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THE COMPOSITION AND STATUS OF WATERBIRDS OF PERUR LAKE IN TAMIL NADU, INDIA

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Abstract: The composition and status of waterbirds in Perur-Sundakamuthur Lake, a wetland in Coimbatore, Tamil Nadu, was studied from May 2014 to April 2016. This wetland is home to resident and local migrant birds throughout the year and is also used by winter migrant birds during a part of the year (September to March). From the data collected so far, the highest number of birds and species diversity was recorded from February to April. It is, therefore, imperative to maintain adequate water levels in these wetlands during these crucial months for the benefit of the northward migrating waterbirds. During the study period, it was also found that activities like road building could have had a deleterious effect on the number of birds that used this wetland. We recommend that similar studies be carried out in some of the adjoining wetlands of the area in a synchronous manner to further understand the subtlety of local avian movements within the greater Coimbatore area.

Keywords: Birds, Coimbatore, diversity, Perur-Sundakamuthur Lake, waterbirds, water level, wetland.

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Author Contribution: Both the authors contributed equally. GP - contributing more on the subject side and RS contributing more on the computer related matters like data entry, formatting etc.

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INTRODUCTION

Birds occupy a range of habitats and are responsive and sensitive to environmental changes. Wetlands are one of the most productive ecosystems and waterbirds play a vital role in its effective functioning. Urban habitats that include wetlands are continuously disturbed by development activities, which affect bird populations (Raju 2015). Although most urban wetlands in India are considered to be extremely polluted, they still attract a large number of winged visitors (Reginald et al. 2007). Our conclusions are based on the compilation and interpretation of data gathered during monthly bird counts in Perur-Sundakamuthur Lake from May 2014 to April 2016.

STUDY AREA

This study was carried out in Perur-Sundakamuthur Lake (Perur Lake henceforth) (10.968 N & 76.928 E), a wetland complex located in the urban fringe of metropolitan Coimbatore, Tamil Nadu. According to Pragatheesh & Jain (2013), the wetland complex in Coimbatore consisting of around 30 lakes was constructed during the Kongu-Chola regimes in 8th and 9th Century AD in the vicinity of the Noyyal River basin. Considering the nature of the river to flood downstream near Noyyal villages and to exploit the scanty rainfall typical of this region, the Kongu-Chola kings channelized the fury of the monsoon by creating a system of lakes and anicuts to aid the recharging of groundwater. Over a period of time, these wetlands came to house a lot of species of birds, fish, and other forms of life. Thus, the wetlands in this dry region not only provide the much-needed water for agriculture but also perform functions such as flood control, groundwater recharge, water purification, nutrient retention, and biodiversity conservation.

The Perur Lake, which has a catchment area of 5.768km², is fed by Kuniyamuthur anicut channel from Noyyal River as an overflow of excess water from Ganganarayanamsamudhram Lake, located further upstream. The length of the road that adjoins the Perur Lake on the eastern side is approximately 2km (formerly a mere bund), which is shaped like a crescent and filled with partial vegetation on one side and residential areas on the other. Given the lack of industrial activity in the area and non-flow of sewer into this lake, it is relatively unpolluted and contains a rich diversity of molluscs and fish that provide food for waterbirds. According to Wetland (Conservation and Management) Rules, 2010,

the violations in this lake are encroachment and road construction as presented in Table 3 (Pragatheesh & Jain 2013).

Size of the wetland

Catchment area: 5.768km²
 Water spread area: 1.072km²
 Capacity: 1,470,777m³ (51.94 m.cft)
 Full tank level: 4.51m
 Maximum water level: 5.12m
 Top bund level: 6.49m
 Depth: 4.511m
 Length of the bund: 1,350.00m
 Length of shoreline: unknown
 Anicut: 3.5Sq.km

Inlets and outlets

It receives excess water from the Ganganarayanamsamudhram Lake.
 Number of inlets: 1 (channel)
 Number of outlets: 7 (one weir & six sluices)
 Length of surplus escape: 35.67m

MATERIALS AND METHODS

The field observations of birds were carried out from May 2014 to April 2016. The periodicity of the survey was once a month, which usually fell on the second Saturdays. A systematic count of birds that were seen and heard was recorded in a checklist by walking along the 2km road in the mornings. The equipment that was used included binoculars (Nikon 10x42.5, Zeiss 10x42 & Eagle optics 10x42) and a spotting scope (Bausch & Lomb 20–80x magnification). In addition, cameras were also used when necessary during the count. The number of people who participated in the count on any given day varied from three to eight.

The identification of birds was carried out with the help of field guides (Grimmet et al. 2011; Paulson 2005; Rasmussen & Anderton 2012). The checklist was prepared using standardized common and scientific names after Grimmet et al. (2011). The status of birds was categorized as resident, local migrant, winter migrant, and vagrant and are defined as follows. It should be added that some species like Lesser Whistling-duck *Dendrocygna javanica* and Little Ringed Plover *Charadrius dubius* have dual status due to their migrant and resident populations.

Resident (R) – A species that stays and breeds in the area throughout the year or most of the year (e.g.: Spot-billed Duck *Anas poecilorhyncha*).

Local migrant (LM) – A species that stays in an area throughout the year or most of the year whose adult population moves outside the area to breed (e.g.: Painted Stork *Mycteria leucocephala*).

Winter migrant (WM) – A species that spends its non-breeding winter months (mostly from September to April) in the area (e.g.: Wood Sandpiper *Tringa glareola*).

Vagrant (V) – A species that occasionally visits an area and whose pattern cannot be discerned (e.g.: Woolly-necked Stork *Ciconia episcopus*).

RESULTS

The bird species recorded in Perur Lake during this period were 112, belonging to 44 families and 18 orders. Since this study focuses exclusively on waterbirds, which are 49 in number belonging to 14 families and seven orders, only their status is discussed in detail and listed in Table 1.

Anseriformes: Anatidae

1. Lesser Whistling-duck *Dendrocygna javanica* is a species that has the potential to breed in this area when conditions are favourable and to not do so when they are not. Therefore, it has the dual status of a possible resident or a local migrant, based on local factors like water levels in the wetland (Ali 2002). This species was recorded throughout the year except during the dry months from April to June (the only exception being that in May 2015 when five birds were recorded due to favourable water conditions). The highest numbers of this species were seen during the winter months of January 2015 and February and March 2016 when 97, 159, and 74 species were recorded, respectively. Based on these observations, this possible breeder in the area during the southwestern monsoon months (Rasmussen & Anderton 2012) is primarily a local migrant during winters in Perur Lake (Fig. 1).

2. Cotton Pygmy-goose *Nettapus coromandelianus* is a local migrant duck in the area that was recorded only during winter months in an erratic manner. They were sighted from November 2014 to January 2015; a single individual was sighted in December 2015 (Fig. 2).

3. Indian Spot-billed Duck *Anas poecilorhyncha* is a resident species that was recorded every month since the count began in March 2014. Its highest counts were recorded during the migratory months of September and October during autumn and also in February, March, and April during spring. In September and October 2014, however, its numbers were depressed due to very high

water levels, which were devoid of shoreline exposure. This dabbling duck favours shallow freshwater lakes with extensive emergent vegetation (Madge & Burn 1988) and shoreline exposure. This characteristic helps to explain its low numbers in September and October of 2014, which were 14 and 22. During similar periods in 2015, however, the numbers of this species were 227 and 114, respectively, due to favourable conditions (Fig. 3). In January 2015, a pair was observed in courtship behaviour, which terminated in copulation. In the October 2015 bird count, when 114 individuals of this species was recorded, an adult bird with a crèche of five chicks was also observed, confirming the breeding status of this bird in this lake.

4. Northern Shoveler *Anas clypeata* is a winter migrant species (Fig. 4a) that was recorded during the winter months between December 2014 and March 2015. The numbers were 113, 140, 131, and 99 in each month of this period. Due to some inexplicable reason, three and nine individuals of this species were recorded only in October 2015 and February 2016, respectively, of the second season.

5. Northern Pintail *Anas acuta* is also a winter migrant duck (Fig. 5a) that was recorded from December 2014 to March 2015, whose numbers were 71, 218, 436, and 30, respectively. Similar to Northern Shoveler, the Pintails were also reduced in numbers during the subsequent year; only two and 14 individuals were recorded in January and February 2016, respectively.

6. Garganey *Anas querquedula*, according to our records for Perur Lake, is the most numerous winter migrant duck (Figs. 6a,b). It was recorded every month from December 2014 to April 2015, with peak sightings in February and March 2015, which were 532 and 436, respectively. Its sightings, however, dwindled during the winter months of 2015–2016 as only 21 and 152 individuals were recorded in February and March 2016, respectively. Note: Species 4, 5 & 6 that are winter migrant ducks were recorded in lesser numbers in 2015–2016 when compared with similar months in 2014–2015. Only continued monitoring can possibly reveal the reasons behind these annual variations.

7. Common Teal *Anas crecca* is a winter migrant species with erratic presence in the lake. The species was recorded in January and February 2015 and a pair was observed in October 2015 (Figs. 7a,b).

