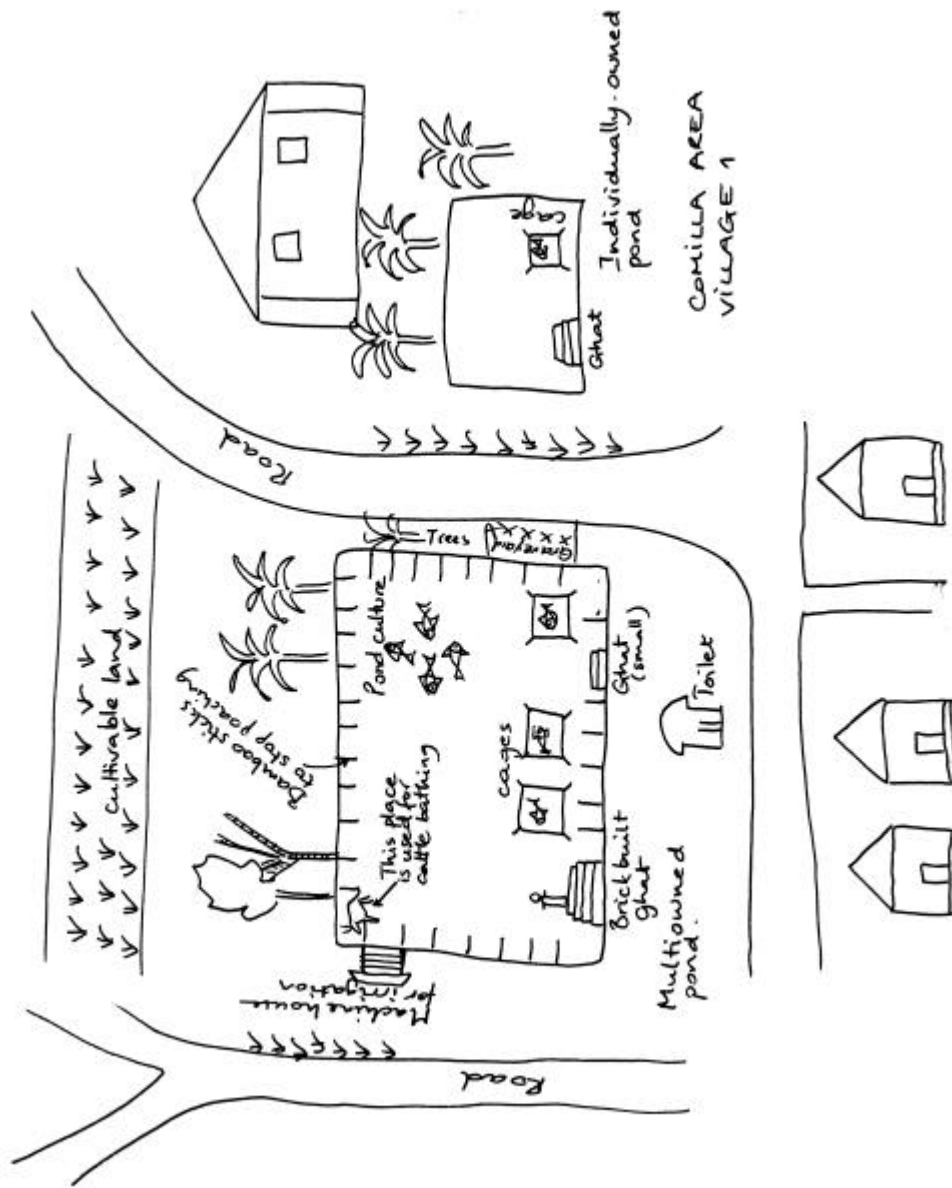
*Village 2:*

Some nuisances are felt more strongly by some of members of the community than by others but are still bearable which may explain why conflicts have not openly arisen. There has therefore been no ‘conflict resolution mechanisms’ set, nor ‘conflict prevention mechanisms’ designed either.

*Village 3:*

No conflict have arisen in this community over the use of the river, therefore no conflict resolution mechanisms have been envisaged.

Figure C1: Mapping exercise in Village 1 (Parishal Para), Comilla region.



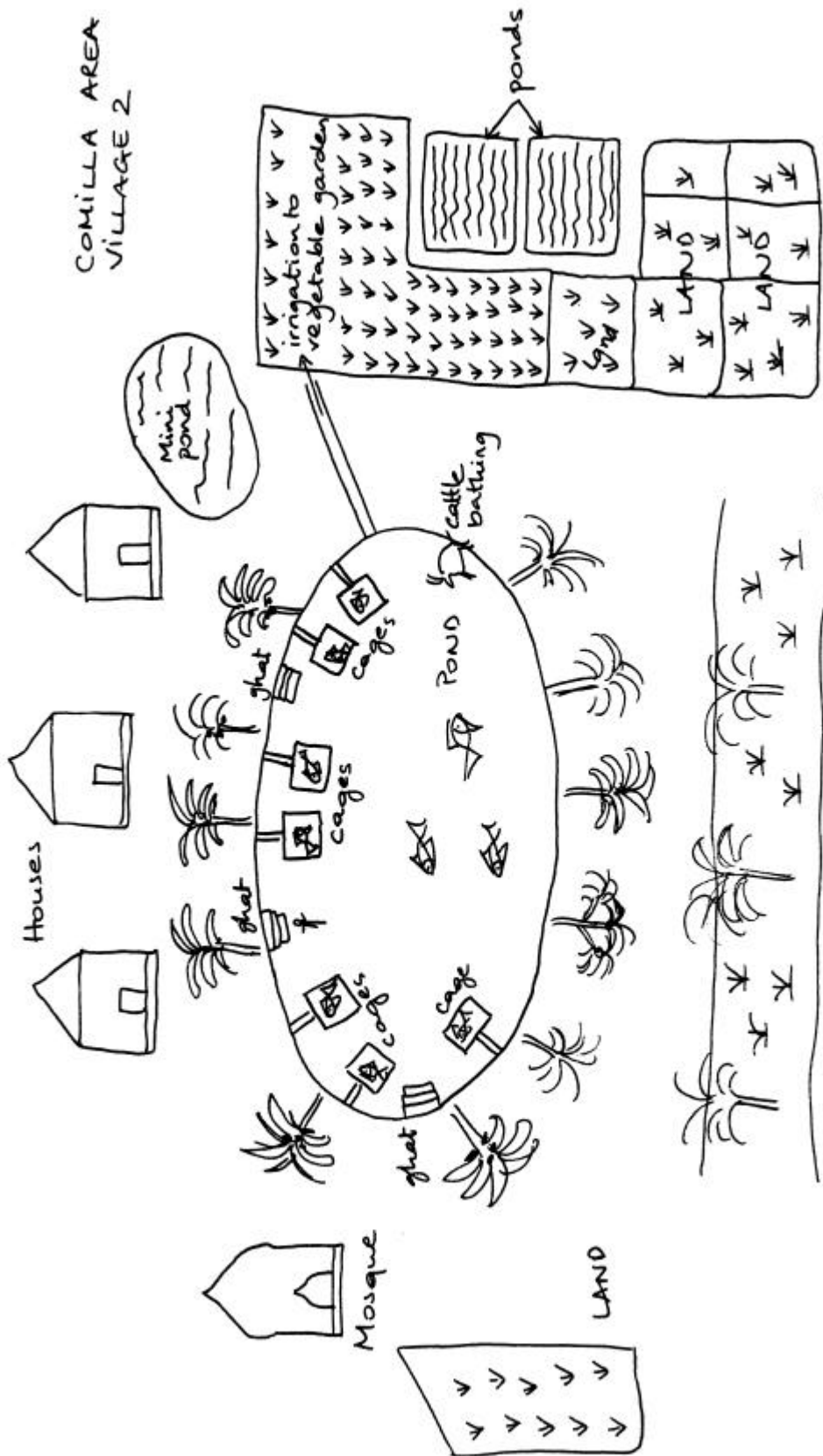
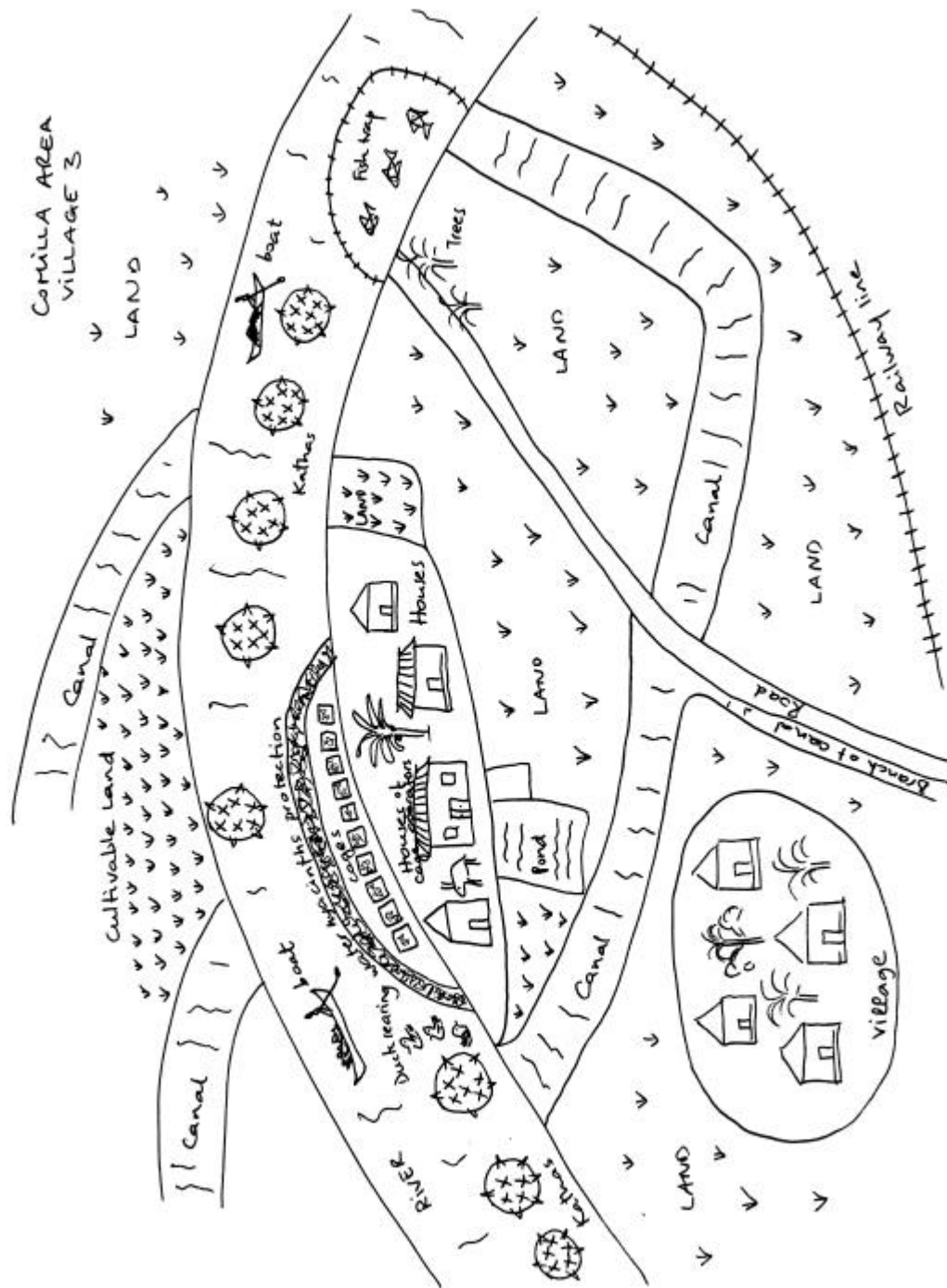


Figure C2: Mapping exercise in Village 2 (Durgapur), Comilla region.

Figure C3: Mapping exercise in Village 3 (Chandi), Comilla region.



### 3.4 BARISHAL REGION

Villages visited and people interviewed in the selected household included:

“Village 1”:	South Sialkathi	“Household 1”:	Mr. Ananta Kumer Gorami and his wife Jarna Rani	
	Union: Nathmulla	“Household 2”:	Mrs. Anju Mistry and her mother-in-law Shefali Mistry	
	Sialkathi	“Household 3”:	Mrs. Arati Rani Gorami and her cousin-in-law Mr. Palash Ch. Gorami.	
“Village 2”:	Thana: Bhandaria	“Household 1”:	Mr. Polin Bihari Halder and his wife Sova Rani	
	District: Pirojpur		“Household 2”:	Mr. Abani Mohan Mondle and his wife Niba Rani
			“Household 3”:	Mr. Md. Mokshed Ali Monshi and his wife Kamrun Na har Labani.
“Village 3”:	North Sialkathi	“Household 1”:	Mr. Jatindra Nath Mondle and his wife Renu Kanan.	
	Union: Vitabaria	“Household 2”:	Mr. Sumil Ch. Bepairand and his wife Malati	
	Thana: Bhandaria	“Household 3”:	Mrs. Anjali Rani Edber and her mother-in-law Shilpi Edber	
	District: Pirojpur			

Fieldwork was carried out on the 12, 13 and 14 January 1999.

### **Survey 1: Reasons for HH cage operators’ dropout or continuation of cage aquaculture.**

Objective 1: To identify the factors responsible for the cage operator’s dropout or continuation, and see if these reasons are similar for both men and women cage operators.

According to CAGES staff, in all three villages visited:

HH1: less successful

HH2: medium successful

HH3: very successful.

#### *Village 1*

Table B1: Perception of performance in cage aquaculture, reasons for success and difficulties perceived by cage operators and their household members in Village 1, Barishal region.

	<i>Perception of Success/failure</i>	<i>Reasons for success</i>	<i>Reasons for difficulties</i>
HH1			
Female (c.o.)	It is good (1 <sup>st</sup> year of culture)	Arati is the most successful because sunlight was high on her pond.	Initial mortality, water deterioration
Male (c.o.)	It is profitable.	He’s not seen others cages. Does not compare farmers.	Found no problem. People demanded cages.
HH2			
Female (c.o.) <i>Anju</i>	It is good though fish mortality occurred, after they were in control. She’s doing as well as Arati.	They don’t share the growth performance among themselves.	Only fish mortality occurred.
Female <i>Anju’s mother in law</i>	Good growth	She’s not observed other fish	No idea

continued

HH3			
Female (c.o.) <i>Arati</i>	Some difficulties faced. After that no problem. She's the most successful	?	Mainly stocking mortality occurred
Male <i>Arati's cousin in law</i>	People are more interested, they want cages. Their fish growth is the highest.	They stocked first. They have a higher number of family members, so the fish growth is higher than others because they can take more care.	They did not face any difficulties

### Village 2

Table B2: Perception of performance in cage aquaculture, reasons for success and difficulties perceived by cage operators and their household members in Village 2, Barishal region.

	<i>Perception of Success/failure</i>	<i>Reasons for success</i>	<i>Reasons for difficulties</i>
HH1			
Female (c. o.)	No success (1 <sup>st</sup> year of culture)	Not shared among farmers	No difficulties in group
Male	1 <sup>st</sup> year of culture.	Abani is the most successful because he takes more care, feeds duckweed.	Space of fish is limited so large size cage is needed
HH2			
Female (c.o.)	1st time growth is good but winter growth is less.	Not shared with others	No problem
Male (c.o.)	It is profitable. Should stock earlier and supply quality feed.	Abani is the most successful. He takes care of pond, e.g. timely liming, maintain water quality	There was stocking mortality.
HH3			
Female	Profitable business like other business	Not shared with other cage operators	No idea
Male (c.o.)	We are successful. Need to stock more fish which may make more profit.	Abani maybe is the most successful, but not shared with other farmers. Large size cage is good.	Some fish escaped from cage in flood period through cage feeding mouth.

### Village 3

Table B3: Perception of performance in cage aquaculture, reasons for success and difficulties perceived by cage operators and their household members in Village 3, Barishal region.

	<i>Perception of Success/failure</i>	<i>Reasons for success</i>	<i>Reasons for difficulties</i>
HH1			
Female (c. o.)	She's aware that mirror carp and silver barb do not grow well. Tilapia grows well.	Anjali is the most successful, because tilapia grows faster than mirror carp in cage.	Last year Anjali's cage was stolen.
Male	Not so successful. Should stock earlier.	Anjali is the most successful. She takes more care of fish	Last year poaching happened to other cages. So they protect the fish strictly.
HH2			
Female (c.o.)	Failure. Feed given to the minimum.	Anjali is the most successful. She can give more time	Poaching of Anjali's cage last year.
Male (c.o.)	No profit made this year. If he gets chance, maybe he'll be more successful in future	Anjali is experienced and takes more care.	This year, no problem. Last year Anjali's cage was stolen. There was a Union parishad election campaign. People saw the fish. After 2 days, cage was stolen.

continued

HH3			
Female (c.o.) <i>Anjali</i>	Successful. Better than last year. Using last year's experience, she's able to produce more fish	She is the most successful. She takes more care than others. She's applying last year's experience.	Poaching last year. This year problem on: - getting feed - stocking mortality.
Female <i>Anjali's mother in law</i>	Not successful	Anjali is the most successful. She takes more care.	Flood affected fish: some died, some escaped.

Gender differences between the perceived reasons for success and difficulties are highlighted and summarised in Table B4 below.

Table B4: Summary of the perceived reasons for success and difficulties and their frequency of occurrence in the respondents' answers in the Barishal region.

Women		Men	
Reasons for success	Reasons for difficulties	Reasons for success	Reasons for difficulties
Take more care: 2	Initial mortality: 4	Take more care: 4	Poaching (last year): 2
Sunlight high on pond: 1	Cage theft (last year): 3	Stocked first: 1	No difficulties: 2
Tilapia culture: 1	No difficulties: 2	Feed duckweed: 1	Stocking mortality: 1
Spend more time: 1	Water deterioration: 1	Look after pond (good water quality + timely liming): 1	Escapees during flood: 1
Experience: 1	Getting feed (this year): 1	Large cage: 1	Small cage"
	Escapees and death during flood: 1	Protect fish against poachers: 1	
		Experience: 1	
Do not share with other cage operators: 4		Do not share with other cage operators: 2	

The fact that cage operators do not seem to share their results and difficulties among each other has not been encountered in the other regions surveyed. In particular in village 1, it was difficult to obtain information on which factors cage operators and their wives thought as contributing to successful cage culture. According to the NGO staff, they did not face any particular problem because "they do not use snail and rotten food for fish. They also use tube well water and they have individual ponds". However, they also indicated that the small size of the ponds in which cage culture is practised is problematic (which was not mentioned as a difficulty by the cage operators themselves). All cage operators interviewed from village 1 faced an initial problem of stocking mortality, which was confirmed by the NGO staff: "they are facing problems of fingerling availability and stocking due to the high temperature and the poor quality of local fingerlings". It was mentioned during the community meeting that the growth performance was poor due to:

- "late stocking,
- the water quality deteriorated because of the protection from the tidal water (connecting canals are closed during the rainy season, so tidal water cannot enter the pond),
- the depth of the water in ponds was reduced and did not allow to set cages,
- decomposition occurred at the bottom of the pond,
- in some cases, feeding was not done properly".

Similarly in village 2, not much information is shared between cage operators but it was mainly recognised by those who answered that more care of both cage fish and pond (i.e. the fish environment) were important in growing fish successfully. The NGO added that "at first [cage operators] faced suitable sized fingerling availability and fingerling transportation problems". In addition, most of them lost fish during last monsoon as they escaped from the cages. During the community meeting held in this village, participants commented on some of the difficulties they faced last year:

- unavailability of fingerlings,
- lower number of cages so "all interested people did not get a cage",
- late stocking of fish ('*Falgon*' (February-March) is a suitable period for the stocking of fingerlings).

Participants also observed that fixed cages were not appropriate to their circumstances as they are difficult to wash and impossible to move when required.

In village 3, the poaching of some cages during the first year of culture was an important problem and was mentioned the most frequently by respondents. In addition to escapees due to the 1998 floods, one cage was completely damaged and two others were partially damaged. According to the NGO, problems in this village relate to fingerling scarcity and small pond size with a fluctuating water level

(“the size of ponds is small, that is why there is less water in the winter and as a result cage culture is disturbed”). During the community meeting, some participants commented that they were interested to start cage culture but were not able to because of a shortage of cages. Even after observing cage operators’ difficulties, they are still willing to start cage culture. In this village, people involved directly and indirectly in cage culture share with each other more than in the previous two villages and recognise that time and care dedicated to cage culture along with a year experience are the most important reasons for success.

From what can be observed in the above table, care is indeed the priority factor for both men and women, although cited more often by males. Females seemed to have observed an initial mortality of fish more often than males, but this is the only major difference that may be noted between genders.

*Feeds available:*

In all three villages, both NGO and cage operators collect and purchase feed. Although the NGO pays for most of the higher feeds used and bought from the market, cage operators contribute from time to time. Collected natural and household feeds are the feeds the most commonly used by cage operators.

<u>Provided by cage operators (collected + HH by-products)</u>	<u>Provided by NGO</u>
Duckweed, broken rice, rice, rice water, leaves, HH waste, poultry waste, snails, earth worms, cow dung with soil, water hyacinths.	Oil cake, rice bran, dry fish, ata, wheat bran, molasses

Ata is not available at the local market, which explains why it is provided by the NGO.

The NGO in charge of village 3 provided more information on the various types of feeds used by farmers:

- snails are only available during the monsoon period,
- duckweed is less available in the winter.

Market prices for ‘higher’ feeds are:

- dried fish                      30Tk/kg
- ata and purified ata        15Tk/kg
- wheat bran                    8Tk/kg
- oil cake                        8Tk/kg
- rice bran                       2-3Tk’kg

*Relationship between success through ‘good feed’ and wealth:*

Table B5: Relationship between success through ‘good feed’ and wealth in Village 1, Barishal region.

	<i>Wealth</i>	<i>Level of success</i>	<i>Lower/‘home’ feed</i>	<i>Higher/purchased feed</i>	<i>Species</i>
HH1 (female) c.o.	Rich	Low	rice	Wheat bran, mustard oil cake, excess cake	Tilapia + sarputi
HH1 (male)	Rich	Low	Broken rice, rice	Mustard oil cake	same
HH2 (female)	Medium high	Medium	Cooked rice	Wheat bran, MOC, prepared feed (with machine supplied by NGO)	Tilapia, sarputi
HH2 (female) c.o.	Medium high	Medium	?	?	same
HH3 (female) c.o.	Rich	High	Poi shak	Wheat bran, rice bran, dried fish, poultry feed (supplied by BRAC)	Tilapia + silver carp
HH3 (male)	Rich	High	Different types of natural feeds, broken rice	Wheat bran, poultry feed	same



Table B6: Relationship between success through ‘good feed’ and wealth in Village 2, Barishal region.

	<i>Wealth</i>	<i>Level of success</i>	<i>Lower/‘home’ feeds</i>	<i>Higher/purchased feeds</i>	<i>Species</i>
HH1 (female) c.o.	Poor	Low	Poi shak, rice, cow dung	MOC, wheat bran, rice bran, dried fish	Tilapia
HH1 (male)	Poor	Low	-	MOC, wheat bran, rice bran, dried fish	same
HH2 (female) c.o.	Richer	Medium	Rice	Snails, MOC, rice bran.	Tilapia + koi
HH2 (male) c.o.	richer	Medium	Rice, Chitagur, poi shak.	MOC, rice bran, dried fish, snails, duckweed	same
HH3 (female)	Medium	High	-	Rice bran, MOC, snails, wheat bran, duckweed	Tilapia, sarputi + koi
HH3 (male) c.o.	Medium	High	Duckweed, broken rice	MOC, wheat bran, ata, snails, earth worms	same

Table B7: Relationship between success through ‘good feed’ and wealth in Village 6, Barishal region.

	<i>Wealth</i>	<i>Level of success</i>	<i>Lower/‘home’ feeds</i>	<i>Higher/purchased feeds</i>	<i>Species</i>
HH1 (female) c.o.	Medium	Low	Poi shak, flour	MOC, wheat bran, rice bran, duckweed	Mirror carp
HH1 (male)	Medium	Low	Flour, wastage	Wheat bran, dried fish, duckweed	same
HH2 (female) c.o.	Richer (land)	Medium	Poi shak, rice, boiled rice water	Rice bran, wheat bran, MOC, duckweed	Sarputi + tilapia
HH2 (male) c.o.	Richer (land)	Medium	Broken rice, poi shak, boiled rice water, leaves of different trees	Rice bran, MOC, dried fish, duckweed	Same
HH3 (female) c.o.	Poorer	High	Cow dung, broken rice, poi shak, flour	MOC, rice bran, ata, duckweed	Tilapia
HH3 (female)	richer	High	Doesn’t know very well.	Rice bran, MOC, wheat bran, Duckweed Doesn’t know very well.	Tilapia + sarputi

There does not seem to be any obvious trends between farmers’ wealth and the feed they can afford with their actual level of success. It also has to be born in mind that the species selected in relation to the diet they are fed is of high importance for the farmers’ success. However, the appropriateness of feeds to species cultivated also needs to be taken into consideration. In village 2, the feeding regimes and species cultivated are similar for all 3 households, although each is experiencing a different level of success. For example, HH1 is poorer than the other two households but still able to use purchased feeds. However it faces low success: is this due to a problem of application, of knowledge? It was seen in the above analysis that information is not shared between farmers (cage operators and their families) which may contribute to the lower results they are obtaining, in spite of using richer feeds.

