Assessment of Fishing Practices on the Exploitation of the Titas Floodplain in Brahmanbaria, Bangladesh

M. Sagir Ahmed[1],*

[1] University of Dhaka, Department of Zoology, Laboratory of Aquatic Resource Management, Dhaka 1000, Bangladesh.

Abstract

Floodplain fishery plays an important role in the economy of the country and the livelihoods of the people living adjacent to those floodplains. There has been indication of declining fisheries stocks that needs closer examination. Consequently, a survey was conducted in the Titas floodplain (Nabinagor-Bokdhor-Urkhulia) to identify the gears, catch per unit effort (CPUE), catch composition, species diversity and production during monsoon, from July to November (two flooding seasons). A total of 35 different types of gears of seven categories were identified. The monthly average number of different gears operated varied from 501 (seine net) to 40 (push net). The highest number of gears operated in September 2003 (1491 gears) and the lowest in November 2002 (455 gears). Fishing effort of seine net, gill net and set bag nets in two flooding seasons were 0.0223, 0.0230, 0.0028 and 0.0216, 0.0233, 0.0036 gears/ha/day, respectively. The set bag net had the highest CPUE (15.41 kg/ha/day) followed by seine net (7.04 kg/ha/day) and gill net (4.85 kg/ha/day). Average CPUE of combined gears in 2002 and 2003 were 4.93 and 4.81 kg/gear/day, respectively and the estimated production of the floodplain was 44 kg/ha/year. In combined catch, more than 20% fish were Cypriniformes (carps) including *Puntius sophore, P. sarana, Labeo rohita* and *Cirrhinus mrigala*, 15% catfish (*Wallago attu, Mystus aor, M. cavasius*, etc.), 13% pearch, 6% eels and the rest 46% were small and medium size fish and prawns. The fishing effort, CPUE and yields did not show any indication on the overexploitation of the resources.

Key words: Floodplain fisheries, fishing effort, gears, species composition, Titas river.

Introduction

Bangladesh has a total 283,008 ha of floodplain area that provides important spawning and feeding grounds for a large number of freshwater fish (Welcomme, 1979; Payne, 1986; de Graff *et al.*, 1999). The floodplains inundated during the monsoon are nutrient rich and play a significant role for four to five months of the year. Larvae, juveniles and adults grow in this habitat, after which they migrate back to rivers or depressions at the end of the monsoon, when the waters recede (Welcomme, 1985; Bayley, 1988; Junk *et al.*, 1989). Furthermore, fishing during the monsoon is an important economic activity for people living adjacent to the floodplains (Payne, 1997; de Graaf *et al.*, 1994). The river Titas and its adjacent floodplains make a substantial contribution to the fishery of country and the livelihoods of fishermen who have free access to it. During the monsoon, this river floods and inundates the adjacent area to form an ideal floodplain both in terms of habitat and species diversity. The Titas floodplain is a representative of thousands of floodplains formed by over 250 rivers of the country.

Within last decade, the floodplain and riverine fisheries production in the country declined by 44% from 207,000 mt in 1983 to 124,000 mt in 1999 (DOF 1983-1999). A number of studies indicated that the major causes of declining fish catch from floodplains are the increased fishing pressure and habitat destruction (Siddique, 1990; FAP 17, 1995; Hoggarth *et al.*, 1999; Tsai and Ali, 1987; de Graff *et al.*, 2001). Species diversity also declined in the floodplain due to non-selective gears, overfishing, destruction of spawning grounds and trapping of so called 'white fish', (i.e., carps and butterfish) during their downstream migration from floodplains to rivers (Ali, 1997; de Graff *et al.*, 2001; Hall, 1998; Hoggarth *et al.*, 1999).

Only a few studies have been undertaken on the status of resources as well as the causes of declining resources in this unique floodplain area. For example, WorldFish has been monitoring the gears used and the catches taken from the upper reaches of this river since 1998 under its Community Based Fisheries Management (CBFM) program (Thompson *et al.*, 2003). However, they did not address to the declining fisheries of the adjacent floodplain. Over 100 types of fishing gears of nine categories are found to be used in the floodplains of Bangladesh (Alam *et al.*, 1997). The intensity of fishing gears, mesh sizes and catch per unit effort are good indicators of the status of exploitation level of floodplain. There are many methods to assess resources and the level of its exploitation. A simple survey method allows for gathering of a large amount of missing information in a relatively short time as well as gathering information that can be analyzed statistically with

repeatable results. The specific aim of this formal survey was to identify the gears, catch per unit effort (CPUE), catch composition, species diversity and production of this floodplain with the potential to formulate the better management practices to conserve the resources.

