# Fisheries Resources and Livelihood of the Villagers of Chitrapara

Study on fisheries resources use for livelihood and identification of fisheries extension and development needs of Gopalganj District, Bangladesh

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Working Paper No. 2001/1

**Development of Sustainable Aquaculture Project**
International Center for Living Aquatic Resources Management (ICLARM)
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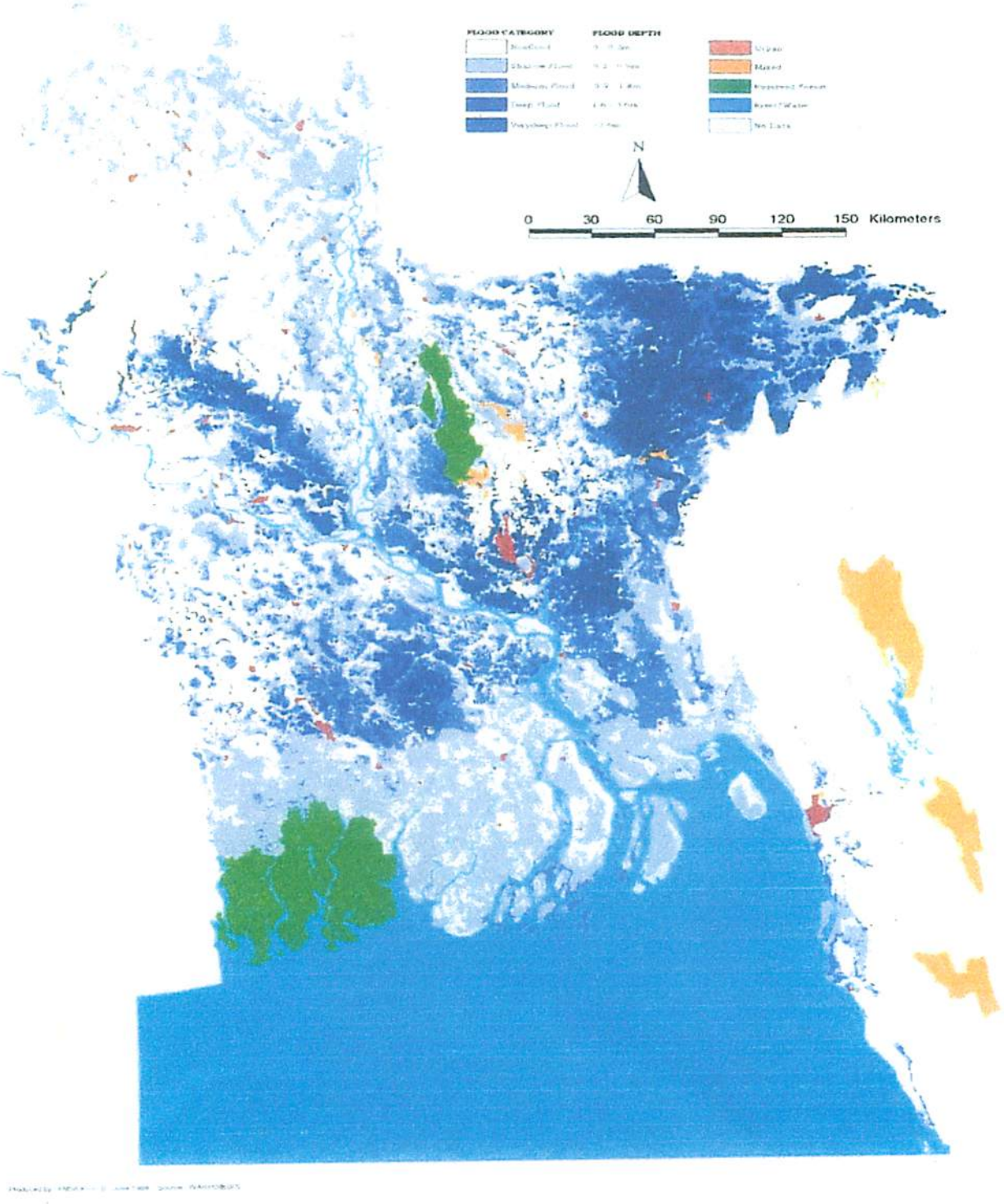
# Acronyms and Abbreviations

| | | |
|---|---|---|
| RDSAP | = | Research for Development of Sustainable Aquaculture Practices |
| BFRI | = | Bangladesh Fisheries Research Institute |
| BAU | = | Bangladesh Agricultural University |
| DU | = | Dhaka university |
| DoF | = | Department of Fisheries |
| NGO | = | Non-government organization |
| ICLARM | = | International Center for Living Aquatic Resources Management |
| PRA | = | Participatory Rural Appraisal |
| DFO | = | District Fisheries Officer |
| STAR | = | Society for Training and Rehabilitation |
| AEZ | = | Agro-ecological zone |
| IAA | = | Integrated Aquaculture-Agriculture |

Figure: 1 Normal Monsoon Flooding of Bangladesh.



# Chapter One

## Fisheries Resources and Livelihood of the Villagers of Chitrapara

### Introduction

The Research for Development of Sustainable Aquaculture Practices Project (RDSAP) has been assisting the national research institutions (BFRI), the national universities (BAU, DU), extension development institutions (DoF) and a number of national non-government organizations (NGOs) in developing, testing and identifying low cost environment friendly aquaculture. Most of which could be made sustainable by the rural poor, using mostly on-farm available resources (Grover 2000).

In a meeting, the Director General of the Department of Fisheries (DoF) requested RDSAP, ICLARM, to undertake and extend activities such as farmer training and field demonstrations in the Gopalganj District. The DoF also suggested organizing a workshop on the use of existing water and fisheries resources and livelihood, and also identifying potential areas for training, field demonstration and extension. Based on the request of DoF, the project has provided support for training of 92 farmers and small-scale aquaculture field demonstrations through a local NGO at Kotalipara. Later, a Participatory Rural Appraisal (PRA) was conducted by the project staff and a local PRA consultant was hired by the project for five days to train the project staff on PRA. The objective of the PRA was to articulate and identify existing fisheries resource use, their impact on livelihoods, and identify areas for further training, field demonstrations and other regional issues to be addressed for the development of aquaculture in small-water bodies.

Gopalganj is known as an aquatic resource rich district with extensive open waters, floodplains, khals, beels, ponds, and ditches. In spite of the potentiality and opportunity, the level of utilization of these huge resources for fish culture remained traditional. There appears to be good potential for enhanced management of these aquatic resources to increase fish harvests (Khan 1986). In the past, life of the villagers was peaceful so they did not think of alternative option for their livelihoods except fishing, fish trading, and subsistence farming. Gopalganj becomes flooded at least three to four months a year (Fig.1). The people also developed their livelihoods based on these water and fishery resources. This report explains the available fishery resource use of the study area and livelihood pattern developed by experience and also the kind of gear, traps, and nets adopted by the farmer/fisherman. The other objective of this study was to identify potential areas for fisheries development in general and fish culture, particularly in small water bodies. The recommendations made are based on the qualitative data/information gathered through PRA tools and field visits and thus they are indicative rather than conclusive.

# Chapter Two
# Method – Approaches Adopted

In recent years, there has been a remarkable expansion in participatory learning in research for problem identification, extension planning, accelerating technology transfer, research, and extension management and planning. The common approaches are Participatory Rural Appraisal (PRA) and Rapid Rural Appraisal (RRA), which have strong methodological and conceptual similarities with many other approaches such as Agro-eco System Analysis, Farmer Participatory Research, Participatory On-farm Action Research and many more activities (CARDS and IIED 1992). The PRA is comprised of a rich menu of visualizations, interviewing and group/team work methods, that have proven valuable for understanding the local living practices, integration of livelihood and resources, and for mobilizing and organizing local resources.

To articulate the living and livelihood of the people and their life-styles, fishing and fish culture and identification of potential areas for fisheries development, culture based fisheries research and development in the closed and semi-close water bodies, Chitrapara village in the Kotalipara Upazilla was selected as the study site. The pond population of Chitrapara village is higher than other villages of Kotalipara Upazilla and one of the partner NGOs of the project is located in the Upazilla. A PRA was conducted for the study (Fig. 2).

Discussions were held among the team members of the PRA (Annex-1) before initiating field work. However, field work was done in two visits. The first visit was done from 14 to 18 May 2000 with a team comprising members from different disciplines, later a part of the team investigated and verified information on some special issues. After each day of field work, all members of the team met and shared the day's learning and drew conclusions for further focus and attention. The preliminary findings of the field work were also shared with the Upazilla fishery officials of Kotalipara and district fishery officials of Gopalganj.

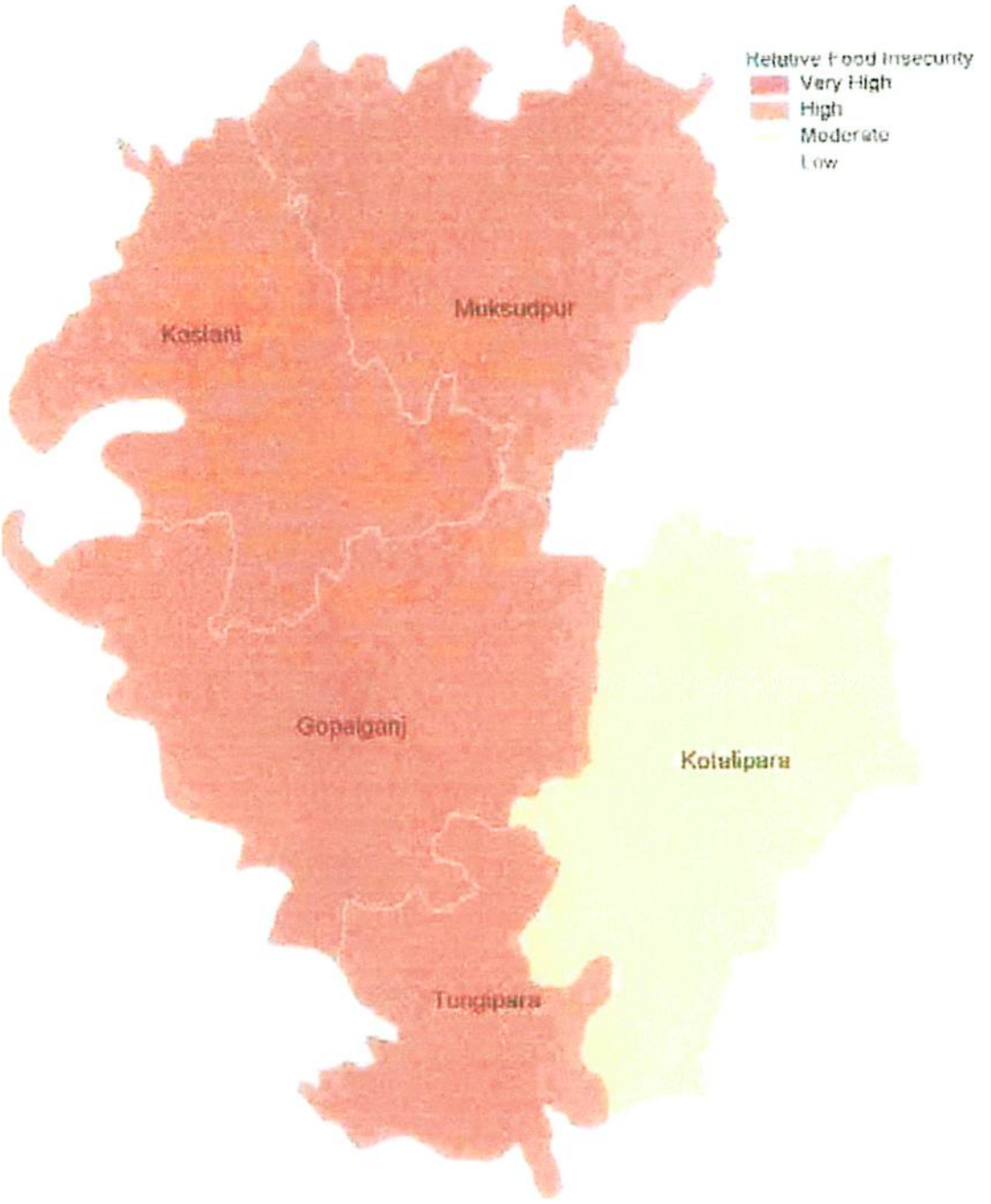
At the end of the field study, the team met at ICLARM, Dhaka, and shared findings and observations of the PRA for enriching content of the study and identifying further areas to be addressed.

A number of PRA tools and semi-structural questionnaires were used to assess and articulate life style of the people, their livelihood and resources, and their interactions. Relevant secondary data were also collected from available literature, such as DoF and other sources.

