ISSN: 2347-5129
(ICV-Poland) Impact Value: 5.62
(GIF) Impact Factor: 0.352
IJFAS 2016; 4(1): 20-23

www.fisheriesjournal.com
Received: 09-11-2015
Accepted: 09-12-2015

J Jagatheeswari
Government College for women (A), kumbakonam, Tamilnadu, India.

B Kishore
Department of Zoology, Andhra University, Visakhapatnam, Andhra Pradesh, India.

PS Rajasekhar
Department of Environmental Science, Andhra University, Visakhapatnam, Andhra Pradesh, India.

Correspondence
J Jagatheeswari
Government College for women (A), kumbakonam, Tamilnadu, India.

Fish diversity and conservation aspects in an aquatic ecosystem, Kondakarla fresh water lake, Visakhapatnam, Andhra Pradesh, India

J Jagatheeswari, B Kishore, PS Rajasekhar

Abstract
The fish diversity in Kondakarla freshwater lake, Visakhapatnam, Andhra Pradesh, India, was studied for a period of 3 years from 2010-2013. Biodiversity and its conservation are regarded as one of natural resources. Kondakarla fresh water lake ecosystem inhabits several aquatic organisms. Change in water quality due to pollution put the fish fauna under stress. Loss of fish species diversity used as an indicator of environmental degradation. This contribution focuses on the diversity of fish population and their conservation aspects in Kondakarla fresh water lake ecosystem, Visakhapatnam, Andhra Pradesh, India. The study revealed the occurrence of 26 species of fishes.

Keywords: Fish diversity, sustainable development, conservation, Kondakarla fresh water lake, Visakhapatnam

1. Introduction
Wetlands in India occupy 58.2 million hectares. It is estimated that fresh water wetlands alone support 20 percent of the known range of bio diversity in India (Deepa R.S &T.V. Ramachandra 1999) [5]. Majority of the inland wetlands are directly or indirectly dependent on the major rivers like Ganga, Brahmaputra, Narmada, Godavari, Krishna, Kaveri and Tapti. Today, wetlands (natural or human modified) provide staple food (rice and fish) for more than half of the world's human population. Over-exploitation of wetland resources (harvesting, fishing and hunting**)** causes the decline of many plants and animals. Land use practices such as agriculture, mining, regulation of water flows, disposal of domestic sewage and industrial effluents degrade and reduce the wetland habitats.
In this context the present study has been chosen to evaluate the present status of fish diversity to protect the biological resources of traditional use values for the livelihood of local communities depending on these lake environments for centuries. Status of Kondakarla Lake ecosystem

2. Materials and Methods
Study area

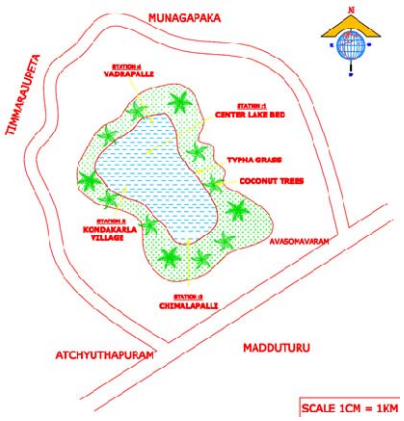

Fig. 1

Status of Kondakarla Lake ecosystem

Kondakarla lake (Fig 1) is the second largest natural fresh water Ecosystem lake in Andhra Pradesh located at a distance of 42 km from Visakhapatnam and 7 km from Anakapalle. It is situated between 17˚3530″ and 17˚3602″ latitudes and 82˚5927″ and 83˚10″ longitude. The lake has a water spread area of 6.5 sq km in summer, and 20 sq km during rainy seasons. The maximum depth of the lake is about 3.5 to 4.0 m during the rainy season and the minimum is about 1.0 m in summer. The marginal area of the lake are used for the cultivation of paddy and sugarcane.