Podicipediformes: Podicipedidae

8. Little Grebe *Tachybaptus ruficollis* is a resident species recorded throughout the year, except in the months of May and June. This bird is extremely water

Table 1. Waterbirds of Perur Lake, Coimbatore, Tamil Nadu

	Common name	Scientific name	Status	Observed months
Anseriformes: Anatidae				
1	Lesser Whistling-duck	<i>Dendrocygna javanica</i>	R/ LM	YR except for Apr & Jun
2	Cotton Pygmy-goose	<i>Nettapus coromandelianus</i>	LM	Nov–Jan
3	Indian Spot-billed Duck	<i>Anas poecilorhyncha</i>	R	YR
4	Northern Shoveler	<i>A. clypeata</i>	WM	Oct–Mar
5	Northern Pintail	<i>A. acuta</i>	WM	Dec– Mar
6	Garganey	<i>A. querquedula</i>	WM	Aug–Apr
7	Common Teal	<i>A. crecca</i>	WM	Oct, Jan, Feb
Podicipediformes: Podicipedidae				
8	Little Grebe	<i>Tachybaptus ruficollis</i>	R	YR except for May, Jun
Ciconiiformes: Ciconiidae				
9	Asian Openbill	<i>Anastomus oscitans</i>	LM	YR
10	Woolly-necked Stork	<i>Ciconia episcopus</i>	V	Mar, Apr
11	Painted Stork	<i>Mycteria leucocephala</i>	LM	Feb–May, Jul, Sep–Dec
Suliformes: Phalacrocoracidae				
12	Indian Cormorant	<i>Phalacrocorax fuscicollis</i>	R	YR except for May, Jun
13	Great Cormorant	<i>P. carbo</i>	LM	Dec, Jan
14	Little Cormorant	<i>P. niger</i>	R	YR
Suliformes: Anhingidae				
15	Oriental Darter	<i>Anhinga melanogaster</i>	R	YR
Pelecaniformes: Pelecanidae				
16	Spot-billed Pelican	<i>Pelecanus philippensis</i>	LM	Jul, Sep, Oct
Pelecaniformes: Ardeidae				
17	Yellow Bittern	<i>Ixobrychus sinensis</i>	LM	Feb–Apr
18	Cinnamon Bittern	<i>I. cinnamomeus</i>	LM	Feb, Apr
19	Grey Heron	<i>Ardea cinerea</i>	R	YR
20	Purple Heron	<i>A. purpurea</i>	R	YR
21	Great Egret	<i>Casmerodius albus</i>	LM	YR
22	Intermediate Egret	<i>Mesophoyx intermedia</i>	LM	YR
23	Little Egret	<i>Egretta garzetta</i>	LM	YR
24	Western Reef-Heron	<i>E. gularis</i>	V	O (Mar)
25	Cattle Egret	<i>Bubulcus ibis</i>	R	YR
26	Indian Pond-Heron	<i>Ardeola grayii</i>	R	YR

	Common name	Scientific name	Status	Observed months
27	Striated Heron	<i>Butorides striata</i>	R	Mar, Apr, Jun–Aug
28	Black-crowned Night-Heron	<i>Nycticorax nycticorax</i>	R	Feb–Apr, Jul–Sep, Nov
Pelecaniformes: Threskiornithidae				
29	Glossy Ibis	<i>Plegadis falcinellus</i>	WM	Sep–Mar
30	Black-headed Ibis	<i>Threskiornis melanocephalus</i>	LM	Mar–May, Aug, Sep
31	Eurasian Spoonbill	<i>Platalea leucorodia</i>	LM	O (Oct)
Gruiformes: Rallidae				
32	White-breasted Waterhen	<i>Amaurornis phoenicurus</i>	R	YR except for Jun
33	Grey-headed Swampphen	<i>Porphyrio porphyrio</i>	R	YR
34	Common Moorhen	<i>Gallinula chloropus</i>	R	YR except for Jun, Jul
35	Eurasian Coot	<i>Fulica atra</i>	R	YR
Charadriiformes: Recurvirostridae				
36	Black-winged Stilt	<i>Himantopus himantopus</i>	WM	Feb–May, Nov
Charadriiformes: Charadriidae				
37	Red-wattled Lapwing	<i>Vanellus indicus</i>	R	YR
38	Little Ringed Plover	<i>Charadrius dubius</i>	WM/ R	Feb–Jun, Sep, Oct
Charadriiformes: Jacanidae				
39	Pheasant-tailed Jacana	<i>Hydrophasianus chirurgus</i>	LM	Sep, Oct, Dec, Jan
40	Bronze-winged Jacana	<i>Metopidius indicus</i>	LM	Aug, Jan
Charadriiformes: Scolopacidae				
41	Common Sandpiper	<i>Actitis hypoleucos</i>	WM	Aug–Apr
42	Green Sandpiper	<i>Tringa ochropus</i>	WM	Nov, Jan–Apr
43	Common Greenshank	<i>T. nebularia</i>	WM	Oct, Feb–Apr
44	Marsh Sandpiper	<i>T. stagnatilis</i>	WM	Feb–Apr
45	Wood Sandpiper	<i>T. glareola</i>	WM	Sep–Nov, Feb–Apr
46	Temminck's Stint	<i>Calidris temminckii</i>	WM	Feb, Mar
47	Little Stint	<i>C. minuta</i>	WM	Oct, Feb–Apr
Charadriiformes: Laridae				
48	Whiskered Tern	<i>Chlidonias hybrid</i>	WM	Sep, Jan–Mar
49	River Tern	<i>Sterna aurantia</i>	WM	Nov, Jan

R - resident, LM - local migrant, WM - winter migrant, V - vagrant, YR - year-round (recorded throughout the year), O - recorded only once

Table 2. Description of water level

Water level	Description
Dry	The absence of water in the lake or the presence of a negligible amount of wetness
Low	The presence of a small amount of water in a few isolated puddles
Medium	The presence of water in the whole lake with shoreline exposure in the periphery
Full	Lake completely filled with water without any shoreline exposure

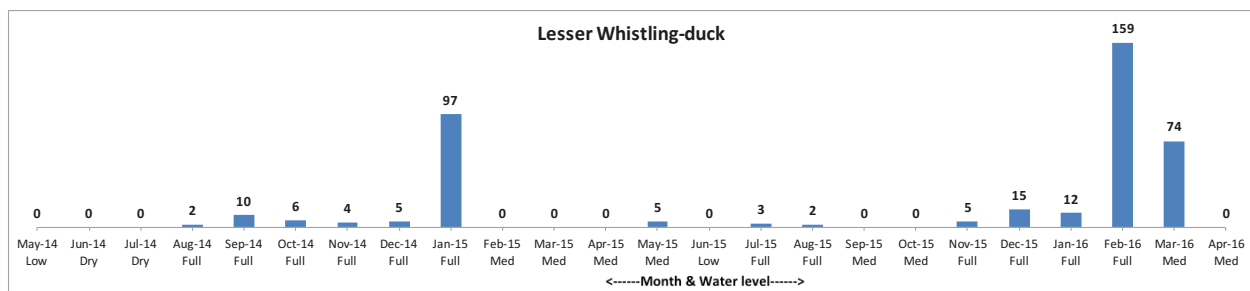
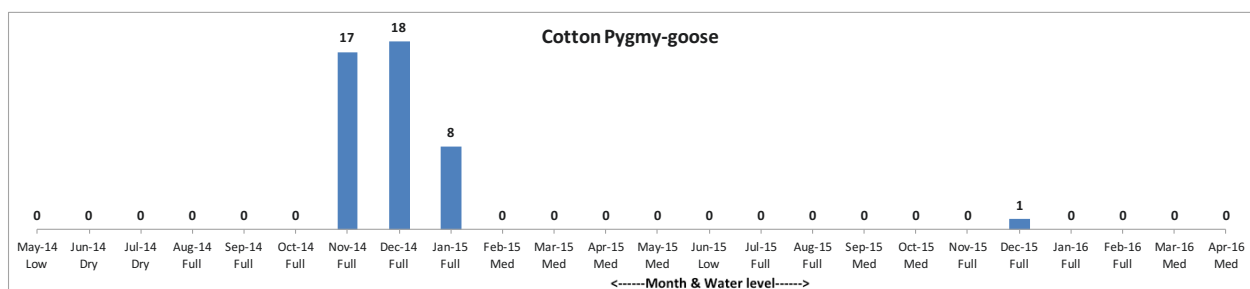
Table 3. Types of encroachments in Perur Lake (Pragatheesh & Jain 2013)

Type of encroachment	Authority	Violation of wetland rules	
Hutments	Private	Section 4(1)(vi)	Hutments located in the land-filled areas.
Agriculture	Private	Section 4(2)(x)	
Dumping of waste		Section 4(1)(iv)	Dumping debris and domestic solid waste along the bund.
Roads		Section 4(1)(vi)	Kovai-Puthur bypass road on the eastern side on the lake & a metal road connecting SH-164 with Kovai-Puthur bypass road on the northern bund.

dependent and rarely leaves the water (Rasmussen & Anderton 2012). Accordingly, its highest counts were recorded during the months when the water level was high, such as 33 in September 2014, 50 and 29 in January and February 2015, respectively (Fig. 8). The breeding season of this species ranges principally between April and October (Ali 2002). This species could probably breed in this lake when water levels are medium to full, which occurs usually after the arrival of the southwestern monsoon. Its breeding status was confirmed in the lake when a flock with three chicks was observed in September 2014. This is evidence of post-breeding dispersal when they were recorded in low numbers from September onwards; however, only future observations can verify this behaviour.