The Upazilla officials of the Department of Fisheries (DoF) also participated in the field work. Farmers of different groups, men and women, participated in the PRA (Annexe-2). The District Fisheries Office (DFO) and a local organization called (NGO) STAR facilitated the entire field activities. Review meetings were held at the end of each field day.

The PRA team were confronted with two problems. The participant farmers were expecting help or relief in the form of kind or cash from the team. Their expectation was to have some financial support in the form of relief. The members of the PRA team were relatively little exposed to such field activities and studies.

Fig. 2 Relative food insecurity of Gopalganj district.



# Chapter Three
# Kotalipara – A general profile of the people and fisheries resources

## 1. Kotalipara – a profile of the people and fisheries resources

Kotalipara is one of the five Upazillas of Gopalganj District, located in the south-eastern part of the district. Kotalipara has 12 unions and 206 villages, each with an average population of 1200, slightly lower than the national average of population per village.

## 2. Aqua and agro ecology

The area around the study village of Chitrapara occupies mainly one aqua and agro-ecological unit known as Khulna-Gopalganj Beels (AEZ 14). The AEZ 14 also occupies a number of separate basin areas in Madharipur, Narail, Jessore, Bagerhat and Khulna. The eastern part of Gopalganj also occupies partly Low Ganges River Floodplains and Ganges Tidal Floodplains.

The soils of the AEZ 14 or Khulna and Gopalganj beels are mostly greyish and dark grey acidic heavy clays, overlying peat or muck (25-100 cm). Soft peat and muck occupy perennially wet basin centers. The general soil includes mainly peat and non-calcareous dark grey floodplain materials. Organic matter content of this type of soil is medium in the ridges and high in the bottom of the beels. The soil is strongly acidic and is low in available phosphorus. The soil fertility is medium (BARC 1997). The major soil type of Gopalganj is mixed with clay and loam. Similar soil type also exists in the study site.

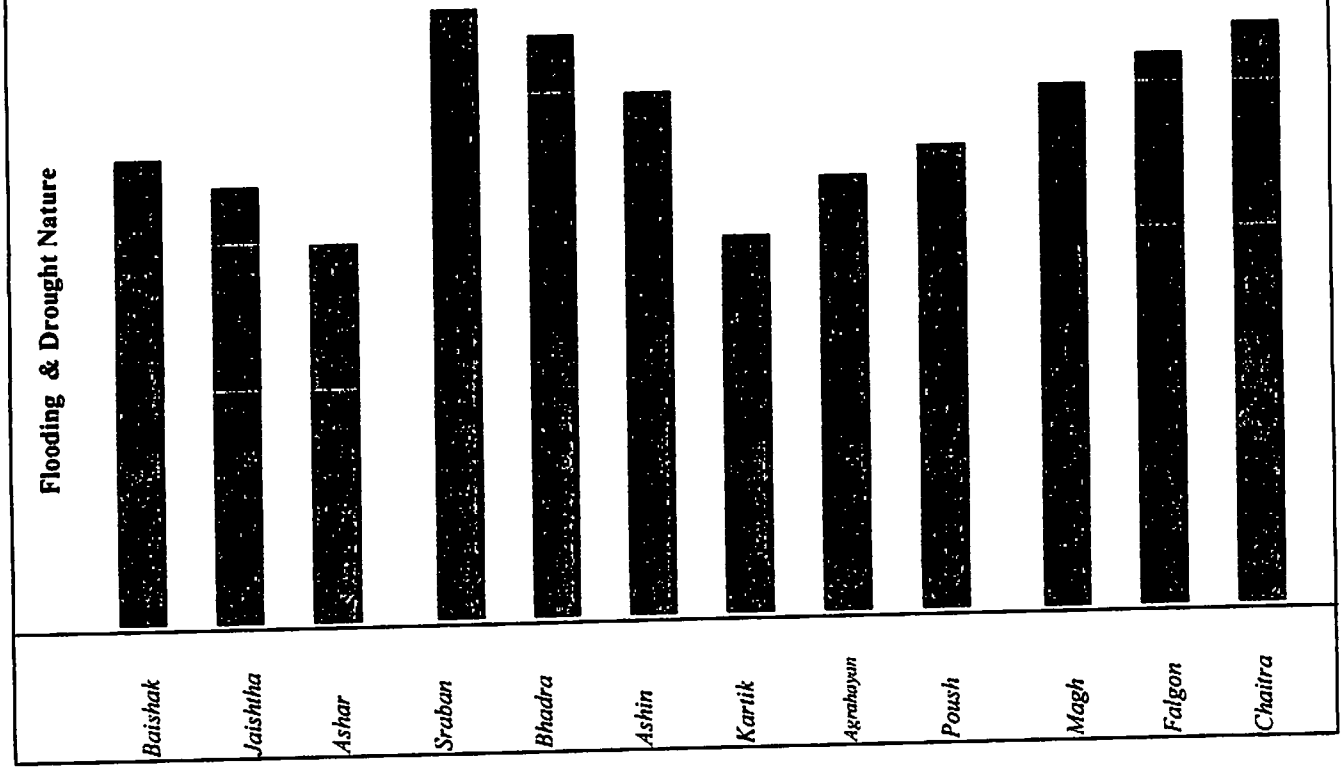
## 3. Flood and drought

The flooding in different areas of Bangladesh consist of a variety of complex processes. In general some of the elements that can be distinguished for analysis (Adnan 1991) of flooding and livelihood and life style are as follows:

- inundation caused from heavy rainfall and raised water levels;
- waterlogging because of protection of free flow of water or poor drainage system;
- siltations of river basins and lowlands and thus submerges wider areas than what it usually does.

Inundation caused by rainfall is limited to the peak rainy months or days. Waterlogging can also be a perennial problem. Heavy rainfall and poor drainage between and within beels, khals and rivers casuse flooding almost every year. The normal flood starts from the month of Baisak (mid April - mid May) and continues till Ashar (mid June - mid July). The participants mentioned that normal flooding has always been beneficial because normal flooding facilitates fishing, transporting goods and services, and does not destroy assets and properties. One of the major fishing periods is summer (Ashar-Bhadra three months).

Figure 3. Farmer's perception of seasonality of flooding and drought period of Kotalipara Upazilla.




The farmer perception of flooding and drought months are shown in Fig. 3. It suggests that the high flood period remains three months, while heavy drought period continues for two months. As flooding periods are prolonged more than drought, most of the farmer livelihood activities emerge from water and flood. On the other hand, the dry period starts from the month of Kartick (mid October -mid November) but the driest months are Falgun (mid February-mid March) and Chaitra (mid March - mid April).

The waterbodies and fisheries resources of Kotalipara Upazilla are shown in Table 1. The total waterbodies and fisheries resources of the area is reported to be 19,800 ha, which may not be an exhaustive estimate of the total seasonal and perennial water bodies but an indication. The Upazilla fishery officials also believed that the number of seasonal and perennial water bodies have increased. In fact, two-third of the total area of Kotalipara is inundated and remains under water for more than three months.

Figure 4. Area affected by open water flood as of 10 September 1998, Gopalgonj.

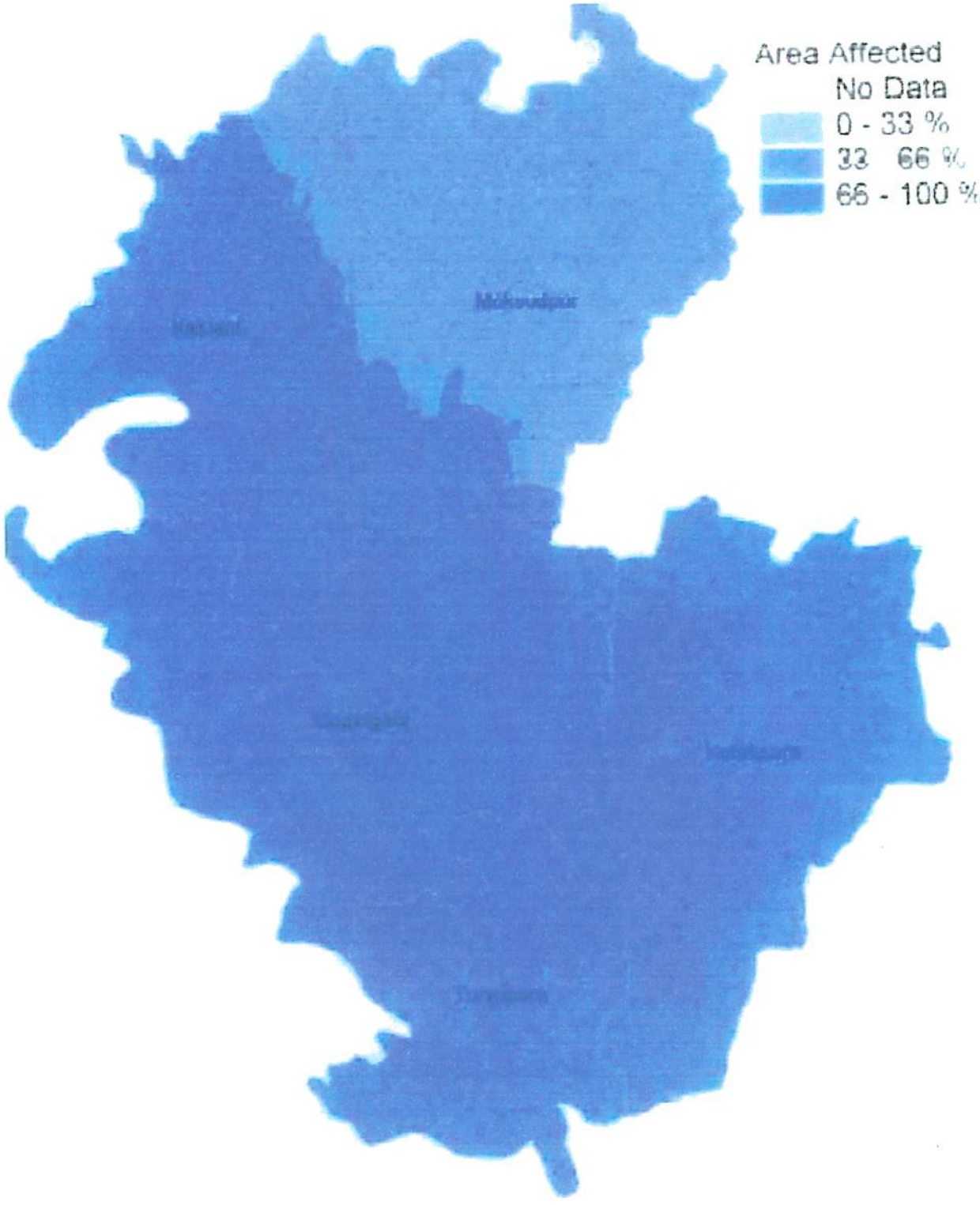


Table 1. Water and fisheries resources of Kotalipara Upazilla, 1999.

| Water and fisheries resources | Total area (ha) | % of total |
|---|---|---|
| Rivers and Khals | 2073 | 10 |
| Beel and floodplain | 16299 | 82 |
| Pond and tank | 1176 | 6 |
| Prawn Gher | 252 | 2 |
| **Total** | **19,800** | **100** |

*Source: TFO office: Kotalipara*

The farmers of the locality, particularly the older persons attended the appraisal, mentioned that Kotalipara was rich in terms of fish availability and fish biodiversity. Most of the local and indigenous fish species are caught from different water bodies at Kotalipara. However, fish harvest has declined because of the following reasons:

- Increased fish harvest efforts;
- Easily accessible employment opportunity to many water bodies;
- The relative income from fish harvest is higher than agricultural wages;
- People's attitude for fish consumption increased that has also increased efforts for fish harvest from different sources (demand pool supply effect);
- Government policy for fisheries development, restoration, improvement did not mitigate the demand for fish at the village level (generalized policy effect).

## 4. Lessons learned

- Not only Kotalipara but the entire Gopalganj could be a future basket for food and nutrition through fish culture and development.
- Two-thirds of the entire area remains under water at least three months in a year, part of which could be converted into fish culture. To some extent these natural water resources could also be stored for supplementary irrigation.
- The most important and the major employment and income of the rural people of Kotalipara is fishing or fish harvest.
- The livelihood of the majority people could be improved if integrated water, crop, fisheries, and livestock development plans are undertaken.

