Bangladesh J. Fish. Res., 4(1), 2000: 69-74

Biodiversity in floodplains with special reference to artificial stocking

M.S. Hossain*, M.A. Ehshan, M.A. Mazid, S. Rahman and A. Razzaque
Bangladesh Fisheries Research Institute, Mymensingh 2201, Bangladesh
**Corresponding author*

Abstract
A five years investigation on fish biodiversity in connection with artificial stocking was conducted in three south-western floodplains of Bangladesh from 1992 to 1996. The ten top most available and ten most rarest fish species were identified. *Puntius sp.*, *Channa punctatus*, *Mystus sp.*, *Anabus testudinius*, *Ambasis sp.*, *Colisha sp.* and *Macrobrachium sp.* etc. were the most common available species. On the other hand, *Mystus aor*, *Notopterus chitala*, *Clupisoma garua*, *Aplocheilus panchax*, *Ctenopharyngodon idella* etc. were the most rarest species. However, the most abundant and the rarest fish species behaved differently in different floodplains in different years. Shannon diversity index was used to assess the extent of diversity in different years. The study revealed that the artificial stocking programme, to some extent, influenced the biodiversity in floodplains.

Key words: Fish biodiversity, Floodplain, Shannon weaver index, Artificial stocking

Introduction

The world wide loss of biodiversity is widely accepted as a major problem, yet it is poorly documented, because of our knowledge of the taxonomy of most organisms is scant (Moyle and William 1990. Though loss of aquatic species is occurring rapidly, aquatic organism have received comparatively little attention to the conservation biologists (Allendorf 1988). A rich diversity of fish species are critical to the ecology and sustainable productivity of the floodplains. While tremendous genetic diversity is embodied 500 fish species which inhabit Bangladesh's inland, estuarine and coastal waters ever little substantive data on the ecology of these species is not available to say something significantly (Nuruzzaman 1993).

In early sixties the open-water fisheries contributed about 90% of the total fish production which in the recent years has drastically dropped to 49% (Mazid and Hossain 1995). The decline is due to habitat degradation of aquatic ecosystems through over exploitation of fisheries resources with increasing population pressure, adverse effects of natural and man-made catastrophes including human interventions through construction of flood control embankments, drainage systems, sluice gates, conversion of inundated land to crop land thereby reducing water area, siltation etc. Under this situation, it is really important to take necessary steps so that floodplains may remain to the harmony with the environment. However, since 1992 government of Bangladesh had

taken a massive fingerling stocking program in some selected floodplains aiming fish production augmentation from the floodplains under the Third Fisheries Project. Stocked species were *Labeo rohita, Catla catla, Cirrhinus mrigala, Cyprinus carpio, Hypopthalmicthyes molitrix* and *Puntius gonionotus.* Present investigation is worthwhile because, it is an important task to ascertain whether stocking floodplains with carp fingerlings had any adverse impact upon resident fish species or not. This study deals with the status of fisheries diversity and its dynamics in three floodplains of Bangladesh during 1992 to 1996 in relation to artificial stocking.

Materials and methods

The study was conducted from June'92 to December'96 in three major floodplains of Bangladesh. These are the Chanda beel of Faridpur-Gopalgonj depression, the Halti beel of Pabna-Natore depression and the BSKB (Basukhali-Salimpur-Kola-Barnal) beel of Khulna-Narial depression. Each floodplain possesses distinctive features. The BSKB is completely closed system floodplain and regulated by several sluice gates. The Halti is semi-open while the Chanda beel is an open system floodplain. The area of Chanda, Halti and BSKB are 10,870ha; 16,770ha, respectively (BCAS 1991). All these beels are prone to monsoon flooding and remain flooded for periods between four and seven months depending on the severity of flood in different years. During the dry season, however, the water area of the beels shrinks to a negligible amount and most of the dried-up land is cultivated with various crops. To accomplish the investigation a weekly data collection schedule was maintained. Data was collected from the fishing spots and peripheral fish landing centres, which are usually called *para* or *gala*. Catch composition by number for individual gear was recorded through the examination of catch for the respective gear. In order to data collection most of the gears i.e., more than 23 types of gears, both selective and non-selective were covered in which only 11 were of selective type. A total of 5,55,769 specimens were sampled in the present study of which 2,18,052; 1,71,985 and 1,65,732 samples belonged to Chanda, Halti and BSKB respectively.

