

Availability and Potentiality of Small Indigenous Species of Fish Throughout the Year in South-Western Region of Bangladesh

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Abstract: This study was conducted with aiming to know the present status of small indigenous fish species (SIS) in Oxbow Lakes/baors and rivers as well as the availability of SIS of fish and their potentiality in the study area. Regular data were collected from some important fish landing center cum markets, Oxbow Lakes and rivers of the study area. The availability of small indigenous species (SIS) of fish declined to a great extent over the years and many of them are rare or endangered due to death of rivers and baors were brought under aquaculture. Besides these, Many of SIS of fish were being increasingly used as trash fish for fish feed purpose. As an over populated country, demand of SIS of fish is increasing day by day. After 1990s almost all Oxbow Lakes have been gradually trying to bring under aquaculture through local community or Department of Fisheries. The most significant message of this study is that, some vulnerable and endangered SIS of fish are locally abundant both in fish landing center, baors and rivers. So they must be conserved for their bioavailability and nutrition throughout the country that would be most intelligent efforts in favor of global ichthyo-biodiversity conservation.

Key words: Ichthyo-Biodiversity • Oxbow Lakes • Critically Endangered Fish • Jessore- Jhenaidah

INTRODUCTION

Bangladesh is blessed with numerous inland water bodies which are very rich in diversity of aquatic species. The inland aquatic habitats and the Sunderban mangrove forest of Bangladesh are rich in faunal diversity containing at least 260 species of freshwater finfish, 63 species of prawn, several species of turtles, tortoises, freshwater mussels and 400 species of fish respectively [1]. Bangladesh is also rich in marine fishes having 475 marine finfish species [2]. In the past, various SIS of fish were abundant in the rivers, Beels, Baors, Haors, Canals, Streams and Ponds. The people of Bangladesh depend on biodiversity for their day-to-day sustenance as well as overall livelihood security. For example, over 15.6 million people live on their lives engaging in fisheries sector in Bangladesh. Sixty percent (60%) of the country's protein requirement is met by the consumption of fish [2]. The main source of this animal's protein requirement

is considered as small indigenous species of fish [3]. These small indigenous fish species are the main, indeed the only source of the protein and most of the fat soluble vitamins for the rural people who represent more than 80% of the total population. Generally female prefer fruits after small fish if they have got money [4]. However SIS of fish can play a significant role to prevent night blindness as a rich source of vitamin-A. Analysis SIS of fish showed that they contain large amount of calcium and most likely also iron and zinc. Some species of fish like *Amblypharyngodon mola*, *Osteobrama cotio*, *Rasbora daniconius* and *Corica soborna* etc. also contain high amount of vitamin-A [5]. It was showed that rural people meet 46% protein and 31% calcium through small fish consumption [6]. Small indigenous species (SIS) of fish are important source of nutrition and livelihood for the rural people of Bangladesh. Despite the crucial role of potentially of aquaculture in the reduction of overexploitation of natural fish stocks and improving food

security in tropical and subtropical regions, aquaculture has had some significant negative impacts on biodiversity and local environments, including the destruction of coastal mangrove forests to make way for ponds, pollution of local water ways, introduction of exotic fish species and its intensive use of natural resources inputs (e.g., fishmeal for use in aquaculture feeds). For example It is believed that the imports of hybrid catfish will increase as a result of the recent ban on giant snakehead cage culture operation due to its dependence on small wild fish for dietary nutrient inputs [7]. Both natural and manmade catastrophes degradation of aquatic environment and the reduction of many wetlands and water areas of Bangladesh have resulted in the disappearance of many suitable habitats of floodplain, Oxbow Lakes, riverine and brackish water small indigenous fish species [8]. Many of these valuable indigenous fish species have been threatened or endangered. Indeed some are already on the verge of extinction. From the 265 freshwater fish species of Bangladesh, over 150 species have been classified as small indigenous species (SIS). Small indigenous species of fish are available in rainy season because of Khals, beels, flood plain areas are inundated with water during this time and SIS take shelter on this habitats using as breeding and nursery ground [9]. Anyway, although some researchers conducted researches on SIS of fish in Bangladesh [10], there was no sufficient data on biodiversity of SIS of fish in the Jessore & Jhenaidah districts. This study was conducted with a view to knowing the availability of SIS of fish and identifying the status of threatened SIS of fish in the study area.

