Fishes from Tamiraparani river system, Tamil Nadu

H S MOGALEKAR

Tamil Nadu Fisheries University, Thoothukundi, Tamil Nadu 628 008 India

Received: 14 August 2018; Accepted: 12 September 2018

ABSTRACT

Streams and rivers originating from Western Ghats have been conferred with diverse fish fauna. Owing to the diverse ichthyofauna, the present investigation was designed to study species diversity, distribution, diversity indices, human use pattern and conservation status of fishes in four fragments of Tamiraparani river system. Altogether, 125 fish species belonging to 13 orders, 44 families and 73 genera were identified from upstream, midstream and lower estuary of Tamiraparani river. In total, 66 fish species were recorded from Vannarapettai, 63 species from Manimuthar, 58 species from Srivaikundam and 53 species from Punnakayal estuary. Cypriniformes (43 species) was the order with diverse species composition and Cyprinidae was the most dominated group represented by 39 species. The river supports 64% food fish, 25.6% ornamental fish and 10.4% ornamental as well as food fish. Out of 125 species, six species were endangered and four vulnerable. Calculated values for various diversity indices were observed on higher side. Our study indicated that the Tamiraparani river system supports highly diverse fish fauna.

Key words: Conservation status, Diversity indices, Fish Fauna, Tamiraparani river system

Tamil Nadu is endowed with rich aquatic resources in the form of streams, rivers, canals (7400 km), major reservoirs (52000 ha), Irrigation tanks (56000 ha) (De 2011, Government of Tamil Nadu 2015). Streams and rivers originating from Western Ghats have been conferred with diverse fish germplasm resources (Johnson and Arunachalam 2009, Mogalekar and Jawahar 2015, Qayoom et al. 2018). Cauvery, Vaigai, Tamiraparani, Periyar and Pennar are some of the important rivers of Tamil Nadu which discharge freshwater into Bay of Bengal through the various estuaries (Mogalekar et al. 2017). Comprehensive studies on the distribution and diversity of fishes in the Tamiraparani river system especially from upstream to estuarine section is lacking. In view of the paucity of such information, a study was done to investigate the distribution and diversity of fishes in the four different localities of Tamiraparani river system from Manimuthar to Punnakayal.

Tamiraparani river is a perennial river of southern Tamil Nadu and has been mentioned as the Porunai Nathi in Sanskrit literature. The river originates from the peak of Pertiapothigai hills above Papanasam along the eastern slope of Western Ghats in the Tirunelveli district of Tamil Nadu. Tamiraparani river basin lies within 08° 82 and 09° 232 N latitude and 77° 092 and 77° 542 E longitude. It traverses to a length of 120 km through Tirunelveli district about 80 km including 24 km in Western Ghat hills and 40 km in Thoothukudi district and finally it confluences in Bay of Bengal at Ponnaikayal village of Thoothukudi district. The catchment area of Tamiraparani with tributaries is 4536 km2. As most of its catchment areas lie in the Western Ghats, river has benefit of both the monsoons, which make it perennial. The annual yield from the river basin is estimated at 48487 million cubic feet. Reservoirs constructed across the river basin are Papanasam, Servaral, Manimuthar, Gadana, Ramanadhi, Karuppanadhi, Gundar, Adavainimar and Vadakku Pachaiyar. It forms a delta in Punnakayal village of Thoothukudi district before out-falling into Gulf of Mannar along Bay of Bengal. The area of the delta is 140.93 km2 (Government of Tamil Nadu 2015).