In village 3, all feeding regimes are similar for the three households. It may be possible that the lower results experienced by HH3 are due to the species cultivated (grass carp) although this would have to be confirmed by an aquaculture expert. Independently of their level of wealth, respondents feed their fish with a more balanced diet in this village than in the other two, and this seems to be resulting in higher results, apart for HH1 who cultivates a different species.

Comparison between the success of male and female cage operators and the feed they are using:

Female cage op.: success level

Low = 3 (37.5%)  
 Medium = 3 (37.5%)  
 High = 2 (25%)

Male cage op.: success level

Low = 0  
 Medium = 2 (66%)  
 High = 1 (34%)

As in the other regions, it may be observed here again that female cage operators are in absolute less successful than their male counterparts at cage aquaculture. If it is assumed that a balanced diet is a key feature in the successful rearing of fish, the lower success of female cage operators is all the more

surprising as they are using a higher number of different types of purchased feeds than male cage operators (7 against 5). This may be a sign that women are not constricted to their house and can access feeds found at the market place, although no specific information was provided regarding them going to the market place by themselves.

The analysis of the possible relationship between wealth and success through the use of higher feeds, as well as between female cage operators' success and the feeds they are using, as carried out in the other regions studied, does not allow any general conclusions. Indeed, it appears that every village and household are very specific and that a valid explanation behind success or failure of a household is not valid for all the village households involved in cage culture.

Objective 2: To highlight the cage operator's perception of success or failure in cage aquaculture and the impact of the activity on his/her HH (or personal) status.

*Personal perception of success and failure:*

Perception of performance by cage operators and their relatives was presented in Objective 1. Globally, the respondents' perception matches information on level of success provided by CAGES staff and their opinion appears objective. In village 1, difficulties faced are mentioned and seem to have been overcome by most participants. In village 2, farmers make many observation and seen now able to suggest technical improvements that may contribute to better results (e.g. "should stock earlier and supply quality feed", "1<sup>st</sup> time growth is good but winter growth is less"). This trend is similar in village 3 where respondents expressed their hope about cage culture. Even in villages where information is not shared between cage operators, every one seems to have a fair idea of the most successful cage operator of the village – although not all are able to explain why.

*Impact of cage aquaculture on personal status within the community:*

*Village 1*

*Women:*

Positive:

- People wanted to see the fish.
- People interested to see the fish and ask for the culture techniques.

Negative:

- Community people criticise growth of fish the first time.
- Enemies think bad and criticise but well wishes appreciated this (?).

*Men:*

- People interested to take cages
- People feel it is an enjoyable activity

*Village 2*

*Women:*

- No effect (? 2)
- People appreciate. Normally ponds of this area are flooded but fish of the cages is still OK.

*Men:*

- No effect.
- People wanted to know the technology.
- Community wanted to know the growth performance of the fish.

*Village 3*

*Women:*

- People come to see the and know the cage technology (? 2)
- Some think it is not good for women to go out from the house.
- No effect.

*Men:*

- People come to know the technology
- Criticise the first time. After seeing fish growth, people become interested.

Results may be summarised simply, regardless of whom the cages are operated by:

	Men	Women
Negative	1 <sup>(1)</sup>	3 <sup>(2)</sup>
No effect	1	3
Positive	5	5

<sup>(1)</sup> at first, then followed by positive criticisms.

<sup>(2)</sup> includes: 1. Judged by men as a bad thing for women, 2. At first, 3. Criticisms by enemies. Conversely to responses obtained in the Jessore area, respondents did not give any details of how, if at all, their social status (i.e. personal status and status within the community) had changed from the fact that they were involved in a new activity. The positive impacts generated by cage culture are mostly related to the fact that outsiders come to the village by curiosity and to find out about cage culture and its techniques, which, in turn, is likely to increase the way people who practice this activity are regarded. It is interesting to see that, although these impacts were mentioned the most frequently, women reported others comments on their *own* involvement in cage culture. Barishal area is not a conservative area, however, the comment “some think it is not good for women to go out from the house” made by a woman reminds that their involvement cannot be taken for granted. This may suggest that women may not get as much assistance and support from others of the opposite sex because of men’s disapproval.

Objective 3: To compare the cage operators’ expectations in terms of support from the local NGO/TO/APO staff with what they have been doing to support cage aquaculture and/or remedy to the problem of dropout.

*Village 1*

Table B8: Respondents’ opinion about NGO/CARE support for cage aquaculture and suggestions for improvement in Village 1, Comilla region.

	Opinion about NGO support	Suggestions for improvements:
Women (non cage op.)	- Support sufficient (? 4)	- No suggestions (? 3)
Men (cage op.)	- Support sufficient (? 2)	- (1) Stocking should be done in proper time, when water just increases (rainy season starts). (2) Improved fish species so that mortality could be minimised - No suggestion
NGO support	<ul style="list-style-type: none"> <li>- Visits twice a week to this village.</li> <li>- NGO helps with feed, cage management, fish death diagnosis, cage shifting, training on cage construction, feed preparation, fingerling transportation and release, cage installing.</li> <li>- Cross-visits with other cage operators.</li> <li>- NGO plays a main role in fingerling selection but the cage operators have the possibility to choose themselves. The NGO paid for the fingerlings.</li> <li>- There is no particular credit system for aquaculture.</li> </ul>	

*Village 2*

Table B9: Respondents’ opinion about NGO/CARE support for cage aquaculture and suggestions for improvement in Village 2, Comilla region.

	Opinion about NGO support	Suggestions for improvements:
Women	<ul style="list-style-type: none"> <li>- Need some improvements</li> <li>- Support sufficient.</li> <li>- More support needed</li> </ul>	<ul style="list-style-type: none"> <li>- 1. Feed machine. 2. Larger cage size.</li> <li>- No suggestions</li> <li>- 1. More cages. 2. More fish.</li> </ul>
Men	<ul style="list-style-type: none"> <li>- More support from PPC (NGO).</li> <li>- Sufficient support</li> <li>- Happy with NGO and CAGES staff support</li> </ul>	<ul style="list-style-type: none"> <li>- 1. Improved species needed. 2. Larger cage size. 3. Feed machine.</li> <li>- More training on water quality, fish growth, fish species. needed.</li> <li>- 1. Timely stocking. 2. Large size cage.</li> </ul>
NGO support	<ul style="list-style-type: none"> <li>- visits 4 days a week in this village.</li> <li>- NGO helps with fish feed, water quality, cage environment, cage management, feed preparation, appropriate quantity of feed, training on cage construction, arranging of cross-visits.</li> <li>- Farmers are involved in the selection of fingerlings. Most of the payment was covered by the NGO, the farmers’ contribution remaining very small.</li> <li>- There is no particular credit system for aquaculture.</li> </ul>	

Village 3

Table B10: Respondents' opinion about NGO/CARE support for cage aquaculture and suggestions for improvement in Village 3, Comilla region.

	Opinion about NGO support	Suggestions for improvements:
Women	- Support sufficient (? 4).	- Supply improved tilapia (GIFT) - No suggestions (? 2). - Feed needed for the poor farmers.
Men	- Support sufficient (? 2).	- 1. Timely stocking. 2. Should prepare feed themselves. - 1. Timely stocking. 2. Feed supply from office but he is able to purchase. Only poor people need feed support. 3. Improved species., fish fingerlings.
NGO support	<ul style="list-style-type: none"> <li>- Visits twice a week.</li> <li>- NGO's contribution includes: cage construction and installation, fingerling transportation and stocking, feed preparation, disease identification and treatment, marketing techniques, information and documentation gathering, cage management, cage shifting when necessary, removal of gas when it forms at the bottom of the cage.</li> <li>- Farmers select their fingerlings, but the NGO provided them.</li> <li>- There is no particular credit system provided for aquaculture.</li> </ul>	

A summary of improvements suggested is presented below (Table B11).

Table B11: Summary of the frequency of the respondents' answers regarding their suggestions to improve the NGO support in the Barishal region.

Women				Men			
Techn. support	fingerlings	feed	others	Techn. support	fingerlings	feed	others
4 ?	-	2 ? ?	No suggestion: 6	9 ? ? ?	1	3 ? ? ? ?	No suggestion: 1 Training: 1

? includes:	Larger cage	1	?? ? includes:	Timely stocking	4
	More cages	1		Improved spp.	3
	More fish	1		Larger cages	2
	Improved fish spp.	1	?? ? ? includes:	Feed machine	1
?? includes:	Feed machine	1		Feed for poor people	1
	Feed for poor farmers	1		Prepare their own feed	1

Villagers appear to be overly satisfied with the support provided by the NGO, although some reserves were emitted in village 2 and more support requested. However, the higher number of women lacking suggestions for the improvement of the NGO support may reveal some gender differences in the sense that they are less aware of what and how things could be improved. Similarly, men requested improved fish species (e.g. GIFT tilapia) more often than females: it is therefore likely that they have a better access to information, in particular technical, than women. Contrarily to other regions studied, no mention was made to the need for a credit system. The NGO visits to the village are frequent and regular, their assistance homogenous from one village to the other which seem to be matching the cage operators' expectations. In village 1, it was suggested during the community meeting that stocking fish earlier, i.e. in late February – March would improve the chances of success.

## Survey 2: Roles, perceived opportunity costs and benefits of cage aquaculture to HH, with particular emphasis on the role of women.

Objective 1: To identify the role of women HH decision making regarding cage aquaculture (decision to start cage culture, daily management, post-harvest decision – expectations from cage culture).

### Village 1

Table B12: Respondents' answers regarding the role of household members in the decision-making process for cage aquaculture and its related tasks in Village 1, Barishal region.

Households	Decision to start cage culture	Decision on distribution of daily tasks	Decision post harvest
HH1			
Female (c.o.)	Heard from Arati (female cage operator) and Nikhil, a relative of hers. First time, her husband prohibited, after that he agreed to see the growth of fish in cage. They decided to do cage culture for family consumption	?	All fish consumed. Would have made 500-600Tk if sold.
Male	His wife discussed and was given permission. To eat fish, mitigate guest demand, profit.	?	All fish consumed. Would have made total of 600 Tk (5Tk/fish) if it were sold.
HH2			
Female (c.o.) <i>Anju</i>	Heard from Arabi and decided to operate. She made decision herself. They stocked fish for family consumption and sale	Herself. Husband said it is your decision, you operate the cage	They consumed all the fish. She doesn't know the actual market price.
Female ( <i>Anju's mother in law</i> )	Discussed with her husband, doesn't know about culture behind this	?	No idea about how much to expect, market prices and how much fish will be eaten by family.
HH3			
Female (c.o) <i>Arati</i>	Paritosh (NGO) informed first and then CAGES staff. Nikhil discussed the matter. Decision was made by herself but discussed with her husband. They planned to rear fish in a cage to mitigate fish crisis, HH demand.	Husband. Husband looks after and helps	They mainly consumed (375/500) fish. If sold 1000Tk min. Do not know the actual market price.
Male	Vegetable workers of Paritosh informed about cage culture. He helped to take net from cage. They decided to start fish culture for consumption.	Mutual understanding.	They consumed all fishes. If sold they could have earned 1000Tk. Price of present stock (125 fish) = 750Tk approx. Market price = 50/60 Tk/kg.

Village 2

Table B13: Respondents' answers regarding the role of household members in the decision-making process for cage aquaculture and its related tasks in Village 2, Barishal region.

Households	Decision to start cage culture	Decision on distribution of daily tasks	Decision post harvest
HH1			
Female (c.o.)	Her son (Subrata) has mainly done all the things. To increase income and lead a good life.	Her son.	50 fish consumed. Maybe more will be eaten in the future. No idea about market prices.
Male	Same as above	Son	If sold, it will be 800-1200 Tk (1-2Tk per fish). Plans to eat but depends on Subrata.
HH2			
Female (c.o.)	Decision made by her husband to know the technology	Decision firstly made by her husband and some responsibilities given to her	Expects 25 fish/kg. Wish to sell all fish
Male (c.o.)	Heard from PPC and discussed with his wife. Decision taken by himself to know the technology, its advantages and disadvantages.	Activities shared among themselves. He performs hard work (bamboo setting, cage washing etc.) while his wife supplies feed.	Expects 1500-1600 Tk total, will invest in cage. 2Tk/fish. Some fish already eaten and will continue.
HH3			
Female (daughter)	Her father mainly decided. Start culture for profit and pleasure.	Decision made by her father and brother.	Will eat fish if necessary. No idea about how much to expect and market price.
Male (c. o.)	Heard from PPC. To get profit and pleasure.	Decision made by his son and himself.	Already sold for 400Tk. Will invest in cage culture. Market price = 3.5Tk/fish, in some cases 4Tk/fish. Plans to eat in future.

Village 3

Table B14: Respondents' answers regarding the role of household members in the decision-making process for cage aquaculture and its related tasks in Village 3, Barishal region.

Households	Decision to start cage culture	Decision on distribution of daily tasks	Decision post harvest
HH1			
Female (c.o.)	Heard from PPC staff. Discussed with her husband. Cage culture to see, for guest entertainment.	Her husband.	No idea about market price. Most fish will be eaten and she has no plan to sell.
Male	Heard from PPC staff. To get profit and fish.	Himself.	Plan to eat. If sold, 20Tk/fish and invest in cage culture.
HH2			
Female (c.o.)	Her husband decided to operate cage and discussed with her. She saw Anjali's cage and was interested.	Decision was made by her husband. In his absence, she looks after the cages.	Plan to eat all. No idea about market price.
Male (c.o.)	Heard from PPC staff and saw the fish of Anjali. Cage culture to see the growth of fish, for his own interest and to get fish.	Mutual understanding among family members.	Expects 3Tk/fish or 40-45Tk per kg. Plans to eat and produce fingerlings by breeding tilapia in cage.

continued

HH3			
Female (c.o.) <i>Anjali</i>	Decision made by herself. To get pleasure, to be involved in a work, to meet with people.	Herself	Some will be sold and some eaten. Expects 2-2.5Tk/fish, or 40Tk/kg. Will invest in cage operation.
Female ( <i>Anjali's mother in law</i> )	Her brother in law decided.	Her brother in law decided.	Minto will decide. No idea about how much to expect, nor market price.

*Decision to start cage culture:*

In terms of making the decision to start cage culture, the above results suggest that, in most cases, even when females *are* cage operators, they have to refer to their husbands first of all, discuss the issue with them and obtain their permission. These often seem reluctant in the first instance but eventually give way to their wives' wishes. If women do not depend on their husband's final say, they will have to seek permission from another male member of their family. Conversely, when men are cage operators, the decision to take on this new activity is rarely discussed with other family members, even though it is likely that these will become involved in the activity. Anjali (village 3, HH3) and Anju (village 1, HH2) are the only noticeable exceptions to this rule: both decided by themselves, one of Anjali's motives being to "meet other people", which underlines the potential for cage culture to open, to some extent, women's horizons and access to the 'outside' world. Most respondents provided indications of their motives for starting cage culture. They appear to be more varied for women than men, although cage culture for auto-consumption and as a source of extra income are dominant for both groups.

Females gave:

Economic benefit: 4 times

Family use: 6 times

Interest, pleasure, to be involved in a different work, meet with people: total 6

Males gave:

Economic benefit: 5 times

Family use: 5 times

Know the technology, pleasure and interest: total 3

Female cage operators' answers regarding how they came to know about cage culture suggest that they more often did through other females already involved in the activity and that the NGO staff had a 'secondary' role (or lets say would help finishing to convince the interested women). This may suggest that networks of women would have a larger impact in the spreading of the activity to women's groups in particular. Men on the other hand appear to be getting their information about cage culture from NGO staff mainly.

*Decision on distribution of daily tasks:*

Decisions over the management of tasks for the daily maintenance of cages are made mainly by husbands (or another man of the household), even though cage culture may be carried out by a female operator. This may be explained by the fact that men are assisting their wives with the management of the cages, in particular to carry out hard tasks and therefore consider that they are entitled to a strong say in the decision making. However, it needs to be noticed that this decision is also made by "mutual understanding" and that women (non-cage operators) may become responsible of the cages when their husband are not available to look after them. The only two exceptions to this are again Anju and Anjali who are entirely responsible for their cages and may also be helped in this by the fact that their husbands and families may be more open and understanding.

*Decision post harvest:*

Most of the fish produced in village 1 was consumed. In the other 2 villages, both household members expressed the same wish: eat some (or most) of their production is the most common answer provided. Although a few of respondents emitted ideas for future plans using money earned from the sale of fish (e.g. "produce fingerlings by breeding tilapia in cage" and "invest in cage operation"), they also insisted on the fact that some fish would be kept for family consumption.

As was indicated above, the motive of family consumption is in general met by those who have started cage culture. In terms of financial gains from their overall production, men, both cage and non-cage operators, seem to have a clearer idea of how much to expect if they sell their present production, or alternatively, if it had been sold. The same observation is valid for the respondents' knowledge of market prices. Indeed, only Anjali (village 3) was able to answer this question. This trend, encountered in all three villages and more broadly throughout Bangladesh, is typical of the situation of women in relation to access they have to their wider environment and to various levels of information. Although

Anju (village 1) who is operating successfully her own cages and who seems to be independent enough and encouraged in this direction by her husband, she nevertheless have a very limited knowledge of information from beyond her household. This may suggest that the decision to eat fish is made without complete information: it may be expected that the knowledge of prices at which fish could be sold were known would influence the decision to sell or keep the fish produced.

Objective 2: To determine the amount of time dedicated to fish culture by all HH members, the division of labour and the opportunity costs, both in terms of time and money, of cage culture.

*Village 1*

Time:

Women:

Time dedicated: Total 30-45 min (incl.10-15 min. feeding time). 2 hrs a day. Doesn't know. 45 min.

Men:

Time dedicated: ½ hour a day only. 20 min. to prepare feed, total of 45 min. to supply feed.

Division of labour:

Table B15: Respondents' answers regarding the distribution of the tasks related to the management of cage aquaculture to household members in Village 1, Barishal region.

Tasks: ? Answers by:?	Buy the seed	Prepare feed	Feed the fish	Harvest fish	Sell fish
HH1					
Female (c.o.)	Supplied by PPC. Doesn't pay for it.	Husband purchases feed.	Husband, sons, herself, her father	Sons	No fish sold.
Male	Supplied by office at no cost.	At noon, he supplies duckweed.	Wife and sons.	Wife and sons	No fish sold.
HH2					
Female (c.o.) <i>Anju</i>	Supplied by PPC at no cost. They purchased 200: 50% in cage and 50% in pond.	Machine supplied by office to prepare feed.	Herself and her sister in law.	50% herself and 50% by her sister in law.	No fish sold yet.
Female ( <i>Anju's mother in law</i> )	Supplied from PPC.	?	Anju's sister in law and herself.	Anju's sister in law and herself.	No fish sold yet.
HH3					
Female (c.o.) <i>Arati</i>	Silver carp purchased from Hawkers at 15Tk/100 fish. Tilapia supplied by PPC free of charge but need to pay after cultivation. S. carps stocked in pond. When it grows up then put them into cage to see growth performance. It is very easy to catch fish form cage.	?	Farmer mainly, her husband helps.	Farmer or her husband	Not sold.
Male	Tilapia supplied from office. His uncle purchased silver carp. Does not know the calculation of price.	His uncle supplies feed.	His aunt and himself.	Uncle and himself and his elder brother	Not sold.

Opportunity costs and effects on other HH activities:

Table B16: Respondents' answers regarding their appreciation of cage aquaculture and the effects, time and financial opportunity costs they feel the activity bears on their usual household activities in Village 1, Barishal region.

Households	Appreciation of cage culture	Effect on other HH activities	Time opportunity cost	Financial opportunity cost
HH1				
Female (c.o.)	Growth was good. Initially, high mortality.	None	At the time of bathing they normally feed the fish (? none)	Feed could be given to cows.
Male	It is good work	None	Leisure period	Other suitable way.



continued

HH2				
Female (c.o.) <i>Anju</i>	Good use of time. In her absence, her sister in law looks after the cages.	None	Would be involved in other activity, e.g. sewing	If money is in hand, it is normally used to purchase duck + poultry for rearing.
Female ( <i>Anju's mother in law</i> )	It is good.	No problem	Would be involved in other HH activities.	Poultry rearing
HH3				
Female (c.o.) <i>Arati</i>	It is a good investment.	No effect	Lazy time spent with others, gossiping, resting.	Money would be spent on other HH activities.
Male	Yes, good investment. Better than poultry rearing.	None	Uncle is a businessman, he could spend more time in his profession.	Vegetable cultivation or poultry rearing.

*Village 2*

*Women:*

Time dedicated: 2 hrs a day. Time not calculated by her (she is not involved in feed collection and preparation). 1hr total a day (incl. 30-40 min. for feed preparation)

*Men:*

Time dedicated: 2-3 hrs a day. 1 ½ hrs a day. ½ hr a day, if snail collected, then 2hrs a day.

Division of labour:

Table B17: Respondents' answers regarding the distribution of the tasks related to the management of cage aquaculture to household members in Village 2, Barishal region.

Tasks: ? Answers by:?	Buy the seed	Prepare feed	Feed the fish	Harvest fish	Sell fish
HH1					
Female (c.o.)	Free supply from PPC.	?	Herself and her daughter.	Only 8 fish harvested by her son.	Not sold yet
Male	Supplied free of charge from PPC. Costs approx. 700-800 Tk.	?	His wife and daughter.	His son.	Not sold yet.
HH2					
Female	Free supply from PPC. Silver carp purchased from Hawkers (250Tk for pond)	Not involved in feed collection and preparation	Herself, her children and husband.	Her husband	Not sold yet.
Male (c.o.)	Free supply from PPC in one cage. In other cage, he stocked his own fingerlings (purchased for 400Tk only) because after harvesting he will have to pay for the fingerling price	?	Himself and his wife (himself for hard works, his wife for supplying feed)	Himself	Not sold yet
HH3					
Female ( <i>daughter</i> )	Office supplied without any costs. She does not know the exact cost of the fingerlings.	She breaks snails	Herself, her brother and father.	Her father and brother	Her brother
Male (c.o.)	Free supply from PPC. Cost: 800Tk/1000 fingerlings, to be paid back by December. Koi purchased with 200Tk only by himself.	Snail collected by his son and broken by daughter	His son and himself	His son and himself	His son sales fish at the local market but now he contacts a person to sale koi fish.

Opportunity costs and effects on other HH activities:

Table B18: Respondents' answers regarding their appreciation of cage aquaculture and the effects, time and financial opportunity costs they feel the activity bears on their usual household activities in Village 2, Barishal region.

Households	Appreciation of cage culture	Effect on other HH activities	Time opportunity cost	Financial opportunity cost
HH1				
Female (c.o.)	Limited time spent	None	Limited (limited time spent). Banana garden	Invest in HH activity.
Male	Good use because there is a deficiency of fish in this village.	None	Agricultural activity and reading.	Other activities of the HH
HH2				
Female	It is good because fish mortality in pond is high	None	Banana garden	Spent in banana garden
Male (c.o.)	Good, he feels proud of this activity	None	Spend more time in banana garden and shop	Banana garden and shop.
HH3				
Female (daughter)	It is good culture practice.	None	Reading and HH activities, duck rearing	Pond fish culture
Male (c. o.)	It is good and done with pleasure.	None	Would seek other activities, e.g. agriculture, pond culture etc.	Other activities (agriculture, pond culture)

### Village 3

#### Women:

Time dedicated: total of 20-25 min. (3 times needed).15 min. a day. 1hr to 1 ½ a day (including duckweed collection). 1hr per day.

#### Men:

Time dedicated: total ½ hr a day (10 min. each time). 30 min a day.

#### Division of labour:

Table B19: Respondents' answers regarding the distribution of the tasks related to the management of cage aquaculture to household members in Village 3, Barishal region.

Tasks: ? Answers by:?	Buy the seed	Prepare feed	Feed the fish	Harvest fish	Sell fish
HH1					
Female (c.o.)	Purchased from Hawker but paid by PPC	herself	Her husband and son	Her husband and son	Not sold yet
Male	Purchased from Hawker and paid by PPC (NGO) (1.5Tk/fish)	?	Himself	Himself	Not sold yet (plans to eat)
HH2					
Female (c.o.)	Supplied by NGO staff. No idea about the price	?	Herself, daughter and husband	Her husband	Not sold yet.
Male (c.o.)	Supplied by PPC (NGO). There was no clear-cut idea to pay fingerling price. Now PPC wants price of fingerlings	?	Himself, his wife and daughter	Himself	Not sold (plans to eat)

continued

HH3					
Female (c.o.) <i>Anjali</i>	Fingerlings supplied by PPC free of charge. Now PPC wants them to pay some money for fingerling costs.	Herself (duck weed collection)	Herself and her daughter	Her husband and son.	Herself to neighbours.
Female ( <i>Anjali's mother in law</i> )	Supplied by PPC. Minto (her brother-in-law) knows all.	?	herself	no	no

Opportunity costs and effects on other HH activities:

Table B20: Respondents' answers regarding their appreciation of cage aquaculture and the effects, time and financial opportunity costs they feel the activity bears on their usual household activities in Village 3, Barishal region.