Ciconiiformes: Ciconiidae

9. Asian Openbill *Anastomus oscitans* is a local migrant stork that breeds in southern India mostly from November to March (Ali 2002). This bird was consistently recorded in Perur Lake from May to July 2014 and again from January to June 2015, with a brief presence in September and October 2015 and then being sighted in sufficient numbers from March 2016 onwards. This pattern indicates that the breeding adults migrate out of the area during its breeding season, which could vary from September to March. High water levels with unexposed shoreline are a deterrent to its presence, as indicated

**Figure 1. Bar graph showing the occurrence trend (in numbers) of Lesser Whistling-duck****Figure 2. Bar graph showing the occurrence trend (in numbers) of Cotton Pygmy-goose**

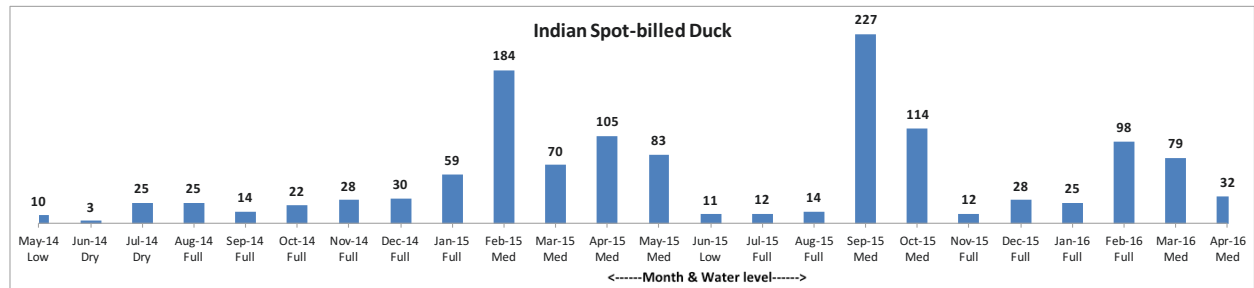


Figure 3. Bar graph showing the occurrence trend (in numbers) of Indian Spot-billed Duck

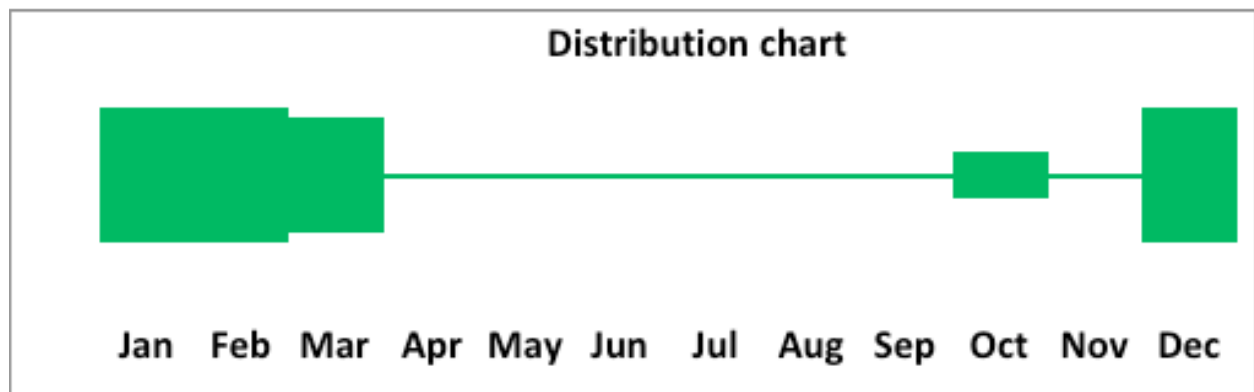


Figure 4a. Distribution chart of Northern Shoveler

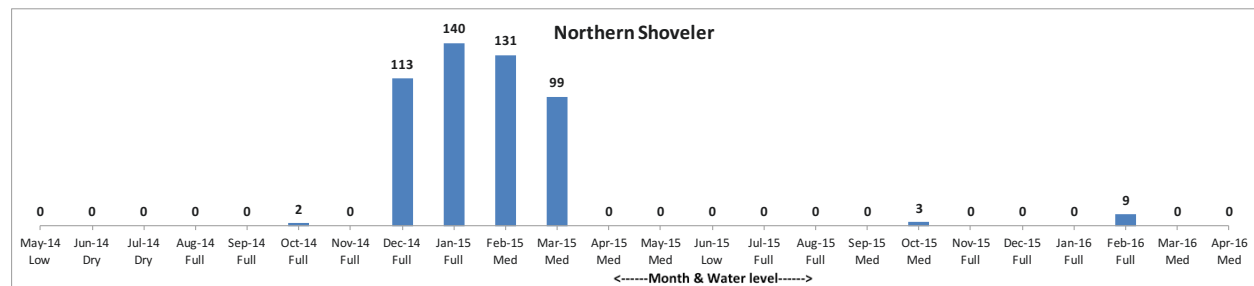


Figure 4b. Bar graph showing the occurrence trend (in numbers) of Northern Shoveler

by the full water levels from August to December 2014 when very few individuals of the species were recorded. In contrast, in September and October 2015, when water levels were less than full with some shoreline exposure, 24 and 17 individuals of this species were recorded, respectively (Fig. 9). Exposed shoreline makes prey-finding possible for this species. Subsequently, when water levels became higher from November 2015 onwards, very few numbers of this species were sighted. This species, however, started to return during the winter months after the full water level receded to expose the shoreline and gradually increased in numbers as the lake dried out.

10. Woolly-necked Stork *Ciconia episcopus* is a vagrant in Perur Lake and was sighted twice in our count

period when three and one individuals were recorded in March 2015 and April 2016, respectively. In addition, Sharang (2016) also reported a flock of 62 birds of this stork species on 29 March 2016 from this lake (Fig. 10). These observations, even though scanty in nature, probably indicate that this species might be using Perur Lake as a transit point during spring migration only. A small population of Woolly-necked Stork breeds in the neighbouring districts of Kerala (Sashikumar et al. 2011).

11. Painted Stork *Mycteria leucocephala* is another local migrant species that breeds in southern India between August and January, varying with local conditions (Ali 2002; Rasmussen & Anderton 2012). This species was observed in the lake only when the water was present in levels that were conducive to prey-finding. Its

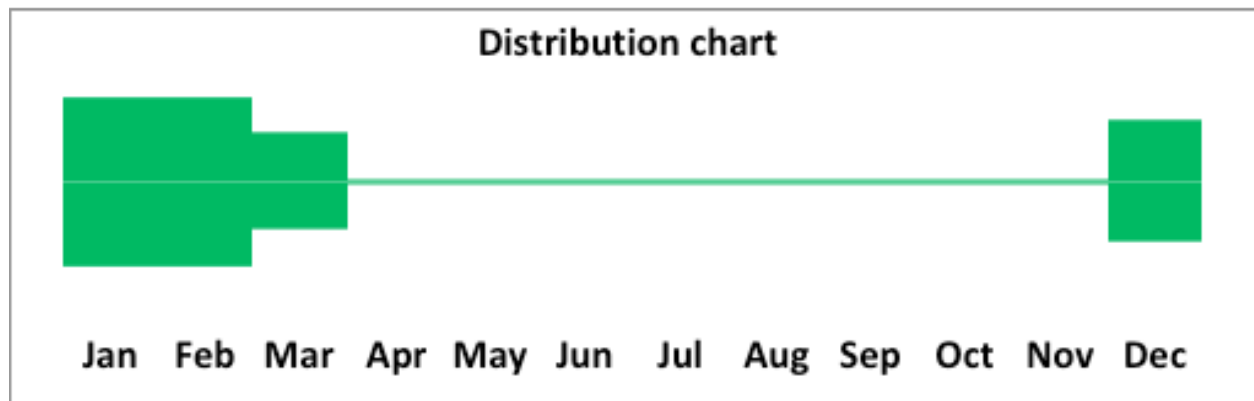


Figure 5a. Distribution chart of Northern Pintail

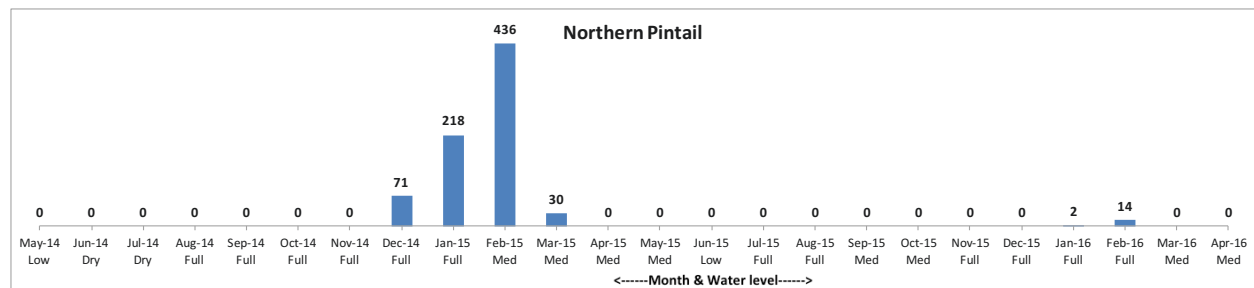


Figure 5b. Bar graph showing the occurrence trend (in number) of Northern Pintail

