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## Management of beel fishery: a special reference to Chapaigachi beel of Kushtia, Bangladesh

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### ABSTRACT

The present study was carried out to observe management system, available freshwater fishes, natural abundance of fishes of Chapaigachi beel in Kushtia Sadar Upazilla, Kushtia, Bangladesh. A field investigation was conducted on existing status of fishery for six months from May to October 2013. The beel is a closed Jalmohal of 289.77 acre and is being managed since 1999 through leasing system for three years under Ministry of Land (MoL). Currently the beel is leased out to "Nandia Matshayajibi Somobay Samity Limited" at a cost of BDT. 17, 25, 000 per year for three years starting from the Bengali year 1420 to 1422. Mainly carp fishes were stocked in the beel and managed for four to five months. A total 68 species belong to 22 families under 9 orders were identified in the beel during study period. Within 68 recorded, 52 fishes were SIS (Small Indigenous Species) and the rest 16 species were large where 5 of them were exotic species. Highest 23 species belonged to the family Cyprinidae. Various unknown migratory birds came around the beel area in the winter season.

**Key Words:** Management, Beel fishery, Fish biodiversity and Chapaigachi beel

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## I. Introduction

Fish is an important traditional food item in the diet of the people of Bangladesh. The proverb goes "Machhe Bhate Bangalee" which means that Bangladeshis (Bangalee) live on fish and rice indicating the importance of fish. After China and India, Bangladesh is the third largest country in the world in inland fisheries (Hussain, 2010). Annual flooding during the rainy season inundates up to 60% of the total land surface. Inland fisheries alone cover an area of 4.6 million ha of which 83.53% comprise open water capture fisheries, and only 16.47% close water system. Total production from Inland fisheries is 29.527 lakh MT (DoF, 2013). The beel is amongst the most fertile and productive ecosystems and important breeding grounds for fishing. It is also very rich depositors of vegetarian,

aquatic plants, reeds and algae. In addition, it constitutes suitable habitat condition for large number of fin-fish, prawns, crabs, turtles, molluscs and birds etc (IUCN, 2008).

"Beel" is a term for a pond (wetland) with static water, as opposed to moving water in rivers and canals - typically called khaals. Beels are large surface water bodies that accumulate surface runoff water through internal drainage channels; these depressions are mostly topographic lows produced by erosions and are seen all over Bangladesh. They mostly occur in between the rivers and canals. Beels are small saucer-like depressions of a marshy character. Many of the beels dry up in the winter but during the rains expand into broad and shallow sheets of water, which may be described as fresh water lagoons. Beels are mainly fed by surface runoff water. A few larger ones are fed by floodwater during the wet season from the parent river channel. Normally, beels remain deeply flooded for most of the wet season. Beels are generally richer in fishes than the rivers. Fish and prawn resident in standing water bodies such as beels move into the floodplains to reproduce and their offspring use the floodplain for feeding and growth. Among 265 freshwater fishes (Rahman, 2005) 143 species are considered small indigenous species (SIS) in our country. All of these species were found available in beel water bodies a few years back, whereas, 54 of them are now threatened, 12 are critically endangered, 28 are endangered, and 14 are vulnerable (IUCN, 2000). As a consequence the total composition of the fish species have been changed in the beel fisheries. Bangladesh has a total of about 4,500 beels covering an area of about 1,14,161 ha which is 2.91% of total inland water bodies. These water bodies provide nearly 3.18% of total inland fish production. The overall production of fish in beels is about 85,208 mt which is rather low, only about 746 kg/ha, and therefore the contribution of beel fishery at the national level cannot be said to be significant (DoF, 2013). Although total fish production from beels were gradually increasing but this is not satisfactory. This is due to the fact that little or no attention has been paid towards the better management of the beel fishery system. The Chapaigachi beel in Kushtia sadar upazilla under Kushtia district is a closed Jalmohal above 20 acres. Chapaigachi beel is one of the most important and largest beels in Kushtia. The beel is occupied an area of 289.77 acre spreading over five unions. The beel is connected by a branch river named Sagor Khali and a canal named Dakatia Khal (subsequently has been named Barisal Khal), which in turn is connected to the Padma river. The average depth of the beel is 8-9 ft. during rainy season. The beel is rich in biodiversity. Some research works would necessary for biological management of the Chapaigachi beel which would be greatly helpful in planning and setting up of strategies for future development and conservation of fisheries resource. Therefore, research work was undertaken on Chapaigachi beel to determine the biodiversity/species composition of Chapaigachi beel with management system of the beel. The present study will enable to find out the problem related to fisheries biodiversity and also will contribute largely to the formulation of an appropriate beel fisheries management policy to conserve fisheries biodiversity of Chapaigachi beel.