MATERIALS AND METHODS

Bangladesh is called a country of hundreds of river and it has 290 rivers from which 94 are international along with numerous Ponds, Beels, Haors, Baors, Lakes, Flood plains, brackish water and marine water bodies. However, Jessore & Jhenaidah districts are mainly important for the availability of Oxbow Lakes or baors in respect of inland closed water bodies.

Selection of the Study Area: There are many baors (Oxbow Lake) and fish landing center of each region in Jessore & Jhenaidah among which 2 fish landing centers, namely Borobazar and Chuadanga bus stand fish market in Jessore, Borobazar and Jhenaidah central fish market in case of Jhenaidah and five important natural water bodies (3 baors and 2 rivers) were selected for this study

Table 1: The list of surveyed natural water bodies

Type of the water body	Name	Location
Baor	Shajiali	Churamonkati, Jessore
	Baluhor	Kotchadpur, Jhenaidah
	Morjad	Chowgacha, Jessore
River	Kapotakha	Chowgacha, Jessore
	Voirab	Sadar, Jessore

Experimental Fish Landing Center: Borobazar and Chuadanga bus stand fish market were brought under this study in Jessore district and Barobazar as well as Jhenaidah central fish market were in case of Jhenaidah district.

Experimental Natural Water Bodies: Required data about small indigenous species of fish (SIS) were collected from important natural water bodies of Jessore & Jhenaidah districts. The list of natural water bodies that were brought under this study is given below (Table 1).

Period of Data Collection: For the study, the data were collected during the months of April 2012 to February 2013.

Visit of Baors and Market and Collection of Data: Visits of two times in a week were made in each of the baors and fish landing center. As the supply of the fishes varied with seasons collection of data were made in different seasons *i.e.* throughout the year by repeated visits in baors and fish landing center cum markets. Data were collected from interviews and focus group discussions with fishermen, retailers and consumers of fish, secondary literature, semi structured and structured questionnaires was developed, pretested and adapted prior to the survey proper.

Target Group

Fish Traders (Retailers): For questionnaire survey 100 fish traders were selected from both of landing centers. Interviews were conducted at times convenient to the traders (retailer) at the market.

Fish Traders (Wholesalers): Wholesalers were the biggest fish traders in the marketing channel but were limited in number. They were asked about the sources of brackish water SIS of fish.

Consumers: The supply of a particular fish species in the market depends on the demand of the consumer preference and availability of that species on that time.

Species Identification: The collected fish were identified on the basis of the descriptions according to Rahman [11], Jhingran and Talwar [12] and Froese and Pauly [13].

RESULTS AND DISCUSSION

Supply of Sis of Fish in the Jessore and Jhenaidah Districts: The supply of SIS of fish in the fish landing center cum markets during the study period showed significant difference between rainy cum summer season and winter season in both of these regions. Supply of external brackish water SIS of fish species came from Khulna and Shatkhira districts adjacent to Jessore district and the availability of saline water species in this area depends on the availability of these species on that locality.

A comparatively daily supply of high amount of SIS of fish were seen in rainy cum summer season in both regions (Figure 1&2) because they got different types of suitable habitats such as Floodplains, Beels, Baors, Khals

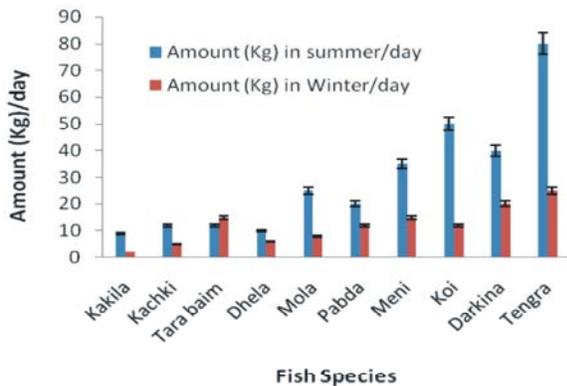


Fig. 1: Variation of daily average (kg) 10 SIS of fish supplied in rainy season cum summer and winter season with standard errors of percentage in Jessore