MATERIALS AND METHODS

Fish sampling was done from June 2015 to May 2016 in four different habitats of Tamiraparani river system, viz. Manimuthar dam and its up-stream waters, Vannarapettai midstream, Srivaikundam dam and Punnakayal estuary in 500 m reach of study sites with the help of local fishermen as well as by survey team. Summary of study sites including location (Latitude, longitude and elevation), habitat, general feature, fishing depthand distance covered for sampling are given in Table 1. Species collection, identification, confirmation and preservation was carried out using available literature (Talwar and Kacker 1984, Talwar and Jhingran 1991, Jayaram 2010, Eschmeyer et al. 2016, Mogalekar 2017). The check list was prepared, fishes were categorized into food or ornamental based on the utilization,

Present address: 1Assistant Professor (mogalekar@wii.gov.in), College of Fisheries, Dr Rajendra Prasad Central Agricultural University, Muzaffarpur, Bihar.
and conservation status was assessed as per IUCN red list category (IUCN2016). Meteorologically, the whole study period was classified as south-west monsoon (June to September, 2015), post-monsoon (October to December, 2015), north-east monsoon (January to February, 2016) and pre-monsoon (March to May, 2016) (Government of Tamil Nadu, 2015). Total numbers of fishes were recorded on monthly basis from the four sampling stations. Seasonal species abundance data was calculated by taking average value of monthly fish abundance data. Seasonal species abundance data used as input data for the calculation of biodiversity indices such as Shannon Wiener species diversity ($H'$), Margalef’s species richness ($d$), Pielou’s species evenness ($J'$), taxonomic diversity ($\Delta$), variation in taxonomic distinctness ($\Lambda^+$) by using PRIMER V6 (Plymouth Routine in Multivariate Ecological Research) software.

RESULTS AND DISCUSSION

Systematic classification of fishes recorded in the Tamiraparani river system with note on human use and conservation status are given in Table 2. The recorded 125 species belong to 13 orders, 44 families and 73 genera. Seventy two species were recorded from freshwater habitat of river and remaining 53 species were from estuarine habitat. In total 66 species of fishes belonging to 7 orders, 15 families and 32 genera from midstream of Tamiraparani river at Vannarapettai, 63 species of fishes belonging to 6 order, 15 families and 32 genera from upstream of Tamiraparani river in and around Manimuthar Dam, 58 species belonging to 8 orders, 19 families and 33 genera from Srivaikundam dam and 53 species belonging to 10 orders, 31 families and 39 genera from Punnakayal Estuary. The top three orders with diverse species composition were Cypriniformes (43 species, 19 genera and 4 families), Perciformes (36 species, 23 genera and 17 families) and Siluriformes (19 species, 8 genera and 6 families). The most diverse family was the Cyprinidae with 39 species and 16 genera, followed by Bagridae with 6 species and 1 genera, and Carangidae with 5 species and 3 genera (Table 2).

Study on fish diversity of Tamiraparani river system is the first of its kind and revealed presence of 125 species contributing about 86.80% of total freshwater fish diversity (Devi and Indra 2000) and about 80.12% of freshwater ornamental fish diversity published from Tamil Nadu (Mogalekar and Jawahar 2015). The number of fishes observed in Tamiraparani river system was greater than that given in earlier reports from Tamil Nadu by Devi et al. (2007), Johnson and Arunachalam (2009), Ramanujam et al. (2014) which might be attributed to limited study areas. All the above reports agreed with dominance of cyprinids over other freshwater fish families. The fishes recorded in the present study were lesser than a recent report by Mogalekar and Jawahar (2015) from Tamil Nadu. Present record of 53 fish species from Punnakayal estuary is lesser than earlier reports from estuaries of Tamil Nadu by Ramanujam and Anbarasan (2008), Ramanujam et al. (2014), Bharadhirajan et al. (2015), Khan (2015), Pavinkumar et al. (2015). Due to non-availability of literature on fish diversity Tamiraparani river effective comparison in rate of decline in fish diversity is not possible but the present report would serve as baseline information for future fish diversity studies.

A list of fishes of Tamiraparani river system comprises of 80 species with food value, 32 species with ornamental value and 13 species could be used for both ornamental as well as food (Table 2). Among the species listed under

