

# Impact of Microhabitat Destruction on Shore Birds in Kaikondrahalli Lake, Bangalore South

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**Abstract:-** Ninety percent of all lake life is born, raised and fed in the first 10-15 meters (30-50 feet) of shallow water shorelines around lakes. This area act as filters, reducing entry of pollutants into the lake, stabilizing soils and protecting against erosion and provide essential food and habitat for the survival of many species of organisms. Most of the plants, microorganisms, insects, amphibians, reptiles, birds, mammals and fishes depend on the shoreline for survival. Keeping shorelines natural is the best way to protect water quality and the value of waterfront properties. Birds are the most conspicuous and significant component of freshwater wetland ecosystem. Presence or absence of birds may indicate the ecological conditions of the wetland area. Thus the objective of this study was to determine the impact of destruction on the shoreline by recording the wetland bird species abundance that utilize Kaikondrahalli Lake's shore habitat for foraging and nesting.

**Keywords:-** Shallow Water, Shoreline, Pollutants, Impact, Destruction, Erosion, Waterfront, Wetland, Abundance, Foraging, Nesting.

## I. INTRODUCTION

Wetlands are characterized by shallow water overlying waterlogged soil, interspersed submerged and emergent vegetation. Wetlands are the most productive ecosystems due to their habitat diversity, great productivity, and diverse attributes including a distinctive avifauna. During the past century, wetland areas have been reduced by more than 50% globally, and their destruction is likely to continue. The gradual loss and degradation of wetlands due to development and pollution have also adversely affected wetland bird species. Ecological associations where one species enhances habitat for another nearby species (facilitations) shape fundamental community dynamics and can promote niche expansion, thereby influencing how and where species persist and coexist. Birds are an important component of biotic community of wetland ecosystems. They respond quickly to changes in habitat. Thus, birds are good bio-indicators of wetland habitat, quality, productivity, and stability. Birds often have correlation with their habitats and have also been used as surrogates for assessing the impact of habitat changes. Monitoring the species abundance, habitat preference, and correlation between species abundance and habitat provides basic information for determining factors causing population fluctuation of bird species.

Subsequently, the information helps in conservation and management of threatened and endangered species. Long-term avian monitoring identifies the bird species that decline due to habitat loss or degradation. Similarly, the assessment of vegetation composition and structure is a useful tool to examine and understand the habitat characteristics and impacts of disturbance or alteration of habitats on the avian species.

Bengaluru city is the fifth largest city in India and is also known as the Garden City. Bengaluru had about 379 water bodies in 1973, due to urbanization it is reduced to about 246 in 1996 with about 81 major water bodies. Recent studies also showed that about 40% of the water bodies in Bangalore were sewage fed. 54 per cent of lakes in the City have been encroached upon for construction activities and turned into garbage dump yards.(Ramachandra T V, et al., January 2016). Wetlands in Bangalore and elsewhere receive largely untreated runoff from much of the developed urban and agricultural areas. Physio-chemical and biological characterization in lakes located all over the city shows that large number of lakes in Bangalore is polluted mainly due to sewage from domestic and industrial sectors.

The prospect of India becoming 50 percent urban by about 2040 is daunting by most standards. This massive increase in urban population is bound to have significant implications on the country's environment.

## II. STUDY AREA

KaikondrahalliLakespread over 48 acres, 23 guntas on Sarjapur Road in Bangalore south; Karnataka, India is located in Kaikondrahalli village at a height of 770m above sea level with latitude of 12.9149802 and Longitude of 77.6710131 about 56 Kms from Kempe Gowda international airport, facing the main Sarjapur road. The lake is a bio-diverse ecosystem and is one of the enviable success stories for the struggling lot of lakes in Bangalore.

Much like the current status of the majority of lakes in the city, Kaikondrahalli Lake was a dump yard, until 2009. This lake is now the darling of the neighborhood. Today, it stands proudly with over a 1000 trees planted around the lake and 38 species of shore birds spotted. An island and raft have been constructed and managed in the wetland for the Protection of Birds. These structures are primarily aimed at providing secure breeding and resting sites for shore birds. Use of islands and rafts by different

breeding species is dependent upon their vegetation cover and geographical location.

