ORIGIN, HABITAT AND ECOLOGICAL CLASSIFICATION OF SOME BONY FISHES AVAILABLE IN KHULNA DIVISION, BANGLADESH

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Abstract: The study identified the origin, habitat and ecological classification of 78 bony fish species belonging to 30 families available in Khulna division. Of the total fish species, 9 were found exotic. Among the collected 78 species, a total of 69 fish species were inhabitants of freshwaters while 4 were found in both fresh and brackish waters and the rest 5 species were found in both brackish and marine waters. The collected fishes belonged to eight trophic guilds; carnivore (43) was the dominant group followed by omnivore (16), insectivore (5), planktivore (5), benthivore (4) and larvivore (1). The fishes also represented eight reproductive guilds; phytolithophil (35) was the most dominant guild followed by phytophil (20), pelagophil (6), psammophil (6), guarder (4), bubble nester (4) and mouth brooder (1). The present study indicates that Khulna Division is very rich in fish biodiversity having diverse forms of trophic and reproduction guilds.

Key words: Fish, origin, habitat, ecological classification, Khulna

Introduction

Fish is found in almost all conceivable aquatic habitats ranging from hot soda springs (e.g. Sarotherodon grahami in Lake Magadi, Kenya) where temperatures exceed 40°C (Lowe-McConnel, 1987) to the waters beneath the Antarctic ice-sheet (e.g. Dallia pectoralis) where the temperature is below 0°C (DeVries, 1980). Fish are found in high mountain lakes from approximately 5 km above sea level (e.g. Schizothorax plagiostomus, in the Tritican Lake) to more than 11 km below the sea level (e.g. deepsea ateleopid, Ateleopus japonicus in the Mariana Trench, Pacific Ocean) (Lagler et al., 1977), in stagnant waters (e.g. taki, Channa punctatus), fast-flowing waters (e.g. masheer, Tor tor), and even in the deep caves (e.g. cavefish, Anoptichthys jordani) where there is total darkness (Jobling, 1995). Fish are numerically the largest group of vertebrates and account for roughly half of all vertebrate species (Jobling, 1995).

There are about 25 625 recognised species of teleost fishes in the world (Nelson, 1994; Anon., 2000; Anon., 2007). In South America there are over 2 400 freshwater species, while it is 2 500 in Africa (Wootton, 1990) and 2000 in South and South East Asia (Hora, 1937). Inland waters of Bangladesh harbour 260 fish species belonging to 145 genera representing 55 families (Day and Buchanan, 1877; Rahman, 2005; Rahman and Akhter, 2007) while 475 species belonging to 133 genera of marine and brackish water fishes are found in the Bay of Bengal and Sundarban (Day, 1878; Azadi, 1985). Khulna division, the Southwest region of Bangladesh is criss-crossed by...
rivers and canals occupying the world-largest mangrove forest, the Sundarban. A total of 281 fish species belonging to 79 families inhabit in fresh, brackish and marine waters of Khulna division (Rahman and Akhter, 2008). Binomial classification of these fishes is available (Rahman, 2005) but information on the origin, habitat use and ecological classification are scanty. In view of the above, the present study was undertaken to prepare a checklist of fishes of Khulna division with information on origin, habitat use and ecological classification, which might help fishery scientists, students, hatchery operators, farmers and policy makers to formulate a comprehensive strategy for proper management and conservation of the resource.

Materials and Methods

The survey was conducted from May 2006 to December 2007 to collect different fish species available in the Khulna division. Survey sites included Bheramara, Jhenaidaha, Kaligang, Kotchandpur, Jessore, Magura, Narail, Debhata, Satkhira, Khulna and Paikgacha. Collected fish samples were taken to the laboratory of the Freshwater Sub-Station of the Bangladesh Fisheries Research Institute, Jessore. Information on origin, habitat use trophic and reproductive guilds of the collected fishes were obtained from different books (Jordan and Evermann, 1917; Hamilton, 1822; Day and Buchanan, 1877; Day, 1878; Bhuiyan, 1964; Gibson, 1978; Billard and Breton, 1979; Jayaram, 1981; Ameen, 1987; Jhingran, 1991; Khan, 1994; Jobling, 1995), from reports (Azadi, 1985; Anon., 1994; Felts et al., 1997; Hora, 1945) and from journals (Khan, 1924 and 1934; Ahmed, 1944 and 1955; Khanna, 1958; Aliskunhi and Sukumar, 1964; Doha, 1973; Balon et al., 1977; Jayaram, 1977; Johannes, 1978; Kramer, 1978; Dewan and Doha, 1979; Huda and Rahman, 1983; Austen et al., 1994; Lyons et al., 1996; Akhter and Rahman, 2008; Rahman and Akhter, 2008) while ecological classification was done according to Balon (1975 and 1981). For ecological classification the following definitions were used:

Trophic guilds:

Planktivores: Mainly depend on phytoplankton and zooplankton. Diet of the adult fish of this trophic guild consists of more than 75% zooplankton and/or phytoplankton (Lyons et al., 1995).