The Shannon weaver index (H') was used to measure the extent of diversity by combining aspects of species richness and evenness. It is perhaps the most commonly used diversity index in ecology. Goswami (1985) used Shannon weaver index to assess zooplankton diversity in coastal waters of India. The formula for Shannon diversity index is: $H' = -\Sigma P_i \, Log_2 \, P_i$

Where P_i (the proportional abundance of the ith species) = (n_i / N)

n_i = number of individuals recorded of ith species

i = is the species reference

N = total of individuals in the sample

($Log_2 = 1.442 \, Log_e$).

Inferences can be drawn on the basis of the H' values calculated. The lesser values will be the lower diversity and vice-versa. For statistical analysis, using Shannon weaver index student's t-test was performed to find out significance of stocking.

Results and discussion

Top ten most available and ten rarest species in different years in different floodplains have shown in Table 1. Total number of fish species caught in the Chanda, Halti and BSKB beels were 47, 55 and 49 nos., respectively. *Puntius sp.* (both *P. stigma* and *P. ticto*) was the most available fish species in all the beels during the study period except 1993 and 1994 in the BSKB beel. Several fish species were found to be exclusive for particular floodplain and as well as some other were not found in other/s floodplain. Such as *Anguilla bengalensis, Mystus bleekery, Colisha chuna, Nemacheilus botia, Hilsha ilisa, Awaous grammepomus, Cirrhinus reba, Botia dario, Rita rita, Silonia silondia* and *Channa gachua* were not available in the Chanda beel; *Anguilla bengalensis, Rhotee cotio, Nandus nandus, Awaous grammepomus, Badis badis* and *Channa gachua* were not available in Halti beel; and *Anguilla bengalensis, Ailia coila, Colisha chuna, Nemacheilus botia, Rhotee cotio, Labeo gonia, Corica soborna, Awaous grammepomus, Badis badis, Silonia silondia, Botia dario, Rita rita, Labeo bata* and *Danio deverio* were not available in the BSKB beel. These species can be treated as *species at risk*. Total 67 species of fish were recorded in three floodplains under study. Ali (1998) enlisted three locally extinct fish species of Chanda beel *viz.*, *Puntius sarana, Rasbora elenga* and *Anguilla bengalensis*. He added that *Notopterus chitala, Labeo calbasu, Mystus aor, Gudusia chapra, Oreochromis mossambica, Euthropiichthys vacha* were rare in the same floodplain.

Table 1. Top most available and the rarest ten fish species in different floodplains during 1992-96

Status	Chanda beel		Halti beel		BSKB beel	
	Scientific name	Local name	Scientific name	Local name	Scientific name	Local name
A1	*Puntius* spp.	Punti	*Puntius* spp.	Punti	*Channa punctatus*	Taki
A2	*Macrobrachium* spp.	Chingri	*Mystus* spp.	Tengra	*Puntius* spp.	Punti
A3	*Colisha faciatus*	Kholisha	*Ambasis* spp.	Chanda	*Anabus testudinius*	Koi
A4	*Mystus* spp.	Tengra	*Glossogobius giuris*	Baila	*Labeo rohita*	Rui
A5	*Nandus nandus*	Bheda	*Channa punctatus*	Taki	*Heteropneustes fossilis*	Shing
A6	*Channa punctatus*	Taki	*Cirrhinus reba*	Raikhor	*Channa striatus*	Shoal
A7	*Xenentodon cancila*	Kakila	Chela spp.	Chela	*Cirrhinus mrigala*	Mrigel
A8	*Glossogobius giuris*	Baila	*Mastacembelus pancalus*	Gochi	*Mystus* spp.	Tengra
A9	*Heteropneustes fossilis*	Shing	*Colisha faciatus*	Kholisha	*Mastacembelus armatus*	Bain
A10	*Channa striatus*	Shoal	*Corica soborna*	Ketchki	*Colisha faciatus*	Kholish
R10	*Labeo calbasu*	Kalibasu	*Bagarius bagarius*	Baghair	*Clupisoma garua*	Ghaura
R9	*Ctenopharyngodon idella*	Grass carp	*Clarias batrachus*	Magur	*Pseusotropius artherinoides*	Batashi
R8	*Labeo gonia*	Ghonia	*Silonia silondia*	Shilong	*Cirrhinus reba*	Raikhor
R7	*Eutropiichthys vacha*	Bacha	*Notopterus chitala*	Chital	*Awaous grammepomus*	Nandi baila
R6	*Gudusia chapra*	Chapila	*Tetradon cutcutia*	Tepa	*Nandus nandus*	Bheda

