Ichthyofaunal diversity of siluriformis from Kolleru Lake, Andhra Pradesh, India

Krishna PV, V Panchakshari, P Suresh, K Prabhavathi and K Anil Kumar

Abstract
In Andhra Pradesh lake Kolleru has been recognized as wet land of International significance and a Ramsar site. The wet lands are very important productive ecosystem and socioeconomic values are well established. Anthropogenic pressure such as large scale encroachment of lake bed for aqua farms, high level use of fertilizers, pesticides, fish/prawn waste discharges, domestic wastes and sewage from three municipalities and discharge of industrial effluents and agriculture run-off have vitally effected and altered the ecological character. Due to continuously increasing natural and anthropogenic stresses, now days this entire species community focus a tremendous problem of survival. The results present study revealed that the occurrence of 14 species belongs to 9 genera and 6 families order siluriformis and family bargidae is dominant group followed by siluridae and ariidae. Out of 14 species percentage of various threat category as per IUCN, 64% were least concern, 22% were near threatened, and 14% were endangered. As per CAMP, 43% were not evaluated, 22% were vulnerable, 14% of both endangered and least concern, and also 7% were least concern. The biodiversity index also discussed in the season wise.

Keywords: Catfish fauna, Kolleru Lake, biodiversity

1. Introduction
Kolleru Lake is one of the National wetland and the largest fresh water lakes of our country. Wetland ecosystems are fragile but productive and vital ecosystem recognized for their role in conservation of biodiversity and are being designated as “Ramsar sites” (International recognized wetlands) which quality under the Ramsar criteria. Role of the wetlands in conserving fish diversity is widely acknowledged as these wetlands are used by the various fish species as a refuge for breeding, feeding and spawning purpose of one stage or the other in their life cycle. The foreshore area is presently under accelerated conversion into fish ponds for culture fish and prawn. The lake is presently facing ecological crisis being situated in the deltaic region between Krishna and Godavari rivers central’ to highly agriculturally and industrially developed area. The industrial pollutants are mainly of organic nature and the agricultural runoff containing nutrients and pesticide residues enter the lake. In addition, the improvements to drainage to remove flood waters by deepening, widening and straightening the out-let creek, has resulted in faster drying up of the lake since 1986 after monsoon. Until 70's the lake level was maintained at more than +5 M.S.L. from July to February and with lesser water level at +3 M.S.L. during March to June [1]. The present situation of longer period of low-level and drying and influx of nutrients, has resulted in coverage of almost the entire area with water hyacinth and other floating weeds, apart from submerged and emergent weeds. This has resulted in reduction of capture fishery of about 4,000 MT. within 10 years period. Acknowledged and these wetlands are used by the various fish species as a refuge for breeding, feeding and spawning purpose of one stage or the other in their life cycle. The lake receives water from several sources of streams Budameru, Tamileru (East, West branches) Ramileru, Gunderu and Bulusuvagu are natural and foremost in terms of water input. Minor streams of Jayanthi, Kattaleru, Ippalavagu, Telleru, Ballaleru and Nedimeru flowing through several mandals also join in Lake Kolleru. The rest of inflow drains are largely manmade and contribute lesser inputs. The Budamerru flows through the mandals of Vijayawada, Gannavaram, Gudivada and Kaikaluru, while the rest of the streams flow through the West Godavari district. Thamilleru originating from Bethupalli in Khamam district reaches Kolleru Lake after passing through Nagireddygudem reservoir in Chintalapuddy.
Madal During 1960s the lake was known as the largest pelican breeding centre in the world for the grey or spotted billed Pelican, *Pelecanus philippensis*, but the colonies declined through 1970s and disappeared completely by 1974 [2].