# Chapter Four
# Chitrapara - A general profile of the study village

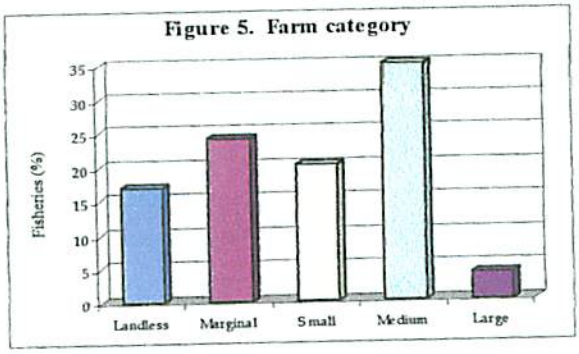
## 1. Chitrapara

Chitrapara is one of the 206 villages of Kotalipara Upazilla. The village comprised of five sub-villages, such as Dokhin Para, Purba Para, Uttar Para, Gochapara and Chitrapara. A group of homesteads usually makes up a village neighborhood that are collectively known as Para. The villagers are Muslims, Hindus, and Christians, the majority are Hindus. Within the sub-villages, households of different religions are located in a cluster areas and are identified as Hindu Para, Muslim Para and Christian Para. The people that live in and around the floodplains are marked by a distinctive socio-economic structure, local power structure, local institutions and organization.

## 2. Households

The category of households of Chitrapara are shown in Figure 5. Of the total 292 households, landless, marginal, and small farmers constituted 61%, which is consistent with the national average. However, the land ownership of the household always do not reflect the resource richness. The productivity or the income received from the available land could be the best indicator, which is explained elsewhere in this report.

Further, the estimate made by the participants suggest that number of medium farms (1-2 ha) are the majority. Only 12 of the 292 households own land more than 2 ha (4%) and are regarded as 'rich' or well-to-do farmers.




Over the past 40 years there has been migration in and out of Chitrapara but a net increase of 117 (67%) household (Table 2). The percent of household in the landless and marginal categories has declined from 43% to 37% over the same period while the percent of large households has remained about the same (3-4%).

### Changes in household category

Table 2. Timeline of household category of Chitrapara.

| Landholding category | No. of households | | |
|---|---|---|---|
| | Year 2000 | Year 1980 | Year 1960 |
| Landless | 50 (17%) | 45 (16%) | 30 (17%) |
| Marginal | 58 (20%) | 61 (22%) | 46 (26%) |
| Small | 70 (24%) | 79 (29%) | 42 (24%) |
| Medium | 102 (35%) | 77 (28) | 51 (29%) |
| Large | 12 (4%) | 11 (4%) | 6 (3.4%) |
| **Total** | **292 (100%)** | **273 (100%)** | **175 (100%)** |

Some of the causes of marginalization as identified by the participants are as follows:

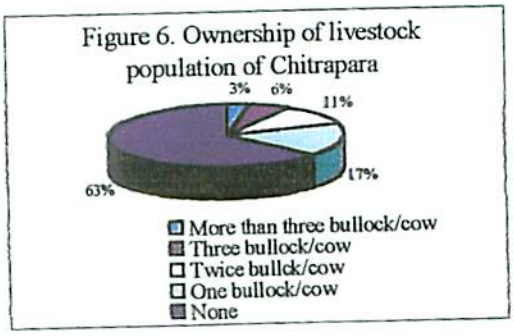
- The traditional cultural power, attitudes and social system caused marginalization from well-to-do to subsistence and from subsistence to landless farmers;
- At least one-third of the year, employment opportunities are very limited;
- The introduction of irrigated farming was limited to some pockets or to select people that did not create employment opportunities compared to the growth and supply of labor.
- One of the major livelihoods of the villagers is fishing. A good number of fishing devices, traps, nets have been emerged and caused higher fishing effort. The subsequent effect is the gradual reduction of fish harvest, meaning income from fishing has been reduced.
- The communication system is poorly developed. As a result, limited business opportunities developed in the area in general and Chitrapara in particular.

### 3. Livestock resources

Farm resources of the villagers of Chitrapara are not only limited to the land owned or operated by the households but also livestock populations, nets and gears, and active manpower in the households. However, resource endowment pattern may differ from one village to the other.

Figure 6 shows livestock ownership pattern of the villagers of Chitrapara. It shows that 63% of the total households do not own any large animals, such as a cow or bullock. The rest 37% of the households own some kind of livestock animals. It also appears that one-fifth (20%) of the total households own at least two bullocks or cows.

Figure 6. Ownership of livestock population of Chitrapara




In other words, it may be said that 20% households own a plough, and the majority (80%) has no bullock or draft power for farming. Further, it may also be said that the supply of cowdung is limited to 20% of the households of Chitrapara.

The ownership of other animals such as goats, chickens, or ducks is also not common to every household. The participants of the appraisal indicated that ducks are one of the most common animals reared by household members. The reasons for few animals as indicated by the participants were as follows:

- The study village is located at the edge of a beel and river. Except for a few months in winter, the area around the village remains under water meaning less opportunities for rearing large ruminant animals.
- The poverty and lean income period forced them to sell bullock or any livestock animals for their survival.
- The price of a pair of bullocks increased and reached beyond the purchasing capacity of most farmers.
- Animal disease and poaching problems.

## 4. Occupation and income – Livelihoods and survival

Occupation is the means of livelihood that comprised capabilities, assets and activities required for a means to make a living. The livelihood and occupation of the people that live in the floodplain areas such as Chitrapara interact with their need and resources available and often opportunity of options is limited to the prevailing context. The ability of transforming structures and processes and livelihood assets influence livelihood options and strategies adopted by the different types of people living in the floodplain areas in general and farmers of Chitrapara in particular. A broad description of occupation of the people is shown in Table 3. It is often misleading to identify farmer's occupation into a single occupation.

Table 3. Occupations of the farmers of Chitrapara.

| Occupation | Rank | Remarks |
|---|---|---|
| Crop farming | 2 | Second major |
| Fish farming | 5 | Secondary |
| Fishing | 1 | Primary |
| Fish marketing | 4 | Secondary |
| Carpentry | 3 | Secondary |
| Daily labor | 6 | Major |

*Rank: 1= highest, 6=lowest*

There are limitations and weaknesses of such categorizations. Because, a farmer is a producer as well as consumer and trader. A farmer is not only engaged in crop farming, he is a fisherman, a fish culturist, a seasonal and part time trader, and also a laborer. Further categorization and seasonality of men's activities are shown in Table 4.

Table 4. Seasonality of livelihood of villagers of Chitrapara.

| Month | Activities |
|---|---|
| **Baishak** | Harvesting of Irri/boro rice, seeding/sowing aman rice, stocking fish in pond |
| ***Jaishta*** | Weeding aman rice, fishing in 'khal', beel |
| ***Ashar*** | Beel, khal, and pond fishing, and van pulling |
| ***Sraban*** | Weeding aman rice, collection grass for livestock, van pulling and beel and 'khal' fishing |
| ***Badra*** | Beel and khal fishing, cow/bullock rearing |
| ***Ashin*** | Sowing/plantation homestead vegetables, fishing in beel |
| ***Kartik*** | Seed bed preparation for Irri/bora rice, trading/small business/fishing |
| ***Agrayan*** | Harvesting aman rice, land preparation for boro/pluses, vegetables, mustard, groundnut, sesame, and linseed |
| ***Poush*** | Plantation of boro rice. Fish trading/fishing |
| ***Magh*** | Plantation of boro rice, fishing in beel, 'khal' and pond |
| ***Falgun*** | Irrigation for boro rice, wage labor, pond preparation for fish culture, fishing in beel and khal |
| ***Chaitra*** | Harvesting HYV boro rice. Land preparation for aman rice, pond preparation, stoking fingerlings, fishing in beel and khal. |

The women's occupations of Chitrapara seemed similar to men, however, there are some differences. The women's involvement in household, field crops, fishing and fish farming is shown below (Table 5). The activities, shown are only related to some income generation or cost saving, while activities such as cooking food, and daily routine activities in the house are not shown.

Table 5. Month-wise activities of individual women besides normal daily routine.

| Month | Activities |
|---|---|
| Baishak | Post harvest activities of boro, robi crop (like nut, teel, mungbeen), feeding pond fish, rearing chickens. |
| Jaishtha | Feeding pond fish, and other homestead work |
| Ashar | Weeding/mulching field crops |
| Sraban | Fishing in khal/beel, vegetable cultivation in the housestead animals and pond fish |
| Bhadra | Weeding rice field, post-harvest of aus rice, feeding |
| Ashin | Assist fish harvest |
| Kartik | Sowing winter vegetable, seed bed preparation, dike reconstruction, feeding pond fish |
| Agrahayan | Post harvest activities of aman rice, molasses preparation |
| Poush | Seeding homestead vegetables, feeding animals and pond fish management |
| Magh | Harvest robi crops, feeding animals and pond fish |
| Falgun | Assist pond preparation for fish stocking. |
| Chaitra | Assist stock fish in pond. |

It suggest, that women of Chitrapara participate in a variety of activities either individually or jointly with their husbands and other family member. The seasonality of livelihood of women of Chitrapara is almost similar to that shown in Table 4. The women of landless, marginal and small farmers participate in some level of field activities. The females of relatively well-to-do Muslim families seldom participate in field activities and their participation is confined to housestead-based activities, such as post-harvest operations, drying, stocking, vegetable farming, and household management.

Table 6. Average annual income of farmers of Chitrapara, 1999-2000.

| Sources of income | Avg. annual income (Tk) | % of total income |
|---|---|---|
| **On farm** | | |
| Farming | 15,400 | 63 |
| Fish culture | 5,000 | 20 |
| Livestock rearing, etc. | 1,500 | 6 |
| Other | 2,700 | 11 |
| **Sub-total** | **24,600** | **100** |
| **Off-farm** | | |
| Labor | 5,600 | 21 |
| Trader | 8,100 | 31 |
| Fishing | 10,000 | 38 |
| Service | 1,500 | 6 |
| Other (Misc.) | 950 | 4 |
| **Sub-total** | **26,150** | **100** |
| **Total Farm income** | **50,750** | |

The average annual income of the farmers of Chitrapara was found to be Tk 50,750, irrespective of the farm category (Table 6). The income received from crop farming was found to be the highest. It also suggests that the average monthly household income of Chitrapara was Tk 4,227 and income per member per day was Tk 24 (assuming 6 members per family).

Of the total income, 52 % income of the farm households were from off-farm, and fishing dominates the total off-farm income. It has been observed that 67% of the total households belong to landless, marginal, and small categories and their annual income largely depends on off-farm sources.

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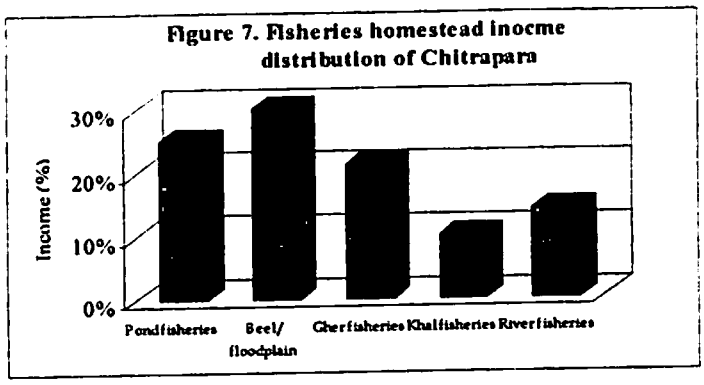
The income distribution from fisheries is shown in Fig. 7. It suggests that beel or floodplain fisheries contribute the highest to household income of Chitrapara.




## 5. Lesson learned

- Although crop sector dominates total farm income, majority income of the (61%) households depend on fisheries.
- Farmers of Chitrapara adopted a variety of survival strategies and livelihood from fisheries.
- Although some similarities of involvement of men and women were observed, women's involvement in well-to-do families are only limited to households or homesteads. Women of marginal and small farm families participate in field and home-based activities.
- Fishing provides the major source of income.
- The average per capita per day income was Tk 26, which may be treated as the average real wage of household members of Chitrapara.
- Only 20% households own a pair of bullocks or draft power.

# Chapter Five
# Water body and its uses - Natural resources for livelihood

It has been mentioned earlier that the villagers of Kotalipara in general and Chitrapara in particular is resource rich in terms of available water bodies and fisheries. In a sense, water is known as life and a source of livelihood. On the other hand, it is also a problem. During summer, water is abundant and more then necessary, while in winter, water is scarce. Farmers of Kotalipara experienced similar experiences. Nevertheless, water around the villages is better than scarcity of water since water-based livelihood prevails.

There are different types, forms, and nature of water bodies around the study village. The villagers have developed different forms of water storage and water harvest ideas and technologies for their livelihoods. The water body and fisheries resources are floodplain, beel, khal, canal, river, pond, doba, roadside ditch/canal, housestead backyard ditch, kua and derelict ponds or ditches. The villagers have access to different nature of water resources. A brief account on the above water and fishery resources and their major livelihood explained in this part of the report.

## 1. Floodplain – A common property water and fisheries resources

Floodplains are integral parts of Bangladesh inland aquatic resources system that extends over 4.3 million ha of water bodies such as rivers, estuaries, boars, beels and haors, and floodplains. In addition, about 5.5 million ha of rice fields, which are intermittently inundated during the monsoon to a depth of 30 cm or more, form parts of the aquatic production system. Together, they form vast inland captured fisheries that offer significant livelihood opportunities to the population and produce the bulk of animal protein (Ahmed 1992; Bhuiyan 1999).