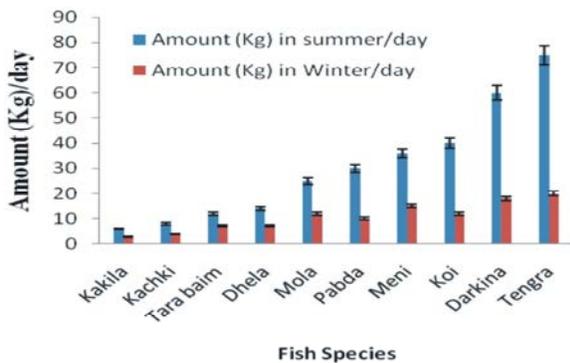


Fig. 2: Variation of daily average (kg) 10 SIS of fish supplied in rainy cum summer and winter season with standard errors of percentage in Jhenaidah

and Rivers and used these habitats as breeding, nursery and grazing ground. Most of SIS fish species breed in shallow water body with aquatic vegetation in rainy season. The daily short supply of SIS in winter was due to drying up of Beels, Khals, especially drying of most of Rivers and Flood plains etc in both regions (Figure 1&2). At Mohisluti fish landing centre (under Tarash, Sirajganj) the highest number of species (79, 96.34%) of small fishes were found. Abundance of different SIS of fishes were found to vary with the season [11] which supports to the present study. Khanam *et al.* [12] was also found similar result in a study conducted in peri urban fish markets. Sen [13] showed the similar findings as the fish marketing of Madaripur town was 33.66% of carps and 29.33% of SIS and 95 species of fish imported from the rural areas conducted in fish markets. Before 1975 aquaculture were not broadly practiced in Bangladesh. People met their protein requirement almost depending on the production of natural water bodies. But small indigenous species are removed from the water bodies after the water bodies are brought under aquaculture. Besides this, indiscriminate usages of persistent pesticide in the agricultural field ultimately discharged into adjacent water bodies and inhibit the normal reproductive process of SIS. Sources of SIS has been declined through land use change, changing the direction of river, filling up of the most local river and climate change. For this, supply of SIS has lessened proportionally with the increasing of population (Table 2). Recently various types of chemicals including formalin has been used and found in locally produced big fish and fish imported from Myanmar and India. For these reasons, conscious people prefer small indigenous species to large fish.

Demand of SIS of Fish in the Study Area: SIS of fishes were not well demanded in past due to their abundance in baors, rivers, haors, beels and other natural water bodies. But presently SIS of fish are not abundant in natural water bodies due to dry up of river, bring up the closed natural water bodies under commercial aquaculture, land- use change, specially the land of low fertility are being converted to ponds, indiscriminate use of pesticide and climate change mainly drought or onset of rainy season. Another important thing is that as the SIS of fish having highly nutritional and tasty they are highly demanded to health aware people. Big fish being presently available in fish market are likely to be mixed with formalin as well as other toxic preservatives. So the householder mainly who has pregnant women lose their interest to purchase big fish from the market. Recently Bangladesh has got

Table 2: Lists of presently identified SIS of fish biodiversity in the present study area