Households	Appreciation of cage culture	Effect on other HH activities	Time opportunity cost	Financial opportunity cost
HH1				
Female (c.o.)	It is a good investment. To see others cage, she is interested to grow tilapia fish.	None	- cow rearing - other HH activities	Spent on unknown activities
Male	It is a good investment	None	- time spent on pond fish culture - HH activities	- pond culture - bettle leaf gardening - cow rearing
HH2				
Female (c.o.)	It is good investment though this year, she cannot get more profit.	None	Spent on HH activities	In other HH activities
Male (c.o.)	It is good: makes pleasure	None	Spend unnecessary time	Spent on HH activities
HH3				
Female (c.o.) <i>Anjali</i>	It is a good investment	None	- Gossiping with others - Walk here and there.	- HH activities - Purchase fish for eating
Female ( <i>Anjali's mother in law</i> )	It is good.	None	Would get involved in other HH activities	Minto (her brother in law) knows.

*Amount of time dedicated to fish culture by HH members and distribution of tasks:*

The distribution of tasks appears both quite atypical compared to the other regions studied in terms of male participation in tasks usually dominated by women (feed preparation and feeding operation) in all three villages, and conventional with men performing harvesting and selling operations mainly in villages 1 and 2. However, in village 1, men and women are involved in the harvest equally. This may be explained by the fact that all fish is kept for home consumption. In this village, some women, cage operators in particular, are getting assistance from their husbands for feed collection and fish feeding, which is quite unusual compared to what has been found in other regions of Bangladesh so far. However, answers have to be treated with care since very few responses were given about feed preparation. Information about the amount of time dedicated by men and women to cage culture is as follows:

	Man	Woman
Village 1	37min/day	1 hr/day
Village 2	1hr40min/day	1hr30min/day
Village 3	30min/day	43min/day

Figures are indicative only (some of the answers provided were approximate).

It was mentioned during the community meeting in village 1 that "men in this village are mainly involved in different activities at the market so they have less time to look after the fish and observe their growth".

*Cage culture opportunity costs (time and money) and effects on other activities:*

Cage culture is appreciated by all respondents as it is judged as a useful activity and good investment of their time with tangible benefits (more fish, earnings, personal rewards). All respondents claimed that cage culture has had no detrimental effect of their household activities.

Although a couple of females indicated that cage culture could be done in parallel of other household activities without conflicting with these, there is no doubt that cage culture, as a new activity, takes up their time and finances which would otherwise be used for other purposes. An inventory of the time and financial opportunity costs of cage culture as judged by respondents is presented below (Table B20).

Table B21: Ranking, by frequency of occurrence in the respondents' answers, of the time and financial opportunity costs of cage culture felt by male and female respondents in the Barishal region.

Time opportunity cost		Financial opportunity cost	
Men	Women	Men	Women
Agricultural activities: 3 Leisure, reading: 3 Profession: 1 Shop: 1 Banana garden: 1 Pond culture: 1	HH activities: 5 Lazy time, resting, gossiping, reading: 4 None, limited: 2 Banana garden: 2 Sewing: 1 Duck rearing: 1 Cow rearing: 1	HH activities: 2 Banana garden: 1 Vegetable culture: 1 Poultry rearing: 1 Agriculture: 1 Bittle leaf gardening: 1 Pond culture: 2 Shop: 1 Other suitable works: 1	HH activities: 4 Does not know: 2 Feed to cows: 1 Purchase ducks and poultry: 1 Banana garden: 1 Pond fish culture: 1 Poultry rearing: 1

Typical of a gender difference, aquaculture encroaching on household activities remains the main concern for women, whereas it encroaches on agricultural and other income generating activities for men. No one mentioned children education suffering from the activity, although spending for "household activities" as given by women may include some general improvements related to the living status of each household member.

*Plans for next year:*

*Village 1*

Table B22: Respondents' answers regarding their cage aquaculture plans for the next season in Village 1, Barishal region.

Households	Current number of cages and species	Plans for next year	+/- cages
HH1			
Female (c.o.)	1 cage (1m3) – tilapia + sarputi	2 cages, 1-tilapia, 1- sarputi + koi	+ 1
Male	same	2 cages. Suitable spp: tilapia, sarputi, pangas	+ 1
HH2			
Female (c.o.) <i>Anju</i>	1 cage (1m3) – tilapia (100% mortality), then sarputi (100% mortality), then restocked with tilapia	Operate this cage. Wishes to cultivate other types of fish, eg. roi, catla etc.	+ 0
Female ( <i>Anju's mother in law</i> )	Same	Depends on Anju's decision	N/a
HH3			
Female (c.o.) <i>Arati</i>	1 cage (1m3) – tilapia + silver carp	2 cages. Plans to culture GIFT tilapia	+ 1
Male	same	Plans to operate cage with Koi fish to see the growth performance and compare it with tilapia	?

Village 2

Table B23: Respondents' answers regarding their cage aquaculture plans for the next season in Village 2, Barishal region.

Households	Current number of cages and species	Plans for next year	+/- cages
HH1			
Female (c.o.)	Same as below.	Larger size cage (double size) with tilapia, grass carp, koi, shrimp.	+ 0 but cage size ? 2
Male	1 cage (8m3) - tilapia	Plans to operate a larger sized cage with silver carp and tilapia	+ 0 but larger size.
HH2			
Female	Same as below	3 cages: cage 1: tilapia cage 2: silver carp cage 3: koi	+1
Male (c.o.)	2 cages of 8m3 each. Fixed cages. Tilapia and koi.	3 cages. Rear fingerlings Koi, tilapia, catla	+ 1
HH3			
Female (daughter)	Same. Doesn't know the exact number	Total cages should be 5. 1. magur; 2. Pangas, 3.? 4.? 5.?	+ 3
Male (c. o.)	2 cages of 8m3 each. 1 – koi (60-70), 1 – tilapia (500)	5 cages: 1. koi; 2. Sarputi; 3. Magur; 4. Tilapia.	+ 3

Village 3

Table B24: Respondents' answers regarding their cage aquaculture plans for the next season in Village 3, Barishal region.

Households	Current number of cages and species	Plans for next year	+/- cages
HH1			
Female (c.o.)	Same as below	2 cages with tilapia and sarputi	+ 1
Male	1 cage (8m3) – mirror carp	2 cages. Spp.: tilapia and sarputi. Already stock tilapia for breeding from which they have plan to collect fingerling for stocking and selling	+ 1
HH2			
Female (c.o.)	Same as below	2 cages with tilapia	+ 0
Male (c.o.)	2 cages: 1? 8m3 + 1? 1m3 Sarputi and tilapia	2 cages with tilapia and koi. In April, koi fingerling is available for 25Tk/100 only.	+ 0
HH3			
Female (c.o.) Anjali	1 cage (3.75m3) – tilapia	2 cages: 1- tilapia; 2- sarputi	+ 1
Female (Anjali's mother in law)	1 cage (8m3) – tilapia and sarputi	Plans to operate 1 cage by herself	+ 1 (?)

Most cage operators are interested in increasing their cage number modestly, but all are fairly clear about the species they wish to cultivate. Most of them are willing to grow different kinds of species and monitor the growth of their fish in order to compare growth rates and select the most suitable species. This is a sign of the farmers' independence in the activity and confirmation that it has not only caught

their interest since they are willing to experiment by themselves, but also that they are willing to take the initial risk involved in the start up of any aquacultural activities.

The NGO staff in village 1 sounded very positive about the future of cage culture in this community because of the interest of cage operators and of the experience they gained during their first year of culture. The NGO now faces the challenge to be able to provide fingerlings in time to the community to ensure that cage culture is continued in the long run.

The NGO was also very hopeful about the future of cage culture in village 2. After a difficult start when cage operators were afraid of the new technology, they now feel comfortable and are getting increasingly interested in cage culture. According to them: “during the monsoon, most of [the farmers] faced fish escaping [from the pond]. But cage culture gives them the new indication that fish cannot escape from the cages”. In addition, “during fish catching from the pond, tilapia hide themselves in the mud, but later they cannot survive. So tilapia in cage is a good system for farmers”. There are several ghers in this community, and the NGO staff suggested that it would be possible for farmers to obtain suitably sized fish from cage culture and to sell them to gher owners, thereby representing an alternative output for the fish production before fish reach full maturity. Alternatively they will be able to eat some of the fish they have produced.

In village 3, the NGO thought that cage culture could be expanded since participants are very interested. However, ponds are the only water bodies available and they have to be of a minimal size to provide the adequate carrying capacity for cage culture. However, they were hopeful since it should be possible to site cages in larger ponds, and with experience, cage management should improve, along with the solving of problems of fingerling availability, transportation and stocking. Participants to the community meeting also commented that people from outside the thana were expressing their interest in cage culture.

Objective 3: To determine the various factors that may influence the role of women in cage culture (ex. social status, wealth, distance from water body, access, education, religion, others?).

#### *Village 1*

According to the NGO, “there are no particular constraints for female cage operators”.

#### *Village 2*

According to the NGO, women are involved in cage culture because there are no cultural constraints in this Hindu dominated area, whereas in Muslim areas, “women are not interested to come to the strangers”.

#### *Village 3*

According to the NGO, cage culture is “like poultry rearing besides household activities. When male persons are not at home, it is easy [for women] to entertain the guests with cage fish. It is easy to harvest them. It seems to cage operators that cage culture is enjoyable and for their pleasure. Women usually stay at home [meaning ‘around the household’], that is why it is easy for them to look after the cages”. “No problem has occurred yet for women as cage operators”.

### **Survey 3: The impact of cage aquaculture at the community level.**

Objective 1: To identify if community members (incl. cage operators and non-cage operators) feel some changes have occurred in their daily activities since the implementation of cage culture.

#### *Village 1*

This village is located near to the thana town. Market days are Saturday and Tuesday. In this village, cages are set in small individually -owned ponds. The children map represents, at a small scale, village houses, ponds and vegetable garden in connection with the location of the river and canal. None of the groups with whom the mapping exercise was carried out reported important changes in their daily activities since the implementation of cage culture in their community. According to the male group, ponds are used for:

- bathing
- cleaning utensils
- cooking
- duck rearing
- watering the vegetable garden

- wild fish rearing

and no water pollution has resulted from cage culture in ponds. All participants to the community meeting opined that household consumption can be mitigated with cage fish culture, that it is good for guest consumption and a good resource utilisation.

Women (cage operators) who contributed to the mapping exercise commented that water was available all year round and that they are not facing any problems due to cage culture either.

However, according to the children, advantages and disadvantages could be disaggregated as follows (Table B25).

Table B25: Children’s perception of the advantages and disadvantages of cage culture in Village 1, Barishal region.

Advantages	Disadvantages
1. “It is easy to entertain guests with cage fish because it is easy to catch cage fish”.	1. “It is easy to poach fish from the cages”.
2. “It is possible that fish escape from the pond during the monsoon, but they cannot escape from the cages”.	2. “During the winter it is difficult to collect duckweed, especially in the morning.”
3. “Feeding is easy and takes less time.”	3. “It is difficult to feed fish in cages in the morning. ( <i>because it is difficult to get up?</i> )”
4. “Cage culture takes less space.”	4. “It is difficult to swim in the small pond if there is any cages.”
5. “Everybody (children + older people) can do cage culture”.	5. “There is problem to catch fish using a net if there is a cage in the pond.”
6. “It is easy to earn money by selling cage fish.”	6. “Many fish died after being released for the 1 <sup>st</sup> time.”
7. “NGO staff provided us with cages.”	7. “Fish die if they feel disturbed due to sampling and net cleaning.”
8. “NGO staff provided support for fish health.”	
9. “Cage fish is very tasty.”	
10. “Fish growth is possible by using natural and HH feed.”	
11. “It is easy to shift cage fish from one pond to another.”	
12. “Predator fish cannot attack cage fish.”	
13. “All types of fish can be cultured in a cage.”	
14. “People feel encouraged to see fish in cages and show interest to the culture.”	

Another advantage mentioned by women from the cage operators’ group is pond fish benefiting from the feed lost from the cages. When possible another pond may be used for “family uses and bathing”, otherwise tubewell water may be used for other household purposes. Women also indicated that cattle bathe in ditches, thereby does not disturb aquaculture activities.

As most men are involved in other types of activities (small businesses at thana town bazaar, agriculture, rickshaw pulling, etc., not all of them are aware of cage aquaculture. During the community meeting, they commented positively about this activity and recognised it as a new source of income. Cage operators said that many villagers come to them and ask them about culture techniques and show a keen interest for the culture. This suggests that in addition to the curiosity created by the introduction of this new technology in the village, it also raises awareness on alternative income generating activities both with village members and outsiders. However, this may be correlated by an increase of jealousy between village members. To prevent this from happening, a female cage operator said that she “was not interested to show her fish to the villagers because there will be a possibility of poaching”.

Women cage operators gave indications on the way river and canal water is managed, and on its consequences on vegetable gardening and fish culture. As Anju (cage operator) said: “There is an internal linkage between the pond and the river. They block the canal for 3-4 months of the year to prevent the river water entering and flooding their vegetable land. But when the canal is blocked, then the flow of pond water is less and the pond water becomes polluted”. This implies that a trade-off has to occur between fish culture and vegetable growing. This trade off, i.e. save the vegetable garden – probably high value crops – but reduce cage culture potential due to water pollution OR loose vegetable but potential for full fish growth and high returns, is likely to have high opportunity costs. Cage culture has been carried out for a year in this village. It would be very interesting to monitor the way water is used by community people in the coming years and study the criteria on which the

decision to block the canal or not is based to see if one activity ‘takes over’ the other or if a balance or compromise is found.

In addition, ponds are very small water bodies (cage size is 1m<sup>3</sup> only) and contain wild fish as shown on the maps and confirmed by the NGO staff. The only difficulty caused by the presence of cages in them relates therefore to the setting of fish nets since other uses of pond water (household purposes for example) may be made from alternative sources (tubewell or other pond).

All map features drawn by respondents have been reproduced in Figure B1 at the end of Survey 3 to illustrate water body uses and location.

*Village 2:*

Cages are located in individually-owned ponds which are subject to tidal water coming from the canal. Many village people have their own ponds. During the community meeting, men indicated that cage aquaculture was a profitable business. Ponds in this area are usually flooded during the rainy season which results in the escape of fish. Crab holes in the ponds can also contribute to the escape of pond fish. Cage culture prevents them both from occurring. They also indicated that fixed cages are not suitable because of the difficulty to wash the cage net and to shift them when necessary.

The presence of cages in house ponds was not considered as a problem by cage operators (both males and females) because of the nearby location of the canal where household members can bathe and complete other activities.

Children perceive cage culture as indicated below (Table B26).

Table B26: Children’s perception of the advantages and disadvantages of cage culture in Villae 2, Barishal region.

Advantages	Disadvantages
1. “Pond fish can escape from the pond, but cage fish cannot”.	1. “It is difficult to give feed during winter due to cold water”.
2. “Fish can be caught easily, it is easy to feed in cages”.	2. “Due to cold water, it is difficult to collect duckweed”.
3. It is easy to catch fish for guest entertainment”.	3. “There is 10% feed wastage in cage”.
4. “Fish is our main food”.	4. “Parents are not interested to show cage fish to avoid fish disturbance”.
5. “There is less fish death in our cage”.	5. “Cage fish cannot move frequently (freely)”.
6. “Cage fish growth is fast if proper feed is used”.	6. “Strong net is harmful to fish scale”.
7. “It is easy to see fish”.	7. “People pluck our flowers when they come to see the cage fish”.
8. “It is easy to observe problems of fish”.	8. “Fish growth is slow”
9. “It is enjoyable to observe cage fish”.	9. “It is difficult to give feed inside the net”.
10. “We get money by selling fish”.	10. “Fish die if we disturb them very frequently”.
11. “Cage fish taste very good”	11. “During feeding sometimes we slip from the narrow bamboo bridge”.
12. “Cage culture is a profitable project”.	
13. “Predator fish cannot attack cage fish”	
14. “There is less fish disease in cage”.	

These comments show the true interest of children in this new activity and their very real and pragmatic appreciation of the benefits and difficulties brought by cage culture.

Although the male group enumerated cleaning utensils, use for cooking, bathing and use for vegetable and banana gardening as uses of house pond water, fish culture does not appear to cause any disturbance. The canal besides the village is an alternative source of water and used to clean utensils. Women also pointed that they use canal water for cooking and bathing and all other works and that the pond they described on their map (Niva Rani’s) was only used for cleaning utensils. According to them, females of the surroundings do not have any hesitations in using this canal. However, they mentioned that the pond water will become polluted because of cage culture and for this reason, they would not use pond water for household purposes. This indicates that, to some extent, cage culture may be a limiting factor of pond water use. However, “due to a good feeding technique, there is no feed wastage and this is why pond fish do not get feed from the cage”, which is also a way to reduce partially water pollution.

No mention was made of cattle bathing.

Jealousy and poaching was mentioned neither the community meeting, nor during individual interviews. However, female cage operators suggested during the mapping exercise that cage operators



would not site their cages in the canal because of “the poaching possibility”. This is understandable because of the canal being open to many more users. As in village 1, it appears that the individual ownership of the water body is an important factor in the successful establishment and development of cage culture in a community. It certainly helps to reduce or smoothen changes in the use of the water body resulting from the siting of cages, as these changes affect a more limited number of individuals.

All map features drawn by respondents have been reproduced in Figure B2 at the end of Survey 3 to illustrate water body uses and location.

*Village 3:*

Ponds are the only suitable water bodies for cage culture in this village. Although they are individually owned, some owners let neighbours use their pond for bathing. The ownership status of each pond used for cage culture was indicated on the women’s map and has been reproduced on the attached map. The NGO staff indicated that ponds are small which disturb culture cycles in the winter when there are water shortages. Females mentioned during the community meeting that “the first times, people criticised about growing fish in a cage. Now they are interested to see the growth of fish”. They themselves thought at the beginning of cage culture that “a new thing may be good or bad”. However, it turned out that, for them, “cage siting is not a problem to use the pond water for other household activities” (also indicated on their map, see Figure B3).

Pond uses include:

bathing, cleaning utensils, cooking, washing clothes, irrigation for paddy field and vegetable garden, drinking water for cattle, duck and fish rearing. The only disadvantage of cage culture they pointed out was the fact that they have to guard cages at night. Advantages include:

- the use by pond fish of cage feed wastage,
- the increased care given to the pond because of the presence of cages,
- cage culture being an enjoyable thing,
- the visit of many people interested to see the cages and to give suggestions.

The presence of a canal in the village releases much of the pressure related to the multiple uses of pond water, as in village 2. Women said “the canal is used for cattle bathing, bathing [of people] and washing clothes. If water is available there, then most of the work is done in the canal. When water is not available in the canal, then they use pond water mainly”.

As in the previous two villages, children have a very clear idea of the benefits and difficulties/disadvantages brought by cage culture (Table B26).

Table B26: Children’s perception of the advantages and disadvantages of cage culture in Village 3, Barishal region.

Advantages	Disadvantages
1. “Cage fish look attractive”.	1. “It is difficult to feed the fish during the winter due to cold water”.
2. “Fish growth in cage is fast”.	2. “Sometimes cage is stolen – for example Anjali’s”.
3. “Easy to rear fish in cage”.	3. “Parents are not interested to show the cages”.
4. “Cage fish taste very good”.	4. “If there are too many fish in the cage then there is a possibility of fish death”
5. “Easy to entertain the guests”.	5. “At present there is a scarcity of water in ponds”
6. “When fish breeds then the pond is sowed”.	6. “During the floods, many fish escaped from the cages”.
7. “Fish can sell well”	7. “Sometimes nets are cut by crabs”
8. “It is a pleasure to sing a song near the cage”	8. “Due to cages, pond water becomes polluted”.
9. “Cage culture is profitable”	9. “When people come to see cage fish, then they steal fruits from the garden”

In summary, changes related to the multiple uses of pond water have been mitigated by the proximity of the canal and the possibility to transfer pond uses to it. There does not seem to be much jealousy between villagers (cage operators and non-cage operators), since there are suspicions that last year’s cage theft may have been carried out by outsiders. However, no information was provided regarding this year’s cage theft.

All map features drawn by respondents have been reproduced in Figure B3 presented at the end of Survey 3 to illustrate water body uses and location.

Objective 2: To identify conflicts that may have emerged since the implementation of cage culture.

*Village 1:*

No conflict has emerged as such in this village since the introduction of cage culture. Objective 1 showed that the disturbance caused by the presence of cages in the ponds is minimal. In addition, the potential for conflict over pond space between village primary and secondary stakeholders is considerably reduced since ponds are individually owned. Poaching and jealousy were not mentioned as significant issues. However, water management and use to maximise vegetable gardening or fish culture may become an issue between cage operators and vegetable growers (we do not know however whether these 2 activities are carried out or not by the same persons). At this stage it is difficult to predict how this situation will evolve. If indeed it becomes an issue and divides the community, it will be interesting to monitor its solving by the villagers themselves (see Objective 3). Possibilities for mitigation may include the re-design of fish ponds to integrate vegetable and fish culture through fertigation (*fertilisation + irrigation*) and enable a more efficient use of pond water when it becomes a scarce and disputed resource (see current work by David Little and Cecile Brugere on KAR project R7123)

*Village 2:*

No significant changes and difficulties resulting from the introduction of cage culture and with the potential to become more serious conflicts seem to have emerged in this village. This was cross-checked between individual interviews, notes from the community meeting and NGO de-briefing and comments on maps.

*Village 3:*

Although the NGO staff mentioned that there were no frictions yet between cage operators and water users, a cage was stolen the first year (Anjali's, female cage operator) during the Union Parish election campaign ("people saw the fish. 2 days after, the cage was stolen"), and two more have been stolen this year. Although Objective 1 suggested that small changes that may have occurred had been dealt with and accepted without difficulty, there may be a potential for more serious conflicts with village outsiders resulting from jealousy.

Objective 3: If relevant, to identify which regulation mechanisms have been implemented by the community to mitigate any possible negative impacts or problems/difficulties due to cage culture.

*Village 1*

As said in Objective 2, conflicts over the blockage to the canal may arise between cage operators and vegetable growers over the next years of cage culture. It will therefore be interesting to study how activities are prioritised, decisions made and compromises, if any, found between the various interest groups.

*Village 2*

Not appropriate so far.

*Village 3*

At this stage, the only potential conflict may be between cage operators and village outsiders. It is uncertain whether the thieves were identified and caught. No information was provided regarding the solving of this problem faced by cage operators.

Figure B1: Mapping exercise in Village 1 (South Sialkathi), Barishal region.

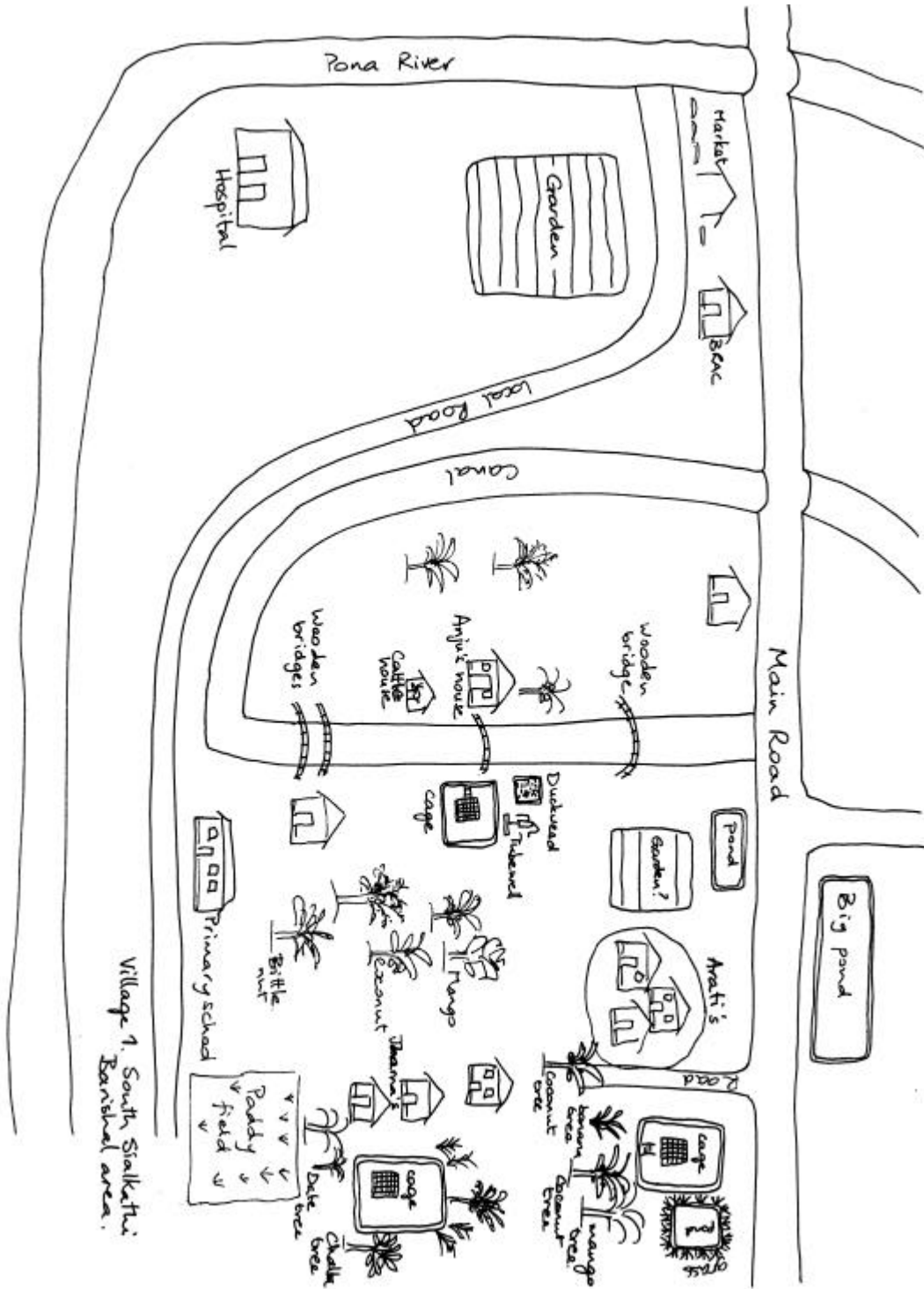


Figure B2: Mapping exercise in Village 2 (Binapani Kaikhali), Barishal region.