In the November 2006, the lake was declared as a wet land of international importance by the Ramsar convention for the conservation and sustainable utilization of wet land [3, 4]. The lake fauna include the species are primarily freshwater and are residents of the lake along with species which live in coastal waters of Bay of Bengal and enter the lake during summer when the saline waters enter the lake through Upputeru channel [1]. The lake Kolleru an important coastal wetland ecosystem, is to examine different anthropogenic activities on the community structure of the water body gained importance of lake being desolated as a Ramsar site the present study assumes importance. These communications record the fish fauna of the resident fish population of the lake, in view of the changes in the lake habitat due to anthropogenic activities. The present work provides an inventory of ichthyofauna of siluriformis of Kolleru Lake in the post-restoration phase. This will serve as a baseline of the ichthyofauna diversity siluriforms of the lake and will facilitate future fish faunal surveys, monitoring and biodiversity studies.

2. Materials and Methods

2.1 Study area: The Lake is situated between a latitudes 16°32'and 16°51'N and Longitudes 81°05’ and 81°20’E. with total catchment area of 4,763 Sq. Km. This lake is fed by 2 rivers, 15 irrigation channels and 15 drains from Krishna and Godavari barrage irrigation system. Thus, the lake swells up during S- W monsoon period from August to December when the level of the lake is around +7 M.S.L., and shrinks to less than 25 Sq. Km. during May and June. There are 50 islands and 98 bordering habitations in the lake region having a total population of 2.16 lakhs. The foreshore area is under cultivation up to +5 M.S.L. The area below +5 M.S.L. is generally free from any cultivation, but this area is used for capture fishery. The reverine fishes use wetlands on their breeding grounds. The Kolleru Lake is a natural shallow coastal wetland formed between the River Krishna and Godavari in Andhra Pradesh. It has been function as a natural flood balancing reservoir between the delta of above rivers. For the present study, data of the fish fauna of the lake have been collected during the period of January 2013- December 2015. Fish samples were collected from landing centers of Kolleru Lake with the help of fishermen using different types of nets namely gill net, cast net and drag nets. The fish samples were preserved in 5% formalin and brought to the laboratory for identification. The fish were identified with the help of the taxonomic keys [5, 6, 7].

Shannon–Weaver’s species diversity index: This is proposed by Shannon and Weaver [8] as measure of information and their diversity across the different areas. Shannon –Weaver’s (H) in commonly used to characterize species diversity in a community. The index account for both abundance and evenness of the species presents. The proportion of the species (Pi) is calculated and multiplied by the natural logarithm of this proportion (log Pi).

As per the formula given by Shannon and Weaver [8]:

\[ H = -\sum (ni/N) \log (ni/N) \]  

Where

- \( H \) = Shannon – Weaver’ index of species diversity in individuals
- \( n_i \) = Total number of individuals.
- \( N \) = Total number of individuals of all species
- \( P_i \) = importance of probability for each species = \( n_i/N \)

3. Results and Discussion

The results of the present study revealed that the occurrence of 14 species belongs to 9 genera and 6 families of order siluriformis. List of fishes including their family, genus species, IUCN [9], CAMP, [10] status and Froese and Pauly [11] were recorded in the present investigation was given (table 1 and fig 1&2). Biodiversity index of fishes was given (Table-2), Data revealed that during North East monsoon months ‘H’ value goes to 0.9764, summer season goes to 1.0229, Southwest monsoon goes to 0.9984, and post monsoon value goes to 1.0059.

