Ichthyofauna of Ranganadi River in Lakhimpur, Assam, India

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Abstract: The ichthyofauna of the Ranganadi River, a tributary of the Brahmaputra River in Lakhimpur district, Assam, India, has not been documented so far. To fill this knowledge gap, samples were taken in the Ranganadi River from April 2012 to March 2014, which included 61 species of fishes belonging to six orders, 17 families and 45 genera. One of these species is Endangered, two are as Vulnerable, and six are Near Threatened according to the International Union for the Conservation of Nature. This study will help support the conservation of fish diversity in the Ranganadi River of Assam and the surrounding ecosystems.

Key words: fish fauna; Ranganadi River basin; Lakhimpur

INTRODUCTION

India ranks ninth in terms of freshwater mega biodiversity, with the northeast region recognized as a global hotspot of freshwater fish species (Kottelat and Whitten 1996; Kansal and Arora 2012). Assam, a part of the Indo-Burma biodiversity hotspot, has many torrential streams, which harbour an adapted ichthyofauna (Sen 1999).

Studies on the diversity and conservation of fish in aquatic ecosystems have always attracted the attention of various fishery researchers (Kar et al. 2006). Aquatic ecosystem provides multiple services in terms of supporting aquatic diversity, as well as climate and flood control (Meyer et al. 2007; Tariq et al. 2014). Bagra et al. (2009) surveyed a total of 35 streams and rivers in Arunachal Pradesh including the Subansiri, Ranganadi and upper stretch of the Dikrong and recorded a total of 213 fish species of which 31 species were from Ranganadi in Kimin (27°21’01” N, 093°57’11” E) and Yazali (27°23’04” N, 093°45’28” E) area of Papum Pare and Lower Subansiri districts. Sampling of the available ichthyofauna in wetlands of Lakhimpur district was done by Bakalial et al. (2014), who surveyed lower Subansiri River drainage and reported 204 species belonging to 34 families. Hazarika (2013) reported 42 species belonging to 19 families from Satajan wetland of Lakhimpur district.

The present study, geographically confined to the Lakhimpur district, state of Assam, is the first report on documentation of the available ichthyofauna.

MATERIALS AND METHODS

Study site

Lakhimpur district (26°48’ N to 27°53’ N, 093°42’ E to 094°20’ E) encompasses an area of 2,977 km². The district is bordered by Siang and Papumpare districts of Arunachal Pradesh in the north, Dhemaji district in the east, the Majuli subdivision of Jorhat district in the south, and Gohpur subdivision of Sonitpur district in the west. The four main rivers are the Brahmaputra, Subansiri, Ranganadi and Dikrong.

Ranganadi River (27°11’11” N, 094°03’54” E at its entry into the state of Assam), a northern tributary of the Subansiri, originates from Dafla hills of Arunachal Pradesh at an altitude of 3,400 m, flows through the Lesser Himalaya, Outer Himalaya and the valley of the River Brahmaputra (Figure 1). The maximum and minimum discharge of the Ranganadi River ranges between 900 to 130 m³/s (unpublished data, Water Resource Department, Lakhimpur District, Government of Assam 2014). The Ranganadi River enters Assam near Johing (27°20’38.96” N, 094°01’56.23” E), traverses 60 km and joins Subansiri River in Pokomiah (27°01’27.72” N 94°03’05” E), in Lakhimpur district of Assam.

Data collection

Fieldwork was done monthly in the lower stretch of the Ranganadi River (27°18’26.7” N, 094°01’48.1” E) during April 2012 to March 2014. The fishes were first preserved in 10% and then transferred to 6% formaldehyde solution in the laboratory. Morphometric measurements for identification of species were done with vernier calliper (Mitutoyo) to the nearest 0.05 mm soon after preservation to avoid shrinkage. For molecular analysis, tissue samples were collected and
preserved in ethanol for some of the voucher specimens before preservation in formaldehyde.

Fish species were identified with the aid of the literature (Jayaram 1999; Nath and Dey 2000; Talwar and Jhingran 1991; Vishwanath et al. 2007). Nomenclature was updated following Froese and Pauly (2015) and Eschmeyer and Fong (2015). The current conservation status of fish species was verified (IUCN 2014). All samples were preserved in the Biodiversity Museum, Institute of Advanced Study in Science and Technology (Guwahati, Assam, India) and given voucher numbers (IASST F 120 to IASST F 180; Appendix, Table A1).

RESULTS

In the present study, 61 species, belonging to six orders, 19 families and 44 genera were recorded (Figure 2). One species is assessed as Endangered, six species are Near Threatened, two species are Vulnerable, and the other 46 species are Least Concern according to the International Union for the Conservation of Nature (IUCN 2014). One additional species is Not Evaluated and four species are Data Deficient (IUCN 2014).