Two-thirds of the total area of Kotalipara, in general and Chitrapara in particular remains under water for at least three to four months in a year. In this period, all the lowland and medium lowland is inundated. These water bodies are referred to as floodplains. The water depth differs from place to place and ranges from 1.5 m to more than 10 m depth. Some of the advantages of the floodplain water bodies as articulated by the villagers are as follows:

| Advantage as perceived by villagers | Rank |
|---|---|
| • Improve communication by boat | 1 |
| • Increase diversity of livelihood through fishing, trading | 2 |
| • Improve and facilitate fish bio-diversity | 4 |
| • Increase income from fishing, boat used for local transportation | 2 |
| • Reduce toxicity of soil and improved soil fertility | 3 |

*Rank: 1=highest, 2=lowest*

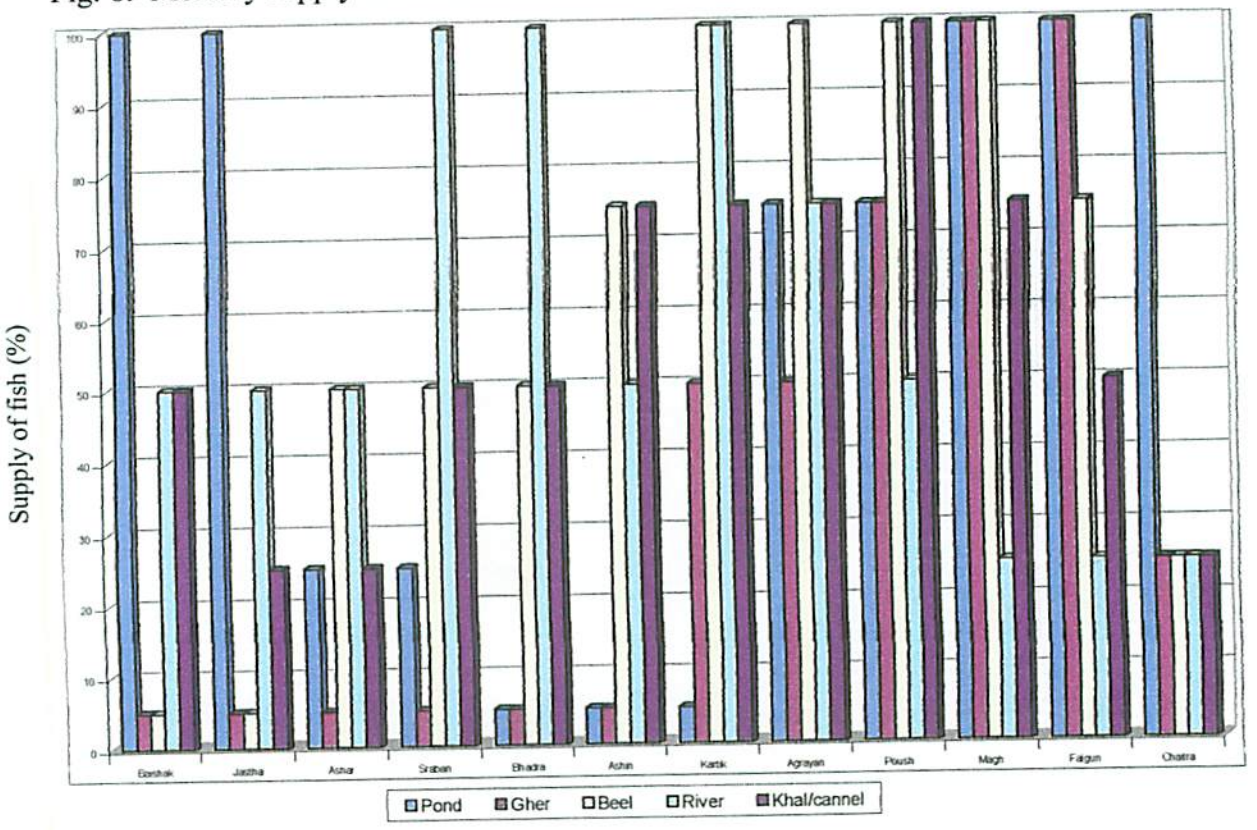
The disadvantages are also identified and mentioned by the farmers attended during appraisal. Some of these are as follows:

- Increased vulnerability of the people and livestock animals.
- Movement of poor farmers are restricted particularly those do not own a boat.

Of the total area of Kotalipara (36,205 ha) about 24,000 ha remain under water at least three to four months (Jaistha, Ashar, Sraban and Bhadra) of a year. Although, DoF identified the total floodplain area of 16, 299 ha, officials of the Upazilla of Kotalipara assume that floodplain area has increased because of siltation of the lowland meaning water covers a larger area than the estimated floodplain.

The floodplain fishing is done almost during 9 months of a year, however, the major fishing months are Jaistha, Ashar, Sraban, and Bhadra (mid June to mid September). A variety of gears, traps, and nets are being used for fishing by old and young men and women from different households. A list of gears used for fishing by the villagers of Chitrapara is shown elsewhere in this report.

Fig. 8. Monthly supply of fish from different sources.




The contribution of floodplain fisheries to household, community, and national economy has been explained in a number of reports. But the estimate of subsistence fishing and welfare of the rural households has never been analyzed. Thompson et al. (1999) stated that miscellaneous small fish caught from the floodplain by the poor people have been neglected in official statistics and policies.

There are 292 households in Chitrapara. If two persons from each household engaged in fishing during Jaishta, Ashar, Sraban, and Bhadra, the peak months for fish harvest in the floodplain, it would suggest that every day about 600 man days employed for subsistence and commercial fishing (who sell at least one-quarter of a kilogram). The socio-economic impact and importance of floodplain, thus could easily be understood.

## 2. Beel - A God-gifted natural and fisheries resources

Beel is a local Bengali name, meaning natural depression of the floodplain. The area of a beel may differ from 10 ha to more than 100 ha. Beels as a fishery resource serve a variety of purposes. A beel is a reserve for water, a good ground for fish growth, a place for breeding fish, a place for livelihood for millions of people's that facilitates low cost transportation.

There are three types of beels such as closed beel, semi-closed beel, open floodplain beel (Thompson et al.1999). The closed beels are not linked with rivers or other beels during any months of a year. The semi-closed beels are those linked with rivers or other beels during summer, the semi-closed beel is in connection with a river or an other water body through natural or regulated khals. Water flow of an open floodplain beel is not restricted by any embankments, sluice gate, etc.

### 2.1 Beel waterbodies of Chitrapara

The study village Chitrapara is also blessed with God-gifted natural resources for fisheries and well-being for the people living in and around the village. These beels are (i) Chakdar beel, (ii) Molgar beel, (iii) Noadar beel, and (iv) Satuniar beel. Although Chakdar beel is the smallest compared to the other three beels, it retains water round the year. One-fourth of the total area of Mongar beel, Noadar beel and Satuniar beel retains water round the year. All these beels are located around the study village Chitrapara. In summer, these beels are linked with the two rivers Paisarhat Nadi and Ghagar Nadi. These two rivers are linked with these three beels during the summer months that creates a fish pass between river-beel-submergible ponds and other waterbodies located around the beels.

In the summer months like Ashar, Sraban and Bhadra, beels located around Chitrapara become the floodplains of Kotalipara Upazilla. The water level recedes or at least starts to recedes from late Bhadra or early Ashin and once the boundaries around the beel are identified or could be marked, activity, and ownership of land within the beel begins.

Not only fishing, but a good number of livelihoods are involved in beels, such as crop farming, fishing, fish culture and collection of aquatic plants like Shapla, snails, etc.

### 2.2 Transects and beel based livelihood

The area of beel used for livelihood is shown in Fig. 9. It appears that crop farming is done in the edges and around the middle part of beel. The bottom part is used for doba or kua, katha, gher farming, and a number of traps and nets are used for fishing in the doba or kua and surrounding areas within the beel.

Figure 9. Transect map of beel user of different livelihood.

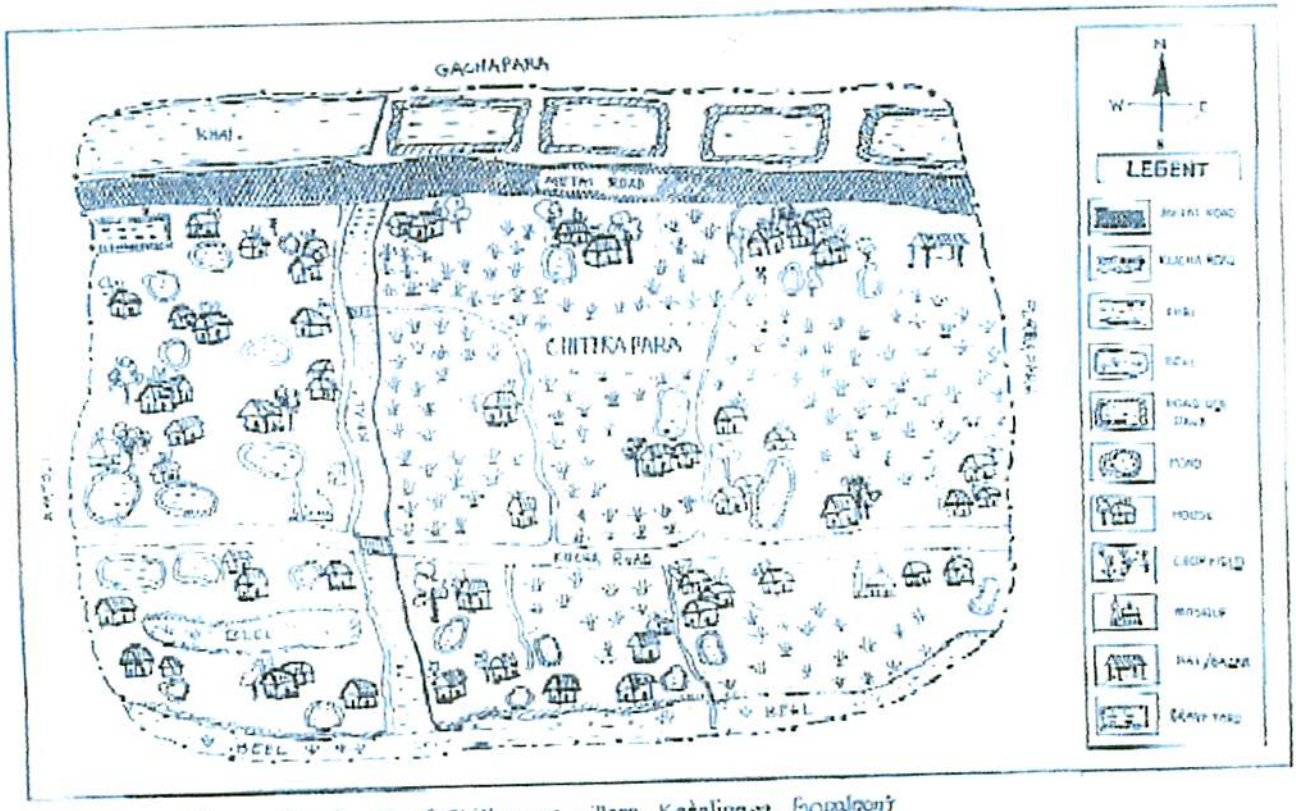



Figure Social map of Chittrapara village, Kotalipara, Gopalgonj

The respondents of the appraisal reported following problem related to their livelihood in beel:

- There is always a conflict of beel fishing and land ownership. The land owner within the beel restricts fishing to non-land owners.
- Competition and conflict between kua/doba or submergible pond owners are noticed almost every year.
- Poaching fish and conflict between land owner and gear emerged almost every year.
- Water lifting for crop farming around doba/kua adjacent to beel. The land owner close to these water bodies (doba/kua) transplant irri boro rice in the dry season. They irrigate rice fields from the beel which is close to doba/kua. At a certain point, kua or doba owners resist them to irrigation from bottom part of the beel. The kua/doba owner does not want water lifting because water level of kua/doba reduces faster which may cause harvesting fish ahead of scheduled months.
- Availability's of snails are reduced.

## 2.4 Lesson learned

- Beels are one of the major sources of livelihood of the villagers of Chitrapara.
- Older farmers reported that fish harvest has declined. Some of the indigenous fish species are disappeared.
- There has always been a heavy pressure of beel fishing.
- These beels could be developed with culture-based system using different methods and strategies such as community-based fish culture and development, fish culture in the kua/doba and catfish culture, hapa-based fish culture, etc.