Activities like nature walks/jogs, bird watching and photo walks are already abuzz around the lake and with a recreational spot and ownership and curiosity has increased not just among the nearby residents but distant visitors as well.

It's a popular point of reference by environmentalists and lake restoration activists, a place for calm and

relaxation for the Bellandur inhabitants and a hot spot for photo and nature walks. The lake upkeep efforts have now entered phase two with the development of cycle paths, jogging track, toilets, solar power lights and an amphitheater. Kaikondrahalli Lake was part of a traditional tank system that was developed over centuries but as the city grew it became increasingly valuable to land developers. Encroachment, growth of unhealthy hyacinths and sewage release became the norm.



Fig 1

### III. MATERIALS AND METHODS

A binocular, Nikon 8 x 42 was used to spot birds and study their activities. An advanced Zoom handy Cam Canon 53X HD was also used to record the activities of the birds as well as its habitat. A Cannon 760D Camera with 18-135mm and 75-300mm lenses were used to take pictures for identification of bird species. Occasionally, a tripod was used based on light conditions. A field guide was also carried to identify birds like, The Text book of Indian birds by Salim Ali, Oxford University press publication, "Birds of the Indian subcontinent" by Richard Grimmet, Carol Inskipp and Tim Inskipp, Helm field guides. A Pocket diary with Pen/ Pencil was used to write down the data like date, duration of study, weather

condition, bird species sighted etc. Comfortable dull color clothing for a fair camouflage was worn.

Point count and Random observation methods were used in this study. Point count is one of the most commonly used survey techniques for determining avian species composition and abundance. Point counts are essentially strip transects of zero length in which the observer performs the count in a 360° arc around a fixed survey station. Survey stations are randomly located throughout the study area to obtain representative samples of the species and numbers of each species present. Random observation is a way of observations made at a randomly selected location over a period of at least five minutes.

## IV. BIRDS SIGHTED

Sl No	Common Name	Scientific Name	Family	Order	Feed	Habitat within the lake	Nesting Season
1	Asian open billed stork	<i>Anastomusoscitans</i>	Ciconiidae	Ciconiiformes	Inv, Small Vert, snakes, fishes	LF, SW	Jun- Dec
2	Black headed ibis	<i>Threskiornismelanocephalus</i>	Threskiornithidae	Pelecaniformes	In, grains, small reptiles	LF	Mar-Oct- NI Nov-Dec- SI
3	Bronze winged jacana	<i>Metopidiusindicus</i>	Jacaniidae	Charadriiformes	Inv, seed roots, TAP	LF	Jun-Sept
4	Black winged stilt	<i>Himantopuslimantopus</i>	Recurvirostridae	Charadriiformes	Inv, tadpoles, small fish, fish eggs and seeds	LF, MF	Aprand Aug
5	Brahminy kite	<i>Haliasturindus</i>	Accipitridae	Accipitriformes	Offal, fish, frogs, small snakes, bats etc	Above OW and perched on trees in island	Dec- Apr
6	Black crowned night heron	<i>Nycticoraxnycticorax</i>	Ardeidae	Pelecaniformes	Crabs, fish, frogs, Aquatic insects	LF, Perched on trees in island	Dec- Feb
7	Common kingfisher	Alcedoatthis	Alcedinidae	Coraciiformes	Inv, Fishes, Reptiles	Perched on overhanging branches of Island trees, close to SOW	Mar- Sept.
8	Common moorhen	<i>Gallinulachloropus</i>	Rallidae	Gruiformes	Inv, grains, SMP	LF, ML	June-Sept
9	Cattle egret	<i>Bubulcus ibis</i>	Ardeidae	Pelecaniformes	Inv, frogs, earthworms.	LF particularly where garbage is accumulated	May in NI, June in SI
10	Eurasian coot	<i>Fulicaatra</i>	Rallidae	Gruiformes	Algae, Veg, seeds and Fr, EOB	ML, OW	May- Sept
11	Grey wagtail	<i>Motacillacineria</i>	Motacillidae	Passeriformes	Inv	LS, LF	Apr- Jul
12	Green sandpiper	<i>Tringaochropus</i>	Scolopacidae	Charadriiformes	Inv, fish, pieces of some vegetation.	LF	late Apr-Jul
13	Great cormorant	<i>Phalacrocoraxcarbo</i>	Phalacrocoracidae	Suliformes	Almost exclusively fish	Middle and open waters and on trees at the shore	Sept- Feb
14	Great egret	<i>Ardea alba</i>	Ardeidae	Pelecaniformes	Fishes ,SV, In	LF and SOW	Mar-Apr
15	Grey heron	<i>Ardeacinerea</i>	Ardeidae	Pelecaniformes	Fish, SV, In	LF, SW	Feb/Jun
16	Glossy ibis	<i>Plegadisfalcinellus</i>	Threskiornithidae	Pelecaniformes	Inv, SV, fishes, snakes and nestling birds.	LF, Perched on trees	Jan
17	Garganey	<i>Spatula querquedula</i>	Anatidae	Anseriformes	Seeds, small fish, crustaceans, snail	Middle and open waters	Apr/May
18	Indian cormorant	<i>Phalacrocoraxfuscicollis</i>	Phalacrocoracidae	Suliformes	Almost exclusively fish	ML, OW	Sept- Feb
19	Intermediate egret	<i>Ardeaintermedia</i>	Ardeidae	Pelecaniformes	Fish, SV, insects, crustaceans	LF, SW	Nov-Feb
20	Indian spot billed Duck	<i>Anaspoecilorhyncha</i>	Anatidae	Anseriformes	grain, seeds, SMP, Inv	ML, OW, sometimes LF with ample aquatic vegetation	NI-Jul- Sept, SI- Nov- Dec
21	Little ringed plover	<i>Charadriusdubius</i>	Charadriidae	Charadriiformes	Inv	LF	Apr-Jun
22	Little cormorant	<i>Microcarboniger</i>	Phalacrocoracidae	Suliformes	fish	ML, OW	Nov-Feb