The lake receives water from Sarada River and excess water runs off into the Bay of Bengal through man make canals. A number of villages are situated around the lake. The lake is spread over an area of 30 sq.km completely filled with water during rainy season. The depth of the lake earlier was about 25ft as per records and now it is not more than 15ft.

The lake is majorly catering the needs of hundreds of acres of agricultural lands of the Anakapalle, Yelamanchili, Atchutapuram and Parawada Mandal of Visakhapatnam district. The major villages of Kondakarla and Vadrapalle occupied by fisherman community depend upon the fishing activity in the lake. The lake is once known as a paradise of migrating birds.

2. Sampling Procedure

Biodiversity of fishes

Sampling and data collection were from February 2010 to December 2013. Sampling was done at fortnightly intervals for limnological characteristics. Specimens were packed, labelled in separate polythene bags, placed in ice box and transported to laboratory within 12 hours for the purpose of identification. Taxonomical identification and classification was done on the basis of morphometric characteristics upto species level. The fish specimens were identified by following regional keys (Mirza, 2003) [10]. The gears were used in Kondakarla lake for fishing include gill nets, plunge basket and traps which are made up of split bamboo pieces are locally made.

Fishes procured from the various spots and purchased from the market were brought to the laboratory in buckets containing freshwater. Immediately on reaching the laboratory fishes were separated according to the species and live fishes were killed in a solution of formalin. This solution kept all the parts of fish intact and helped to keep fins and other body parts in an expanded condition. Dead fishes were also kept in the formalin solution. Formalin solution was prepared (as described by Jayaram, 1999) [8] by diluting one part of concentrated formalin or commercial formaldehyde with nine parts of water. Fishes brought to the laboratory were fixed in this solution in separate jars according to the species. Smaller fishes were directly placed in the formalin solution, while larger fishes were given an incision on the abdomen before they were fixed. However care was taken to avoid a deep cut, which injures or exposes the internal organs.

Before fixation the colour pattern of the fishes, specific marks, spots, and designs were noted as far as possible in live condition, since formalin decolorizes the fish color on long preservation. The fishes collected and fixed were labeled giving a serial number exact locality from where collected, date and time of collection spot, wherever possible. The common local name of the fish used in this region was labeled on each jar containing the fish.

The identification of the species was done mainly on the basis of the color pattern, specific spots or marks on the surface of the body, shape of the body, structure of various fins and fin formula etc.

3. Results

Distribution and status of fishes

In habitat wise distribution fishery fauna was always confined to interior lake habitats and in the present study a total of 26 species of fishes (Table 1) were documented from lake environments belonging to families, Notopteridae (*Notopterus notopterus),* Anguillidae (Anguilla bengalensis), Cyprinidae (*Cyprinus carpio, Catla Catla, Labeo rohita, Puntius ticto ticto, Puntius sophore, Osteobrama vigorsii, Ctenoptergo idella, Cyprinus mrigala,* Bagridae (*Mystus gulio, Mystus vittatus, Mystus cavasius),* Siluridae (*Wallago attu, Ompok bimaculatus),* Heteropneustidae (*Heteropneustes fossilis),* Mugilidae (*Rhinomugilcorsula),* Belonidae (*Xenetodon cancila),* Poeciliidae (*Gambusia affinis),* Mastacembelidae (*Macrognathus Pancalus),* Cichlidae (*Tilapia mossambica, Etroplus suratensis)*, Anabantidae (*Anabas testudineus),* Belontiidae (*Colisa fasciatus)* and Channidae (*Channa striatus, Channa punctatus).*

Most of these fishes are abundant in the lake. Six species like *Catla Catla, Cyprinus mrigala, Anabas testudineus, Channa striatus, Channa punctatus, Wallago attu etc, are having commercial food. 11 species like Labeo rohita, Heteropneustes fossilis, Wallago attu, Channa striatus, Channa punctatus, Puntius ticto ticto, Puntius sophore etc. were fine food. Etroplus suratensis, Tilapia mossambica, Colisa fasciatus,* Anguilla bengalensis were having coarse food.