- A detailed study on the beel fishing, species availability, livelihood, kua/doba fishing and how these relate to the household income and welfare may be undertaken.
- The project DSAP may design demonstration for different nature of waterbodies, such as doba, kua and submergible pond.

## 3. Golda and polyculture of carps in rice fields – Gher fish farming: A newly evolved livelihood

### 3.1 Background

Golda and other freshwater prawns are abundantly available in natural waters like rivers, crest, canals, beels and floodplains of Bangladesh. With the increasing demand for golda in the international market, the golda farming has been increasing particularly in the southern regions of Bangladesh. Farmers of Kotalipara initiated Golda and polyculture of carps in rice fields known as ghers after the liberation war of Bangladesh. In mid 70s, only three farmers of Chitrapara initiated golda and carp fish culture in a rice field. In late 1999, Golda and carp culture in rice fields has increased to more than 200 farms. The activity calendar of golda and polyculture of carp in rice fields is shown in Fig. 16. It shows changes of employment opportunities. In earlier days (before mid 1970), only aman rice cultivation was done. There were only two major activities, such as land preparation and sowing rice seed and harvesting of rice.

### 3.2 Newly evolved Gher farming

With the introduction of rice and fish farming, employment and income opportunities have increased over the years. The activity calendar of gher rice-fish farming is shown in Fig. 9. The feeding schedule and the type of feed applied to gher fish culture is shown in Table 7.

Table 7. Feeding schedule and feeding for shrimp and carp culture in Gher farming, 1999.

| Month | Supplementary feed | (No.) | Feeding period |
|---|---|---|---|
| *Baisak (14 April-15 May)* | • Wheat flour and one egg<br>• Wheat flour and two egg<br>• Rice bran | 10<br>10<br>10 | once in a day<br>once in a day<br>once in a day |
| *Jaistha (16 May-15 June)* | • Snail | 30 | once in a day |
| *Asher (16 June-15 July)* | • Snail<br>• Pellet-fish meal | 30 | once in a day (morning)<br>once in a day (afternoon) |
| *Sraban (16 July-15 Aug)* | • Snail<br>• Pellet-fish meal | 30 | once in a day (afternoon)<br>once in a day (morning) |
| *Bhadra (16 Aug.-15 Sep.)* | • Snail<br>• Pellet-fish meal | 30 | once in a day (afternoon)<br>once in a day (morning) |
| *Ashin (16 Sep.-15 Oct.)* | • Snail<br>• Pellet-fish meal | 30 | once in a day (morning)<br>once in a day (afternoon) |
| *Kartik (16 Oct.-15 Nov.)* | • Boiled wheat grain<br>• Snail | 30 | once in a day (morning)<br>once in a day (afternoon) |
| *Agrahayan (16 Nov-15 Dec.)* | • Boiled wheat grain | 30 | Twice every day |

The feeding pattern shows that farmers applied different types of feed at the different growth stages of golda culture. The entire feeding was done for culture and growth of golda. The farmers said that feeding for carps is not required and they never used any feed for carp fish culture in golda rice farming.

Table 8. Cost and return (ha) of rice-fish (Golda and carp) culture in Gher farming.

| Particulars | Unit | Qty. | Unit price (Tk) | Total value (Tk) |
|---|---|---|---|---|
| *Gross Benefit (GB)* | | | | |
| Golda | kg | 105 | 410 | 43,050 |
| Carp | kg | 400 | 33 | 13,200 |
| ***Sub-total (GB fish)*** | | | | **56,250** |
| *Gross Benefit (GB)* | | | | |
| Rice grain | kg | 2000 | 5 | 10,000 |
| Rice straw | - | - | - | 700 |
| ***Sub-total rice*** | | | | **10,700** |
| **Gross Benefit of rice and fish** | | | | **66,950** |
| **Production inputs/variable costs for fish production** | | | | |
| • Eradication of predatory fish | kg | 2 | 280 | 560 |
| • Liming | kg | 75 | 5.50 | 412 |
| • Stocking | | | | |
| Golda fingerlings[1] | nos | 7500 | 6 | 9000 |
| Carp | nos | 1400 | 0.50 | 700 |
| Previous stock | nos | 239 | 17.78 | 4250 |
| • Wheat flour | kg | 5 | 7 | 35 |
| • Egg | kg | 30 | 2 | 60 |
| • Rice bran | kg | 5 | 24 | 120 |
| • Snail | kg | 5150 | 2 | 10,300 |
| • Pellet[2] | kg | 870 | 7 | 6090 |
| • Boiled wheat grain | kg | 540 | 5.5 | 2970 |
| **Sub-total golda and carp** | | | | **34,497** |
| *Production inputs/variable cost for rice* | | | | |
| • TSP | kg | 50 | 12.5 | 625 |
| • MP | kg | 25 | 9.5 | 238 |
| • Urea | kg | 50 | 6.24 | 312 |
| • Insecticide | | - | - | 370 |
| • Irrigation | time | 2 | 225 | 450 |
| **Sub-total rice cultivation** | | | | **1995** |
| Total production/variable cost in rice+fsih farming | | | | 36,492 |
| Total gross benefit from rice+fish farming | | | | 66,950 |
| Net profit in rice+fish farming | | | | 19,758 |

[1] Size of golda fingerlings was 6-7 cm

[2] Contents of pellet-oilcake, dried fish dust, flour, rice bran, dried snail dust.

### 3.3 Cost and return of Gher farming

The economic analysis of golda and carp culture in rice fields is shown in Table 7. The summary cost and benefit is shown in Table 8.

Table 9. Summary of Golda and polyculture of carps in rice fields in an area of .53 ha.

| Particular | Total value (Tk) | % Share |
|---|---|---|
| Gross benefit from golda | 43,050 | 64 |
| Gross benefit form carp | 13,200 | 20 |
| Gross benefit from rice | 10,700 | 16 |
| **Sub-total: Gross benefit** | **66,950** | **100** |
| Variable cost of fish culture | 34,497 | 95 |
| Variable cost of rice farming | 1,995 | 05 |
| **Sub-total: rice and fish farming** | **36,492** | **100** |
| **Net benefit** | **30,458** | |

The summary of golda and polyculture carps in rice fields suggest that the major cost, 95% of the total cost of Tk 36,492 was used for golda culture. The share of return was also higher (64%) from golda farming. Rice contributed 16% of the total income.

The net benefit from golda and polyculture fish in rice field was found to be Tk 30,458 from a plot of .53 ha. The average net income was Tk 56, 993 from a per ha of rice-fish plot.

Gher farmers mentioned that capital for golda PL purchase and feed were the major problems for gher fish farming. The PRA facilitators asked the participants, assuming that capital is not a problem, what are the other technical and social problems have you confronted? Identified problems are shown below:

| Problems identified | Score | Extent of problem |
|---|---|---|
| Golda PL of desired size | High | Almost every year |
| Price of golda PL | High | Almost every year |
| Mortality of stocked PL | High | Every year |
| Supply of snails | Moderate | Decreasing supply |
| Flooding | High | High probability |
| Price of feed | High | Every year |
| Awareness of production technology | High | Most farmers not aware of improved technology |

### 3.4 Lesson learned

- As many as 200 farmers adopted golda and polyculture of carps in rice fields.
- Newly evolved golda and polyculture carps in rice fields increased employment opportunities and distributed work over the years.
- Stocking density of golda was 14,250 PL per hectare that was higher than the recommended stocking rate.
- An intensive feeding practices were followed by the farmers. These practices evolved from age-old practices of the farmers.
- Profit from golda-carp-rice was higher than rice only.

Figure 10. Rice-fish Gher farming calendar of Chitrapara.

| Activity | Bengali month | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Baisak | Jaishta | Asher | Sraban | Bhadra | Ashin | Kartik | Agrahayan | Push | Magh | Falgun | Chaitra |
| • Gher-repair/cleaning | | | | | | | | | | | ■ | |
| • Liming | | | | | | | | | | | | ■ |
| • Stocking | | | | | | | | | | | | |
| Golda PL | ■ | | | | | | | | | | | |
| Carp | | | ■ | ■ | | | | | | | | |
| • Supplementary feed | | | | | | | | | | | | |
| Wheat flour and egg | ■ | ■ | | | | | | | | | | |
| Snail (Shamuk) | | | | ■ | ■ | ■ | ■ | | | | | |
| Pellet-fish meal | | | | ■ | ■ | ■ | ■ | | | | | |
| Boiled wheat grain | | | | | | | | ■ | | | | |
| • Netting for fish growth | | | | | ■ | ■ | ■ | | | | | |
| • Harvesting | | | | | | | | | | | | |
| Golda | | | | | | | | | ■ | ■ | | |
| Carps | ■ | | | | | | | | | ■ | ■ | ■ |
| • Preparation for IRRI rice | | | | | | | | ■ | ■ | | | |
| • Fertilization | | | | | | | | | | | ■ | |
| • Transplantation | | | | | | | | ■ | | | | |
| • Irrigation/plant protection | | | | | | | | | | | ■ | |
| • Harvesting | ■ | | | | | | | | | | | |
| • Practices before rice fish farming | ■ | ■ | ■ | | | | | | | | | |
| B. aman rice sowing | | | | | | | | | | | | ■ |
| Harvesting | | | | | | | | ■ | | | | |

## 4. Kua (pond/ditch) fishing – A locally developed fishing livelihood

Kua fishing system has developed locally. It is also known as pager or submergible pond/ditch fishing. However, there are some differences between kua and submergible ditch or pond. The submergible ditch or ponds are located close to the homestead and are also known as borrow pits. Kua are usually located in floodplain areas or in beel and the purpose is to harvest fish from natural sources. This nature of fishing is limited to floodplain and beel areas. There appears two reasons for emerging kua fishing. In summer, lowlands and floodplains are flooded leaving open access to all. Anyone of the locality can fish anywhere on the floodplain during this period. The land owners brought up the idea of kua fishing, they believed that if a kua could be developed and boundaries could be identified through some means in late summer showing a bamboo stake that would indicate the restricted area for fishing. The farmers perceived that income from this nature of fishing could be increased compared to crop farming in the dry seasons. The other reason is that when the flood recedes, fish also move from shallow to deep water. Because water level of a kua is deeper than the water level outside the kua, fish tend to find their shelter in ditches. The kua fish farmers also use tree branches for better shelter and to attract fishes. Some of the kua owners of Chitrapara also apply feed such as oilcake, snails and sometimes bran for two reasons: to grow fish and to trap fish in kua. The farmers also indicated that kua fishing is used for other purposes such as in late summer or early winter, price of fish reduces and some of their harvest from floodplain river or other sources they stock fish in the kua. Some level of feeding is also applied for fish growth during this period.

| Activity | Bengali month | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Baisak | Jaishta | Asher | Sraban | Bhadra | Ashin | kartik | Agrahayan | Push | Magh | Falg. | Chaitra |
| Kua repair/renovation | ■ | | | | | | | | | | | |
| Tree branches | | | ■ | | | | | | | | | |
| Bamboo stake | | | | | ■ | | | | | | | |
| Feeding | | | | | | ■ | | | | | | |
| Harvesting | | | | | | | ■ | | | | | |
| Re-stocking | | | | | | | | ■ | | | | |
| Harvesting | | | | | | | | | ■ | ■ | | |

In kua fishing, primarily a variety of local fish species are harvested. The gross income depends on the location of kua and fish availability in the beel or floodplain. However, fish harvest also depends on skill and knowledge of the kua owner or operator. An economic analysis of kua fishing is shown in Table 9.

Table 10. Cost and return of kua fish farming in Chitrapara, 1999.

| Particulars | Total price (Taka) |
|---|---|
| **Gross Benefit (GB)** | |
| Fish (all species) | 12500 |
| Crab | 500 |
| **GB** | **13000** |
| **Variable cost** | |
| Bamboo/tree branches, etc. | 150 |
| Oil cake | 600 |
| Snails | 40 |
| Boat (rented) | 200 |
| Labor | 600 |
| **Total variable cost (TVC)** | **1590** |
| **Net Benefit Tk/year** | **11410** |

The variable cost of a kua is found to be Tk 1,590 ha and the gross benefit was Tk 13,000. The net benefit of kua was Tk 11,410 per year. The BCR appeared 7.18, which is more than double than that of rice farming.

### 4.1 Lesson learned

- Kua fishing is a locally developed fishing livelihood of many people of Chitrapara.
- Kua fishing is particularly limited to land owners. Leasing is not practiced commonly.
- Local and indigenous fish species are mainly harvests from kua fishing.
- Detailed study on kua fishing should be undertaken to determine the nature of fishing and species of fish harvested from kua.
- Further, study may be undertaken to determine the fish yield and income difference on feeding, management and size of kua.
- An interim production and management of kua fishing may be undertaken on different levels of feeding after the flood recedes. Field demonstration may be undertaken following areas;

  Different levels of low cost feeding and fertilization in kua fish farming.
  Different density of stocking local and indigenous fish species and feeding in kua fish farming.

