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Ichthyological survey of the checklist of fauna in Stanley Reservoir, Tamil Nadu, South India- Diversity, Distribution, Threats and conservation action

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ABSTRACT

Ichthyological survey was made in 40 Km radius of upstream and downstream areas of Stanley Reservoir, Tamil Nadu (Southern India), covering 17 sampling stations during January to December, 2013. The survey revealed the presence of seventy (71) species of fishes belonging to eight (8) orders, twenty (21) families and forty eight (48) genera. Among them, two species are critically endangered, six species are endangered, six species are near threatened, three species are vulnerable, fifty two species are least concerned, one species is in the data deficient category and one species is in the not assessed categories. The highest species diversity was found out in Mettur and lowest species diversity was recorded in Palar stream. The anthropogenic/ developmental stressors including water barrages and other impoundments, industrial pollution, destructive fishing practices are threatening the rich Ichthyological diversity and endemism in the Stanley reservoir. Hence there is an urgent need to develop and implement

conservation plans, some of which are discussed.

Key Words: Stanley Reservoir, Western Ghats, biodiversity status, improper fishing, conservation.

1. INTRODUCTION

Complete information on the distribution pattern and diversity of species is sine quo non for taking appropriate and timely decision for biodiversity conservation strategies. Collection, collation and dissemination of such information is especially important for poorly known yet threatened taxa like freshwater fish, and for critical biodiversity areas such as 'Hotspots'. The Western Ghats reported/ considered to be as part of the Western Ghats - Sri Lanka Biodiversity Hotspot in peninsular India is an exceptional region of freshwater biodiversity (Dahanukar et al., 2011). Fish constitutes almost half of the total number of vertebrates in the world and India is one of the mega biodiversity countries of the World (Mittermeier and Mittermeier, 1997). The identification of areas with high species diversity is an essential component for protecting biodiversity (Allan and Flecker, 1993). The Western Ghats streams exhibit high variability in fish diversity and the assemblage structure is determined by specific ecological conditions (Arunachalam et al., 1999, 2000, 2005). Reservoirs can provide significant contributions to global fisheries (Miranda, 1999), but the effectiveness of their contributions depends largely on adequate fish assemblages and proper management of the reservoir fisheries.

The Cauvery is one of the perennial rivers of Tamil Nadu, flowing from west to east with a number of distributaries and tributaries before it confluence into the Bay of Bengal. The river flows with three minor tributaries: Palar, Chinnar and Thoppar enter as Cauvery above Stanley Reservoir in Mettur, where the dam has been constructed (Hora, 1941). The Stanley Reservoir (Mettur Dam), one of the largest masonry dams of the world, is 5,300 ft long, 214 ft high at the deepest portion of the river and 171 ft broad tapering to 2.5 ft at the top contains 54.6 million cubic ft, or 3,640,000 tons of masonry, and cost Rs. 480 lakhs to build. The reservoir formed by the dam is a lake of 60 sq. miles, impounding 95,660 mile cubic feet of water at its maximum level, which is 796 feet above mean sea level (Hora 1941; Sreenivasan, 1966; Dhevakrishnan and Hussain 2012). Some information related to distribution and diversity of fishes from the Cauvery River is available (Jerdon, 1848; Bhimachar and Rao, 1941; Rajan, 1955). Anticipating fish population structural changes due to dam construction some men surveys were already taken for fisheries development (Hora, 1941). A study was conducted to study the importance of freshwater resources in inland fishery involved tropical impoundments, hydrobiological features of fish production in Stanley reservoir (Sreenivasan, 1966). Jayaram et al., (1982) carried out a detailed survey of Cauvery river system and published major account on fish fauna. The inventory of the fish diversity in and around of Grant Anicut area was published by Balasundaram et al., (1999).

The Cauvery River has been recognized as a very important area for fish fauna and the perusal of available literature reveals only limited information on piscine biodiversity is available in Stanley reservoir. Most checklists of fishes from this region are not supported by voucher specimens, photographs and/or taxonomic notes and are mere compilations of secondary information from some of the earlier 'dated' papers/checklists. Therefore, the aim of this study was to survey the ichthyofauna of Stanley reservoirs in the midreach of Cauvery river basin and to list out the checklist (backed by voucher specimens) of freshwater ichthyofauna was provided, and also expected to contribute to the knowledge about the species distribution, threats and conservation which can be useful for better management and conservation of the fish fauna of the Stanley reservoir.

2. MATERIALS AND METHODS

The fish survey and collections were made in and around (40 Km, radius) the Stanley Reservoir in Mettur. The sampling was done in 17 sites of above and below the Stanley reservoir (Figure 1) *viz*: Hogenakkal (S1), Palar (S2), Chettipatti (S3), Pullavadi (S4), Kolathur (S5), Sumilapalayam (S6), Uttanur (S7), Kattur (S8), Kunandyar (S9), Kirakaranur (S10), Pammutinagram (S11), Mettur (S12), Chekkanur Barrage (S13), Nerinchipettai Barrage (S14), Kuthiraikkalmedu Barrage (S15), Uratchikottai Barrage (S16), and Karuppanaickenpalayam (S17).

