

## Abundance, migration and management of Jatka (juvenile hilsa, *Tenualosa ilisha*) in the Gajner Beel, Pabna, Bangladesh

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### Abstract

Studies on the abundance, migration and management of Jatka (juvenile hilsa, *Tenualosa ilisha*) were conducted in the Gajner Beel, located at the south-east corner of the Pabna Irrigation and Rural Development Project (PIRDP) in Sujanagar Upazila of Pabna district, Bangladesh. The main Jatka season was found to be extended from mid August to mid October. Veshal/Bandh/Khora Jal (lift net) and Ber Jal (beach seine net) were found as the major gears involved in Jatka fishing. The estimated total amount of Jatka caught from the Beel during the studied season was 46.2 t. The migratory route of Jatka is extended from the Padma and/or Jamuna rivers to the Badai river and then to the Beel through the sluice gate. The possibility of breeding of hilsa in the Beel was nullified. Finally, a community based management plan was suggested for implementation by the Gajner Beel management committee.

Key words : Jatka, *Tenualosa ilisha*, Beel, Migration

### Introduction

In Bangladesh context, Beel (natural depression) fishery has significant role in the total fish production of the country. The Gajner Beel, located in the Pabna Irrigation and Rural Development Project is very important for fisheries development (Ali and Alam 2005). A sluice gate has been constructed for facilitating water level management for crop production in the Beel areas. In the rainy season and/or after water intake through the sluice gates, the average water depth of the Beel becomes 2-4 meter holding only for 3-4 months (mostly August-November) for fish production. Thereafter the Beels are dried up draining through the sluice gates for crop cultivation. After inundation by rainfall and/or water intake, the fisheries resources of the Beel become a common public property. However, the total Beel area becomes a vast sheet of water with depth ranging from one to four meters or even more during the rainy season. In the rainy season and after water intake through the sluice gate, the total area including the floodplain stands at about 25,000 ha. Thus there is a wide scope for enhancing fish stock/production in the above area through proper sluice gate operation and by adopting other suitable management options.

Jatka is the juvenile stage of hilsa, *Tenualosa ilisha* (Hossain 1985, Mazid and Islam 1991, Rahman and Naevdal 1998). The Jatka also resembles adults of the two species of Indian river shads (*Gudusia chapra* and *Goniolosa manmina*), locally called chapila. Hence, many fishers and consumers often refer mistakenly to Jatka as chapila in fish market (Mazid 1994, Rahman 1997). Hora and Nair (1940) described the historical information regarding Jatka and confirmed that it is the young of hilsa. Using molecular genetic technology, Rahman and Naevdal (1998) confirmed that Jatka is the offspring of hilsa by comparing genotype and genotype distributions with previous analysis of adult hilsa. The Jatka remain around the nursery grounds for about 5-6 months and attain a maximum size of 15-16 cm (Raja 1985, Mazid and Islam 1991), but with a dominant size of 10-12 cm (BFRI/RS 1994, Rahman and Haldar 1998). However, Hossain (1975) reported that when Jatka become larger than 7 cm they may migrate to the deeper parts of the river, and finally when they reach about 12 cm they disappear from the river. Gradually the Jatka acquire the ability to tolerate saline water and move downstream to the estuary. There they spend their young life stages in brackish water. Later, the young move offshore for feeding and grow to adult size.

The hilsa fish contributes more than 13% (about 0.2 million tons) of the total fish production of the country worth over US\$800 million (Tk. 4,000 crores) each year. The fishery provides livelihood to about 2.5 million people (about 2% of the total population) directly or indirectly (Mazid 1998). Moreover, hilsa is also an exportable commodity earning about Tk. 1,000 millions as foreign exchange each year (Mazid 2005). However, in recent times, the hilsa production is gradually declining particularly from the inland water sector (Khan 2000, Rahman 2001). There are many reasons behind this decline of which, indiscriminate killing of juvenile hilsa (Jatka) is the critical one. Total annual catch of Jatka in Bangladesh is about 0.02 million tons. If 10% of this Jatka could be protected, an additional production of 0.10 million tons of adult hilsa, worth about US\$400 million could be obtained each year (Miah and Haldar 1995, Mazid 1998).

Considering the importance of the Gajner Beel, some works specially on the impacts and management of the sluice gates were conducted in the recent past (Halls 1998, Hoggarth *et al.* 1999, Halls *et al.* 2000, Ali and Alam 2005). However, very little work has been done so far on the Jatka fishery of the Beel. This article reports first time exclusively on the important Jatka fishery of the Gajner Beel. The report concentrates on the abundance, possibility of spawning, migration, fishing methods, fishing season and landings of Jatka in the Gajner Beel. Finally, different management strategies for the fishery were suggested.