## 5. Katha fishing –an indigenously development fish culture and livelihood

One of the most popular fishing practices followed in many open water bodies like khal, beel, rivers, haors and baors is katha fishing. Katha consists of a collection of submarzed branches of trees hold in a place with bamboo poles. This is usually covered with water hyacinth. Katha fishing is known in different local names such as dol, jal, kutta, katha, dolerkhas, kheo, chhop and chata. Katha is used for fish shelter or trap. Farmers stated that katha fishing has been practiced for generations. An experienced farmer (more than 70 years old) stated that it is an age-old practice and has been developed locally. The changes in katha fishing practices were also observed. The farmers indicated that the nature of the katha composition, frequency of fishing, type of ingredients for trapping fish and type of fish harvest and time of harvest have changed. Farmers of the locality could not identify who had initiated katha fishing. They had seen these practices from their childhood. Meaning, the

fishing is being practiced by the previous generations of the villagers. The traditional practice of katha fishing was that farmers of the locality used some tree branches in a nearby beel, river or khal to make their lives easier to harvest fish. None of them used any kind of food for trapping and/or culture, and tree branches for katha fish farming. In mid 1970s, the number of katha increased, competition among katha fish farmers also increased. They started to use different types of tree branches available in the village, such as water surface covers with water hyacinth as to protect fishing by others, bamboo as pillears around katha.

Katha fish farmers apply some levels of supplementary food and feed in different forms and compositions for fish trapping and growth. These practices of feeding have also emerged from their age-old experiences and beliefs. In mid 1970s, katha farmers used to apply dung in a gunny bag and boil rice with mud balls. The practices of supplementary food and feed for katha fishing has changed. These changes emerged through the age-old practices and experiences of the katha fish farmers. Types of feed and food applied in katha fish are as follows:

Cowdung/compost
Mud ball with compost/cowdung
Boiled rice mixed with bran
Mustard oil cake with bran
Coconut oil cake with bran and dung
Rice bran with dung
Snail meat
Boiled wheat grain

The quantity of food and feed application largely depend on the ability and experiences of the katha fish farmers. Unique practices were followed by the farmers, such as feeding that was started in late September, especially when flood waters used to recede. The type of feed used for katha fish differs across fish growth and harvest periods. The type of food and feed to be applied depending on the nature of food habits shrimp prefer boiled rice and wheat grain, carp prefers rice bran, etc.

The preparation of katha fishing starts from summer such as June-July and established in late August or early September, or once the probability of flooding is over. The management and other cultural activities such as addition of bamboo stakes around katha, feeding and protection against poaching is done if required.

The harvesting period depends on the location and the type of katha. If the katha is located in a shallow water, harvesting starts from December and if in deep water then first harvest is usually done in the month of January. Kathas are of two types (i) seasonal and (ii) year round. Seasonal kathas are established in khals, haors, and baors. katha established in rivers can be harvested over the year and are thus known as 'sara boshor' (katha for year round). As many as 6-8 harvests can be done, if the katha is established in the main river.

A variety of fish are harvested through katha fishing. Some of the species and the change of the fish species harvest in two different periods are shown below:

Table 11. Timeline of fish harvested in the katha fishing of Chitrapara.

| Species | Rank available in 1998 | Rank3 available in 1970 | Remarks |
|---|---|---|---|
| Ayre | 2 | 1 | All season |
| Boal | 3 | 1 | Winter |
| Ruhu | 3 | 2 | Both season |
| Shoal | 4 | 1 | Winter |
| Baim | 2 | 1 | All season |
| Puti | 1 | 1 | Winter |
| Tengra | 1 | 1 | Winter |
| Chigri(Golda) | 4 | 2 | All season |
| Chanda | 2 | 1 | Winter |
| Boguri | 4 | 1 | Winter |
| Potka | 5 | 2 | Winter |
| Batashi | 1 | 1 | Winter |
| Pabda (river) | 2 | 1 | Winter |
| Chella | 2 | 2 | All season |
| Tatkin | 5 | 3 | Winter |
| Bacha | 3 | 2 | Summer |
| Chella (longer) | 4 | 2 | Winter |
| Kalia | 3 | 2 | Early winter |
| Taki | 5 | 3 | Winter |
| Foli | 2 | 2 | Winter |
| Chital | 4 | 1 | All season |
| Meni | 2 | 1 | Winter |
| Ghosha Chingree | 4 | 1 | Winter |
| Balia/Bele | 2 | 2 | Summer |

[3]Ranks highest = 1, lowest = 5

The timeline of fish harvest from katha fishing suggests that as many as nine different fish species are not easily available and may be regarded as threatened species. The most available fish harvested from this type of fishing were local punti, batashi and tengra. The other type of fish harvested from katha are shown in the timeline. The seasonality of fish harvest suggests that the major harvest is done in the winter season.

Income seasonality is shown in Table 12. The peak harvesting month start from mid November and ends in mid January. The modest or lean harvest starts from April and ends in March.

On average, income from katha fishing was found to be Tk 3,827 per harvest. In peak harvest month, income ranges from Tk 5,500 to Tk 7,000 per katha harvest. The income from lean period ranges Tk 1,990 to Tk 2,500 per katha harvest.

Table 12. Income seasonality from katha fish farming of Chitrapara.

| Month | Range of net income |
|---|---|
| **Peak harvest** | |
| Agrahayan (mid Nov. - mid Dec.) | 5500-7000 |
| Poush (mid Dec. - mid Jan) | 6500-7000 |
| **Modest harvest** | |
| Baisak (mid April-mid May) | 1990-2500 |
| Jaista (mid May-mid June) | 1900-200 |
| Magh (mid Jan.-mid Feb) | 2000-2500 |
| Falgun (mid Feb.-mid March) | 2500-3000 |
| Chaittra (mid March-mid April) | 2000-2500 |

## 5.1 Problems of katha fishing as identified by the respondents

- Restricted accessibility. Local elites dominate over the suitable places for katha fishing, and demand for share from katha fishing.
- Desired tree branches are not available.
- High flooding always affect and destroy katha fishing.
- Dike erosion in almost every year.
- Power-driven boats destroy katha.
- Poaching fish through fish trap around katha.

Table 13. Cost and return of katha fish farming in Chaitrapara.

(Katha size: 0.21 ha)

| Particulars | Unit | Qty | Unit price (Tk) | Total value (Tk) |
|---|---|---|---|---|
| Gross benefit (GB)(all species) | - | - | - | 6,340 |
| Variable cost | | | | |
| Bamboo, tree branches etc. | - | - | - | 2,950 |
| Rent of a boat | no. | 1 | - | 200 |
| Labor | Person | 15 | 80 | 1,200 |
| Total variable cost | | | | 4,350 |
| **Net benefit** | | | | **1990** |

## 5.2 Lessons learned

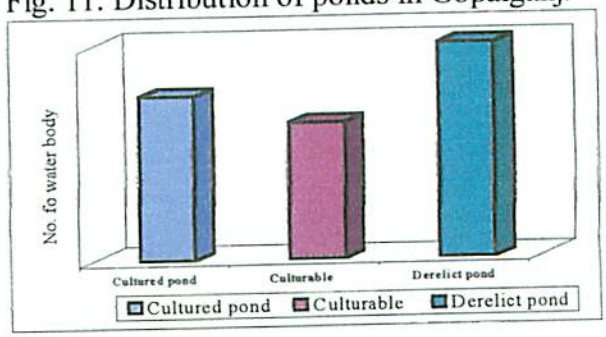
- Although katha fishing is illegal under the Fish Production and Preservation Act 1950, katha fishing is practised by the fishermen and farmers of Chitrapara.
- Katha fishing is an indigenously developed fish trapping and fish farming system.
- The type of materials used for trapping and culturing fish have improved and have changed.
- Katha fishing and cultural practices adopted by the farmers and fishermen need attention. A detailed study on the type of fish species caught and its implication to bio-diversity may be undertaken.
- Katha fishing could be developed as culture-based fishing in the floodplains.

## 6. Pond - (Man made) water reservoir and fisheries resources for survival

A pond or ditch or borrow pit is an integral part of a homestead. This is true for the people living in relatively low lying areas. The pond or small water bodies are found all over the country. Potentiality of fish culture in ponds and small water bodies is very high. The scenario of fish culture in ponds and ditches of Gopalganj are almost similar to other areas of Bangladesh. The distribution of ponds and small water bodies is shown in Fig. 11.

Of the total ponds of Gopalganj, almost 50% of the area are derelict and are not used for any fish culture practice. One-third of the total ponds are being used for some level of fish culture.

Fig. 11. Distribution of ponds in Gopalganj.




The most common technical and social problems related to the unused resources are summarized as follows:

- Multiple owner and uses incompatible for fish culture, which have reflected in decisions to disinvest.
- Seasonal flooding and drought in the dry season.
- Inadequate fish seed.
- Incompatible to other sub-system of the farm households.
- Inadequate training and extension.

It has been mentioned earlier that almost every household of the 292 has at least one small water body at the study village - Chitrapara. In general, it appears that none of them has used any set of recommended cultural and management practices in their ponds or small water bodies. Some of the reasons as identified by the participants are as follows:

- Seasonal flooding or risk of flooding convinced them not to invest in pond fish culture.
- Lack of capital for renovation of dikes and cash input required for fish culture.
- Lack of quality fry and fingerlings.
- Fish harvest in open water bodies is easier and comparatively less costly.
- Little awareness of income potentiality from pond fish culture.

The level of knowledge on fish culture in ponds or small water body has been assessed through group discussions. Since divisibility of pond fish culture technology is higher, it is always difficult to assess the level of knowledge. However, the PRA team made an assessment as shown in Table 14. It showed that the pond operator's level of knowledge on fish culture was marginally 'poor', while level of knowledge on harvesting and marketing was relatively high.

Table 14. Matrix ranking of level of knowledge on fish culture practices.

| Nature of knowledge | Knowledge ranking | Remarks |
|---|---|---|
| Pre stocking management | 1 | very poor |
| Stocking recommend ratio/species | 1 | very poor |
| Ratio/species | 2 | poor |
| Post-stocking management | 4 | good |
| Harvesting and marketing | | |

*Ranks: low level of knowledge = 1, higher level of knowledge = 4*

None of the participants followed recommended stocking density for pond fish culture. Farmers stock fish in their ponds whenever and whatever fish species are available to them. The farmer's knowledge and perception of stocking fish in ponds is yet traditional and not consistent with the recommended practices.

Table 15. Matrix ranking on fish stocking in pond or small water body.

| Species stocked | Rank on stocking density | Remark |
|---|---|---|
| Silver | 12 | easily available |
| Catla | 10 | easily and traditionally available |
| Ruhu | 10 | easily and traditionally available |
| Mrigal | 8 | traditionally available |
| Rajputi | 7 | available locally |
| Caliboush | 5 | available from local river |
| Tilapia | 5 | available locally |
| Mirror | 1 | seldom available |
| Grass carp | 1 | seldom available |
| Desiputi | 1 | seldom available |
| Mohasol | - | not available |
| Goinna | - | not available |

*Rank: High stocking density = 12; low stocking density = 1*

The farmers of Chitrapara are largely dependent on open water floodplain, beel, khal and the river fisheries. Pond fisheries or culture fisheries remain yet beyond their preferences. However, pond or water bodies beside the homestead serves an important role for the household welfare and household economic development. The sub-mergable waterbodies or ditches are stocked naturally. In summer, they are inundated and submerged, and different wild fish species are stocked. During summer, ditch owner use different nets and gears for fishing and thus they serve for subsistence fishing. In early winter, women use water for partial irrigation of homestead vegetables. In the dry season, ditches are also used for vegetable and species cultivation.

Pond water is used for domestic uses, drinking, bathing, cleaning, and washing clothes and utensils and livestock watering. Since water is used for different household and domestic purposes, none of the farmers attending were interested in using cowdung in their ponds.

The farmers or pond operator's perception on stocking was also reflected to the household welfare and economy. Although farmers are not aware of the recommended practices for stocking they perceive pond fish as a reserved capital. The higher stocking frequency and density are an indication of higher propensity of saving. However, farmers are not aware of the carrying capacity of their ponds. Meaning farmers are not aware of inverse relations between high level of fish stocking and total capital accumulation through stocking fish in ponds.

Participants who attended preferred to stock ruhi, catla, mrigal, silver and mirror carp. They also prefer to stock other species whenever available and cost effective. It may be a difficult task to motivate farmers for adopting recommended practices of fish culture because of their age-old tradition, culture, and belief.

The participants also wished to have larger or bigger sized fish in their ponds. They also indicated that fish growth had reduced compared to earlier (20 years ago) days.