R5	*Tilapia* spp.	Tilapia	*Labeo bata*	Bata	*Mystus bleekeri*	Gulsha
R4	*Corica soborna*	Ketchki	*Hilsa ilisha*	Hilsa	*Gudusia chapra*	Chapila
R3	*Notopterus chitala*	Chital	*Notopterus notopterus*	Pholi	*Mystus aor*	Aire
R2	*Mystus aor*	Aire	*Aplocheilus panchax*	Kan-pona	*Notopterus chitala*	Chital
R1	*Clupisoma garua*	Ghaura	*Ctenopharyngodon idella*	Grass carp	Badis badis	Napit koi

A= Available, R= Rare

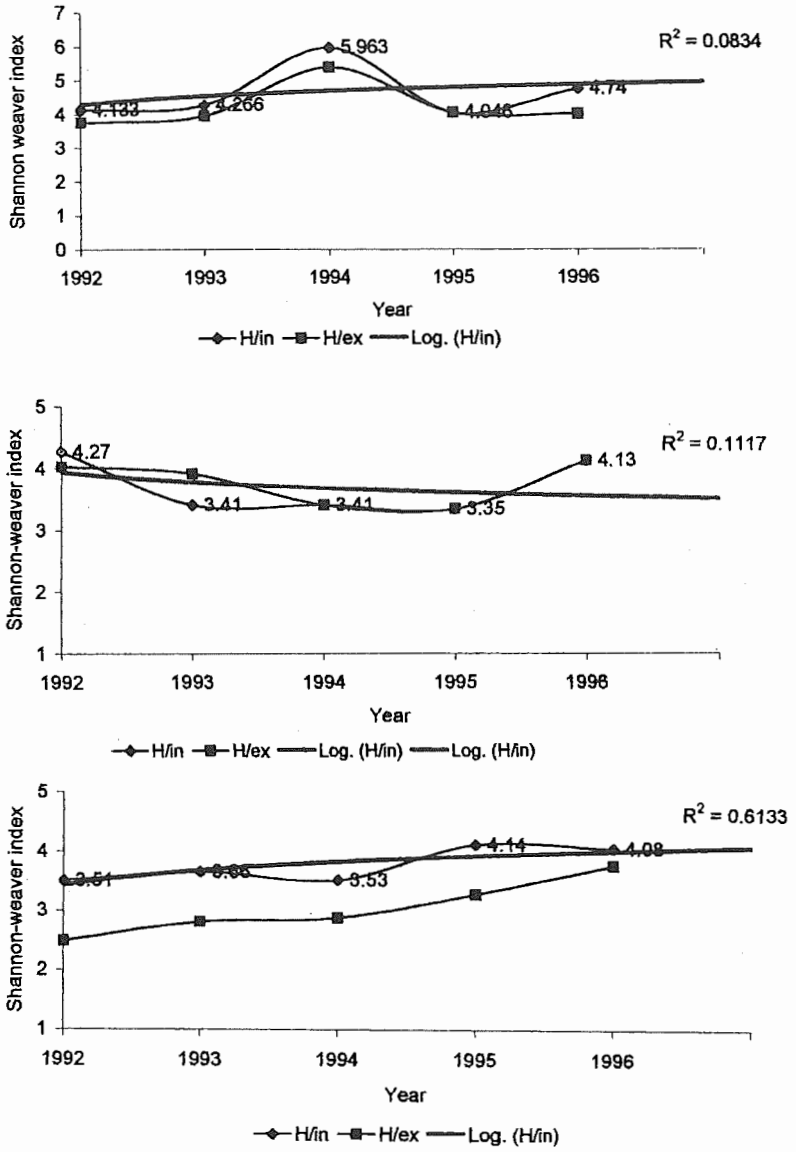
Yearly variation of Shannon weaver index and its trend line of the Chanda, Halti and BSKB beels are shown in Figs. 1, 2 and 3, respectively. Table 2 represents stocking and non-stocking years and Shannon diversity index for those years. Chanda beel showed the highest diversity index ($H'=5.96$), this was the consecutive third year of stocking, when the maximum number (43) of fish species were also caught (Fig. 1). In 1995, the index was found to be lower values ($H'=4.05$) seems due to non-stocking effects. Halti beel showed the highest diversity index ($H'=4.27$) in the year 1992. After 1993 it showed decreasing trend might be due to desist on stocking program from 1994 (Fig. 2). The BSKB beel showed the diversity index ($H'=4.14$) in 1995 when total number of fish species were also the highest (43). Perhaps continuous stocking program made this positive trend. It can be mentioned that among three study floodplains only in BSKB beel, stocking program was continued up to 1996. Student t-test using Shannon weaver index showed significant impact (at 1% level) of stocking in Chanda beel and BSKB beel. In case of Halti beel it was not derived because stocking program in this floodplain was held only first two years. Shannon weaver index was also derived by Rao *et. al.* (1991) in Chambal river, India. They found that species diversity was drastically reduced due to industrial effluents.

