

## Fish Biodiversity in Certain Rivers of Tripura

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### Abstract

Ichthyological survey conducted in rivers Monu, Feni, Muhuri, Juri, Kakri, Dhalai and Deo in different regions of Tripura province, revealed the occurrence of 44 species of freshwater fishes. Individually, the number of species recorded in each of these rivers were 10 species in the river Monu, 11 species in river Feni, 14 species in river Muhuri, 15 species in river Dhalai, 15 species in river Deo, 7 species in river Juri and 5 species in river Kakri. Results of studies on water quality parameters and fish catching devices have been discussed.

**Key words :** Fish diversity, Tripura, North-East India Hotspot.

Biodiversity has immense importance in the context of recent advances made in science and technology and this provides a wide spread need for conservation of natural ecosystem in aqua regime. Further, biodiversity is essential for stabilization of ecosystem, protection of over all environmental quality and for understanding the intrinsic worth of all species on the earth (1). Fishes make-up most of the abundant classes of vertebrates, both in terms of number of species and number of individuals. They exhibit enormous diversity of size, shape, number and biology, and in the habitats in which they live; 21,723 species of fish under 4,044 genera, 445 families and 50 orders have been recorded in the world (2).

The north-eastern region of India (25°55' 12.09'' to 27°42' 21.28'' N and 89°38' 22.44'' to 97°04' 9.67'' E) has a large number of diverse types of waterbodies which include both lotic and lentic systems. It comprises seven provinces and is one of the hotspots of biodiversity. These provinces with their unique topography, diverse physiographic features and varied water quality patterns are a lucrative field for ichthyological studies with innumerable hill streams, rivers, and wetlands. Nevertheless, the region is fed by two major drainage systems, viz., the Brahmaputra river system (forming the Brahmaputra valley and the Barak

river system forming the Barak valley). The drainages in Tripura mostly enter Bangladesh independently (3). The Province of Tripura (23°49' 51.18'' to 23°53' 57.42'' N and 92° 12' 50.43'' to 92° 24' 34.76'' E) is flanked by both hills and plains with four principal rivers, viz. Monu, Khowai, Gomati and Feni. In addition, there are other smaller rivers, viz. Muhuri, Juri, Kakri, Dhalai, Deo, Haora. Of these, the rivers Monu, Khowai, Gomati and Feni have been studied in great detail by Kar (4—9) and Kar et al. (10—12). However, not much works have been done on the fishes of the rivers Deo, Juri, Kakri and Muhuri. As such, a preliminary study was undertaken to record the fish biodiversity along with water characteristics and fish catching devices in the rivers Juri, Kakri, Deo, Monu, Dhalai, Feni and Muhuri rivers in Tripura. The river Juri originates from Mauglarai Hills and the river Kakri originates from Baugsul Hill in Damchhara and flows into Bangladesh independently. The river Deo originates from the Zampui Hill ranges, flows northwards through the valley between Zampui and Shakhan ranges, locally called Kanchan valley with Dharmanagar sub-division. Later, the river Deo turns westward cutting through the Shakhan and meets the river Monu in mid-valley between the Shakhan and Longtarai ranges in Kailashahar sub-division (6, 7).

**Table 1.** Habitat inventory of the surveyed rivers in Tripura.

	Name of the rivers	Place	Date 2007	Valley segment	Breadth of river (approx.) (m/km)	Depth of the river (approx.) (m)	Micro-habitat type	Substratum
1	Juri	Dharmanagar	14 Oct	Alluvial	55.0	3.0	Run	Mainly silt
2	Kakri	Dharmanagar	25 Oct	Alluvial	41.0	2.9	Run	Mainly silt
3	Deo	Pechartal	8 Nov	Alluvial	96.0	4.2	Run	Sandy
4	Monu	Kailasahar	24 Oct	Alluvial	83.0	4.8	Run, some turbulence	Mainly sand and silt
5	Dhalai	Ambasa	23 Oct	Colluvial	47.0	3.7	Run with some turbulence	Mainly sand and silt with some gravels
6	Feni	Sabrum	30 Oct	Colluvial	85.0	3.9	Run-sheet with some turbulence	Mainly sand and silt
7	Muhuri	Belonia	31 Oct	Colluvial	72.0	2.09	Mainly run	Mainly sand