Sl. No.	Local name	English name	Scientific name
1	Kajuli	Gangetic ailia	<i>Ailia coila</i>
2	Mola	Mola carplet	<i>Amblypharyngodon mola</i>
3	Mola	Indian Carplet	<i>Amblypharyngodon micmlepis</i>
4	Koi	Climbing perch	<i>Anabas testudineus</i>
5	Napit koi	Blue Perch	<i>Badis badis</i>
6	Napit koi	Blue Perch	<i>Badis chittagongis</i>
7	Bud koi	Mottled loach	<i>Acanthocobitis botia</i>
8	Rani	Bengal loach	<i>Botia Dario</i>
9	Putul	Reticulate loach	<i>Botia lohachata</i>
10	Nama chanda	Elongate glass-perchlet	<i>Chanda nama</i>
11	Ranga chanda	High fin glassy perchlet	<i>Chanda ranga</i>
12	Lal chanda	Indian glassy fish	<i>Pseudomonas ranga</i>
13	Gachua	Walking snakehead	<i>Channa orientalis</i>
14	Bacha	Garu bacha	<i>Clupisoma garua</i>
15	Taki	Spotted snakehead	<i>Channa punctatus</i>
16	Choto Kolisha	Dwarf gourami	<i>Colisa chuna</i>
17	Khalisa	Banded gourami	<i>Colisa fasciata</i>
18	Lal khalisha	Dwarf gourami	<i>Colisa lalia</i>
19	Chuna kolisa	Dwarf gourami	<i>Colisa lalia</i>
20	Kachki	Ganges river sprat	<i>Corica soborna</i>
21	Chap chela	Dind danio	<i>Danio devario</i>
22	Darkina	Flying barb	<i>Esomus danricus</i>
23	Luiza darkina	Gangetic Scissortail Rasbora	<i>Rasbora rashora</i>
24	Darkina	Slender Rasbora	<i>Rasbora daniconius</i>
25	Bele	Tank goby	<i>Glossogobius giurus</i>
26	Chuno bele	Glass Goby	<i>Gobiopterus chuno</i>
27	Chapila	Indian rivershad	<i>Gudusia chapra</i>
28	Bata	Bata	<i>Labeo bata</i>
29	Bhangan bata	Boga labeo	<i>Labeo boga</i>
30	Gutum	Guntea loach	<i>Lepidocephalus guntea</i>
31	Gutum	Annandale Loach	<i>Lepidocephalichthys annandalei</i>
32	Tara Baim	Lesser spiny eel	<i>Macrogathus aculeatus</i>
33	Guchi	Barred spiny eel	<i>Mastacembelus pancalus</i>
34	Tengra	Day's mystus	<i>Mystus bleekeri</i>
35	Gulsha tengra	Striped dwarf catfish	<i>Mystus cavasius</i>
36	Buzuri tengra	Ghuiitta tengra	<i>Mystus tengra</i>
37	Meni	Gangetic leaffish	<i>Nandus nandus</i>
38	Pholi	Bronze featherback	<i>Notopterus notopterus</i>
39	Modhu Pabda	Pabdah catfish	<i>Ompok pabda</i>
40	Kani pabda	Butter catfish	<i>Ompok bimaculatus</i>
41	Kanchan punti	Rosy barb	<i>Puntius conchoniuis</i>
42	Phutani punti	Spottedsail barb	<i>Puntius phutunio</i>
43	Sarpunti	Olive barb	<i>Puntius sarana</i>
44	Jat punti	Pool barb	<i>Puntius sophore</i>
45	Tit Punti	Ticto barb	<i>Puntius ticto</i>
46	Teri puti	One spot barb	<i>Puntius terio</i>
47	Chala puti	Swamp barb	<i>Puntius chola</i>
48	Mola punti	Glass barb <i>Puntius</i>	<i>Puntius guganio</i>
49	Dhela	Cotio	<i>Osteobrama cotio</i>
50	Chela	Large razorbelly minnow	<i>Salmostoma bacaila</i>
51	Ful chela	Fine scale razorbelly minnow	<i>Salmostoma phulo</i>
52	Shing	Stnging catfish	<i>Heteropneustes fossilis</i>
53	Magur	walking catfish	<i>Clarias batrachus</i>
54	Gang magur	Grey eel-catfish	<i>Plotosus canius</i>
55	Kakila	Freshwater garfish	<i>Xenentodon cancila</i>
56	Cheka	Square head catfish	<i>Chaca chaca</i>
57	Bhagna	Reba carp	<i>Cinhius reba</i>
58	Putul rani	Reticulata loach	<i>Botia lohachata</i>
59	Potka	Ocellated puffer fish	<i>Tetraodon cutcutia</i>
60	Potka	Milkspotted Puffer	<i>Chelonodon patoca</i>
61	Khanpona	Blue panchax	<i>Aplocheilus panchax</i>
62	Neftani	Perch	<i>Ctenops nobilis</i>