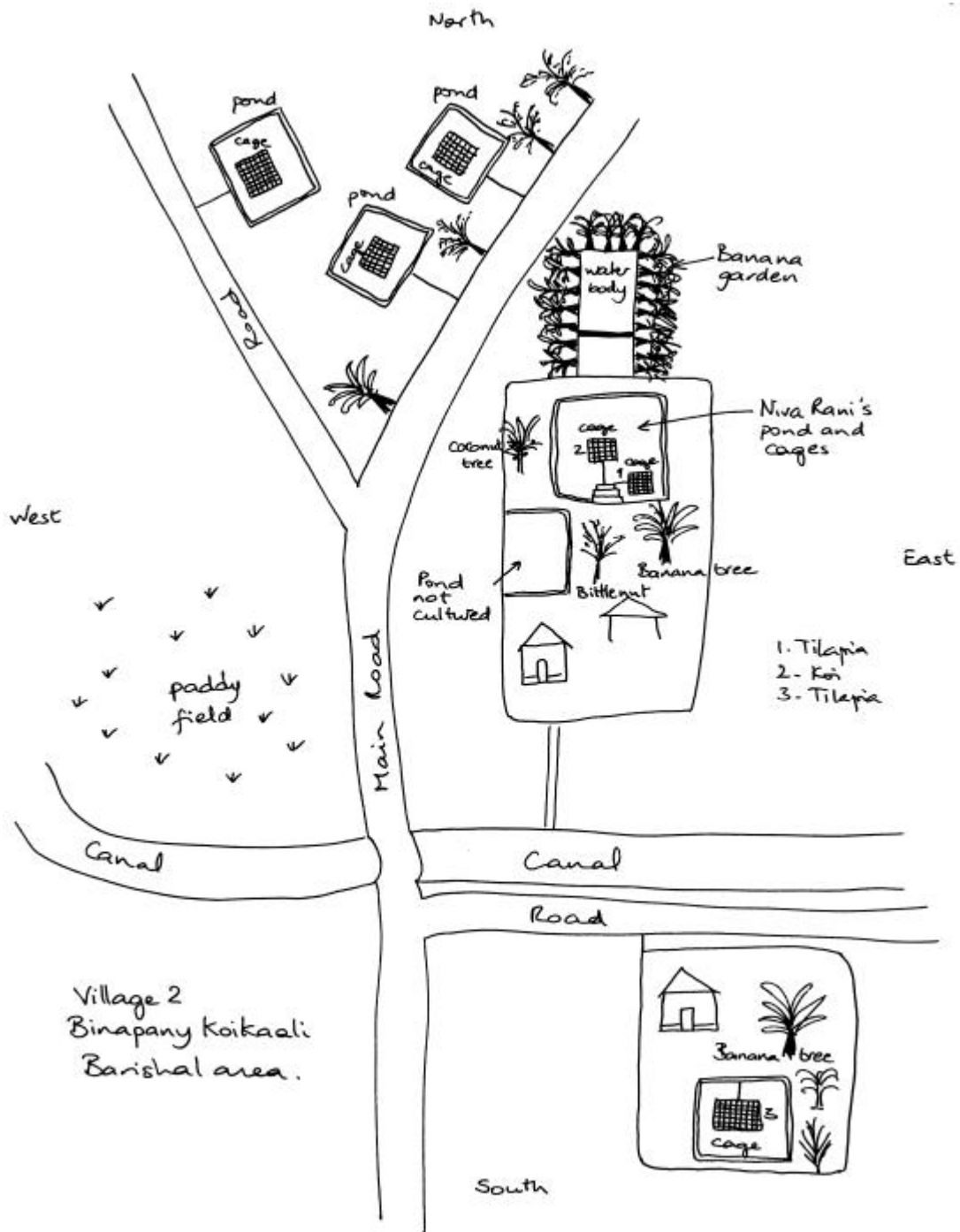
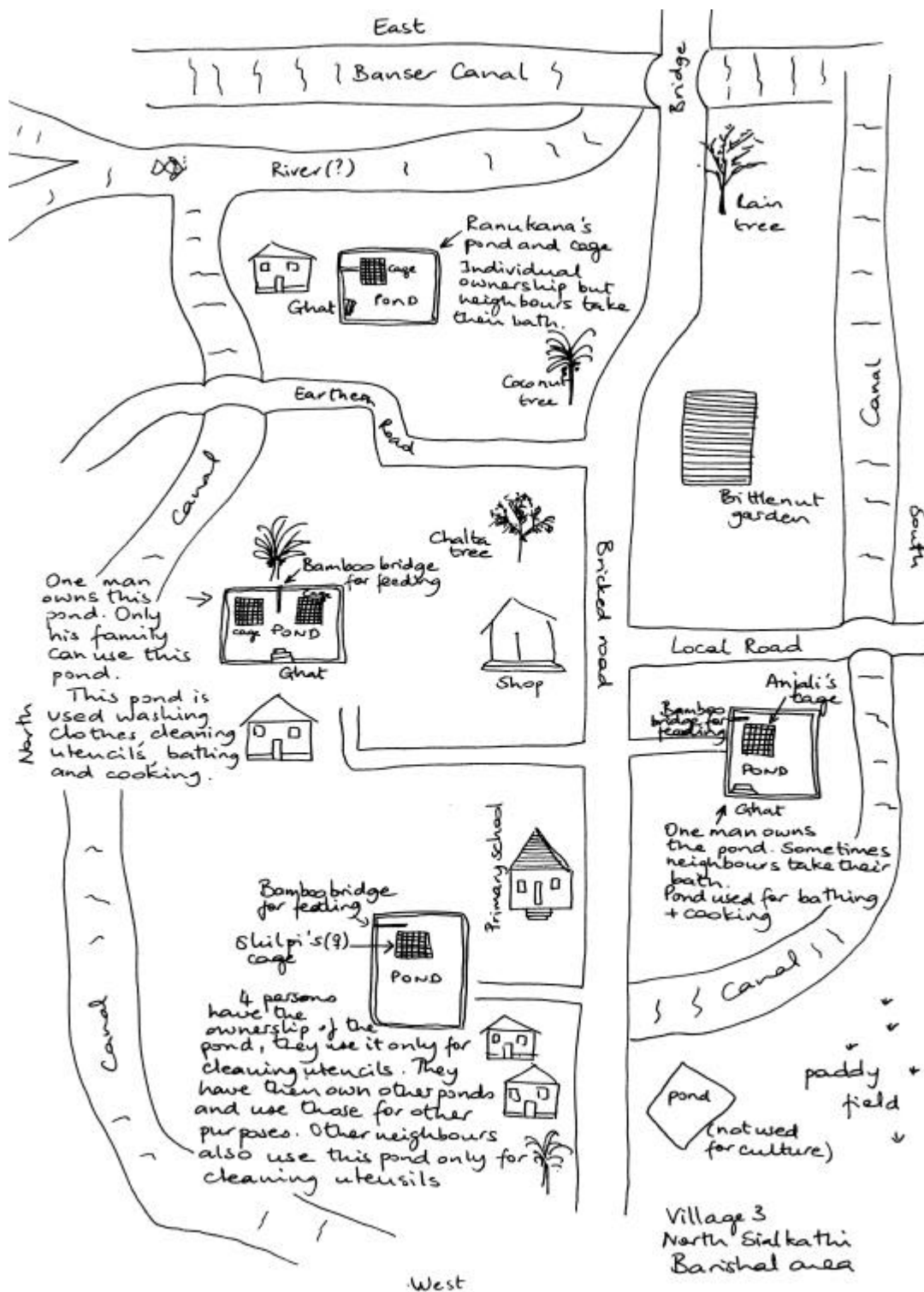


Figure B3: Mapping exercise in Village 3 (North Sialkathi), Barishal region.



### 3.5 JESSORE REGION

Villages visited and people interviewed in the selected household included:

“Village 1”:	Rantjitpur	“Household 1”:	Mr. Khelafot Hossain and his wife Helena Khatun
	Union: Naohata	“Household 2”:	Mr. Sekander Mia and his wife Sokhina.
	Thana: Mohammadpur	“Household 3”:	Mr. Abdul Malek Biswas and his wife Jahanava
“Village 2”:	Boro Sondali	“Household 1”:	Mr. Drobo Kanti Bisaro and his wife Sochitva Biswas
	Union: Sondali	“Household 2”:	Mr. Jogash Chandra Biswas and his wife Triahna Rani Biswas
	Thana: Abhoynagor	“Household 3”:	Mr. Brinchepadoa Biswas and his wife Ronjeta Biswas
“Village 3”:	Pakdia	“Household 1”:	Mrs. Shova Rani Biswas and her daughter in law Doly Rani Biswas
	Union: Arabpur	“Household 2”:	Mr. Ashim Kumar Biswas (Thakurdas) and his wife Aruna Rani
	Thana: Jessore Sadar	“Household 3”:	Mrs. Anjara Rani Biswas and her mother-in-law Chopola rani Biswas
	District: Jessore		

Fieldwork was started on the 15 December 1998 and pursued on the 16 and 18 January 1999.

In village 1, cage operators are only males. In village 3, participants are mostly women, with 98% of them being involved in cage culture through an NGO working with women in priority.

#### **Survey 1: Reasons for HH cage operators’ dropout or continuation of cage aquaculture.**

Objective 1: To identify the factors responsible for the cage operator’s dropout or continuation, and see if these reasons are similar for both men and women cage operators.

##### *Village 1*

According to CAGES and NGO staff:

HH1: very successful

HH2: medium successful

HH3: less successful (has dropped this year).

Table J1: Perception of performance in cage aquaculture, reasons for success and difficulties perceived by cage operators and their household members in Village 1, Jessore region.

	<i>Perception of Success/failure</i>	<i>Reasons for success</i>	<i>Reasons for difficulties</i>
HH1			
Female	Her husband is the most successful. More successful this year than last (more cages, more fish).	Give more labour, guard the cages, use local food.	Her husband’s boat was stolen, net cutting.
Male (c. o.) <i>Khelafot</i>	It is profitable. If there are 10 cages, a family can easily run. More profit this year (high market prices), more fish.	They depend on purchased feed as he has less time to look after the fish.	Net cutting, boat theft, parasite killing fish (technical problem).
HH2			
Female	Profitable	- Does not know.	- Someone cut our cage. They shifted cage and set it close to house
Male (c.o.) <i>Sekander</i>	1 <sup>st</sup> cycle: made profit 2 <sup>nd</sup> cycle: lost fish worth 3000Tk as s.o. cut net. Made profit 1500Tk.	Khelafot faced no problem. He covered cages with fine mesh and saved fish from parasites.	Low quality seed and parasite killed fish. Net cutting of his son.

	3 <sup>rd</sup> cycle: less profit. Khelafot is the most successful.		
continued			
HH3			
Female	Husband told fish grew in cage. But silver carp died so they could not make the desired profit. She doesn't know who is the most successful farmer, her husband did not tell her.	?	<i>Not continuing cage culture this year (her husband made a new boat with money)</i>
Male (c.o.)	Be more successful if fish did not died. Less profit as silver carps died. Khelafot is the most successful.	Khelafot could manage to finish 2 cycles. He took more care and made more profit.	Sekander's cage was cut, lots of fish lost. Might be because of jealousy. He made a new boat with cages money. He had no money to start cage culture so he stopped.

#### Village 2

According to CAGES and NGO staff:

HH1: very successful

HH2: medium successful

HH3: less successful.

Table J2: Perception of performance in cage aquaculture, reasons for success and difficulties perceived by cage operators and their household members in Village 2, Jessore region.

	<i>Perception of Success/failure</i>	<i>Reasons for success</i>	<i>Reasons for difficulties</i>
HH1			
Female	Not fully satisfied but satisfied for 1 <sup>st</sup> year of culture. Her husband is the most successful.	Last year's experience helped for this year's culture. Good management	Some fish died but she doesn't know the causes
Male (c. o.) <i>Droba Kanti Biwas</i>	He feels that he did better than last year due to last year's experience. However, due to some problem from himself and Prodiplan (NGO), he could not start cage culture in due time.	He is the most successful (for grass carp culture) due to proper nursing and cage management, sufficient food.	For him: lack of knowledge about cage culture. Lack of fingerling collection. For others: poor net quality (escapes), aquatic weed decomposition, high feed cost at 1 <sup>st</sup> time.
HH2			
Female	She's not pleased because fish are not big (catla) (1 <sup>st</sup> yr of culture).	Prokash Biwas is the most successful because he grows grass carp and good and proper feed.	Fish escaped due to net cutting, weed decomposition and catla does not grow well.
Male (c.o.)	Catla fish is not appropriate for cage culture.	Prokash Biwas is the most successful. His fish spp. was grass carp. Timely and nutrient enriched feed used. Higher number of cages (7) than others	Net cutting due to poor quality. Aquatic decomposition. Catla not growing very well.
HH3			
Female	1 <sup>st</sup> year of culture	Droba Kanti Biwas because he is well experienced, starting later to follow others.	She doesn't know.
Male (c.o.)	1 <sup>st</sup> year of culture	Droba Kanti Biwas due to good nets and proper management	Aquatic weed decomposition, net cutting due to poor net quality, fish escaping

Village 3

According to CAGES and NGO staff:

HH1: very successful

HH2: medium successful

HH3: less successful.

Table J3: Perception of performance in cage aquaculture, reasons for success and difficulties perceived by cage operators and their household members in Village 3, Jessore region.

	<i>Perception of Success/failure</i>	<i>Reasons for success</i>	<i>Reasons for difficulties</i>
HH1			
Female (daughter in law)	Feels well. Fish growth is satisfactory. 9 months of fish culture	Anima (not interviewed) is the most successful. She stocked quality seed.	Due to jute retting, culture period was shorter.
Female (c. o.) Mother in law	Will earn money for her own from cage culture. Her fish have grown already. 9 months of fish culture. Mukti (not interviewed) made most success.	Her husband is involved in aquaculture. She got ideas from her husband, took more care of cage fish. Anima was also successful.	Jute retting.
HH2			
Female (c.o.)	Cage culture could be very profitable, it could demand less effort than poultry. 9 months of fish culture (since July 1998)	3 participants did not sell their fish during jute retting. They will make more profit.	Fish were dying during jute retting so most of the participants sold their cage fish. They could not culture fish for more than 2 months in that period.
Male	Yes, successful. It developed relations among the group members and reduced quarrel among them. Cultured since July 1998.	More successful this year (1999) due to more experience. 2-3 participants did not sell their fish, they will make more profit. No conflicts between group members, they learn from each other.	Fish died from jute retting.
HH3			
Female (c.o.) Daughter in law	This year due to water pollution, she made losses. Next year planning for more profit. 9 months of culture.	Anima is the most successful. Water pollution was less in her place.	Water pollution (due to jute retting)
Female Mother in law	Due to jute retting and poisoning, most of the fish died and caught disease and they made loss. 9 months of culture.	Anima is the most successful.	Fish mortality due to jute retting and poisoning.



Gender differences between the perceived reasons for success and difficulties are highlighted and summarised in Table J4 below.

Table J4: Summary of the perceived reasons for success and difficulties and their frequency of occurrence in the respondents' answers in the Jessore region.

Women		Men	
Reasons for success	Reasons for difficulties	Reasons for success	Reasons for difficulties
Good management + labour: 3	Jute retting: 5	Good cage management + care: 4	Net cutting: 4
Experience: 2	Net cutting: 3	Purchased feed: 2	Aquatic weed decomposition: 3
Use local food: 1	Fish death: 2	Sufficient food: 1	Poor net quality (escapes): 2
Good + proper feed: 1	Weed decomposition: 1	Fine mesh nets: 1	Parasites: 2
Guard cages: 1	Catla slow growth: 1	Quality nets: 1	Low quality seed: 2
Cage close to house: 1	Poisoning: 1	Grass carp culture: 1	Boat theft: 1
Grass carp culture: 1	Boat stolen: 1	Experience: 1	Lack of knowledge: 1
Timely start: 1		No conflicts between group members: 1	High feed cost: 1
Quality seed: 1			Catla slow growth: 1
Ideas from husband: 1			Jute retting: 1

Factors contributing to the success or difficulties of farmers are varied and quite similar for men and women, in particular regarding success in cage culture. Labour, care and management of the cages were cited the most frequently by both males and females (cage operators and non-cage operators) as the key to successful cage aquaculture. The use of proper feeds is the second most common factor cited. Reasons for difficulties are also similar for both groups but to a lesser extent. Fish escaping from cages due to net cutting is the main reason for losses and difficulties. The problem of fish death resulting from water being polluted by jute retting is more specific to village 3. It may appear that males are more able to identify reasons for difficulties, when these are of a technical nature. However, women seem very aware of the technical aspects contributing to a successful cycle of fish growth (e.g. quality seed, timely start of the growth cycle). The importance for women of having the cages located close the house is typical of their situation and emphasises the importance of taking the cultural factors limiting their movement (i.e. *parda*) into consideration for their adequate and practical involvement in cage culture. Women also mentioned experience as a factor for success, underlining the importance of the continuous training required for the successful apprehension of techniques involved in cage culture and the appropriate targeting of their needs.

In village 1, there is a major parasite problem. Parasites affect cultured fish by causing anaemia, all year round, but in particular in May and June. The existence of this parasite in the river was unknown until cage culture started in 1997. One solution to this problem may involve using fine mesh nets outside the cages to prevent parasites (5 to 15mm long approximately) entering cages and attacking fish. NGO staff pointed out that golda prawns (*Macrobracium spp.*) are not affected by the parasites. If no solution is found to the parasite problem, the culture of *Macrobracium spp* may be an alternative form of aquaculture (see Paul Bulcock's MSc Thesis, June 1999, for further information). Although jute retting was considered as a problem by the NGO staff, it was not mentioned by the villagers themselves. Trials with tilapia and African catfish, two fish apparently less affected by polluted water, have been implemented and seem to provide good results. The NGO also confirmed the occurrence last year of net cutting due to "village politics" (a cage operator was candidate for the school committee, and its opponent may have cut his nets (no proof has been provided yet). No problem of this kind occurred this year.

Difficulties related to the multiple use of the water body (open access river) were not directly felt by cage operators, neither females, nor males, apart from the use of water for jute retting (see Survey 3). The situation is similar in village 3 where the water body used for the siting of cages is a leased river from the government, and where the jute retting problem is a major hindrance to full growth cycles. Other uses of the river (for fishing in particular) are not seen as conflicting and creating difficulties for cage culture.

According to the NGO staff, farmers in village 2 were faced with the unavailability of fry at the crucial time. This was not mentioned by the cage operators themselves during individual interviews but got a mention during the community meeting. However the NGO confirmed the net quality problem (short lasting nets: "the upper surface of nets was destroyed by sunlight and rain", nets cut by rats during the flood: "rats cut nets for eating dead fish in cages") and water pollution by aquatic weeds cited by the people interviewed. In village 2, where cage culture is carried out in both government and privately owned canal and bill, no problems resulting from the conflicting use of water were seen as a hindrance

to cage culture. However, comments such as “women participants had difficulties to get access to the bill because it is far from their house” were made during the community meeting. The dramatic extent of the 1998 floods has also to be taken into account as a major factor impeding the complete and appropriate running of cage culture by participants.

*Feeds available:*

In village 1, farmers have to provide feed by themselves, from the local market or their household. The NGO neither provide feed nor contributes to feed costs, but instead may provide a loan to the farmers towards fingerling and feed costs.

Collected + HH by-products

Duckweed (small-scale availability), several species of aquatic weeds, jackfruit peels, banana leaves, algae, kitchen waste, snails, etc.

**From the market**

Rice bran @ Tk2/kg (only a small quantity is from the HH, no sufficient production due to lack of land)

Molasses @ Tk6/kg

Oil cake @ Tk7/kg

Wheat bran @ Tk8/kg

V. small prawns @ Tk15/kg (waste from the market or other small fish not eaten)

Fish meal @ Tk25/kg

The NGO is trying to make pellet feed with combined components. This would improve the nutrition qualities of the feed as well as reduce its cost (Tk11-12/kg).

In village 2, both farmers and NGO are in charge of feed provision. 75% of feed money is provided by the NGO and the rest is the farmers’ responsibility. Farmers purchase their own feed. The issue of feed quality was addressed during a feed formulation workshop.

Feed collected and provided by the farmers

Snails, aquatic weeds, water lilies, different leaves, rice bran, broken rice, rice water, epil epil leaves, figs.

In village 3, the NGO supplies a small proportion of feed, but the rest is done by the farmers themselves.

Feed collected and provided by the farmers

Snails, duckweed, mussels, rice water, cow dung

**Feed provided by the NGO**

Rice bran, oil cake

*Relationship between success through ‘good feed’ and wealth:*

Table J5: Relationship between success through ‘good feed’ and wealth in Village 1, Jessore region.

	Wealth	Level of success	Lower feed	Higher feed	Species
HH1 female	‘Richer’	High	Banana leaves, grass, aquatic weeds (more)	Snails, oil cake, rice bran (less of last two)	Grass carp, silver barb, prawn, <i>calbasha</i> , <i>Mystus aor</i>
HH1 Male (c.o.)	‘Richer’	High	Banana leaves, soft grass, aquatic weeds, rice,	Oil cake and rice bran (purchased), snails	same
HH2 female	V. poor	Medium	Rice, aquatic vegetation	Snails, mustard oil cake, rice bran	Silver barb
HH2 male (c.o.)	V. poor	Medium	None (?)	Snails in July and August, mustard oil cake, rice bran	same
HH3 female	‘Medium’	Low	Boiled broken rice	Only rice bran, snails	Silver carp, silver barb, tilapia, catla, rui, mrigal
HH3 Male (c.o.)	‘Medium’	Low	Broken rice (boiled), coconut cake, aquatic vegetation	Snail meat	same

Table J6: Relationship between success through 'good feed' and wealth in Village 2, Jessore region.

	<i>Wealth</i>	<i>Level of success</i>	<i>Lower feeds</i>	<i>Higher feeds</i>	<i>Species</i>
HH1 Female (c.o.)	Rich	High	Rice soap	Oil cake, wheat bran, rice bran, snail by cooking	Snake head, grass carp, anabass
HH1 Male (c.o.)	Rich	High	Rice soap, coconut cake, aquatic weed, especially for grass carp	Oil cake, rice bran collected from rice mill, snail (little amount)	same
HH2 female (c.o.?)	Medium	Medium	Rice	Rice bran, oil cake	Catla
HH2 male (c.o.)	Medium	Medium	Rice	Rice bran, oil cake	same
HH3 female	Poor	Low	Rice	Rice bran, oil cake	Catla, common carp, grass carp
HH3 male (c.o.)	Poor	Low	Rice	Rice bran, oil cake	same

Table J7: Relationship between success through 'good feed' and wealth in Village 3, Jessore region.

	Wealth	Level of success	Lower feeds	Higher feeds	Species
HH1 Female	Medium	High	Cow dung, duckweed	Oil cake, rice bran	Silver carp, tilapia
HH1 Female (c.o.)	Medium	High	duckweed	Oil cake, rice bran, a few mussels	Silver barb, tilapia, rui
HH2 Female (c.o.)	Richer	Medium	-	Rice bran, mussels, oil cake	Silver barb (sold), tilapia (newly stocked)
HH2 male	Richer	Medium	Rice	Rice bran, MOC, mussels	Same
HH3 Female c.o.	Poorer	Low	Duckweed	MOC, rice bran, mussels	Tilapia (2 <sup>nd</sup> cycle) silver barb (1 <sup>st</sup> cycle)
Female c.o.	Poorer	Low	Duckweed, rice	Rice bran, oil cake	same

The *a-priori* that richer farmers may be able to afford higher feeds does not seem to hold true. There does not seem to be any dominant trend relating wealth to success through the provision of higher feeds. However, what may be noticed in villages 1 and 2 is that wealthier farmers seem to be more successful thanks to the balanced diet of vegetable and protein components. Unbalanced fish diet, either lacking of vegetable components or protein components results in lower fish growth, as experienced by HHs3, villages 1 and 2. It is interesting to point out that poor to very poor cage operators may still reach a certain level of success through the use of snails and mussels which can be collected and have a high protein content. Although these are 'free', they nevertheless have a high labour and time costs which may weigh on other activities. However, success through the provision of appropriate feeds also has to be considered in relation to the species of fish cultivated. The appropriateness of the feeds used to the species cultivated still has to be investigated further.

