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WINGED WANDERERS: SHOREBIRD INVASION AT KONDAKARLA AVA LAKE, ANDHRA PRADESH, INDIA

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ABSTRACT

Kondakarla Ava Lake, nestled within the picturesque landscapes of Visakhapatnam, Andhra Pradesh, India, serves as a vital sanctuary for a remarkable diversity of avian life. This study unveils the richness and abundance of bird populations inhabiting this unique ecosystem. Through meticulous field surveys spanning multiple seasons, we documented over 37 bird species, including a significant number of endangered and threatened species. The lake's diverse habitats, encompassing wetlands, woodlands, and agricultural fields, provide a rich tapestry for resident and migratory birds, each exhibiting distinct habitat preferences and foraging behaviors. Our research delves deeper, analyzing the factors influencing avian diversity and distribution patterns. We examine the intricate relationships between bird communities and their environment by analyzing habitat structure, water quality, and human disturbances. This study highlights the critical role Kondakarla Ava Lake plays in avian biodiversity conservation. The findings underscore the need for effective management strategies to mitigate anthropogenic threats like pollution and habitat degradation. The long-term sustainability of this invaluable avian sanctuary hinges on collaborative efforts between researchers, conservationists, and local communities.

KEYWORDS: Kondakarla Ava Lake, Agricultural fields, Avian biodiversity conservation, Anthropogenic threats, Degradation, Conservationists, Local communities.

Study area & Geo-graphy

Kondakarla lake is a freshwater lake spread to an area of 6.5 Sq.km situated between 17036'38"N latitudes and 82059'53"E longitudes in Visakhapatnam district of Andhra Pradesh, India (Figure 1). It is classified under lacustrine of littoral category encompassed by small hillocks of Eastern ghats and vast plains interspersed by tree species such as Cocas nucifera, Borassus flabellifer, Acacia nilotica and Azadirachta indica with dense growth of shrub and herbaceous communities are of typical coastal littoral vegetation. The lake received freshwater flows through an inlet Munagapaka channel of Sarada river and flooded waters in rainy season reached to the Bay of Bengal by creeks, which is about 10 km distance from the lake. The details of geographical and physical features of Kondakarla are given Table 1.

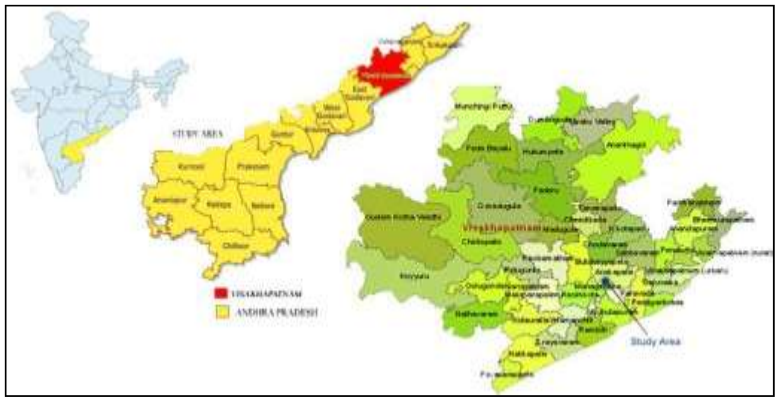

Fig 1: Map showing the location of Lake Kondakarla in Visakhapatnam district, Andhra Pradesh, India.

Lake Parameters	Characteristic Features
Geo-graphical location	$17^0$36'38" N Latitude & 83^0 08'53" E Longitude
Area (Hectares)	450 (4.5 Sq.km)
Maximum depth (meters)	0.5 to < 3.5
Surface temp (^{0}C)	22.0 – 38.5
Lake type of origin	Riverine- Lacustrine system
Bottom type	Silt & clayey-Muddy-soft bottom
Dominant vegetation	Macrophytes and Submerged hydrophytes

METHODOLOGY

Assessment of the population of water birds

Systematic water birds count was carried out at different sites (three random sites were selected), each during January 2021 to December 2023. During counts, each site was divided into many sections in each section the birds were counted. All the birds on the ground or in the water were counted using binocular and any bird flying across the observer was also

included in the counting. Birds flying behind the observer were not counted. Migratory, wintering, breeding/ summering and resident water birds were commonly encountered in the wetlands during the monsoon season (Van Eeden *et al*. (2020).

Density: Calculation of bird density

The density of different ecological groups were calculated as number/hac.

Species diversity was calculated by using Shannon-Weiner (1949) index.