23	Little grebe	<i>Tachybaptusruficollis</i>	Podicipedidae	Podicipediformes	Insects, small fish, tadpole, frog	Middle and open water	Mar-Oct
24	Little egret	<i>Egretta garzetta</i>	Ardeidae	Pelecaniformes	Mainly fish, SV, Inv	LF	June
25	Northern pintail	<i>Anas acuta</i>	Anatidae	Anseriformes	Seeds, rhizomes of aquatic plants, Nesting season-Inv.	ML, OW	Apr and Jun
26	Oriental darter	<i>Anhinga melanogaster</i>	Anhingidae	Suliformes	Inv, small fish, snakes tadpoles	ML, OW close to island.	NI-Aug, SI-Apr-May
27	Painted stork	<i>Mycteria leucocephala</i>	Ciconiidae	Ciconiiformes	fish	Hunts at LF and SW, nesting on trees	Oct-Apr
28	Pied kingfisher	<i>Ceryle rudis</i>	Alcedinidae	Coraciiformes	Inv, fish	on trees in island and LF with overhanging branches close to shallow open water	Feb- Apr.
29	Purple heron	<i>Ardea purpurea</i>	Ardeidae	Pelecaniformes	Inv, fish, SV, snakes,	fringe with ample aquatic vegetation	
30	Purple swam hen	<i>Porphyrio porphyrio</i>	Rallidae	Gruiformes	stems and sap from aquatic plants	LF	Apr-May
31	Pond heron	<i>Ardeola grayii</i>	Ardeidae	Pelecaniformes	Frogs, fish, crabs, insects	LF, perched on trees above water polluted with garbage	May-Sept
32	Red wattled lapwing	<i>Vanellus indicus</i>	Charadriidae	Charadriiformes	Inv	Fringe and flying over open waters	Mar- Aug
33	River tern	<i>Sterna aurantia</i>	Laridae	Charadriiformes	Inv, fish, tadpoles	ML, OW	Feb-May
34	Spot billed pelican	<i>Pelecanus philippensis</i>	Pelecanidae	Pelecaniformes	crustacean Fishes, SV	OW	Oct-Nov
35	White breasted water hen	<i>Amaurornis phoenicurus</i>	Rallidae	Gruiformes	Inv, grains	LF with ample aquatic vegetation and weeds	Jun-Oct
36	Wood sandpiper	<i>Tringa glareola</i>	Scolopacidae	Charadriiformes	Inv in moist/dry mud	Fringe	Aug- Dec
37	White throated kingfisher	<i>Halcyon smyrensis</i>	Alcedinidae	Coraciiformes	Fish, SV, snakes, In, even birds	waterside trees, Fence, Platforms etc	Apr to Jul
38	White browed wagtail	<i>Motacilla maderaspatensis</i>	Motacillidae	Passeriformes	In, spiders	LF	Mar- Oct