Fishes were collected with the help of gill nets, cast nets and drag nets from Jan. to Dec. 2013. The sampling was made in 100-200 m stretches of each site. Local fisherman was involved in netting and collection. 17 sampling sites were chosen in the survey area based on habitat types, water quality and depth. All the essential data like place of collection, date, habitat characters, number of fish sampled, colour and markings of the body was recorded. Five to

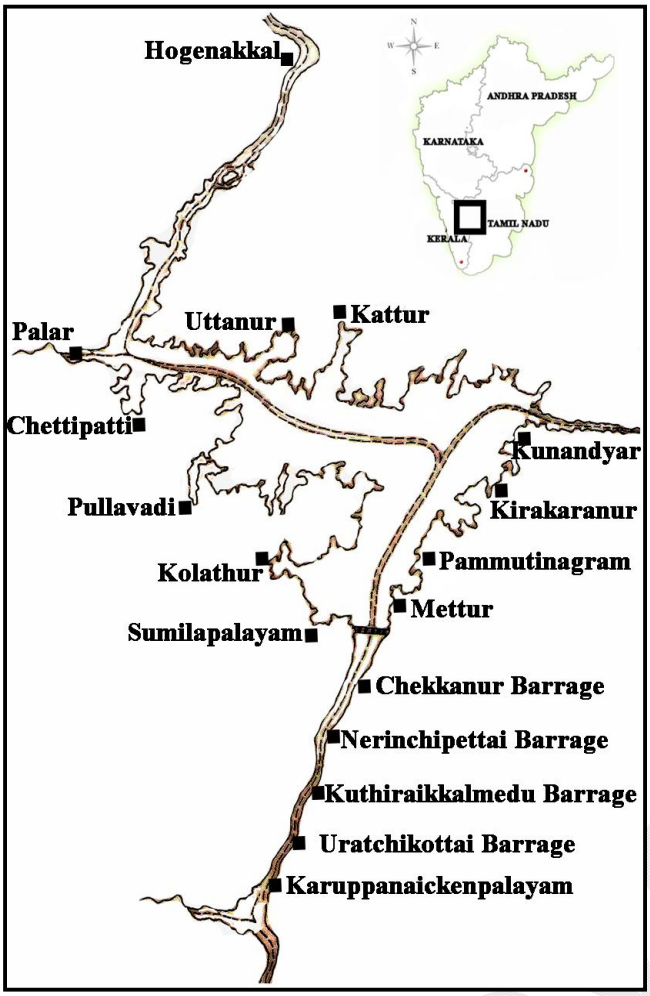

Figure 1

Showing the locations/ study sites of upstream and downstream areas of Stanley Reservoir, Tamil Nadu

ten specimens of each species were taken for identification while the rest were released back into the water. The additional species were purchased from the fishermen who used to fish on the riverside. The specimens were lively photographed with Canon 1100 Digital SLR camera and preserved in 7% formalin solution. The large sized fishes were injected with 7% formalin solution to prevent the decay of visceral organs. The collected specimens were transported to Department of Biotechnology Cum Laboratory museum of the Periyar University Museum of Natural History (PUMNH- a newly started one in the year, 2013), Salem, Tamil Nadu, India and assigned the specimen catalogue numbers. The species identification and confirmation were carried out using available literature (Talwar and Jhingran, 1991; Jayaram, 2010). Morphometric measurements and meristic counts for taxonomic identifications generally follows Hubbs and Lagler (1964). The species valid nomenclatural names were adopted as per the Catalogue of Fishes of the California Academy of Sciences (Eschmeyer and Fricke, 2011; Pethiyagoda et al., 2012) and fish status was checked in IUCN red list (IUCN, 2013).

3. RESULTS

The details of fish species recorded from the present study sites are given in Table 1. The present survey of Stanley reservoir revealed the presence of seventy (71) fish species (Figure 2) belonging to eight (8) orders, twenty (21) families and fourty eight (48) genera. Among those only one species of Osteoglossiformes, *Notopterus notopterus* was recorded and they have body and head scaled; body strongly compressed; abdomen not keeled and non serrated; caudal region tapering and very long; maxillaries and parasphenoid well toothed forming the greater part of the upper jaw; maxilla and pre-maxilla firmly bound together and have restricted mobility; teeth on premaxillaries vomer, palatines and tongue; no pharyngeal teeth, paired gill membrane partly united; dorsal, pectoral and pelvic fins present; barbels absent and no adipose fin; anal fin long, confluent with small caudal fin and this is an economically important food fish. Followed by one species of Anguliformes, *Anguilla bengalensis* was recorded with elongated body, smooth, with minute or rudimentary scales embedded in skin; margin of upper jaw made up anteriorly of premaxillaries; maxillaries with teeth; gill opening narrow and wide slits; teeth present on jaws and palate; pectoral fin laterally inserted, pelvic fin absent, anal fin elongate.

Cypriniformes dominates the catch list with forty two (40) species belonging to three (3) families; twenty four (25) genera and they have protractile and toothless mouth; the oral portions may contain barbels; dorsal fins composed of soft branched rays but anterior ray unbranched and last simple ray often ossified into a spine which may bear weak or strong serrations; head without scales and body was covered with cycloid scales; lateral lines are complete or incomplete. Followed by twelve (12) species of Siluriformes belonging to four (4) families; eight (8) genera they have skin naked or with bony scutes or plates; never with true scales; mouth non protractile; superiorly bordered by pre-maxillaries and dentaries which are generally toothed; serving as basses of maxillary barbels; nearly four pairs of barbells varying in length; adipose fin smooth; long or short may be reduced or absent; pharyngeal bones with small conical or villiform teeth. Among these species *Mystus punctatus*, *Silonia childreni are* in endangered status; *Mystus armatus*, *Ompok bimaculatus* and *Wallago attu* are in the threatened status. By virtue of its size and flavour of *Ompok bimaculatus* and *Wallago attu* is locally preferred and is widely consumed. During the last 20 years the wild populations of these species has suffered a steady decline of over 50 percent mainly due to over exploitations, lost of habitat, pollution, siltation and destructive method like dynamite fishing (Mouler and Walker, 1998).