| Sampling site | Latitude and Longitude (Elevation) | Habitat | Description of sampling site, fishing depth, distance covered for sampling |
|---------------|-----------------------------------|---------|--------------------------------------------------------------------------------|
| Manimuttar (S1) | 8°37'09.10"– 8°38'40.96'N and 77°23'44.87"– 77°24'32.07'E (107 to 102 m) | Dam and Upstream-river | One of the major dam on Tamiraparani river in Tirunelveli district with total catchment area of 920 ha. The depth of the dam is about 110 feet and depth of fishing varied from 10–50 feet. |
| Vannarapettai (S2) | 8°43'44.94"– 8°44'00.27'N and 77°42'56.11"– 77°43'01.52'E (34 to 32 m) | Midstream-river | Major fish landing centre on the Tamiraparani river in Tirunelveli. The depth of fishing ranged from 15–30 feet. |
| Srivaikundam (S3) | 8°37'49.30"– 8°37'35.49'N and 77°54'29.95"– 77°54'38.83'E (19 to 13 m) | Dam and Midstream-river | Major fish landing centre on the Tamiraparani river system in Thoothukudi district. Depth of the fishing varied from 5–20 feet. |
| Punnakayal (S4) | 8°37'41.63"– 8°37'40.66'N and 78°07'07.93"– 78°07'23.03'E (0 m) | Downstream estuary | The river Tamiraparani drains into Punnakayal estuary in Thoothukudi district. The estuary is characterised by muddy flats and mangrove forests. Depth of fishing was 5–15 Feet. |
Table 2. Fish diversity of Tamiraparani river system with note on human use and conservation status

| Taxa                                      | Distribution | Human Use | IUCN Status |
|-------------------------------------------|--------------|-----------|-------------|
| **Order: Anguilliformes**                 |              |           |             |
| Family: Anguillidae                       |              |           |             |
| *Anguilla bengalensis* (Gray, 1831)       | S1, S2, S3   | Food      | NT          |
| *Anguilla bicolor* McClelland, 1844       | S3, S4       | Food      | NT          |
| **Family: Congridae**                     |              |           |             |
| *Conger cinereus* Rüppell, 1830           | S4           | Food      | NE          |
| **Order: Beloniformes**                   |              |           |             |
| Family: Adrianichthyidae                  |              |           |             |
| *Oryzias dancena* (Hamilton, 1822)        | S2, S3       | Ornamental| LC          |
| **Family: Belonidae**                     |              |           |             |
| *Xenentodon cancila* (Hamilton, 1822)     | S2, S3       | Ornamental, Food | LC |
| *Strongylopterus aurita* (van Hasselt, 1823) | S4         | Ornamental, Food | LC |
| *Tylorhina crocodilus* (Pérorn and Lesueur, 1821) | S4         | Food      | NE          |
| **Family: Hemiramphidae**                 |              |           |             |
| *Hyphrophampus limbatus* (Valenciennes, 1847) | S2, S3     | Food      | LC          |
| *Hemirhamphus marginatus* (Forsskål, 1775) | S4           | Food      | NE          |
| **Order: Clupeiformes**                   |              |           |             |
| Family: Clupeidae                         |              |           |             |
| *Ehirava fluviatilis* Deraniyagala, 1929  | S3, S4       | Food      | NE          |
| *Nematalosa nasus* (Bloch, 1795)          | S4           | Food      | LC          |
| *Tenuola ishia* (Hamilton, 1822)          | S4           | Food      | LC          |
| **Family: Engraulidae**                   |              |           |             |
| *Stolephorus commersonii* Lacepêde, 1803  | S4           | Food      | NE          |
| *Stolephorus indicus* (van Hasselt, 1823) | S4           | Food      | NE          |
| **Order: Cypriniformes**                  |              |           |             |
| Family: Balitoridae                       |              |           |             |
| *Bhavana australis* (Jerdon, 1849)        | S1, S2       | Ornamental| LC          |
| **Family: Cobitidae**                     |              |           |             |
| *Lepidocephalichthys guntelae* (Hamilton, 1822) | S1, S2, S3 | Ornamental| LC          |
| *Lepidocephalichthys thermalis* (Valenciennes, 1846) | S1, S2, S3 | Ornamental| LC          |
| **Family: Nemacheilidae**                 |              |           |             |
| *Nemacheilus triangularis* Day, 1865      | S1, S2       | Ornamental| LC          |
| **Family: Cyprinidae**                    |              |           |             |
| *Amblypharyngodon microlepis* (Bleeker, 1853) | S2, S3      | Ornamental| LC          |
| *Cirrhinus cirrhosis* (Bloch, 1795)       | S1, S2, S3   | Food      | VU          |
| *Cirrhinus macrops* Steindacher, 1870     | S1, S2, S3   | Food      | NE          |
| *Cirrhinus irigal* (Hamilton, 1822)       | S1, S2, S3   | Food      | LC          |
| *Ctenopharyngodon idella* (Valenciennes, 1844) | S1, S2, S3 | Food      | NE          |
| *Ctenopharyngodon limnaeus* (1758)         | S1, S2, S3   | Food      | VU          |
| *Dawkinsia arulius* (Jerdon, 1849)        | S1, S2       | Ornamental| EN          |
| *Dawkinsia filamentos* (Valenciennes, 1844) | S1, S2      | Ornamental| LC          |
| *Dawkinsia tanakparnei* (Silas, 1954)     | S1, S2       | Ornamental| EN          |
| *Dawkinsia rohani* (Rema Devi, Indra and Knight, 2010) | S1, S2      | Ornamental| VU          |
| *Devario aequipinnatus* (McClelland, 1839) | S1, S2, S3  | Ornamental| LC          |
| *Devario malabaricus* (Jerdon, 1849)      | S1, S2       | Ornamental| LC          |
| *Esomus danricus* (Hamilton, 1822)        | S1           | Ornamental| LC          |
| *Garra mullya* (Sykes, 1839)              | S1           | Ornamental| LC          |
| *Garra kalakadensis* Rema Devi, 1993      | S1           | Ornamental| EN          |
| *Catla catla* (Hamilton, 1822)            | S1, S2, S3   | Food      | LC          |
| *Hypselobarbus curmaca* (Hamilton, 1807)  | S1           | Food      | EN          |
| *Hypselobarbus dobsoni* (Day, 1876)       | S1           | Food      | DD          |
| *Hypselobarbus dubius* (Day, 1867)        | S1           | Food      | EN          |
| *Hypselobarbus kolus* (Sykes, 1839)       | S1           | Food      | VU          |
| *Labeo calbasu* (Hamilton, 1822)          | S1, S2, S3   | Food      | LC          |
| *Labeo dyschelius* (McClelland, 1839)     | S1, S2, S3   | Food      | LC          |
| *Labeo fimbriatus* (Bloch, 1795)          | S1, S2, S3   | Food      | LC          |
| *Labeo kontus* (Jerdon, 1849)             | S1, S2, S3   | Food      | LC          |
| *Labeo pangusia* (Hamilton, 1822)         | S1, S2, S3   | Food      | NT          |
(Table 2. Contd...)

