Bangladesh J. Fish. (Special Issue, 2007) 30 : 37-51

Source and abundance of Jatka (juvenile hilsa, *Tenualosa ilisha*) in the Gajner *beel*, Sujanagar, Pabna

M. A. Mazid, M. J. Rahman and M. G. Mustafa[1]
Bangladesh Fisheries Research Institute, Mymensingh-2201
[1]WorldFish Center, Bangladesh and South Asia Office, Banani, Dhaka-1213

Abstract. Investigations on the source, abundance, migration, exploitations and management options of Jatka (juvenile hilsa, *Tenualosa ilisha*) fisheries 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. This article reports exclusively on the important Jatka fishery of the Gajner *beel*. The Padma and the Jamuna was identified as the sole source of Jatka in the Beel. The migratory route of Jatka was found to be extended from the Padma and/or Jamuna rivers to the Badai river and then to the *beel* through a sluice gate at Talimnagar village. The possibility of breeding of hilsa in the *beel* was nullified. The main Jatka fishing season was found extended from mid August to mid October. Lift net (Veshal/Bandh/Khora Jal) and beach seine net (Ber Jal) were found to be the major gears involved in Jatka fishing. The total quantity of Jatka caught from the *beel* during 2004-05 fishing season was estimated to be 46.2 mt. Finally, a community based management plan was suggested for implementation by the Gajner *beel* management committee.

Introduction

The hilsa (*Tenualosa ilisha*, Clupeidae) is an important migratory species in the Indo-Pak subcontinent and the Persian Gulf region, especially in Bangladesh and India. The species is an extremely popular food fish to the people of Bangladesh where it contributes more than 13% (about 0.23 million tons) to the total fish production of the country worth over US $ 800 million (Taka 40.0 billion) each year (Mazid *et al*., 2005). 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 million as foreign exchange each year (Mazid, 2005).

Jatka is the juvenile stage of the hilsa (Mazid and Islam, 1991, Rahman and Naevdal, 1998, Rahman, 2001). The Jatka also resembles adults of two species of Clupeids (*Gudusia chapra* and *Goniolosa manmina*), locally called chapila (Rahman, 2001, Mazid *et. al*., 2005). Hence, many fishers and fish traders often mistakenly refer Jatka as chapila to the consumers in the fish market (Mazid, 1994, Rahman, 1997). Hora and Nair (1940) provided 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. 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). Gradually the Jatka acquire the ability to tolerate saline water and move downstream to the estuary. They spend their young stages in brackish water. Later, they move to the offshore areas for feeding and grow to the adult size.

Since the last few decades, the hilsa production is gradually declining particularly from the inland waters (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 (Mazid *et al*., 2005). 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, Mazid *et al*., 2005).

In Bangladesh, *beel* (natural depression) fishery has a significant role in the total fish production of the country. The Gajner *beel*, located in the Pabna Irrigation and Rural Development Project (PIRDP) is very important for fisheries development (Ali and Alam, 2005). A large sluice gate with six openings has been constructed for regulating water level 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 meters but the water for fish production was available for 3-4 months only (mostly from August to November). Thereafter the *beel* is dried up for crop cultivation. After inundation by rainfall and/or water intake, the fisheries resources of the *beel* become a common property. One third of the *beel* area is used for both rice and Rabi crop (crops cultivated during the dry season) production. The remaining two third areas are used for Boro crop cultivation. 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 production in the above area through proper maintenance of the water level and by adopting other suitable management options.

Considering the importance of the Gajner *beel*, some works especially on the impacts and management of the sluice gates were conducted in the recent past (Hoggarth *et al*., 1999, Halls *et al*., 1999, 2000, Ali and Alam, 2005). However, little work has been done so far on the Jatka fishery of the *beel* (Mazid *et al*., 2005). Normally, *beel* is not the usual habitat of Jatka. The nursery grounds of Jatka are located in the mainstream of the Gangetic river systems (Mazid and Islam, 1991,

Rahman, 2001, Mazid *et al*., 2005). Report of the availability of Jatka in such a remote Beel, located far upstream from the present breeding and nursery grounds of hilsa was the main driving force of the present work. In view of the above, studies were conducted to trace out the source, abundance, possibility of spawning, migration, fishing methods, fishing season and landings of Jatka in the Gajner *Beel* as well as to suggest different management strategies for the fishery.