Herbivores: Primarily feed on higher aquatic plants/vegetation. Diet of the adult fish consists of more than 75% plant material (Lyons et al., 1995).

Omnivores: Take all possible food materials both of plant and animal origin. Choice of food depends on availability (Lyons et al., 1995).

Detritivores: Take detritus as food (Goldstein and Simon, 1999).

Insectivores/Invertivores: Take all kind of insects/invertebrates as the main food (Lyons et al., 1995).

Larvivores: Specialist feeders that feed on larvae of insects, fish and other organisms (Goldstein and Simon, 1999).

Benthivores: Mainly feed on benthic organisms (Goldstein and Simon, 1999).

Molluscivores: Specialist feeders depending on mollusks and isopods (Goldstein and Simon, 1999).

Carnivores: Primarily feed on animal matters. Diet of the adult fish consists of more than 75% animal materials (Lyons et al., 1995).

Parasitic: Parasitism being a form of carnivorism in which the parasite is smaller in body size than the host (Goldstein and Simon, 1999).
Reproductive guilds:

**Pelagophils/Broadcaster**: Non-adhesive and non-photophobic eggs that are released and scattered in open waters, in areas where the direction of the water current is favourable for their distribution and survival (Balon et al., 1977).

**Lithopelagophils**: Eggs deposited on rocks and gravel. Embryos and larvae are not photophobic (Balon et al., 1977).

**Lithophils**: Fish spawns exclusively on gravel, rocks, stones, rubble or pebbles where their embryos and larvae develop. Embryos are highly photophobic (Balon, 1975).

**Phytophils**: Fish scatters or deposits eggs with an adhesive membrane that sticks to submerged, live or dead aquatic plants, or to recently flooded terrestrial plants; sometimes they deposit eggs on logs and branches but never on the bottom. Embryos and larvae are not photophobic (Balon, 1975).

**Phytolithophils**: Fish deposits eggs in relatively clear water habitats on submerged plants, if available, or on other submerged items such as logs, gravel and rocks. Embryos and larvae are photophobic (Balon, 1975).

**Psammophils**: Fish scatter eggs directly on the clean sand/mud or near fine roots of plants that hang over sandy bottom. Eggs are small and adhesive, and the embryos are photophobic (Balon, 1975).

**Nest builders**: Build nests with plant materials or bubbles in rocks, gravels and sand or hard bottom. Eggs are adhesive and embryos are photophobic (Balon et al., 1977).

**Guarders**: Choose rocks, gravel and submerged plants for attachment of their eggs. Usually the male guard and fan the eggs but in many species both sexes are reported to guard the eggs (Balon et al., 1977).

**Mouth brooders**: Incubate their eggs in the buccal cavity. Usually the male takes eggs in its mouth (Balon et al., 1977).