$H' = -\sum Pi(InPi)$

Where

H'= Shannon-Weiner Index

Pi= the proportion of the each species in the sample (Pielou, 1966) The Evenness' Pielou's index will be calculated by using formula

$J' = H'-1/S$

H= Species diversity index;S=Number of species

Diversity

Species diversity has two components: The species richness in the community and species evenness or equitability (Verner, 1985). The diversity was measured most directly as number of species and expressed as an index that incorporated the interplay of species richness and relative abundance of species into single value for the given community (Wiens, 1989). A number of indices have been used to calculate diversity.

Species Richness

Species richness was calculated using the number of species recorded in various habitat types. Species richness was measured by the number of water bird species recorded from different habitats of the wetland during monthly censuses (Verner, 1985) NASA FIRMS (2022). The species richness was also enumerated for all ecological groups Balasubramanian, P,*et al* (2004).

Taxonomic Classification of Birds

The taxonomic classification of birds was used to group the birds by using different orders and families. There are many orders of birds among than the water birds included Ciconiiformes, Anseriformes, Pelecaniformes and Charadriiformes, (Ali, Salim (1985**)**

(Bharatha Lakshmi, B., 2006 & 2008)**.** The updated and latest nomenclature proposed by (Salim Ali and Ripley 1983) was followed in this study.

RESULTS

Totally 1,06,549 individuals of waterbirds belonged to 37 species and 31 genera, included under 14 families and 7 orders were recorded from the Kondakarla Ava Lake during period of January 2021 to December 2023. Among the 37 species, 5 species were migratory, 17 species were resident and 15 species were resident migratory, in which 5 species are categorized as Near Threatened Species andthe remaining 32 species were Least Concern as per the IUCN categories, (2022) Almeida et al. (2021). The Kondakarla Ava Lake facilitates one of the significant wetland habitats for the waterbirds including migratory waterbirds (Table 4.1). Besides, totally 14 species of phytoplanktons, 13 species of zooplanktons, 10 species of molluscan forms, 10 species of polychaetes and 10 species of fishes were recorded during the study period.Apart from these observations the physico-chemical factors of water and soil and environmental factors were also recorded during the investigation in order to understand their relationship with the waterbird community (W.H.O (2022).

Table 1: Water birds recorded in the Kondakarla Ava Lake from January 2021 to December - 2023.

S.No	Common Name	Scientific Name	Order	Family	Migration Status	IUCN Status
1	Wood Sandpiper	*Tringa glareola*	Charadriiformes	Scolopacidae	M	LC
2	Marsh Sandpiper	*Tringa stagnatilis*	Charadriiformes	Scolopacidae	M	LC
3	Common Sandpiper	*Actitis hypoleucos*	Charadriiformes	Scolopacidae	RM	LC
4	Common Redshank	*Tringa totanus*	Charadriiformes	Scolopacidae	RM	LC
5	Common Green shank	*Tringa nebularia*	Charadriiformes	Scolopacidae	M	LC
6	Pacific Golden Plover	*Pluvialis fulva*	Charadriiformes	Charadriidae	M	LC
7	Black WingedStilt	*Himantopus himantopus*	Charadriiformes	Recurvirostridae	R	LC
8	Red-Wattled Lapwing	*Vanellus indicus*	Charadriiformes	Charadriidae	R	LC
9	Lesser Whistling Duck	*Dendrocygna javanica*	Anseriformes	Anatidae	R	LC
10	White Breasted Water hen	*Amaurornis phoenicurus*	Gruiformes	Rallidae	R	LC
11	Purple Moorhen	*Porphyrio porphyrio*	Gruiformes	Rallidae	R	LC