Anabas testudineus, Gambusia affinis are Larvivorous. Puntius ticto ticto, Puntius sophore are having bait value. Channa striatus, Heteropneustes fossilis, Notopterus notopterus are having Medical value **(**Table 2).

4. Discussion

Kondakarla lake drew national attention due to the indulgence of man leading to cultural eutrophication of the lake. Around the lake varied activities prevail ranging from sewage entry through drains, sediment deposition through rivers and creeks. Industrial effluents are released from the nearby industries of leather, dairy, parboiled and sugar factories and agricultural wastes including fertilizers and pesticides. The lake is surrounded by densely populated human habitations which mainly depend on agriculture and fishing.

Physical habitat degradation effects the stream fish assemblages structure (Casatti, L. 2006) [2]. Change in water quality due to untreated industrial effluents and municipal sewage not only increases the load of pollutants to streams about also put the fish fauna under stress Matthews and Berg, (1997) [9]. Fish assemblages have been used as an indicator of environmental degradation (Arunachalam, 2000) [1]. Fish diversity in streams and rivers is considered as a diagnostic tool to highlight the impact of environmental changes (Das and Chakrabarty, 2007) [3] Loss of fish species diversity determines the severity of habitat degradation of an aquatic ecosystem (Ganesan and Hughes, 1998) [6].

Biodiversity studies of fresh water fishes of Kondakarla Lake particularly have not received its due attention. It is hoped that this work will serve as identification manual for interested workers in ichthyology in general and more particularly of Kondakarla lake region and also stimulate the much needed more extensive future work embarrassing various aspects. In the present work a total number of 26 species of fishes were recorded.

Fish responds to changes in its environment whether it is human induced or natural (Han, 2007) [7]. Jayaram (1999) [8], Srivastava (1980) [11] and Day (1878) [4] also agreed with the description of all fish specimen materials examined.

Conservation programmes help fish production to be more sustainable while at the same time maintains diversity. Conserving diversity also improves the likelihood of maintaining minimal viable population of rare and late-successional species. Maintaining ichthyodiversity is important because it is not always possible to identify which individual species are critical to aquatic ecosystems sustainability. Many fish species may provide genetic material and may serve as ecological indicators. Diversity reduces disease problems and encourages recovery from disturbances. Integrating the concepts sustainable development and conservation measures could help improve the situation. Measures such as some amounts of desiltation could lead appreciable improvement in the levels of in the certain water quality parameters like pH, dissolved oxygen etc., and fish yield could reveal a quantum jump within a short period of time.

Fishermen and ichthyologists have a critical role to play in understanding and protecting diverse fish resources. The ongoing process of ecosystem change, as it is evident in lake Kondakarla today, directly or indirectly affects the abundance and composition of the fish species. The state of the fish community may be seen as a valid integrative indicator of aquatic ecosystem quality and health and little more distantly may be viewed as a regional quality of life for the human beings. Conservation of fish diversity assumes top most priority under the changing the circumstances of gradual habitat degradation.

The management of wetlands both freshwater and coastal is more important as these areas have traditional values for fish, wildlife and man. Systematic management plan has to be drawn in an integrated way to recognize the user relationship between the biological and physical components and seek to maximize the benefits that can be obtained from sustainable multiple uses.

During 1987 IWRB launched Asian Water fowl senses to create awareness among the conservation about the needs of water fowl and wetlands and to record the species distribution and annual variations in wetlands of all types.

During AWC count some wetlands are well documented particularly noted coastal and the newly accredited wetlands. But the perennial and non-perennial of the country, especially in Andhra Pradesh have not been documented properly for the purpose of management for sustainable development.