## II. Materials and Methods

Chapaigachi is one of the most important beels in Kushtia, located in about 12.42 mile away from Kushtia Sadar and occupied an area of 289.77 acre spreading over five union and fourteen villages. This is a semi-closed and somewhat arc shaped inland waterbody. Soil of the beel area is mainly sandy soil is encountered near the beel bank. The beel is connected by a branch river named Sagor Khali and a canal named Dakatia Khal (subsequently has been named Barisal Khal), which in turn is connected to the Padma river. Rainfall is the main source of water in the beel. Average depth of the beel is 8-9 ft. during rainy season. Central part of the beel (originally Chapaigachi beel) remains dry in the dry season and the most depressed part of the beel (local people call it-Nandiar beel and Haruriar beel) which retain water throughout the year. Boro rice is generally cultivated in the dry area of the beel during winter season. The beel is famous for rich in biodiversity. For data collection from the fishermen of Chapaigachi beel a questionnaire was prepared in accordance with the objectives of the study. Primary data were collected from fishermen by researcher herself on beel management strategies and other aspects of Chapaigachi beel fish biodiversity. Several visits were made to the study area to collect accurate information related to objectives of the study through interview schedule. Questionnaire was developed in a logical sequence of that the target group could answer chronologically. Questions related to the fishermen and their socio-economic status, species available in the beel, species abundance, seasonal variation and disappearances of fishes what were predominantly available in Chapaigachi beel, fishing gears, fishing duration, peak harvesting season,

beel management strategies and other aspects of Chapaigachi beel fish biodiversity were included in the questionnaire. Data from 40 fishermen were made at home or beel sites during fishing. Secondary data included relevant information on status on beel management activities were collected through literature and publications available from Upazila Fisheries Office, quarterly and annual reports.