12	Common Coot	*Fulica atra*	Gruiformes	Rallidae	RM	LC
13	Painted Stork	*Mycteria leucocephala*	Ciconiiformes	Ciconiidae	RM	NT
14	Oriental WhiteIbis	*Threskiornis melanocephalus*	Pelecaniformes	Threskiornithidae	R	NT
15	Glossy Ibis	*Plegadis falcinellus*	Pelecaniformes	Threskiornithidae	RM	LC
16	Black Crowned Night Heron	*Nycticorax nycticorax*	Ciconiiformes	Ardeidae	R	LC
17	Indian BondHeron	*Ardeola grayii*	Ciconiiformes	Ardeidae	R	LC
18	Little Egret	*Egretta garzetta*	Ciconiiformes	Ardeidae	R	LC
19	Large Egret	*Casmerodius albus*	Ciconiiformes	Ardeidae	R	LC
20	Whiskered Tern	*Chlidonias hybridus*	Charadriiformes	Laridae	RM	LC
21	Little Tern	*Sterna albifrons*	Charadriiformes	Laridae	R	LC
22	Pintail Snipe	*Gallinago stenura*	Charadriiformes	Scolopacidae	M	LC
23	White-Breasted kingFisheser	*Halcyon smyrnesis*	Coraciiformes	Alcedinidae	R	LC
24	Lesser Pied KingFisheser	*Ceryle rudis*	Coraciiformes	Alcedinidae	R	LC
25	Small Blue KingFisheser	*Alcedo atthis*	Coraciiformes	Alcedinidae	RM	LC
26	Little Grebe	*Tachybaptus ruficollis*	Podicipediforms	Podicipitidae	R	LC
27	Spot BilledPelican	*Pelecanus philippensis*	Pelecaniformes	Pelecanidae	RM	NT
28	Indian Little Cormorant	*Phalacrocorax niger*	Pelecaniformes	Phalacrocoracidae	RM	LC
29	Darter	*Anhinga melanogaster*	Pelecaniformes	Phalacrocoracidae	RM	NT
30	Grey Heron	*Ardea cinerea*	Ciconiiformes	Ardeidae	RM	LC
31	Purple Heron	*Ardea purpurea*	Ciconiiformes	Ardeidae	RM	LC
32	Eurasian Spoonbill	*Platalea leucorodia*	Pelecaniformes	Threskiornithidae	RM	LC
33	Spot BilledDuck	*Anas poecilorhyncha*	Anseriformes	Anatidae	RM	LC
34	Yellow-Wattled Lapwing	*Vanellus malabaricus*	Charadriiformes	Charadriidae	R	LC
35	River Tern	*Sterna aurantia*	Charadriiformes	Charadriidae	R	NT
36	Cattle Egret	*Bubulcus ibis*	Ciconiiformes	Ardeidae	RM	LC
37	Asian Open bill	*Anastomus oscitans*	Ciconiiformes	Ciconiidae	R	LC

R= Resituant, RM= Resitant Migrant, M= Migrant , LC= Least concern, NT= Near Threatened

Table 2: Overall year wise variations of characteristics of birds recorded from January 2021 to December 2023. (Values are Mean ± SE).

S. No.	Characteristic of Birds	Year		
		2021	2022	2023
1	Density (No. /ha.)	329.9 ± 43.15	737.6 ± 99.76	961.3 ± 194.66
2	Diversity (H')	0.01 ± 0.001	0.02 ± 0.002	0.02 ± 0.004
3	Richness (No. of species)	14.7 ± 0.68	19.7 ± 1.10	23.2 ± 1.27

DISCUSSION

The study focused and collected data on the population characteristics of waterbirds, physico-chemical parameters of water and soil, assessment of availability of food and prey items of waterbirds, other environmental paratmeters and recommendation for the management of wetlands (Westerbom *et al* 2002). The data were collected from January 2021 to December 2023. During the study period 1, 06,549 individuals of waterbirds belonged to 37 species and 31 genus, included under 14 families and 7 orders were recorded. Among the 37 species, 5 species were migratory, 17 species were resident and 15 species were resident migratory. Among them five species such as Darter (*Anhinga melanogaster*), Spot Billed Pelican (*Pelecanus philippensis*), Painted Stork (*Mycteria leucocephala),* Black Headed Ibis (*Threskiornis melanocephalus*) and River Tern (*Sterna aurantia)* are categorized as Near Threatened and the remaining 32 species are Least Consent as per the IUCN catégories, (2017) Wilen, B.O., and Bates, M.K, (2004).

SUMMARY

In the Kondakarla Ava Lake facilitates one of the potential wetland habitats of waterbirds including migratory waterbirds in the Visakhapatnam District, Andhra Pradesh, India. Obviously, the present study reveals that theecology of the lake also supports the waterbirds community to a significant level. However, the lake is facing lot of threats by human activities, which will disturb the survival of waterbirds during breeding and non-breeding seasons of the waterbirds. On the basis of the analysis the lake has been identified for the conservation of waterbirds, and various issues have been discussed, and recommendations have been made for the conservation and management of the lake. Besides on the basis of the results of the investigation the State and Central Governments, especially the Ministry Environment and Forest have been recommended to declare the Kondakarla Ava Lake as Important Bird Area (IBA) in Andhra Pradesh, Southern part of India. In addition to that the lake can be declared as a protected area as Waterbird Sanctuary in the near future in order to conserve the waterbirds visited in the lake.

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