Fish Faunal Diversity of Chilika Lake, Odisha, India

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Abstract:
Chilika Lake, an assemblage of marine, brackish and freshwater ecosystems, on the east coast of India is a designated Ramsar site and a biodiversity hotspot. Intensive Fish Faunal inventories and biodiversity assessments were carried out and now documented 317 species belonging to 207 genera, in 88 families and 23 orders, including two endemic (Gobiidae) and one exotic cichlid species (*Oreochromis mossambicus*). This paper presents that the lake fishery is largely migratory species-dependent. An account of faunal characteristics for 129 commercially important species is provided. This also documents 48 threatened species and 103 species under different categories of conservation status.

Key words: Fish fauna, Chilika Lake, Biodiversity, Checklist, threatened species, CDA.

INTRODUCTION:

Pisces are the major group of vertebrates which shows an enormous diversity in shape, size, biology and habitat (Bobdey, 014). Biodiversity is an important factor for the stability of an ecosystem (Shukla & Singh, 2013). India is one of the megadiversity countries in the world. There are 450 families of freshwater fishes globally, out of which 40 families are represented from India (Keshave et al., 2013)Pisces are the major group of vertebrates which shows an enormous diversity in shape, size, biology and habitat (Bobdey, 2014). Biodiversity is an important factor for the stability of an ecosystem (Shukla & Singh, 2013). India is one of the megadiversity countries in the world. There are 450 families of freshwater fishes globally, out of which 40 families are represented from India (Keshave et al., 2013)Pisces are the major group of vertebrates which shows an enormous diversity in shape, size, biology and habitat (Bobdey, 2014). Biodiversity is an important factor for the stability of an ecosystem (Shukla & Singh, 2013). India is one of the megadiversity countries in the world. There are 450 families of freshwater fishes globally, out of which 40 families are represented from India (Keshave et al., 2013)Pisces are the major group of vertebrates which shows an enormous diversity in shape, size, biology and habitat (Bobdey, 2014). Biodiversity is an important factor for the stability of an ecosystem (Shukla & Singh, 2013). India is one of the megadiversity countries in the world. There are 450 families of freshwater fishes globally, out of which 40 families are represented from India (Keshave et al., 2013).

Pisces are the major group of vertebrates which shows an enormous diversity in shape, size, biology and habitat (Bobdey, 2014). Biodiversity is an important factor for the stability of an ecosystem. India is one of the megadiversity countries in the world. There are 450 families of freshwater fishes globally, out of which 40 families are represented from India (Keshave Kottelat., 2013). Chilika Lake is the largest coastal wetland ecosystem on the Indian subcontinent (Mohapatraetal. 2007) and the largest brackish water lake in Asia (Mangla 1989; Dujovny 2009). It is one of the region’s finest repositories of aquatic biodiversity and a fisheries resource supporting the livelihoods and nutritional security of more than 200,000 local fishers. The unique and fragile ecosystem of Chilika Lake gradually began to lose its ecological integrity due to coastal processes, significant decrease in salinity regime, and degraded drainage basin with associated anthropogenic impacts (Mohanty et al. 2009). Between 1950 and 2000, the lake fishery was in a continuing state of decline when the fisheries output reached its lowest point by the end of the 1990s. The lake fishery suffered serious setbacks since the later part of the 1980s with the salinity level sharply decreasing to 9.6 PSU, compared to a level of more than 22.0 PSU in the 1960s (Mohanty et al. 2009). The recruitment corridors (outer channel and Palur canal) also gradually silted up, adversely affecting the recruitment of fish and shellfish seed from the sea into the lake, while silted up river mouths (Mahanadi tributaries draining into the lake) in the northern sector of the lake also affected freshwater seed recruitment from riverine sources. In the aftermath of the gradual closure of the old lake mouth and Palur canal, the lake began transformation towards a freshwater ecosystem, causing substantial changes in the Fish Faunal composition. Continued degradation of the ecosystem, changes in ecological characteristics, overall loss of biodiversity and decline in productivity adversely affected the livelihoods of local communities. In 1993, Chilika Lake was included on the Montreux Record of the Ramsar convention for its deteriorated state of health. It became imperative to take action for the restoration of the fragile ecosystem of the Chilika Lake and *internalia* enhance its fisheries and bioresources for the greater benefit of the communities depending on them. Chilika Development Authority (CDA), based on the outcome of a rigorous numerical model study (Mohapatra et al. 2007), carried out a hydrological intervention by opening a new lake mouth during September 2000 along with the treatment of catchment and other restoration measures (Ghosh et al. 2006).
Conservation and sustainable management of Fish Faunal biodiversity in an aquatic ecosystem assume a greater importance in India as fishery resources have historically been, and continue to remain, a base for livelihood and access to high quality animal protein. Thus during the pre-restoration period (until 2000) a total of 233 species had been reported as present in the lake. As reported by Mohanty et al. (2007), during 2000–2003 (post-restoration phase) a total of 43 species were recorded for the first time, bringing the total to 276 species.