awarded from the United Nations for significant progress in reducing mother and infant mortality as well as in aspect of nutrition to the pregnant women. Small fish species meet 57% of the protein requirement of the rural people and small fish contributed 40 percent and 31 percent of the total recommended intakes of vitamin A and calcium, respectively, at household level, in the peak fish production season as well as fresh water small indigenous species is considered as the source of essential fatty acid [14]. Some important minerals such as Iron (Fe) and Zinc (Zn) for human being are found in Derkina (*Esomus danricus*) and other freshwater small fish [14]. Surveys of perceptions of small fish species in rural Bangladesh show that many are considered beneficial for well being, nutrition and health and women ranked small fish as the second most preferred food to buy – after fruits – if they had more income to spend on food [4]. Growing urbanization is one of the factors modifying food consumption patterns, with an impact also on the demand for fish and fishery products. People living in urban areas tend to devote a higher proportion of their income to food purchased and, in addition, to eat out of the home more frequently and to purchase larger quantities of fast and convenience foods. Moreover, increasing urbanization compounds the pressure on adjacent areas to meet the demand of large, concentrated populations [15].

The dietary contribution of fish is more significant in terms of animal proteins, as a portion of 150 g of fish provides about 50-60 percent of the daily protein requirements for an adult. Fish proteins can represent a crucial component in some densely populated countries where total protein intake levels may be low. In fact, many populations, more those in developing countries than developed ones, depend on fish as part of their daily diet. For them, fish and fishery products often represent an affordable source of animal protein that may not only be cheaper than other animal protein sources, but preferred and part of local and traditional recipes. For example, fish contributes to, or exceeds, 50 percent of total animal protein intake in some small island developing States, as well as in Bangladesh [15].

As small fish are more perishable, so processing technology can be used to preserve these species for future consumption and spoilage free. One kind of a short time- handy drier having capable of removing dirt and chemicals has been invented for small fish drying without changing nutritious value in Mali [16]. The low supply and high demand have made some SIS of fish like Mola, Dhela, Derkina, Gutam, Chanda, Kakila, tara baim Pabda, Chela, Shing, Magur etc. very expensive. Survey data from Bangladesh show that the total fish consumption among the rural poor has decreased, as well as the

proportion of small fish species of total fish consumption [17]. In a word, it can be said that the supply of SIS of fish is declining where the demand is increasing gradually.

Biodiversity of SIS of Fish in Natural Water Bodies in the study area in stead of Biodiversity of SIS of Fish in Natural Water Bodies in the study Barea:

A total of 600 baors having an area of 5488 ha are situated in the south west part of our country. Among this area 1127 ha and 807 ha are within the territory of Jessore and Jhenaidah district respectively. Before 1990s when the natural water bodies were not brought under commercial aquaculture Most of SIS fish species out of about 150 were found in rivers, baors, beels, floodplains and other natural water bodies.

Out of one hundred forty three (143) SIS of freshwater fish species of Bangladesh, fifty four (54) are considered as threatened species by IUCN [18]. An authentic study conducted by FAP6 has also found that the numbers of fresh water fish species have been gradually declining and some species have been locally extinct. Full flood control and control flooding had an adverse impact on fish biodiversity and resulted in a reduction of 33% of the total number of fish species recorded annually in Bangladesh.

Although after completion of this experiment, it has been noticed that a few critically endangered and endangered SIS of fish are abundantly found in the three oxbow lakes and two rivers. The list of commonly abundant threatened SIS of fish is presented in the (Table 3).

A total of 54 native freshwater fish species of Bangladesh have been declared threatened in Bangladesh by IUCN [18]. Among them 12 species are recorded as critically endangered, 28 species are endangered and rest 14 species are vulnerable. Out of 54 threatened freshwater fish species of Bangladesh, 24 species had been found in both of Shajiali, Morjad, Baluhar Baor as well as Kapatakha and Voirab Rivers (4 species are critically endangered, 7 species are endangered and rest 9 species are vulnerable).

The main reason for the reduction as well as being endangered condition of SIS in baors is the introduction of alien species such as *Oreochromis niloticus*, *Pangasius hypophthalmus*, *Clarias gariepinus* and *Ctenopharyngodon idella* in baor culture system. This result of the present study is similar to the study conducted by Haque [19]. He reported that 17-23 species were more or less fall in vulnerable condition due to the predatory alien species commercially cultured with native species in baors.