Two species of Mugiliformes *Xenentodon cancila* and *Hyporhamphus xanthopterus* belonging to two (2) genus and they have body oblong, elongate, compressed and depressed anteriorly to a little extent; head and body with scales; opercles with spine; very fine teeth; gill openings wide, gill rakers long, two dorsal fins short, widely separated, first with spines; anal fin slightly longer than second dorsal; pelvic fins sub abdominal with a spine and suspended

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Table 1

List of freshwater fish species in Stanley Reservoir, Mettur, Tamil Nadu (January to December, 2013)

Sl. No.	List of Fishes	Order	Family	Conservation Status (IUCN 2013)	Specimen key
01	*Notopterus notopterus* (Pallas, 1769)	Osteoglossiformes	Notopteridae	Least concern	PUMNH 01/ 2013
02	*Anguilla bengalensis* (Gray, 1831)	Anguliformes	Anguillidae	Least concern	PUMNH 02/ 2013
03	*Hypophthalmichthys molitrix* (Valenciennes, 1844)	Cypriniformes	Cyprinidae	Near Threatened	PUMNH 03/ 2013
04	*Salmophasia acinaces* (Valenciennes, 1844)	Cypriniformes	Cyprinidae	Least Concern	PUMNH 09/ 2013
05	*Salmophasia bacaila* (Hamilton, 1822)	Cypriniformes	Cyprinidae	Least Concern	PUMNH 08/ 2013
06	*Salmophasia boopis* (Day, 1874)	Cypriniformes	Cyprinidae	Least Concern	PUMNH 05/ 2013
07	*Barilius canarensis* (Jerdon,1849)	Cypriniformes	Cyprinidae	Endangered	PUMNH 30/ 2013
08	*Barilius gatensis* (Valenciennes, 1844)	Cypriniformes	Cyprinidae	Least Concern	PUMNH 31/ 2013
09	*Barilius bendelisis* (Hamilton, 1807)	Cypriniformes	Cyprinidae	Least Concern	PUMNH32 / 2013
10	*Labuca labuca* (Hamilton, 1822)	Cypriniformes	Cyprinidae	Not assessed	PUMNH 33/ 2013
11	*Devario aequipinnatus* (McClelland,1839)	Cypriniformes	Cyprinidae	Least Concern	PUMNH 04/ 2013
12	*Rasbora cauverii* (Jerdon, 1849)	Cypriniformes	Cyprinidae	Least Concern	PUMNH 34/ 2013
13	*Amblypharyngodon melettinus* (Valenciennes, 1844)	Cypriniformes	Cyprinidae	Least Concern	PUMNH 27/ 2013
14	*Amblypharyngodon mola* (Hamilton, 1822)	Cypriniformes	Cyprinidae	Least Concern	PUMNH 28/ 2013
15	*Cyprinus carpio* Linnaeus, 1758	Cypriniformes	Cyprinidae	Vulnerable	PUMNH 29/ 2013
16	*Tor khudree* (Sykes, 1839)	Cypriniformes	Cyprinidae	Endangered	PUMNH 47/ 2013
17	*Neolissocheilus hexagonolepis* (McClelland, 1839)	Cypriniformes	Cyprinidae	Near Threatened	PUMNH 48/ 2013
18	*Neolissochilus bovanicus* (Day, 1877)	Cypriniformes	Cyprinidae	Critically Endangered	PUMNH 10/ 2013
19	*Systomus sarana* (Hamilton, 1822)	Cypriniformes	Cyprinidae	Least Concern	PUMNH 49/ 2013
20	*Dawkinsia filamentosa* (Valenciennes, 1844)	Cypriniformes	Cyprinidae	Least Concern	PUMNH 50/ 2013
21	*Puntius chola* (Hamilton, 1822)	Cypriniformes	Cyprinidae	Least Concern	PUMNH 06/ 2013
22	*Puntius dorsalis* (Jerdon, 1849)	Cypriniformes	Cyprinidae	Least Concern	PUMNH 07/ 2013
23	*Puntius sophore* (Hamilton, 1822)	Cypriniformes	Cyprinidae	Least Concern	PUMNH 51/ 2013
24	*Pethia ticto* (Hamilton, 1822)	Cypriniformes	Cyprinidae	Least Concern	PUMNH 68/ 2013
25	*Pethia conchonius* (Hamilton, 1822)	Cypriniformes	Cyprinidae	Least Concern	PUMNH 69/ 2013
26	*Gonoproktopterus carnaticus* (Jerdon, 1849)	Cypriniformes	Cyprinidae	Least Concern	PUMNH 52/ 2013
27	*Gonoproktopterus dubius* (Day, 1867)	Cypriniformes	Cyprinidae	Endangered	PUMNH 53/ 2013
28	*Osteochilichthys nashii* (Day, 1868)	Cypriniformes	Cyprinidae	Least Concern	PUMNH 62/ 2013
29	*Kantaka brevidorsalis (*Day, 1873)	Cypriniformes	Cyprinidae	Least Concern	PUMNH 63/ 2013
30	*Cirrhinius chrrhosus* (Bloch, 1795)	Cypriniformes	Cyprinidae	Vulnerable	PUMNH 61/ 2013
31	*Gibelion catla* (Hamilton, 1822)	Cypriniformes	Cyprinidae	Least concern	PUMNH 60/ 2013
32	*Labeo fimbriatus* (Bloch, 1795)	Cypriniformes	Cyprinidae	Least concern	PUMNH 59/ 2013
33	*Labeo kontius* (Jerdon, 1849)	Cypriniformes	Cyprinidae	Least Concern	PUMNH 11/ 2013
34	*Laboe calbasu* (Hamilton, 1822)	Cypriniformes	Cyprinidae	Least concern	PUMNH 12/ 2013
35	*Labeo rohita* (Hamilton, 1822)	Cypriniformes	Cyprinidae	Least concern	PUMNH 14/ 2013
36	*Bangana ariza* **(**Hamilton, 1807)	Cypriniformes	Cyprinidae	Least concern	PUMNH 58/ 2013
37	*Schismatorhynchos nukta* (Sykes, 1839)	Cypriniformes	Cyprinidae	Endangered	PUMNH 13/ 2013
38	*Garra mullya* (Sykes, 1839)	Cypriniformes	Cyprinidae	Least concern	PUMNH 57/ 2013
39	*Garra gotyla stenorhynchus* (Jerdon, 1849)	Cypriniformes	Cyprinidae	Least concern	PUMNH 15/ 2013
40	*Garra mcClellandi* (Jerdon, 1849)	Cypriniformes	Cyprinidae	Least concern	PUMNH 56/ 2013
41	*Nemacheilus monilis* (Hora, 1921)	Cypriniformes	Balitoridae	Least Concern	PUMNH 55/ 2013
42	*Lepidocephalichthys thermalis* (Valenciennes, 1846)	Cypriniformes	Cobitidae	Least Concern	PUMNH 54/ 2013
43	*Sperata aor* (Hamilton, 1822)	Siluriformes	Bagridae	Least Concern	PUMNH 17/ 2013
44	*Sperata seenghala* (Sykes, 1839)	Siluriformes	Bagridae	Least Concern	PUMNH 16/ 2013
45	*Mystus punctatus* (Jerdon, 1849)	Siluriformes	Bagridae	Critically Endangered	PUMNH 19/ 2013
46	*Mystus armatus* (Day, 1865)	Siluriformes	Bagridae	Near Threatened	PUMNH 18/ 2013
47	*Mystus cavasius* (Hamilton, 1822)	Siluriformes	Bagridae	Least Concern	PUMNH 20/ 2013
48	*Mystus keletius* (Valenciennes, 1839)	Siluriformes	Bagridae	Least Concern	PUMNH 21/ 2013
49	*Ompok bimaculatus* (Bloch, 1794)	Siluriformes	Bagridae	Near Threatened	PUMNH 22/ 2013
50	*Wallago attu* (Bloch & Schneider, 1801)	Siluriformes	Bagridae	Near Threatened	PUMNH 24/ 2013
51	*Silonia childreni* (Sykes, 1839)	Siluriformes	Schilbidae	Endangered	PUMNH 23/ 2013
52	*Pangasius pangasius* (Hamilton, 1822)	Siluriformes	Pangasiidae	Least Concern	PUMNH 67/ 2013
53	*Clarias batrachus* (Linnaeus, 1758)	Siluriformes	Clariidae	Least Concern	PUMNH 25/ 2013
54	*Heteropneustes fossilis* (Bloch, 1794)	Siluriformes	Clariidae	Least Concern	PUMNH 64/ 2013