Table 1

Inv- Invertebrates, SV-Small vertebrates, Veg- Vegetation, EOB-Eggs of other birds, Fr-Fruits, In- Insects, TAP-Tuber of Aquatic Plants, SMP- Shoots of Marshy Plants, LF= Lake Fringe, SW-Shallow Water, MF, Mud Flats, OW-Open Waters, ML-Middle of the Lake, LS- Lake Shore, SOW-Shallow Open Water, NI-North India, SI-South India.

## V. RESULTS

Bird species were monitored during November, 2017 to January, 2018. A total of 38 species of shore birds comprising 17 families and 10 orders were recorded. Results revealed that the habitat characteristics such as existence of gradually sloping littoral zone, its vegetation composition (i.e. emergent and submerged vegetations, grasses, shrubs, and trees) for safety and nesting, microclimate variables (temperature, relative humidity and light intensity) and more importantly availability of appropriate food were the key factors that influenced the distribution, diversity and density of the wetland bird species. This study also revealed that the wetland bird species have adapted a fairly unique set of microhabitat and microclimate conditions.

Sl. no	Orders	Number of species	Relative Percentage (%)
1	Pelicaniformes	2	5.26
2	Ciconiformes	11	28.9
3	Charadriiformes	7	18.4
4	Coraciiformes	3	7.89
5	Accipitriformes	1	2.63
6	Gruiformes	4	10.52
7	Passeriformes	2	5.26
8	Anseriformes	3	7.89
9	Suliforms	4	10.52
10	Podicipediforms	1	2.63

Table 2:- List of order.