| Taxa                        | Distribution | Human Use | IUCN Status |
|-----------------------------|--------------|-----------|-------------|
| *Labeo rohita* (Hamilton, 1822) | S1, S2, S3 | Food      | LC          |
| *Pethia ticto* (Hamilton, 1822) | S1, S2, S3 | Ornamental | LC          |
| *Puntius sophore* (Hamilton, 1822) | S2, S3 | Ornamental | LC          |
| *Puntius amphibius* (Valenciennes, 1842) | S2, S3 | Ornamental | DD          |
| *Puntius himaculatus* (Bleeker, 1863) | S2, S3 | Ornamental | LC          |
| *Puntius chola* (Hamilton, 1822) | S2, S3 | Ornamental | LC          |
| *Puntius dorais* (Jerdon, 1849) | S1, S2, S3 | Ornamental | LC          |
| *Puntius melanostigma* (Day, 1878) | S1 | Ornamental | NE          |
| *Puntius vittatus* Day, 1865 | S1, S2, S3 | Ornamental | LC          |
| *Rasbora daniconius* (Hamilton, 1822) | S1, S2 | Ornamental | LC          |
| *Rasbora dandia* (Valenciennes, 1844) | S1 | Ornamental | NE          |
| *Salmostomabacaila* (Hamilton, 1822) | S2, S3 | Ornamental, Food | LC |
| *Salmophasis antrahi* (Day, 1869) | S2, S3 | Ornamental, Food | LC |
| *Systomus sarana* (Hamilton, 1822) | S1, S2, S3 | Ornamental, Food | LC |