In village 1, no women are cage operators although the wife of the most successful participant expressed an interest in managing her own cage. On the contrary, women of village 3 are specifically targeted (98% of the participants are women). Among female and male cage operators, it can be observed from the above table that, although female participation in cage culture is important and not impeded by cultural factors as much as in other areas of Bangladesh, women are still less successful than men:

Female cage op.: success level

Low = 3 (50%)

Medium = 1 (17%)

High = 2 (33%)

Male cage op.: success level

Low = 2 (40%)

Medium = 1 (20%)

High = 2 (40%)

The inventory of 'home' and 'market' feeds used by male and female cage operators surprisingly show that female cage operators use slightly more 'market' feeds than their male counterparts (3 for females: oil cake, wheat bran and rice bran; 2 for males: oil cake and rice bran). However, it is unclear whether females go out to the market place themselves to purchase the feed they need. The inventory also suggests that female cage operators use 5 different types of 'home' feeds, against 8 for male cage operators. The less diverse feed composition used by women may therefore explain their lower results. However, the feeds used by women do not present any particular trend (e.g. quickly prepared feeds, feeds that do not have to be fetched far from the house, etc.), which could contribute to the monotony of the fish diet.

**Objective 2: To highlight the cage operator's perception of success or failure in cage aquaculture and the impact of the activity on his/her HH (or personal) status**

*Personal perception of success and failure:*

Results from the questionnaires for each village are presented in the tables for Objective 1.

Households interviewed in village 1 judge their own performance in correlation with the information on the level of success by CAGES staff. In addition, all agree in recognising that Khelafot, one of the men interviewed, is the most successful cage operator. The situation is similar in village 3, where most of the participants recognise Anima as the most successful female cage operator. In village 2, the lady

of HH2 seems unsatisfied with the fish growth observed, although her household is thought to be medium successful by CAGES staff.

*Impact of cage aquaculture on personal status within the community:*

*Village 1*

*Women:*

- No bad effects
- No bad feed-back from the rest of the community, people encouraged.
- No bad effects. Increased knowledge and skills about cage culture.
- People interested to see the fish and ask for the culture techniques.

*Men:*

- Initially people discouraged. Now they have changed their minds.
- People encourage. They come to know about cage culture. Potential to sell fish in any family crisis (? i.e. risk mitigation)
- Neighbours appreciated him for doing cage culture.

*Village 2*

*Women:*

- Good impression
- Good
- She does not know very specifically

*Men:*

- No effect socially but benefits financially.
- He received a new technology, so he felt happy.
- No comments among the society or community.

*Village 3*

*Women:*

- Neighbours are encouraging
- Now people are encouraging
- Neighbours are encouraging. Easy to harvest fish. Can sell the fish anytime.
- No effect (? 2)

*Men:*

- No effect.

Results may be summarised simply, regardless of whom the cages are operated by, in the following table (J8).

Table J8: Respondents' answers according to gender regarding the impact of cage culture their social status in the Jessore region.

	Men	Women
Negative at start	1	0
No effect	1	3
Positive		
at community level	3	5
at personal level	3	1
Does not know / answer without precision	-	3

It therefore appears that cage aquaculture has a positive impact on the people who practise it, both in improving the way they are considered by other members of the community and in improving their personal (both social and financial) status. However, when the impact of cage culture is felt positively by the respondents, a higher number of women feel it to improve their status within the community than their personal status, whereas men judge both equally. This therefore suggests that cage culture may be a means by which women's confidence as active members of the community is boosted and their work and contribution recognised by other villagers, males in particular. The general impression from villages 1 and 3 is the support and encouragement given by all members of the community to cage culture participants, female cage operators especially in village 3.

Objective 3: To compare the cage operators' expectations in terms of support from the local NGO/TO/APO staff with what they have been doing to support cage aquaculture and/or remedy to the problem of dropout.

*Village 1*

Table J9: Respondents' opinion about NGO/CARE support for cage aquaculture and suggestions for improvement in Village 1, Jessore region.

	Opinion about NGO support	Suggestions for improvements:
Women (non cage op.)	<ul style="list-style-type: none"> <li>- Need more support, but positive as people encouraged and gave new ideas.</li> <li>- Need more support</li> <li>- ?</li> </ul>	<ul style="list-style-type: none"> <li>- Credit, more visits</li> <li>- Proper monitoring and technical support</li> <li>- Provision of money (i.e. credit) and technical support.</li> </ul>
Men (cage op.)	<ul style="list-style-type: none"> <li>- Need more technical support</li> <li>- ?</li> </ul>	<ul style="list-style-type: none"> <li>- Credit support, business-minded farmers, interested farmers.</li> <li>- Visits by NGO once a week, more people aware of cage culture, credit facilities, nets.</li> </ul>
NGO support	<ul style="list-style-type: none"> <li>- 1 visit to the village per week minimum</li> <li>- Technical support: training (from NGO to farmers the 1<sup>st</sup> year, from farmer to farmer the 2<sup>d</sup> year) and cage construction, fingerling transport and stocking, cage management (washing and feeding), feed formulation and feeding techniques, species selection.</li> <li>- Fingerlings obtained from Jessore. Farmers pay for the fingerlings themselves. The NGO recommends species, farmers go to the hatchery and choose the species they want.</li> <li>- Cross-visits are arranged with other villages to share experience.</li> <li>- No particular credit system for aquaculture is provided.</li> </ul>	

NB: Farmers are not aware that they may not get nets free of charge in the future.

*Village 2*

Table J10: Respondents' opinion about NGO/CARE support for cage aquaculture and suggestions for improvement in Village 2, Jessore region.

	Opinion about NGO support	Suggestions for improvements:
Women	<ul style="list-style-type: none"> <li>- Good</li> <li>- Good</li> <li>- Good</li> </ul>	<ul style="list-style-type: none"> <li>- Technical knowledge</li> <li>- Need training, increase number of cages, provision of fingerlings and feed.</li> <li>- No specific idea</li> </ul>
Men	<ul style="list-style-type: none"> <li>- ?</li> <li>- Good and they are benefiting</li> <li>- ?</li> </ul>	<ul style="list-style-type: none"> <li>- Need support (both NGO + CAGES), interest-free loan (DFID CAGES Fund) to help them at the crucial moment, training in particular.</li> <li>- Increase number of cages, need more training (qualitative training)</li> <li>- Need more support (cage materials, fingerlings, money, training)</li> </ul>
NGO support	<ul style="list-style-type: none"> <li>- 2 visits to the village per week. Technical staff and the field supervisor visit the village once a month.</li> <li>- NGO provides support with feed and feeding techniques, net cleaning, fish disease, growth observation, training and feed formulation, cage construction and fingerling transportation.</li> <li>- Farmers are involved in the fingerling selection and the NGO paid for them. There are no credit facilities for aquaculture in particular.</li> </ul>	

Village 3

Table J11: Respondents' opinion about NGO/CARE support for cage aquaculture and suggestions for improvement in Village 3, Jessore region.

	Opinion about NGO support	Suggestions for improvements:
Women	<ul style="list-style-type: none"> <li>- Need to continue the input support</li> <li>- ?</li> <li>- ?</li> <li>- Need more support</li> <li>- ?</li> </ul>	<ul style="list-style-type: none"> <li>- Need more support (more cages)</li> <li>- Need more support (training, quality fingerlings)</li> <li>- Need more support (refresher training, result sharing)</li> <li>- No specific idea</li> <li>- Need more support (quality inputs)</li> </ul>
Men	<ul style="list-style-type: none"> <li>- ?</li> </ul>	<ul style="list-style-type: none"> <li>- Need to sit with the group members once fortnightly to discuss more about cage culture</li> </ul>
NGO support	<ul style="list-style-type: none"> <li>- Village visited 4 times a week.</li> <li>- NGO support includes resource feed utilisation, fish grading, cage shifting, fish sampling, preparation for problem prevention – jute retting, cage management.</li> <li>- The NGO selected and paid for the fingerlings but some farmers purchased their own fingerlings.</li> <li>- There is not a particular credit system provided for aquaculture.</li> </ul>	

NB: “?” indicates the lack of answer on the behalf of the respondent.

The appreciation of the NGO assistance is very high in village 2, but respondents appear a bit more critical in villages 1 and 3. In village 1 however, the encouragement and new ideas provided by the NGO seem to be very appreciated by the cage operators' wives.

Suggestions for improvement are similar in all 3 villages. They are summarised in Table J12 hereafter.

Table J12: Summary of the frequency of the respondents' answers regarding their suggestions to improve the NGO support in the Jessore region.

Women				Men			
Techn. support	fingerlings	feed	others	Techn. support	fingerlings	feed	others
2 + <del>2</del>	2	1	<del>2</del>	1 + <del>2</del> <del>2</del> <del>2</del>	1	0	<del>2</del> <del>2</del> <del>2</del> <del>2</del>
<del>2</del> includes:	cages	2		<del>2</del> <del>2</del> <del>2</del> includes:	nets	1	
	monitoring	1			cage materials	1	
	quality inputs	1			cages	1	
<del>2</del> <del>2</del> includes:	training	4		<del>2</del> <del>2</del> <del>2</del> <del>2</del> includes:	credit	4	
	credit	2			training	2	
	result sharing	1			result sharing	1	
					visits	1	
					better awareness	1	

The importance of training required by participants and their need for financial assistance in the form of credit to pursue cage culture successfully is underlined. However, answers suggest that training is a priority for women, whereas the provision of a credit system is the men's priority. This may be explained by the fact that women have so far participated less, or say more distantly, in cage culture, and now that their interest has been raised, they feel the need to obtain more technical training and knowledge to start their own enterprise. As men may be a step further and already possessing sufficient knowledge about the activity, they are now requiring the financial assistance to pursue their interest in cage culture.

## Survey 2: Roles, costs, opportunity costs and benefits of cage aquaculture to HH, with particular emphasis on the role of women.

Objective 1: To identify the role of women HH decision making regarding cage aquaculture (decision to start cage culture, daily management, post-harvest decision – expectations from cage culture)

### Village 1

Table J13: Respondents' answers regarding the role of household members in the decision-making process for cage aquaculture and its related tasks in Village 1, Jessore region.

Households	Decision to start cage culture	Decision on distribution of daily tasks	Decision post harvest
HH1			
Female	NGO staff came to their house. Her husband shared with her. Made decision together. Decided to do cage culture as they live by the river	Mutual understanding. According to the necessity.	Does not know how much to expect. Due to community conflict, she could not visit her cages frequently, she has to go to her cage site by a long way. Market price: Tk60/kg for grass carp, Tk50/kg for silver barb. Will eat 1 or 2 fish very often.
Male (c.o.) <i>Khelafot</i>	NGO staff motivated and provided training for 5 participants during 3 days. Decided as could sell fish as well keep for home consumption	Mutual understanding. All family members are involved.	Expects Tk3000 (net profit) from grass carp and silver barb. Will keep prawn to give them time to complete their growth, then they will give good returns. Will spend money for children and education Market price: Tk50/kg When necessary, eat few fish.
HH2			
Female (*)	She found out about cage culture when she saw her neighbours' cage	Husband	Does not know how much to expect, nor market prices. Few fish for family consumption
Male (c.o.)	NGO staff contacted Khelafot. Then Khelafot contacted other people in the village. He decided himself to do cage culture	Himself	Expects approx. Tk800. Market price: Tk40/kg Seed quality was not good. Few fish eaten
HH3			
Female	Heard from neighbours. Husband decided.	Her husband told her to make the feed.	N/A (not continuing this year, husband made a new boat with money)
Male (c.o.)	NGO staff informed in a meeting about cage culture. Then he started.	Himself. He collected feed and his wife prepared it.	No cage culture this year (built a boat with money). Sold 6kg of fish at Tk52/kg. They ate 0.5kg of fish.

The NGO motivated people first. Then provided training, then asked interested people to take cages.

(\*) In the monsoon, when the cage was close to her house, she first saw the fish inside the cage. In winter, cages are shifted to a deeper portion of the river, so she had less chance to see the fish.



Village 2

Table J14: Respondents' answers regarding the role of household members in the decision-making process for cage aquaculture and its related tasks in Village 2, Jessore region.

Households	Decision to start cage culture	Decision on distribution of daily tasks	Decision post harvest
HH1			
Female (c.o.)	Discussed with husband but main role played by husband	Own interest and mutual understanding	Does not know how much to expect. Mkt price: 4Tk/piece Currently eating fish
Male	Was informed by NGO. Family decided to do cage culture for more profit. Wife was also interested and she is operating a cage.	Cage management by husband (mutual understanding), feed formulation by wife	Stocked grass carp to purchase fingerlings and the rest of the money for family needs. Mkt prices: grass carp: 80Tk/kg, snakehead: 40Tk/kg. Currently eating fish
HH2			
Female (c.o.?)	Both husband and wife decided for benefits. Training received and tested new technology.	Mutual understanding. Help each other.	No idea about how much to expect. Mkt price: 40-45 Tk/kg No fish will be eaten.
Male (c.o.)	NGO informed about cage culture. Both husband and wife decided for more benefit	Both husband and wife	No idea about how much to expect. Mkt price: 45Tk/kg No fish will be eaten
HH3			
Female	Mainly decided by her son, but he's sharing with her.	Mainly decided by her son, but discussed with her.	Does not know how much to expect. Same for mkt price. No fish will be eaten
Male (c.o.)	Discussed with his son and he decided. Decision of both family members.	Husband, wife and son. Main role played by his son.	Due to net cutting most of the fish escaped so they only have 300 pieces left. Mkt price: 30Tk/kg No fish will be eaten

Village 3

Table J15: Respondents' answers regarding the role of household members in the decision-making process for cage aquaculture and its related tasks in Village 3, Jessore region.

Households	Decision to start cage culture	Decision on distribution of daily tasks	Decision post harvest
HH1			
Female (daughter in law)	Mother in law and husband decided	Mutual understanding	No idea about how much to expect. Mkt price: 40Tk/kg Will buy fingerlings and spend for child. No fish will be eaten
Female (mother in law) c.o.	Mainly herself. NGO also influenced.	Herself	No idea about how much to expect. Mkt price: 40Tk/kg Will make gold ornament with this money and purchase fingerlings
HH2			
Female (c.o.)	They are members of the group formed by NGO. NGO staff and group leader discussed with all and the group decided.	Both husband and wife.	Expects 700-800Tk from this cycle. Will do another 2 cycles in this year. Mkt price: 50Tk/kg selling price. Will buy fingerlings for the next cycle. Will spend for children or HH activities. No fish will be eaten

Continued (HH2)

Male (c.o.)	Group leader mobilised all group members. Motivated all members. Husbands were very much co-operative.	Both but emphasise on wife. Mutual understanding. They distributed their jobs	Expects 450 Tk. Will spend for fish. Mkt price: 40Tk/kg. They will catch fish from the river and sell cage fish.
HH3			
Female (c.o.) <i>daughter in law</i>	NGO approached the group. As group member she decided to go for cage culture. NGO and group influenced.	Mother in law and sister in law	They got 380Tk (1 <sup>st</sup> sale). Mkt price: 40Tk/kg No fish was be eaten
Female (mother in law) (c.o.)	NGO approached the group. All group participants were mobilised	Mainly NGO staff, daughter in law and herself.	Sold all fish as they caught disease. Mkt price: 40Tk/kg Will buy new fingerlings with this money. 0.5kg eaten in one day.

“Mkt” = market

*Decision to start cage culture:*

In village 1, the NGO is working only with male cage operators (4 operators in 1997 with 5 cages, 2 operators in 1998 with 5 cages). The wife of the best cage operator is interested to start cage culture. However, other females are not because of their involvement in other activities and because they do not feel familiar enough with cage culture. It may be observed that women have a very passive role in this village. Apart from HH1, where the decision to start cage culture was shared between husband and wife and helped by the fact that they live by the river, women in the other 2 households did not have a say in their husbands’ decision to start this new activity.

In village 2, the situation is different as some women *are* cage operators. Although their husbands have a strong say in their own decision to start cage culture, the decision is made conjointly. Husbands also consulted their wives before deciding to become cage operators.

This is even more so the case in village 3 where women are the main target group for the development of cage culture (98% of the participants are females). Other members of the family and of the group seem to be consulted prior to deciding to take up the activity, maybe for support and encouragement. However, the final decision on this matter remains women’s.

Not all respondents gave the reasons behind their choice to start cage culture. Among those who did,

Females gave:

Economic benefit: once

Living by the river: once

Males gave:

Economic benefit: 3 times

Home consumption: once

*Decision on distribution of daily tasks:*

The pattern of decision-making regarding the distribution of the daily tasks involved in the management of cages is very similar to the one regarding the decision to start cage culture in all 3 villages.

The lack of power of women is underlined further in village 1, in particular in HH3 where the wife has to prepare the feed as she is told. This contrasts with village 2 (at the exception of HH3, where the male cage operator dominates the decisions made), and even more with village 3 in which this decision is based upon “mutual understanding” and shared between husband and wife or the other family member involved indirectly in cage culture.

*Decision post harvest:*

It is interesting to notice that only one of the female cage operators interviewed and who are new to cage culture has a clear idea of how much to expect from the harvest (assuming it would be sold). Again, the trends regarding the way post-harvest decisions are made are similar to the way the other two decisions are made in each of the villages studied. In village 1, the lady interviewed from HH1 expressed her wish to “eat 1 or 2 fish very often”, whereas her husband simply said that they would “eat a few fish, when necessary”... Money made from the first year of culture in HH3 was used up entirely according the husband’s scheme: for the building of a new boat, leaving his wife, who had nevertheless contributed to the activity, completely out of the benefits brought by aquaculture and only enduring his decision. Post-harvest decisions seem to be more concordant between males and females in village 2, in particular regarding the decision over the auto-consumption of fish. This trend is

accentuated in village 3 where female cage operators appear to be very much in control of their production and post-harvest decisions with very clear ideas of how they will dispose of the money. In particular, one will use the money for herself (to make gold ornaments) and will reinvest in cage culture, for the benefit of her family.

When provided, details over the way respondents envisage using the money earned from cage culture show:

**WOMEN**

- To buy fingerlings: 4
- For children: 2
- For ornaments: 1
- For the household: 1

**MEN**

- For children and education: 1
- To make boat: 1
- To buy fingerlings: 1
- For family needs: 1
- To purchase fish for consumption: 1

The emphasis put by women on purchasing fingerlings for the next cycles may suggest their wish to pursue cage culture and the high potential they place on this activity for extra income for their children and household in general as well as for themselves. However, it is also interesting to point out that men also want to use the money generated by cage culture for the benefit of their own family (children and education + family needs + home consumption, totalling 3).

Globally it seems that cage operators, whether male or female ( in particular in the context of village 3), are very much in control and responsible for the overall fish production process. He or she is also in charge of the delegating of the tasks involved in the daily management of cage culture (e.g. feed formulation and application) and has a dominant say in the decision-making process. It may be therefore that cage culture, when assigned to a particular person, gives this person a sort of extra 'power' and independence in the way decisions relating to this activity are made, and this regardless of their gender.

The following table (J16) outlines the knowledge of market prices per kg of fish species of respondents of each sex in each village visited.

Table J16: Indication of market prices by respondents (male and female) in villages 1, 2 and 3 in the Jessore region.

	Women		Men	
	Species	Price/kg	Species	Price/kg
Village 1	Grass carp	60	Grass carp	50
	Silver barb	50, ?		
	Silver carp, barb, tilapia, catla, rui, mrigal	?	Silver barb	50, 40
			Silver carp, barb, tilapia, catla, rui, mrigal (sold)	52
Village 2	Snakehead, grass carp,anabass	4 Tk/piece	Grass carp	80
			Snakehead	40
	Catla	40-45	Catla	45
	Grass, common carp, catla	?	Grass, common carp, catla	30
Village 3	Silver barb, tilapia	40,45	Silver barb	40
	Silver barb	50, 40, 40		
	Silver barb	40		

There are too few results to attempt to calculate average prices for the species cultivated. Table J16 suggests that market prices cited in villages 1 and 3 are consistent between male and female respondents. This is interesting since contrarily to village 3 where women are in charge and thus to some extent expected to know market prices, women in village 1 have a secondary role in cage culture but yet are aware of market prices. This therefore suggests that information circulates freely enough between all villagers and that women are not kept out of this circuit as it was the case for example in the conservative Sylhet area. This is similar in village 2, although the market price cited by two men, one cage operator and the other not, for grass carp was significantly different (cage operator: 30Tk/kg; non-cage operator: 80Tk/kg). Who is actually right?

Objective 2: To determine the amount of time dedicated to fish culture by all HH members, the division of labour and the opportunity costs, both in terms of time and money, of cage culture

*Village 1*

Time:

*Women:*

Time dedicated: 1 hr/day; 1 hr/day, less than 1 hr/day

*Men:*

Time dedicated: 1 hr/day (it takes more time to pick snails); 1 hr/day; feed prep. + feeding = ½ hr, twice a day (= 1hr/day total).

Division of labour:

Table J17: Respondents' answers regarding the distribution of the tasks related to the management of cage aquaculture to household members in Village 1, Jessore region.

Tasks: ?	Buy the seed	Prepare feed	Feed the fish	Harvest fish	Sell fish
Answers by:?					
HH1					
Female	Both, whenever any of them gets a chance to purchase fish. From fry traders	Herself	Husband, daughter and son	Both know, discuss	Her husband sells fish at the market.
Male (c.o.)	Himself, from fry traders. Grass carp @ 500Tk, silver barb @ 680Tk, prawn caught from river by fish trap.	Daughter prepares feed. Wife sometimes helps when she gets time. He picks snails himself.	Himself. When he's absent from home, his son and daughter feed the fish	Himself	Himself, sold to retailer.
HH2					
Female	Husband, from fry traders. Silver barb: 500-600 @ 600Tk.	Herself.	Husband and son	Husband	Husband
Male (c.o.)	Himself, from fry traders. Silver carp: 5kg @ 600Tk total	?	Himself	Himself	Himself
HH3					
Female	Her husband. Seed collected from the pond, 500 fingerlings (=3kg) @ 40Tk/kg paid to pond owner	She makes feed by herself in house. Husband collected snails	Husband	?	Husband sold fish at market, not shown at home. Doesn't know to whom fish was sold
Male(c.o)	Himself, bought fish seed from pond owner	He collected feed and his wife prepared feed.	Himself, sometimes his elder son	Himself, with help from his elder son.	Himself

Opportunity costs and effects on other HH activities:

Table J18: Respondents' answers regarding their appreciation of cage aquaculture and the effects, time and financial opportunity costs they feel the activity bears on their usual household activities in Village 1, Jessore region.

Households	Appreciation of cage culture	Effect on HH activities	Time opportunity cost	Financial opportunity cost
HH1				
Female	Yes, good investment	No effect	Fishing, HH activities, goat rearing, pigeons	Stock business, goat rearing
Male (c.o.)	Yes, encouraging	No bad effects. Involved and encouraged family members	Fishing, produce date or palm juice, family members involved in HH activities	Spend for the HH, goat/poultry rearing
HH2				
Female	No extra time for cage culture	No effect	HH activities, fishing in the river	Keep money as savings, now it is an investment
Male (c.o.)	Good effort	No bad effect	Ferry boat	Spend it for HH activities
HH3				
Female	Increased knowledge and skills, extra income for family	none	No extra time for leisure. HH activities, husband involved in fishing with fish traps	Money spent for purchasing feed, otherwise they could have saved this money for the future.
Male (c.o.)	Yes, very good	They are fishermen, live on the river. So it is not a burden nor does not need extra time	Rest time	Would spend in family

*Village 2*

*Women:*

Time dedicated: 1 hr/day (when fish fed snails) or ½ hr/day when fish are not fed snails; 1 hr/day; feed preparation: 1 hr/day

*Men:*

Time dedicated: av. 3hr for 3 cages, collects snails on the way to catching wild fish; 2 hrs/day; he only feeds the fish so this does not use extra time, he does it on his way to the bill (he goes to the bill for a variety of purposes).

Division of labour:

Table J19: Respondents' answers regarding the distribution of the tasks related to the management of cage aquaculture to household members in Village 2, Jessore region.

Tasks: ? Answers by:?	Buy the seed	Prepare feed	Feed the fish	Harvest fish	Sell fish
HH1					
Female (c.o.)	Husband, she does not know	?	Husband and her	Husband	Husband
Male (c.o.)	Fingerlings purchased by himself but capital provided by NGO. From local fish trader. G. carp: 800 @ 440Tk Snakehead locally collected Anabass: 2k@ 90Tk + 2kg@ 70Tk	Wife	Himself and wife	Himself	Himself (sold 653 fish for 2612 Tk)
HH2					
Female	Husband purchased fingerlings from fry traders. 600Tk spent on fingerlings.	Feed collected and formulated by her	Husband	? Restocked in ghar	N/A (no fish sold)
Male	NGO provided money and he purchased fingerlings himself from fish trader. 1200 catla for 600Tk	Feed collected and formulated by wife	Himself	? Restocked in own ghar	N/A
HH3					
Female	Fingerlings purchased by younger son	Feed formulation by younger son and herself	Her husband	Restock in smaller pond	N/A (fish escaped)
Male (c. o.)	His son collected fish seed from fry trader. Does not know the fingerling costs.	Feed managed and formulated by female members of the HH	Himself	Restocked in a small pond	N/A

Opportunity costs and effects on other HH activities:

Table J20: Respondents' answers regarding their appreciation of cage aquaculture and the effects, time and financial opportunity costs they feel the activity bears on their usual household activities in Village 2, Jessore region.