At present these wetlands are under severe threat by man in a multiple way such as the discharge of pesticides, herbicides, nutrients from domestic sewage. Hydrological alternation by channels, roads, poaching and scaring of water fowl on agriculture lands or intense life stock grazing.

Intense developments of wetland for fishery production and large scale introduction of herbivorous fishes resulting in changes in the ecology of wetlands, increased sedimentation caused by serious erosion in the water catchment areas and excessive recreational use of wetlands which resulting in the reduction of species in these aquatic bodies.

Habitat destruction is the biggest problem both for wetland and terrestrial ecosystem possess severe threats both fauna and flora to the brink of extinction. Therefore an integrated approach is required in planning conservation programmes. Conservation must help to mitigate threats to the most threaten species and sub species.

Basing on the present finding the following conservations measures are proposed, which are also economically feasible and protect the balancing nature of the Kondakarla ecosystem in future

1. Over exploitation of flora in and around the lake area should be minimized. Some selected areas which represent high diversity of water fowl should be protected and developed into suitable habitats like agriculture exploitation of the lake habitats and its surrounding areas should not be allowed.
2. Entry of effluents into the lake should be checked and properly maintained annually.
3. Afforestation activity should be intensified along the catchment areas which provide good roosting and breeding sites for number of water fowl.
4. Environmental awareness and eco development programs should be organized at the grass root level so has to create awareness about the important of wetland and water fowl conservation.

Table 1: Check list of fishes in Kondakarla lake

S.No	Family	Scientific name	Common name	Local name	Status
1.	Notopteridae	*Notopterus notopterus*	Bronze feather back	Yerrathok	A
2.	Anguillidae	*Anguilla bengalensis*	Common eel	Polasa	A
3.	Cyprinidae	*Cyprinus carpio*	Grass carp	Bocha - gandumeenu	A
4.	Cyprinidae	*Catla Catla*	Pulsa	Pulsa	A
5.	Cyprinidae	*Labeo rohita*	Labeo roho	Boche	A
6.	Cyprinidae	*Puntius ticto ticto*	Two spot barb	Parigi	A
7.	Cyprinidae	*Puntius sophore*	Spot fin swamp barb	Kethalam surrah	A
8.	Cyprinidae	*Osteobrama vigorsii*	Sykes	Culim poun	A
9.	Cyprinidae	*Ctenoptergo idella*	Grass carp	Miriyalu	A
10.	Cyprinidae	*Cyprinus mrigala*	Mrigal carp	Venkendai	A
11.	Bagridae	*Mystus gulio*	Long whiskered cat fish	Mukul jella	A
12.	Bagridae	*Mystus vittatus*	Striped dwarf cat fish	Erraiella	A
13.	Bagridae	*Mystus cavasius*	Common carp	Thella jella	A
14.	Siluridae	*Wallago attu*	Fresh water shark	Kaduru	A
15.	Siluridae	*Ompok bimaculatus*	Two spot glass cat fish	Wadlah muku	A
16.	Heteropneustidae	*Heteropneustes fossilis*	Scorpion cat fish	Margulu	A
17.	Mugilidae	*Rhinomugil corsula*	Corsula mullet	Corootoolti surrah	LA
18.	Belonidae	*Xenetodon cancila*	'Chuchhe Bam'	Ghoti	A
19.	Poeciliidae	*Gambusia affinis*	Western mosquito fish	Kothisavalla	A
20.	Mastacembelidae	*Macrognathus Pancalus*	Striped spiny eel	Parparaal	MA

21.	Cichlidae	*Tilapia mossamica*	Sea mullet	Korua	A
22.	Cichlidae	*Etroplus suratensis*	Banded pearl spot	Karimeen	A
23.	Anabantidae	*Anabas testudineus*	Climbing perch	Vanjaram Rava	A
24.	Belonitidae	*Colisa fasciatus*	Giant gourami	Kethalam surrah	A
25.	Channidae	*Channa striatus*	Striped snake head murrel	Shanaga pappu	A
26.	Channidae	*Channa punctatus*	Spotted snake head	Kurrameenu	A