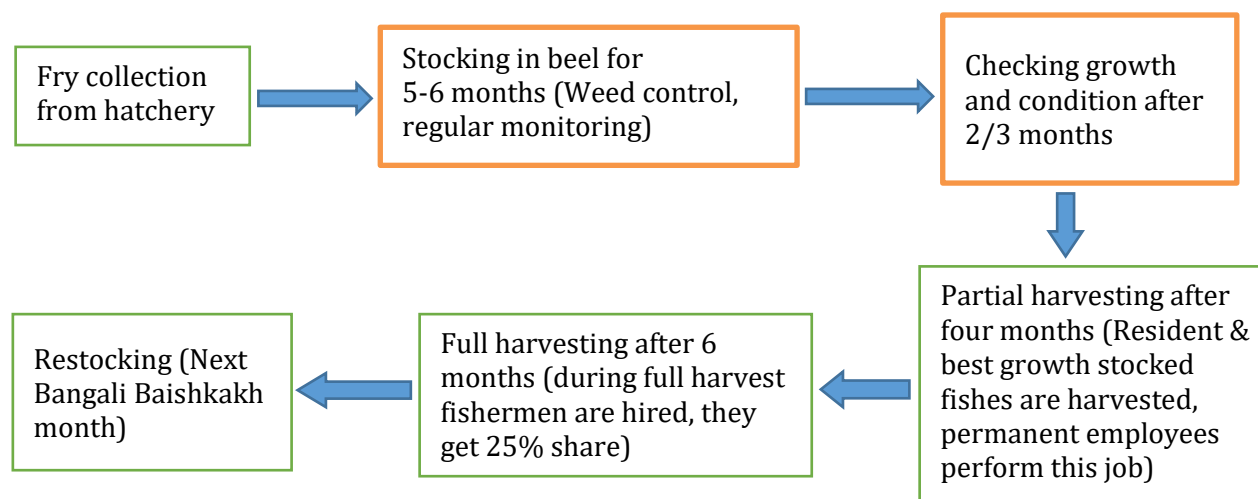
### III. Results and Discussion

#### Physical structure of the beel

Chapaigachi beel is the largest beel in Kushtia Sadar Upazilla. The beel is located in about 12.42 mile away from Kushtia Sadar. The beel is a semi-closed and an arc shaped water body having a water area of 289.77 acre during dry season spreading over five unions. During monsoon the beel spread out to several hundred acre. The beel is connected by a branch river named Sagor Khali and a canal named Dakatia Khal (subsequently has been named Barisal Khal), which in turn is connected to the Padma river. The most part of the beel (originally Chapaigacchi beel) remains dry in the dry season and the most depressed part of the beel (local people call it-Nandiar beel and Haruriar beel) which retain water throughout the year. Due to building new house for the surrounding peoples the area of the beel decreasing day-by-day.

#### Management regime of the beel

The beel is leased out to “Nandia Matshayajibi Somobay Samity Limited”, the President of which is Md. Ziaur Rahman. This cooperative society took lease of the beel from the Government at a cost of BDT. 17,25,000/-per year for three years starting from the Bengoli year 1420 to 1422. For management of the beel activities there is a Beel management Committee (BMC). The Beel management Committee (BMC) released 20,000kg of 150-200g weighted fish fry of Rui, Catla, Grass crsp, Mirror carp, Bighead carp, Mrigel etc in bengli month of Baishakh. The fish fry were collected from Jassore, Natore and some local hatchery of Kushtia. Then 145-150kg fish fry were released in bengli month of Vadro. The growth and condition of fish was checked out after 2/3 month interval. The fish will be harvested from November 15 to December 31. Mainly the carp fishes were stocked in the beel and managed for five to six months. No artificial feed is given and the fish species fully depend on natural feed. Harvested fishes included more than the stocked species. Many of the non stocked species were available as the species got the chance of recruitment. During stocking period fishing is strictly prohibited by the local fishermen.



**Figure 01. Management flow chart practiced in Chapaigachi beel.**

Poor fishers of the Samity could not pay the lease value and hence they had to depend on the rich man/mohajan/chairmen for payment of lease money. The rich man/ Chairmen would pay the lease money on behalf of the fishers' society and would get full control of the Jalmohals. The fishers undertook fishing on payment of money or as laborer or on catch share/contract basis. The fishermen who worked on contract basis get 25% of share. As a result traditional/local fishers face poverty and loss of fishing rights and had to move other work as day laborer.

#### Hydrological condition of the Chapaigachi beel

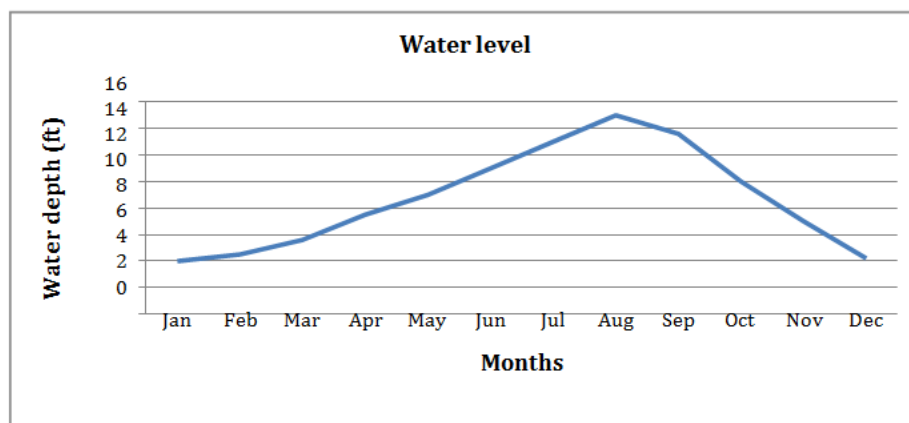
The hydrological conditions of the river-floodplain-beel water have been shown in the Table 01. A strong influence of the hydrological conditions of the beels on the beel fishes has been described by different authors. According to different authors (Ali, 1997; FAP, 1994; BFRI and WFC, 2003-04) the hydrological conditions of the beels are categorized into different parameters (Table 01). The early flooding is particularly important for fisheries since it stimulates the start of spawning of many floodplain resident species of fish. Seasonal changes are very important in the biology and life cycle of the floodplain resident fishes.