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 in Sujanagar (partly attached to Sathia and Bera) Upazila of Pabna district, Bangladesh at the confluence of the Padma and the Jamuna rivers. 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).

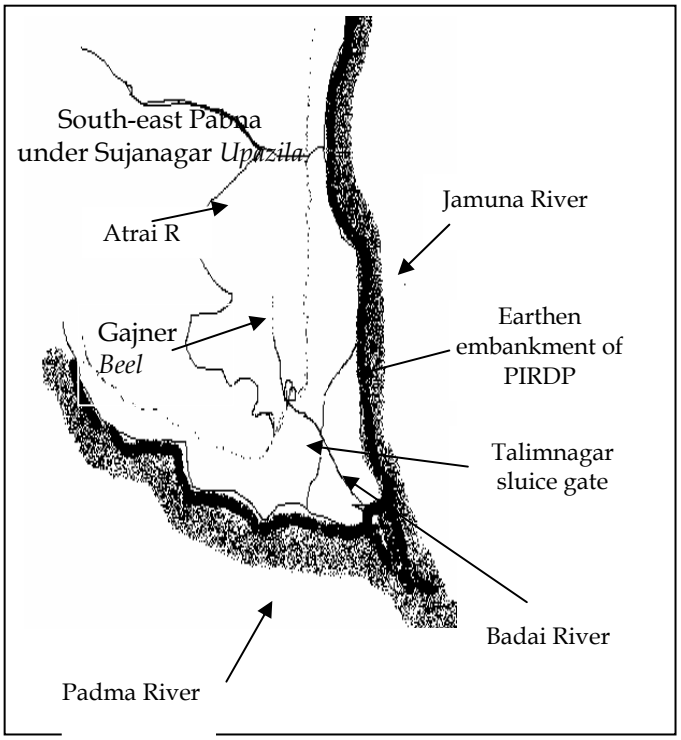

Fig. 1. Map showing the approximate location of sluice gate, connecting rivers and surroundings of the Gajner Beel, Sujanagar, Pabna.

Survey of the Beel area

The Gajner *beel* and adjacent water bodies were surveyed in September 2004. The entire water area of the *beel* were visited by boat and the surrounding land areas by local transportation and on foot. During the visit, information on the *beel* 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 samples were compared with those of the juvenile hilsa as described by Rahman and Naevdal (1998) and Rahman (2001) and confirmed that the samples collected are the juvenile of hilsa, *Tenualosa ilisha*. Special care was taken in separating the 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 to detect the availability of Jatka and the possible breeding grounds of hilsa in the *beel*. Possible migratory routes of the hilsa juveniles in the 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 suitability of the *beel* for the survival of hilsa was monitored monthly by examining water levels, water qualities and catch compositions. In the dry season (December-June), the *beel* got almost dried up and no hilsa/Jatka was found in the catch. The water level and water quality were absolutely unsuitable for hilsa to survive during the dry season in the *beel*. Therefore, hilsa juveniles, avaliable in the beat must have come from the adjoining water bodies to the *beel* in the rainy season (July-November). During the survey it was confirmed that the Badai river connects the Beel with the Padma/Jamuna rivers (Fig. 1) and this route was probably the only migratory route of the Jatka to and from the *beel*.

Participatory Rural Appraisal

The Participatory Rural Appraisal (PRA) techniques were used for gathering baseline information about the Gajner *beel*, its resources, management system, conflicts and related problems. Particular emphasis was given to collect 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 and resource management system of the *beel* 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 landowners, leaseholders, sluice gate operators, government officials and local people.