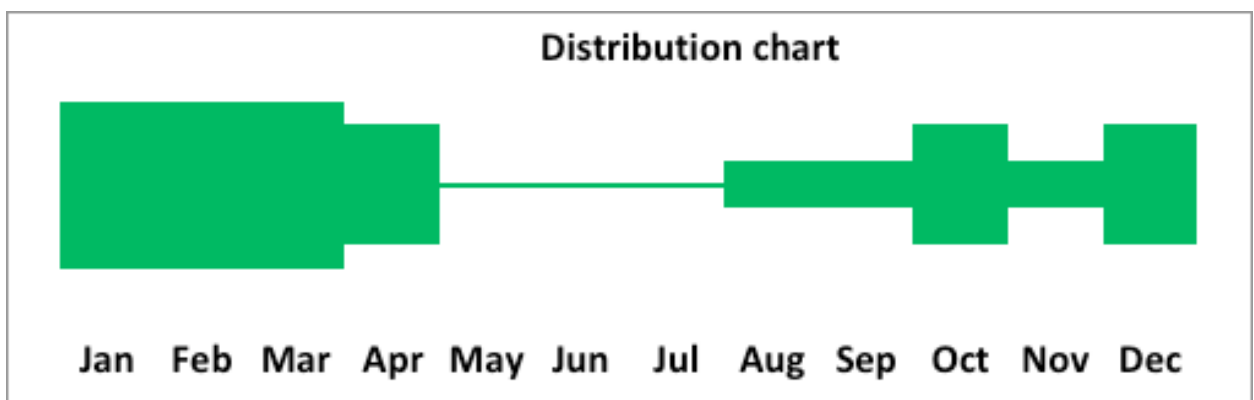


Figure 6a. Distribution chart of Garganey

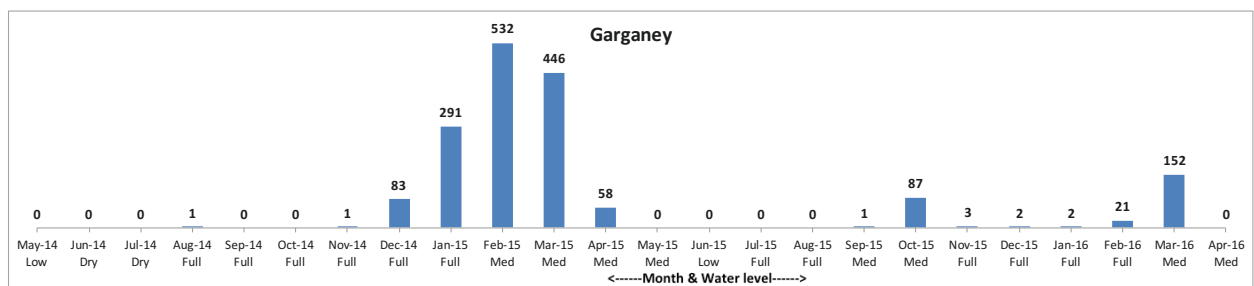
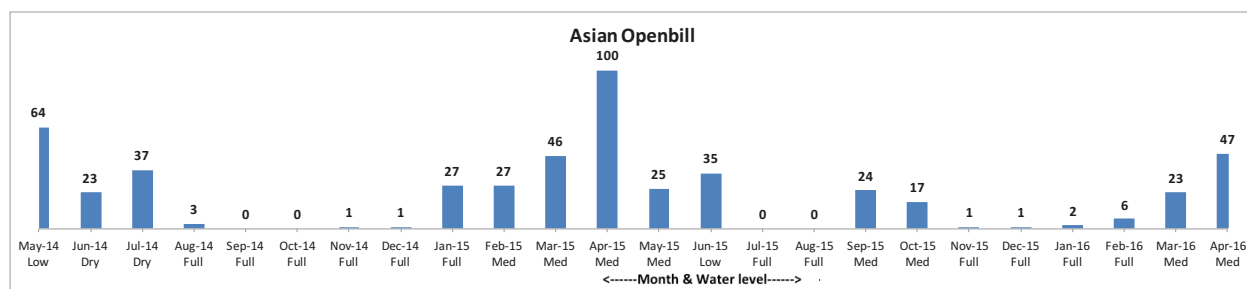
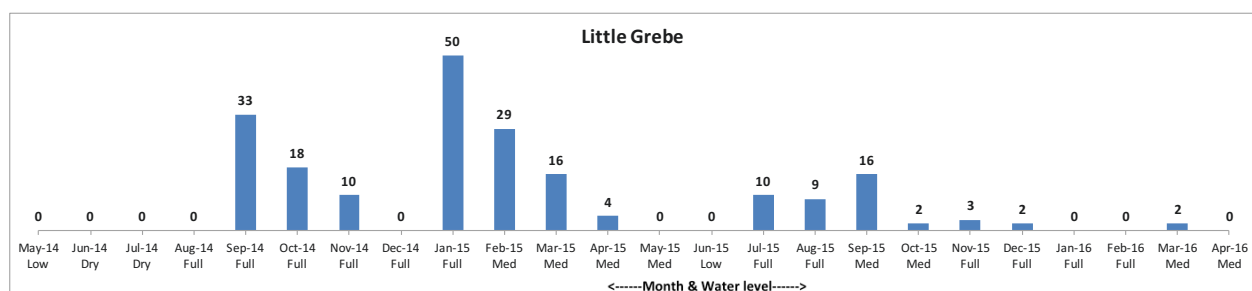
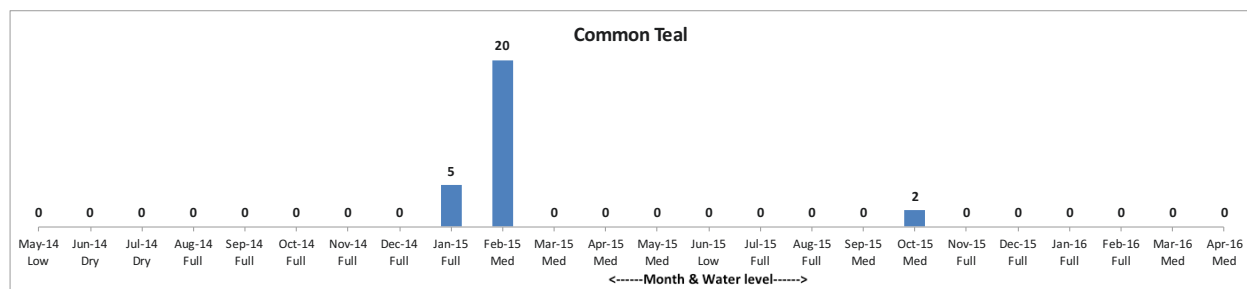
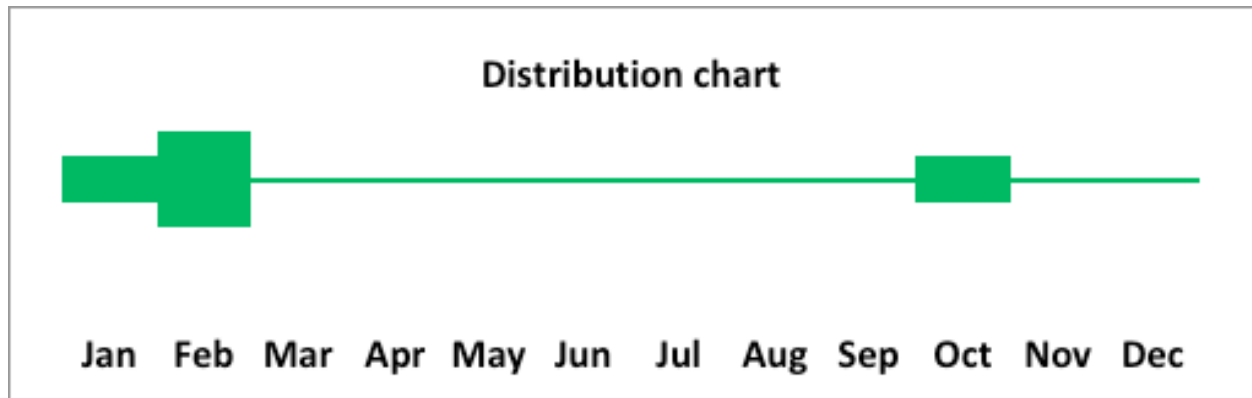


Figure 6b. Bar graph showing the occurrence trend (in numbers) of Garganey



highest counts were recorded in September and October 2015 and in April 2016 when 30, 34, and 35 individuals were sighted, respectively (Fig. 11), when the water level was between shallow and medium, which made prey-finding possible. In the study area, it was present mostly from September to May. This species is listed as Near Threatened due to its moderate population reduction owing to hunting, drainage, and pollution (Rahmani 2012).

Suliformes: Phalacrocoracidae

12. Indian Cormorant *Phalacrocorax fuscicollis* is a resident cormorant species and its presence is sparse in Perur Lake. This species was observed in all months of the year except during the summer months of May, June, and July 2014 and from March to June 2015. The highest number was recorded in February 2016 when 11 individuals of this species were sighted. Its absence in October 2014 even when the water level was full shows the erratic presence of this species in Perur Lake. This species probably breeds in the area in other water bodies.

13. Great Cormorant *Phalacrocorax carbo* is a local migrant cormorant species that was sighted twice during our count period, in December 2015 and January 2016. In both the occurrences, only a single bird was recorded (Fig. 13).

14. Little Cormorant *Phalacrocorax niger* is a resident cormorant species that was recorded every month since the count began in March 2014. Its highest counts were recorded in the winter months of January and February 2015 when 252 and 203 individuals were sighted, respectively (Fig. 14). The population of this species drastically reduced when the water levels were low, especially during the summer months from April to July. This species could be a possible breeder in this lake when conditions are favourable. The breeding season of this bird in southern India chiefly lies between November and February (Ali 2002).

Suliformes: Anhingidae

15. Oriental Darter *Anhinga melanogaster* is a resident species that was recorded year-round except in May & September 2014 and March & April 2016. Its highest counts were recorded in November and December 2014 and in September 2015 when 22, 24, and 23 individuals of this species were sighted, respectively. This species is listed as Near Threatened because of its moderate population reduction due to pollution, drainage, hunting, and collection of eggs and nestlings (Rahmani 2012).