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55	*Xenentodon cancila* (Hamilton, 1822)	Mugiliformes	Belonidae	Least Concern	PUMNH 65/ 2013
56	*Hyporhamphus xanthopterus* (Valenciennes, 1847)	Mugiliformes	Hemiramphidae	Vulnerable	PUMNH 71/ 2013
57	*Aplocheilus lineatus* (Valenciennes, 1846)	Cyprinodontiformes	Cyprinodontidae	Least Concern	PUMNH 26/ 2013
58	*Gambusia affinis* (Baird and Girard, 1853)	Cyprinodontiformes	Poecilidae	Least Concern	PUMNH 66/ 2013
59	*Mastacembelus aramatus* (Lacepede, 1800)	Synbranchiformes	Mastacembelidae	Least Concern	PUMNH 38/ 2013
60	*Parambassis ranga* (Hamilton, 1822)	Perciformes	Centropomidae	Least Concern	PUMNH 39/ 2013
61	*Nandus nandus* (Hamilton, 1822)	Perciformes	Nandidae	Least Concern	PUMNH 70/ 2013
62	*Etroplus canarensis* (Day, 1877)	Perciformes	Cichlidae	Endangered	PUMNH 40/ 2013
63	*Etroplus maculatus* (Bloch, 1795)	Perciformes	Cichlidae	Least Concern	PUMNH 42/ 2013
64	*Etroplus suratensis* (Bloch, 1790)	Perciformes	Cichlidae	Least Concern	PUMNH 41/ 2013
65	*Oreochromis mossambicus* (Peters, 1852)	Perciformes	Cichlidae	Near Threatened	PUMNH 44/ 2013
66	*Glossogobius giuris* (Hamilton, 1822)	Perciformes	Gobiidae	Least Concern	PUMNH 43/ 2013
67	*Anabas testudineus* (Bloch, 1792)	Perciformes	Anabantidae	Data Deficient	PUMNH 45/ 2013
68	*Pseudosphromenus cupanus* (Cuvier, 1831)	Perciformes	Belontinae	Least Concern	PUMNH 37/ 2013
69	*Channa marulius* (Hamilton, 1822)	Perciformes	Channidae	Least Concern	PUMNH 36/ 2013
70	*Channa punctata* (Bloch, 1793)	Perciformes	Channidae	Least Concern	PUMNH 35/ 2013
71	*Channa striata* (Bloch, 1793)	Perciformes	Channidae	Least Concern	PUMNH 46/ 2013

Table 2

Fish distribution from 40 km radius of upstream/downstream areas of Stanley Reservoir, Mettur, Tamil Nadu '+' = Present; '-' = Absent