Monitoring of water quality parameters

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

Collection of fish samples

Fish samples were collected monthly from the Gajner *Beel* and preserved in 10% buffered formalin in properly labeled containers and were brought to the laboratory of the Bangladesh Fisheries Research Institute, Mymensingh for further analyses. Catch rate and fish species composition were analyzed. Each of the species of fin fishes was separated carefully. Special care was taken in separating the two Jatka-like species, *viz*. *Gudusia chapra* and *Goniolosa manmina*. After that, weight (g) of each of the fish sample was taken and the percentage composition of each of the species was calculated.

Estimation of the quantity of Jatka

The quantity 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 a motorized boat to count the gears involved in Jatka fishing in the Jatka harvesting season (mid August to 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:

- The Gajner *beel* of the Sujanagar Upazila located within the Pabna Irrigation and Rural Development Project (Fig. 1) was found to be 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 was surrounded by a total of 172 villages under 14 Union Parishads of which 10 were situated in Sujanagar, three in Bera and the remaining one in Sathia Upazila. The important villages were: Bonkola, Char Dhulai, Sarivite, Badai, Soyedpore, Athkhani, Ulat, Tirmoni and Talimnagar.
- The Gajner *beel* was a vast water mass created through union of 16 *beels* of which 11 *beels* were small (<20 acres) and five were large (>20 acres). The total public (Khash) area of the Gajner Beel was 534 acres (contribution of 11 small *beels* was about 101 acres while that of the five large *beels* was about 433 acres) during the rainy season and after water intake through the sluice gate, the total area including the floodplain used to become about 25,000 ha.
- Bangladesh Water Development Board (BWDB) has constructed a large sluice gate with six openings on the embankment of the Badai river at the mouth of the Gajner *beel* at Talimnagar village. The sluice gates are used to regulate the water level in the *beel*, the opening and closing of the sluice gates were monitored and regulated by a committee of important stakeholders including those of agriculture and fisheries sectors. The Badai river was found to flow into the Padma river at a distance of about 4 km from the sluice gate which ultimately flew into the Jamuna river (Fig. 1).

Findings of the Participatory Rural Appraisal

There were some common property areas (Khash, i.e. public water bodies called Jalmohals) in the deeper region (where water was found to remain throughout the year). However, most areas of the *beel* were privately owned crop fields. These areas were found to be inundated 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 operated by one or two small motorized boat was the most important fishing gear used in the *beel*. The mesh size of the net was so small that any fish, even juveniles of any species could not escape through it. The most detrimental fishing practice that mostly affected the abundance of the fish population in the *beel* was the "Bandh/Veshal/Khora Jal" (bamboo and net fence) used for fishing in the feeder canal/river. Other gears operating in the *beel* were Current Jal, Jhaki Jal, Moi Jal, Barshi, traps, etc.

No fishing regulation, except leasing out the fishing rights was in operation. However, occasional seizing of seine net (Ber Jal) by the Department of Fisheries, Government of the Peoples Republic of Bangladesh (DoF) led mobile court were reported. There was no sanctuary in the *beel* at the moment, but DoF has proposed to the Government to establish a sanctuary in the Gajner *beel* to protect the natural brood stocks for ensuring natural propagation to enhance the fisheries resources of the Gajner *beel*.

Physical water quality parameters

Important physical parameters of water of the *beel* as recorded during September 2004-August 2005 are presented in Table 1. The water color of the *beel* was found to be greenish during September-November 2004 but it became very turbid in December 2004 due to the drying of the *beel*. The dry season started from December 2004 and continued up to June 2005. During the dry season, no water quality parameter could be recorded, because almost all the *beel* areas, except the feeder canal, were dried up. In July 2005 due to the incoming turbid river water, the water colour of the *beel* became very turbid. By August 2005 the water was found to recover its normal greenish colour again.