Cyprinidae is the most species rich family, with 20 species belonging to 16 genera. Next in species richness are Sisoridae with 6 spp., 3 genera), Cobitidae (5 spp., 3 genera), Bagridae (4 spp., 3 genera), Nemacheilidae (3 spp., 3 genera), Erethistidae (3 spp., 2 genera), Badidae and Psilorhynchidae (each with 3 spp., 1 genus), Ambassidae (2 spp., 2 genera), Amblycipitidae and Olyridae (each with 2 spp., 1 genus), Balitoridae, Schilbeidae, Siluridae, Gobiidae, Channidae, Anguillidae, Mastacembelidae, Belonidae (each with 1 sp.).

Altogether, 32.8% of the fish species recorded belong to the family Cyprinidae, 9.8% to Sisoridae, 8.2% to Cobitidae, 6.6% to Bagridae, 4.9% to Erethistidae, Badidae, Psilorhynchidae and Nemacheilidae, 3.3% to Olyridae, Ambassidae and Amblycipitidae, 1.6% to Balitoridae, Gobiidae, Mastacembelidae, Channidae, Belonidae, Anguillidae, Schilbeidae and Siluridae. Endangered fish (Amblyceps arunachalensis), Vulnerable fishes (Devario assamensis and Botia rostrata), and Near Threatened fishes (Balitora brucei, Tor tor, Aborichthys kempi, Glyptothorax striatus and Anguilla bengalensis) were also recorded during the survey. Eleven of the 61 recorded species are coldwater fishes, seven species are warm–cold water fishes, 21 species are warmwater fishes and the other 21 species were not categorised as per Kapoor et al. (2002).

Ojha and Singh (1992) characterized the fish species from hill streams as inhabitants of swift, turbulent and cascading hyperoxic water, and these species exhibit a number of adaptive modifications. The ichthyofauna is composed of 27 “hill stream species” and 29 riverine species (Froese and Pauly 2015; Ojha and Singh 1992). Our study also recorded five migratory species (Froese and Pauly 2015) (Table 1).

Species such as Badis badis, Barilius bendelisis, Acanthocobitis botia, Chanda nama were more abundant (B.bendelisis = 110/400, B.badis = 68/400, A. botia = 57/400, C. nama = 42/400). However, only one specimen for Tor tor, Anguilla bengalensis, Devario assamensis and Mastacembelus armatus were captured. Badis badis and Chanda nama could be collected only in post-monsoon season and at the beginning of the winter.

DISCUSSION

Anthropogenic activities such as the construction of dams for a hydroelectric power project in the upper or middle stretches of rivers may influence hydrology of dammed rivers as well as the efficiency of the channel downstream of the dam site (Dynesius and Nilsson 1994; Baxter 1997; Batalla et al. 2004). Downstream,
| Order      | Species                          | IUCN Red List status | Habitat |
|-----------|----------------------------------|----------------------|---------|
|           |                                  |                      | H | R | M.F |
| Cypriniformes | Barilius bendelisis (Hamilton, 1807) | LC                   | + | - |     |
|           | Barilius vagra (Hamilton, 1822)  | LC                   | + | - |     |
|           | Barilius shacra (Hamilton, 1822) | LC                   | + | - |     |
|           | Danio dangila (Hamilton, 1822)   | LC                   | + | - |     |
|           | Cobia moar (Hamilton, 1822)      | LC                   | + | - |     |
|           | Lepidocephalichthys guntea (Hamilton, 1822) | LC | + | - |     |
|           | Chagunius chagunio (Hamilton, 1822) | LC | + | - |     |
|           | Garra gotyla (Gray, 1830)       | LC                   | + | - |     |
|           | Psilorhynchus balitora (Hamilton, 1822) | LC | + | - |     |
|           | Acanthocobitis batia (Hamilton, 1822) | LC | + | - |     |
|           | Aborichthys kempi Chaudhuri, 1913 | NT                   | + | - |     |
|           | Rasbora daniconius (Hamilton, 1822) | LC | + | - |     |
|           | Schistura triapens Kottelat 1990 | LC                   | + | - |     |
|           | Balitora brucei Gray, 1830      | NT                   | + | - |     |
|           | Crossocheilus latius (Hamilton, 1822) | LC | + | - |     |
|           | Puntius guganio (Hamilton, 1822) | LC                   | + | - |     |
|           | Pethia ticto (Hamilton, 1822)    | LC                   | + | - |     |
|           | Aspidoparia jaya (Hamilton, 1822) | LC | + | - |     |
|           | Danio rerio (Hamilton, 1822)    | LC                   | + | - |     |
|           | Labeo dyocheilus (McClelland, 1839) | LC | + | - |     |
|           | Garra annandalei Hora, 1921     | LC                   | + | - |     |
|           | Tor tor (Hamilton, 1822)        | NT                   | + | - |     |
|           | Canthophrys gongota (Hamilton, 1822) | LC | + | - |     |
|           | Botia almorhae Gray, 1831       | LC                   | + | - |     |
|           | B. rostrata Günther, 1868        | VU                   | + | - |     |
|           | B. histrionica Blyth, 1860       | LC                   | + | - |     |
|           | Osteobrama coto (Hamilton, 1822) | LC                   | + | - |     |
|           | Devario assamensis (Barmann 1984) | VU | + | - |     |
|           | Psilorhynchus sucatio (Hamilton, 1822) | LC | + | - |     |
|           | Laubuka laubuca (Hamilton, 1822) | LC                   | + | - |     |
|           | Cirrhinus reba (Hamilton, 1822)  | LC                   | + | - |     |
|           | Psilorhynchus arunchalensis (Hamilton, 1822) | DD | + | - |     |
| Siluriformes | Amblyceps sp.                    | —                    | + | - |     |
|           | Amblyceps arunchalensis Nath & Dey, 1889 | EN | + | - |     |
|           | Olyra kempi Chaudhuri, 1912**    | LC                   | + | - |     |
|           | Mystus dirogravensis (Chaudhuri 1913) | LC | + | - |     |
|           | Eutropiichthys vacha (Hamilton, 1822) | LC | + | - |     |
|           | Garra cenia (Hamilton, 1822)    | LC                   | + | - |     |
|           | Bataisia tengana (Hamilton, 1822) | LC | + | - |     |
|           | Mystus vittatus (Bloch, 1794)    | LC                   | + | - |     |
|           | Eretistoides montana Hora,1950   | DD                   | + | - |     |
|           | Olyra longicaudata McClelland, 1842 | LC | + | - |     |
|           | Wallago attu (Bloch & Schneider, 1801) | NT | + | - |     |
|           | Sperata seenghala (Skyes,1939)  | LC                   | + | - |     |
|           | Glyptothorax cavia (Hamilton, 1822) | LC | + | - |     |
|           | G. striatus (McClelland, 1842)   | NT                   | + | - |     |
|           | Pseudogobius ferula Ng, 2006     | DD                   | + | - |     |
|           | Pseudogobius shawi (Hora, 1921)  | LC                   | + | - |     |
|           | Nangra assamensis Sen & Biswas, 1994 | LC | + | - |     |
|           | Glyptothorax telchitta (Hamilton,1822) | LC | + | - |     |
|           | Glyptothorax trilineatus Blyth, 1860 | LC | + | - |     |
| Perciformes | Parambassis baculis Hamilton, 1822 | LC | + | - |     |
|           | Chanda nama Hamilton, 1822       | LC                   | + | - |     |
|           | Badis badis (Hamilton, 1822)    | LC                   | + | - |     |
|           | Badis singenesis Geetakumari & Kadu, 2011 | NE | + | - |     |
|           | Badis konobos Kullander & Britz, 2002 | DD | + | - |     |
|           | Glossogobius giurus (Hamilton, 1822) | LC | + | - |     |
|           | Channa gachua (Hamilton, 1822)   | LC                   | + | - |     |
| Anguilliformes | Anguilla bengalensis (Gray, 1831) | NT | + | - |     |
| Synbranchiformes | Mastacembelus armatus (Lacepède, 1800) | LC | + | - |     |
| Beloniformes | Xentodon cancila (Hamilton, 1822) | LC | + | - |     |

* In Eschmeyer and Fong (2015), Aspidoparia jaya is mentioned as Cabdio jaya.
** Olyra kempi is mentioned as the synonym for Olyra longicaudata.
the Ranganadi River experiences the effects of having the North Eastern Electric Power Corporation (NEEPCO) dam, with a capacity of 405 MW (27°20′03″ N, 093°49′00″ E) at Yazali in Lower Subansiri district, Arunachal Pradesh. The modified river flow downstream of the dam have a variety of negative effects on the fish fauna, including loss of stimuli for migration, loss of routes for migration and spawning grounds, decrease in the survival of eggs and juveniles, and diminished food production (Kansal and Arora 2012). Besides these known impacts, the presence of high species diversity reduces disease problems and encourages recovery from disturbances (Kar et al. 2006). The NEEPCO dam might have affected the fishes and eventually the diversity

Figure 2. Indigenous fishes collected from April 2012 to March 2014 in the Ranganadi River. A: Anguilla bengalensis. B: Mastacembelus armatus. C: Parambassis baculis. D: Amblyceps arunchalensis. E: Glyptothorax telchita. F: Glyptothorax trilineatus. G: Olyra kempi. H: Tor tor. I: Canthophrys gongota.
of the fishes in the lower stretch the Ranganadi River. However, 61 fish species were recorded in the Ranganadi River within Assam, including a number of threatened species.

The Ranganadi River enters Assam on a steep gradient and gradually becomes a slow flowing river before joining the Subansiri River at Pokoniaghat. Presence of *A. arunchalensis*, *A. bengalensis*, *A. kempi*, *B. brucei*, *B. rostrata*, *D. assamensis*, *G. striatus*, *T. tor* and *Wallago attu* shows the presence of many different microhabitats within the river, which are important for feeding and breeding. These features could also help increase the ichthyofaunal diversity in the Ranganadi River.

Fishes such as *Tor tor*, *Labeo dyocheilus*, *Barilus bengelisis*, *Anguilla bengalensis* and *Glossogobius giuris* can migrate long distances in trans-Himalayan rivers (Talwar and Jhingran, 1991; Das and Bordoloi 1997; Hill and Hill 1994; Menon 1999). Depending on the water quality and environmental factors such as temperature and rainfall, these fish species migrate to the large rivers for feeding or breeding.

Fish ladders are generally believed to re-establish connectivity between critical habitats for migratory species and reduce the anthropogenic stress on the fish fauna. However, to be useful, fish ladders must assure both upward and downward movements of fishes. It is imperative to maintain a minimum water flow, especially during the winter, when the contribution of the rainfall greatly decreases (Agostinho et al. 2007).

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APPENDIX

Table A1. Voucher numbers of the samples deposited in the museum of Institute of Advanced Study in Science and Technology (IASST).

| Species                      | Voucher No. | Species                      | Voucher No. | Species                      | Voucher No. |
|------------------------------|-------------|------------------------------|-------------|------------------------------|-------------|
| Barilius bendelisis          | IASST F 120 | Canthophrys gongota          | IASST F 141 | Pseudolaguvia ferula         | IASST F 162 |
| B. vagra                     | IASST F 121 | Botia almorhae               | IASST F 142 | P. seudolaguvia shawi        | IASST F 163 |
| B. shacra                    | IASST F 122 | Botia rostrata               | IASST F 143 | Nangra assamensis            | IASST F 164 |
| Danio dangila                | IASST F 123 | B. histrionica               | IASST F 144 | Glyptothorax telchitta       | IASST F 165 |
| Cribido morar                | IASST F 124 | Osteobrama catio catio       | IASST F 145 | G. trilineatus               | IASST F 166 |
| Lepidocephalichthys guntea   | IASST F 125 | Devario assamensis           | IASST F 146 | Parambassis baculis         | IASST F 167 |
| Chagunius chagunio           | IASST F 126 | Psilorhynchus sucatio        | IASST F 147 | Chanda nama                  | IASST F 168 |
| Garra gotyla gotyla          | IASST F 127 | Laubuka laubuca              | IASST F 148 | Badis badis                  | IASST F 169 |
| Psilorhynchus baltora        | IASST F 128 | Cinninus reba                | IASST F 149 | Badis singenensis            | IASST F 170 |
| Acanthocobitis botia         | IASST F 129 | Amblyceps sp.                | IASST F 150 | Badis kanabos                | IASST F 171 |
| Aborichthys kempfi           | IASST F 130 | Amblyceps arunachalensis     | IASST F 151 | Glossogobius giuris          | IASST F 172 |
| Schistura tirapensis         | IASST F 131 | Olyra kempfi                 | IASST F 152 | Channa gachua                | IASST F 173 |
| Balitora brucei              | IASST F 132 | Mystus dibugarensis          | IASST F 153 | Anguilua bengalensis         | IASST F 174 |
| Crossocheilus latius         | IASST F 133 | Gagata cenia                 | IASST F 154 | Mastacembelus armatus        | IASST F 175 |
| Puntius gugano               | IASST F 134 | Batasio tengana              | IASST F 155 | Xenentodon cancila           | IASST F 176 |
| Pethia ticto                 | IASST F 135 | Mystus vittatus              | IASST F 156 | Psilorhynchus arunachalensis | IASST F 177 |
| Aspidoparasia jaya           | IASST F 136 | Erethistoides montana        | IASST F 157 | Glyptothorax striatus        | IASST F 178 |
| Danio rerio                  | IASST F 137 | Olyra longiaucicata          | IASST F 158 | Eutropiichthys vacha         | IASST F 179 |
| Labeo diocheilus             | IASST F 138 | Wallago attu                 | IASST F 159 | Rasbora daniconius           | IASST F 180 |
| Garra annandalei             | IASST F 139 | Sperata seenghala            | IASST F 160 |                             |             |
| Tor tor                      | IASST F 140 | Glyptothorax cavia           | IASST F 161 |                             |             |

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