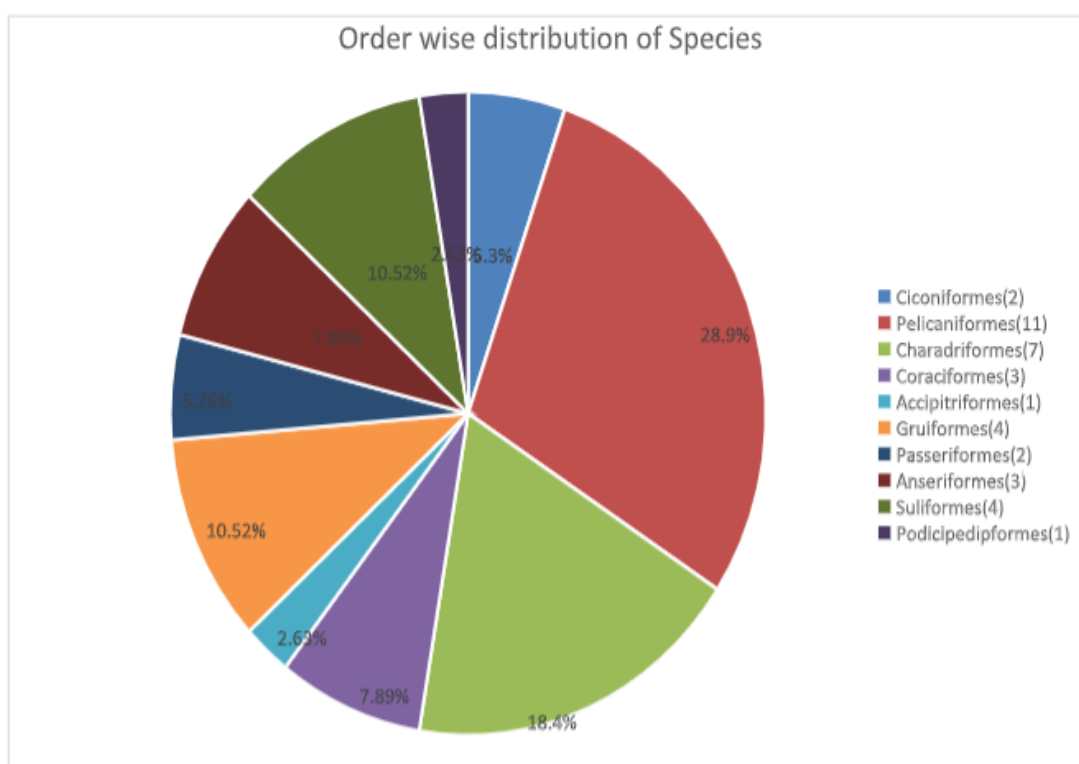


Fig 1:- Graphical representation of the list of orders

	Shallow Water	Open Water	Polluted Region	Middle (Close To The Island)	Flooded Fields	Fringe Of The Lake	Perching On Island Trees	Middle Of The Lake	Fringe With Vegetation	Fens	Platforms
Pelicaniformes	3	1	1		1	1	1	1	1		
Ciconiformes	2					1					
Charadriiformes		2				5					
Coraciiformes	1	1				1	2			1	1
Accipitriformes		1					1				
Gruiformes		1			2	1		1			
Passeriformes						2					
Anseriformes		2		1					1		
Suliforms		4		1			1	3			
Podicipediforms		1									

Table 2:- Table showing order versus habitat

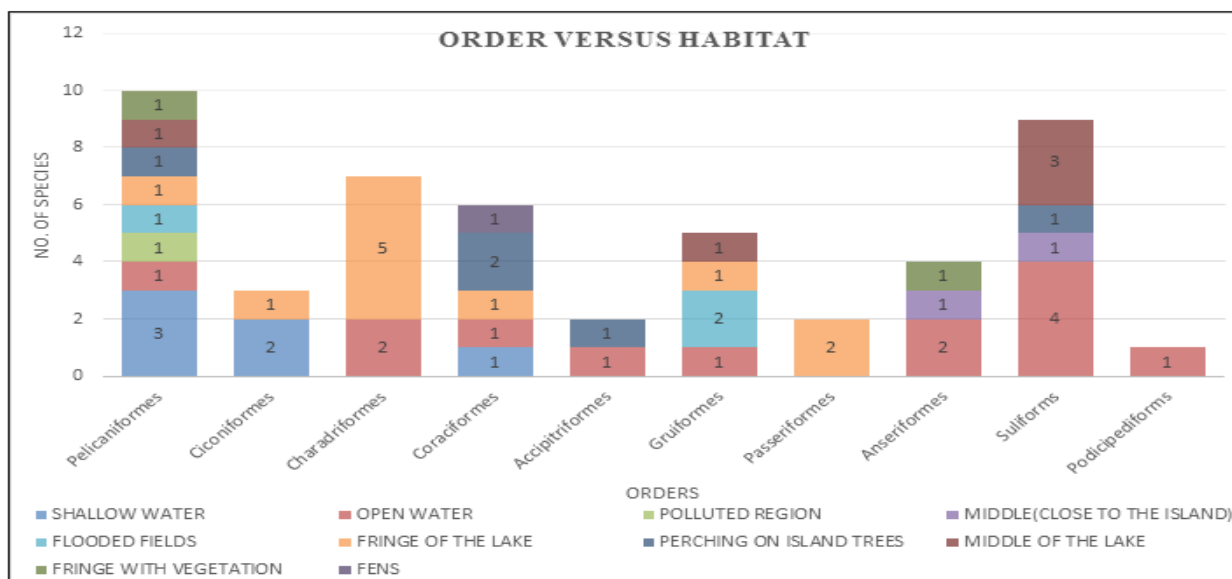


Fig 2:- Graphical representation of order versus habitat

	Orders	Jan to Mar (1 <sup>st</sup> quadrant)	April to June (2 <sup>nd</sup> quadrant)	Jul to Sept (3 <sup>rd</sup> quadrant)	Oct to Dec (4 <sup>th</sup> quadrant)
1	Pelicaniformes				1
2	Ciconiformes	1	2	1	2
3	Charadriiformes	4	6	6	3
4	Coraciiformes	2	3	2	
5	Accipitriformes	1	1		1
6	Gruiformes	1	4	3	2
7	Passeriformes	1	2	2	1
8	Anseriformes	1	2	1	2
9	Suliformes	4	1	2	4
10	Podicipediformes	1	1	1	1

Table 3:- Table showing order versus nesting season.