Table 1 Important physical parameters of water of the Gajner Beel, Sujanagar, Pabna, Bangladesh during 2004-05 fishing season

Month	Current direction	Vegetation	Water colour	Depth (m)	Trans-parency (cm)	Tempe-ratur (°C)	Comments
Sep-04	Stable	Sufficient rooted and submersed	Greenish	1-6	-	-	Sluice gate closed
Oct-04	Stable	Sufficient rooted and submersed	Greenish	1-6	25	28	Sluice gate closed
Nov-04	Strong out going	Sufficient rooted and submersed	Greenish	0-2	22	27	Sluice gate opened
Jul-05	Strong incoming	Sufficient rooted and submersed	Very turbid	0-1	06	28	Sluice gate opened, Beel partially filled up
Aug-05	Almost stable	Sufficient rooted and submersed	Greenish, turbid feeder canal	ii 1-5	20	28	Sluice gate opened, Beel almost filled up

December to June is the dry season

Occurrence, abundance and distribution of Jatka

Jatka was found to appear first in the *beel* in July at the time of water intake through the sluice gates. Initially they were found to stay in the feeder canal, then they moved to the deeper region of the *beel* and finally dispersed gradually to the other areas of the *beel* depending on the water depth of the *beel*. The abundance of Jatka was found to be higher in the deeper regions than in the shallower regions. It was found that the abundance of Jatka was the highest in August. After August, the abundance started to reduce gradually and they became almost confined to the feeder canal only. When the sluice gates were opened 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 main Jatka fishing season was found to extend from mid August-mid October. Veshal/Bandh/Khora Jal (lift net covering large area as fence which sometimes coverd the entire width of the main channel) and Ber Jal (beach seine net) were the two main gears involved in Jatka fishing. The Jatka dominated catch was obtained only from the Veshal/Bandh/Khora Jal. The total number of Ber Jal and Veshal Jal used were 170 and 12, respectively throughout the season. The daily catch rate of Jatka for Ber Jal was found to be 5 kg and 3 kg, for the first and second months season, respectively while that for Veshal Jal was 10 and 5 kg for the first and second months of the season, respectively. The estimated quantity of Jatka caught by the Ber Jal and Veshal Jal was 25.5 and 3.6 t in the first month while the same was 15.3 and 1.8 t, respectively in the second month. The estimated total landing of Jatka from the Gajner Beel in a Jatka fishing season was found to be 46.2 mt (Table 2). The total landed quantity of Jatka from the Beel was found to be marketed on daily basis in the local fish markets. The marketing name of Jatka is 'Chapila', because Chapila is popular to most of the people and Jatka apparently resembles Chapila.

Table 2 Gear- and month-wise estimated amount of Jatka caught in the Gajner Beel, Sujanagar, Pabna, Bangladesh during the 2004-05 Jatka season

Duration	Type of gear	Total 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

A number of indigenous small fish together with migratory riverine species was observed in the Gajner *beel*. A total of 44 species of fin fishes were listed from the *beel* and their percentage composition was calculated (Table 3). It is evident that both Beel resident and riverine cyprinids (carps, barbs and minnows) dominated the list. Important carp species were, *Labeo rohita, Cirrhinus cirrhosus, Labeo calbasu, Catla catla* and *Cirrhinus reba.* Some important minnows were *Rohtee cotio, Esomus danricus, Salmostoma phulo, Salmostoma bacaila* and *Amblypharyngodon mola.* Among the barbs, *Puntius ticto* and *Puntius sophore* were the two most important species.

Table 3 Monthly percentage composition of important species in the Gajner Beel, Sujanagar, Pabna, Bangladesh during 2004-05 fishing season