**Order: Cyprinodontiformes**

- **Family: Aplocheilidae**
  - *Aplocheilus lineatus* (Valenciennes, 1846) S1, S2, S3 Ornamental | LC |
  - *Aplocheilus parvus* (Sundara Raj, 1916) S1, S2, S3 Ornamental | NE |

- **Family: Poeciliidae**

**Order: Elopiformes**

- **Family: Elopidae**
  - *Elos machnata* (Forsskål, 1775) S4 | Food | LC |

**Order: Gonorynchiformes**

- **Family: Chanidae**
  - *Chanos chanos* (Forsskål, 1775) S4 | Food | NE |

**Order: Mugiliformes**

- **Family: Mugilidae**
  - *Chelon parsia* (Hamilton, 1822) S4 | Food | NE |
  - *Mugil cephalus* Linnaeus, 1758 S4 | Food | LC |

**Order: Perciformes**

- **Family: Acanthuridae**
  - *Acanthus mata* (Cuvier, 1829) S4 | Food | LC |

- **Family: Ambassidae**
  - *Chanda nama* Hamilton, 1822 S2, S3, S4 | Food | LC |
  - *Parambassis ranga* (Hamilton, 1822) S2, S3, S4 | Food | LC |

- **Family: Anabantidae**
  - *Anabas testudineus* (Bloch, 1792) S2, S3 | Food | LC |

- **Family: Carangidae**
  - *Carangoides ferdau* (Forsskål, 1775) S4 | Food | NE |
  - *Caranx ignobilis* (Forsskål, 1775) S4 | Food | NE |
  - *Caranx sexfasciatus* Quoy and Gaimard, 1825 S4 | Food | LC |
  - *Scomberoides tol* (Cuvier, 1832) S4 | Food | NE |
  - *Scomberoides commersonnianus* Lacepède, 1801 S4 | Food | NE |

- **Family: Channidae**
  - *Channa orientalis* Bloch and Schneider, 1801 S2, S3 | Food | NE |
  - *Channa punctata* (Bloch, 1793) S1, S2, S3, S4 | Food | LC |
  - *Channa striata* (Bloch, 1793) S1, S2, S3 | Food | LC |

- **Family: Cichilidae**
  - *Etoplus maculatus* (Bloch, 1795) S1, S2, S3, S4 | Ornamental, Food | LC |
  - *Etoplus suratensis* (Bloch, 1790) S1, S2, S3, S4 | Ornamental, Food | LC |
  - *Oreochromis mossambicus* (Peters, 1852) S1, S2, S3, S4 | Food | NT |
  - *Oreochromis niloticus* (Linnaeus, 1758) S1, S2, S3 | Food | NE |

- **Family: Gerreidae**
  - *Gerres filamentosus* Cuvier, 1829 S4 | Food | LC |
  - *Gerres setifer* (Hamilton, 1822) S4 | Food | NE |