**Table 01. Hydrological condition of the river-floodplain-beel**

Parameters	Aspects
Sources of water	Rivers and Rainfall
Pre-monsoon river flood surge and recession	March-April
Early-monsoon river flood surge	Early May
Sustained monsoon beel flooding	June-October
Late-monsoon beel drainage	Early September
Dry season fish refuge habitat area contraction	Late October January
Unseasonable beel inundation from local rainfall during dry season	December-February

### Water depth variation

As the Chapaigachi beel is a large beel, the water depth varies in different areas and fluctuates in different months and ranged from 4 to 15 ft. The average depth is 9 ft. The highest water depth was recorded in August and the beel remains water whole year except some part of the beel. The highest value of water depth was recorded in the canal of the beel was 15 ft (Figure 02).



**Figure 02. Water depth fluctuations of the Chapaigachi beel (January to December, 2013).**

### Fish biodiversity

Chapaigachi beel is an ideal place for most of all kinds of indigenous fishes. Locally the beel is called "Maacher beej tola". But the biodiversity of resident species in studied beel are gradually declining due to environmental degradation, siltration, irrigation, priority to given cultures of non-resident species, and many other causes. According to the statement of the fishermen and the people from surrounding area of the beel it was revealed that, different species of fish which were abundant in Chapaigachi beel are now in great threat. Some of them are already extinct, some are threatened, and some are vulnerable. From the study it was found that Khoira, Bacha, Ghaura, Barali, Rani etc. are not found now-a-days in Chapaigachi beel. In the beel, 68 species belonging to 22 family under 9 order were found in different seasons (Table 02). All the species are not found in equal amount. Among them 23 species belong to the family Cyprinidae; within 68 recorded, 52 fishes were SIS (Small Indigenous Species) and the rest 16 species were large fish. There were 5 exotic species recorded in the beel. Among 68 species the maximum fish species (23) were under Cyprinidae family and the family Bagridae represented 5 fish species. Four families (Ambassidae, Anabantidae, Channidae and Palaeomonidae) represented 4 species each and another three families (Siluridae, Sisoridae and

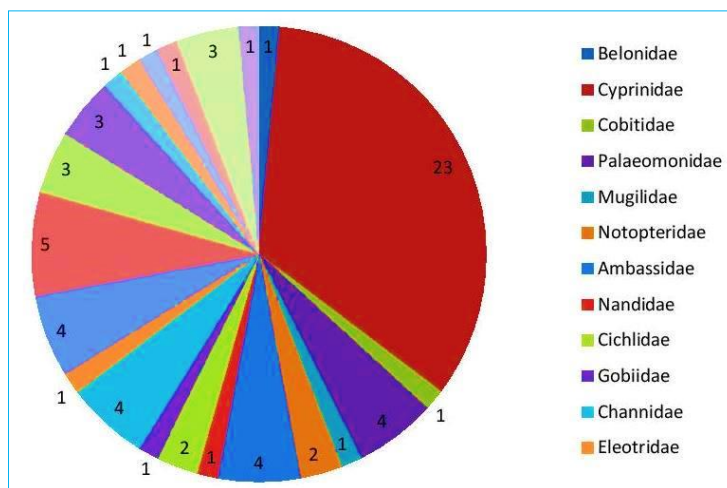
Mastacembelidae) represented 3 species each, two families (Cichlidae and Notopteridae) represented 2 species each and the rest eleven families represented 1 species each.