Table 3: Commonly available threatened SIS of fish in the natural water bodies of the present study

Sl. No.	Local name	Scientific name	Status
1	Taki	<i>Channa punctatus</i>	No threatened
2	Cheng	<i>Channa orientalis</i>	***Critically endangered
3	Kholisha	<i>Colisa fasciata</i>	No threatened
4	Darkina	<i>Esomus danricus</i>	No threatened
5	Sarpunti	<i>Barbodes sarana</i>	Endangered
6	Tit punti	<i>Pantius ticto</i>	Vulnerable
7	Buzuri Tengra	<i>Mystus bleekeri</i>	No threatened
8	Gulsha tengra	<i>Mustus cavasius</i>	Endangered
9	Meni	<i>Nundas nandus</i>	Vulnerable
10	Tara baim	<i>Macrogathus aculeatus</i>	Endangered
11	Gutum	<i>Lepidocephalus guntea</i>	Endangered
12	Bele	<i>Glossogobius giuris</i>	Vulnerable
13	Napit Koi	<i>Badis badis</i>	***Critically endangered
14	Rani	<i>Botia Dario</i>	Vulnerable
15	Putul rani	<i>Botia lohachata</i>	Endangered
16	Guchi	<i>Mastacembelus pancalus</i>	Vulnerable
17	Kakila	<i>Xenentodon Cancila</i>	Vulnerable
18	Bhangan Bata	<i>Labeo bata</i>	Endangered
19	Mola	<i>Amblypharyngodon mola</i>	Vulnerable
20	Chela	<i>Chela laubuca</i>	Endangered
21	Dhela	<i>Osteobrama cotio cotio</i>	Vulnerable
22	Titpunti	<i>Pantius ticto</i>	Vulnerable
23	Kachki	<i>Corica soborna</i>	**Critically endangered
24	Ghora chela	<i>Seculicura gora</i>	***Critically endangered

***Critically endangered= this species is in critically endangered condition in both Baors and rivers in the present study.

** Critically endangered= this species is in critically endangered condition in only Baors in the present study.

A total of 62 small indigenous species of fish was identified collected from various natural waters. Because of various environmental modification and manmade interventions, some SIS of fish species were in endangered or critically endangered in Bangladesh [18]. Similarly, in the natural water bodies of the Jessore & Jhenaidah districts of Bangladesh, some SIS of fish are reducing alarmingly and found very rare due to drying up of rivers and most of the baors are being gradually brought under aquaculture. More or less same statement is described by Hossain *et al.* [20]. According to them, the habitat degradation recently has become a great concern in most aquatic ecosystems in Bangladesh. Marked changes have been observed in natural fish populations of many fish species because of unplanned environmental modifications, much dependent on aquaculture, introduction of alien species, indiscriminate use of persistent toxic pesticides in agricultural land and manmade interventions affecting the spawning and feeding grounds of fishes.

CONCLUSION

Small indigenous species (SIS) are playing a vital role in securing food and nutritional demands of the people of Bangladesh. For improving diversity & abundance of SIS

of fishes, several pragmatic steps such as establishment of sanctuary, introduction of SIS-carp composite culture and development of new breeding technology must be ensured and implemented.

REFERENCES

- Islam, Md. S. and M. Haque, 2004. The mangrove-based coastal and near shore fisheries of Bangladesh: ecology, exploitation and management. *Reviews in Fish Biology and Fisheries*, 14: 153-180.
- DoF (Department of Fisheries), 2012. National Fish Week 2012. Compendium (In Bengali). Department of Fisheries, Ministry of Fisheries and Livestock, Bangladesh, pp: 13.
- Haug, A., O.A. Christophersen, J. Kinabo, W. Kaunda and L. O. Eik, 2010. Use of dried kapenta and other products based on whole fish for complementing maize-based diets. *African Journal of Food, Agriculture, Nutrition and Development*, 10: 2478-2500.
- Deb, A.K. and C.E. Haque, 2011. Every mother is a mini-doctor: ethnomedicinal use of fish, shellfish and some other aquatic animals in Bangladesh. *Journal of Ethnopharmacology*, 134: 259-267.