Households	Appreciation of cage culture	Effects on HH activities	Time opportunity cost	Financial opportunity cost
HH1				
Female (c.o.)	Good use of time + money	None	Leisure time	HH purpose
Male (c.o.)	It is great profit for short time, short investment	None	HH work	Family needs
HH2				
Female	Yes, good investment	No effect on HH work	HH activities	For cattle rearing, HH needs
Male (c.o.)	Yes. They do not spend extra time for cage culture. Generally, they go to the bill for a variety of purposes	No effect	HH activities	HH expenses, farming
HH3				
Female	Yes, good	None	HH activities	HH activities
Male (c. o.)	Yes	none	HH activities	Expenses for HH needs

*Village 3*

*Women:*

Time dedicated: 40 min/day; 1 hr/day; 1-2hrs/day (more time for mussel collection); 1hr/day.

*Men:*

Time dedicated: 1hr/day.



Division of labour:

Table J21: Respondents' answers regarding the distribution of the tasks related to the management of cage aquaculture to household members in Village 3, Jessore region.

Tasks: ? Answers by:?	Buy the seed	Prepare feed	Feed the fish	Harvest fish	Sell fish
HH1					
Female (daughter in law)	NGO	?	Husband	N/a (1 <sup>st</sup> cycle)	N/a (1 <sup>st</sup> cycle, not sold)
Female (c.o.) Mother in law	From NGO's hatchery and other hatchery. Total cost: Tk280 (own: 80, NGO: 200)	?	Herself and daughter in law	N/a (1 <sup>st</sup> cycle)	N/a (1 <sup>st</sup> cycle, not sold)
HH2					
Female (c.o.)	The group, from fry traders. 40Tk/kg	Children and herself collect mussels. She prepares mussels.	Morning: herself, evening: children. Sometimes even husband feeds fish.	Silver barb: husband and herself.	Husband
Male (c.o.?)	They collected themselves from one hatchery. NGO provided seed money. 280Tk for 7kg.	He purchased, wife collected duckweed and mussels.	Mainly wife and children	Wife	Wife. He introduced her to the retailers
HH3					
Female (c.o.) Daughter in law	Fry traders, from one hatchery. Tk480 for 4 cages	?	All family members	Husband + mother in law	Brother in law
Female (c.o.) mother in law	Nephew, from one hatchery. No idea about seed cost.	?	herself	Herself	Younger son

NB: “?” indicates a lack of answer on the behalf of the respondent.

Opportunity costs and effects on other HH activities:

Table J22: Respondents' answers regarding their appreciation of cage aquaculture and the effects, time and financial opportunity costs they feel the activity bears on their usual household activities in Village 3, Jessore region.

Households	Appreciation of cage culture	Effects on HH activities	Time opportunity cost	Financial opportunity cost
HH1				
Female ( <i>daughter in law</i> )	Useful	None	Pass leisure time	As they purchase feed for cows, they also give some for cage fish from there
Female (c.o.) <i>Mother in law</i>	Yes, useful	None	Leisure time	Would spend for livestock and poultry feed
HH2				
Female (c.o.)	Yes, it takes very minimum time	No, not even any extra burden on HH activities	HH activities, sewing purpose	Cattle, ducks and poultry
Male (c.o.?)	As day by day everything gets mechanised (e.g. rice husking, net making etc.), women are getting more free time	None	HH activities but c. culture requires very little time	No extra costs. Costs come from cattle and poultry feeding.
HH3				
Female (c.o.) <i>Daughter in law</i>	Useful	She seemed over-worked.	Net making and other HH activities	They spend very negligible money for cages
Female (c.o.) <i>mother in law</i>	Could spend only little time for cage culture as waterbody was polluted	None	HH activities, net making	Clothing and ornaments

*Amount of time dedicated to fish culture by HH members and distribution of tasks:*

In the villages surveyed, the average amount of time for cage culture is:

	Man	Woman
Village 1	1hr/day	1hr/day
Village 2	2hrs30min/day	1hr/day
Village 3	1hr/day	1hr/day

However, two women and a man added that it takes longer when snails or mussels have to be picked up and fed to the fish. Conversely, one cage operator of village 2 commented that even though the water body was at a distance from his house, he would go there anyway to catch wild fish and the collection of snails of his way would not cost him any extra time. In this village, women's participation was said to be constrained by the distance of the water body from their house. This may explain why the average amount of time spent by them on cage culture is lower than for their male counterparts. Although figures of the above table do not reflect it, males in village 1 complained that they are "lacking of time" for cage culture because they are involved in "seasonal businesses and other activities", and therefore relying on the contribution of their wives for the daily management of cages. Their role however is very secondary, as was observed in the analysis for Objective 2.

Regarding the division of labour, it appears as in the other regions of the country that the purchase of seed, harvesting and selling of fish are exclusively male tasks even if cage operators are females. This is however at the exception of village 3 where women cage operators are harvesting their own fish (sometimes with their husband's help) and where a female cage operator (the only one so far) markets her fish herself, after being introduced to the retailers by her husband. The preparation of feed is exclusively carried out by women, with the occasional help of their children, whether they are cage operators or not. However, when females are not cage operators, the feeding task is completed by men (the cage operators). Conversely, women cage operators are involved in the feeding operation, with some assistance provided by their husband. This may suggest that when women have the responsibility of their own cages, there may also be able to decide and be more assertive in delegating aquaculture tasks.

*Cage culture opportunity costs (time and money) and effects on other activities:*

Cage culture is globally very appreciated by the respondents as an extra source of profit and a good investment of their time and effort, without having detrimental effects on their household activities.

A summary of the opportunity costs felt by the villagers interviewed, without distinction of villages, is given below.

Table J23: Ranking, by frequency of occurrence in the respondents' answers, of the time and financial opportunity costs of cage culture felt by male and female respondents in the Jessore region.

Time opportunity cost		Financial opportunity cost	
Men	Women	Men	Women
HH works/activities: 4 Fishing: 1 Date + palm juice production: 1 Ferry boat: 1 Leisure/rest: 1	HH works/activities: 8 Leisure: 4 Fishing: 2 Net making: 2 Sewing: 1 Goat rearing: 1 Pigeons: 1	For HH activities: 4 For the family: 2 Goat/poultry rearing: 1 Farming: 1 No extra costs: 1	HH purposes: 3 Savings: 2 Cattle rearing: 2 None/negligible: 2 Stock business: 1 Goat rearing: 1 Livestock + poultry feed: 1 Poultry rearing: 1 Clothing and ornaments: 1

Conversely to what was found in the other areas studied, some men and women mentioned that cage aquaculture did not take them extra time, effort and money as they could combine it with their other activities or use household by-products as feed that would otherwise remain unused. However, for most of the respondents, both male and female, the time and financial opportunity costs of cage culture weighs on household activities principally. The personal time of women for 'leisure' seems also to be encroached upon by the cage management tasks. As in the Comilla region, women with more financial resources would get involved in 'business', or income generating, activities such as animal rearing and stock business. Two of them expressed their concern for the future through the idea of having kept

money as “savings” instead of investing in cage culture. This has not been encountered in the other areas studied.

*Plans for next year:*

*Village 1*

Table J24: Respondents’ answers regarding their cage aquaculture plans for the next season in Village 1, Jessore region.

Households	Current number of cages and species	Plans for next year	+/- cages
HH1			
Female	3 cages (1? 1m3 + 2? 8m3) – grass carp, silver barb, prawn, calbashu, <i>Mystus aor</i>	Will try for more cages. Will observe cost-benefit this year. Priority on children education	+ ?
Male (c.o.)	same	Continue with these cages. Happa spawning of tilapia (next March)	+ 0
HH2			
Female	1 cage (8m3) – silver barb (net cut 1 <sup>st</sup> cycle, now in 2 <sup>nd</sup> cycle)	More cage (+1). Will take same time for management and make more money	+ 1
Male (c.o.)	Same	2 cages, tilapia and silver barb. 25” –3” fingerlings will be stocked	+ 1
HH3			
Female	1 cage (1m3) – 1 <sup>st</sup> cycle: silver barb, tilapia, silver carp, catla, rui, mrigal	1 cage.	+ 0
Male (c.o.)	same	Need 2 cages, 1 (tilapia + silver barb), 1 with grass carp	+ 1

*Village 2*

Table J25: Respondents’ answers regarding their cage aquaculture plans for the next season in Village 2, Jessore region.

Households	Current number of cages and species	Plans for next year	+/- cages
HH1			
Female (c.o.)	3 cages (8m3) – snakehead, grass carp, anabass	Operate 2 cages, one with grass carp, the other unknown. Husband operate 4 cages	+ 3
Male(c.o.)	Same	Increase number of cages. Expects to operate 4 cages and wife 2 cages. Interested to culture grass carp in cage and also any new species	+ 3
HH2			
Female	2 cages of 8m3 each. Catla	4 cages: Grass carp species for feed costs minimised	+2
Male (c.o.)	Same	Operate 4 cages (Bill and pond). Grass carp or tilapia culture in cage	+ 2
HH3			
Female	4 cages of 8m3 each. Catla, common carp, grass carp	5 cages and she operates 1 specially (i.e. 4+1). The canal is near her house. Grass carp.	+ 1
Male (c. o.)	Same	4 cages: careful handling, awareness	+ 0

Village 3

Table J26: Respondents' answers regarding their cage aquaculture plans for the next season in Village 3, Jessore region.

Households	Current number of cages and species	Plans for next year	+/- cages
HH1			
Female (daughter in law)	2 cages (8m <sup>3</sup> ) – silver barb, tilapia	2 more cages with tilapia and rui	+ 2
Female (c.o.) Mother in law	4 cages (2? 8m <sup>3</sup> fixed + 2? 1m <sup>3</sup> fixed in PVC frame) – tilapia, silver barb, rui	One more cage. Tilapia will be stocked	+ 1
HH2			
Female (c.o.?)	3 cages: 1? 8m <sup>3</sup> fixed + 2? 1m <sup>3</sup> PVC frame. S. barb sold, tilapia stocked	Will stock in the next season. 2 more cages with tilapia, silver barb, common carp.	+ 2
Male (c.o.?)	Same	Wife will decide. Set cages in more rows rather than a single row. Will stock grass carp also, its price is high	+ ?
HH3			
Female (c.o.) daughter in law	4 cages (4? 1m <sup>3</sup> : 2 for herself, 2 for mother in law) 1 <sup>st</sup> cycle: silver barb (sold after 28 days because of jute retting) 2 <sup>nd</sup> cycle: tilapia(cultured for 1 month and stopped due to disease)	Will continue	+ ?
Female (c.o.) mother in law	Same	Will start with one more cage	+ 1

All households are modest in their plans for the next production cycles, and the largest number by which one household is planning to increase its number of cages is 3, in village 2. However, most of them have noticed some differences in fish growth rates and are willing to experience with different species, or to produce fingerlings (HH1, village 1). This is particularly the case in village 1 where a female non-cage operator wishes to ‘monitor’ the costs and benefits brought by cage culture to her household, prior deciding whether to invest further in it (“will observe cost-benefit this year. Priority on children education”). An obvious gender difference may be observed in HH3 of village 2 in which the wife would like to become the operator of her own cage, while her husband is not planing to increase the overall number of cages managed by his household. The choice of species chosen may be made for several reasons: for feed costs minimisation, for a high market price commanded by the species. Species farmers are wishing to grow were mentioned:

Grass carp: 7 times

Tilapia: 6 times + 1 for spawning

Silver barb: 3 times

“New species”, rui and common carp: once.

In village 1, NGO staff believes that the number of farmers involved in cage culture will not increase next year. According to them, the related increase in the number of cages will not cause any social or environmental problem. Farmers from neighbouring communities are also expressing their interest in cage culture.

NGO staff dealing with village 2 is positive about the future of cage culture in this village. According to them, the interest in cage culture is likely to be sustained due to the presence of the open water body, the availability of feed (“natural”) and fingerlings, the existence of “marketing channels”, the benefits brought by cage culture (“extra earning source”) and the fact that cage culture is “socially accepted”. Even farmers who faced losses last year are now benefiting from their first experience.

Comments from the NGO about the future of cage culture in this community where the activity is practised by women dominantly, were very positive as well: they are “very interested”, have “no

hesitation”, plenty of water available, a water body adjacent to their houses, it is a fishermen community (Hindu dominantly), “not conservative”, and a “co-operative society”.

Objective 3: To determine the various factors that may influence the role of women in cage culture (ex. social status, wealth, distance from water body, access, education, religion, others?)

#### *Village 1*

In this village, NGO is working only with male cage operators. The wife of the best cage operator is now interested to start cage culture. However, no other females are interested. According to the NGO staff, reasons behind this refusal are because they are busy with other activities and not familiar with cage culture.

#### *Village 2*

Until last year, the involvement of women in cage culture was low as the water body used for aquaculture was distant from their houses. Some of them also felt afraid of the new technology. In addition, women mentioned during the community meeting that they had difficulties in accessing the bill which was far from their houses. However, the NGO is hopeful that the participation of women should improve since the region is mostly Hindu and thus without cultural constraint to their involvement. Indeed, females are now showing an interest in cage culture because of “their access to the group and the water body” (NGO).

#### *Village 3*

Village 3 is unique since women are the cage culture participants at 98%. No cultural constraints were mentioned and their involvement at all stages of the production cycle and decision-making is strong, as was observed previously.

### **Survey 3: The impact of cage aquaculture at the community level.**

Objective 1: To identify if community members (incl. cage operators and non-cage operators) feel some changes have occurred in their daily activities since the implementation of cage culture

#### *Village 1:*

Cages are located in a government river with open-access. Fishermen who catch fish in this river have to pay a small fee to the government. However cage operators don't.

When asked if any problem had been generated by the introduction of cage culture, community meeting participants answered negatively: “no problem for boating, netting, washing, bathing”. For jute producers, cage aquaculture is not a problem for their activity. However, cage operators mentioned that jute retting in the river made cage culture impossible during the months of July and August. They nevertheless suggested that to minimise this problem, they could sit cages in a deeper portion of the river during the jute retting period. Jute retting is therefore not a reciprocal problem for both parties.

Activities taking in the river include (see mapping exercise, Figure J1):

- Fishing with fish traps, nets and angling with long lining. Fish caught from the river include *Mystus tangra*, prawns, silver barb, *shol* (local fish), *boeal* (local fish), catla, rui, mrigal, calbaus, grass carp, local catfish, anabass (koi).
- Jute retting
- Boat traffic (goods transportation), including ferry crossing
- Duck rearing
- Human bathing, cleaning, washing
- Cattle bathing
- Cage aquaculture

Mapping exercise with women, children, cage operators, and non-cage operator groups revealed a number of changes that have occurred over the use of the river.

According to the group of non-cage operators, the route followed by boats has changed slightly. Before the siting of cages, jute retting occurred randomly across the river. Now jute producers take into account cages location to choose a retting place. Fishermen (i.e. non cage operators) also considered as a minor inconvenient the fact that harvesting fish with large nets was made more difficult in parts of the river due to the cage setting. However, for them, advantages brought by the presence of cages in the river are threefold:

1. Lost feed from the cages attracts river fish around the cages and has a good impact on fishermen.
2. Tilapia fry which escaped from the cages was harvested by other community people.
3. The fact that cages are guarded at night provides more security for fishermen since their nets, fish traps and boats are guarded at the same time.

Advantages 1 and 3 were also mentioned by the group of cage operators.

According to cage operators, the siting of cages in the river presented a number of disadvantages such as:

- the fact that floating weeds and other materials are brought by the water current near the cages and cause pressure on the cages walls,
- the risk of drift bamboo transported by the river hitting cages,
- the presence of jute retting in the river and resulting water pollution hampering cage culture,
- the presence of parasites (aquatic insect) in the river attacking wild and cultured fish.

However, their general appreciation of cage culture includes the fact that they are able to earn money when it is needed, they can entertain their guests, fish consumption of their family is increased and knowledge and skills of other family members about cage culture are gradually improved.

The problem of jute retting was also cited by women and children. According to women, water pollution due to jute retting hampers all activities using water. However, the degree of pollution depends on the water currents during the rainy season. For the children, “when water of the river is polluted by jute retting and the decomposition of aquatic weeds, they bath in the pond”. According to their implacable logic, cage culture could be used to clean the river of aquatic weeds: “aquatic weeds decompose in February and March. Aquatic weed is used as a fish feed and the ghat become clean. So if more cages are operated, then the river becomes clean, free of water hyacinths and algae”.

Regarding the choice for cage siting, women said that the place chosen for cages was only used for jute retting during the rainy season. According to cage operators, cages are far away from the community ghat so that they do not cause any disturbance to ghat users. Indeed, females added that they do not feel any embarrassment to use their own ghat due to the presence of cages.

This river has multiple uses. Even though the boat transport route, net setting and jute retting had to be shifted after the introduction of cages in the river, it seems that these disturbances are of minor importance compared to those resulting from water pollution due jute retting. More than cage culture having a negative impact on the physical and social environments of this community, it appears that, on the contrary, both water pollution and the presence of water parasites causing fish anaemia impede the complete success of fish culture.

Only NGO staff mentioned some jealousy between villagers: some nets were cut last year due to village ‘politics’ as mentioned earlier. However, no problem of this kind has happened this year.

All map features drawn by respondents have been reproduced in Figure J1 presented at the end of Survey 3 to illustrate water body uses and location.

#### *Village 2:*

Two adjacent water bodies are used for cage siting: a canal and a *bill* . The canal is not used by community outsiders.

#### *Bill use:*

During the mapping exercise, the male group (non-cage operators) commented that on average they had benefited from the first year of cage culture and are now requiring more cages. According to them, an increase in the number of cages would not damage the environment. Indeed, prior the siting of cages, the bill had not been used for the last ten years and has now become a waterlogged area. They think that cage culture could be an alternative way to use the bill area more efficiently, all the more that farmers’ houses are located close to it. However, another, and potentially conflicting – or competitive, use of the bill is for paddy rice cultivation at various times of the year. The problem of allocation of resources, both land and water to fish or rice farming is similar to the one encountered in village 1, Barishal area.

#### *Canal use:*

The only uses of the canal include boating, fishing (using nets, baskets and hooked lines), cage culture and irrigation. People use their boats to go to the bill, but the presence of weeds makes boat traffic difficult.

From the reading of the maps or notes from the community meeting and NGO de-briefing, no obvious changes seem to have been felt by villagers since the introduction of cages in both the canal and bill. Male cage operators indicated: “there is no problem to row boats [in the canal] due to the cages” because “boats are rowed in the middle of the canal” (female group). However, women also mentioned

in passing that “people from this community used to catch fish in the canal which is now the place used by cages. They now use vacant places to catch fish”.

Difficulties for cage culture seem to be arising from the fact that water availability varies throughout the year and that water becomes polluted in the middle of the year. Reasons why this occurs were not given. Cages are then shifted to prevent polluted water affecting fish culture. Indication of where the cages are shifted were not provided by the participants. Women commented that: “villagers thought that there will be no problem with more cages. If, in the future, they face any problems in the canal, they will shift cages to the ponds”.

Although ghats were placed on the women’s map, no mention was made of their use for household activities. Cattle bathing was not mentioned either.

None of the participants referred to the existence of jealousy due to cage culture.

All map features drawn by respondents have been reproduced in Figure J2 presented at the end of Survey 3 to illustrate water body uses and location.

#### *Village 3:*

Children were at school and women busy cooking, so no community meeting was held. The mapping exercise started straight away with only a group of men and a group of female cage operators.

This community is a community of fishermen. 52 households are Hindu and are fishermen. The water body used for cage culture is a river leased for 3 years by the government to the fishermen. 40-45 households of this community are entitled to fish here. Outsiders do not come here for fishing. However, these leave the water body open to cage operators, and according to the NGO in charge of this village, they are “not conservative”, and there are “good inter-relationships” between the two groups. Before cage siting, this place was unused. The river’s water is also used for irrigation and for human and cattle uses (bathing etc.).

#### *The jute retting problem:*

Both cage operators and fishermen are suffering from water pollution and resulting fish death generated by jute retting during a few months of the year. The problem is qualified as “huge” by NGO staff. For fishermen, “fish catching is stopped for 3 months”. For cage operators, “some fish died so some [cage operators] sold their fish to save the situation”. However, jute retting is not thought to be the only source of problems. As observed by female cage operators, “besides jute retting, drainage water falls into the river. It causes fish diseases”.

#### *The use of ghats:*

Ghats (steps leading to the water) are used for washing, cleaning and bathing, for cattle bathing. Boats may also stop there and they may be used as a fish selling and buying point. Cattle use may also occur on the same ghat. For the male group, “there are no problems to use ghats due to cages”. Females added that jute sticks may be washed and cleaned besides their ghat.

It seems therefore that cage culture has not brought any changes to the usual use of the river by these two groups. In addition, females said that “people living on the other side of the river did not make any comments about the cages”. However, the only man interviewed individually (a shopkeeper) mentioned that “sometimes fishermen think that cages are reducing their catching area”, the only negative point mentioned about cage culture.

All map features drawn by respondents have been reproduced in Figure J3 presented at the end of Survey 3 to illustrate water body uses and location.

### Objective 2: To identify conflicts that may have emerged since the implementation of cage culture

#### *Village 1:*

Conflicts as such have not appeared in this community, although there have been indications of some changes occurring since the implementation of cage culture. But as was indicated by non-cage operators, these changes can only be qualified of “minor” at the present time. In addition, it was reinforced that fishermen benefited indirectly from the presence of fish farming and that cage siting had not disturbed ghat users, in particular women. However, one may speculate that if conflicts are to arise, they are likely to be between jute producers and cage operators (along with other water users) because of the major disturbance caused by water pollution at a certain time of year.



*Village 2:*

The most obvious change that seems to have occurred in this village since the introduction of cage culture relates to the fact that fish catching in the canal has now been replaced by fish farming (Objective 1). No other comments about potential tensions between water users were made.

However, there may be in the future potential for conflicts over the most effective use and exploitation of the degraded (i.e. waterlogged) bill resources. If paddy farmers are not cage operators, it may be possible that competitive use of the bill for both activities may generate tensions in the village. If problems or conflicts were to occur, a possible mitigation measure may be the development of integrated rice-fish culture in the *bill*. As for village 1 in the Barishal area, it will be interesting to monitor the way decisions are made over the use of the bill, i.e. how and which culture is prioritised over the other, especially if one culture develops further at the expense of the other, monitor its socio-economic consequences (and potential conflicts).

*Village 3:*

NGO staff qualified this village as a “co-operative society”. Indeed no jealousy between villagers and cage operators was expressed by any of the participants. The only negative comment made related to the decreasing space available in the river for fishermen to put their nets. This may become more problematic if the number of cages increases dramatically. However, at this stage, the problem of jute retting is one more important and urgent to solve. If conflicts were to arise soon, they may be more likely to be between cage operators and jute producers than cage operators and fishermen.

Objective 3: If relevant, to identify which regulation mechanisms have been implemented by the community to mitigate any possible negative impacts or problems/difficulties due to cage culture

*Village 1:*

Since no open conflicts have emerged since the siting of cages in the river, no conflict regulation mechanisms have been necessary. The siting of cages in a deeper portion of the river during the peak of the jute retting period was suggested by a cage operator during the community meeting as a mitigation measure to the water pollution created.

*Village 2:*

No conflicts as such have emerged since the implementation of cage culture in this village.

*Village 3:*

No conflicts as such have emerged since the implementation of cage culture in this village.

Figure J1: Mapping exercise in Village 1 (Ranjitpur), Jessore region.

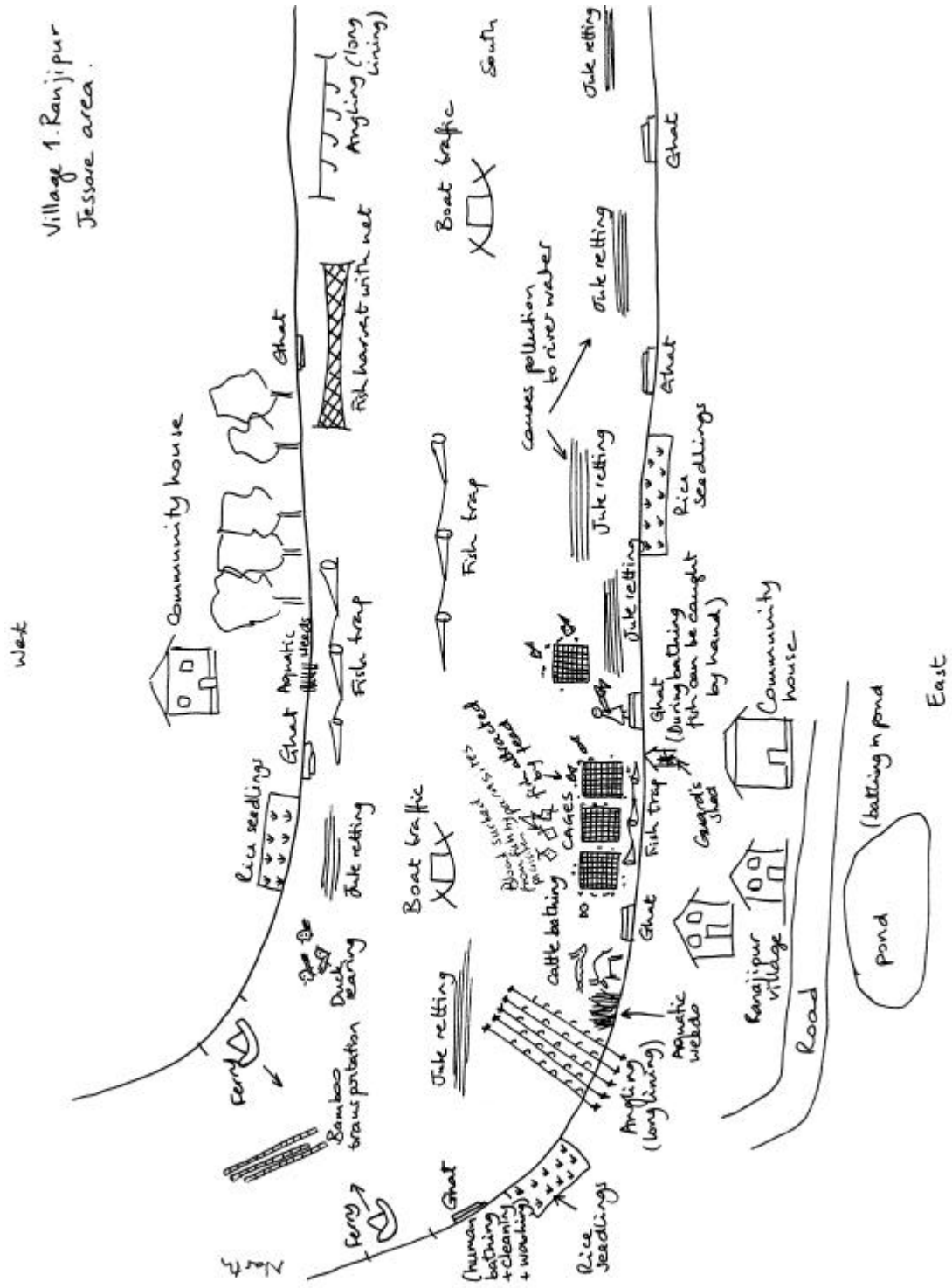


Figure J2: Mapping exercise in Village 2 (Sondali), Jessore region.