Sl. No.	List of freshwater fishes	Sampling areas																
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
01	*Notopterus notopterus* (Pallas, 1769)	+	-	+	+	-	+	+	-	+	+	+	+	-	+	+	+	-
02	*Anguilla bengalensis* (Gray, 1831)	+	-	-	-	+	-	-	+	-	-	-	+	+	+	-	+	-
03	*Hypophthalmichthys molitrix* (Valenciennes, 1844)	+	-	+	-	-	+	-	+	-	+	-	+	-	-	-	-	-
04	*Salmophasia acinaces* (Valenciennes, 1844)	-	+	-	-	+	-	+	+	-	-	-	+	-	-	+	-	+
05	*Salmophasia bacaila* (Hamilton, 1822)	+	-	-	+	-	+	+	-	-	+	+	+	+	+	+	-	-
06	*Salmophasia boopis* (Day, 1874)	+	+	+	-	-	+	-	+	+	+	+	+	-	-	+	-	-
07	*Barilius canarensis* (Jerdon,1849)	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
08	*Barilius gatensis* (Valenciennes, 1844)	+	+	+	-	+	-	-	+	+	+	+	+	-	+	+	-	-
09	*Barilius bendelisis* (Hamilton, 1807)	+	-	-	+	-	-	-	-	+	+	+	+	+	+	+	+	+
10	*Labuca labuca* (Hamilton, 1822)	-	-	-	+	-	+	-	-	-	-	-	+	-	-	+	-	+
11	*Devario aequipinnatus* (McClelland,1839)	+	-	-	+	+	+	+	+	+	+	+	+	-	+	-	+	+
12	*Rasbora cauverii* (Jerdon, 1849)	-	-	-	+	-	+	-	-	+	-	-	+	+	+	-	-	+
13	*Amblypharyngodon melettinus* (Valenciennes, 1844)	-	+	-	-	-	+	-	+	-	-	-	+	-	-	-	-	-
14	*Amblypharyngodon mola* (Hamilton, 1822)	+	-	+	-	+	-	+	+	+	+	+	+	+	-	+	-	+
15	*Cyprinus carpio* (Linnaeus, 1758)	-	+	+	-	+	-	-	-	+	-	-	+	+	-	-	+	-
16	*Tor khudree* (Sykes, 1839)	+	-	-	-	-	-	-	-	+	+	-	-	-	+	-	-	+
17	*Neolissocheilus hexagonolepis* (McClelland, 1839)	+	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-
18	*Neolissochilus bovanicus* (Day, 1877)	-	-	-	-	-	-	-	-	-	-	-	+	-	+	-	+	+
19	*Systomus sarana* (Hamilton, 1822)	+	-	-	+	+	+	-	-	+	+	+	+	+	+	+	+	+
20	*Dawkinsia filamentosa* (Valenciennes, 1844)	+	+	-	+	+	-	-	+	+	+	+	+	+	+	+	+	+
21	*Puntius chola* (Hamilton, 1822)	-	+	-	+	-	+	+	-	+	-	-	-	-	+	-	+	+
22	*Puntius dorsalis* (Jerdon, 1849)	+	-	-	-	+	-	+	+	+	+	+	+	-	-	+	-	-
23	*Puntius sophore* (Hamilton, 1822)	+	-	-	-	+	-	-	-	+	-	-	+	-	-	-	-	-
24	*Pethia ticto* (Hamilton, 1822)	+	-	-	-	-	+	+	-	-	-	-	+	-	+	-	-	+
25	*Pethia conchonius* (Hamilton, 1822)	+	+	+	+	+	-	+	+	+	+	+	+	+	+	+	-	+
26	*Gonoproktopterus carnaticus* (Jerdon, 1849)	+	-	+	+	+	-	-	-	+	+	+	+	+	+	-	+	-
27	*Gonoproktopterus dubius* (Day, 1867)	-	-	-	-	-	+	-	-	+	+	+	-	-	-	+	+	+
28	*Osteochilichthys nashii* (Day, 1868)	+	-	-	-	-	-	-	+	-	-	-	+	-	-	+	-	+
29	*Kantaka brevidorsalis* (Day, 1873)	+	-	-	-	-	+	-	-	-	-	-	-	-	-	+	+	+
30	*Cirrhinius chrrhosus* (Bloch, 1795)	+	+	-	-	-	+	-	-	-	+	-	-	-	+	-	-	+
31	*Gibelion catla* (Hamilton, 1822)	+	-	+	+	+	-	+	+	+	+	+	+	-	+	-	+	-
32	*Labeo fimbriatus* (Bloch, 1795)	+	-	+	+	-	+	+	+	+	+	+	+	+	+	-	-	-
33	*Labeo kontius* (Jerdon, 1849)	-	-	-	+	-	-	+	-	-	+	+	+	-	+	-	+	-
34	*Laboe calbasu* (Hamilton, 1822)	+	+	+	+	+	+	+	+	+	+	+	+	+	-	+	-	+
35	*Labeo rohita* (Hamilton, 1822)	+	-	+	-	+	-	-	+	+	-	-	+	-	-	+	-	-
36	*Bangana ariza* (Hamilton, 1807)	+	-	-	+	-	-	-	-	-	+	+	+	-	-	+	+	+