Local name	Scientific name	Monthly composition (%)						
		Sep. 2004	Oct. 2004	Nov. 2004	Dec. 2004	Jul. 2005	Aug. 2005	Mea
Jatka	*Tenualosa ilisha*	2	0	0	0	0	13	2.5
Katal	*Catla catla*	0.2	0	4	4	0	0.2	1.4
Rui	*Labeo rohita*	0.5	1.5	5	5	0.1	1	2.2
Kalbaus	*Labeo calbasu*	0.4	0.2	1	1	0	1	0.6
Gonia	*Labeo gonia*	1	0	0	1	0	1	0.5
Bata	*Labeo bata*	0.5	0	0	1	0	0.5	0.3
Mrigal	*Cirrhinus mrigala*	0.5	0	4	4	0	0.1	1.4
Bata	*Cirrhinus reba*	0.1	0	2	1	0	0.2	0.6
Dhela	*Rohtee cotio*	0.1	0.2	0.2	0.1	0	0.1	0.1
Darkina	*Esomus danricus*	0.2	0.1	0.1	0.1	2	0.1	0.4
Phulchela	*Salmostoma phulo*	2	1	0.1	0.1	0.1	0.1	0.6
Chela	*Salmostoma bacaila*	3	0.2	0.2	0.2	0.2	0.2	0.7
Mola	*Amblypharyngodon mola*	4	1	1	1	1	3	1.8
Titputi	*Puntius ticto*	4	5	6	5	3	4	4.5
Puti	*Puntius sophore*	6	6	9	9	6	8	7.3
Magur	*Clarias batrachus*	0	0	1	1	0	0	0.3
Boal	*Wallago attu*	1	0.5	6	6	0	0.1	2.3
Pabda	*Ompok pabda*	0.2	0.1	2	3	0.1	0.1	0.9
Shing	*Heteropneustes fossilis*	0.1	0	1	1.5	0	0.1	0.5
Kajuli	*Ailia coila*	0.1	0	0.1	0.2	0	0.2	0.1

Local name	Scientific name	Monthly composition (%)						
		Sep. 2004	Oct. 2004	Nov. 2004	Dec. 2004	Jul. 2005	Aug. 2005	Mea
Air	*Aorichthys aor*	0	0	0.5	0.4	0	0	0.2
Tengra	*Mystus vittatus*	2	4	4	1	0.5	0.4	2.0
Tengra	*Mystus tengara*	3	3	4	1	0.4	0.5	2.0
Chapila	*Gudusia chapra*	6	5	0	0	4	6	3.5
Chapila	*Goniolosa manmina*	16	8	0	0	5	16	7.5
Tarabaim	*Macrognathus aculeatus*	8	2	4	6	6	4	5.0
Baim	*Mastacembelus armatus*	1	2	2	4	1	2	2.0
Chirka	*Mastacembelus pancalus*	12	9	11	12	8	7	9.8
Chanda	*Chanda nama*	7	8	3	3	5	7	5.5
Chanda	*Chanda ranga*	9	9	5	4	9	9	7.5
Gajar	*Channa marulius*	0.5	0.1	4	5	0.1	1	1.8
Shol	*Channa striatus*	2	2	6	7	0.2	2	3.2
Taki	*Channa punctatus*	0.5	0.4	4	5	0.1	1	1.8
Cheng	*Channa orientalis*	0.1	0.2	1	2	0.1	0.2	0.6
Kakila	*Xenentodon cancila*	2	3	1	1	2	3	2.0
Foli	*Notopterus notopterus*	0.2	0.2	0.1	1	0	0.2	0.3
Koi	*Anabas testudineus*	0.1	0	1	1	0	0.1	0.4
Kholisha	*Colisa fasciatus*	2	2	1	1	0.2	0.3	1.1
Baila	*Glossogobius giuris*	2	2	4	4	1	4	2.8
Meni	*Nandus nandus*	1	1	2	2	0	0.1	1.0
Rani	*Botia Dario*	0.2	0.2	1	1	0.2	0.3	0.5
Gutum	*Lepidocephalus guntea*	0.3	0.2	4	4	0.1	0.2	1.5
Khorsula	*Rhinomugil corsula*	0.1	0.2	0.1	0.1	0	0.1	0.1
Snails, clams, frogs, insects, etc.		2	3	3	2.9	3	3	2.8
Shrimps	*Macrobrachium sp.*	6	6	6	7	5	7	6.2
Total								100