The present work provides an intensive inventory of the ichthyofauna of Chilika Lake. This will serve as a baseline of the Fish Faunal diversity of the lake and will facilitate future Fish Faunal surveys, monitoring and fish biodiversity studies (Figure 2).

**Study Area:**
The study area comprises the entire Chilika Lake, which is located along the east coast of India in the state of Odisha between latitudes 19°20'13.06'' N and 19°54'47.02'' N and longitudes 085°06'49.15'' E and 085°35'32.87'' E (Figure 1 ). The inundation area of the lake varies between 1,165 km² during monsoon to a minimum of 906 km² during the dry summer season. The lake’s length is 64.3 km and its mean width 20.1 km (Ghosh and Pattnaik 2005). The lake is separated (Figure 1.1) from the Bay of Bengal by a sandbar of 100–1,500 m width; an outer channel 32 km long connects the main lake with the Bay of Bengal.

(Figure 1: Location map of Chilika lake)
Materials and Methods:
The work done by following methods

Sampling and data analysis

Fish samples were collected fortnightly during the study period with help of skilled fishermen by fishing craft and gears with mesh size 3/8”.

Collected fish species were preserved in 10% formalin in laboratory. The fishes were identified by referring standard literature (Day, 1958; Jhingran, 1992; Jayram, 2010).

Result & Discussion:

Species diversity

An updated checklist of fishes reported from Chilika Lake during the last 84 years of pre-restoration (1916–2000) and 14-year post-restoration (2000–2014) results in a total of 317 valid species (18 cartilaginous and 299 bony fishes) belonging to 207 genera, 88 families and 23 orders (Table 1 figure 3). These are inclusive of 77 new records made during the post-restoration period. Eschmeyer and Fong (2014) considered the family Mugilidae as Perciformes and placed this family between Cepolidae and Cichlidae. However, Nelson (2006) placed this family in Mugiliformes, as did Froese and Pauly (2014) and that classification is followed here. One sparid species, Acanthopagrus latus, earlier recorded from Chilika Lake was later considered as Acanthopagrus longispinnis. Similarly, the name of the Indian species, Lutjanus russellii (Lutjanidae) was reassigned as Lutjanus indicus (Allen et al. 2013). The Indian snapper Lutjanus indicus was invariably confused with its sibling species L. russellii (Allen et al. 2013). Species collected during surveys carried out during the post-restoration period are indicated with single asterisk (*) and new records collected during the same period are indicated with double asterisks (**); thus the checklist includes 178 earlier reported species and 77 new records (Mohapatra et al. 2007; Mohanty et al. 2007; Satpathy and Panda 2009; Mohapatra et al. 2013 and 2014) made during the post-restoration period totaling 255 collected out of 317 species known from the lake, accounting for a 80.44%