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37	*Schismatorhynchos nukta* (Sykes, 1839)	+	-	-	+	-	-	-	-	+	-	-	-	-	+	-	-	-
38	*Garra mullya* (Sykes, 1839)	+	-	-	+	-	+	-	+	-	+	+	+	+	+	+	+	+
39	*Garra gotyla stenorhynchus* (Jerdon, 1849)	-	-	-	-	-	-	-	+	-	-	-	+	+	+	+	+	+
40	*Garra mcClellandi* (Jerdon, 1849)	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-
41	*Nemacheilus monilis* (Hora, 1921)	+	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	+
42	*Lepidocephalichthys thermalis* (Valenciennes, 1846)	+	-	-	-	-	-	-	-	+	-	-	-	+	+	-	+	+
43	*Sperata aor* (Hamilton, 1822)	+	+	+	-	+	+	-	+	+	+	+	+	+	-	+	-	+
44	*Sperata seenghala* (Sykes, 1839)	+	-	+	+	+	+	+	+	+	+	+	+	-	+	+	-	-
45	*Mystus punctatus* (Jerdon, 1849)	-	-	+	-	+	-	-	-	-	+	+	-	+	-	-	+	-
46	*Mystus armatus* (Day, 1865)	+	-	-	-	+	+	-	-	-	-	-	-	+	+	-	-	+
47	*Mystus cavasius* (Hamilton, 1822)	+	-	-	+	+	-	+	+	+	-	-	-	-	+	+	-	+
48	*Mystus keletius* (Valenciennes, 1839)	-	-	-	-	-	-	-	-	-	-	-	+	-	+	+	+	+
49	*Ompok bimaculatus* (Bloch, 1794)	+	-	+	+	-	+	+	+	-	+	+	+	+	-	+	-	-
50	*Wallago attu* (Bloch & Schneider, 1801)	+	-	+	+	+	+	+	+	+	+	+	+	-	+	-	+	-
51	*Silonia childreni* (Sykes, 1839)	-	-	-	+	-	-	-	-	-	+	-	-	-	-	+	+	-
52	*Pangasius pangasius* (Hamilton, 1822)	+	-	-	+	+	-	+	+	-	+	+	+	-	-	-	+	-
53	*Clarias batrachus* (Linnaeus, 1758)	-	-	-	+	-	-	-	+	-	+	+	+	+	+	-	+	-
54	*Heteropneustes fossilis* (Bloch, 1794)	-	-	-	+	-	+	+	+	-	-	-	-	-	+	-	+	+
55	*Xenentodon cancila* (Hamilton, 1822)	-	-	-	+	+	-	+	-	-	+	+	+	+	+	+	+	+
56	*Hyporhamphus xanthopterus* (Valenciennes, 1847)	-	-	-	+	-	+	-	-	+	+	+	+	+	+	+	+	+
57	*Aplocheilus lineatus* (Valenciennes, 1846)	+	+	+	-	+	+	-	+	-	+	+	+	+	-	+	-	+
58	*Gambusia affinis* (Baird and Girard, 1853)	-	-	-	-	-	-	+	+	-	+	+	+	+	-	-	-	-
59	*Mastacembelus aramatus* (Lacepede, 1800)	+	-	-	+	+	-	+	+	+	+	+	+	+	+	+	-	+
60	*Parambassis ranga* (Hamilton, 1822)	+	+	+	-	+	-	+	+	+	+	+	+	+	+	+	+	+
61	*Nandus nandus* (Hamilton, 1822)	-	-	-	+	-	-	-	+	-	+	+	+	-	+	-	+	-
62	*Etroplus canarensis* Day, 1877	+	+	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-
63	*Etroplus maculatus* (Bloch, 1795)	-	-	+	-	+	+	-	+	+	+	+	+	+	+	+	+	+
64	*Etroplus suratensis* (Bloch, 1790)	+	-	+	+	+	+	-	+	+	+	+	+	+	+	+	+	+
65	*Oreochromis mossambicus* (Peters, 1852)	-	+	+	-	-	+	+	+	+	+	-	+	+	+	+	+	+
66	*Glossogobius giuris* (Hamilton, 1822)	-	-	-	-	+	-	-	+	+	-	-	+	+	+	+	+	+
67	*Anabas testudineus* (Bloch, 1792)	+	-	+	+	-	+	-	+	-	+	+	+	-	-	-	-	-
68	*Pseudosphromenus cupanus* (Cuvier, 1831)	-	-	-	+	-	+	-	+	-	-	-	-	+	-	-	+	-
69	*Channa marulius* (Hamilton, 1822)	+	-	-	-	-	-	+	-	-	+	+	+	-	+	-	-	-
70	*Channa punctata* (Bloch, 1793)	-	+	-	-	-	+	-	-	+	-	-	-	+	+	+	+	-
71	*Channa striata* (Bloch, 1793)	+	+	+	-	-	+	-	+	+	-	-	+	-	-	-	+	-
	Total number of species in each sampling areas	**46**	**17**	**24**	**33**	**30**	**32**	**25**	**38**	**36**	**42**	**37**	**54**	**33**	**41**	**36**	**36**	**37**

from a elongated shoulder bone; lateral line absent. These two species are dominates the major catch in the lower reaches of the reservoir.

Two species Cyprinodontiformes *Aplocheilus lineatus* and *Gambusia affinis* belonging to two (2) families and two (2) genera and they have body short, compressed; head and body with scales; margin of upper jaw formed solely by premaxillaries; teeth in both jaws also in the superior and inferior pharyngeal bones; upper and lower pharyngeal bones well developed; a single spineless dorsal fin, pelvic fins present on abdominal. These species are with good ornamental value and were used as a live food for carnivorous aquarium fishes; effective in mosquito control and widely introduced, but found to compete with indigenous fish and to upset the ecological balance (Miranda, 1999). Only one species of Synbranchiformes, *Mastacembelus aramatus* was recorded and it had body eel-like, compressed, with small scales; margin of upper jaw formed by the pre-maxillaries, the maxillaries being internal parallel to them; gill membrane attached to isthmus, and gill openings in the form of a slit or pore under head; three or four branchial arches; ventral fin rudimentary; no paired fins, lateral line absent.

Twelve species of Perciformes belonged to seven (7) families and eight (8) genera were recorded and they have the skin with ctenoid scales; protractile mouth; upper jaw with the premaxillaries; head and cheeks with canals, pores; opercular region entirely serrated, upper and lower pharyngeal well developed and toothed; two dorsal fins, first spinous; pectoral fin inserted laterally and vertically on the sides, pelvic fins, anal fin with spines. Among these species *Etroplus canarensis* is an endangered status and exotic *Oreochromis mossambicus* is in near threatened condition.