Catfishes, snakeheads and freshwater eels were also very important contributors to the fish production of the *beel*. The most important catfish was the freshwater shark (*Wallago attu*), followed by Tengara (*Mystus vittatus*), Bujuritengra (*Mystus tengara*) and butter catfish (*Ompok pabda*). Four important species of snakeheads were, Gajal (*Channa marulius*), Shol (*Channa striatus*), Taki (*Channa*

punctatus) and Cheng (*Channa orientalis*). Three important species of freshwater eels were, Tarabaim (*Macrognathus aculeatus*), Shalbaim (*Mastacembelus aculeatus*) and Gochibaim (*Mastacembelus pancalus*). Clupeids (hilsa and chipla) also contributed greatly. Three important clupeid species were, hilsa/Jatka (*Tenualosa ilisha*) and chapila (*Gudusia chapra* and *Goniolosa manmina*).

The percentage composition of different important species/group of fishes in Gajner *beel* shows that Jatka contributed only about 2.5%, while three species of freshwater eels contributed about 16% to the total catch. Other important contributors were glass perch (13%), barbs (12%), chapila (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% (Table 3).

However, fish species composition was found to depend on the season and fishing methods. Fish harvested in August-September by using Khora/Veshal net were mostly dominated by clupeids followed by cyprinids while those harvested by seine net (Ber Jal) were dominated by small indigenous species. On the other hand catfish and eels were the dominant groups when total harvest was made by drying up of the ponds within the Beel.

Discussion

Availability of Jatka and possibility of breeding of hilsa

There may be two possible reasons behind the availability of juveniles in a water body: first, breeding of the fish within the water body; second, migration of the juveniles from the adjacent water bodies. Regarding first one of the two possibilities, physical properties of the Gajner *beel* clearly indicate that it is not possible for hilsa to survive in the *beel* during the dry season (December-June) because the *beel* was found to almost dry up in the dry season and there was no traces of hilsa in the catch when all the fishes were harvested either by drying the water bodies or by any other means. Therefore, the availability of Jatka in the Gajner Beel is not due to breeding of hilsa in the *beel*.

The second possibility was then investigated carefully and it was concluded that the Jatka might have migrated into the Gajner *beel* from the Padma and/or Jamuna rivers via the Badai river which was found to pass by the side of the *beel* connecting the two mighty rivers. The Padma river 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 ((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. Catching of considerable quantities of Jatka in the last week of August 2005

confirms 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 got drifted in to the upstream areas of the Padma river by the tidal current probably started to search for a suitable nursery ground. Rahman *et al*. (1992) reported that an ideal nursery ground of hilsa should have shallow water depth, high aquatic vegetations; specially the submersed algae for food while Rahman (2001) reported that pleasant water the qualities, devoid of strong water current with riverine fresh water are prerequisites for an ideal nursery ground of hilsa. The Gajner *beel* was an ideal nursery ground of hilsa as it was found to possess all the above characteristics, it was filled with riverine freshwater having 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 migrated into the *beel* was found to depend largely on two main anthropogenic activities *viz*. when and to what extent the sluice gates were kept open and what other barriers were 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*.

Relationship of water quality parameters with the abundance of Jatka

The velocity of water current was found to depend upon the season and opening of the sluice gate and combinations of these two determined the entrance and exit of fish including Jatka in the *beel*. Other water quality parameters were found to be normal in the Beel (Table 1). Closing and opening of the sluice gate mainly determined the volume of water in the *beel*. The *beel* was found to be mainly used alternately for crops and fisheries. The crop season was the dry season (December-June) and the remaining months (July-November) was the fishing season. In November, water depth reduced remarkably due to the opening of the sluice gate and in December, the *beel* got almost dried up and plant cropping started. After harvesting the crops in July, the sluice gate was opened for water intake from the Padma river into the *beel* via the Badai river. The incoming river water was found to be very turbid with suspended silts and clay particles. At that time different riverine

species of fish were found to enter into the Beel through the incoming water. The water then slowly settled down in the *beel* and became clear. The water quality was found to recover gradually and became greenish.