Pelecaniformes: Pelecanidae

16. Spot-billed Pelican *Pelecanus philippensis* is a local migrant species and its sighting in Perur Lake is sparse. This species was recorded in September and October of 2014 and 2015; a single member was recorded in July 2015. Its highest count was recorded in September 2015 when 25 numbers of this species were sighted. Notably, the presence of this species was observed in the lake when water levels were above medium. In 2001, Bird Life International listed this species as Vulnerable. Increased protection, however, enabled a recovery in numbers of this species and it was downlisted from Vulnerable to Near Threatened in 2007 (Rahmani 2012).

Pelecaniformes: Ardeidae

Bitterns, as a group, are uncommon in Perur Lake and their secretive nature resulted in infrequent sightings.

17. Yellow Bittern *Ixobrychus sinensis* &

18. Cinnamon Bittern *Ixobrychus cinnamomeus* are the two species of local migrant (LM) bitterns recorded in Perur Lake. Yellow Bittern was recorded in February, March & April 2015 and March 2016 and their numbers were three, two, two, and one, respectively (Fig. 17). Cinnamon Bittern was recorded in February 2015 and April 2016; in both occurrences, a single bird was sighted (Fig. 18). These are possibly local migrants that are sparsely recorded in the lake during winter months.

19. Grey Heron *Ardea cinerea* is a resident species that was recorded year-round in Perur Lake. Its highest counts were recorded in September and October 2015 when 46 and 21 individuals were sighted, respectively, when the water conditions were probably favourable. Their habitat preferences are brackish water, wetlands, reedbeds, and paddy fields (Rasmussen & Anderton 2012). Its breeding season in southern India ranges from November to March (Ali 2002). It is probable that in September and October this species might be using this lake as a transit point (Fig. 19).

20. Purple Heron *Ardea purpurea* is a resident species that was recorded year-round except in May 2014 and July 2015. Its highest counts were recorded in April 2015 and February 2016 when nine and 11 individuals of this species were sighted, respectively. Its breeding season in India ranges from June to March depending on locality (Ali 2002), and in neighbouring Kerala, it reportedly breeds in July and August (Sashikumar et al. 2011).

21. Great Egret *Casmerodius albus* is a local migrant species in the lake. It was recorded year-round in Perur Lake except from August to October 2014, July 2015, and December 2015. They were usually sighted in

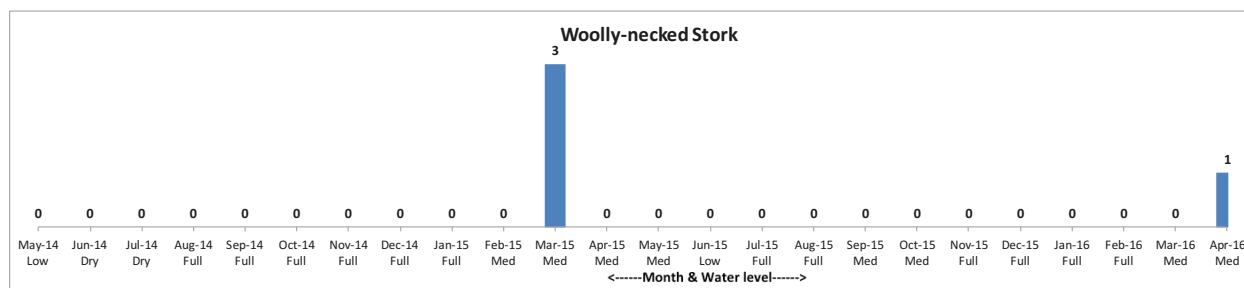


Figure 10. Bar graph showing the occurrence trend (in numbers) of Woolly-necked Stork

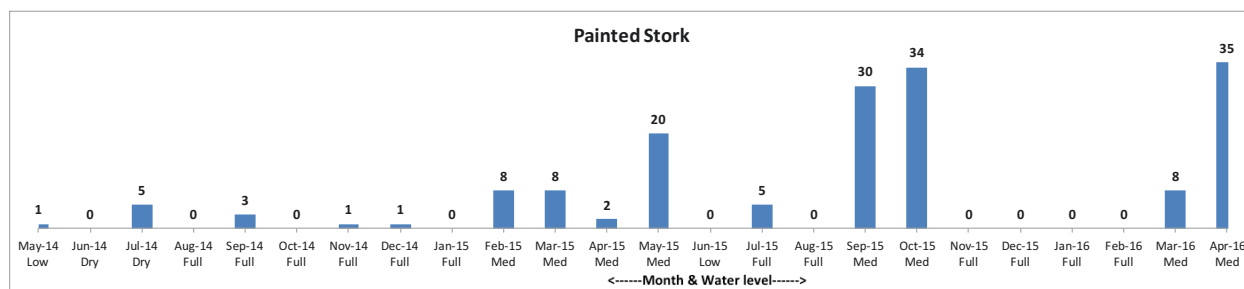


Figure 11. Bar graph showing the occurrence trend (in numbers) of Painted Stork

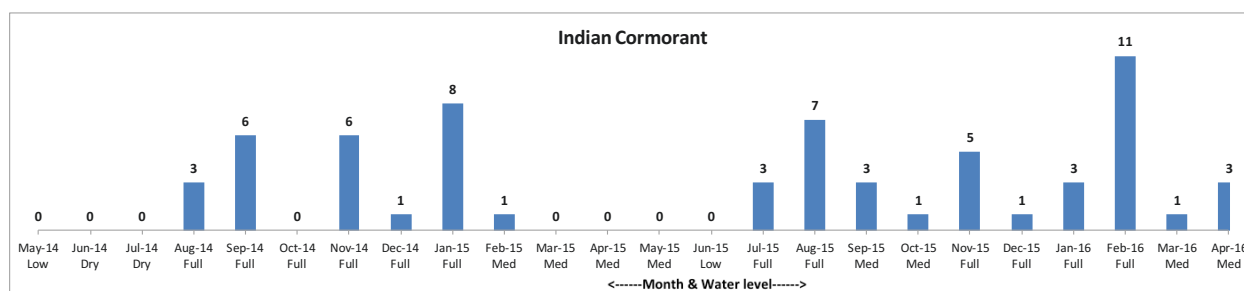


Figure 12. Bar graph showing the occurrence trend (in numbers) of Indian Cormorant

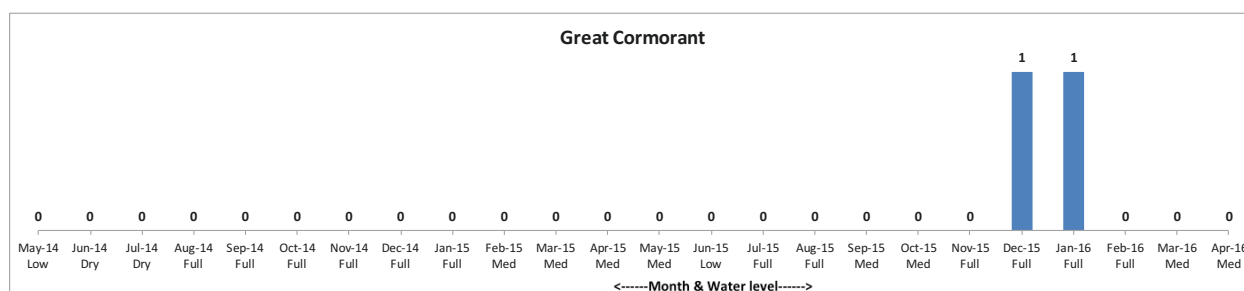


Figure 13. Bar graph showing the occurrence trend (in numbers) of Great Cormorant

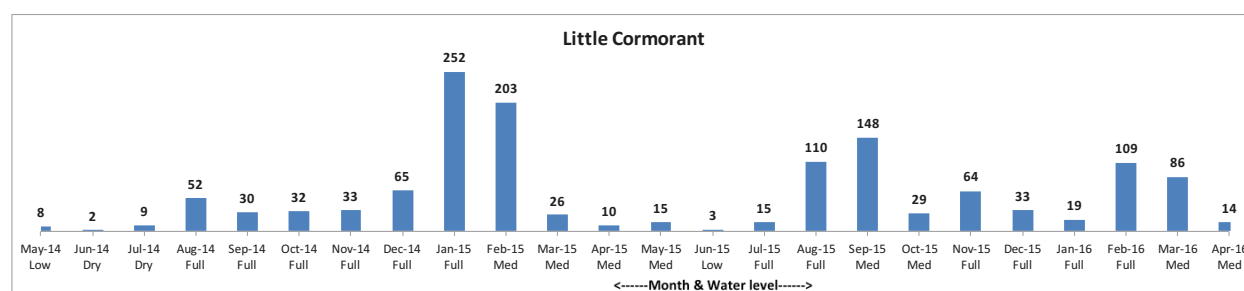


Figure 14. Bar graph showing the occurrence trend (in numbers) of Little Cormorant