Materials and Methods

The River Titas, located in Brahmanbaria district, is a trans-boundary river, 50-80 m wide (in dry season). It flows into the River Meghna near Salimgonj (Figure 1). During the dry season, the upper reaches of the river become dry, except for some pools. After the onset of the monsoon (July-November), the river floods, forming the floodplain. This study was conducted from July to November in 2002 and 2003 at the Nobinagor-Bokdhor-Urkhulia floodplain (Figure 1). The total area of the water body was about 700 ha.

A census of all gears operating in the study area was undertaken on weekly basis using a floodplain gears survey form. Total catch by species was recorded for all gill nets, seine nets, set bag nets, cast nets, push nets, tarps and long lines operating during that census. Furthermore, the mesh size, owner status and number of units used by the fishermen were recorded. A catch assessment monitoring questionnaire developed for CBFM (Kader *et al.*, 1999) was used in the present study. Catch monitoring data were collected on weekly basis from the fishermen during fishing. Total daily catches by gear type were estimated from their average catch rates and average number of gears recorded daily using a model equation developed by de Graff and Chinh (1992),

$$Y_d = \sum_g \overline{CPUE}_g . \overline{f_g}$$

where, Y_d= total daily catch for gear (g)
$CPUE_g$= daily mean catch per unit effort for gear
f_g= mean effort (gears,day^{-1}).

The daily catch per unit of area (CPUE) was calculated as the total daily catch (Y_g) divided by the sampled floodplain area.

Results

Fishing Gears

A total of 35 different kinds of fishing gears were found and these were categorized into 7 types. Seine nets and gill nets were the most frequently used gears. They were found in operation from July to November (Figures 2a and 2b). Set bag nets were used only in the month of September and October. In terms of catch, set bag net was most productive gear followed by seine net and gill net (Figures 3a and 3b)

Fishing Effort and Yield

Fishing effort (gears/ha/day) and catch per unit effort (kg/gear/day) of different gears indicated that the seine net had the highest fishing effort (0.0233 gear/ha/day), while the set beg net had the highest catch per unit effort (15.41 kg/gear/day) (Table 1). Total estimated weight of fish caught by seine nets and gill nets were 16,522 kg and 11,147 kg in 2002 which has dropped to 16,368 kg and 10,519 kg respectively in 2003 (Table 2a and 2b). The highest catch with combined gears (7,706 kg) was recorded in
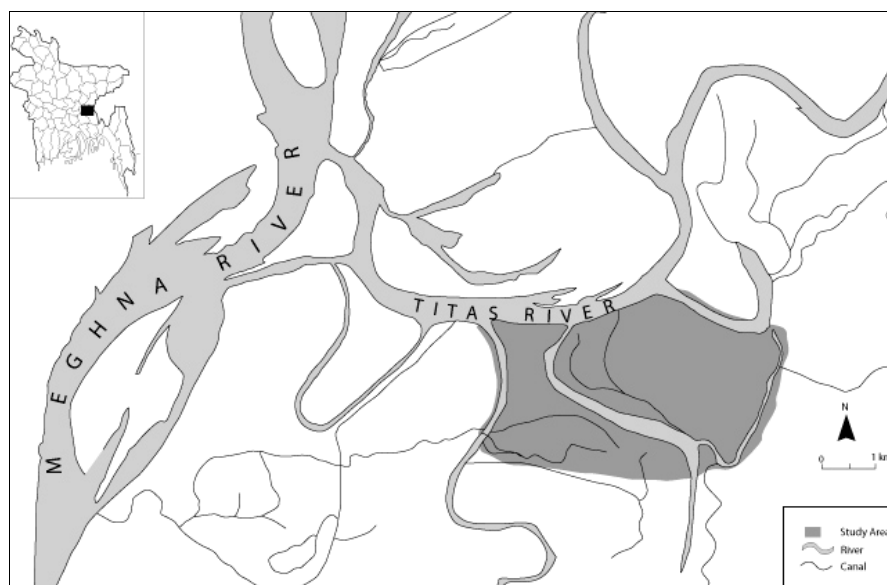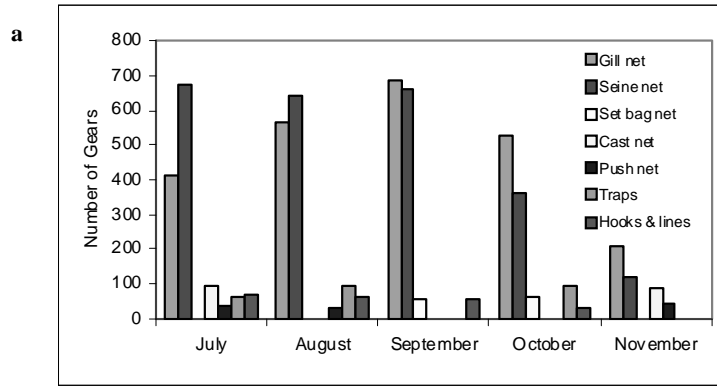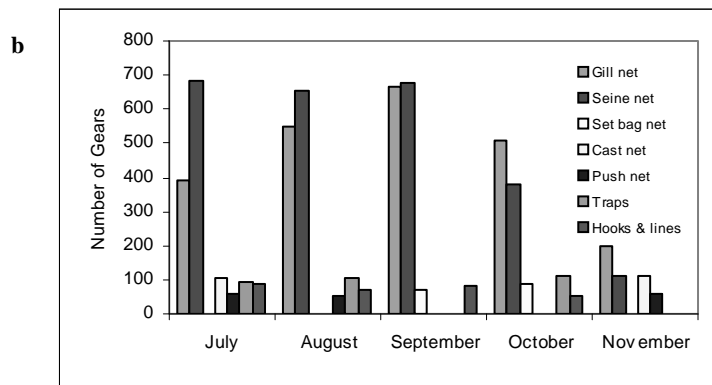