Table 2. Shannon weaver index in different years

Beels	1992		1993		1994		1995		1996	
	H'_{in}	H'_{ex}	H'_{in}	H'_{ex}	H'_{in}	H'_{ex}	H'_{in}	H'_{ex}	H'_{in}	H'_{ex}
Chanda	4.13	3.76	4.27	3.95	5.96	5.39	4.05*	4.05	4.74	4.01
Halti	4.27	4.03	3.94	3.41	3.41*	3.41	3.35*	3.35	4.13*	4.13
BSKB	3.51	2.49	3.66	2.82	3.53	2.89	4.14	3.30	4.08	3.79

* *No artificial stocking*

Present investigation reveals that the overall performance of *C. carpio*, *L. rohita* and *Catla catla* was satisfactory and they are suitable for floodplain stocking. But it was not clearly understood whether there was any adverse effect of stocked species, especially of exotic carp on any specific resident species or group of species or not. Jhingran (1997) commented transplantation of exotic fish into open water as a subject of controversy. He also stated that, without any knowledge of production potential of the floodplain *ad hoc* stocking could be considered as a wasteful exercise.



Figs. 1-3. Yearly variation of Shannon-weaver index of Chanda, Halti and BSKB beels and their trend lines.

Conclusions

The overall diversity index of fish in the Chanda and Halti beel were found to be lower after stopping the stocking, while diversity index showed increasing trend in BSKB beel as stocking program was continued. The findings of the present study reflect a primary picture of fisheries biodiversity of the three floodplains. Although it can be concluded that, stocking program had an impulsive impact on fish biodiversity but impact of stocked species on non-stocked resident species was not clearly understood in the present study. Food habit and food competitions are very crucial factors with respect to survivability in case of artificial stocking. So it is suggested that, cautious and scrupulous study should be conducted before such open-water stocking to find out the

competition and interaction between resident and stocked species. Special attention and further studies also should be continued on presently recorded rare species.

References

Ali, M.Y., 1998. Wetland Resources Management and Use in Chanda Beel. Bangladesh Centre for Advancement Studies (BCAS). Dhaka. 19 pp.

Allendorf, F.W., 1998. Conservation biology of fishes. *Conservation Biology*. 2: 145-148.

BCAS, 1997. Floodplain Production Monitoring. BCAS, Dhaka. (an unpublished report)

Goswami, S.C., 1985. Zooplankton standing stock and composition in coastal waters of Goa, West coast of India. *Indian J. Marine Science*. 14: 177-180.

Hussain, M. G. 1997. Stock improvement and genetic resource conservation of floodplain fishes. *In*: Open-water fisheries of Bangladesh. (eds. C. Tsai and M. Y. Ali). The University Press Limited, Dhaka. pp. 49-64.

Jhingran, A.G., 1997. Stock enhancement in the floodplain fisheries of north-eastern Bangladesh. *In*: Open-water fisheries of Bangladesh. (eds. C. Tsai and M. Y. Ali). The University Press Limited, Dhaka. pp. 183-198.

Mazid, M.A. and M.S. Hossain, 1995. Development of fisheries resources in floodplains. FRI publication no. 12. Fisheries Research Institute, Mymensingh, Bangladesh . 16 pp. (in Bangla)

Moyle, P.B. and Williams, J.E., 1990. Biodiversity loss in the temperate zone: decline of the native fish fauna of California. *Conservation Biology*, 4(3): 275-284.

Nuruzzaman, A.K.M., 1993. Cluster of Ideas and Actions for Fisheries Development in Bangladesh. Fish publisher, Dhaka. 416 pp.

Rao, K.S., S. Srivastava, U. Choubey and B.S. Rao, 1991. Observation on biological monitoring concepts of some riverine ecosystems central India. *Proc. Nat. Symp. Freshwat. Aqua*. pp 146-148.

(Manuscript received 13 August 1998)