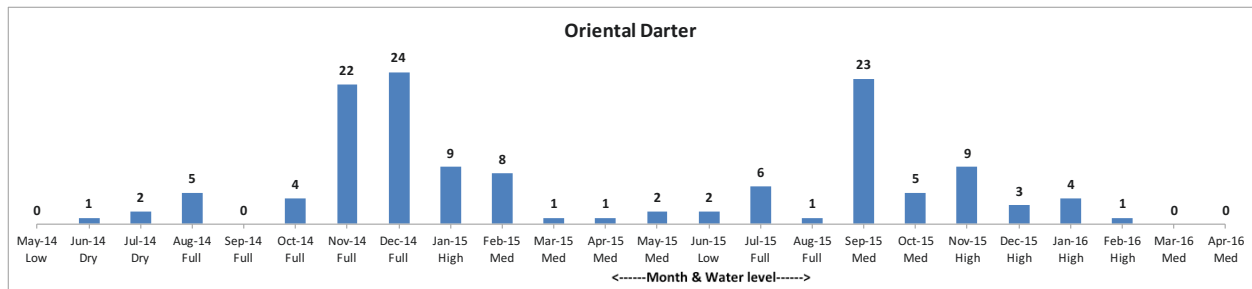


Figure 15. Bar graph showing the occurrence trend (in numbers) of Oriental Darter

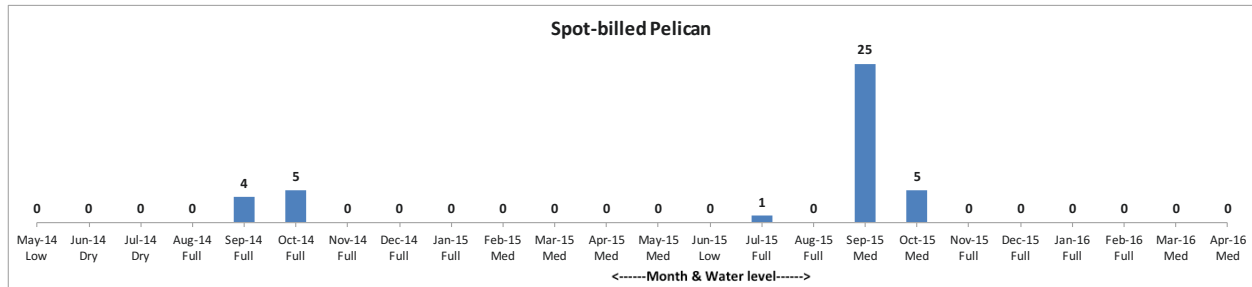


Figure 16. Bar graph showing the occurrence trend (in numbers) of Spot-billed Pelican

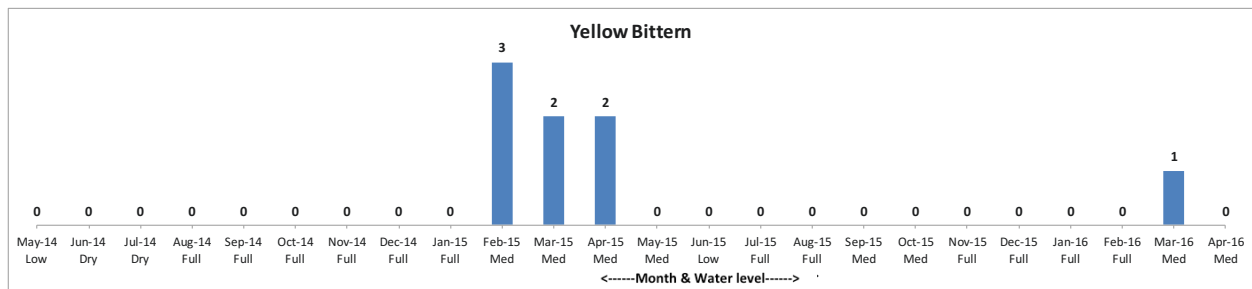


Figure 17. Bar graph showing the occurrence trend (in numbers) of Yellow Bittern

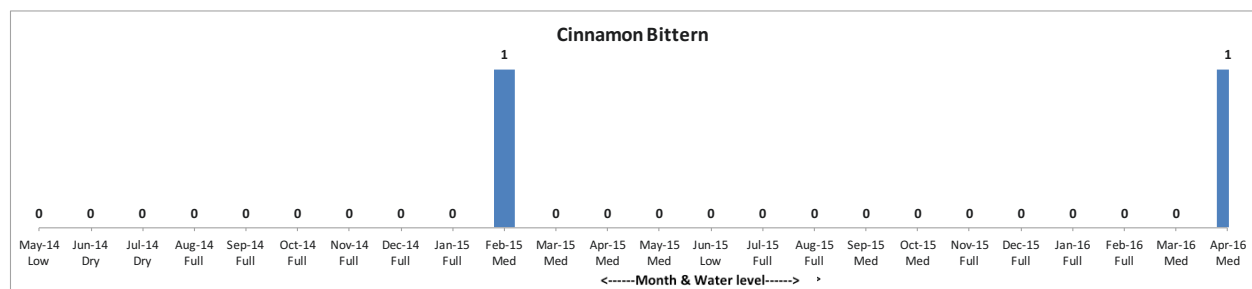


Figure 18. Bar graph showing the occurrence trend (in numbers) of Cinnamon Bittern

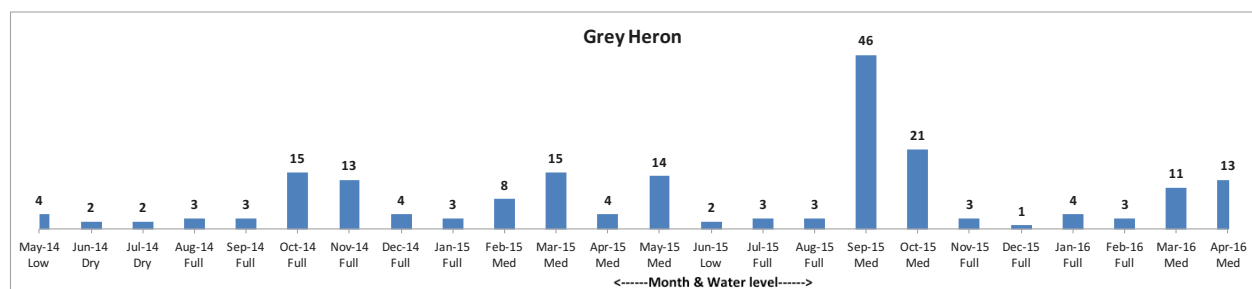


Figure 19. Bar graph showing the occurrence trend (in numbers) of Grey Heron

numbers ranging from one to eight in this lake; however, the highest count was recorded in April 2016 when 31 individuals of this species were sighted (Fig. 21). This observation shows that this species might be using Perur Lake as a transit point during spring migration.

22. Intermediate Egret *Mesophoyx intermedia* is a local migrant species in the lake. It was recorded year-round in the lake, except for the dry months of May and June 2014 and the months from September to November 2014 when the water level was full. Its highest count was recorded in April 2016 and December 2015 when 24 and 17 individuals of the species were sighted, respectively.

23. Little Egret *Egretta garzetta* is another local migrant species in the lake that was recorded year-round. The highest counts of this species were recorded in the spring migration period of March and April 2015 and April 2016 when 60, 116, and 215 individuals were sighted, respectively (Fig. 23).

Note: In analysing the numbers of the three white egret species, namely Great, Intermediate, and Little, it can be deduced that these species probably use Perur Lake as a transit point mostly during the months of March and April. This can be clearly seen in the respective figures (Figs. 21, 22 & 23) when their numbers are at the highest levels.

24. Western Reef-Heron *Egretta gularis* is a vagrant species in the area. This bird was recorded once in Perur Lake when a sole bird was sighted in March 2015 (Fig. 24).

25. Cattle Egret *Bubulcus ibis* is a resident species that was recorded year-round in the lake. The highest counts of this species were recorded in November 2014 and April 2015 when 37 and 40 individuals of this species were sighted, respectively (Fig. 25). Birds with breeding plumage were observed during its breeding months of November to March; however, no nests were recorded in the vicinity of the lake. It builds untidy stick nests in mixed colonies with Cormorants and Pond Herons, often in the vicinity of little villages (Ali 2002).

26. Indian Pond Heron *Ardeola grayii* is a resident that was recorded year-round in the lake. Its highest counts were recorded in January 2015 and April 2016 when 65 and 64 of this species were sighted, respectively (Fig. 26). According to Ali (2002), its breeding season in southern India is from November to January and its nesting behaviour is similar to that of Cattle Egret. We, however, sighted some birds of this species displaying its breeding plumage in April and May 2015 though no nests were recorded in the vicinity of the lake. Its presence is higher in winter and also during spring migration, indicating that some of them might be using this lake as

a transit point.

27. Striated Heron *Butorides striata* is a resident species in our area that was recorded in the months of August 2014, March 2015, June to August 2015, and April 2016. The highest count of this species was recorded in April 2016, when four birds were sighted. Even though a resident breeder, it was unrecorded for many months during our count (Fig. 27), due to its secretive and crepuscular behaviour. Occasionally, however, it may be also active during the daytime, particularly in cloudy overcast weather. Its breeding season is from March to August with local variations (Ali 2002). In April 2016, a single bird in breeding plumage was observed in this lake.

28. Black-crowned Night-Heron *Nycticorax nycticorax* is a resident species and its presence is sparse in Perur Lake. Its highest count was recorded in February 2016 when 18 individuals of this species were sighted flying overhead (Fig. 28). Most of them were immature or juvenile birds, indicating its possible breeding in the area. This species, however, is largely unrecorded during our counting sessions due to its nocturnal and crepuscular nature similar to that of the Striated Heron. According to (Ali 2002), this species breeds from December to February in southern India.