## Materials and methods

### *Study area*

The study area was the Gajner Beel, located around the south-east corner of the Pabna Irrigation and Rural Development Project (PIRDP). The PIRDP is located in the Sujanagar (partly attached to Sathia and Bera) Upazila of Pabna district, Bangladesh at the confluence of the Padma and Jamuna rivers (Fig. 1). The earthen embankment of the

project together with a large sluice gate at Talimnagar point on the Badai river mainly regulate the water levels as well as migration of fish to and from the Beel (Fig. 1).

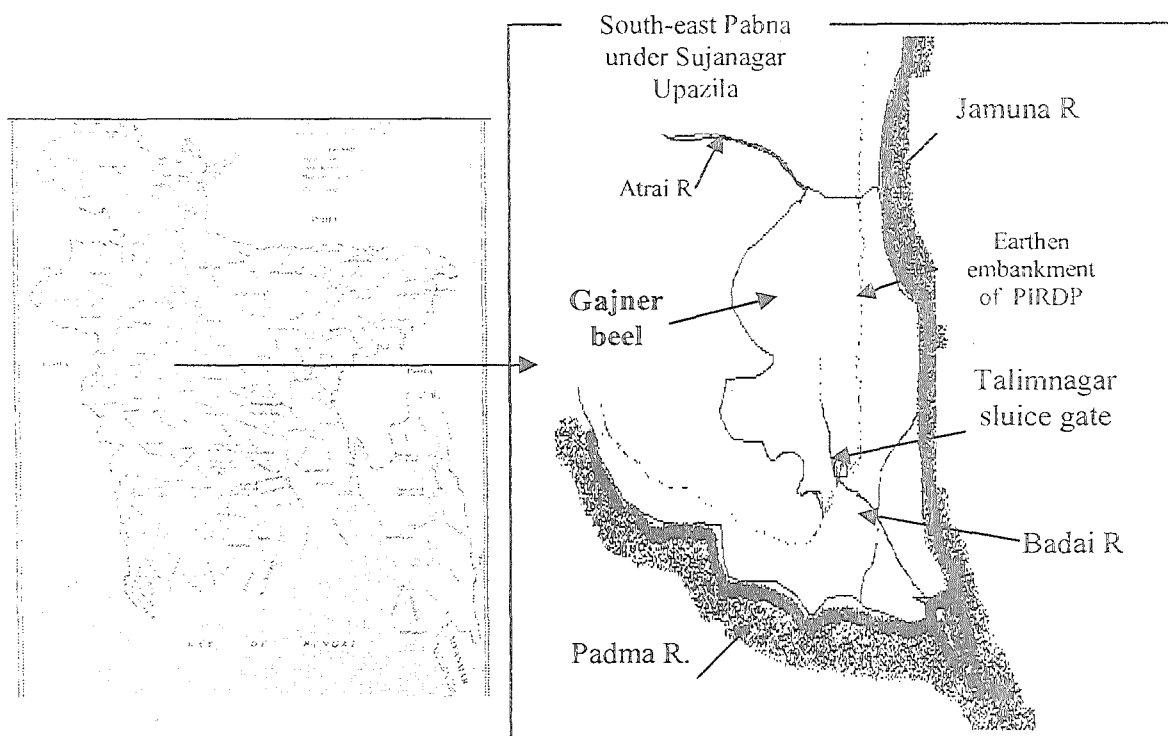


Fig. 1. Map showing the approximate locations of sluice gate, connecting rivers and surroundings of the Gajner Beel, Sujanager Upazila, Pabna.

#### *Survey of the Beel areas*

The Gajner Beel and adjacent water bodies were surveyed in September'04. The entire water areas of the Beel were visited by boat and the surrounding land areas were visited by local transportation and on foot. During the visit, information on the Beels and its resources were collected through interviewing the local people including fishers.

#### *Identification of Jatka*

To identify the species of Jatka of the Gajner Beel, Jatka sample was collected from the Beel and brought to the laboratory of the Bangladesh Fisheries Research Institute, Mymensingh. In the laboratory the morphometric and meristic characteristics of the Jatka was compared with the morphometric and meristic characteristics of juvenile hilsa described by Rahman and Naevdal (1998) and Rahman (2001) and confirmed that the jatka is the juvenile of hilsa, *Tenualosa ilisha*. Special care was taken in separating other two Jatka-like species, viz. *Gudusia chapra* and *Goniolosa manmina*.