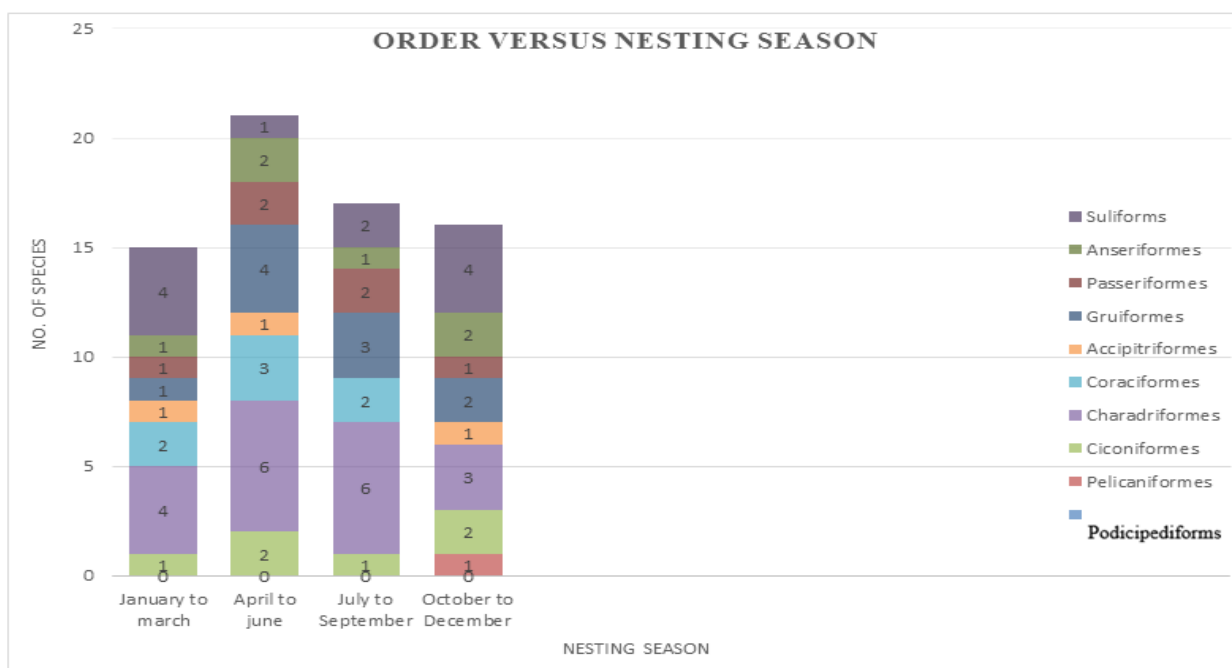


Fig 3:- Graphical representation of order versus nesting season

Food	pelicani formes	ciconiformes	charadri formes	coraciformes	accipitriformes	gruiformes	passeriformes	anseriformes	suliformes	podicipediformes
Snail	4	1	5			2	1	3		
Crab	6	1	3	3			1	2	1	
Worms	3	1	1			2				
Frogs	10	1		1	1					1
Lizards	6	1		1						
Snakes	2	1		1	1				1	
Insects	17	1	6	5		2	1	2	1	1
Fishes	9	2	3	3	1	1			3	1
tadpole			2						1	1
Beetle	1		1	1			1			
Shrimp	5		3	2			1	2	1	
Mammals	4			1						
Bats					1					
Spiders	3		3				1			
Nestling birds	1									
Grains	1					2		2		
Paddy shoots						2				
Rhizome			2					1		
Seeds						1		3		
fruits						1				
Algae						1				
Shoots of aquatic plants								1		
Tubers			1							