(Figure 2: Fish Species in Chilika Lake/Lagoon)
<table>
<thead>
<tr>
<th>Fish Name</th>
<th>Class: Teleostei</th>
<th>Order:</th>
<th>Family:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chirocentrus dorab</td>
<td></td>
<td>Clupeiformes</td>
<td>Chirocentridae</td>
</tr>
<tr>
<td>Etroplus suratensis</td>
<td></td>
<td>Cichliformes</td>
<td>Cichlidae</td>
</tr>
<tr>
<td>Oreochromis mossambicus</td>
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<td>Cichliformes</td>
<td>Cichlidae</td>
</tr>
<tr>
<td>Clarias batrachus</td>
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<td>Sillariformes</td>
<td>Claridae</td>
</tr>
<tr>
<td>Lepidocephalius gunnea</td>
<td></td>
<td>Cypriniformes</td>
<td>Cobitidae</td>
</tr>
<tr>
<td>Cynoglossus lida</td>
<td></td>
<td>Pleuronectiformes</td>
<td>Cynoglossidae</td>
</tr>
<tr>
<td>Cynoglossus lingua</td>
<td></td>
<td>Pleuronectiformes</td>
<td>Cynoglossidae</td>
</tr>
<tr>
<td>Cynoglossus puncticeps</td>
<td></td>
<td>Pleuronectiformes</td>
<td>Cynoglossidae</td>
</tr>
<tr>
<td>Cirrhinus cirrhosus</td>
<td></td>
<td>Cypriniformes</td>
<td>Cyprinidae</td>
</tr>
<tr>
<td>Gymnostomus ariza</td>
<td></td>
<td>Cypriniformes</td>
<td>Cyprinidae</td>
</tr>
<tr>
<td>Labeo boga</td>
<td></td>
<td>Cypriniformes</td>
<td>Cyprinidae</td>
</tr>
<tr>
<td>Labeo calbasu</td>
<td></td>
<td>Cypriniformes</td>
<td>Cyprinidae</td>
</tr>
</tbody>
</table>
**Labeo calla**

**Class:** Teleostei  
**Order:** Cypriniformes  
**Family:** Cyprinidae

**Labeo gonius**

**Class:** Teleostei  
**Order:** Cypriniformes  
**Family:** Cyprinidae

**Labeo rohita**

**Class:** Teleostei  
**Order:** Cypriniformes  
**Family:** Cyprinidae

**Osteobrama vigorsii**

**Class:** Teleostei  
**Order:** Cypriniformes  
**Family:** Cyprinidae

**Pethia ticto**

**Class:** Teleostei  
**Order:** Cypriniformes  
**Family:** Cyprinidae

**Osteobrama peninsularis**

**Class:** Teleostei  
**Order:** Cypriniformes  
**Family:** Cyprinidae

**Puntius chola**

**Class:** Teleostei  
**Order:** Cypriniformes  
**Family:** Cyprinidae

**Puntius sophore**

**Class:** Teleostei  
**Order:** Cypriniformes  
**Family:** Cyprinidae

**Puntius vittatus**

**Class:** Teleostei  
**Order:** Cypriniformes  
**Family:** Cyprinidae

**Systomus sarana**

**Class:** Teleostei  
**Order:** Cypriniformes  
**Family:** Cyprinidae

**Tariqilabeo latius**

**Class:** Teleostei  
**Order:** Cypriniformes  
**Family:** Cyprinidae

**Amblypharyngodon mola**

**Class:** Teleostei  
**Order:** Cypriniformes  
**Family:** Danionidae
Chela cachius
Class: Teleostei
Order: Cypriniformes
Family: Danionidae

Danio rerio
Class: Teleostei
Order: Cypriniformes
Family: Danionidae

Esomus danrica
Class: Teleostei
Order: Cypriniformes
Family: Danionidae

Laubuka laubuca
Class: Teleostei
Order: Cypriniformes
Family: Danionidae

Rasbora daniconius
Class: Teleostei
Order: Cypriniformes
Family: Danionidae

Rasbora rasbora
Class: Teleostei
Order: Cypriniformes
Family: Danionidae

Salmostoma bacaila
Class: Teleostei
Order: Cypriniformes
Family: Danionidae

Brevitrygon imbricata
Class: Elasmobranchii
Order: Myliobatiformes
Family: Dasyatidae

Himantura marginata
Class: Elasmobranchii
Order: Myliobatiformes
Family: Dasyatidae

Himantura uarnak
Class: Elasmobranchii
Order: Myliobatiformes
Family: Dasyatidae

Pastinachus sephen
Class: Elasmobranchii
Order: Myliobatiformes
Family: Dasyatidae