### 6.1 Lesson learned

- Although number or prevalence of ponds or small water bodies is high, over stocking without feeding and fertilization reduced total fish yield.
- There are huge number of small water bodies one in almost every household, none of these was found to be used for active fish culture.
- Flooding ponds is one of the major problems.
- Level of knowledge of improved fish culture and management is poor.

# Chapter Six
# Integration and Recycling of Fisheries - Natural Resources for Livelihood

The integrated and recycled natural resources for livelihood of the farmers of Bangladesh are emerged traditionally based on their circumstances, needs, and importance. It is not only limited to Bangladeshi farmers, but most Asian subsistence farmers followed integration, and recycled the fisheries resources for their better livelihood and living. Farmers of Chitrapara also integrated their livelihoods within and between the accessible resources. The interaction of the natural resources eco-system and household needs are interconnected and difficult to delineate or isolate. However, the IAA program of ICLARM initiated research on integrated and intensified use of the natural resources for livelihood and welfare of the households (ICLARM 2000 and Dey et al. 2000).

The traditionally evolved integrated and recycled natural resources use for the livelihood is shown in Fig. 13. The integration and recycling functions and complexities shown are based on the consultation with the farmers. It is believed that the real linkages, integration and recycling would be many more than what has been captured. Nevertheless, it shows clearly that farmers of Kotalipara in general, and Chitrapara in particular are heavily dependent on fisheries based livelihoods. The beel fisheries like katha, kua are highly integrated to the household economy. Ponds or small waterbodies are integrated with beel, khal and river fisheries systems. Pond or homestead backyard ditches serve as reservoirs of different sizes and species of fish. The inflow and outflow linkages and integration also suggests similar scenarios. The livestock population was limited to 20% households, however, it appears that the livestock provided reasonable inflow-outflow linkages, which suggest the importance of the system. Although rice fields are ideally linked with several eco-systems, majority farmers (61%) of Chitrapara are dependent on off-farm income and fishing from different sources.

The linkages articulated through the PRA suggest that development initiative of one sub-system like pond fish culture may not be a good initiative for fisheries development in small-scale waterbodies in the region. The linkages as shown in Fig. 13. indicated that the pond is used as a fish reservoir, regarded as savings accumulated fish harvests from different sources that explicitly mismatches recommended practices.

Figure 12. Bio resource flow of Chitrapara.

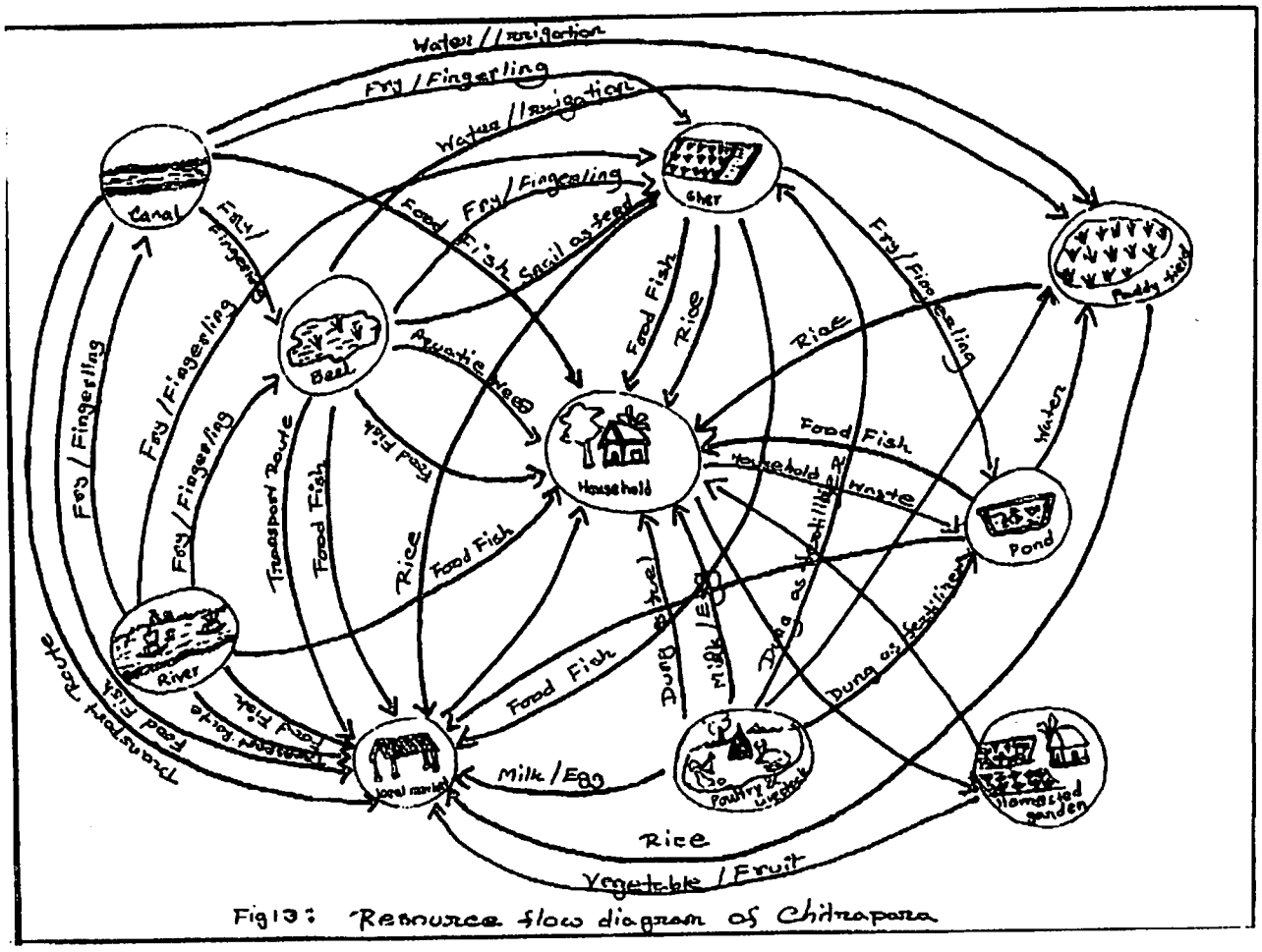



Fig 13: Resource flow diagram of Chitrapara

Because people of the region are inextricably acquainted with fishing from different methods in open water bodies, culture-based fishing should start from the general awareness of the people through politicizing the importance and need for culture, presentation, and restoration. The next thought for fishery development may be given to culture fisheries in open water bodies, floodplains, beel, khal or rivers through improvement, adjustment, renovation of the existing practices that can include katha fishing to katha fish culture and fishing, kua fishing to kua fish culture and fishing and improvement of other fishing practices. The linkage within and between the fisheries and other farming systems may be integrated through culture-based business initiatives such as farmer managed nurseries, which would require relatively less time for culture and reduce flood risk.

# Chapter Seven
# Fishing gears uses by the fishermen and farmers

Many types of nets and gears are used by fulltime, part-time fishermen and fish farmers of Kotalipara. The use of gear depends on target species, hydrological conditions, portability, labor intensiveness, capital costs and gear material availability. The commonly observed fishing gears and methods used by the farmer's, and fishermen of Chitrapara are listed below.

***Bandoira jal***: An uncommon net mainly used to catch catla, rui, mrigel, and kalibaus. It is a fixed gear.

***Bel jal***: A triangular bigger sized net used for fishing icha, chanda, puti, tengra, chapila. It is a fixed gear.

***Ber jal***: A conventional beach seine and hauled by a team of fishermen. The number of fisherman to operate depends on size and weight of the net.

***Borsi***: Hooks and long-lines baited with punti are used in many places.

***Chai***: A basket trap. It is also baited with snail meat.

***Coach***: This is a spear used for large catfish.

***Current jal***: A small mesh net used for catching small species.

***Cungi***: A trap made of series of bamboo with hole joint together by a continuous nylon thread.

***Dak jal***: A large mesh gillnet.

***Dara jal***: The net is attached to a long rope operated by two fishermen. The net is used to encircle fish. An auxiliary net is used to scope harvest fish so trapped.

***Dol jal***: It is a specialized net used for enclosing katha set in a river. The length of the net is dependent on the area of the katha and the depth of the river. Bigger nets are made by joining together several stock net pieces. The net is set and tied to bamboo poles fixed around katha. Two or three boats set the net from two ends, quickly enclosing the area. The net is gradually drawn together as the tree branches are removed from the katha. The net served as an enclose are while actual harvesting is made by other net such as small mesh ber jal and cast net.

***Dori***: A fish trap used to catch small prawns and all types of fish fry.

***Dormo jal***: A small, simple lift net, operated from the shore. The net is allowed to sink to the bottom, and then raised by pulling on a rope. The net is portable and can be moved easily from one fishing spot to another.

***Dormo jal***: A specialized gear used for catching mainly boal and large fish in river and beel.

***Duri***: A reed fish fence with basket trap(s). These can be quite small to quite large. Duri are erected during the dry season from late October to March. Small species of fish are caught.

***Faash jal/Piya jal***: A rectangular large mesh net used for catching kalibaus, bach and koi.

***Ghana Ber jal***: A small net that is usually set in floodplain canals.

***Ghora jal***: It is specialized for Hilsha (Ilish). It is set at the confluence of rivers and floodplain canals.

***Ghurti jal/Goin jal***: A specialized type of net. Three persons are required to operate the net. It is a rectangular net.

***Goira jal***: A rectangular shaped basket type net. The net is fixed with a bamboo at the opening and a 30-35 m long rope is used to pull the net.

***Horhoria jal***: A rectangular box type net. Two persons required to operate the net.

***Jam jal***: Jam jal is a rectangular net. The net is used for broodstock harvest in the river.

***Jhaki jal***: This is a casnet. Owned mainly by subsistence fishermen. Mainly small fish are caught.

***Kati jal***: This is a seine net with a large mesh size and operated by 6-7 fishermen.

***Kapri jal***: A large net with very small mesh size.

***Khara jal***: A large, fixed lift net with a complicated frame. The net includes two horizontal lever arms to which the net is attached and a platform for the fishermen to sit on.

***Kona jal***: A fine meshed net. Seven or eight fishermen are required to operate the net.

***Laua jal***: A net used for Hilsha (Ilish). It is set at the confluence of rivers and floodplain canals.

***Leski jal***: A mainly fine meshed net. Four fishermen required to operate the net. The net is used in rivers and deep floodplains.

***Lori jal***: A large mesh net used to catch gazer during the dry season and all other carps and large catfish during monsoon.

***Moha jal***: A small mesh seine net, used in rivers for small species. Large mesh sizes are also used for rui, catla and boal.

***Pati ban***: This is a bamboo pen which has a number of baskets and is placed horizontally across canals and rivers. This gear is mainly used during rising and falling water levels, not during the peak of the monsoon.

***Pawal jal***: A seine net.

***Pine jal***: This in a net with a mesh size of about 1 cm. It is operated by a number of fishermen using two boats.

***Sangla jal***: A specialized net for Hilsha (Ilish).

***Savar jal***: A very fine-meshed net used to catch carp spawn and fry.

***Shib jal***: This is lift net with thin mesh.

***Sitka jal***: A large mesh seine net. It is used in rivers to catch mainly ghonia, boal and sarputi.

***Thaki jal***: This is a conical shaped net. It is used to catch prawn, gulsha, air, kalibaus and other bottom dwelling species of fish.

***Thela jal***: It is known as 'poor person's net'. A small triangular push net on a bamboo frame. It is the most widely used subsistence fishing gear. It is also known as a Flan jal.

***Uich*** : This is a fish trap set in the bottom of flooded areas.

***Uthar jal***: A large conical net, like a seine net. Typically, two canoes are joined together end-to-end with a bamboo bridge to create a long working platform to operate the net.

***Vat jal***: The net is operated by two fishermen.

***Vim jal***: The net is used mainly for catching prawns in river. It is a fixed gear net and can catch almost all types of fishes.

# Chapter Eight
# Conclusions and Recommendations

To understand and articulate the living and livelihood, fishing and fish culture resources and systems, identification of potential needs, and areas for fisheries extension and development, a PRA was conducted in Chitrapara village at Kotalipara of the Gopalganj district. The Chitrapra village was selected purposively for two reasons, (i) pond population in this village was higher than other villagers of Kotalipara Upazilla , and (ii) one of the partner NGOs of RDSAP is also located in the Kotalipara Upazilla. The officials of DoF, Kotalipara, and Gopalganj and the partner NGO-STAR facilitated the field studies.

The multi disciplinary team of the monitoring staff of RDSAP, ICLARM Bangladesh office conducted the study. A local PRA expert was also hired for five days to train the staff of RDSAP and to facilitate the PRA. The PRA was conducted through two field visits.

Gopalganj is rich in aquatic resources. These aquatic resources could be one of the major food baskets for future generations. Despite the resource richness, life and livelihood of the people remained under developed.