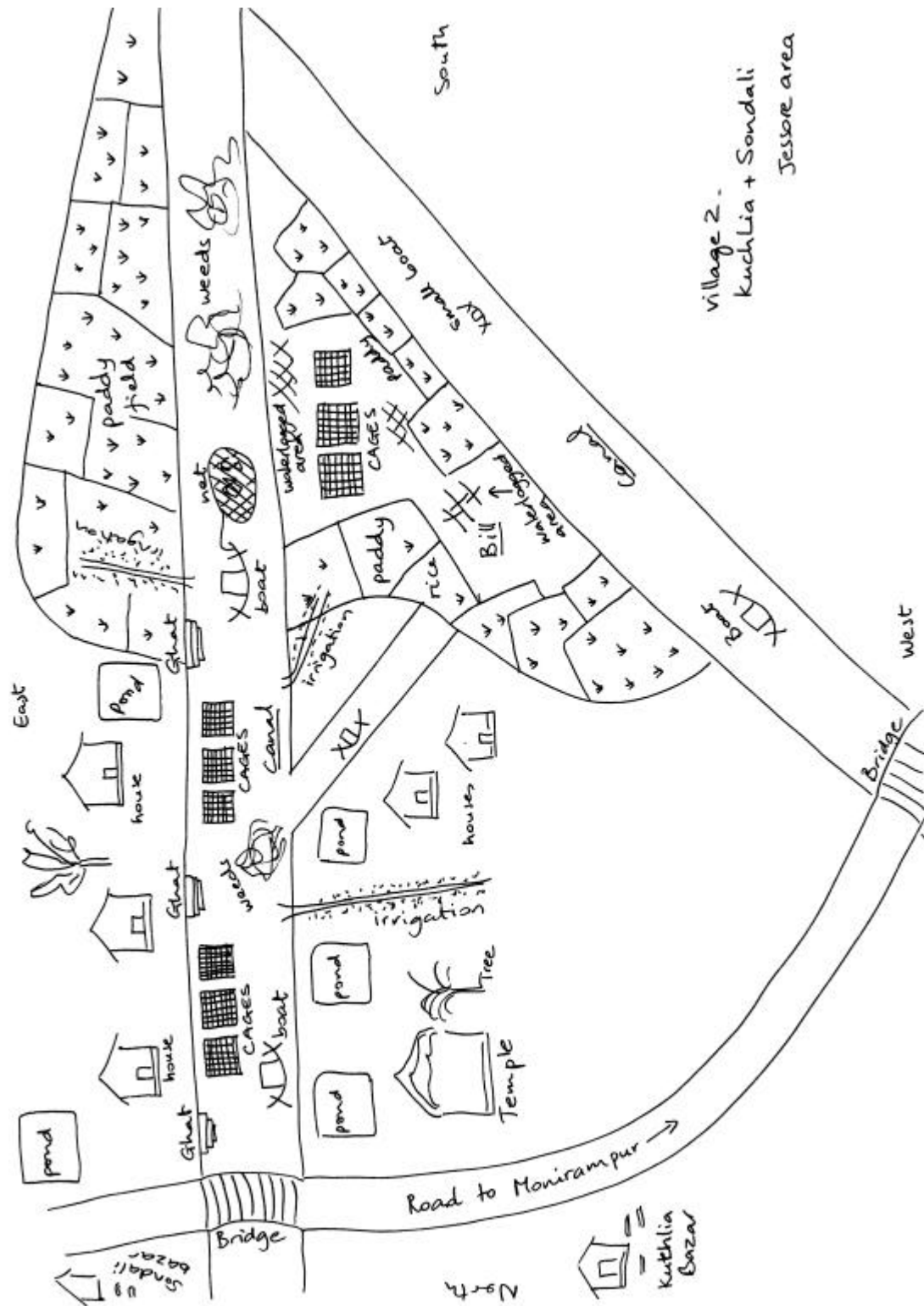
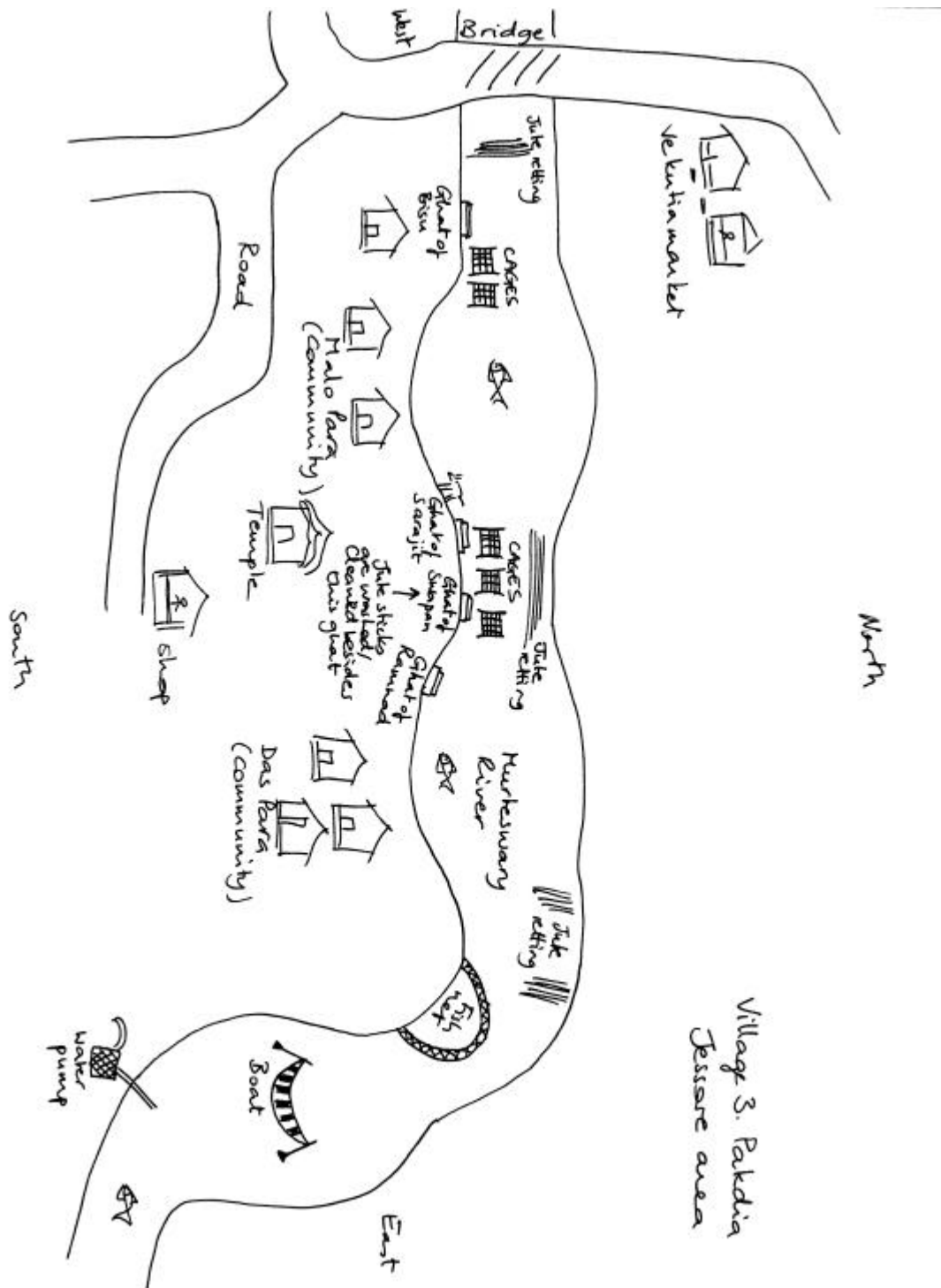


Figure J3: Mapping exercise in Village 2 (Pakdia), Jessore region.



## 4. Synthesis of findings

Data collected in each of the five regions of Bangladesh studied revealed interesting issues and allows comparisons to be made between the areas studied. A synthesis of the findings highlighting the main issues encountered in each area, is presented hereafter.

### 4.1 Fish growing in cages??

Participants made rich extra comments shedding light on the way cage aquaculture, as a new technology in Bangladesh, has been progressively accepted and perceptions have evolved since its implementation in targeted villages. A negative *a-priori* about cage culture is a recurrent factor in all areas: farmers starting cage culture were perceived as “mad” by other villagers but “now people are interested”, in particular women because they “can observe that the fish [in cages] are growing” (Sylhet). Ignorance and doubts are also important deterrents. Some water users said they “did not know the culture, so did not take it”. Others were “confused about the practice” (Dhaka). “Firstly people thought that fish would never grow inside a cage. Now their thinking has changed: it is proved that fish can grow inside a cage” (Sylhet). “At the first time of starting cage culture, some neighbours teased cage operators, but they started cage culture later” (Comilla). Lack of awareness about the potential profits to be made from aquaculture, along with practical concerns derived from a lack of knowledge (“where will we get the technology?”, “where to collect nets and cages?”, “guarding time is a problem. We might get cold in the rain at night” - Jessore) deterred some farmers to get involved in the activity. The “seeing is believing” motto certainly helps in convincing and giving rise to the villagers’ interest and curiosity: “cage operators attended cross-visits and learned more about the new technology”, “many villagers come to us [cage operators] and ask about the culture techniques and show a keen interest” (Barishal).

### 4.2 Constraints and difficulties

If most of those who have started farming fish are satisfied with the culture, they are nevertheless confronted to a range of difficulties and constraints regarding the successful rearing of their fish. Reasons for failure and difficulties are varied and several are common to all areas. They are summarised in Table 4.1 below.

Table 4.1: Main factors affecting the successful rearing of fish by cage operators in the Dhaka, Sylhet, Comilla, Barishal and Jessore areas.

Dhaka area	Sylhet area (*)	Comilla area	Barishal area	Jessore area
Escapees	Lack of co-operation	Poaching, poisoning	Initial mortality	Jute retting
Floods (1998)	Unequal share of workload	Net cutting (crabs)	Theft of cage and poaching	Poor net quality (nets cut by crabs)
Small fingerlings	Poor feed quality and feeding techniques	Fish mortality	Escapees during the 1998 flood	Aquatic weed decomposition
Poaching	Stocking water	Escapees	Problem with getting feed	Parasites (fish death)
Fish mortality	Lack of care and time	Weather (storm)	Small cages	Boat theft
Lack of interest, and therefore lack of care	Floods (1998)	Lack of co-operation		High feed cost
Distance from the water body	Feeding costs	Lease of pond		Low quality seed
		Water retention		Poisoning
		Family problem		

(\*) Cages are managed co-operatively by a group of cage operators.

Apart from difficulties related to the type and status of water body used and which are specific to each area, a number of them, such as poaching and theft, poor quality feed, fish mortality and escapees and lack of co-operation between group members where cage culture is practised co-operatively, are common to all the places where cage culture is practised.

Poaching and theft of fish is occurring on a regular basis in each area studied and is a problem faced by many cage operators. These crimes may be committed for two types of reasons: for personal use (Sylhet – but “the thief was caught and got punished”) or as revenge by jealous neighbours or other water users (Dhaka – fishermen, Comilla – between those who have access to the pond and those who do not in a village, and a fundamental group in another village, Barishal – during an election campaign: “people saw the fish, two days later, the cage was stolen”). This therefore suggests that the interest and curiosity created by cage culture, as well as potential conflicts between water users (although never mentioned as such by the stakeholders), may, in some instances, lead to the expression of jealousy. This in turn can lead to degrading actions such as poaching and theft of fish. Villages particularly exposed to this problem are those using rivers to support cage culture because of the wider number of

water users and navigation taking place. A prevention measure has been the institution of guarding shifts by cage operators to guard cages at night, which is efficient in most cases, except when “the guard came to have dinner, then the fish were stolen” (Comilla). The emergence of conflicts within communities will be dealt with in a later section.

Poor quality feed was also mentioned frequently by cage operators. Since cage culture is still in its infancy in most areas, farmers are still experimenting with different kinds of feeds. Most feed ingredients are household by-products (rice bran, broken rice, duckweed, banana leaves, trash fish). Other ingredients, some of which with a higher protein content – and commanding a higher price - are purchased on the market (mustard oil cake, wheat and wheat bran, molasses, fish meal), while others are collected specifically to feed the fish (snails, mussels). However, high feed costs are a hindrance for cage operators from resource-poor households, in particular during the starting phase of cage culture (e.g. Jessore). The suitability of all these types of feed to the species farmed still has to be assessed by farmers. However, it was suggested that the development of appropriate fish feed would have to take into consideration the Muslim culture of Bangladesh after a female cage operator of the Dhaka area indicated that she “does not want to eat snail-fed fish”.

The escape of fish due to floods, nets cut by crabs or other reasons (poaching excluded) was another reason for difficulties in completing a full growth cycle. Cage culture carried out in ponds seems to minimise this difficulty as escaped fish remain easily catchable. In addition, feed lost from the cages is “an extra source of feed for pond fish” (Comilla) and, “during the floods, some fish came from outside and stayed in this pond because of the feed lost from the cages” (Sylhet). Thus in this instance, cage operators attract wild fish in their pond, thereby increasing the supply of non-cage operators catching fish in the pond for their personal use (“tilapia fry which escaped from the cages was harvested other community people” – Jessore).

Lack of co-operation between group members is particular to the Sylhet region where cage culture is practised co-operatively between farmers. In this area, most of the targeted farmers are amongst the poorest and as such, have to sell their labour on a daily basis to support their families. Their contribution to the group to manage the cages is therefore limited to their spare time, which explains why group members with more time have to bear most of the workload. It was nevertheless recognised in most instances that co-operative cage culture has more advantages than when practised individually in terms of facilitation of problem solving through discussions, dissemination of knowledge and ideas, and sharing of the benefits proportional to personal contribution.

In addition, it was found that distance from the water body is a particular hindrance for women to contribute fully to cage culture. As mentioned by a husband in the Dhaka area: “my wife doesn’t help because the water body is too distant, therefore not enough time is spent looking after the fish”. However, in the Sylhet area, more religiously conservative than any other area of Bangladesh, this trend is exacerbated by *parda*, i.e. the restriction of women’s movement dictated by a fundamentalist interpretation of the Koran. On several occasions, women said that their “socio-cultural condition” does not permit to go outside, so husbands perform outside work while women carry out the feed preparation from inside their house. Indeed, the only day when women are allowed to venture outside their houses to go and watch the fish is on market day, when all men have left to go to the nearby village market place. Conversely, the involvement of women is facilitated in Hindu-dominated areas (e.g. Barishal), in which women have an easier access to the group of cage operators and to the water body.

The context in which the difficulties cited above occur suggests that the type and ownership status of the water body selected for cage culture is as crucial as the proper technical management of the cages. The selection of an appropriate water body, in particular its proximity from targeted homesteads will help to prevent many of the downfalls of cage aquaculture and facilitate the interest and involvement of women in the activity.

#### 4.3 How about women’s participation?

Although women’s participation in cage aquaculture is one of CAGES aims, there are differences in their degree of involvement between regions and in their contribution to the daily management and decision-making related to the activity.

##### *4.3.1 Decision-making:*

Common to all regions is the fact the decision-making process regarding starting cage culture, distributing tasks and disposing of the fish production or income earned is heavily influenced by husbands or household’s males, whether women are cage operators or not. The only true exception is in village 3 of the Jessore area where a group of women has been specifically targeted. In this case, they

refer to their husbands for encouragement and support rather than a “permission” or an approbation. Reciprocally, wives are “consulted” by their husbands prior to starting cage culture. In terms of expectations from cage culture and reasons for getting involved in the activity, motives are different between male and female respondents. In the Comilla, Barishal and Jessore areas, motives mentioned by respondents are summarised below (Table 4.2 ).

Table 4.2: Reasons mentioned for starting cage culture in the Comilla, Barishal and Jessore areas, by gender.

Females	Males
Economic benefit: 10 times total	Economic benefit: 15 times total
Family use: 8 times total	Leisure time and family use: 6 times total
Living by the river: 1	Home consumption: 1
Interest and use of leisure time, meet with other people, be involved in a different work: 7 times total	Pleasure, interest, know about the technology: 3 times total

Motives outlined above may suggest that women see cage aquaculture not only as a means by which they are able to feed their family, but also as an opportunity to overcome their segregation in the society they live in. However, in the Sylhet area, more conservative region of Bangladesh, women’s comments reveal the impact of *parda* on their lives, giving an indication of the strong gender discrimination they are facing regarding their involvement in any activity taking place beyond the boundaries of their household. Even for female cage operators involved with a group of cage operators, their participation has to be “discussed” with their husbands and their tasks are determined by both the group leader and their social condition. Comments such as “Mr. Nurul Huda Pir [*husband and unofficial group leader*] asked women to perform the work from inside the house” made by women themselves reveal how limited and secondary their contribution to cage culture is in this region compared to the other areas studied. In the Barishal area, although not thought to be conservative and where Hinduism is widespread, a woman commented that “some think it is not good for women to go out of their houses”. Decisions over the role of each household members in the management of cages are usually made “jointly” or through “mutual understanding”, although some are also said to be “based on necessity” and consider cage culture as a “household activity”. This therefore may suggest that feed collection, preparation and application – the most time consuming tasks – ‘naturally’ devolve on women.

Both the weight of women in post-harvest decisions and actual plans (eat, sale the fish or how to use the money earned) and priorities vary widely in each area, villages and household.

Findings suggest that:

- In the Dhaka area, cage culture, when carried out by female cage operators could serve both household consumption and entrepreneurial ventures, whereas male cage operators tend to consider it as an income generating activity (IGA) only.
- In the Sylhet area, where cages are managed by a group of cage operators, women have very little say over the final use of the fish production. Household consumption does not seem to be encouraged for individuals have to purchase fish from the group. It is expected that at the end of the first cycle, most of the money earned may be re-invested in cage culture. A woman indicated: “very little fish will be eaten by the family: just to taste and for family interest”.
- In the Comilla area, women would either keep the fish for household consumption or, if sold, they would use the earnings for household purposes or “for sewing purpose” (which in turn may be an IGA) or for “purchasing her favourite things”.
- In the Barishal area, both males and females prioritise family fish consumption, although money earned through the sale of some fish will be re-invested in cage culture.
- In the Jessore area, women, in particular when they are in charge of cage aquaculture operations, appear to be the most in control of post-harvest decisions with clear ideas of how to dispose of the money: for personal use (“to make gold ornaments”) or to reinvest in cage culture, for the benefit of their whole family. One of the female cage operators’ plan for next year is to “try for more cages: I will observe costs and benefits this year. Priority on the education of children”.

Some of the comments made by women involved in cage culture disclose their awareness of the potential freedom they can gain from cage culture through increased financial autonomy and suggests that this motivation must be implicit in their willingness to start cage culture.

Respondents were also asked about their financial expectations from cage culture and knowledge of current market prices at which they could sell their fish to assess the level of information women in particular have access to, including technical information and knowledge about cage culture. Although levels of information seem to vary quite slightly between villages and regions, they are nevertheless symptomatic of the present situation of women in Bangladesh. For instance, in Sylhet, a woman said she “doesn’t know how much to expect as she does not visit the cage site”. This contrasts with the

Dhaka, Comilla and Jessore areas where women are more aware of the market prices they can expect for their fish. However, although some female cage operators in the Barishal appeared to be very independent in their choices, have a surprisingly limited knowledge of information from beyond their household, which may suggest that their post-harvest decisions are made without the complete knowledge of all external factors such as market prices.

In the cultural context of Bangladesh, women appeared to be learning about cage culture through their own observations when cages are located in their surrounding environment, and through communications with other women, as a way to overcome their restriction of movement. As a non-cage operator lady put it: “In the monsoon, when the cage was close to the house, she saw the fish inside the cage. In winter, when the cage was shifted to a deeper portion of the river, she had less chance to see the fish” (Jessore). Environmental constraints such as the lack of water and the need to shift cages to a different location may thus be added to the existing social and cultural constraints female non-cage operators are facing. These not only impede their potential involvement in cage culture, but also prevent them from gaining knowledge through “indirect” channels (i.e. not through NGO training for example). The availability of a water body nearby their house and in which cages may be located is therefore crucial to facilitate women’s participation in cage aquaculture.

#### 4.3.2 Division of tasks

Table 4.2 provides estimates of the overall time spent managing cages each day by gender:

Region	Women	Men	Average time Women	Average time Men
DHAKA			50min	1hr05
Village 1	30min.	1hr30min		
Village 2	1hr	1hr		
Village 3	1hr	40min (longer if snail feed)		
COMILLA			1hr05	49min
Village 1	1hr30	42min		
Village 2	15min	5min		
Village 3	1hr30	1hr40		
SYLHET			2hr05	2hr43
Village 1	2hrs	3hr40		
Village 2	2hrs	2hrs		
Village 3	2hr15	2hr30		
BARISHAL			67min	52min
Village 1	1hr08	37min		
Village 2	1hr30	1hr30 (longer if snail collected)		
Village 3	43min	30min		
JESSORE			1hr	1hr30
Village 1	1hr	1hr		
Village 2	1hr(longer if snail collected)	2hr30		
Village 3	1hr	1hr		

**NB: Figures for the Dhaka area have to be treated carefully as the number of household interviews carried out was smaller than in the other two areas.**

This quantitative data has to be complemented by the qualitative data collected about the division of tasks between household members which showed that feed collection and preparation are mainly carried out by women, with occasional help from children, whereas seed collection, harvesting and selling of fish are men’s task, whether cage operators are male or female. One notable exception is in Jessore, village 3, where a wife (cage operator) was introduced by her husband to market retailers. The strict cultural context of the Sylhet region explains why men spend on average longer every day looking after cages than women: “Mr. Jalal is doing the work, so women have less work. Little work load but interesting”. But, as was mentioned by another of them: “she would like to get involved more but culture does not permit”. Distance from the water body is recurrent problem: in Jessore, village 2, women’s participation was said to be constrained by the fact that the water body is far from their house, which explains why the amount of time they devote to cage management is less than their male counterparts.



### 4.3.3 Trade-offs and opportunity costs at the household level

Although a female respondent did not want to compare cage culture to cattle farming or poultry rearing because “cage culture is cage culture” (Dhaka), the activity is, in general, considered as a useful investment of time, energy and money as cage operators and villagers see fish growing and because “there [may be] a deficiency of fish in this village” (Barishal). However, the impact of the activity on each individual and their household is reflected in comments related to opportunity costs and trade-offs of aquaculture, which are perceived differently according to genders. Answers to questions:

- “If your household members were not involved in cage culture, how would they spend the time which is currently spent on cage culture?” ? allocation of time to aquaculture rather than other activities = ‘time’ opportunity cost
  - “If your household members were not involved in cage culture, on what would have they spent the money you invested in cage culture?” ? allocation of financial resources (i.e. money) to aquaculture rather than other activities = ‘financial’ opportunity cost
- and their frequency of mention are presented per area, in Table 4.3 below:

Table 4.3: Frequency of mention by men and women, of the perceived time and financial opportunity costs of cage culture on their activities, in the five regions of study.