### *Identification of the migratory routes of Jatka*

During the survey, special emphasis was given on the availability of Jatka and examining the possibility of breeding of hilsa in the Beel. Possible migratory routes of hilsa juveniles in Gajner Beel were also taken into consideration. The connection of the Beel to the surrounding land and water areas were noted. The water level and water level management systems, i.e. the sluice gates operations were monitored throughout the year. The possibility of the survival of hilsa in the Beel was monitored monthly by examining water levels, water qualities and catch compositions. In the dry season (December-June), the Beel almost dried up and no hilsa was found in the catch. The water level and water quality were absolutely unfavourable for hilsa to survive in the dry season. Therefore, hilsa juveniles must come from the connected water bodies to the Beel in the rainy season (July-November). During the survey it was confirmed that the connected water body is the Badai river which is again connected to the Padma/Jamuna rivers (Fig. 1) and this route was considered as the migratory route of the Jatka to and from the Beel.

### *Participatory Rural Appraisal (PRA)*

The Participatory Rural Appraisal (PRA) technique was used for gathering baseline information about the Gajner Beel, its resources, management system, conflicts and related problems. Particular emphasis was given on the information about the availability of Jatka in the Beel. Specific information regarding the abundance, distribution, fishing and marketing of Jatka in the Beel were collected during the PRA sessions. The opinions of important stakeholders in addressing the existing problems of infrastructure development of the Beel and resource management were also considered. The tool used to conduct the PRA was the Focus Group Discussion, which included all of the important stakeholders, such as fishers, agriculture land-owners, lease holders, sluice gate operators, government officials and local people.

### *Monitoring water quality parameters*

Some important water quality parameters of the Gajner Beel were monitored on monthly basis during September 2004-August 2005, except the dry season (December-June) when water was not available for sampling. The parameter included water colour, depth, temperature, transparency, dissolved oxygen content and pH. Water current and its direction were also monitored. The water quality parameters of the Beel were studied with a view to understand the relationship between water quality and abundance of Jatka in such a remote Beel, located upstream far away from the present breeding and nursery grounds of hilsa.

### *Collection of fish samples*

Fish samples were collected monthly from the Gajner Beel. The samples were brought to the laboratory at Bangladesh Fisheries Research Institute, Mymensingh and

preserved in formalin for further analysis. From the samples, catch rate and species composition were analyzed. Each of the species of finfishes was separated carefully. Special care was taken in separating other two Jatka-like species, viz. *Gudusia chapra* and *Goniolosa manmina*. After that, weight (g) of each of the species was taken and the percentage composition of each of the species was calculated.

#### *Estimation of the amount of Jatka*

The amount of Jatka catch in the Gajner Beel was estimated separately for different gears on monthly basis. Total fishing areas of the Beel was surveyed by motorized boat to count the gears involved in Jatka fishing in the Jatka season (mid August-mid October). Average daily catch of Jatka in a particular month was considered as daily catch rate for that gear for that particular month. Then the catch rate was multiplied by the total number of gears involved to get the total daily catch of Jatka. From this daily total catch, monthly and seasonal catch was estimated using simple arithmetic.

#### Results

##### *Salient findings of the survey*

The salient information obtained during the survey were as follows:

The Gajner Beel of the Sujanagar Upazila located within the Pabna Irrigation and Rural Development Project (Fig. 1) was found as a very large seasonal water body surrounded by the earthen man-made embankment. A part of the Beel was found attached to the Bera and Sathia Upazila of the Pabna district. The Beel is surrounded by a total of 172 villages under 14 Union Parishads of which 10 are situated in Sujanagar, three in Bera and the remaining one in Sathia Upazila. Some important villages are: Bonkola, Char Dhulai, Sarivite, Badai, Soyedpore, Athkhani, Ulat, Tirmoni, Talimnagar, etc.

The Gajner Beel consists of 16 small Beels of which 11 Beels are small (<20 acres) and five are large (>20 acres). The total public (khash) area of the 11 small Beels is about 101 acres and the total khash area of the five large Beels is about 433 acres. The total existing khash area of the Beel is about 534 acres. In the rainy season and after water intake through the sluice gate, the total area including the floodplain stands at about 25,000 ha.