5. Thilsted, S.H., N. Roos and N. Hasan, 1997. The role of small indigenous fish species in food and nutrition security in Bangladesh. *Naga- The ICLARM Quarterly*, July-December, pp: 13-15.
6. Roos, N., M.A. Wahab, C. Chamnan and S.H. Thilsted, 2007a. The role of fish in food-based strategies to combat vitamin A and mineral deficiencies in developing countries. *Journal of Nutrition*, 137: 1106-1109.
7. Mustafa, M.G., 2003. Fish Catch Trends in 10 CBFM Sites, Working paper, CBFM-2, World Fish Center, Bangladesh.
8. Wahab, M.A., 2003. Small indigenous fish species of Bangladesh: Potentials for culture and conservation. Technical Proc. of BAU-EENRECA/DANIDA Workshop on Potentials of SIS in Aquaculture and rice-field stocking for improved food of nutrition security in Bangladesh. 30-31 October 2002, BAU, Mymensingh, pp: 1-12.
9. Hossain, M.A., M.K. Ahsan and M.A. Hussain, 2003. Small fish resources in the rivers, flood plains and unplanned areas of Bangladesh. Technical Proc. of BAU-EENRECA/DANIDA Workshop on Potentials of SIS in Aquaculture and rice-field stocking for improved food of nutrition security in Bangladesh. 30-31 October 2002, BAU, Mymensingh, Bangladesh, pp: 166.
10. Hossain, M.A. and S. Afoze, 1991. Small fish as resource in rural Bangladesh. *Fish byte*, 9: 16-18.
11. Rahman, A.K.A., 2005. Fresh water fishes of Bangladesh. 2nd edn. Zoological Society of Bangladesh, Dhaka, Bangladesh, pp: 71-310.
12. Jhingran, A.G. and P.K. Talwar, 1991. Oxford and HIB Publishing Co., Pvt. Ltd., New Delhi, India. *Inland Fishes of India and Adjacent Countries*, pp: 1158.
13. Froese, R. and Pauly, 2007. Fish Base. Available from URL: <http://www.fishbase.org/Country/Country Checklist. Php>.
14. Hossain, M.A., K. Afsana and A.K.M. Azad Shah, 1999. Nutritional value of some. Small indigenous fish species (SIS) of fish in Bangladesh, *Bangladesh Journal of Fisheries Research*, 3: 77-85.
15. Khanam, M.N.A., M.B. Ali, M.M. Ali and M.A.R. Hossain, 2003. Supply and marketing channel of small indigenous species of fish and livelihood strategy of the retailers in a peri-urban fish market. Technical proc. of BAU-DANIDA. Workshop on potentials of SIS in Aquaculture and Rice- field stocking for improved food nutrition security in Bangladesh, pp: 135-142.
16. Sen, A.K., 2008. Availability and marketing of fishes in Madaripur town. MS thesis, Department of Fisheries Management, Bangladesh Agricultural University, Mymensingh, pp: 79.
17. Roos, N., M.A. Wahab, R. Hossain and S.H. Thilsted, 2007b. Linking human nutrition and fisheries: incorporating micronutrient dense, small indigenous fish species in carp polyculture production in Bangladesh. *Food and Nutrition Bulletin*, 28(2) Supplement, S280-S293.
18. FAO, 2012. The state of world fisheries and aquaculture 2010. FAO Fisheries and Aquaculture Department, Food and Agricultural Organization of the United Nations, Rome, Italy, pp: 25.
19. Heilporn, C., H. Benoît, F. Debaste, F. Van der Pol, C. Boey and A. Nonclercq, 2010. Implementation of a rational drying process for fish conservation. *Food Security*, 2: 71-80.
20. Thompson, P., N. Roos, P., Sultana and S.H. Thilsted, 2002. Changing significance of inland fisheries for livelihoods and nutrition in Bangladesh. *Journal of Crop Production*, 6: 249-317.
21. IUCN, 2001. Red book of threatened fishes of Bangladesh. IUCN- The world Conservation Union, pp: 116.
22. Haque, A.K.M.A., 2012. 'Impact of carp stocking on species diversity, yield and recruitment of non-stocked indigenous fish in Oxbow Lakes of Bangladesh, National fisheries report, pp: 119-120.
23. Hossain, M.A.R., M.Z. Ali, M.N.A. Khanam, S. Devnath and A.K.M.R. Amin, 2002. Participatory rural appraisal with small indigenous species of fish (SIS) retailers in two fish markets. *Progress. Agric.*, 13: 133-138.