The industrial effluents released in to the catchment of the lake from paper and sugar industries in Krishna and Godavari district and the municipal wastes from Vijayawada, Eluru and Gadivadda flowing in to the lake Kolleru. The other sources of pollution of agriculture runoff containing residues of several Argo-chemicals, fertilizers, and fish farm discharges containing antibiotics, drugs, chemicals, food wastes and other effluents from surrounding area. As a result, the water of the lake turned more alkaline in nature, turbid, nutrient rich, low dissolved oxygen, high BOD, changes in total dissolved solids and salinity imbalance in Lake Kolleru. Barman [12] have reported that the 10 sps of siluriformis cat fishes in the Kolleru lake. An assessment of biodiversity status for the listed species and assessment of endangered species from the siluriforms of Kolleru Lake was attempted for the present study. The biodiversity status of fishes and endangered fishes of Lake Kolleru based on IUCN criteria [9, 11] have documented the list of the species, which were assessed for biodiversity status. Mothanthy et al., [13] have recorded that the 22 species of order siluriformis fishes in Chilka Lake Odisha. Krishna et al., [11] have observed 14 species in siluriformis in Kolleru Lake. Further, various scientists reported that the cat fishes of Kolleru Lake [14, 15, 16]. Most of the natural lakes in India are undergoing major ecological changes due to urbanization, industrialization and increased anthropogenic activities. The trophic status of a lake ecosystem is mostly dependent on the ageing phenomena and the anthropogenic impact through habitat destruction. The lakes undergo rapid transition from oligotrophic to eutrophic conditions due to abiotic and biotic factors traceable to anthropogenic activities [17]. These ecological changes in the water bodies bring about noticeable changes in the community structure of the organisms inhabiting it. It formed as a basin between the gradually growing deltas of the peninsular rivers Godavari and Krishna near their tail end region of the east coast. The lake discharges its excess water into the Bay of Bengal through a 72 km long out-flowing brackish water canal called Upputeru. The catchment of the lake extends up to 6121km² of which 4763km² comprised of upland and 1358km² are deltaic. Excessive nutrient addition, especially from Anthropogenic sources lead to explosive weed growth. The exploitation of the aquatic floating weeds particularly *Eichrinia crassipes* (water hyacinth) affects fish and other aquatic life [18]. The high vegetative capacity and rapid growth of *Echhrris crassipes* endow it with high vegetative development and
productive rates. These characteristic, along an extreme
tolerance have given this macrophyte efficient mechanism for
reproduction and dispersion, rendering it able to form dense
stands within a few months in a large variety of habitats such
as rivers, lakes, and reservoirs. This could be the result of
shelter of predators and competitions popular explosions of
these plants because an increase in appropriate sites for the
development intermediate hosts like snail, which are vectors
of several diseases. Krishna et al., (2013) have reported that
the impede drains shuts out sunlight to phytoplankton and
submerged hydrophytes and offers breeding ground for
certain vector insects. The floating weeds are also noun to
cause deplitation of dissolved oxygen by way of their decay
and aidsilition by trapping suspended solids and dust. Further
variations water level, water pressure on land and increasing
land scale modifications have added to deterioration of the
lake [19]. Srinivas Rao and Rama Rao, [20] ha ve r ep or te d
that land scale modifications have added to deterioration of the
variations water level, water pressure on land and increasing
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and aidsilition by trapping suspended solids and dust. Further
variations water level, water pressure on land and increasing
land scale modifications have added to deterioration of the
lake [19]. Srinivas Rao and Rama Rao, [20] ha ve r ep or te d
that

Table 1: Fish faunal diversity, IUCN, and CAMP status

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Order</th>
<th>Family</th>
<th>Species</th>
<th>IUCN</th>
<th>CAMP</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Siluriformes</td>
<td>Bagridae</td>
<td>Mystus gulio</td>
<td>LC</td>
<td>NE</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>M. vittatus</td>
<td>LC</td>
<td>VU</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>M. cavassius</td>
<td>LC</td>
<td>L.Rnt</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>M. bleekeeri</td>
<td>LC</td>
<td>VU</td>
</tr>
<tr>
<td></td>
<td>Siluridae</td>
<td></td>
<td>Ompok bimaculatus</td>
<td>NT</td>
<td>EN</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Ompok pabda</td>
<td>NT</td>
<td>EN</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Wallago attu</td>
<td>NT</td>
<td>L.Rnt</td>
</tr>
<tr>
<td></td>
<td>Pangasidae</td>
<td></td>
<td>Pangasius pangasius</td>
<td>LC</td>
<td>NE</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Clarias batrachus</td>
<td>LC</td>
<td>NE</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>C. gariepinus</td>
<td>NE</td>
<td>NE</td>
</tr>
<tr>
<td></td>
<td>Heteropneustiidae</td>
<td>Heteropneustes fossilisi</td>
<td>LC</td>
<td>MU</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Ariidae</td>
<td></td>
<td>Arius arius</td>
<td>LC</td>
<td>LC</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Nemapteryx caelatus</td>
<td>EN</td>
<td>NE</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Plicofolis dussamieri</td>
<td>LC</td>
<td>NE</td>
</tr>
</tbody>
</table>
Table 2: Biodiversity index of Ichthyofauna of Siluriformis from Kolleru Lake