The river Monu originates from the Longtarai Hills in the Shakhan Tang range and its takes course through the valley between Shakhan and Longtarai ranges to the northern direction. After meeting the river Deo, it runs further northward and passes through the Subdivisional headquarters at Kailasahar and enters Bangladesh. The river Monu is about 93 km long with catchment area of about 2,228 km<sup>2</sup>. The river Dhalai is said to have originated from the Longtarai hill ranges and flowing the Ambasa region, it enters Bangladesh (8). The river Feni is said to have originated from the escarp of the Chittagong Hill tracts and flows down beside the village Shilachhari along the Indo-Bangladesh border. Finally, it enters Bangladesh through a village called Amlighat (9). The river Muhuri originates from the Kailashi hills and flows down by the side of Shantirbazar and Belonia sub-division and finally enters Bangladesh as reported by Kar (9).

Compared to the average annual fish production of 6–7 kg per ha from the Indian water bodies, the over all fish production from the water bodies of Tripura is not less (9). However, contrary to the demand, the present fish production rate cannot fulfil the needs of the consumers. Loss of habitat, unsustainable harvest and fish disease (notably epizootic ulcerative syndrome or EUS) are some of the reasons for the depleting trend of fish yield. Under this background, a preliminary study was undertaken to record the present status of fish diversity in certain rivers across the length and breadth of the Province of Tripura (9). Such works from the NE region of India

are scanty (4–22). But most of them are concerned with taxonomy (biodiversity), biology and aquaculture.

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### Methods

General survey of the fishes was done using standard procedures of Armontrout (23). Also, NBFGR manual (24) was consulted for studying the habitat parameters. Headwater to downstream studies were based on River Continuum Concept as advocated by Vannote, et al. (25).

Fish samples were collected through experimental fishing using caste nets (dia 3.7 m and 1.0 m), gill nets (vertical height 1.0m–1.5 m; length 100 m–150

**Table 2.** Physico-chemical Characteristics of the Surveyed Rivers in Tripura.

	Name of water body	Temp. of water (C)	Turbidity (NTU)	pH	DO (mg/l)	FCO <sub>2</sub> (mg/l)	TA (mg/l)	Conductivity (µmho/cm)
1	River Deo	27.0	160	6.74	5.9	14	104	159
2	River Manu	28.5	212	7.1	7	8	110	163
3	River Dhalai	26.8	70	6.6	4.9	12.5	103.5	157
4	River Feni	27.2	90	6.63	3.4	10	63	100
5	River Muhuri	28.1	344	6.58	3.6	9	42	69

**Table 3.** Ichthyodiversity in the surveyed water bodies in Tripura. Ma : Manu, Fe : Feni, Mu : Muhuri, Dh : Dhalai, De : Deo, Ju : Juri, Ka : Kakri. + =Present and – = Absent.

Name of fish	Ma	Fe	Mu	Dh	De	Ju	Ka
1 <i>Notopterus notopterus</i> (Pallas.)	+	-	-	+	-	-	-
2 <i>Gudusia chapra</i> (Ham.-Buch.)	+	-	-	-	-	-	-
3 <i>Salmostoma bacaila</i> (Ham.-Buch.)	+	-	+	+	-	-	-
4 <i>Aspidoparia morar</i> (Ham.-Buch.)	-	-	-	-	+	-	-
5 <i>Barilius bakeri</i> Day	-	-	-	-	+	-	-
6 <i>Barilius barna</i> (Ham.-Buch.)	-	-	-	+	-	-	-
7 <i>Esomus danricus</i> (Ham.-Buch.)	-	+	-	-	-	+	-
8 <i>Amblypharyngodon mola</i> (Ham.-Buch.)	-	+	-	-	+	-	+
9 <i>Puntius chola</i> (Ham.-Buch.)	-	-	-	-	+	+	-
10 <i>Puntius vittatus</i> Day	+	+	+	+	-	-	-
11 <i>Puntius puntio</i> (Ham.-Buch.)	-	-	+	+	+	-	-
12 <i>Puntius sarana orphoides</i> (Valenciennes)	-	-	-	+	-	-	-
13 <i>Cirrhinus mrigala</i> (Ham.-Buch.)	-	-	-	-	+	+	-
14 <i>Catla catla</i> (Ham.-Buch.)	-	-	-	-	-	+	+
15 <i>Labeo caeruleus</i> Day	-	-	+	-	-	-	-
16 <i>Labeo boga</i> (Ham.-Buch.)	-	+	+	+	-	-	-
17 <i>Labeo gonius</i> (Ham.-Buch.)	-	+	+	-	-	-	-
18 <i>Labeo rohita</i> (Ham.-Buch.)	-	+	-	-	+	+	-
19 <i>Crossochilus latius latius</i> (Ham.-Buch.)	+	-	-	-	+	-	-
20 <i>Psilorhynchus suction</i> (Ham.-Buch.)	-	-	-	+	-	-	-
21 <i>Botia Dario</i> (Ham.-Buch.)	+	-	-	-	-	-	-
22 <i>Botia rostrata</i> Gunther	-	-	-	-	+	-	-
23 <i>Lepidicephalus Guntea</i> (Ham.-Buch.)	-	+	-	-	+	-	-
24 <i>Mystus tengara</i> (Ham.-Buch.)	-	+	-	-	-	-	-
25 <i>Mystus bleekeri</i> (Day)	+	-	+	-	-	-	-
26 <i>Eutropiichthys murius</i> (Ham.-Buch.)	+	-	-	-	-	-	-
27 <i>Pangasius pangasius</i> (Ham.-Buch.)	-	-	-	-	-	+	-
28 <i>Amblyceps mangois</i> (Ham.-Buch.)	-	-	-	-	+	-	-
29 <i>Bagarius bagarius</i> (Ham.-Buch.)	-	-	-	-	+	-	-
30 <i>Gagata gagata</i> (Ham.-Buch.)	-	-	+	-	+	-	-