Table 4:- Table showing order versus food habit

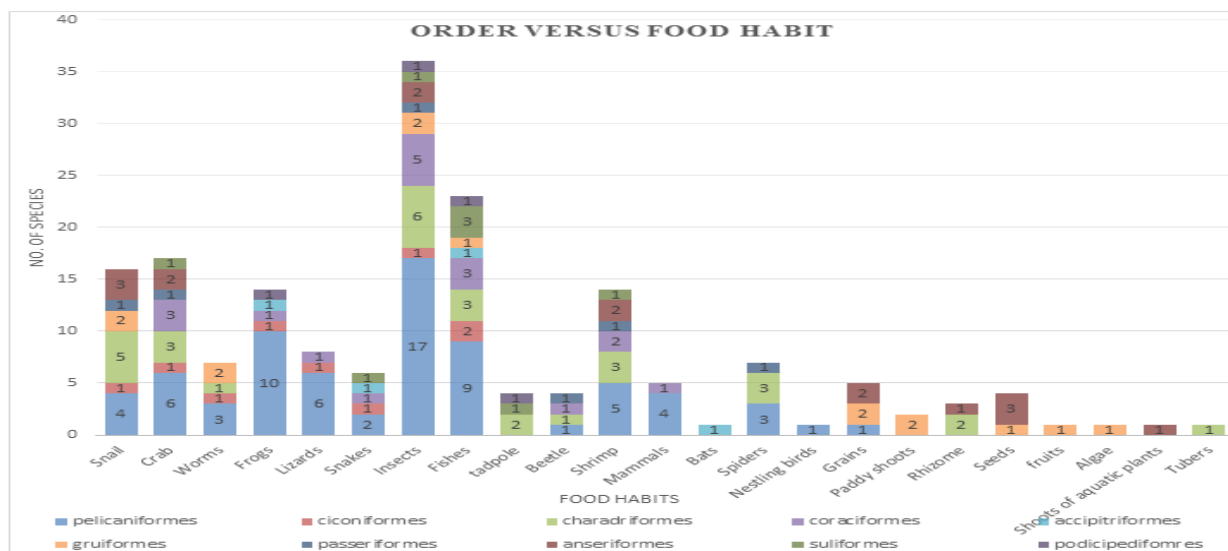


Fig 4:- Graphical representation of order versus food habit

**VI. CONCLUSION**

Among the 10 orders of shore birds recorded, order Ciconiformes with 11 species dominate the shore birds followed by Charadriiformes, Coraciformes, Gruiformes and so on. Regarding the use of the microhabitat, majority of the orders use open water area of the lake, Pellicaniformes prefer organically rich sites while

Passeriformes remain to stay at the fringe while some Coraciformes prefer fence and some platforms.

With regard to the feeding preferences, Pelicaniformes exhibit diverse food habit, most of the Gruiformes prefer plant diet while Anseriformes exhibit mixed diet. Regarding the nesting season, almost all the orders exhibit nesting in each quadrant of the year, thereby

indicating the important of the shore habitat and its vegetation characteristics for these birds except the Pelicaniformes which prefers to nest in the last quadrant of the year. Development of walking path around the lake has practically eliminated the sloping littoral zone of the lake and water with sufficient depth directly hits the walk way. This littoral zone is very essential for the growth of certain vegetations used by certain shore birds that occupy the fringe area for feeding, breeding and nesting activities. Periodic removal of vegetation has been observed near the walk way, there by exposing the hiding area for birds occupying the fringe for various activities. Sewage inlets in to the lake, increase in built up area (concretization, paved surfaces) with a sharp decline of 79% area in water bodies affecting the micro-climate etc. Removal of shoreline riparian vegetation and unabated construction activities in the valley zone has threatened these urban wetlands. Too many para-state agencies and lack of co-ordination among them, too less governance have also contributed to the improper management of lakes.

### RECOMMENDATIONS

Walkway could be constructed a little far beyond the sloping littoral zone. Littoral zone have to be maintained as natural as possible by retaining the naturally grown vegetation cover. This could ensure the safety of the birds for their activities. Let only treated sewage through constructed wetlands and shallow algae pond into the lake (as in Jakkur Lake). Decentralised treatment of municipality waste water preferably at ward levels (similar to Jakkur Lake). Decongest and decontaminate Bangalore". Good governance, single agency with the statutory and financial autonomy to be the custodian of natural resources(ownership, regular maintenance and action against polluters (encroachers as well as those contaminate through untreated sewage and effluents, dumping of solid wastes) are important to monitor the good conditions of a lake.

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