A large sluice gate with six openings is located on the Badai river at the mouth of the Beel at Talimnagar village (Fig. 1). The sluice gate is owned by the Bangladesh Water Development Board, but monitored and regulated by a committee of important stakeholders including those of agriculture and fisheries sectors. The sluice gate is used to regulate the water level in the Beel connecting to the Badai river. The Badai river at a distance of about 4 km from the sluice gate connected to the Padma river which is further connected to the Jamuna river (Fig. 1).

### *Salient findings of the Participatory Rural Appraisal (PRA)*

The salient information obtained by the PRA are summarized below:

There are some common property areas (Khash water bodies called Jalmohals) in the deeper region (where water remains throughout the year). However, most areas of the Beel are privately owned crop fields. These areas inundate during the rainy season and also due to the intake of water through the sluice gates.

Seine net (Ber Jal) made of fine synthetic filaments is operated by one or two small motorized boat is the most important fishing gear used in the Beel. The mesh size of the net is so small that any fish, even juveniles of any species cannot escape through it. The most detrimental fishing practice that mostly affects the abundance of the fish population in the Beel is the "Bandh" (bamboo and net fence) fishing in the feeder canal/river. Other gears operating in the Beel are Current Jal, Veshal Jal, Khora Jal, Jhaki Jal, Moi Jal, Barshi, traps, etc.

No fishing regulation, except leasing the fishing rights is in operation. However, occasional seizing of seine net (Ber Jal) by mobile court were reported. There is no sanctuary in the Beel at the moment, but the Department of Fisheries has proposed to the Govt. to establish a sanctuary in the Gajner Beel to protect the natural brood stocks for ensuring natural propagation to enhance its fisheries resources.

### *Water quality parameters*

Important physico-chemical parameters of water of the Beel recorded during September'04-August'05 are presented in Table 1. From the table, it is revealed that the water colour of the Beel was greenish during September-November'04 but it became very turbid in December'04 due to the impact of drying of the Beel. The dry season started from December'04 and continued up to June'05. During the dry season, no water quality parameters was recorded, because almost all the Beel areas, except the feeder canal, were dried up. In July'05 due to the incoming turbid river water, the water colour of the Beel also became very turbid. In August'05 the water qualities again settled to its normal greenish colour (Table 1).

### *Occurrence, abundance and distribution of Jatka*

The monthly investigation of catch composition in the Gajner Beel confirmed that the Jatka appeared first in the Beel in July at the time of water intake through the sluice gates. Initially the Jatka stay in the feeder canal, the deeper region of the Beel and then gradually disperse other areas of the Beel depending on the water depth of the Beel. The abundance of Jatka was found higher in the deeper region than that of in the shallower region. Monthly sampling also confirmed that the abundance of Jatka was the highest in August. After August, the abundance of Jatka reduced gradually and the distribution

Table 1. Important physico-chemical parameters of water of the Gajner Beel, Sujanager Upazila, Pabna

Months	Current direction	Vegetation	Water colour	Water depth (m)	Transparency (cm)	Temp-Rature (°C)	DO (mg/l)	pH	Comments
Sep-04	Stable	Sufficient rooted and submersed	Greenish	1-6	-	-	8.0	-	Sluice gate closed, other paramaters was not recorded during the first visit
Oct-04	Stable	Sufficient rooted and submersed	Greenish	1-6	25	28	8.5	7.8	Sluice gate closed
Nov-04	Strong out going	Sufficient rooted and submersed	Greenish	0-2	22	27	-	7.5	Sluice gate opened
December-June is the dry season									
Jul-05	Strong incoming	Sufficient rooted and submersed	Very turbid	0-1	06	28	8.0	7.7	Sluice gate opened, Beel partially filled up
Aug-05	Almost Stable	Sufficient rooted and submersed	Greenish, turbid in feeder canal	1-5	20	28	8.5	7.8	Sluice gate opened, Beel almost filled up

also reduced to the feeder canal only. When the sluice gates open to drain out the water from the Beel, the abundance and distribution of Jatka reduced drastically and hardly any Jatka could be found in the Beel due to the downward migration and intense fishing of the Jatka.