**Table 3.** Continued.

Name of fish	Ma	Fe	Mu	Dh	De	Ju	Ka
31 <i>Glyptothorax telchitta telchitta</i> (Ham.-Buch.)	-	-	-	+	-	-	-
32 <i>Clarius batrachus</i> (Linn.)	-	-	-	-	-	-	+
33 <i>Heteropneustes fossilis</i> (Bloch.)	-	-	+	-	-	-	-
34 <i>Xenentodon cancila</i> (Ham.-Buch.)	-	-	+	-	-	-	-
35 <i>Macragnathus aral</i> (Bloch & Schneider)	-	-	+	+	-	-	-
36 <i>Macragnathus pancalus</i> (Ham.-Buch.)	-	+	-	+	-	-	-
37 <i>Mastacembelus armatus</i> (Lacepede)	-	-	-	+	+	-	-
38 <i>Chanda nama</i> (Ham.-Buch.)	-	+	+	-	-	+	-
39 <i>Parambassis ranga</i> (Ham.-Buch.)	-	-	-	-	-	-	-
40 <i>Nandus nandus</i> (Ham.-Buch.)	-	-	-	+	-	-	-
41 <i>Glossogobius giurie giuris</i> (Ham.-Buch.)	-	-	+	-	+	-	-
42 <i>Anabas testudineus</i> (Bloch.)	+	-	-	-	-	-	+
43 <i>Colisa fasciatus</i> (Schneider)	-	+	-	+	-	-	-
44 <i>Channa punctatus</i> (Bloch.)	-	-	+	+	-	-	+

m), drag nets (vertical height 2.0 m), triangular scoop nets (vertical height 1.0 m) and a variety of traps. Camouflaging technique was also used to catch the fishes. Fishes were preserved at first in concentrated formaldehyde in the field itself and then in 40% formalin. Fishes were identified following standard literature of (2, 3, 26). Yield statistics were extrapolated after Dey and Kar (18), and Kar (3) from daily catch statistics recorded at the landing stations following FAO (27).

The physico-chemical characteristics of water were analyzed after the methods in APHA et al. (28) while the different aspects of fish catching devices were studied after Kar and Day (9, 29–31).