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Name of the Species</th>
<th>NE</th>
<th>SR</th>
<th>SW</th>
<th>PM</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Mystus gulio</td>
<td>-0.0643</td>
<td>-0.0824</td>
<td>-0.0765</td>
<td>-0.0669</td>
</tr>
<tr>
<td>2</td>
<td>M. vittatus</td>
<td>-0.0654</td>
<td>-0.0865</td>
<td>-0.0562</td>
<td>-0.0734</td>
</tr>
<tr>
<td>3</td>
<td>M. cavasius</td>
<td>-0.0767</td>
<td>-0.0772</td>
<td>-0.0591</td>
<td>-0.0660</td>
</tr>
<tr>
<td>4</td>
<td>M. bleekeri</td>
<td>-0.0717</td>
<td>-0.0834</td>
<td>-0.0682</td>
<td>-0.0768</td>
</tr>
<tr>
<td>5</td>
<td>Ompok bimaculatus</td>
<td>-0.0628</td>
<td>-0.0375</td>
<td>-0.0670</td>
<td>-0.0793</td>
</tr>
<tr>
<td>6</td>
<td>Ompok pabda</td>
<td>-0.0626</td>
<td>-0.0465</td>
<td>-0.0707</td>
<td>-0.0692</td>
</tr>
<tr>
<td>7</td>
<td>Wallago attu</td>
<td>-0.0659</td>
<td>-0.0778</td>
<td>-0.0613</td>
<td>-0.0709</td>
</tr>
<tr>
<td>8</td>
<td>Pangasius pangasius</td>
<td>-0.0736</td>
<td>-0.0682</td>
<td>-0.0619</td>
<td>-0.0692</td>
</tr>
<tr>
<td>9</td>
<td>Clarias batrachus</td>
<td>-0.0765</td>
<td>-0.0759</td>
<td>-0.0721</td>
<td>-0.0747</td>
</tr>
<tr>
<td>10</td>
<td>C. gariepinus</td>
<td>-0.0638</td>
<td>-0.0643</td>
<td>-0.0787</td>
<td>-0.0713</td>
</tr>
<tr>
<td>11</td>
<td>Heteropneustes fossilis</td>
<td>-0.0676</td>
<td>-0.0748</td>
<td>-0.0854</td>
<td>-0.0738</td>
</tr>
<tr>
<td>12</td>
<td>Arius arius</td>
<td>-0.0754</td>
<td>-0.0742</td>
<td>-0.0829</td>
<td>-0.0654</td>
</tr>
<tr>
<td>13</td>
<td>Nemapteryx caelatus</td>
<td>-0.0745</td>
<td>-0.0876</td>
<td>-0.0826</td>
<td>-0.0721</td>
</tr>
<tr>
<td>14</td>
<td>Plicofollis dussumieri</td>
<td>-0.0756</td>
<td>-0.0876</td>
<td>-0.0758</td>
<td>-0.0767</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>-0.9764</td>
<td>-1.0239</td>
<td>-0.9984</td>
<td>-1.0057</td>
</tr>
</tbody>
</table>

H = -∑(ni/N) log ni/N = 0.9764

Abbreviations: NE: North East monsoon; SR: Summer; SW: South West monsoon; PM: Post monsoon.

4. References