In general, the water qualities of the Gajner *beel* were found to be very pleasant and suitable for the juvenile hilsa. The greenish colour of water together with sufficient aquatic vegetation including submerged algae ensured availability of sufficient food for the Jatka (Rahman *et al*., 1992). In July, due to the strong incoming water from the river to the *beel*, Jatka entered into the Beel and remained there for a few months as the *beel* was a good nursery ground. Water depth was found to vary between 1 m and 6 m during the wet season. In August-September, the water depth and water current of the *beel* became suitable for Jatka (Rahman, *et al*., 1997). Suitable water quality parameters together with the operation of the sluice gates were the causes behind the abundance of Jatka in the Gajner *beel* during the wet season while during the dry season, most of the beel areas became a dry crop field.

Species composition

The mean overall contribution of Jatka to annual catch was found to be very low (only 2.5%), while the percentage composition of Jatka in August, 2005 was about 13% of the total fish catch. After August, the percentage composition of Jatka was found to decline gradually up to September. As soon as the sluice gate was opened in October it disappeared almost completely because of the downward migration. As Jatka disappeared in the main fishing season (October-November), the percentage composition in the overall catch in the season was poor. However, in August, the percentage composition of Jatka and other Jatka-like clupeids *viz*. *Gudusia chapra* and *Goniolosa manmina* was dominant, particularly in the catch by Veshal/Khora Jal. Therefore, detail gear-wise assessment of the percentage composition of Jatka may provide better information.

The percentage composition of Jatka was about 30% in the catch of Veshal/Khora Jal in August, 2003 (Ali, personal communication). Although, the overall percentage composition of Jatka as obtained in the present study is very low (2.5%) in comparison to the figure obtained in August 2003, it cannot be considered controversial. Because, in that study neither the percentage composition of Jatka alone in the overall catch of the season nor that of the Jatka and Chapila were segregated. However, the combined percentage composition of Jatka for the month of August (13%) together with the Chapila (11%), as obtained in the present study (24%), may be considered very similar to the figure obtained in 2003.

Conclusion

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, formulation of a sound management plan for the development of total fisheries resources of the Beel is not possible solely on the basis of the information related to Jatka. For the development of a complete management plan, detail information regarding the quantities of Jatka and other fisheries resources as well as their relationship with the operation of the sluice gate need further investigation.

Acknowledgements

The authors are grateful to the Upazila Fisheries Officer, Sujanagar, Pabna for providing some basic information about the Gajner Beel and its surroundings. Gratitude is also extended to the local people and especially the fishers of the Beel for helping at the time of field works, PRA and training. This research and dissemination was funded by the Department for International Development (DFID).

Literature cited

Ali, M. L. and S. S. Alam. 2005. Management of sluice gate/regulators for fish stock enhancement in modified floodplain without harm to rice. Paper presented in the seminar 'Inland openwater fisheries development and management in poverty reduction' held on the occasion of the Fish Fortnight, 2005. Bangladesh Center for Advanced Studies (BCAS), 16 pp.

BFRI/RS. (Bangladesh Fisheries Research Institute, Riverine Station, 1994). Hilsa Fisheries Development and Management. Annual Report 1994, Bangladesh Fisheries Research Institute, Riverine Station, Chandpur, 21 pp.

Halls, A.S., D.D. Hoggarth and K. Debnath. 1999. Impacts of hydraulic engineering on the dynamics and production potential of floodplain fish populations in Bangladesh: implications for management. *Fisheries Management and Ecology*, **6**:261-285.

Halls, A.S., D.D. Hoggarth and K. Debnath. 2000. Impacts of hydraulic engineering on the dynamics and production potential of floodplain fish populations in Bangladesh: implications for management. In: Cowx, I.G. (ed.). *Management and ecology of river fisheries*. Fishing News Books, Blackwell Science Ltd., pp. 331-345.

Hoggarth, D.D., R.K. Dam, K. Debnath and A.S. Halls. 1999. Recruitment sources for fish stocks inside a floodplain river impoundment in Bangladesh. *Fisheries Management and Ecology*, **6**:287-310.