A - Abundant
LA - Less Abundant
MA - Moderately Abundant
R - Rare

Table 2: Economic classification of fishes in Kondakarla lake

S.No	Scientific name	Commercial food	Fine food	Coarse food	Others
1.	*Notopterus notopterus*	_	_	X	X(M.V)
2.	*Anguilla bengalensis*	--	--	X	--
3.	*Cyprinus carpio*	X	X	--	--
4.	*Catla Catla*	X	X	--	--
5.	*Labeo rohita*	--	X	--	--
6.	*Puntius ticto ticto*	--	X	--	X(B)
7.	*Puntius sophore*	--	X	--	X(B)
8.	*Osteobrama vigorsii*	_	X	--	--
9.	*Ctenoptergo idella*	--	--	X	--
10.	*Cyprinus mrigala*	-	X	--	--
11.	*Mystus gulio*	--	X	--	--
12.	*Mystus vittatus*	--	X	--	--
13.	*Mystus cavasius*	--	X	--	--
14.	*Wallago attu*	X	X	--	--
15.	*Ompok bimaculatus*	_	_	X	_
16.	*Heteropneustes fossilis*	X	X	_	X(M.V)
17.	*Rhinomugil corsula*	_	_	X	_
18.	*Xenetodon cancila*	--	--	X	--
19.	*Gambusia affinis*	_	_	X	X(L.V)
20.	*Macrognathus Pancalus*	_	X	_	_
21.	*Tilapia mossamica*	--	--	X	--
22.	*Etroplus suratensis*	--	--	X	--
23.	*Anabas testudineus*	--	--	X	--
24.	*Colisa fasciatus*	--	--	X	_
25.	*Channa striatus*	X	X	--	X(M.V)
26.	*Channa punctatus*	X	X	--	--

M.V = Medical value
S.V = Scientific value
L.V = Larvivorous
B = Bait

5. References

1. Arunachalam M. Assemblage structure of stream fishes in the Western Gnats (India) Hydrobiologia, 2000; 430:1-31.
2. Casatti L. Exploration of spatial and temporal patterns of fish diversity and composition. in a tropical esuarine system of Mexico. Reviews in fish biology and fisheries, 2006; 12:167-177.
3. Das SK, D Chakrabarthy The use fish community structure as a measure of ecological degradation. A case study in two tropical rivers of India, Biosystem, 2007; 90:188-196.
4. Day F. The fishes of India; being a natural history of the fish known to inhabit the seas and fresh waters of India, Burma and Ceylon. Texas and Atlas in 4 parts. London, 1878, 20-778.
5. Deepa RS, TV Ramachandra. Impact of Urbanization in the Interconnectivity Wetlands. Paper presented at the National Symposium on Remote sensing Applications for Natural Resources Retrospective, Indian society of Remote sensing, Bangalore, 1999, 19-21.
6. Ganesan V, RM Hughes. Application of an index of biotic integrity (IBI) to fish assemblages of the rivers Khan and Kshipra (Madya Pradesh), India. Freshwater biology 1998; 40:367-383.
7. Han CC. Spatial and temporal variations of two cyprinids in a subtropical mountain reserve a result of habitat disturbance. Ecology of Freshwater Fish, 2007; 16:393-403.
8. Jayaram KC. The Freshwater Fishes of the Indian Region Narendra Publishing House, Delhi, 1999, 551.
9. Mathews KR, NH Berg. Rainbow trout response to water temperature and dissolved oxygen stress in two southern California streams pools, Journal of Fish Biology. 1997; 50:50-67.
10. Mirza MR. Check list of Freshwater fishes of Pakistan. Pakistan Journal of Zoology: Supplement Series. 2003; 3:1-30.
11. Srivastava GJ. Fishes of eastern Uttar Pradesh and Bihar, 1980, 1-201.