Diodon hystrix
Class: Teleostei
Order: Tetraodontiformes
Family: Diodontidae
The higher fish faunal inventory made during the post-restoration period may be attributed to a number of interventions, including the opening of a new artificial lake mouth nearer to the main water body of the lake (11 km from Magarmukh), desiltation of 14 km long Palur canal restoring the connectivity with the sea through the mouth of Rusikulya River, dredging of a 27 km long new channel connecting Magarmukh and the river confluence point in the northern sector, and desiltation of the lead channel between Magarmukh and the lake mouth. The hydrological intervention in 2000 increased the tidal flux by 44% and salinity level in the lake by 35% as compared to the pre-restoration period. Because salinity dynamics are the main driving force enhancing fisheries in general and fish diversity in particular, the enhancement of fish faunal diversity recorded during post-restoration period was likely mainly attributable to it. In general, opening of the new lake mouth in the year 2000 showed positive impact on the lake fisheries due to improvement in overall water quality (Mohanty et al. 2009). Recruitment success, effective seaward migration of catadromous fishes and restoration of degraded habitats being facilitated by hydrological intervention also likely helped enhance fish faunal diversity. The entire scenario changed during the eco-restoration period with positive effects. The freshwater fish fauna of the Mahanadi River system was reflected in the freshwater fish fauna of Chilika Lake as the tributaries of Mahanadi River drain into it.

The families and species numbers in each order is depicted in (Figure 4), indicating that Perciformes is numerically the largest with 150 (47.32%) species followed by Clupeiformes with 36 (11.36%) species, Cypriniformes with 25 (7.89%) species and Siluriformes with 23 (7.25%) species. Pristiformes, Rajiformes, Gonorynchiformes, Orectolobiformes, and Cyprinodontiformes were represented by single species only (Figure 4).

In total, 15 families (Balistidae, Diodontidae, Acanthuridae, Ephippidae, Mullidae, Nemipteridae, Lac-tariidae, Tetrarogidae, Synbranchidae, Atherinidae,
Table 1. Number of families, genera and species, and total for each taxonomic category.

<table>
<thead>
<tr>
<th>Order</th>
<th>Family</th>
<th>Genus</th>
<th>Species</th>
</tr>
</thead>
<tbody>
<tr>
<td>Orectolobiformes</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Carcharhiniformes</td>
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<td>5</td>
<td>7</td>
</tr>
<tr>
<td>Pristiformes</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Rajiformes</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Myliobatiformes</td>
<td>2</td>
<td>4</td>
<td>8</td>
</tr>
<tr>
<td>Osteoglossiformes</td>
<td>1</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Elopiformes</td>
<td>2</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Anguilliformes</td>
<td>4</td>
<td>6</td>
<td>9</td>
</tr>
<tr>
<td>Clupeiformes</td>
<td>5</td>
<td>18</td>
<td>36</td>
</tr>
<tr>
<td>Gonorynchiformes</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Cypriniformes</td>
<td>2</td>
<td>17</td>
<td>25</td>
</tr>
<tr>
<td>Siluriformes</td>
<td>9</td>
<td>16</td>
<td>22</td>
</tr>
<tr>
<td>Aulopiformes</td>
<td>1</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Mugiliformes</td>
<td>1</td>
<td>5</td>
<td>11</td>
</tr>
<tr>
<td>Atheriniformes</td>
<td>1</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Cyprinodontiformes</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Beloniformes</td>
<td>3</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td>Syngnathiformes</td>
<td>1</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Synbranchiformes</td>
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<td>3</td>
<td>4</td>
</tr>
<tr>
<td>Scorpaeniformes</td>
<td>3</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>Perciformes</td>
<td>37</td>
<td>95</td>
<td>150</td>
</tr>
<tr>
<td>Pleuronectiformes</td>
<td>3</td>
<td>4</td>
<td>8</td>
</tr>
<tr>
<td>Tetradontiformes</td>
<td>4</td>
<td>9</td>
<td>10</td>
</tr>
</tbody>
</table>

(Figure 3: Orders, families and species numbers for ichthyofaunal components of Chilika Lake)