Hora, S.L. and K.K. Nair. 1940. Further observations on the bionomics and fishery of the Indian shad *Hilsa ilisha* (Ham.) in Bengal waters. *Records of Indian Museum,* **42**:35-40.

Mazid, M.A. 1994. Welcome address. Proc. seminar on sustainable development of the marine fisheries resources in Bangladesh. Cox's Bazar, Bangladesh. Aug 29, 1994. Bangladesh Fisheries Research Institute and Food and agriculture Organization of the United Nations, 81 pp.

Mazid, M.A. 1998. An overview of hilsa fishery research in Bangladesh. In: Mazid, M.A. and S.J.M. BlaBer (eds.). *Hilsa fisheries research in Bangladesh*. Proc. BFRI/ACIAR/CSIRO workshop, 3-4 March, 1998, Dhaka, Bangladesh. Bangladesh Fisheries Research Institute, Mymensingh, pp. 6-10.

Mazid, M.A. 2005. Abundance, distribution and population study of Jatka (juvenile hilsa, *Tenualosa ilisha*) in Gajner Beel/Beel Gondohosti in Sujanagar Upazila of Pabna district. Annual report, Bangladesh Fisheries Research Institute, Mymensingh, 26 pp.

Mazid, M.A. and S. Islam. 1991. Hilsa Fishery Developement and Management. A report published by Fisheries Research Institute, Mymensingh, Bangladesh, 16 pp.

Mazid, M.A., M.J. Rahman and M.G. Mustafa. 2005. Abundance, migration and management of Jatka (juvenile hilsa, *Tenualosa ilisha*) in the Gajner Beel, Pabna, Bangladesh. *Bangladesh J. Fish. Res.*, **9**(2):191-202.

Miah, M.S. and G.C. Haldar, 1995. Effects of Jatka fishery on hilsa production. In: Mazid, M.A. (ed.). *Fisheries Development and Technologies*. A fish fortnight compendium, 1995. Fisheries Research Institute, Mymensingh, Bangladesh, pp. 78-81.

Rahman, M. 1997. Studies on population structure of shad in Bangladesh waters with emphasis on population genetics of hilsa shad (*Tenualosa ilisha*). Ph D thesis, Dep. Fish. and Mar. Biol., University of Bergen, Norway, 120 pp.

Rahman, M.J. 2001. Population biology and management of hilsa shad (*Tenualosa ilisha*) in Bangladesh. Ph.D. thesis, The University of Hull, England, 258 pp.

Rahman, M.A. and G.C. Haldar. 1998. Assessment of current hilsa resources in Bangladesh. In: Mazid, M.A. and S.J.M. BlaBer (eds.). *Hilsa fisheries research in Bangladesh*. Proc. BFRI/ACIAR/CSIRO workshop, 3-4 March, 1998, Dhaka, Bangladesh, pp. 20-27.

Rahman, M. and G. Naevdal, 1998. Identification of juvenile hilsa in Bangladesh by genetic methods. *Fisheries Management and Ecology*, **5**:255-260.

Rahman, M.A., M.J. Rahman, G. Moula and M.A. Mazid. 1992. Observation on the food habits of Indian shad, *Tenualosa (=Hilsa) ilisha* (Ham.) in the Gangetic river system of Bangladesh. *J. Zool.*, **7**:27-33.

Rahman, M.A., M.A. Mazid, M.S. Islam, M.J. Rahman and G. Moula. 1997. Experimental pond culture of hilsa *Tenualosa ilisha* (Hamilton) at Chandpur, Riverine Station. *Bangladesh J.Fish.*, **20**(1-2): 131-133.

Raja, B.T.A. 1985. A review of the biology and fisheries of *Hilsa ilisha* in the upper Bay of Bengal. FAO/UNDP Proj. Mar. Fish. Resour. Manage. Bay of Bengal, Colombo, Sri Lanka. *FAO/UNDP BOBP/WP/37*, 66 pp.