**Table 02. Available fish and prawn species in Chapaigachi beel**

Order	Family	Local Name	Scientific Name	Status
Beloniformes	Belontiidae	Kakila	<i>Xenentodon cancila</i>	native
Cypriniformes	Cyprinidae	Carpio	<i>Cyprinus carpio</i>	Introduced
		Mirror carp		
		Rui	<i>Labeo rohita</i>	native
		Kalibaus	<i>Labeo calbasu</i>	native
		Baitka	<i>Labeo pangusia</i>	native
		Mrigal	<i>Cirrhinus cirrhosus</i>	native
		Catla	<i>Catla catla</i>	native
		Mola/Moya	<i>Amblypharyngodon mola</i>	native
		Silver carp	<i>Hypophthalmichthys molitrix</i>	Introduced
		Bighead carp	<i>Aristichthys nobilis</i>	Introduced
		Grass carp	<i>Ctenopharyngodon idella</i>	Introduced
		Thai sarpunti	<i>Barbonymus gonionotus</i>	Introduced
		Sarputi	<i>Puntius sarana</i>	native
		Kanchan punti	<i>P. conchonus</i>	native
		Gilipunti	<i>P. gelius</i>	native
		Teri punti	<i>P. terio</i>	native
		Mola punti	<i>P. guganio</i>	native
		Phutani punti	<i>P. phutunio</i>	native
		Jat puti	<i>P. sophore</i>	native
		Bhadi punti		
		Titputi	<i>P. ticto</i>	native
		Darkina	<i>Esomus danricus</i>	native
		Danrika		
		Bata	<i>Cirrhinus reba</i>	native
		Ghora chela	<i>Securicula gora</i>	native
		Sepchela	<i>Chela laubuca</i>	native
	Cobitidae	Gutum	<i>Lepidocephalichthys guntea</i>	native
Decapoda	Palaeomonidae	Chingri	<i>Macrobrachium rosenbergii</i>	native
		Chotak icha	<i>Macrobrachium malcomsonii</i>	native
		Choto chingri	<i>Macrobrachium lammarrei</i>	native
		Dimua icha	<i>Macrobrachium villosimanus</i>	native
Mugiliformes	Mugilidae	Khorsula	<i>Rhinomugil corsula</i>	native
Osteoglossiformes	Notopteridae	Foli	<i>Notopterus notopterus</i>	native
		Chital	<i>Chitala chitala</i>	native
Perciformes	Ambassidae	Phopa chanda	<i>Pseudambassis beculis</i>	native
		Lal chanda	<i>Pseudambassis lala</i>	native
		Nama chanda/ Lomba chanda	<i>Chanda nama</i>	native
		Ranga chanda	<i>Pseudambassis ranga</i>	native
	Nandidae	Meni	<i>Nandus nandus</i>	native
	Cichlidae	Tilapia	<i>Oreochromis mossambicus</i>	Introduced



		Nilotica	<i>Oreochromis niloticus</i>	Introduced
	Gobiidae	Bele	<i>Glossogobius giuris</i>	native
	Channidae	Shol	<i>Channa striatus</i>	native
		Gajar	<i>Channa marulius</i>	native
		Taki	<i>Channa punctatus</i>	native
		Cheng/ Gachua	<i>Channa orientalis</i>	native
	Eleotridae	Bhut bele	<i>Eleotris fusca</i>	native
	Anabantidae	Koi	<i>Anabas testudineus</i>	native
		Lal khalisha	<i>Colisa fasciatus</i>	native
		Chuna khalisha	<i>Colisa lalius</i>	native
		Boicha	<i>Colisa sota</i>	native
Siluriformes	Bagridae	Ayre	<i>Sperata aor</i>	native
		Tengra	<i>Mystus vittatus</i>	native
		Gura tengra	<i>Chandramara chandramara</i>	native
		Golsha- tengra	<i>Mystus bleekeri</i>	native
		Bajari tengra	<i>Mystus tengara</i>	native
		Boal	<i>Wallago attu</i>	native
		Kani pabda	<i>Ompok bimaculatus</i>	native
		Madhu pabda	<i>Ompok pabda</i>	native
		Baghair	<i>Bagarius bagarius</i>	native
		Kani tengra	<i>Glyptothorax cavia</i>	native
		Dhal magur	<i>Glyptothorax telchitta</i>	native
		Pangus	<i>Pangasius pangasius</i>	native
		Shingi	<i>Heteropneustes fossilis</i>	native
		Chaca or Gengeni	<i>Chaca chaca</i>	native
Synbranchiformes	Kuchia		<i>Monopterusuchia</i>	native
	Baim		<i>Mastacembelus armatus</i>	native
	Guchi baim/ Pankal baim		<i>Mastacembelus pancalus</i>	native
	Tarabaim		<i>Macrogathus aculeatus</i>	native
Tetraodontiformes	Potka		<i>Tetraodon cutcutia</i>	native