**Live bearers**: Eggs are fertilized internally before they are expelled from the body cavity (Balon et al., 1977).

**Results**

A total of 78 fish species (69 native and 9 exotic) belong to 30 families were recorded from the 11 survey sites (Table 1). Three families namely Catostomidae, Characidae and Cichlidae were found exotic to Bangladesh. Of the 69 freshwater fish species, 4 were found in both fresh and brackish waters while 5 in both brackish and marine waters (Table 1). Collected fishes belong to 8 trophic guilds; carnivore (43) was the most dominant guild followed by omnivore (16), insectivore (5), planktivore (5) and benthivore (4). Only one larvivore species was recorded (Table 1). No molluscivores and parasitic fishes were recorded. Fishes of the study areas displayed a wide range of feeding habits and occupied many trophic guilds from detritivores to secondary carnivores. Similarly, collected fishes represented 8 reproductive guilds. Phytolithophil (35) was the most dominant guild, followed by phytophil (20), pelagophil (6), psammophil (6), guarder (4) and bubble nester (4). Only one mouth brooder species was recorded from the survey sites (Table 1). No lithopelagophils and livebearers were recorded.
| Sl | Family/Fishbase/Scientific name | English common name | Bangla name | Origin | Habitat use | TG | RG |
|---|---------------------------------|---------------------|------------|--------|-------------|----|----|
|   | **Family 1: Cyprinidae**        |                     |            |        |             |    |    |
| 1 | Amblypomus mola (Hamilton)     | Mola carplet        | Mola/Molongi | Bangladesh | F   | P   | Ph |
| 2 | Aspistoria jaya (Hamilton)     | Jaya                | Jaya       | Bangladesh | F   | O   | Ph |
| 3 | Carassius auratus (L.)         | Goldfish            | Goldfish   | Europe    | F   | O   | Ph |
| 4 | Carassius carassius (Hamilton)| Crucian carp        | Crucian carp | China    | F   | O   | Ph |
| 5 | Catla catla (Hamilton)         | Katla/ Katal        | Katla/ Katal | Bangladesh | F   | P   | Pe |
| 6 | Chela cachius (Hamilton)       | Silver hachet       | Chep chela | Bangladesh | F   | O   | Pe |
| 7 | Cirrhinus mirgala (Hamilton)   | Mirgal/ Mirka       | Mirgal/ Mirka | Bangladesh | F   | B   | Pe |
| 8 | Cirrhinus reba (Hamilton)      | Tatkini/ Raik       | Tatkini/ Raik | Bangladesh | F   | O   | Pe |
| 9 | Cyprinus carpio L.             | Scale carp          | Scale carp | China    | F   | O   | Ph |
|10 | Cyprinus carpio L.             | Koi carp            | Koi carp   | China    | F   | O   | Ph |
|11 | Labeo calbasu (Hamilton)       | Orange fin labeo    | Kalibaus/Baus/Kalia | Bangladesh | F   | B   | Pe |
|12 | Labeo rohita (Hamilton)        | Labeo               | Rui/ Rohu  | Bangladesh | F   | P   | Pe |
|13 | Puntius conchonius (Hamilton)  | Rosy barb           | Kanchan punti | Bangladesh | F   | H   | Ph |
|14 | Puntius gonionotus (Bloeker)   | Silver barb         | Thai Sarpunti | Thailand | F   | H   | Ph |
|15 | Puntius sophore (Hamilton)     | Spotted barb        | Jatpunti/ Vadi punti | Bangladesh | F   | O   | Ph |
|16 | Puntius ticto (Hamilton)       | Tic-tac-toe barb    | Til punti  | Bangladesh | F   | O   | Ph |
|17 | Puntius guganios (Hamilton)    | Glass barb          | Mola punti | Bangladesh | F   | O   | Ph |
|18 | Puntius casuatis (Hamilton)    | Kosusti barb        | Kosuati    | Bangladesh | F   | O   | Ph |
|19 | Rohett coto (Hamilton)         | Barb                 | Dhela/ Dipali | Bangladesh | F   | O   | Ph |
|20 | Securicula gora (Hamilton)     | Razorbellcy minnow  | Gora chela | Bangladesh | F   | O   | Ph |
|21 | Salmotomma bacia (Hamilton)    | Large razorbellcy minnow | Katari       | Bangladesh | F   | O   | Ph |
|22 | Tor pullowora (Hamilton)       | Mahascer            | Mohashol   | Bangladesh | F   | B   | Li |
|   | **Family 2: Characidae**       |                     |            |        |             |    |    |
|23 | Serrasalmus nattereri (Kner)   | Common piranha      | Piranha    | South America | F   | C   | Ph |
|   | **Family 3: Channidae**        |                     |            |        |             |    |    |
|24 | Channa gachua (Hamilton)       | Walking snakehead   | Cheng/ Raga | Bangladesh | F   | C   | Gr |
|25 | Channa marulius (Hamilton)     | Great snakehead     | Gozard/ Gajal | Bangladesh | F   | C   | Gr |
|26 | Channa punctatus (Bloch)       | Spotted snakehead   | Taki/ Lata/ Okol | Bangladesh | F   | C   | Gr |
|27 | Channa striatus (Bloch)        | Striped snakehead   | Shol       | Bangladesh | F   | C   | Gr |
|   | **Family 4: Cichildae**        |                     |            |        |             |    |    |
|28 | Oreochromis niloticus GIFT (Peters) | GIFT Tilapia     | GIFT Tilapia | Africa  | F & B | O   | Mb |
|29 | Nandus nandus (Hamilton)       | Mud perch           | Meni/ Veda | Bangladesh | F   | C   | Pl |
|30 | Nandus nandus (Hamilton)       | Mud perch           | Meni/ Veda | Bangladesh | F   | C   | Pl |