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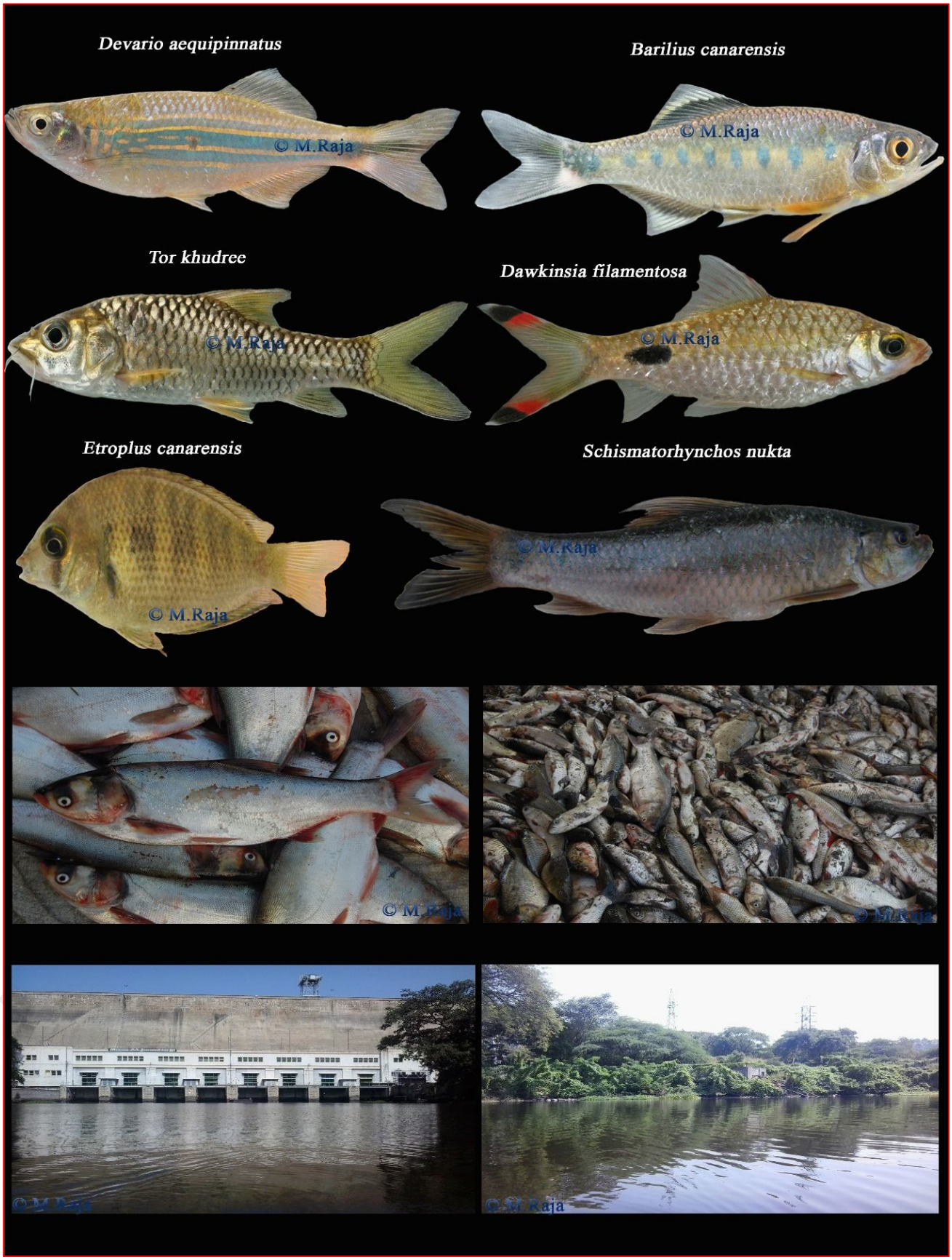

Figure 2

Some of the endangered/ threatened and exploited fish diversity at Stanley Reservoir

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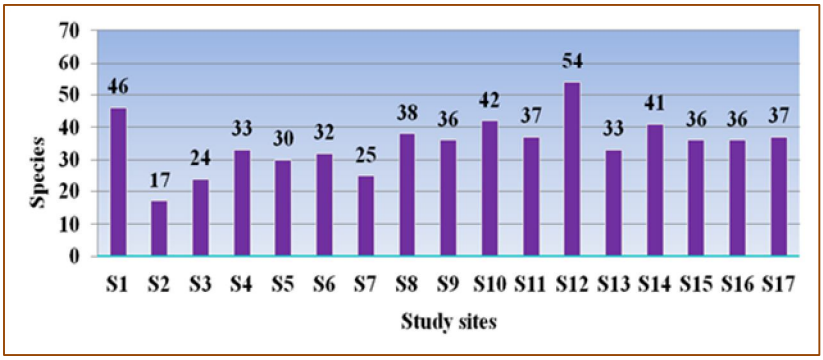

Figure 3

Species richness within the study sites of upstream and downstream areas of Stanley Reservoir, Tamil Nadu

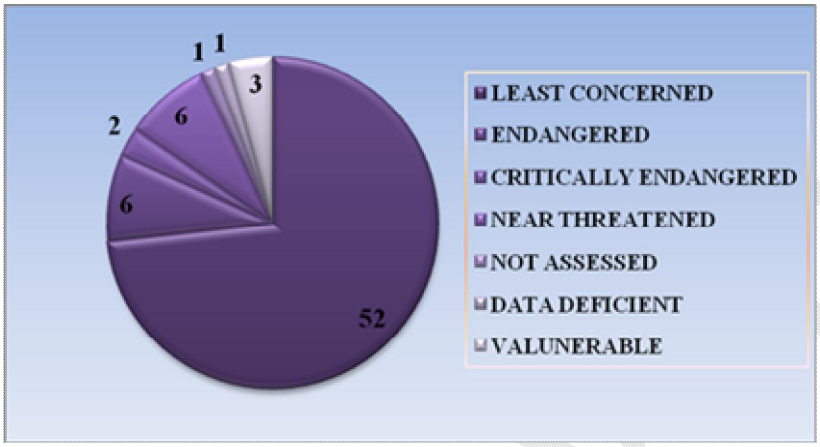

Figure 4

Conservation status of fish species collected from different study sites of upstream and downstream areas of Stanley Reservoir, Tamil Nadu

The detailed account on fish population changes were recorded by Sreenivasan (1976, 1984) and Ranganathan and Natarajan (1978). Among the indigenous species, *Barbus dubius* and *Cirrhinus cirrhosa* were the major species and they are dominated in the catch in the earlier years. While, *Labeo fimbriatus* and *Labeo kontius* were the minor ones. The important game fish like the mahseer *Tor khudree* and *Neolissocheilus hexagonolopis* disappeared from the reservoir so also did *Labeo kontius* and *Barbus carnaticus* (Sreenivasan, 1988).