Dussumieridae, Synodontidae, Hemiscylliidae, Sphyridae and Rhinobatidae- and five orders (Tetradonti-formes, Atheriniformes, Aulopiformes, Orectolobiformes and Rajiformes) were documented for the first time in Chilika Lake during the post-restoration survey. No representatives of two families, namely Chirocentridae and Cobitidae, were found during the survey after opening of the new mouth. Sixty-five species of fish, mostly Gobiidae, were not re-collected during the post-restoration period. Two elasmobranchs (Glyphis gangeticus and Pristis pectinata) have never been recollected since they were first reported.
Pristis pectinata, once a wide-ly distributed sawfish, has been eliminated from large areas of its former range, and therefore its absence from Chilika Lake indicates its likely elimination from the lake ecosystem. (Mohanty et al.2015). However, the sawfish recorded as Pristis pectinata from Chilika Lake may be referred as Pristis clavata as observed by Faria et al. (2013). The Ganges Shark (Glyphis gangeticus) was once recorded from Chilika Lake (Chaudhuri 1916b) but the species has never been sighted or reported thereafter. Most literature records and specimens identified as this species are actually Bull Sharks Carcharhinus leucas or other carcharhinids. How-ever, after an extensive search over 10 years, a few spec-imens of this species were sighted in 1996 in the lower reaches of the Ganges River in West Bengal, India (Com-pagno 2002, 2007). There is no verified marine record of the G. gangeticus to date. Therefore the only report from Chilika was perhaps due to misidentification and con-fusion with C. leucas, which definitely occur in the lake.

Migratory and resident species

Out of the total 317 species, 271 (85.49%) and 46 (14.51%) were categorized as migratory and resident species respectively. Therefore the lake fishery is strongly migratory species-dependent. The migratory species are either seasonal migrants or incidental visi-tors to the lake from both the sea and inflowing rivers. The higher number of migratory species is perhaps due to ecorestorative measures implemented after 2000, particularly the opening of the new lake mouth and resultant improvement in water quality. Because migratory species form the major component of the lake fishery, sustainability of ecorestoration measures, particularly the optimal functioning of the lake mouth and Palur canal to enhance recruitment and breeding migrations assume greater significance. Migra- tory species included 14 catadromous species (Anguilla bengalensis, Anguilla bicolor bicolor, Chanos chanos, Liza macroplepis, Liza melinopterus, Liza parsi, Liza planiceps, Liza subviridis, Ellochelon vaigiensis, Lates calcarifer, Mool-garda cunnesius, Moolgarda seheli, Moolgarda speigleri and Mugil cephalus) and 13 anadromous species (An-dontostoma chadacuna, Brachirus orientalis, Hilsa kelee, Ilisha megaloptera, Pastinachus sephen, Pisodonophis boro, Pisodonophis cancivorus, Rhinomugil corsula, Stolephorus commersonii, Tenualosa ilisha and Tenualosa toli).

Categorization of marine, estuarine/brackish and freshwater species

Chilika Lake being an assemblage of marine, brack-ish and freshwater ecosystems, harbors fish species belonging to these three regimes thereby enhancing Fish Faunal diversity and contributing to the com-mercial landings. A modified form of the widely accepted categorization by Elliot et al. (2007) is adapted here to categorize the fishes of Chilika Lake into marine, brackish and freshwater species. All marine species are considered as migratory oricients and many of the freshwater species are riverine migrants. Our study of Fish Faunal diversity in Chilika Lake indicates that marine, brackish and freshwater species constitute 35.65%, 43.85% and 20.50% respectively (Figure 4).

Figure 4. Fish Faunal composition of marine, brackish and freshwater species of Chilika Lake.