Table 1 Origin, habitat use and ecological classification of some collected fish species (n=78) of Khulna division.
| No. | Scientific Name                    | Common Name             | Habitat          | Family  |
|-----|-----------------------------------|-------------------------|------------------|---------|
| 31  | Ompok pabda (Hamilton)            | Butter catfish          | Madhu pabda     | Pl      |
| 32  | Ompok pabo (Hamilton)             | Pabo catfish            | Pabda            | Pl      |
| 33  | Anabas oligolepis (Bloch)         | Spotted perch           | Thai koi         | Pl      |
| 34  | Anabas testudineus (Bloch)        | Climbing perch          | Koi              | Pl      |
| 35  | Colisa fasciata (Bleck & Schneider) | Giant gourami       | Khailsha/ Khaila | Pl      |
| 36  | Colisa lalia (Hamilton)           | Doarf gourami           | Lal Khailsha/Boisa | Pl    |
| 37  | Ctenops nobilis McClelland        | Frail gourami           | Neftami          | Pl      |
| 38  | Tetraodon cuccutus (Hamilton)     | Freshwater puffer       | Potka/ Tepa/ Kutkuitta | Pl    |
| 39  | Tarutia aculeata (Bloch)          | Spotted spinyeel        | Tengra           | Pl      |
| 40  | Mastacembelus armatus (Lacèpède) | Stripped spinyeel       | Sal baim/ Baim   | Pl      |
| 41  | Mastacembelus pancalus (Hamilton) | Spinyeel               | Guchi/ Pankal/ Chikra | Pl    |
| 42  | Batalio tengara (Hamilton)        | Bagrid catfish          | Tengra           | Pl      |
| 43  | Mystus bleekeri (Day)             | Day's mustus            | Golsha tengra    | Pl      |
| 44  | Mystus gulio (Hamilton)           | Long whiskers catfish   | Nona tengra      | F & B   |
| 45  | Mystus tengara (Hamilton)         | Bagrid catfish          | Guitta tengra    | Pl      |
| 46  | Sperata aor (Hamilton)            | Long whiskered catfish  | Ayre             | Pl      |
| 47  | Chanda nama Hamilton              | Glassy fish             | Nama chanda      | Pl      |
| 48  | Pseudeutropius atherinoides       | Indian river shad       | Chapila          | Pl      |
| 49  | Ailia coila (Hamilton)            | Gangetic ailia          | Kajuli/ Baspata  | Pl      |
| 50  | Eutropiichthys vacha (Hamilton)   | Bacha                   | Bepha            | Pl      |
| 51  | Pseudeutropius atherinoides (Bloch) | Indian potasi      | Batasi           | Pl      |
| 52  | Silonia silonida (Hamilton)       | Silond catfish          | Shilong          | Pl      |
| 53  | Notopterus chitala (Hamilton)     | Clown knife fish        | Chitol           | Pl      |
| 54  | Notopterus notopterus (Pallas)    | Bronge feather back     | Foli             | Pl      |
| 55  | Apocypris bato (Hamilton)         | Mud skipper             | Chiring/ Rutta   | Ps      |
| No. | Scientific Name | Common Name | Habitat | Trophic Guild | Reproductive Guild |
|-----|----------------|-------------|---------|---------------|---------------------|
| 61  | Awaous guamensis (Valenciennes) | Mud skipper | Budbaillya/Bele | Bangladesh | F C Ps |
| 62  | Glossogobius giuris (Hamilton) | Tank goby | Bele/ Bailla | Bangladesh | F C Ps |
| 63  | Lepidolophus guentzi (Hamilton) | Guntea loach | Gatum/ Puiya | Bangladesh | F C Ps |
| 64  | Claris batrachus (L.) | Walking catfish | Magur | Bangladesh | F D Pl |
| 65  | Heteropeynesides fossili (Bloch) | Stinging catfish | Shingi/ Shing | Bangladesh | F D Pl |
| 66  | Gobioides rubicundus (Hamilton) | Red chewa | Lal chewa | Bangladesh | F & B C Ps |
| 67  | Rhinomugil corsula (Hamilton) | Freshwater mullet | Khalla/Arwari/Ural | Bangladesh | F P Ph |
| 68  | Aplachius panchax (Hamilton) | Blue panchax | Kanpona/Choukani | Bangladesh | F L Ph |
| 69  | Eleutheronoma tetractylum (Shaw) | Four finger threadfin | Tailla | Bangladesh | B & M C Pe |
| 70  | Polynemous paradiseus L. | Paradise fish | Tapasi/ Muni | Bangladesh | F & B C Ps |
| 71  | Setipina taty (Valenciennes) | Scaly hairfin anchovy | Teli phasa | Bangladesh | B & M C Pl |
| 72  | Thryssa pusivus (Hamilton) | Oblique jaw thryssa | Ram phasa | Bangladesh | B & M C Pl |
| 73  | Toxotes chatareus (Hamilton) | Archer fish | Archer fish | Bangladesh | B & M C Pl |
| 74  | Johnius coitor (Hamilton) | Croaker | Koitor/Koitor poa | Bangladesh | B & M C Pl |
| 75  | Chaca chaca (Hamilton) | Squarehead catfish | Cheka/Gangainna | Bangladesh | F C Li |
| 76  | Hypostomus plecostomus | Black sucker fish | Black sucker fish | North America | F B Pl |
| 77  | Hyporhamphus guamardi (Valenciennes) | Half beak | Ek thuita | Bangladesh | F C Pl |
| 78  | Anguilla bengalensis | Gray & Hardwicke | Bambish | Bangladesh | F C Pl |