### Results and Discussion

The results of the present study on habitat inventory of the rivers, their physico-chemical characteristics and fish biodiversity are presented in Tables 1 to 3, respectively. Further, studies on fish catching devices in the surveyed rivers in Tripura have been

**Table 4.** Fishing crafts and gears used in river Manu in Tripura and their CPGH.

	Name of fishing gear	Shape	Duration of operation	Nos. of person involved	Dimension of the gear	Area of the gear	CPGH	Name of fishes caught
1	Ural jal	Circular	4	2	Dia-2.5 m	19.63 m <sup>2</sup>	$3.2 \times 10^{-2}$ kg/per/m <sup>2</sup> /h	<i>Notopterus notopterus</i>
2	Chitka jal	Triangular	3	1	Base-1.83 m Ht-1.52 m	1.39 m <sup>2</sup>	$47.9 \times 10^{-2}$ kg/m <sup>2</sup> /h	<i>Mystus bleekeri</i>
3	Paron	Conical	8	1	Base-0.2 m	0.06 m <sup>2</sup>	1.04 kg/m <sup>2</sup> /h	<i>Salmostoma</i> sp.
4	Hook & Line	–	8	1	50 hooks		$3.7 \times 10^{-3}$	<i>Puntius</i> sp. <i>Channa</i> sp.
5	Dori	Rectangular	8	1	L-0.91 m B-0.61 m	0.56 m <sup>2</sup>	0.33 kg/m <sup>2</sup> /h	<i>Puntius</i> sp. and <i>Anabas</i> sp.
6	Pelain	Triangular	3	1	Base-1 m Ht-1 m	0.5 m <sup>2</sup>	0.66 kg/m <sup>2</sup> /h	<i>A. mola</i> , <i>Puntius</i> , <i>Esomus</i>

presented in Tables 4 and 5.

Ichthyological diversity in aquatic ecosystem refers to variety of fish species. Depending on context and scale, ichthyodiversity can refer to alleles and genotypes within a piscian population, co-species or life forms within a fish community. Further, biodiversity is essential for stabilization of ecosystem, protection of environmental quality, for understanding intrinsic worth of all species on the earth (32).

Studies revealed that there is variation in valley segment in having mostly alluvial valley segment in the plains and colluvial in the upstream rheophilic region. Colluvial valley segment gives a favorable habitat for colonization by fishes as reported by Kar (9). A

variety of fish covers, notably turbidity, deep pools, over hanging vegetation, bottom-free big boulders, were recorded as fish covers which protect the fishes from predation and hunting. Most of the rivers surveyed are mesoriparian. Riparian vegetation are scanty and consists mainly of evergreen trees with some amount of shrubs and herbs. The water bodies are subjected to human interference in the form of release of domestic and agricultural wastes sometimes tea garden refuges. The riparian land use pattern consists of human habitation, cultivation (Table 1). Temperature, turbidity, pH, dissolved oxygen (DO), free carbon dioxide (FCO<sub>2</sub>), total Alkalinity (TA), and conductivity were the parameters studied with regard to physico-chemical characteristics of water (Table

**Table 5.** Fishing crafts and gears used in river Juri, Kakri and their CPGH.

	Name of fishing gear	Shape	Duration of operation	Nos. of person involved	Dimension of the gear	Area of the gear	CPGH	Name of fishes caught
1	Ural jal	Circular	4	2	Dia-2.5 m	19.63 m <sup>2</sup>	$3.2 \times 10^{-2}$ kg/m <sup>2</sup> /h	<i>Catla catla</i> , <i>Labeo</i> sp., <i>Cirrhinus</i> sp.
2	Chitka jal	Triangular	3	1	Base-1.83 m Ht-1.52 m	1.39 m <sup>2</sup>	$47.9 \times 10^{-2}$ kg/m <sup>2</sup> /h	<i>Channa</i> sp., <i>Pangasius</i> sp.
3	Hook and Line	–	8	1	50 Hooks		$3.7 \times 10^{-3}$	<i>Puntius</i> sp., <i>Channa</i> sp.
4	Paron	Conical	8	1	Base-0.2 m Ht-0.3 m	0.06 m <sup>2</sup>	1.04 kg/m <sup>2</sup> /h	<i>Puntius</i> sp., <i>Channa</i> sp., and <i>Clarias</i> .
5	Pelain	Triangular	3	1	Base-1 m Ht-1 m	1.5 m <sup>2</sup>	0.66	<i>A. mola</i> , <i>Channa</i> sp. <i>Esomus</i> .
6	Dori	Rectangular	8	1	L-0.91 m B-0.61 m	0.56 m <sup>2</sup>	0.33 kg/m <sup>2</sup> /h	<i>Channa</i> sp., <i>Puntius</i> sp. and <i>Anabas</i> sp.

2).