### *Fishing, landing and marketing of Jatka*

The amount of Jatka in the Gajner Beel was estimated by collecting information on the catch and effort involved in Jatka fishing during the Jatka season. The main Jatka season was extended hardly two-month period during mid August-mid October. Veshal/Bandh/Khora Jal (lift net covering large area as fence which sometimes covers the entire width of the main channel) and Ber Jal (beach seine net) were the two main gears involved in Jatka fishing. The total number of Ber Jal and Veshal Jal used were 170 and 12, respectively throughout the season (Table 2). The daily catch rate of Jatka for Ber Jal was found to be 5 kg and 3 kg, for first and second months of the season, respectively (Table 2). The daily catch rate of Jatka for Veshal Jal was found to be 10 and 5 kg for first and second months of the season, respectively. In the first month, the estimated quantity of Jatka caught by the Ber Jal and Veshal Jal were 25.5 and 3.6 t and for the second months, the figures were 15.3 and 1.8 t, respectively. The estimated total landing of Jatka from the Gajner Beel in a Jatka season was found to be 46.2 t (Table 2). The daily landed amount of Jatka from the Beel is marketed on daily basis to the local fish-market. The marketing name of Jatka is 'Chapila', because most buyers popularly know the Chapila fish, which resemble Jatka.

Table 2. Gear- and month-wise estimated amount of Jatka caught in the Gajner beel, Sujanagar Upazila, Pabna during the Jatka season (mid August-mid October)

Duration	Type of Gear	Total no. of gear	Catch/gear/day (kg)	Monthly (30 days) total catch (kg)
Mid August-Mid September	Ber jal (Beach seine)	170	5	25,500
	Khora/ Veshal/ Bandh jal	12	10	3,600
Mid September-Mid October	Ber jal (Beach seine)	170	3	15,300
	Khora/ Veshal/ Bandh jal	12	5	1,800
Total for the season				46,200

### *Species composition*

The species composition of the Gajner Beel fishery was studied to identify the relative importance of different species/groups of fisheries resources available in the Beel. A great combination of indigenous small fish together with migratory riverine species was observed in the Beel. Both resident and riverine cyprinids (carps, barbs and minnows) dominated in the Beel. Catfishes, snakeheads and freshwater eels were also very important contributors to the fish production of the Beel.



The percentage composition of different important species/group of fishes in Gajner Beel was estimated considering the overall catch of the Beel during the fishing season in 2004 (Fig. 2). From the figure it is revealed that Jatka contributed only about 3%, while freshwater eels contributed about 16% of the catch. Other important contributors were glass perch (13%), barbs (12%), river shads (11%), catfish (8%), snakeheads (8%), carps 7% and minnows (4%). Beside these, combined contribution of miscellaneous other small species of fish and shrimp was about 18% of the catch.

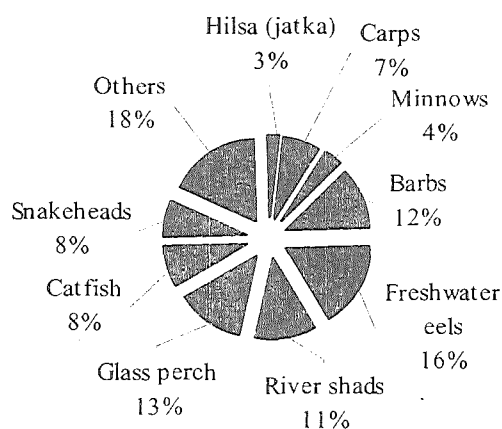


Fig. 2. Approximate percentage composition (by overall weight) of important species/groups of fish in Gajner Beel, Sujanagar Upazila, Pabna.

## Discussion

### *Availability of Jatka and possibility of breeding of hilsa*

There are two possible sources of availability of juveniles in a water body: firstly, breeding of the fish within the water body; secondly, migration of the juveniles from adjacent water bodies. Both the possibilities were investigated to determine the sources of Jatka in the Gajner Beel. Firstly, the assessment of the physico-chemical properties of the Gajner Beel (Table 1) indicated that hilsa could not survive during the dry season (December-June), because, in the dry season, the Beel was almost dried up and no traces of hilsa were recorded in the catch, when caught either by drying the water bodies or by any other means in the deepest area of the Beel.

The second possibility was then investigated carefully and evidence of the migration of Jatka from the adjacent water bodies was established. The downstream of the Badai river is connected to the Padma river (Fig. 1) which is the known natural nursery ground of hilsa, and Jatka is reported to be available in the interconnected Padma and Jamuna rivers and their tributaries ((Hossain 1985, Mazid and Islam 1991, Rahman and Naevdal 1998, Rahman 2001). As the Badai river is one of the tributaries of the Padma river, which joins the Gajner Beel in the upstream through the sluice gate, migration of Jatka from the Padma and/or Jamuna rivers to the Gajner Beel is possible. During the

sampling in the last week of August 2005, considerable quantities of Jatka were caught that confirmed that the Jatka migrated from the Padma/Jamuna river to the Beel through the sluice gate.