- **Family: Gobiidae**
  - *Glossogobius giuris* (Hamilton, 1822) S1, S2, S3 | Ornamental, Food | LC |
| Taxa | Distribution | Human Use | IUCN Status |
|------|--------------|-----------|-------------|
| *Acentrogobius ennorensis* Menon and Rema Devi, 1980 | S4 | Food | NE |
| Family: Leiognathidae | | | |
| *Leiognathus brevirostris* (Valenciennes, 1835) | S4 | Food | NE |
| *Secutor insidiator* (Bloch, 1787) | S4 | Food | NE |
| Family: Lutjanidae | | | |
| *Lutjanus argentimaculatus* (Forsskål, 1775) | S4 | Food | NE |
| *Lutjanus johnii* (Bloch, 1792) | S4 | Food | NE |
| Family: Mullidae | | | |
| *Upeneus moluccensis* (Bleeker, 1855) | S4 | Food | NE |
| Family: Osphronemidae | | | |
| *Pseudosphromenus cupanus* (Cuvier, 1831) | S2 | Ornamental | LC |
| Family: Scatophagidae | | | |
| *Scatophagus argus* (Linnaeus, 1766) | S4 | Food | LC |
| Family: Serranidae | | | |
| *Epinephelus diacanthus* (Valenciennes, 1828) | S4 | Food | NT |
| *Epinephelus malabaricus* (Bloch and Schneider, 1801) | S4 | Food | NT |
| Family: Sillaginidae | | | |
| *Silago sihama* (Forsskål, 1775) | S4 | Food | NE |
| *Silago vincenti* McKay, 1980 | S4 | Food | NE |
| Family: Siganidae | | | |
| *Siganus canalicus* (Park, 1797) | S4 | Food | NE |
| *Siganus javus* (Linnaeus, 1766) | S4 | Food | NE |
| *Siganus lineatus* (Valenciennes, 1835) | S4 | Food | NE |
| Family: Teraponidae | | | |
| *Terapon jarbua* (Forsskål, 1775) | S4 | Food | LC |
| *Terapon puta* Cuvier, 1829 | S4 | Food | NE |
| Order: Pleuronectiformes | | | |
| Family: Cynoglossidae | | | |
| *Cynoglossus arel* (Bloch and Schneider, 1801) | S4 | Food | NE |
| Family: Soleidae | | | |
| *Brachirus orientalis* (Bloch and Schneider, 1801) | S4 | Food | NE |
| Order: Siluriformes | | | |
| Family: Ariidae | | | |
| *Arius arius* (Hamilton, 1822) | S4 | Food | LC |
| *Arius jella* Day, 1877 | S4 | Food | NE |
| *Arius maculatus* (Thunberg, 1792) | S4 | Food | NE |
| *Arius subrostratus* Valenciennes, 1840 | S4 | Food | NE |
| Family: Bagridae | | | |
| *Mystus bleekeri* (Day, 1877) | S1, S2, S3 | Food | LC |
| *Mystus caucavius* (Hamilton, 1822) | S1, S2, S3 | Food | LC |
| *Mystus gulio* (Hamilton, 1822) | S1, S2, S3, S4 | Food | LC |
| *Mystus malabaricus* (Jerdon, 1849) | Ornamental | NT |
| *Mystus oculatus* (Valenciennes, 1840) | S1, S2, S3 | Food | LC |
| *Mystus vittatus* (Bloch, 1794) | S1, S2, S3 | Ornamental, Food | LC |
| Family: Claridae | | | |
| *Clarias batrachus* (Linnaeus, 1758) | S1, S2, S3, S4 | Food | LC |
| *Clarias gariepinus* (Burchell 1822) | S1, S2, S3 | Food | LC |
| Family: Heteropneustidae | | | |
| *Heteropneustes fossilis* (Bloch, 1794) | S1, S2, S3 | Food | LC |
| *Heteropneustes longipectoralis* Devi and Raghunathan, 1999 | S1 | Ornamental, Food | DD |
| Family: Schilbeidae | | | |
| *Neotropius atherinoides* (Bloch, 1794) | S1, S2 | Ornamental, Food | LC |
| Family: Siluridae | | | |
| *Ompok bimaculatus* (Bloch, 1794) | S1, S2, S3 | Food | NT |
| *Ompok malabaricus* (Valenciennes, 1840) | S1 | Food | LC |
| *Pterocryptis wynadensis* (Day, 1873) | S1 | Food | EN |
| *Wallago attu* (Bloch and Schneider, 1801) | S1, S2, S3 | Food | NT |
| Order: Synbranchiformes | | | |
| Family: Mastacembelidae | | | |
threatened category, 6 species are endangered while 4 species are vulnerable. There are 115 species under the non-threatened category, among which 9 are near threatened, whereas 64 species belonged to least concern category, 3 species were data deficient and 39 species have not been evaluated against IUCN criteria (Table 2).