The results revealed variations among the parameters. DO portrays higher values (7.0 mg/liter) in river Manu. Lower DO values (3.4 mg/liter) were recorded in river Feni. Turbidity shows highest value (344.0 NTU) in river Muhuri and lowest (70.0 NTU) in Dhalai. River Manu showed maximum pH (7.1) while river Muhuri showed minimum value of pH (6.58). Further, river Deo showed maximum value of FCO<sub>2</sub> (14.0 mg/liter) and river Manu showed the lowest value (8.0 mg/liter). The river Manu displayed highest value of TA (110 mg/liter) while river Muhuri portrayed the lowest value (42.0 mg/liter). Further, highest value of conductivity was exhibited by river Manu (163.0 micromhos/cm) and lowest value of conductivity was portrayed by river Muhuri (69.0 micromhos/cm) (Table 2).

Similar results were obtained by other workers (9, 14). Forty four ichthyospecies belonging to 33 genera, 19 families and 7 orders were recorded from the surveyed rivers in Tripura. Of these, 30 species (81.82%) belonged to the Primary FW group while the remaining (18.18%) species belonged to Peripheral class. Fish biodiversity along with habitat inventory parameters in a number of rivers in Barak drainage in Assam and in the provinces of Mizoram and Tripura were reported earlier (3, 4, 10—12, 19, 22, 33—35). In the present study, *Salmostoma bacaila* and *Labeo boga* were recorded in most of the rivers indicating their abundance. On the other hand, *Eutropiichthys murius*, *Amblyceps mangois* and *Labeo caeruleus* were recorded only from few of the surveyed rivers, indicating their rarity (Table 3).

Conservation of rare and endangered species are to be given prime importance for their *in situ* conservation.

#### References

- Gadgil M. and D. Kar. 2000. Conserving India's biodiversity : Let people speak. Pages 583—589. Setting biodiversity conservation. World Wide Fund (WWF) for Nature, India, New Delhi, pp. 707.
- Jayaram K. C. 1999. The freshwater fishes of the Indian region. Narendra Publ. House (Delhi), India.
- Talwar P. K. and A. G. Jhingran. 1991. Inland fishes of India and adjacent countries, volumes I & II. Oxford and IBH Co. Pvt. Ltd., New Delhi, India.
- Kar D. 2003. Fishes of Barak drainage, Mizoram and Tripura. Pages 203—211 in A. Kumar, C. Bohra and L. K. Singh, editors. Environment, pollution and management. APH Publ. Corp., New Delhi, India.
- Kar D. 2004. A glimpse into the fish bioresources of North-East India with a note on their management, conservation and biotechnological potential. Proc. Nat. Symp. on biodiversity conservation and sustainable utilization of environmental resources. Tripura Univ., India.
- Kar D. 2005. Fish genetic resources and habitat diversity of the Barak drainage. Pages 68—76 in T. V. Ramachandra, N. Ahalya and C. R. Murthy, editors. Aquatic ecosystems, conservation, restoration and management. Capital Publ. Co., Bangalore, India.
- Kar D. In press. Fish fauna of river Barak, Mizoram and Tripura with a note on conservation. J. Freshwater Biol. 16 (2005).
- Kar D. 2005. Fish diversity in the major rivers in southern Assam, Mizoram and Tripura. Proc. 2nd Intern. Symp. on GIS and spatial analyses in fisheries and aquatic sciences, 2—6 Sep 2002. Univ. Sussex, Brighton, UK. (Eds.), volume 2, Fisheries and aquatic GIS research Group, Kawagoe, Saitama, Japan, pp. 679—691.
- Kar D. 2007. Fundamental of limnology and aquaculture biotechnology. Daya Publ. House, New Delhi, India.
- Kar D., B. A. Laskar, M. Mandal, Lalsiamliana and D. Nath. 2002. Fish genetic diversity and habitat parameters in Barak drainage, Mizoram and Tripura. Indian J. Environ. and Ecopl. 6 : 473—480.
- Kar D., B. A. Laskar, D. Nath, M. Mandal and Lalsiamliana. 2002. *Tor progenius* (McClelland) under threat in river Jatinga, Assam. Sci and Cult. 68 : 211.
- Kar D., B. A. Laskar and D. Nath. 2002. *Tor* sp. (mahseer fish) in river Mat in Mizoram. Aquaculture 3 : 229—234.
- Kar D. 1990. Limnology and fisheries of Lake Sone in the Cachar district of Assam (India). Matsya 15—16 : 209—213.
- Dey S. C. 1973. Studies on the distribution and taxonomy of the ichthyofauna of the hill streams of Kamrup-Khasi-Garo regions of Assam with special reference to the functional morphology of some rheophilic fishes. D. Sc. thesis, Univ. Calcutta, India, India.
- Sen N. 2000. Occurrence, distribution and status of diversified fish fauna of north-east India. Pages 31—48 in A. G. Ponniah and U. K. Sarkar, editors. Fish diversity of north-east India. Nat. Bur. Fish Gen. Resour., ICAR, Lucknow, India.
- Ghosh S. K. and A. P. Lipton. 1982. Ichthyofauna of the NEH Region with special reference to their economic importance. ICAR Res. Com., NEH Reg. Shillong, Spl. Bull. 1 : 119—126.
- Sen T. K. 1985. The fish fauna of Assam and the neighboring north-eastern states of India. Records of Zool. Surv. of India. Occas. Paper No. 64 : 1—216.
- Dey S. C. and D. Kar. 1990. Fish yield trend in Sone, a tectonic lake of Assam. Matsya 15—16 : 39—43.
- Kar D. and S. C. Dey. 2002. On the occurrence of advanced fry of *Hilsa (Tenulosa) ilisha* (Hamilton-