Pelecaniformes: Threskiornithidae

29. Glossy Ibis *Plegadis falcinellus* is a winter migrant species that was recorded in the lake during the winter months from September to March. The highest counts were recorded in September and October of 2015 when 53 and 68 of this species were sighted, respectively. During September and October of 2014, however, this species was not recorded in the lake. A plausible explanation can be arrived at by analysing its sight recordings in conjunction with the water level variations. When water levels were shallow with shoreline exposure that facilitated prey-finding, this species was recorded in large numbers as was the case in September and October 2015. When water levels were full in September and October of 2014, however, they were absent. This fact can be clearly seen in Fig. 29b where the water level was medium and its numbers were higher.

30. Black-headed Ibis *Threskiornis melanocephalus* is a local migrant species that was recorded erratically in the lake. The highest count was recorded in April 2016 when six of this species were sighted. According to (Ali 2002), its nesting season is largely "ill-defined" and it may nest in southern India from November to December. This species was unrecorded in the lake during those months. According to Rahmani (2012), this species is nomadic and migratory in nature depending upon the availability

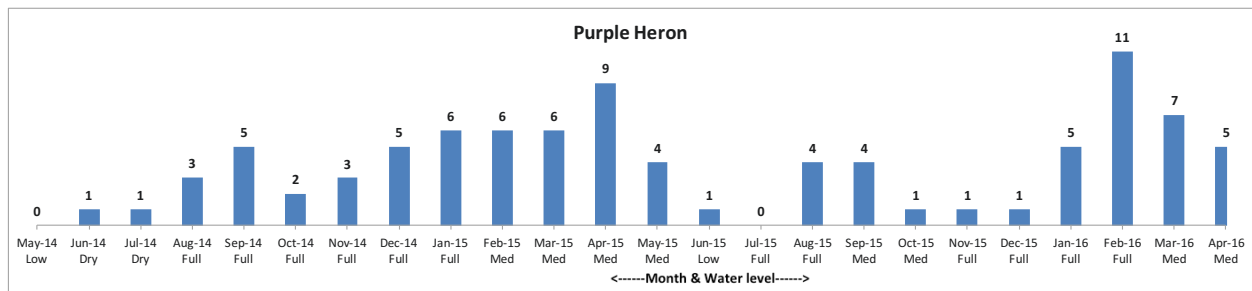


Figure 20. Bar graph showing the occurrence trend (in numbers) of Purple Heron

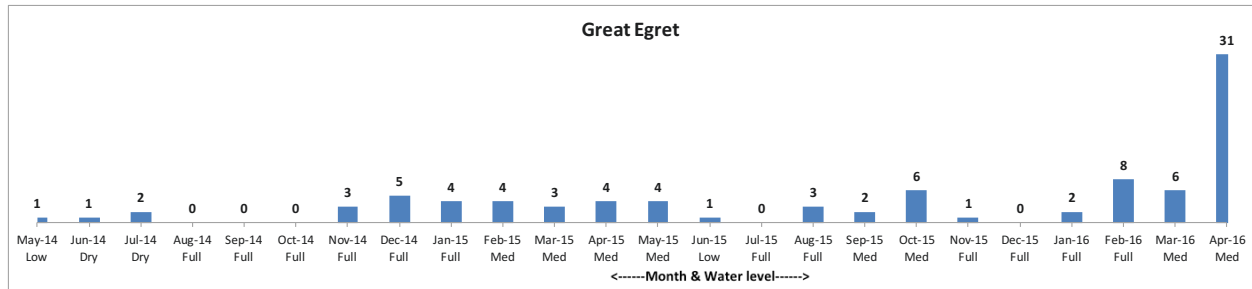


Figure 21. Bar graph showing the occurrence trend (in numbers) of Great Egret

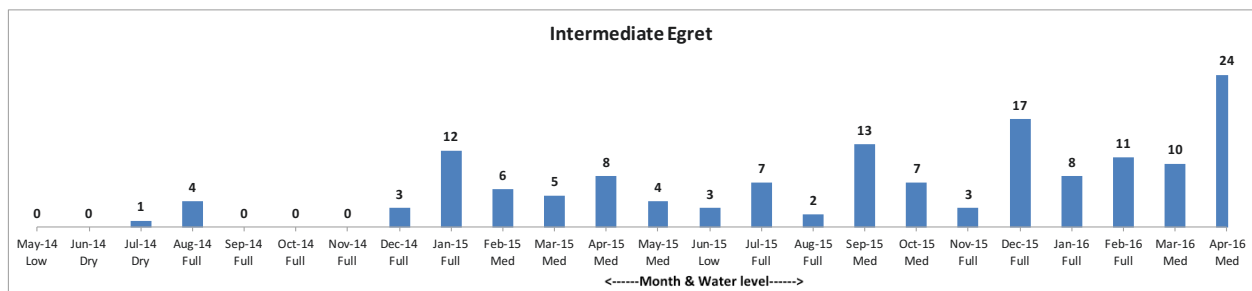


Figure 22. Bar graph showing the occurrence trend (in numbers) of Intermediate Egret

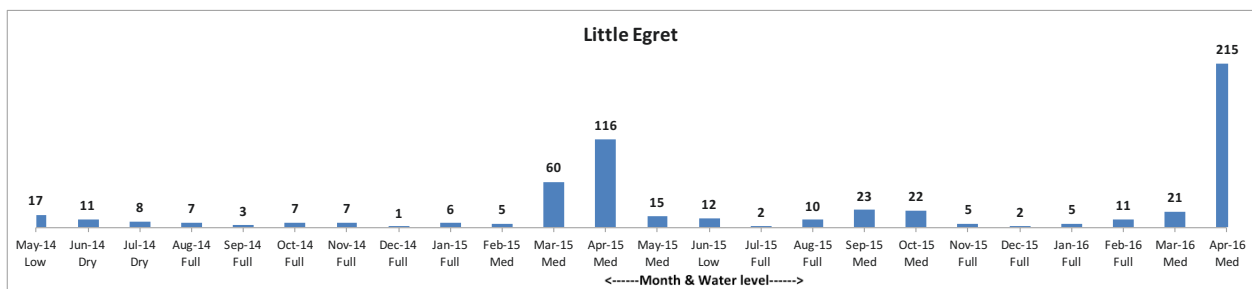


Figure 23. Bar graph showing the occurrence trend (in numbers) of Little Egret

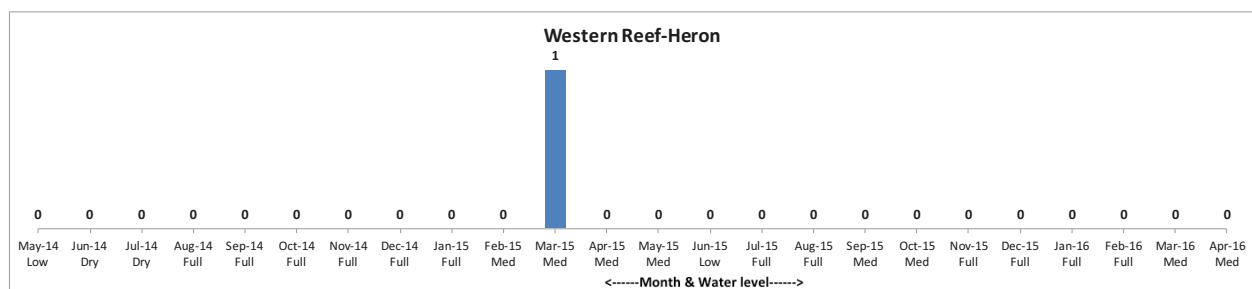


Figure 24. Bar graph showing the occurrence trend (in numbers) of Western Reef-Heron

of water. Since its population reduction in Asia due to an entire gamut of threats from hunting, disturbances at the breeding colonies to drainage, and conversion of foraging habitats to agriculture lands, it is listed as Near Threatened.

31. Eurasian Spoonbill *Platalea leucorodia* is a local migrant species that was recorded only once in October 2015 when 11 individuals of the species were sighted. It is not possible to conduct an analysis based on this single observation.

Gruiformes: Rallidae

32. White-breasted Waterhen *Amaurornis phoenicurus* is a resident species that was recorded year-round except during the drier months in the lake from May to July. Its highest count was recorded in February 2015 when six individuals of this species were sighted (Fig. 32). Its breeding season is from June to October or during southwestern monsoon (Ali 2002).

33. Grey-headed Swampfen *Porphyrio porphyrio* is a resident species that was recorded year-round in Perur Lake. The highest counts of this species were recorded in February and March of 2015 and 2016 when 48, 25, 44, and 74 individuals were sighted, respectively. In addition, in April 2016, 27 birds were sighted, possibly indicating its larger counts during spring migration. In the lake, this species is mostly recorded when water is present and its highest counts are recorded when the water levels vary between low and medium. Its breeding season is during the monsoon months of June to September (Ali 2002). During the March 2016 count, however, when the highest number of this species was recorded, three chicks were sighted accompanying an adult indicating its possible breeding status.

34. Common Moorhen *Gallinula chloropus* is a resident species that was recorded year-round, except in June and July in the lake. Its breeding season is from June to September or during the southwestern monsoon (Ali 2002). The highest counts were recorded in January and April of 2015 when 25 and 30 individuals of this species were sighted, respectively.