Calculated values for various diversity indices presented in Table 3. The Shannon Wiener diversity index ($H'$) values were found to be on higher side and varied from 4.76 during north-east monsoon to 4.72 during pre-monsoon. The maximum value of Margalef richness index ($d$) was 21.89 also recorded during the north-east monsoon season. However the minimum value was 21.76 recorded during the post-monsoon season. The maximum value of Pielou’s evenness index ($J'$) was 0.9929 recorded during north-east monsoon and the minimum value of 0.9896 during pre-monsoon season. The taxonomic diversity index ($D$) calculated during the various seasons varied from 86.55 during south-west monsoon to 86.24 during pre-monsoon. Variation in taxonomic distinctness (Lambda+) was maximum (536) during north-east monsoon, while minimum value (508.9) observed during south-west monsoon.

According to calculated values of Shannon Wiener diversity index and Margalef richness index ecological status of fishes in Tamiraparani river system was rich. Calculated values for Pielou’s evenness index were observed on higher side. Thus, it could be inferred that the species evenness is high which might be due to representation of individual species in evenly nature and not dominated by individual species. Higher values of taxonomic diversity index suggest that, the species in the assemblage were distantly related. In the absence of literature on fish diversity indices in Tamiraparani River system effective comparison of diversity indices estimates could not possible.

The fish fauna of Tamiraparani river system is highly diverse and setting up of a local level management body is vital for the conservation and proper management of the fish biodiversity.

ACKNOWLEDGEMENT

The author is grateful to the Authorities of Fisheries College and Research Institute, Tamil Nadu Fisheries University, Thoothukudi, Tamil Nadu, for Tamil Nadu Merit Scholarship and facilities provided during the course of study.

REFERENCES

Bharadhirajan P, Murugan S, Gopalakershan A and Murugesan P. 2015. Finfish diversity in Coleroon estuary, Southeast coast of India. *Indian Journal of Geo-Marine Sciences* 44(1): 104–109.

De DK. 2011. Estuarine Fisheries, pp 208–237. *Handbook of Fisheries and Aquaculture*, 2nd edn. (Eds) Ayyappan A, Moza U, Gopalkrishnan A, Meenakumari B, Jena JK and Pandey AK. ICAR, New Delhi.

Devi KR and Indra TJ. 2000. Freshwater ichthyofaunal resources of Tamil Nadu, pp 77–97. *Endemic Fish Diversity of Western Ghats*. (Eds) Ponniah AG and Gopalakrishnan A. NBFRG – NATP Publication. National Bureau of Fish Genetic Resources, Lucknow, U.P., India.

Devi KR, Indra TJ and Raghunathan MB. 2007. Ichthyofauna of Indira Gandhi Wildlife Sanctuary, Tamil Nadu. *Records of the Zoological Survey of India* 277: 1–42.

Eskmeyer W N, Fricke R and van der Laan R (Eds). 2016. *Catalog of fishes: genera, species, references*. Retrieved from http://researcharchive.calacademy.org/research/ichthyology/catalog/fishcatmain.asp, Accessed from 19–28 May 2016.

Government of Tamil Nadu. 2015. Study for formation of flood carrier canal from Kannadian channel to drought prone areas of Sathankulam, Thisayanvilai by interlinking Tamiraparani, Karuneniyar and Nambiyar Rivers in Tirunelveli and

(Continued...)

| Taxa | Distribution | Human Use | IUCN Status |
|------|--------------|-----------|--------------|
| Macrognathus aral (Bloch and Schneider, 1801) | S1, S2, S3 | Ornamental, Food | LC |
| Mastacembelus armatus (Lacepède, 1800) | S1, S2, S3 | Ornamental, Food | LC |
| Triacanthus biaculeatus (Bloch, 1786) | S4 | Ornamental | NE |
| Arothron leopardus (Day, 1878) | S4 | Ornamental | NE |

S1, Manimutthar dam and its up-stream waters; S2, Vannarapettai; S3, Srivaikundam; S4, Punnakayal estuary. EN, Endangered; VU, Vulnerable; NT, Near threatened; LC, Least Concern; DD, Data Deficient; NE, Not Evaluated.