- Buchanan) in Chatla Haor Seasonal wetland of Assam. Proc. Zool. Soc. Calcutta 55 : 15—19.
20. Kar D., S. C. Dey and N. C. Datta. 2003. Welfare biology in the new millennium. Allied Publ. Pvt. Ltd. Bangalore, India.
  21. Kar D., A. Roy and S. C. Dey. 2004. An overview of fish genetic diversity of north-east India. Proc. Nat. works. on rational use of water resources for aquaculture, 18—19 Mar 2004. CCS Haryana Agric. Univ. 1 : 164—171.
  22. Kar D. and N. Sen. 2007. Systematic list and distribution of fish biodiversity in Mizoram, Tripura and Barak drainage in north-east India. Zoos' Print J. 22 : 2599—2607.
  23. Armontrout N. B. 1990. Aquatic inventory : Bureau of land management, Eugene district (USA), pp. 32.
  24. NBFGR. 2000. Manual on habitat inventory. Nat. Bur. of Fish Gen. Resour. (ICAR), Lucknow, India.
  25. Vannote R. L., G. W. Minshall, K. W. Cummins, R. Sedell and C. E. Cushing. 1980. The river continuum concept. Canadian J. Fish and Aquatic Sci. 37 : 130—137.
  26. Menon A. G. K. 1999. Checklist : Freshwater fishes of India. Occasional Paper No. 175. Zool. Surv. India, Calcutta, India.
  27. FAO. 1974. Design of fisheries statistical surveys : Inland waters. Food and Agric. Organ. Fish. Tech. Pap. 133 : 1—122.
  28. APHA, AWWA and WPCF. 1995. Standard methods for the examination of water and wastewater. Am. Pub. Hlth. Assoc. NY, USA.
  29. Kar D. and S. C. Dey. 1991. Gill nets in Lake Sone of Assam with their economics and impact on fishery. J. Appl. Zool. Res. 2 : 76—79.
  30. Kar D. and S. C. Dey. 1993. Variegated encircling gears in Lake Sone of Assam. J. Appl. Zool. Res. 4 : 171—175.
  31. Kar D. and S. C. Dey. 1996. Scooping gears of Lake Sone in Assam. J. Appl. Zool. Res. 7 : 65—68.
  32. Jhingran V. G. 1991. Fish and fisheries of India. Hindustan Publ. Corp., New Delhi, India.
  33. Kar D., S. C. Dey, S. Kar, R. G. Michael and M. Gadgil. 1996. Ichthyoecology, management and conservation fish resources of Lake Sone in Assam (India). Tiger Paper (FAO, UN), 23 : 27—32.
  34. Kar D., A. V. Nagarathna, T. V. Ramachandra and S. C. Dey. 2005. Fish diversity and conservation aspects in an aquatic ecosystem in north-east India. Zoos' Print J. 21 : 2308—2315.
  35. Kar D., B. A. Laskar and D. Nath. 2006. Length-weight relationship of *Neolissochilus hexagonolepis* (McClelland) and *Garra lissorhynchus* (McClelland) from river Jatinga in Cachar district of Assam. Indian J. Fish. 52 : 495—496.