The major thrust of this appraisal was to articulate use of existing natural and man-made aquatic resources, livelihood, constraints and identification of lessons learned or needs for aquaculture extensions and development. In view of the above, lessons learned or needs of the respective areas of development had been identified and shown accordingly in the text. Nevertheless, based on this appraisal, the following conclusions and recommendations are made:

## 1. Summary conclusions

- The study area represent AEZ 14 known as Gopalganj-Khulna Beel. More than two-third of the total area remain under water for more than four months of a year indicates presence of a vast floodplain waterbodies. Almost every household has a doba or submergible pond or borrow pit.
- Sixty-one percent households of Chitrapara are landless, marginal, and small farmers.
- Sixty-three percent households do not own large animal/bullock or draft power. Only 20% of them own a pair of bullock.
- Major occupation of the villagers is fishing in different waterbodies.
- Kua, katha, gher fishing are traditionally developed for fish harvest
- A wide range of trap, net and other means of fishing was followed by the farmers.

## 2. Recommendations

Based on the above findings, discussions and conclusions, followings are some of the interm recommendations be suggested:

- Extension and development programs for the people and aquatic resources should blend to reduce the dysfunctional elements. The aquatic resources and their user's livelihood development could not be progressed through a short-term development intervention because farmers use their ponds as reservoir of fish stocked through different means, and harvest as and when needed. In such a system it is difficult to identify a good pond use extension and development strategy.

  Floodplain, and river fishing are functionally interlinked with the pond fish and livelihood of the people. The development of one sector of aquatic resource can not be done without taking care of other areas. To articulate importance and needs for extension development following recommendations may be made:

- Public awareness needs to be developed on the need and importance of aquatic resources management and development. In a society where majority is functionally illiterate and are also subsistence farmers, a class room - oriented strategy for building awareness will not create any noticeable change and reflection, rather, there is a need to politicise through local leaders using different means and methods.

- Although katha fishing is illegal, it could be developed as a culture fisheries. Following options may be followed for katha fish culture farmers:

  i Demonstration on the different levels of feeding practices with traditional tree branches used in katha fishing.
  ii Effectiveness of using different tree branches with improved feeding in floodplains or khals.
  iii Building awareness through training on the food habits of fish that could be cultured in katha.

- Kua or doba fishing may be developed into a culture fish farming. Following strategies may be adopted:

  i Orientation and awareness through training or other means of mass media. Awareness program may be adopted to develop level of knowledge on fish habits, fish growth patterns, feeding practices on wild and exotic fish species.

  ii Field demonstrations on different levels of feeding and cultural management.

- Some limited demonstrations could be established on pond fish farming in two ways as to compare and contrast potentiality and viability of pond fish farming in the region:
    - i Demonstration on the polyculture of carps on recommended technology under farmer's management.
    - ii Polyculture of carps and recycling of fish stock from floodplain to beel (kua/doba) and to pond fish farming.
    - iii Training and motivation on fish culture potentiality, fish growth and stocking, stocking and feeding and their interrelationships.

## Acknowledgements

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# ANNEXES

## Definitions and glossary of waterbodies and fisheries resources

| | |
|---|---|
| Aman | Season for growing summer rice. Planting occurs in June/July and harvesting is in November/December. |
| Aquaculture | The production of aquatic organisms for subsistence or commercial purposes under controlled conditions. Based on husbandry techniques and generally involving manipulation of environmental factors. Applied to fin fish, shell fish, aquatic plants etc. |
| Aratdar | Fish Trader. |
| Beel | Natural depression in the floodplain. The area of a beel differs, it is often many hectares. Water levels varies from season to season and is known as annually flooding. Retain water for all or part of the dry season. |
| Bhat | Generic Bangla term for rice. |
| Baor | Ox-bow lake or other natural water channel isolated from the main river system due to a change in the course of the rivers. |
| Boro | Season for growing irrigated winter rice. Planting occurs in December/January and harvesting is in April/May. |
| Borrow Pit | Pit where earth has been removed for building up the homestead or similar purpose. |
| Carps | Common carp, Cyprinus carpio |
| Dadan | Credit system, which involves a kind of debt bondage. A Mahajan or Aratdar secures future supplies of fish for a fixed price against advanced credit, This credit may be in the form of cash or kind (ice, fishing materials etc). |
| Dim | Fish spawn. |
| Doba | Pond or borrow pit in low land. |
| Duck weed | Small free floating aquatic plants. |
| Elite | Relatively wealthy and influential (middle and upper class) people in a community. |
| Fingerlings | Young fish, 'finger' sized. Local name: Ponamach or Angulipona |
| Fish culture | The stocking of fish in ponds and other water bodies, where some control is exercised over the environment, inputs (e.g. of feed and management) are made, and ownership of the stocked fish and the rights to harvest them is designated to a particular group or individual. |

| | |
|---|---|
| Floodplain | Seasonally flooded (generally annually), low lying areas of land associated with a river system. |
| Food security | An important prerequisite to food security is equity for all in access to food that inturn requires either access to means of production or purchasing power. |
| Fry | Juvenile fish, larger than hatchlings but smaller than fingerlings. Local name: Dhani. |
| Haor | Extensive area of low lying land (similar to a large Beel) which floods for part of the year. In the dry season it may form a number of Beels. |
| Hatchery | Fish seed farm for spawning and hatching |
| Jahl | Generic Bengla term for fishing net. |
| Jalmohal | A fishery or water estate that is state property. Recognized sub-division of river, baor, beel or similar water body, used exclusively for fisheries. |
| Juli | Pond or Borrow pit along road side. |
| Khas | Any piece of "Common" land or small water body (owned by the Government). |
| Mach | Generic Bangla term for fish. |
| Boal | Cat fish |
| Mahajan | Money lender. |
| Monsoon | Literal meaning is season. There are 2 monsoons: the North East Monsoon which falls from November to April (dry season); the South West Monsoon which falls from May to October (wet season). |
| Nursery | Ponds where hatchling and fry are grown up to fingerling size. |
| Patil wallah | Fry and Fingerlings Trader (kuchura Bepari), who visit the pond side with juvenile fish. |
| pH | A measure of acidity & alkalinity. Uses a scale of 1-14; 1 is the most acidic, 14 is alkaline. For good water quality pH 7-9 is neutral. |
| Poldering | The building up the banks of rivers and other water courses and water bodies to prevent flooding. |
| Polyculture | Cultivation of two or more species. Generally applied to mixed carp culture. |
| Ponamach | Fingerlings. |

| | |
|---|---|
| Pond | Generally a borrow pit, very occasionally a purpose made pond. Often used for fish culture. Bengali or local name of pond is pukur. |
| Renue | Hatchlings |
| Rotenone | Fish toxin. |
| Tank | Small water storage reservoir. Sometimes used for fish culture. Often used synonymously with pond or borrow pit. |
| Upazilla | Smallest administrative unit in Bangladesh. |
| Water table | The level below the ground's surface at which the soil is saturated with water. |
| Lime | Refers to CaO, $Ca(OH)_2$. It is a disinfectant, neutralizer of acidity. |
| Turbidity | Presence of suspended or colloidal matter or planktonic organisms that reduces light penetration of water. |
| Zooplankton | Very minute brownish animal in water which do not have active capacity to swim. They are mainly the natural food of fishes. |
| Phytoplankton | Very minute green algae in water. They are the natural food of fishes. |

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Annex 1. List of the PRA Team.

Mr. Wajed Ali Shah, ICLARM and PRA Team Leader

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Mr. Siraj Miah, NGO representative, Member PRA Team

Ms. Reva Rani Baidda, NGO representative

Mr. Dulal Miah, ICLARM

Annexe 2. Participants attended in the PRA, Chitrapara.

| Name | Village |
|---|---|
| **Pond owners** | |
| 1. Mongol Bishwas | Purbapara |
| 2. Aril Bishwas | ,, |
| 3. Sidduque Miah | ,, |
| 4. Samsul Haque Miah | Chitrapara |
| 5. Sultan Ahmed | ,, |
| 6. Hasan Ali Miah | ,, |
| 7. Bidadhar Bishwas | Purbapara |
| **Open water fish farmer** | |
| 1. Abdur Rashid Khan | Horinahati |
| 2. Motilal Gatia | Gachapara |
| 3. Nazar Ali Miah | Chitrapara |
| 4. Samsuddin Miah | ,, |
| 5. Farook Hossain | ,, |
| 6. Anukul Bhokta | Purbapara |
| **Fishries and Fish Traders** | |
| 1. Md. Roknuzzaman | Bhuarpara |
| 2. Abul Hossain | Chitrapara |
| 3. Anwar Hossain | Unshia |
| 4. Siraj Shikdar | Bhuarpara |
| 5. Sayedul Islam | Chitrapara |
| **Women participants** | |
| 1. Shikha Biswas | Purbapara |
| 2. Ambia Begum | Chitrapara |
| 3. Surma Begum | ,, |
| 4. Bishoka Begum | ,, |
| 5. Biva Bishwas | Purbapara |
| 6. Halima Khanom | ,, |
| 7. Tohmina Khanom | Chitrapara |
| 8. Monoara Begum | ,, |
| 9. Jamiron Begum | ,, |

Annexe 3. Bengali months and corospending English periods.

| Bengali month | Corrosponding period in English calander |
|---|---|
| Baishak | 14th April to 15th May |
| Jaishtha | 16th May to 15th June |
| Ashar | 16th June to 15th July |
| Sraban | 16th July to 15th August |
| Bhadra | 16th August to 15th September |
| Ashin | 16th September to 15th October |
| Kartik | 16th October to 15th November |
| Agrahayan | 16th November to 15th December |
| Poush | 16th December to 15th January |
| Magh | 16th February to 15th February |
| Falgon | 16th February to 15th March |
| Chaitra | 16th March to 15th April |

Annexe 4. Fish species and local name.

| Local Name | Scientific Name | Local Name | Scientific Name |
|---|---|---|---|
| African Magur | *Clarias gariepimus* | Nandina | *Labeo nandina* |
| Ayre | *Seperata aor* | Pabda | *Ompok pabda* |
| Bacha | *Eutrophicthys vacha* | Pangus | *Pangasius pangasius* |
| Bagha Ayre | *Bagharius bagharius* | Potka | *Tetraodon cutcutia* |
| Baila | *Glossogobius giuris* | Puti | *Puntius sophore* |
| Banspata | *Ailia punctata* | Rajputi | *Barbodes gonionotus* |
| Bara baim | *Mastacembelus armatus* | Rui | *Labeo rohita* |
| Bata | *Cirrhinus reba* | Rupchanda | *Pampus chinensis* |
| Bighead carp | *Aristichthys nobilis* | Sharputi | *Puntius sarana* |
| Boal | *Wallago attu* | Shillong | *Silonia silondia* |
| Catla | *Catla catla* | Shing | *Heterophneustes fossilis* |
| Chanda | *Parambassis baculis* | Shol | *Channa striatus* |
| Chapila | *Gudusius chapra* | Silver carp | *Hypophthalmichthys molitrix* |
| Chela | *Chela cachius* | Taki | *Channa punctata* |
| Chital | *Chitala chitala* | Tara baim | *Macrognathus aculeatus* |
| Chuna kholisha | *Trichogaster chuna* | Tatkini | *Crossocheilus latius* |
| Common carp | *Cyprinus carpio* | Tengra | *Mystus tengra* |
| Darkina | *Esomus danricus* | Tilapia | *Oreochromis mossambicus* |
| Dhela | *Osteobrama cotio* | Tilapia | *Oreochromis mossambicus* |
| Ekthota | *Dermogenys pusilla* | | |
| Fesha | *Setipinna phasa* | | |
| Foli | *Notopterus notopterus* | | |
| Gajar | *Channa marulius* | | |
| Ghaura | *Clupisoma garua* | | |
| Goinna | *Labeo gonius* | | |
| Golda | *Macrobrachium rosenbergii* | | |
| Golsha | *Mystus cavasius* | | |
| Grass carp | *Ctenopharyngodon idellus* | | |
| Gura icha | *Macrobrachium styliferus* | | |
| Gutum | *Lepidocephalichthys guntea* | | |
| Guzi Ayre | *Seperata seenghala* | | |
| Ilish | *Tenualosa illisha* | | |
| Kachki | *Corica soborna* | | |
| Kajuli | *Ailia coila* | | |
| Kakila | *Xenentodon cancila* | | |
| Kalibaus | *Morulins calbasu* | | |
| Khalisha | *Colisa fasciatus* | | |
| Koi | *Anabas testudineus* | | |
| Magur | *Clarias batrachus* | | |
| Meni | *Nandus nandus* | | |
| Mirror carp | *Cyprinus carpio* | | |
| Mola | *Amblypharyngodon mola* | | |
| Mrigal | *Cirrhinus cirrhosus* | | |