Table 3. Diversity indices of finfishes in Tamiraparani river system recorded during different seasons.

| Index/Season | South-west monsoon | North-east monsoon | Post monsoon | Pre monsoon |
|--------------|---------------------|-------------------|-------------|------------|
| $S$ | 118 | 121 | 118 | 118 |
| $N$ | 212 | 240 | 216 | 215 |
| $H'(\log_e)$ | 4.733 | 4.762 | 4.731 | 4.721 |
| $d$ | 21.84 | 21.89 | 21.76 | 21.79 |
| $J'$ | 0.9921 | 0.9929 | 0.9918 | 0.9896 |
| Delta | 86.55 | 86.47 | 86.39 | 86.24 |
| Lambda+ | 508.9 | 536 | 531.8 | 531.6 |

$S$, Number of species; $N$, Number of individuals; $H'(\log_e)$, Shannon Wiener species diversity; $d$, Margalef species richness; $J'$, Pielou’s species evenness; Delta, Taxonomic diversity; Lambda+, Variation in taxonomic distinctness.
Thoothukudi Districts, Tamil Nadu. Comprehensive Environmental Impact Assessment Report, Water Resources Organisation, Public Works Department. WAPCOS Limited. Vol. I, 516 pp.

Government of Tamil Nadu. 2015. Fisheries Department, Inland Fisheries. Retrieved from http://www.fisheries.tn.gov.in/Inland-main.html, Assessed on 25 October 2015.

IUCN. 2016. The IUCN Red List of Threatened Species. V2015.2. IUCN, Gland, Switzerland and Cambridge, UK. http://www.iucnredlist.org.

Jayaram K C. 2010. *The Freshwater Fishes of the Indian Region*. 2nd edn. Narendra Publishing House, Delhi. 616 pp.

Johnson J A and Arunachalam M. 2009. Diversity, distribution and assemblage structure of fishes in streams of southern Western Ghats, India. *Journal of Threatened Taxa* 1(10): 507–13.

Khan AS. 2015. Variations in the diversity of commercially important finfishes in Vellar Estuary, south-east coast of India. *Indian Journal of Fisheries* 62(4): 116–19.

Mogalekar H S. 2017. ‘Fish diversity of selected reservoirs of southern Tamil Nadu’. Ph.D. Thesis, Tamil Nadu Fisheries University, Nagapattinam, Tamil Nadu. 196 pp.

Mogalekar H S, Canciyal J, Jawahar P, Patadiya D S, Sudhan C, Pavinkumar P, Prateek, Santoshkumar S and Subburaj A. 2017. Estuarine fish diversity of Tamil Nadu, India. *Indian Journal of Geo Marine Sciences* 46(10): 1968–85.

Mogalekar H Sand Jawahar P. 2015. Freshwater ornamental fish diversity of Tamil Nadu. *Journal of the Inland Fisheries Society of India* 47(2): 27–37.

Pavinkumar P, Jawahar P and Mogalekar HS. 2015. Estuarine fish diversity of Manakudy estuary, Kanyakumari district, Tamil Nadu, India. *Journal of Environment and Bio-Sciences* 29(2): 523–28.

Qayoom U, Pawar R A, Mohite S A, Sawant M S, Nirmale V H, Pawar S P, Goswami M and Lakra W S. 2018. DNA barcoding of some commonly exploited fishes from the northern Western Ghats, India. *Indian Journal of Animal Sciences* 88(2): 245–50.

Ramanujam M E and Anbarasan R. 2008. A preliminary report on the ichthyofauna of Yedayanthittu Estuary (Tamil Nadu, India) and rivulets draining into it. *Journal of Threatened Taxa* 1(5): 287–94.

Ramanujam M E, Devi K R and Indra T J. 2014. Ichthyofaunal diversity of the Adyar Wetland complex, Chennai, Tamil Nadu, southern India. *Journal of Threatened Taxa* 6(4): 5613–35.

Talwar P K and Jhingran A G. 1991. *Inland Fishes of India and Adjacent Countries*. Vol 1 and 2, 1158 pp. Oxford and IBH Publishing Co, New Delhi.

Talwar P K and Kacker R K. 1984. *Commercial Sea Fishes of India*, 997 pp. Zoological Survey of India, Calcutta.