#### Comilla

Time opportunity cost		Financial opportunity cost	
Men (10 answers)	Women (11 answers)	Men (8 answers)	Women (9 answers)
- Leisure time: 3/10 - HH works: 2/10 - Study: 2/10 - Business purpose: 2/10 - Agriculture: 1/10	- HH work: 6/11 - Leisure time: 2/11 - Sewing: 1/11 - Study: 1/11 - Poultry: 1/11	- HH purpose: 3/8 - Study: 1/8 - Business purpose: 3/8 - Fish culture in pond: 1/8	- HH purpose: 3/9 - House hotel purpose: 1/9 - Business and other works: 1/9 - Poultry rearing: 3/9 - Goat rearing: 1/9

#### Dhaka

Time opportunity cost		Financial opportunity cost	
Men (9 answers)	Women (7 answers)	Men (4 answers)	Women (7 answers)
- Leisure: 2/9 - Crops: 1/9 - Poultry: 1/9 - Cattle: 1/9 - HH activities: 1/9 - None: 1/9 - Boating activity: 1/9 - Other works: 1/9	- Leisure: 4/7 - Other works: 3/7	- None: 2/4 - Other purposes: 1/4 - Own consumption: 1/4	- Goat farming: 2/7 - Does not want to compare cage culture with other activities: 1/7 - Duck rearing: 1/7 - Cattle: 1/4 - Poultry: 1/4 - Other purposes: 1/7

#### Sylhet

Time opportunity cost		Financial opportunity cost	
Men (24 answers)	Women (18 answers)	Men (16 answers)	Women (23 answers)
- Family affairs/works: 6/24 - Small business: 4/24 - Fisheries: 2/24 - None: 1/24 - Other activities: 1/24 - Cattle: 1/24 - Tree nursery: 1/24 - Mechanics shop: 1/24 - House/seasonal activities: 1/24 - Accounting of businessman: 1/24 - Rest: 1/24 - Education: 1/24 - Share cropping: 1/24 - Farming: 1/24 - Labour: 1/24	- Family work/activities: 5/18 - Homestead gardening: 2/18 - Seasonal business: 2/18 - Visits to relatives: 1/18 - Cattle: 1/18 - Goat rearing: 1/18 - Chicken rearing: 1/18 - Common work: 1/18 - Tree nursery: 1/18 - Farming: 1/18 - Share cropping: 1/18 - Family dairy activities: 1/18	- Family purposes: 3/16 - Woodwork or other little business: 2/16 - Present and future trading: 2/16 - Agricultural labouring: 1/16 - Goat rearing: 1/16 - Cattle: 1/16 - Tree nursery: 1/16 - Mechanics shop: 1/16 - Saving for the future: 1/16 - Saving among group for small business: 1/16 - Homestead gardening, vegetables: 1/16 - Poultry rearing: 1/16	- Family purposes: 3/23 - Small business: 3/23 - Education: 2/23 - Rice husking: 1/23 - Savings: 1/23 - Cattle: 1/23 - Goat rearing: 1/23 - Chicken rearing: 2/23 - Fishing: 1/23 - Duck rearing: 1/23 - Gardening: 1/23 - Agricultural labouring: 1/23 - Does not know: 1/23 - Mechanics: 1/23 - Nursery: 1/23 - Farming: 1/23 - Share cropping: 1/23

### Barishal

Time opportunity cost		Financial opportunity cost	
Men (11 answers)	Women (17 answers)	Men (12 answers)	Women (12 answers)
Leisure: 2/11 Pond fish culture: 2/11 Agricultural activity: 2/11 Other profession: 1/11 Reading: 1/11 Banana garden: 1/11 Shop: 1/11 HH activity: 1/11	Other HH activities: 5/17 Gossiping: 2/17 Banana garden: 2/17 No (limited) opportunity costs: 2/17 Sewing: 1/17 Lazy time, resting: 1/17 Reading: 1/17 Duck rearing: 1/17 Cow rearing: 1/17 Walk here and there: 1/17	Pond fish culture: 2/12 HH activities: 2/12 Spent in other way: 1/12 Vegetable culture: 1/12 Poultry rearing: 1/12 Banana garden: 1/12 Shop: 1/12 Agriculture: 1/12 Bettle leaf garden: 1/12 Cow rearing: 1/12	HH activities: 4/12 Purchase poultry for rearing: 2/12 Feed for cows: 1/12 Banana garden: 1/12 Pond fish culture: 1/12 Other activity (HH act. excluded): 1/12 Purchase fish for eating: 1/12 Does not know: 1/1

### Jessore

Time opportunity cost		Financial opportunity cost	
Men (9 answers)	Women (20 answers)	Men (10 answers)	Women (14 answers)
HH activities (incl. for family members): 5/9 Fishing: 1/9 Produce date or palm juice: 1/9 Resting: 1/9 Ferry boat: 1/9	HH activities: 8/20 Leisure: 4/20 Fishing (incl. for husband): 3/20 Net making: 2/20 Goat rearing: 1/20 Pigeon rearing: 1/20 Sewing: 1/20	Spend for HH: 6/10 Goat rearing: 1/10 Poultry rearing: 1/10 Farming: 1/10 Cattle and poultry feed: 1/10	HH purpose: 3/14 Savings: 2/14 Cattle rearing: 2/14 Feed for cows and poultry: 2/14 Stock business: 1/14 Goat rearing: 1/14 Poultry rearing: 1/14 Clothing and ornaments: 1/14 None: 1/14

*NB: respondents may have given several different answers.*

These tables suggest that the encroachment of cage culture on daily activities is borne differently by men and women. In spite of the constraints this activity represents, a woman thought that “comparatively, it is more profitable than other works” (Sylhet). Both men and women have reorganised their daily routine to include time to look after their fish and cages: “[cage culture has] no detrimental effect on household activities as all together [male cage operators] adjust their work with mutual understanding with other group members [and other family members]” (a woman, Sylhet). In the Jessore area, a man indicated that “as day after day things are mechanised (e.g. rice husking, net making), women are getting more free time” – quickly taken over by aquaculture management tasks... Through their comments, female respondents appear to be very aware of the potential of cage culture: “if we need fish, then somehow [cage culture] is meeting the purpose and is also a chance to get money” (Sylhet). However, they are also aware of the labour and attention required: “the more labour provided, the better the results, so I give maximum labour to get profits” (Dhaka). They are also aware of the potential danger if family funds and savings are diverted away from education towards cage culture: “Sometimes spending for cage operation rather than education. My son cannot concentrate on his educational work. Now he has reorganised his work and routine” (Sylhet).

In summary, the main constraints to women’s full participation in cage culture include:

- Distance from the water body: “wife does not help because water body is too distant, therefore not enough time is spent looking after the fish” (Dhaka).
- Access to the water body and ownership conflicts: “at first, operators faced difficulties to get access to the shared pond, but later, they solved [this problem] and set their cages [in the pond]” (mentioned by NGO staff, Comilla). If access to the water body is a problem for some male cage operators, it is *a fortiori* for female cage operators. “Due to a conflict with her neighbours [over a land issue], she could not visit her cages frequently. She has to go a long way to get to her cage site to avoid the neighbours’ house” (Jessore). It was also thought that individual ownership of pond was an advantage for succeeding in cage culture.
- *Parda*, especially in the Sylhet region, which restricts women’s movement and indirectly their access to information. As it was mentioned by men during the community meeting, “women are helping the

farmer from inside the house preparing feed, discussing issues and on Bazaar day<sup>3</sup>, they are visiting the cages”. All other influential factors such as social status, wealth, distance, access and education/access to knowledge, are derived from the strict religious culture of this area.

Household size was not found to be a significant determinant in women’s participation. Wealth and social status were not found to be determining factors in the success or dropout of the activity in the Dhaka, Comilla and Jessore areas. However, in the cultural context of the Sylhet area, both poverty and relative wealth may be impeding factors to the direct participation of women in cage culture: the first will push women to sell their labour outside and leave little time for them to dedicate to cage culture. The later will keep women inside their houses since there will be no necessity for them to sell labour to help supporting their household. The cultural and religious context of the Barishal area, dominated by Hinduism, is thought to facilitate the involvement of women in cage culture and their support by male members of the community, in comparison to Muslim areas where “women are not interested to come to strangers” (NGO comment, Barishal).

#### 4.4 And the impacts of cage culture on communities?

The introduction of cage culture in targeted villages has induced some changes in the use villagers make of the water body. However, nowhere these changes were perceived as open conflicts and certainly not treated as such by water users who simply seem to have adapted their activities to the presence of cages in the water body.

Common uses of wide water bodies (e.g. rivers, canals, etc.) include, in addition to cage culture:

- boating and river traffic, including ferry crossing (\*)
- washing utensils and cleaning
- bathing
- cattle bathing
- fishing (\*)
- duck farming
- jute retting (\*)
- irrigation.

(\*) = more limited in the case a ‘closed’ water body: pond for example.

As all these uses are occurring simultaneously on the water body, its physical characteristics as well as ownership status will play an important role in supporting or not all the various uses made out of the water.

In most instances, cage culture was felt as not bearing negative impacts on other water users, as reflected in comments made during the community meeting and the mapping exercises: “bathing nearby cages is not a problem because soapy water does not harm fish” (Dhaka), “cattle farmers, duck rearers and boatmen do not cause trouble to cage operators” (Dhaka). In one of the Comilla villages, the place which is presently occupied by cages was vacant and unused before and, according to the cage operators’ group, there has been no change in the water quality due to the presence of the cages in the pond. The extra advantage of having cages in a pond is that the feed lost from the cages is “an extra source of feed for pond fish” and, because of the feed, “fish from the pond gather near the cage and it is easy to catch them”. According to cage operators of a Sylhet village, “before the cage setting, people used to fish in the canal. They are still fishing but not coming to the cage site”. The presence of extra water bodies (e.g. individual ponds, village canal) enable water uses to be shifted from one to the other without causing any problem: “villagers thought that there would be no problem with more cages. If in the future they face any problems in the canal, they will shift cages to the ponds” (Village 2, Jessore, also in village 2, Barishal).

Other opportunities brought to communities through the introduction of cage culture appear in a number of quotes made by all stakeholders. Cage culture is seen as:

- an educational experience: “Learning a new thing” (children, Sylhet), “knowledge development” (cage operators, Dhaka)
- a source of income: “Cage culture is a profitable business and an extra source of income” (cage operators, Comilla), “cage culture is a profitable project” (children, Barishal).
- a solution to unemployment: “Unemployment will be mitigated” (other water users, Sylhet)

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<sup>3</sup> Bazaar day is the day when all men leave the village to go to the market place in a neighbouring community. Their absence from the village enables women to leave their houses without violating *parda* nor men’s honour.

- a solution to food shortage: “fish will be available when needed” (other water users, Sylhet), “the number of fish is increasing in the pond” (non-cage operators, Sylhet); “fish is our main food” (children, Barishal).
- a source of encouragement: “neighbours and other villagers feel encouraged to see the cages” (women, Sylhet); “everybody (children and older people) can do cage culture (children, Barishal)
- a place of interest and curiosity: “Cage fish is now a place of enjoyment, a site for visit and it is interesting to see the movement of fish” (children, Sylhet), “Non-cage operators are becoming interested in cage culture” (cage operators, Sylhet), “ It looks beautiful with the cages. People feel encouragement when they cross the river to see the cages and also show interest in a new thing like cage culture” (children, Comilla), “we have an interest in cage culture” (women, Sylhet), “it is easy to entertain the guests, easy to catch and sell the fish” (cage operators, Comilla; children, Barishal).
- a source of indirect benefits for non-cage operators, in particular fishermen and other villagers. For fishermen, the lost feed from the cages attracts river fish around the cages and “has a good impact on fishermen”, and the guarding of cages at night also provides protection for their nets, traps and boats (Jessore). For other villagers, tilapia fry escaping from cages can be harvested by them. “When fish breeds, then the pond is sowed” (children, Barishal).

In addition, cage operators of the Sylhet area where cage culture is practised in group stated that “co-operative cage culture has created a unity among [them] which did not exist before”.

Although potential conflicts were not expressed directly by participants, the mapping exercise complemented by additional comments revealed that a number of changes had occurred in the use of the water body and that these may potentially lead to the development of more serious conflicts.

Some of the changes that have occurred relate to the place where bathing takes place, for both humans and cattle. In one of the conservative Sylhet villages, one may assume that the cage site was decided taking into account the location of the *ghat* women use to carry out their own activities to avoid any embarrassment the proximity of the cages and cage operators may cause to them. However, fishermen had to change to location of their seine nets in the canal and the new setting is now very close to the women’s *ghat*, as shown on the children’s and cage operators’ maps, resulting in the creation of the same embarrassment for women. In another of the Sylhet villages, cattle have to bathe a bit further away to avoid disturbance to the cages.

Another change relates to the siting of fishermen’s nets and trapping devices, which may have to be placed in different locations due to the presence of cages in the water body. In a Comilla village, non-cage operators complained about the difficulty to catch fish with their nets because of the siting of cages in the pond. Similarly, in one of the Dhaka villages, some mishaps occurred after cages were shifted to parts of the water used as fishing grounds by professional fishermen. In addition, maps often represent the location of *kathas* (fish capture device) close enough to cages to suggest that some interference could occur with cage culture. Although not a major issue in the Jessore area, the presence of cages in the fishermen’s water body was nevertheless mentioned twice: “people from this community used to catch fish in the canal which is now the place used for cages. They now use vacant places to catch fish” (women, Jessore), “sometimes fishermen think that cages are reducing their catching area” (a shopkeeper, Jessore).

In addition, the modification of boatmen’s transport routes to avoid cages was mentioned by women (both cage and non-cage operators) in the Comilla area: “before starting cage culture, the river was used for boating, but now boatmen row their boats in a different way”.

However, if cage culture does affect other activities as seen above, the reciprocal is also valid in a number of instances. The location of jute retting also had to be shifted away after it was observed that the polluted water resulting from the decomposition of the bark was responsible for fish death (Dhaka). in villages 1 and 3 in the Jessore area, it has become a major problem for both cage operators and fishermen who have to stop their activities during three months of the year. Water pollution also affects cage culture: “besides jute retting, drainage water falls into the river. It causes fish diseases” (female cage operator, Jessore).

In the Barishal and Jessore areas, villagers of two different communities found themselves confronted with ‘dilemmas’ related to the best – and competitive - use of a scarce and unevenly distributed good: water. In village 1, Barishal, a trade-off has to be made between using water for fish culture or vegetable gardening – probably high value crops, which is likely to have high opportunity costs and may potentially generate conflicts between vegetable growers and cage operators. The situation is similar in village 2, Jessore area, over the use of the *bill* (waterlogged area used for paddy rice cultivation at various times of the year, which is also the site for cage culture). However, there may be

more potential in this village to integrate rice-fish culture without generating too many trade-offs between all interested parties.

The above enumeration of ‘difficulties’ generated by the implementation of cage culture suggests that some monitoring will be necessary to detect conflicts in time and envisage possible mitigation measures – if these are not implemented spontaneously by community members. Indeed, if all these ‘problems’ are still at the stage of ‘bearable nuisances’, they are likely to become exacerbated if the number of cages in the water bodies increases proportionally to the farmers’ growing ambitions. Conflicts and jealousy between villagers are also likely to be triggered by the ownership status of the water body selected for aquaculture. A potential for jealousy may be detectable in the Barishal area where cage operators are not eager to share their success in cage culture. A female cage operator asserted that “she is not interested to show her fish to the villagers because there is a possibility for poaching” (Barishal). Similarly, children from this region commented that: “it is easy to poach fish from the cages” and that “sometimes cages are stolen – for example Anjali’s” which explains why their “parents are not interested to show the cages”. Multi-ownership of a pond by a defined number of households, with access and water use limited to these households, is not necessarily a generator of problems between pond owners (“there is no problem, though there is multi-ownership [of the pond], Sylhet). However, multi-ownership has the potential for creating frictions between those in the village who have access to a pond and those who don’t, in particular in areas where water resources are limited (e.g. “the community people feel jealous among themselves” – NGO comment, “if all cage operators want to install cages in their pond, they can, but due to the lack of security, they do not want to do it”, female non-cage operator, Comilla). The potential for conflict also exists in the case of a water body with free and open access to water users, being either under government ownership with free access or leased to a single individual who leaves free access to water users. Problems may arise over the right of appropriation of the benefits of cage culture if the government or anyone else realises the potential value this activity can add to a water body, especially when arrangements of taking lease of the water body are lacking (e.g. Sylhet).

The future increase in the number of cages set in a particular water body, as well as the success of cage operators, is therefore likely to be determined by the concomitance two sets of factors: the water body carrying capacity, ownership status and traditional uses, the social conflicts between communities and their members which this increase may generate, and the ability of villagers to deal with them.

## **5. Methodological difficulties and suggestions for follow-up surveys:**

Difficulties related to the methodology employed for the surveys and identified during both the analysis of the data collected and CAGES project annual review in January 1999, are twofold and linked to each other:

1. Relevance of some of the surveys objectives and questionnaire design
  2. Very lengthy and time consuming analysis process due to the type of data collected (qualitative).
- However, the actual process of data collection (visits to the targeted villages, household interviews, community meetings, de-briefing with NGO and CARE-CAGES staff) proved to be working relatively efficiently.

### 5.1 Survey objectives and questionnaire design

***The survey objectives were based on the identification of knowledge gaps by CAGES staff. They were conceived as a way to improve the understanding of the socio-economic impacts of cage culture on both communities and households and highlight household members’ perception of cage culture, appreciation of the challenges it entails and personal contribution to the activity.***

Shortcomings related to the definition of some of the surveys objectives and their relevance to the studies were encountered during the analysis process when it appeared that:

- either information to “answer” the objective had not been collected properly,
- or findings did not make any significant and new contribution to the already existing knowledge.

This was typically the case with:

- a. Survey 1, first part of Objective 2, regarding the “personal perception of success and failure”. Indirect answers to this question were provided by the respondents during household interviews. However, the relevance of this question may be questionable.

- b. Survey 2, Objective 3, regarding the factors influencing the role of women in cage culture. Although indirect observations by CAGES staff and indirect information and comments provided by female respondents during the household interview enabled the formulation of some interesting findings, no specific question was designed to answer this objective in the questionnaire or the mapping exercise.
- c. The same applies to Survey 2, Objective 4, regarding whether the involvement of women in cage culture contributes changes to their social status. Although answering this objective would have probably brought very interesting findings, nothing to answer it specifically was included in the survey methodology which lead to superficial and speculative conclusions in most cases. This explains why this objective was dropped in the analysis of the Barishal and Jessore areas.

However, trying to answer these two objectives at this early stage of the social surveys has nevertheless enabled a preliminary insight into the constraints of women's full participation in cage culture. If further gender investigations are pursued in the context of the CAGES project, these two objectives would have to be met through the use of a survey specifically and carefully designed for this purpose, and not as part of another survey as it is presently the case.

Survey 3 objectives and methods may be kept as originally defined and may be used as such for the monitoring of further impacts and changes brought to communities by cage culture in follow-up surveys.

#### 5.2 Time-consuming data analysis

Collection of primarily qualitative data for in-depth case-study analysis was the aim of each of the surveys. If the "reading" and interpretation of maps from the mapping exercise and notes from the community meeting were fairly straightforward and reasonably quick for Survey 3, this was not the case with the manual analysis of the open-ended questions of the household interviews. The "time" factor was largely underestimated for the analysis given the amount of information collected. Following comments from the project annual review to help with the follow-up surveys, an amended, more concise and targeted household survey format (Surveys 1 & 2) was drafted. It aims to incorporate in more equal proportions qualitative and quantitative data and allow its faster, more systematic and less subjective interpretation, while still providing the in-depth information required for household case studies. The amended version of the questionnaire format also takes into consideration the points made in section 5.1 above regarding the "usefulness" of some of the surveys objectives.

The new version of the questionnaire is presented in Appendix 2.

QUESTIONNAIRE

Name:

Wife/husband of:

Experience/success c.a.:

Other occupations:

Village:

Union:

Thana:

District:

**General**

1. A very brief note of his/her house to indicate wealth.

2. How many people live in your household? What age are the members of your household?

3. How many years have you produced fish in cages?

4. How many cages of what size, and what species do you farm?

5. How many fish are there per cage?

**Roles, perception of opportunity costs and benefits to of cage aquaculture households, with particular emphasis on the role of woman.**

6. Who decided to try cage aquaculture? Why?

7. Who:            buys the seed? From whom? How much does it cost?

Feeds the fish?

Harvests fish?

Sells fish?

8. Who decided on these roles?

9. What are fish fed?

10. How long does this take each day?

11. How much money do you expect to make this year and what do you plan to do with it?

12. How much do you expect to sell 1 kg of your fish for?

13. How many fish will be eaten within the family?

**Reasons for drop out or continuation of operators in cage aquaculture. Includes technical / financial failures, as well as personal change in circumstance (married, leave area, etc.)**

14. How successful do you feel you have been in cage aquaculture?

15. Have you been more successful than last year, and why?

16. You have had people that have had difficulties in your group, why do you think that is?

17. Who is the most successful farmer in your group and why?



18. What do you think of the support that is given by the NGO and CAGES staff?

19. How can this be improved?

**Roles, costs, opportunity costs and benefits to households of cage aquaculture, with particular emphasis on the role of woman.**

20. Is cage aquaculture a good use of your time, money, energy?

21. If your household members were not involved in cage aquaculture, how would they spend the time which is currently spent on cage aquaculture?

22. If your household was not involved in cage aquaculture, on what would you have spent the money you have invested in cage culture?

23. Does cage culture have a detrimental effects on other household activities?

24. How has cage aquaculture affected the status of your household within the community?

25. What are your plans for next season?

F) Appendix 2

**CAGES SOCIAL SURVEYS**

Name (M/F):

Wife/Husband/relative of:

Level of success (circle):                      low                      medium                      high

Experience in cage culture:

Other occupations:

Village:

Union:

Thana

District:

Region:

**SURVEY 1) REASONS FOR HOUSEHOLD CAGE OPERATORS' CONTINUATION AND DROPOUT FROM CAGE AQUACULTURE** *(May include technical / financial failures, as well as personal change in circumstances like marriage, leaving area etc.)*

1. Have you been more successful than last time, and why?

2. You have had people (in your cage group – use when appropriate) who have had difficulties during cage culture, why do you think that is?

3. Who is the most successful farmer (in your group – use when appropriate) and why?

4. How can the support provided by the NGO and CAGES be improved?

5. Are there any constraints/difficulties in your (if respondent is a women) / your wife's (if respondent is male cage operator) participation in cage culture? If yes, which ones?

6. How has cage culture affected the status of your household (and your personal status) within the community?

--

7. What are your plans for next cycle?

Continue?                      Yes                      No

If yes,

Species cultivated	Number of cages (+ / -)?	Other plan (please specify)

**SURVEY 2) ROLES, PERCEPTION OF OPPORTUNITY COSTS AND BENEFITS OF CAGE CULTURE TO HOUSEHOLDS, WITH PARTICULAR EMPHASIS ON WOMEN**

1. Who is / was responsible for the following activities?

Decision to take up cage culture	Decision on distribution of management tasks	Buying seed	Preparing Feed	Feeding fish	Harvesting fish	Selling fi
✍						
✍						
✍ Why? ✍ ✍ ✍						

Code:

- 1. Operator (male)
- 2. Operator (female)
- 3. Wife
- 4. Husband
- 5. Sons
- 6. Daughters

- 7. NGO staff
- 8. Male relatives
- 9. Female relatives
- 10. Neighbours
- 11. CAGES staff
- 12. Others (please specify)

2. Will cage fish be eaten (or has been eaten)? **Yes** **No**

If yes, how much?

--

3. Time spent on cage culture by household members: (Matrix exercise)

Involvement of different people	Amount of time spent in one day on				
	cage management	feed preparation including collection	feeding	harvesting	selling
Cage operator (male/female)					
Husband/wife					
Sons					
Daughters					
Others					

***If others, please specify who and what is the relation with cage operator----***

4. How will you use the money earned from cage culture? (distribution of earnings)  
Rank priorities from 0 to 5 (0 = no earning spent on this, 5 = most of earnings spent on this)

Earned from cage (if not 1 <sup>st</sup> cycle)	Use for HH purpose	Children education	Next cage planning	IGA purpose	Other (please specify)
.....Tk. Expects to earn from cage (if 1 <sup>st</sup> cycle)					
.....Tk.					

**Do you know what is the market price of the species you are cultivating?**

Yes

No

If yes, what is it? (in Tk/kg)?

--

5. Opinion about cage culture

5.1 What do you think of cage culture for your household? (*open question for qualitative answer*)

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5.2 Alternative uses of time – time opportunity costs of cage culture –

**If cage culture did not exist, how would you use the time you currently spend on cage culture?**

Types of activities	HH activities (please specify)	Leisure time (please specify)	IGA activities (please specify)	Existing activities (please specify)	Other (please specify)
Cage operator (male/female)					
Husband/wife					
Son/ Daughter					
Other relative					

NB: enter information in the row corresponding to the person interviewed only.

5.3 Alternative uses of money – financial opportunity cost of cage culture -

If you had kept your money instead of spending for cage culture, how would you use it?

Types of activities	HH activities (please specify)	Leisure time (please specify)	IGA activities (please specify)	Existing activities (please specify)	Other (please specify)
Cage operator (male/female)					
Husband/wife					
Son/ Daughter					

Other relative					
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NB: enter information in the row corresponding to the person interviewed only.

5.4 Has cage culture a detrimental effect on other household activities?

Yes

No

If yes, what effect?

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**SURVEY 3: THE IMPACT OF CAGE CULTURE AT THE COMMUNITY LEVEL.**

*Find out the water body access and use pattern along with changes that may have occurred since the introduction of cage culture and potential conflicts between water users.*

1. Community meeting, mapping exercise and NGO de-briefing

Community meeting: as was carried out before, with questions about how people (females and males) feel about cage culture, if they are facing any difficulties, if it is good, then why not all of them have taken cages etc...

Mapping exercise: remember to ask about changes that have occurred in the group's habits of using the water body, if there may be potential for conflicts, and if there are conflicts/problems, what has been done to solve them.

NGO de-briefing: use the same form as the one designed in 1998 for guidance and check-list of things to ask (see Chapter 2).