**Figure 03. Number of fish species found under different families during study period in Chapaigachi beel.**

### Bird population of the beel

Local birds namely Kani Bok, Sada Bok, Shalik, Chokha, Khanda Khucha, Pankouri etc were abundant in the beel area. Besides, various unknown migratory birds came around the beel area in the winter season. Bangladesh has rich in aquatic fish biodiversity with 265 freshwater fish species where minnows, catfish, eels, perch, gobies, clupeids and prawns constituted the major portion (DoF, 2009). A rich diversity of fish fauna is contributing significantly to the ecology and sustainable productivity of the floodplains. (Barr et al., 2004) reported that during the monsoon the floodplains of Bangladesh become integrated into a single biological productive system. About 20-30 fish species which are resident in the floodplains and tolerant of low levels of oxygen provided the majority of the national freshwater fish production. Total inland water body cover an area of about 4.6 million ha. Among the various inland fisheries resources, beel play a major role in fish production from time immemorial. The area of the Chapaigachi beel was about 289.77 ha which is very little compared to the total area of inland water body in Bangladesh but large in compare to the other beels. The area of the beel spread out to thousand hacters during monsoon. (Joadder, 2008) carried out a study on the ecological aspect of beel Kumari, Rajshahi with average area of is about 500 ha. A total of 76 fish species belonging to 26 families and 1 species of prawn were identified so far from the beel. (Imteazzaman and Galib, 2013) found a total of sixty-three fish species including 55 indigenous and 8 exotic species inhabiting in the Halti beel. Three critically endangered, eleven endangered and eight vulnerable fish species of Bangladesh were also recorded in this water body. The total area of the water body is about 1012.5 ha (during monsoon) and 15.95 ha (during dry season). (Kostori et al., 2011) conducted an estimation of the abundance and diversity of Small Indigenous Species (SIS) of fish in the Chalan beel. A total of 82 SIS fish belonging to 10 orders, 22 families and 46 genera were recorded. Ahmed et al. (2004) found 52 fish species in Shakla beel belonging to 36 genera, 20 families and (Rahman, 2000) observed that thirty three fish species were present in Rajdhala beel. In the present study a total of 68 species belong to 22 family under 9 order were found in the Chapaigachi beel. Within 68 recorded, 52 fishes were SIS (Small Indigenous Species) and the rest 16 species were large fish. The highest number of fish species (23) was under Cyprinidae family. From the study it was found that presently khoira, bacha, ghaura, barali, rani etc. are not found in the Chapaigachi beel. There were five exotic species recorded in the beel. Locally the beel is called "Maacher beej tola". But the biodiversity of resident species in studied beel are gradually declining due to environmental degradation, siltration, irrigation, priority to given cultures of non-resident species, and many other causes.

### IV. Conclusion and Recommendations

Mainly carp fishes were stocked in the beel and managed for four to five months. Fishers reported that lease value of beel is fixed at a very higher rate without considering the fish resource status which encourages over fishing and affect fishers access to the resource as they cannot pay high lease value and ultimately the control of beel goes to the rich people and the fishers work there as laborer or on catch share basis. Fishermen who worked on contract basis get 25% of share. The revenue oriented management or leasing system of beel creates scope of the entry of the middleman in controlling the fisheries resource. In Chapaigachi beel there is no Governmental and non-governmental survey conducted before. The study was conducted for a short period of time. Long term studies on biodiversity, fishing gears and socio-economic condition are much essential to know the changes in the biodiversity and socio-economic development of the fisher community for better and sustainable beel fishery management. Based on findings of the study on the prevailing management condition of beel fishery, following measures can be undertaken for better management. As the management of open water Jalmohal is very difficult due to the size and nature, biological and social management under community based fisheries management policy should be taken up for effective and sustainable management and to improve the socio-economic condition of the fisher.

For proper management of the beel following measures could be taken:

- The *beel* should be transferred from the MoL to MoFL as early as possible on long term basis of 50 years or more.
- Leasing period of 1-3 years should be increased for long time upto 10 years or more and lease should be given to the genuine fishermen those who live in adjacent area of the *beel*.
- As a part of management, close fishing season should be maintained strictly for 3-4months during breeding season of resident fish species.

- Use of destructive fishing gears should be strictly prohibited.
- Establishment of sanctuaries for endangered and threatened species.
- Each of the *beel* has their own biological, environmental and social characteristics. Local management approach should be developed.
- Training facilities should be provided to the fishermen.
- Guarding by the society members by rotation, and
- Commercial Banks and other financial institution should come forward with collateral free special supervisory credit-program for fingerling stocking and overall management.

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