Faunal characteristics

The fish fauna of Chilika Lake includes two endemic gobiid species (Acentrogobius griseus and Bathygobius ostreicola) and one exotic cichlid species (Oreochromis mossambicus), which entered the lake during 1998 from aquaculture units on island villages. In total, there are 13 high value target species (Mystus gulio, Strongylura strongylura, Channa striata, Etroplus suratensis, Tenu-alsoil a ilisha, Hyporhamphus limbatus, Lates calcarifer, Liza macroplepis, Moolgarda cunnesius, Mugil cephalus, Eleu-theronema tetractrum, Daysciaena albida and Sillago sihama) out of a total of 129 commercially important species, these are in large demand in the market and command higher unit prices. The current ichthyofau-nal analysis further documented for the first time 114 species belonging to 48 families with ornamental value for home and public aquarium use, a resource with con-siderable economic potential. Documentation of native ornamental fish germplasm resources from Chilika Lake calls for conservation and wise use that could poten-tially augment livelihoods of local communities through small-scale ornamental fish trade and captive breeding practices. Further research is warranted to develop tech-nologies for artificial propagation (captive breeding) and rearing of important native ornamental fishes from Chilika Lake. The faunal characteristics also indicated that 56 species are breeding in the lake and five species (Daysciaena albida, Eleutheronema tetractylum, Gerres setifer, Leio-gnathus equalus and Nematalosa nasus) have two populations, one in the lake and the other in coastal waters. Similarly Rhinomugil corsula, the only freshwater mullet in the region, also has two populations one in the lake and the other in the rivers. Out of 317 fish species known so far from Chilika Lake, 278 are known to be food fishes (129 are commercially important – the oth-ers are eaten but neither commercially harvested nor have consumers demand).
An assessment of biodiversity status for the listed species and assessment of threatened fishes from the total of 317 fish species known from the lake was attempted for the first time in the present study. Review of literature on the biodiversity status of fishes and threatened fishes of India based on IUCN criteria (Ponniyah 1993; Molur and Walker 1998; Menon 2004; Barman et al. 2007; Lakra et al. 2010; IUCN 2014; Froese and Pauly 2015) documented a total list of 151 species from Chilika Lake which were assessed for biodiversity status. In total, 35 species in 25 families were recorded as threatened and categorized under Critically Endangered (CR), Endangered (EN), Vulnerable (VU) (Table 2; Figure 5). Further, 13 more species in eight families are categorized as Near Threatened (NT) that need conservation measures unless they may slip to threatened category very soon. Only 88 species (27.76%) were assessed as List Concern (LC), whereas 15 species (4.73%) were categorized as Data Deficient (DD). Most importantly, 166 species (52.36%) of fishes of Chilika Lake were Not Evaluated (NE) for their conservation status. In other words, status of 52.36% of fishes is unknown, and need to be evaluated at least at the national level.

The most of the common threats to the biodiversity of fishes of India stems from various anthropogenic and natural stressors (Das et al. 2004; Kurup and Radhakrishnan 2006; Rout et al. 2007), as has been observed for fishes in Chilika Lake. There, the most relevant threats were degradation of aquatic environment, siltation and encroachment of spawning grounds in the lake by Gheries operation, other destructive fishing practices, unabated expansion of illegal large pen culture units (Gheries).

Table 2. Assessment of biodiversity status of Chilika fishes (Categorization of threatened and non-threatened species with conservation status).