#### *Reasons for migration of Jatka to the Gajner Beel*

The main reason of migration of Jatka to the Gajner Beel is the suitability of the Beel as a nursery ground of the hilsa juveniles. The hilsa juveniles drifted to the upstream areas of the Padma river by the tidal current search for a suitable nursery ground. An ideal nursery ground of hilsa should have shallow water depth, high aquatic vegetation, specially submersed algae for food (Rahman *et al.* 1992), pleasant water qualities, devoid of strong water current and filled with riverine fresh water (Rahman 2001). Gajner Beel is an ideal water body possessing the above characteristics. The Beel is filled with riverine freshwater, has got very pleasant water qualities, necessary aquatic vegetation and of course devoid of strong water current. However, the fluvial connection of the Beel to the Padma river is the prerequisite for the migration of Jatka to the Beel. Without this connection, whatever the water qualities may be, Jatka would not be able to migrate to the Beel.

Nevertheless, the quantity of Jatka to be migrated into the Beel largely depended on two main anthropogenic activities, *viz.* when and to what extent the sluice gates are opened and what other barriers are erected (e.g. Bandh/Khora Jal) on the migratory route of the Jatka. Timely opening of the sluice gates (opening in the Jatka season) in full extent and absence of barrier in the migratory route (e.g. setting up net or any other barrier prior to the sluice gates and river mouth) will ensure greater quantity of Jatka to be migrated into the Beel.

#### *Species composition*

The percentage composition of Jatka was about 30% for the catch of Veshal/Khora Jal in August, 2003 (Mr. Ali, personal communication). Although, the overall percentage composition of Jatka as obtained from the present study was very low (3%) (Fig. 2) compared to the figure obtained in August 2003, it cannot be considered controversial. Because, he did not consider the percentage composition of Jatka to the overall catch of the season or the year. However, the percentage composition of Jatka for the month of August, as obtained in the present study (25%), is very similar to the value obtained in 2003.

#### *Suggested management measures*

The information regarding the migration of Jatka from the adjacent rivers to the Beel would be valuable for the overall management of the fisheries of the Beel. However, for the development of a complete management plan, detail information regarding the quantities of Jatka and its relationship with the operation of the sluice gate needs further investigation. Moreover, formulation of a sound management plan for development of the total fisheries resources of the Beel is not possible solely on the basis of the

information related to Jatka. Detail information on other fisheries resources as well as other stakeholders is required for the development of an integrated management plan. This would need information of all other fisheries and crop resources of the Beel areas. Nevertheless, depending on the information generated from the present study, the following management measures for the Gajner Beel are put forward for implementation:

**Timely and effective operation of sluice gates :** Timely and effective operation of the sluice gates largely determine how and to what extent of the hilsa and other important riverine species can migrate to the Gajner Beel. Opening of sluice gates in the spring tide in June and July is essential to ensure sufficient recruitment of Jatka and other important riverine species in the Beel. The opening of the gates should be maximized to facilitate undisturbed migration of the species to the Beel. The sluice gate management committee may be trained to understand the migration pattern of fishes for enhancement of the fisheries resource. Representatives from the fishers should be included in the committee to ensure proper management. The suggestions made by Ali and Alam (2005) regarding sluice gate operation can be followed.

**Control of Bandh/Khora/Veshal Jal and Ber Jal :** Bandh/Veshal/Khora Jal and Ber Jal are the two major gears that are detrimental to Jatka as well as other important fish species in the Beel. More than 50% of fish potentially being caught by those gears before they even reach the sluice gates (Ali and Alam 2005). The escapees those get chance to enter into the Beel through the sluice gate, again become the subject of repeated intense fishing by those gears. Only a few escapees get chance to grow full season in the Beel. Restriction on use or complete ban of those gears during June-August will enhance total fish production many folds.

**Formation of community based Gajner Beel management committee :** The Gajner Beel is surrounded by many villages. The areas are very remote and boat is the main way of transportation. In this situation, it is very difficult for the fisheries authority to properly implement the Fish Act. Therefore, a Gajner Beel management committee is essential to implement the suggested management measures. The committee should include representatives from all stakeholders, including one from each villages involved in the fishing. The activities of the committee should be monitored by the fisheries authority.

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