Figure 1. Map of the study area, the Titas River and its adjacent floodplain area.

The highest number of gears operated in September (1,464 gears) and the lowest in November (455 gears).

The highest number of gears operated in September (1,491 gears) and the lowest in November (475 gears).

Figure 2. Number of gears used in fishing (**a**) during July to November 2002, (**b**) during July to November 2003 (Set bag nets were operated only during the month of September and October).
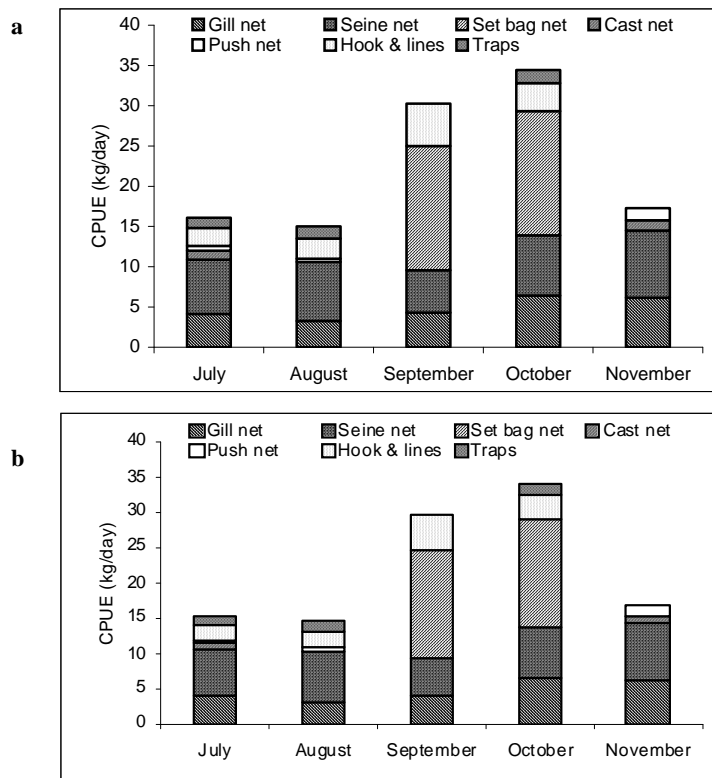

Figure 3. Average catch (kg) per day with different types of gears in the Titas floodplain (**a**) form July to November 2002, (**b**) form July to November 2003.

Table 1. Fishing effort (gears/ha/day) and catch per unit effort (kg/ha/day) for the different types gears at the Titas floodplain

Gear type	Fishing Effort (gears/ha/day		Catch per Unit Effort (CPUE)	
	2002	2003	2002	2003
Gill net	0.0223	0.0216	4.85	4.76
Seine net	0.0230	0.0233	7.04	6.87
Set bag net	0.0028	0.0036	15.41	15.20
Cast net	0.0042	0.0049	1.21	0.95
Push net	0.0018	0.0026	0.83	0.78
Traps	0.0038	0.0047	1.46	1.38
Hooks & Lines	0.0026	0.0033	3.75	3.74

Table 2. Monthly estimated weight (kg) of fish caught with different types of gears from the Titas floodplain

(a) in 2002

Gear type	July	August	September	October	November	Total
Gill net	1,709.80	1,837.08	2,934.36	3,370.50	1,295.70	11,147.44
Seine net	4,556.25	4,739.84	3,491.40	2,737.50	997.20	16,522.19
Set bag net	0.00	0.00	924.00	955.42	0.00	1,879.42
Cast net	102.30	0.00	0.00	0.00	117.00	219.30
Push net	24.00	13.60	0.00	0.00	67.50	105.10
Traps	80.60	139.50	0.00	148.80	0.00	368.90
Hooks & Lines	156.20	155.00	316.20	108.50	0.00	735.90
Total	6,629.15	6,885.02	7,665.96	7,320.72	2,477.4	30,978.25

(b) in 2003

Gear type	July	August	September	October	November	Total
Gill net	1,587.60	1,721.50	2,743.92	3,258.90	1,207.80	10,519.72
Seine net	4,486.75	4,702.90	3,476.25	2,812.00	891.00	16,368.90
Set bag net	0.00	0.00	1,064.00	1,292.85	0.00	2,356.85
Cast net	82.40	0.00	0.00	0.00	121.00	203.40
Push net	30.00	21.60	0.00	0.00	82.65	134.25
Traps	110.40	147.00	0.00	170.50	0.00	427.90
Hooks & Lines	198.00	172.80	416.00	172.50	0.00	959.30
Total	6,495.15	6,765.80	7,700.17	7,706.75	2,302.45	30,970.32

October and the lowest (2,302 kg) was in November 2003. The total estimated catch from the floodplain was 30,978 kg for 2002 flooding season.

Species Composition

A total of 57 species of fish were recorded from the catch including two exotic species (*Hypophthelmichthyes molitrix* and *Puntius gonionotus*) (Table 3). More than 20% of total catch comprised of Cypriniformes (mostly carps) followed by Siluriformes 15.6% (catfish), Perciformes 13% and eels (5.4%) and remaining 46% of catch were small and medium sized fish. As a single species, *Wallago attu* (9.1-11.1%), *Nandus nandus* (8.5-10.2%), *Gudusia chapra* (8.40%), *Glossogobius giuris* (5.2%) and *Puntius sophore* (5.1%) dominated the catch (Table 4). Small prawns comprised seven species contributing 15.1-19.2% of total catch.

Discussion

In Bangladesh, fishers use over 100 different types of fishing gears of nine categories (Alam *et al.*, 1997). Several nets are designed to catch many species while others are used to catch a particular

species. Description of the Titas floodplain gears and mode of operation are detailed by Ahmed *et al.* (2003). In the present investigation, seine nets were the main gears followed by gill nets and set bag nets. Kader *et al.* (1999) also found seine and gill nets as dominant gears in three floodplain rivers in Bangladesh.

Floodplain fish are often categorised in two groups on the basis of their behaviour (Sao-Lean and Dom Saveun, 1955). White fish migrate to the main river channel in the late dry season in order to avoid the unfavourable conditions on the floodplain. At the beginning of the monsoon, with the rising of the water level, they either spawn upstream in the main channel or spawn in the floodplain. After spawning in the main channel, the eggs and larvae drift passively downstream towards the inundated floodplain (de Graaf *et al.*, 1999). The main species of white fish comprise Cyprinidae and Schilbeidae. Black fish have a broad environmental tolerance and can sustain the harsh conditions of the floodplain during the dry season. Black fish include members of the Clariidae, Siluridae and Ophiocephalidae. On the basis of this classification, a high percentage of white fish (Table 3) is attained in the Titas floodplain. Both beel resident (*Mastacembelus pancalus*, *Lepidocephalus*

Table 3. Species composition (% of total catch) estimated from the Titas floodplain during July 2002 to November 2003

Groups	Local name	Scientific name	% of total catch	
			2002	2003
Fin fish	Boal	*Wallago attu*	11.1	9.1
	Meni	*Nandus nandus*	10.2	8.5
	Chapila	*Gudusia chapra*	8.4	8.4
	Silver carp	*Hypophthalmichthyes molitrix*	5.8	5.8
	Bele	*Glossogobius giuris*	5.2	5.1
	Kanchaputi	*Puntius sophore*	5.1	5.1
	Jatputi	*Puntius sarana*	4.3	4.2
	Ruhu	*Labeo rohita*	3.5	3.2
	Foli	*Notopterus notopterus*	2.5	2.4
	Tara baim	*Mastacembelus armatus*	2.5	2.5
	Mrigal	*Cirrhinus mrigala*	1.9	1.7
	Kaikla	*Xenentodon cancila*	1.8	1.7
	Bara baim	*Macrognathus aculeatus*	1.5	1.5
	Guchi baim	*Mastacembelus pancalus*	1.5	1.5
	Ayre	*Mystus aor*	1.4	1.2
	Ranga chanda		1.3	1.5
	Golchanda	*Chanda baculis*	1.3	1.5
	Golsha tengra	*Mystus cavasius*	1.2	1.1
	Koi	*Anabas testudineus*	1.1	1.1
Crustaceans	Gura icha	Small prawns (7 species)	15.1	19.2
	Golda icha	*Macrobrachium rosenbergii*	1.7	1.7
	Crabs	-	0.2	0.2
Others	-	-	11.4	11.8
Total			100.0%	100.0%

Table 4. Estimates of catch per unit area (CPUA) from Bangladesh floodplains

References	Location	CPUA (kg/ha/year)
Welcomme (1985)	All	78
FAP (unpublish data)	All	107[a]
ODA (1997)	All	68-202[b]
Halls *et al.* (1999)	Northwest region	51-130
Ahmed, M. (Present study)	Titas floodplain	44[c]

[a] Includes floodplain and beels.
[b] Arithmetic mean value was estimated as 119 kg/ha/year
[c] Flooding season of 5 months per year

guntea, Puntius sophore, *Anabas testudineus,* etc.) and riverine species (*Wallago attu, Glossogobius giuris, Labeo rohita, Cirrhinus mrigala, Catla catla, Mystus aor*, etc.) were found in this floodplain. In comparison with other floodplains (Sarker *et al.*, 1999; Kader *et al.*, 1999), the total number of species in the combined catch indicated that this floodplain is rich in species diversity.

Based upon an estimated total floodplain area for the country of 2.8 x 10^6 ha, the national catch statistics indicate a catch per unit area CPUA) for Bangladesh floodplains of 60-130 kg/ha/year (Table 4). The present study estimated a yield of 44 kg/ha/year based upon the survey in two fishing seasons (153 days each). Average floodplain production has been estimated to be 40-60 kg/ha/year by Welcomme (1979; 1985) from lightly exploited floodplain-river systems. The highest yields corresponded to permanent water bodies in the floodplains, while the lowest yield were found at

floodplain fished for 4 months a year (de Graaf *et al.*, 1994; de Graff, 2000). The fishing effort, CPUE and yield values had no indication on the over exploitations of resources in this floodplain. Nevertheless, increased amount of small prawns comprised 19% of total catch which might be a forecast towards the over exploitations of some slow growing species in this floodplain (Welcomme, 1985; Hoggarth *et al.*, 1999) which needs further investigation. More studies, on biology and population dynamics of commercially exploited species are also needed to formulate a sustainable management strategy for this floodplain.

Acknowledgements

References

Ahmed, M.S., Hossain, M.M. and Zaman, A. 2003. Floodplain gears of Bangladesh: A case study of the Titas floodpalin, Brahmanbaria. Bangladesh J. Zoology, 30(2): 253-256.

Alam, S.S., Ali, M.Y. and Tsai, C. 1997. Fishing gears of floodplain fisheries in Bangladesh: A case study of Chanda, BKSB and Halti beels. Chu-fa-Tsai and M.Y. Ali (Ed.) Open Water Fisheries of Bangladesh. University press Ltd., Dhaka: 137-152.

Ali, M.A. 1997. Fish, water and people, Reflections on inland openwater fisheries resources in Bangladesh. The University Press Limited, Dhaka, 154 pp.

Bayley, P.B. 1988. Factors affecting the growth rates of young floodplain fishes: Seasonality and density dependence. Environmental Biology of Fishes, 21: 127-147.

de Graff, G.J. 2000. Compartmentalisation Pilot Project, Final Report, Annex F, Fisheries, FAP 20, Tangail, Bangladesh, 92 pp.

de Graaf, G.J. and Chinh, N.D. 1992. Floodplain fisheries in the southern province of Vietnam. Annual Report, Ministry of Fisheries, 9 pp.

de Graaf, G.J., Born, A.F., Uddin, A.K.M. and Huda, M. 1994. Final report special fisheries study. Compertmentalization pilot project, FAP 20, Technical note 94/10. Tangail, Bangladesh, 87 pp.

de Graaf, G.J., Born, A.F., Uddin, A.K.M. and Huda, M. 1999. Larval movement in the River Lohajong, Tangail, Bangladesh. Fisheries Management and Ecology, 6: 109-120.

de Graaf, G.J., Born, A.F., Uddin, A.K.M. and Martin, F. 2001. Floods, fish and fishermen. Eight years' experience with floodplain fisheries in Bangladsh. University Press Ltd., Dhaka, 174 pp.

Department of Fisheries (DOF). 1983-1999. Fish catch statistics of Bangladesh, Department of Fisheries, Dhaka, Bangladesh, 330 pp.

FAP (Flood Action Plan) 17. 1995. Final Report. Overseas Development Adminstration, UK.

Halls, A.S. 1998. An assessment of the impact of hydraulic engineering on fllodplain fisheries and species assemblages in Bangladesh. PhD. thesis, London: University of London. 526 pp.

Halls, A.S., Hoggarth, D.D. and Debnath, K. 1999. Impacts of hydraulic engineering on the dynamics and production potential of floodplain fish populations in Bangladesh. Fish. Manage. Ecol., 6: 261–285.

Hoggarth, D.D., Cowan, V.J., Halls, A.S., Aeron-Thomas, M.A., McGregor, J.A., Garaway, C.A., Payne, A.I. and Welcomme, R.L. 1999. Management guidelines for Asian floodplain river fisheries, FAO Fisheries Technical Paper 384/2, Rome, 117 pp.

Junk, W.J., Bayley, P.B. and Sparks, R.E. 1989. The flood pulse concept in river-floodplain systems. D.P. Dodge (Ed.), Proceedings of the International Large River Symposium, Canadian special publication of Fisheries and Aquatic Sciences, 106: 110-127.

Kader, M.M., Hossain, M.M. and Kabir, S. 1999. Patterns of fish catches in River and open beels. In: M.M. Hossain (Ed.), Community based fisheries management and future strategies for inland fisheries in Bangladesh. Proceedings of national wokshop on CBFM, DOF, Ford Foundation, Dhaka: 45-50.

ODA, 1997. Impacts of flood control and drainage with or without irrigation (FCD/I) projects on fish resources and fishing communities in Bangladesh: executive summary of the Flood Action Plan (FAP), 17 Final Report. In: C. Tsai and Y.M. Ali, (Eds.), Openwater Fisheries of Bangladesh. University Press, Dhaka: 199–212.

Payne, A.I. 1986. The ecology of tropical lakes and rivers. John Wiley & Sons, New York, 301 pp.

Payne, A.I. 1997. Tropical floodplain fisheries. In: C. Tsai and M.A. Ali (Eds.), Open water fisheries of Bangladesh. The University Press Limited, Dhaka: 1-26.

Soa-Leang and Dom Saveun. 1955. Apercu general sur la migration et la reproduction des poissons d'eau douce du Cambodge. Proc. IPFC 5: 138–162.

Sarker, A.C., Sultana, P. and Thompson, P. 1999. Case study of community based management of Goakhola-Htiara beel. In: M.M. Hossain (Ed.), Community based fisheries management and future strategies for inland fisheries in Bangladesh. Proceedings of national wokshop on CBFM, DOF, Ford Foundation, Dhaka: 27-32.

Siddiqui, H.M. 1990. Flood control and drainage development: Physical environmental issues. In: A.A. Rahman, S. Huq and G.R. Conway (Eds.), Environmental aspects of surface water systems of Bangladesh. Dhaka University Press Ltd., Dhaka: 104-108.

Thompson, M.P., Sultana, P. and Islam, N. 2003. Lessons from community based management of floodplain fisheries in Bangladesh. Journal of Environmental Management, 69: 307–321

Tsai, C.F. and Ali, M.Y. 1987. The changes in fish community and major carp population in beels in the Sylhet-Mymensingh basin, Bangladesh. Indian Journal of Fisheries, 34: 78-88.

Welcomme, R.L. 1979. Fisheries Ecology of Floodplain Rivers. Longman Group Ltd., London, 317 pp.

Welcomme, R.L. 1985. River Fisheries. FAO Technical Paper No 262, Rome, 320 pp.