<table>
<thead>
<tr>
<th>Family</th>
<th>CR</th>
<th>EN</th>
<th>VU</th>
<th>NT</th>
<th>Total threatened species</th>
<th>LC</th>
<th>DD</th>
<th>Total species assessed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acanthuridae (surgeon fishes)</td>
<td></td>
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<td></td>
<td></td>
<td>2</td>
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<tr>
<td>Adrianichthyidae (rice fish)</td>
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<td></td>
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<td></td>
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<tr>
<td>Ambassidae (perchlets, glass fishes)</td>
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<td></td>
<td></td>
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<td>4</td>
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<td>4</td>
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<tr>
<td>Anabantidae (climbing perches)</td>
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<td>Anguillidae (freshwater eels)</td>
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<td>Aplocheilidae (asian revulines)</td>
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<tr>
<td>Bagridae (bagrid catfishes)</td>
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<td>3</td>
<td></td>
<td></td>
<td>4</td>
</tr>
</tbody>
</table>
Belonidae (needle fishes) & 1 & 1 & 1  
Carangidae (jacks, trevallies, pompanos, scads) & 1 & 1 & 1  
Carcharhinidae (reiquem sharks) & 1 & 4 & 5 & 5  
Channidae (snakeheads, murrels) & 4 & 4 & 4  
Cichlidae (cichlids) & 1 & 1 & 1 & 1 & 2  
Clariidae (air-breathing catfish) & 1 & 1 & 1  
Clupeidae (herrings, allies) & 2 & 2 & 4 & 4 & 6  
Cobitidae (loaches) & 1 & 1 & 1  
Cyprinidae (carps, minnows) & 3 & 3 & 20 & 1 & 21 & 24  
Dasyatidae (stingrays) & 1 & 1 & 2 & 3 & 3 & 5  
Datnioididae (freshwater triple tails) & 1 & 1 & 1  
Eleotridae (gudgeons) & 1 & 1 & 1  
Engraulidae (anchovies) & 2 & 1 & 3 & 3  
Gobiidae (gobies) & 6 & 3 & 9 & 9  
Haemulidae (grunts, rubberlips) & 1 & 1 & 1 & 1 & 2  
Hemiramphidae (halfbeaks) & 1 & 1 & 1  
Hemiscyllidae (bamboo sharks) & 1 & 1 & 1  
Heteropneustidae (airsac catfish) & 1 & 1 & 1  
Leiognathidae (pony fishes, silverbellies) & 3 & 3 & 3  
Mastacembelidae (spiny eels) & 3 & 3 & 3  
Megalopidae (tarpons) & 1 & 1 & 1  
Myliobatidae (eaglerays) & 1 & 1 & 1  
Nandidae (leaf fishes) & 1 & 1 & 1  
Notopteridae (featherbacks) & 1 & 1 & 1 & 1 & 2  
Ophichthidae (snake eels) & 2 & 2 & 2  
Osphronemidae (gouramies) & 2 & 2 & 2  
Pangasiidae (shark catfish) & 1 & 1 & 1  
Platycepalidae (flatheads) & 1 & 1 & 1  
Polyneomidae (threadfin fishes) & 1 & 1 & 1  
Pristidae (saw fish) & 1 & 1 & 1  
Pristigasteridae (pellonias) & 1 & 1 & 1  
Rhinobatidae (guitar fishes) & 1 & 1 & 1  
Scatophagidae (scats) & 1 & 1 & 1  
Schilbeidae (schilbid catfishes) & 2 & 2 & 3 & 3  
Sciaenidae (croakers) & 2 & 1 & 3 & 3  
Scombriidae (mackerels, seerfishes, tunas, albacores) & 2 & 1 & 3 & 3  
Serranidae (groupers, rock-cods) & 1 & 2 & 3 & 1 & 1 & 4  
Siganidae (spinsfoots, rabbitfishes) & 1 & 1 & 1  
Siluridae (eurasian catfishes) & 1 & 1 & 1 & 3 & 3  
Sisoridae (sisorid catfish) & 1 & 1 & 2  
Sphyridae (hammerheaded shark) & 1 & 1 & 2 & 2  
Synbranchidae (swamp eels) & 1 & 1 & 1  
Syngnathidae (pipe fishes, sea horses) & 1 & 1 & 1 & 1 & 2  
Terapontidae (terapon perches) & 2 & 2 & 2  
Tetradontidae (puffers) & 1 & 1 & 1  
Tetraodontidae (waspfishes) & 1 & 1 & 1  

<table>
<thead>
<tr>
<th>Total</th>
<th>1</th>
<th>9</th>
<th>25</th>
<th>13</th>
<th>48</th>
<th>88</th>
<th>15</th>
<th>103</th>
<th>151</th>
</tr>
</thead>
<tbody>
<tr>
<td>% to the total assessment of species</td>
<td>0.66</td>
<td>5.96</td>
<td>16.56</td>
<td>8.61</td>
<td>23.18</td>
<td>58.28</td>
<td>9.93</td>
<td>76.82</td>
<td>100.00</td>
</tr>
</tbody>
</table>

CR-Critically Endangered; EN- Endangered; VU-Vulnerable; NT-Near Threatened; LC-List Concern; DD-Data Deficient

drastic decline in salinity dynamics, and siltation at the river mouth and Magarmukh (the gateway between the inlet channel and the lake proper). Mohanty et al. (2007) reported that six economic species (*Tenualosa ilisha*, *Rhinomugil corsula*, *Acanthopagrus berda*, *Chanos chanos*, *Megalops cyprinoides* and *Elops machnata*) almost disappeared from commercial landings during the eco-degradation phase but gradually reappeared during the ecorestoration phase.
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REFERENCES:


