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Assessment of piscine diversity and physicochemical properties of soor sarovar (Keetham Lake)

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Abstract
For increasing food production India will have to utilize all the resource, fishes one of the most important aquatic fauna for livelihood and food security as well as play a major role for maintaining aquatic food chain. Piscine diversity of Soor sarvovar were assessed during October 2014 to November 2015.Total 65 fish species were recorded belonging to 8 order, 21 families, and 47 genera. Cypriniformes contributed to be a major order with 38.46% followed by Siluriformes 23.07% and Perciformes 21.53% other other like Clupeiformes, Osteoglossiformes, Beloniformes, Mugiliformes, Synbranchiformes shared 4.61, 3.07, 1.53, 3.07, 4.61 percentage respectively. Physicochemical characters found to be under desired condition.

Keywords: piscine diversity, physicochemical properties, soor sarovar

Introduction
Health of aquatic ecosystem, management of the commercial fish species, geographical location, aquatic environment optimization, enforcement of laws, rules and regulations and their implementation, fish habitat restoration programs play major role to promote piscine diversity. The Soor Sarovar Lake is a water body which is situated beside the Agra Delhi highway (NH 2). It is a source of water for Agra in the months of summer. The entire lake is formed in a catchment area of 7.13 km². Soor Sarovar Lake is pentagonal in shape. There are artificially created islands for shelter and breeding grounds to the migratory birds; Soor Sarovar Lake is a scenic lake. This lake is under the control of forest department and it was a good source of revenue from the sale of large size fishes such as Indian major carps (*Catla catla, Labeo rohita, Cirrhinus mrigala*), catfishes, *Wallago attu*, *Rita rita*, *Mystus spp*, *Clarias batrachus* etc. In monsoon season 70 to 80% of the water body is covered with weeds particularly Water Hyacinth despite constant dredging. The irrigation department owns the land; so coordination is required, particularly to maintain adequate water levels for optimum removal of Water Hyacinth. A drain from the Agra canal comes down to Sur Sarovar from Okhla, carrying Water Hyacinth along with it. This means that re-establishment of the weed is certain even after it is removed from this water body. A chain link gate to prevent Water Hyacinth entering the lake has been broken. In December 20-25% of the lake was cleared of Hyacinth, manually through people's participation. During survey of the lake some avifauna was also seen in this lake. Species diversity is likely to be further reduced due to increased temperatures, reduced precipitation and increased water tapping for agriculture and other uses [1, 2]. Human activities have resulted in drastic degradation of aquatic resources consequential in the alteration of structure and function. As fish constitute almost half of the total number of vertebrates it is very important that their diversity is conserved. Hence the present study was conducted to analyze the piscine diversity in Soor Sarovar Lake.

Table 1: Morphometric characters and metrological data of Soor Sarovar lakes.

Parameters	Soor Sarovar lakes
Latitude	77°51'37"E
Latitude	27°15'57"N
Altitude (masl)	171
Area (ha)	403
Maximum depth (m)	8.0
Surface area (km^2)	7.83
Catchment area (km^2)	7.13
Annual rainfall (mm)	1300

Materials and Methods

Statistically designed five sampling sites were selected for catching fishes and ecological sampling (fig.1 and 2). Alive fish sample were collected at various experimental fishing sites after that fresh specimen were identified and preserved in 10% formalin for further analysis at laboratory. For catching fish mainly tow type of fishing nets gill net and cost net of varying mesh size were operated by local expert fisherman. During netting maximum care should be taken to avoid defecation or disgorgement of fish's organs due to stress. Collected specimens were identified on the basis of morphometric and meristic characters. Morphometric characters include Position and diameter of the eye, Length of snout, Length and depth of the specimen Maximum and minimum girth, Length of Pre caudal fin Pre pectoral fin, Pre dorsal fin, and Pre anal fin *etc*. Meristic characters includes counting fin rays, counting branchiostegal rays, counting gill rackers and lateral line scale count *etc.* Fishes are identified based on the work of [3] with minor amendment as followed by Day's Fauna [4-6]. For analysis of ecological condition of Soor Sarovar using standard methods [7] sampling were conducted between 9:00 AM and 11:00 AM. Water samples were directly taken in wide mouth pre cleaned plastic bottles for analysis of various physico-chemical properties. ELICO water quality analyzer PE 138 kit used for the determination of dissolved oxygen concentration or by Winklers method on site. Samples were transported to the laboratory for analysis of other parameters, under standard ideal conditions. ELICO water quality analyzer model no.PE 138 was used for analysis of Temperature, pH and dissolved oxygen. ELICO SL27 spectrophotometer used measurement of Ammonia, nitrate, nitrite and phosphate.

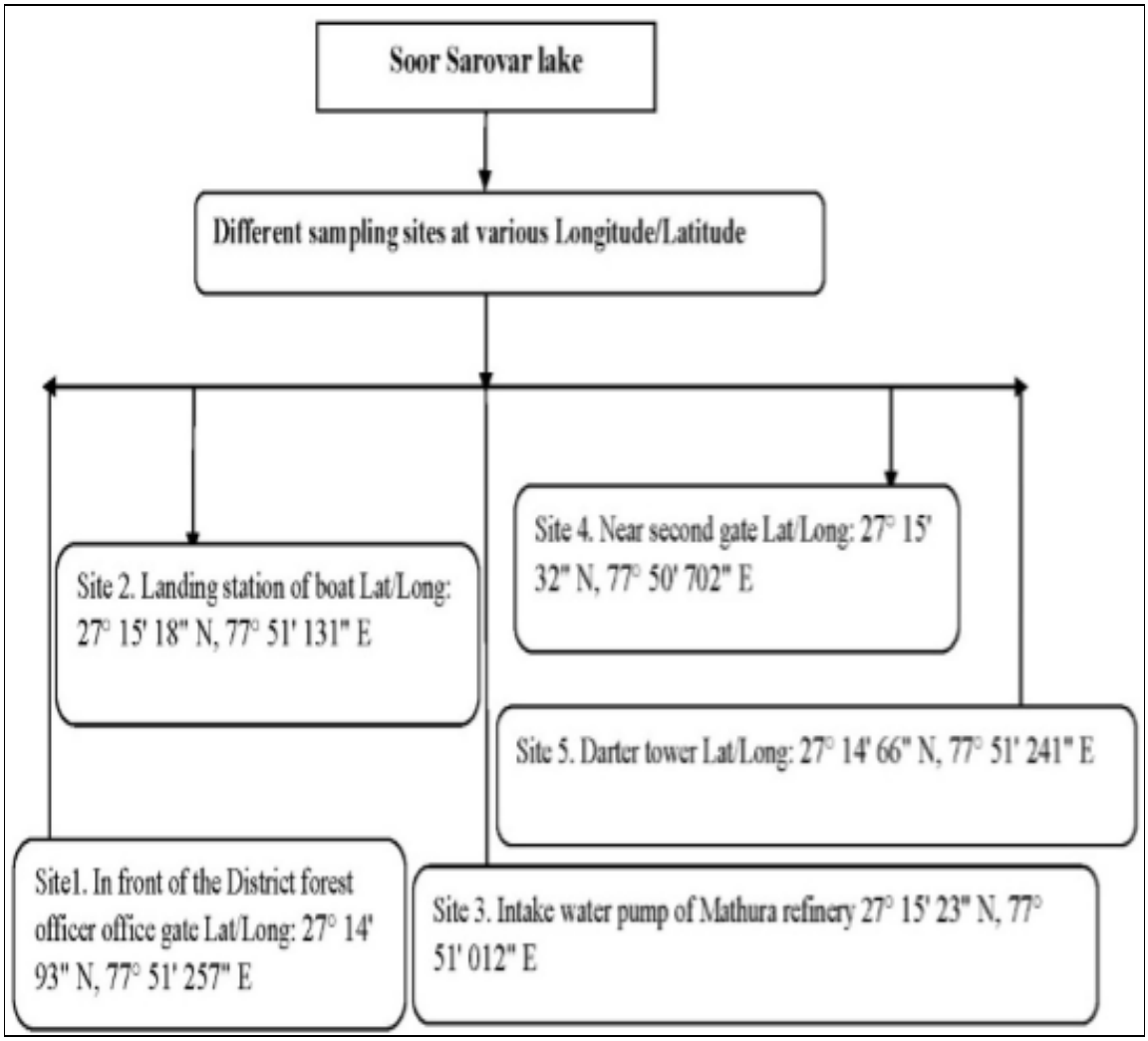

Fig 1: experimental design Soor Sarovar Lake

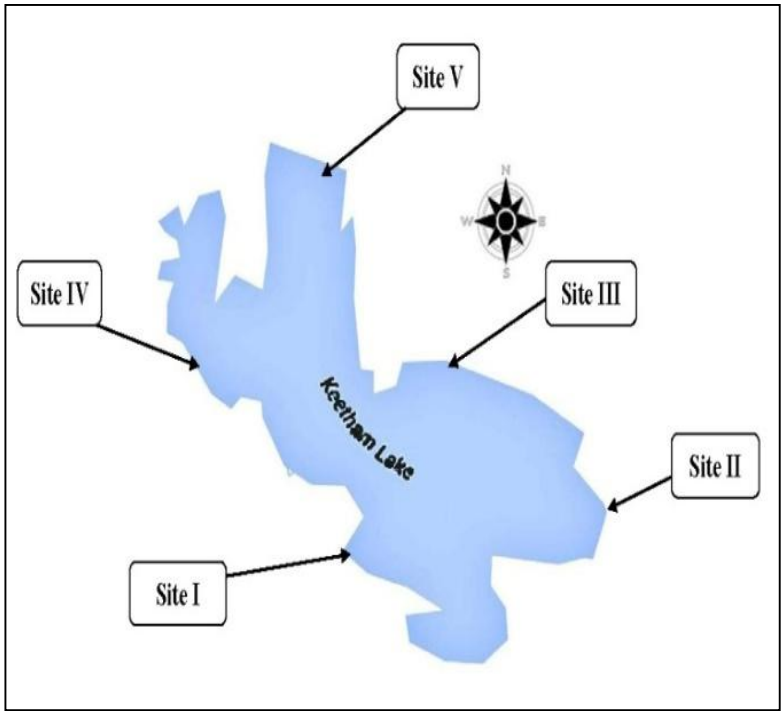

Fig 2: Sampling site of Soor Sarovar Lake (*Google map)*

Results and Discussion

Piscine Diversity

From present investigation we were recorded that out of 65 species 57 were least concern (LC) 4 near threatened (NT) 3 data deficient (DD) and 1 venerable (VU) were recorded. During study period Order cypriniformes (25 species) contributed maximum as compared to siluriiformes (15 species) and perciformes (14) followed by clupeiformes (3 species) synbranchiformes (3 species) osteoglossiformes and mugiliformes each 2 species while, beloniformes shared only single species (fig. 3to6). Highest percentage shared by Order cypriniformes 38.46% comprising fish species are *Amblypharyngodon mola, Aspidoparia morar, Hypophthalmichthys nobilis, Ctenopharyngodon idella, Gibelion catla, Cyprinus carpio, Esomus danricus, Hypophthalmichthys molitrix, Labeo angra, Labeo bata, Labeo calbasu, Securicula gora, Puntius chola, Puntius sarana, Puntius ticto etc.* followed by order Siluriformes and Perciformes, having share 23.07% and 21.53% respectively order Clupeiformes and Synbranchiformes each contributed only 4.61% followed by Osteoglossiformes and Mugiliformes shared 3.07% and remaining order Beloniformes contributed only 1.53% comprising fish species are *Wallago attu, Mystus bleekeri, Mystus tengara, Sperata aor, Sperata seenghala, Pangasius pangasius, Chitala chitala, Clarias batrachus, Notopterus notopterus, Rhinomugil corsula, Sicamugil cascasia, Channa gachua, Channa punctatus, Nandus nandus etc.* Same result is noticed by Sakhare, (2001) [8] who have reported in his investigation from Jawalgaon reservoir in Solapur district of Maharashtra. Reservoir and lake contributed the single largest inland fishery resources both in terms of size and production potential (Kamble *et al*. 2013) [9]. Fish responds to changes in its environment whether it is human induced or natural (Han, 2007) [10]. Jayaram (1999) [11], Srivastava (1980) [12] and Day (1878) [13] also agreed with the description of all fish specimen materials examined.

Table 1: Piscine diversity of Soor Sarovar (Keetham Lake)

Order	Family	*Scientific name*	Local/ common name	IUCN Status
Cypriniformes	Cyprinidae	*Amblypharyngodon mola*	Dhawai	LC
		Aspidoparia morar	Kenwachi/Harda	LC
		Hypophthalmichthys nobilis	Bighead carp	DD
		Gibelion catla	Bhakur/Catla	LC
		Laubuca laubuca	Dendula	LC
		Cirrhinus mrigala	Nain/Mrigal	LC
		Cirrihina reba	Raia	LC
		Crossocheilus latius	Petphorani	LC
		Ctenopharyngodon idella	Grass carp	DD
		Cyprinus carpio	Common carp	VU
		Danio devario	Patukari	LC
		Esomus danricus	Dendua, Flying barb	LC
		Hypophthalmichthys molitrix	Silver carp	NT
		Labeo angra	Thuthuniahia raia	LC
		Labeo bata	Bata	LC
		Labeo calbasu	Karonchi	LC
		Labeo dero	Kalabans	LC
		Labeo gonius	Kurai Labeo	LC
		Labeo rohita	Rohu	LC

		Osteobrama cotio	Gurda	LC
		Securicula gora	Dariai chalho	LC
		Puntius chola	Sidhari, Swamp Barb	LC
		Puntius sarana	Barb/Olive barb	LC
		Puntius sophore	Pool barb, Stigma Barb	LC
		Puntius ticto	Ticto barb, Firefin Barb	LC
Siluriformes	Siluridae	*Wallago attu*	Padhani/Barari	NT
	Bagridae	*Mystus bleekeri*	Tengra	LC
		Mystus cavasius	Sutahawa tengra	LC
		Mystus tengara	Tengana	LC
		Sperata aor	Dariai tengara	LC
		Sperata seenghala	Dariai tengara	LC
		Rita rita	Hunna, Rita, Belgagra	LC
	Sisoridae	*Gangata cenia*	Tinkatia	LC
	Schilbeidae	*Ailia coila*	Patasi/Minti	NT
		Clupisoma garua	Baikari/Karahi	LC
		Eutropiichthys vacha	Banjhoo	LC
		Silonia silondia	Silondia Vacha, Silund	LC
	Pangasiidae	*Pangasius pangasius*	Payasi	LC
	Heteropneustidae	*Heteropneustes fossilis*	Singhi, Stinging catfish	LC
	Clariidae	*Clarias batrachus*	Mangur	LC
Clupeiformes	Clupeidae	*Gudusia chapra*	Suhia, Indian River Shad	LC
		Gonialosa manmina	Majhali suhia	LC
	Engraulidae	*Setipinna phasa*	Phansi	LC
Osteoglossiformes	Notopteridae	*Chitala chitala*	Moi, Knifefish	NT
		Notopterus notopterus	Patra, Featherback	LC
Beloniformes	Belonidae	*Xenentodon cancila*	Kauwa	LC
Mugiliformes	Mugilidae	*Rhinomugil corsula*	Corsula	LC
		Sicamugil cascasia	Yellowtail mullet	LC
Perciformes	Channidae	*Channa gachua*	Chanaga, Dwarf Snakehead	LC
		Channa marulius	Saur	LC
		Channa punctatus	Girai	LC
		Channa striatus	Sauri, Striped Snakehead	LC
		Channa stewartii	Saur	LC
	Ambassidae	*Pseudambassis baculis*	Chanri,	LC
		Chanda nama	Chanri	LC
		Parambassis ranga	Chanri, Indian Glassy Fish	LC
	Sciaenidae	*Johnius coitor*	Patharchatti/Bhola	LC
	Badidae	*Badis badis*	Sumha	LC
		Nandus nandus	Dhebri	LC
	Anabantidae	*Anabas testudineus*	Kawai	DD
	Osphronemidae	*Trichogaster fasciata*	Khosti	LC
		Trichogaster lalius	Khosti	LC
Synbranchiformes	Mastacembelidae	*Mastacembelus pancalus*	Malga/Barred spiny eel	LC
		Mastacembelus armatus	Bam/Zig-zag eel	LC
	Synbranchidae	*Monopterus cuchia*	Andhasanp/Cuchia, Mud eel	LC

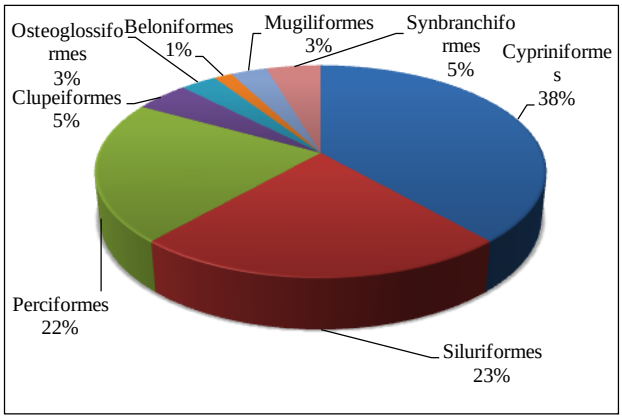

Fig 3: Percentage contribution of each order

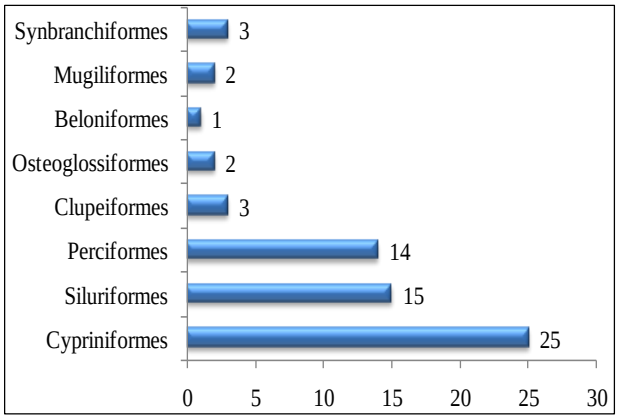

Fig 4: Order-wise fish species abundance

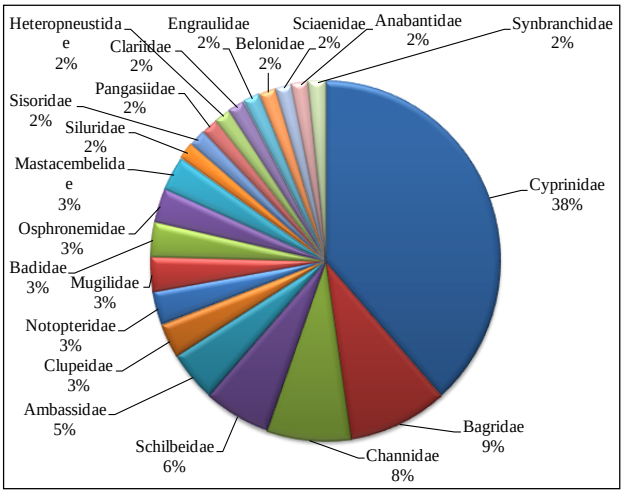

Fig 5: Percentage contribution of each Family

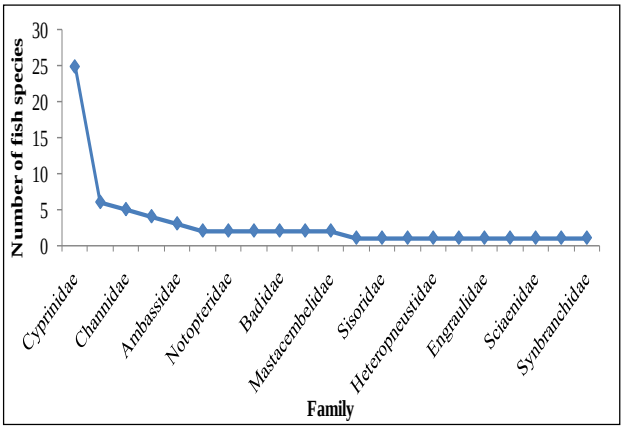

Fig 6: Family-wise fish species abundance

Physicochemical Properties

To evaluate physico-chemical parameters of water must be within ideal ranges (Jobling, 1994) [14]. In the present study, fluctuation of water quality parameters was found less during the study period (Table. 2). The water quality parameters were found to be within the acceptable ranges, except the temperature where fluctuation was somewhat more. Temperature is an important variable that controls growth of fish both under wild conditions (Fry, 1971) [15] and in the culture. The recorded temperature range of Soor saovar lake is 20-29.80 ^{0}C and suitable for survival, growth and reproduction for aquatic animals Bhatnagar *et al.* (2004) [16]. The pH of water was in the range of 7.73±0.10 to 8.02±0.17 during study period Ekubo and Abowei, 2011 [17]. The dissolved oxygen (DO) content in Soor sarovar lake ranged from 5.76±0.11 to 5.93±0.11 mg l^{-1} which was favourable for growth of fish and is in agreement with optimum DO level of 5-7 mg l^{-1} as suggested by Stone and Thomforde (2004) [18]. In present study, alkalinity was recorded in the range of 96.93±2.19-98.40±1.80mg l^{-1} which is in the acceptable range according to Boyd and Lichtkoppler (1979) [19]. Ammonia is the by-product from protein metabolism excreted by fish and bacterial decomposition of organic matter such as wasted food, faeces, dead planktons, sewage *etc* ammonia concentration found in Soor sarovar lake 0.57±0.00 to 0.61±0.01 mg l^{-1} according to OATA (2008) [20] the levels below 0.02 ppm were considered safe. Nitrite is an intermediate product of the aerobic nitrification bacterial process, produced by the autotrophic *Nitrosomonas* bacteria combining oxygen and ammonia, range of nitrite in Soor sarovar lake were reported 0.30±0.03 to 0.31±0.02 mg l^{-1} similar result also reported by Santhosh and Singh (2007) [21].

Table 2: Ranges of different physico-chemical parameters of water for the different treatment during the study period

Parameters	Summer	Winter	Monsoon
Temperature (^{0}C)	29.8	20	25.5
pH	7.73±0.10	7.79±0.06	8.02±0.17
Alkalinity (mg l^{-1})	96.93±2.19	98.40±1.80	97.86±2.34
Hardness (mg l^{-1})	121.73±3.36	129.2±4.22	123±3.13
Dissolved oxygen (mg l^{-1})	5.89±0.09	5.76±0.11	5.93±0.11
Ammonia (mg l^{-1})	0.57±0.00	0.60±0.01	0.61±0.01
Nitrate (mg l^{-1})	0.70±0.14	1.01±0.144	1.17±0.18
Nitrite (mg l^{-1})	0.30±0.03	0.31±0.02	0.32±0.02
Phosphate (mg l^{-1})	0.25±0.06	0.24±0.01	0.21±0.01

Conclusion

The study area Soor sarovar (Keetham) lake is rich in piscine diversity. Fluctuations in physico-chemical property of lake directly or in directly effect on fish species abundance and also to biological characters of whole aquatic ecosystem. Conservation of fish diversity assumes first priority under altering situation of gradual habitat degradation. Therefore a sustainable strategies needs to search more fish species, employment and save fish community of this lake. The study will provide future strategies for development and fish management.

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