The above and below the 40 Km radius of the Stanley reservoir, the highest species diversity (Table 2; Figure 3) was recorded in Mettur (S12; n= 53); followed by the Hogenakkal (S1; n= 46) and Kirakaranur (S10; n= 41). The lowest species diversity was recorded in the Palar (S2; n=17), and Uttanur (S7; n=23). The present survey records the presence of two (2) critically endangered species namely *Neolissochilus bovanicus* and *Mystus punctatus*; six (6) endangered species such as *Barilius canarensis*, *Tor khudree*, *Gonoproktopterus dubius*, *Schismatorhynchos nukta*, *Silonia children* and *Etroplus canarensis*; six (6) economically important as well as near threatened species were, *Hypophthalmichthys molitrix*, *Neolissocheilus hexagonolepis*, *Ompok bimaculatus*, *Wallago attu*, *Oreochromis mossambicus* and *Mystus armatus*; three (3) vulnerable species, *Cyprinus carpio* and *Cirrhinius chrrhosus*; and fifty two (52) species are least concerned (Figure 4). The *Labuca labuca* is in the data deficient status and *Anabas testudineus* is in the not assessed in IUCN 2013.

Dawkinsia filamentosa, *Puntius chola*, *Puntius dorsalis*, *Puntius sophore*, *Pethia ticto*, *Pethia conchonius*, *Nemacheilus monilis* and *Lepidocephalichthys thermalis* were the prominent ornamental fishes in our findings. The economically important Indian major carps and large species of *Labeo fimbriatus*, *Labeo kontius*, *Laboe calbasu*, *Labeo rohita*, *Bangana ariza*, *Gibelion catla, Cyprinius carpio* and *Cirrhinius chrrhosus Sperata aor*, *Sperata seenghala*, *Ompok bimaculatus*, *Wallago attu*, *Silonia children*, *Pangasius pangasius*, *Clarias batrachus*, *Heteropneustes fossilis*, *Etroplus suratensis*, *Oreochromis mossambicus*, *Channa marulius* and *Channa striata* were found in much abundance.

4. DISCUSSION

The survey reveals that the factories near the river bank and flow of effluents into the river is one of the major factors that might have affected the present fish diversity. The pesticides (especially organphosphates) are randomly used in the river bank paddy fields which can also affect the fish population. The urbanization is a consequence of population growth and its consequent impacts on ecosystems represents a threat to native species assemblages and a challenge for biological conservation (Albert et al., 2003; Vitousek et al., 2008). In urban areas, where aquatic ecosystems are constantly suffering the discharges of effluents produced by human activities (Paul and Meyer, 2001), populations of fish have to frequently adapts to environmental changes, resulting in reduction the number of fragile species and the increased density of fishes resistant to environmental variations (Reash and Berra, 1987). In these environments the fish assemblages are functionally less diverse than in nonurban streams, and they are vulnerable to invasion by exotic fish species, which can compete and prey on native fish populations (Cunico et al., 2011). The knowledge of the diversity of fishes, their present status (according to IUCN, 2013), role in ecosystem and human economy are prerequisite for adopting the proper conservation strategies. The factors responsible for threatening of ichthyofauna resources are habitat loss and degradation, over exploitation, role of introduced species etc. To overcome the

threatening of fish resources in this reservoir, the suggestions are public awareness programmes, monitoring of pollution in the nearby industries and its prevention and control, habitat conservation.

Dams are a major threat to freshwater biodiversity (Vorosmarty et al., 2010). Several dams worldwide now impair habitat and migration opportunities for many freshwater fish species (Liermann et al., 2012) including those that are endemic and threatened (Xie et al., 2007). But downstream of the Stanley reservoir in the Cauvery River has been dammed extensively (water barrage), mainly for generation of powers and this supports extensive area under agriculture and plantations. Agro-based pollutants such as chemical fertilizers, pesticides, weedicides and nutrients are frequently washed down into the river, constituting a major ecological problem. Eutrophication has resulted in the abundance of filamentous algae and weeds in the lower reaches of the river, particularly from all the water barrages.

Interaction with the local fishermen and Inland fisheries department regarding the abundance of fish diversity in the Stanley reservoir showed that, the diversity has been reduced drastically due to illegal fishing; dynamite; improper commercial fishing which destroyed fish habitats and changed the whole ecosystem. On the other hand, nets with a small mesh size are used to catch shrimps, small fish and young fish (for cultivation purposes) but they also trap unwanted bigger fish that are killed and thrown away; net holes should be large enough to let young fish escape; spawning fish should not be harvested; fishing should be allowed only in restricted areas; unwanted fish should be put back in the river before they die, moreover illegal aquarium traders who are visiting frequently for collection to the wild ornamental species in the reservoir should be noted by the local fishermen.

In-situ conservation of endemic, endangered and threatened fish species is necessary to protect fish diversity. It has been suggested by the authors the fisheries department and forest department should be established in the suitable habitat of Cauvery basin and its flood plains. The threatened fish species should be collected from the reservoir for rearing and propagation in fish seed producing centre of the Inland fisheries department. In this regard, initiatives have been proposed/ commenced to promote the threatened species among the fish farmers after developing the aquacultural techniques. The present survey was carried out within forty kilometres stretch upstream and downstream of the Stanley Reservoir at seventeen selected points and the findings are promising. This survey was probably first of its kind in the study site and therefore, further studies have to be carried out in entire Cauvery river system to know the exact fish diversity.

SUMMARY POINTS

1. The present survey records the presence of two critically endangered, six endangered, six threatened, three vulnerable species and fifty two least concerned species.
2. The diversity has been reduced drastically due to illegal fishing; dynamite; improper commercial fishing which destroyed fish habitats and changed the whole ecosystem.
3. *In-situ* conservation of endemic, endangered and threatened fish species is necessary to protect fish diversity.

FUTURE ISSUES

Future research on a survey on the distribution and diversity status of fish fauna in Panjapalli/Chinnar Dam, Tamil Nadu part of Eastern Ghats is in progress. Factories near the river bank and flow of effluents into the river is one of the major factors that might affect the fish diversity.

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