B = Brackishwater, Be = Benthivore, Bn = Babble nester, C = Carnivore, D = Detritivore, F = Freshwater, Gr = Guarder, I = Insectivore, L = Larvivore, Li = Lithophil, M = Molluscivore, Mb = Mouth-brooder, O = Omnivore, P = Planktivore, Pa = Parasitic, Pe = Pelagophil, Ph = Phytophil, Pl = Phyto-lithophil, Ps = Psammophil, RG = Reproductive guild, TG = Trophic guild.
Discussion

Result of the present study indicate that aquatic habitats of Khulna division have high fish species diversity, which demand attention for their management. The present findings are on line with the works of Rahman and Akhter (2007) and Akhter and Rahman (2008). Information on trophic and reproductive guilds of the collected samples were determined to provide guildlines to develop strategies for conservation of the fishery resources. The concept of the ecological classification was developed to simplify analysis and to assist in the prediction of community change (Austen et al. 1994). Guild concept may be used to classify fish species according to their habitat preference, feeding habit, reproductive strategy, and tolerance of water quality degradation (Root, 1967). The studied fish samples displayed a wide range of feeding habits. They exhibit diverse trophic guilds from detritivores to secondary carnivores. However, it is rare for fish to specialise in one particular food category throughout the entire life cycle. There is often a correlation between morphological traits and trophic role because morphology determines how a fish can feed. Generally body shape, mouth morphology, teeth, gill rakers and the structure of the alimentary canal are used to determine pattern of diet selection. Presence of high percentage of carnivores and omnivores indicates a healthy trophic structure in the aquatic habitats of Khulna division.

Presence of high percentage of phytolithophils and phytophils indicating availability of the quality spawning habitats for the fishes in Khulna division, which is supported by Rahman and Akhter (2007) who reported that ichthyodiversity in the Khulna division is high. Reproductive processes are diverse in fish populations. Each group of fishes has their own reproductive strategies and tactics, which require different habitats and climatic conditions. Majority of fish in the world are seasonal breeders and each species has its own periods of breeding. Each species shows a series of regular temporal changes in its reproductive activity, which are repeated annually, and therefore, make up the annual reproductive cycle (Gibson 1978, Johannes 1978, Billard & Breton 1979). Spawning requirements are different in different groups of fishes and generally fish reproduce en masse. Therefore, it is recommended to undertake detailed studies on habitat use and ecological classification of fish species available in the Khulna division by exploring all possible fish habitats.

Conclusion

Present study indicates that the aquatic habitats of Khulna Division have high fish diversity. A healthy trophic structure in the aquatic habitats is also proved through the presence of high percentage of carnivores and omnivores. Also, the presence of phytolithophils and phytophils in high percentage indicate the availability of quality spawning habitats. However, more detailed study on the resource and its habitats is recommended. Attention should also be taken for maintaining proper management and conservation to keep hold the status of the fish resources in the Division.

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