35. Eurasian Coot *Fulica atra* is a resident species that was recorded year-round in the lake except for the months of July 2014, June 2015, and April 2016. From August 2014 to February 2015, the range of variation of this species sighted was from 68 to 584, when the highest counts occurred between September and October 2014 and also during the winter months of January and February 2015. The plausible reasons behind such an occurrence could be the fact that the combination of local migrant birds, as well as locally breeding birds, could have

been sighted simultaneously, especially in September and October 2014 when the counts were 575 and 584, respectively. It is worth noting that during this period, the water levels were favourable for breeding, which ranged from medium to full. During a similar period in 2015–2016, however, its numbers were significantly reduced due to unfavourable water levels. Even though Ali (2002) states that Eurasian Coots breed during the monsoonal months of July and August, according to Rasmussen & Anderton (2012), this species could possibly breed in southern India up to November. A juvenile bird and a nest of grassy vegetation were recorded during our November 2014 count. Additionally, a single chick was observed in March 2016. These observations confirm its breeding status in the lake when conditions are favourable.

Charadriiformes: Recurvirostridae

36. Black-winged Stilt *Himantopus himantopus* is a winter migrant species that was recorded in the lake in a sporadic manner when water levels were less than full with adequate shallow water and shoreline exposure. The highest counts were recorded in March 2015 and 2016 when 26 and 56 of this species were sighted, respectively. During these months, water levels were medium and facilitated prey-finding. Its long stilt-like legs, when compared with other waders, enable it to find prey by walking further in the water (Ali 2002).

Charadriiformes: Charadriidae

37. Red-wattled Lapwing *Vanellus indicus* is a resident species that was recorded year-round, except in May and June 2014 when the water level was very low and January of 2015 and 2016 when the water level was high. Its highest count was recorded in September and October of 2015 when 15 and 16 individuals were sighted, respectively. Its breeding season is chiefly from March to August (Ali 2002). A juvenile of this species was observed in July 2015.

38. Little Ringed Plover *Charadrius dubius* has two subspecies that are called *C.d. curonicus*, which is entirely a winter migrant in India, and *C.d. jerdoni*, a possible breeder and resident (Hayman et al. 1986). This species was recorded in February and March of 2015 and 2016 and in May, June, September and October 2015. Its highest counts were recorded in March 2015 and 2016 when 84 and 39 individuals of this species were sighted, respectively, during the spring migration season when water levels were favourable and there was adequate shoreline exposure. An overwhelming majority of the birds sighted during these months are the migratory form *C.d. curonicus*. When conditions are favourable,

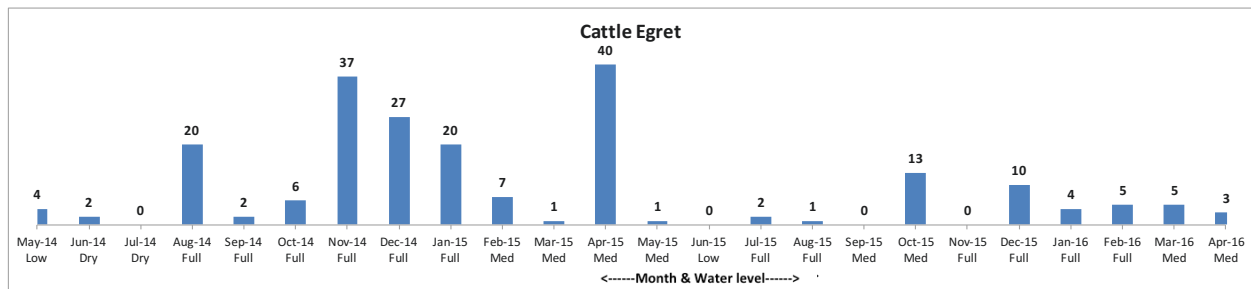


Figure 25. Bar graph showing the occurrence trend (in numbers) of Cattle Egret

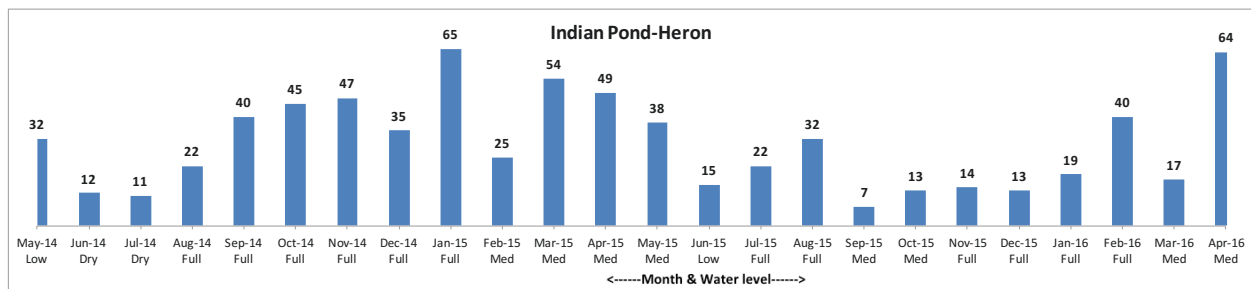


Figure 26. Bar graph showing the occurrence trend (in numbers) of Indian Pond-Heron

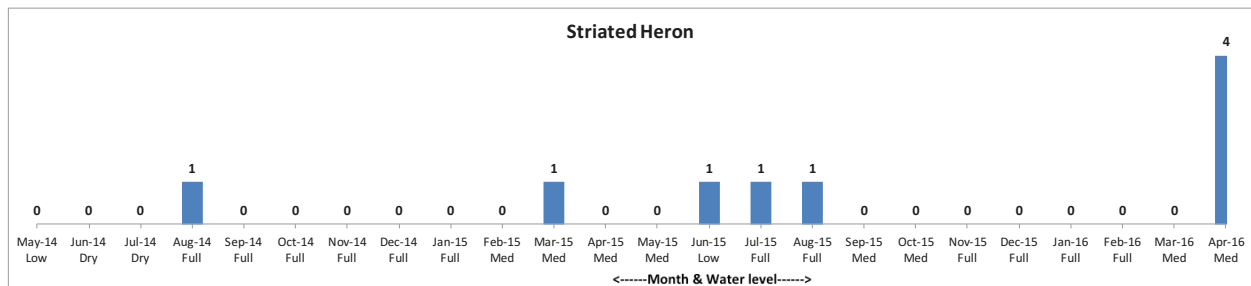


Figure 27. Bar graph showing the occurrence trend (in numbers) of Striated Heron

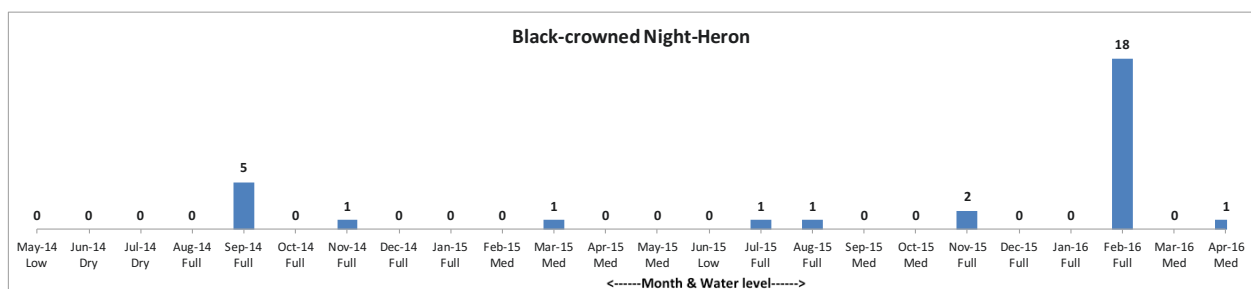


Figure 28. Bar graph showing the occurrence trend (in numbers) of Black-crowned Night-Heron

the resident subspecies *C.d. jerdoni* could be a possible breeder in this lake. In May and June 2015, three and one individuals of this subspecies were recorded, respectively. Due to changing water levels, however, its nesting could not be confirmed.

Charadriiformes: Jacanidae

39. Pheasant-tailed Jacana *Hydrophasianus chirurgus* is a local migrant species that was infrequently recorded in the lake. Its numbers when sighted were very few such as one, one, and two in September, October, and December 2014, respectively; however, 17 individuals of the species were sighted in January 2015, which is an

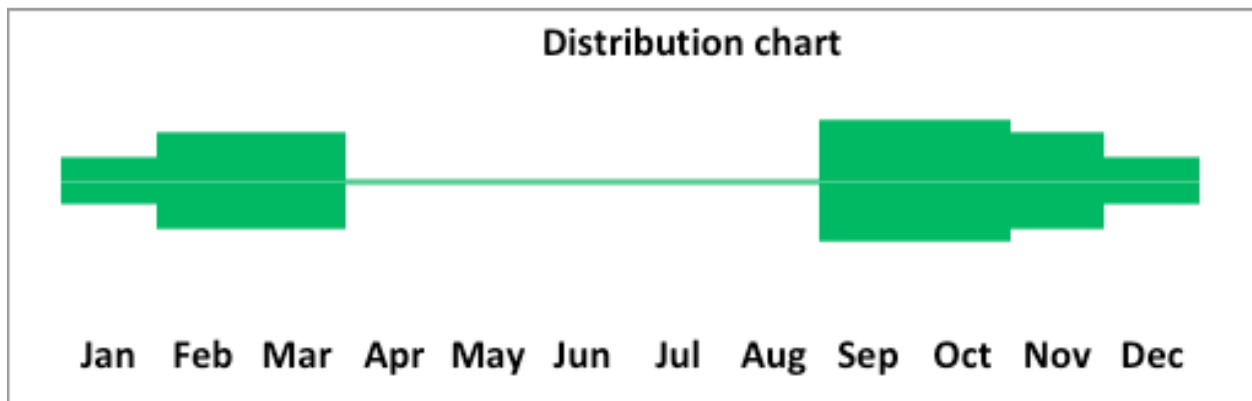


Figure 29a. Distribution chart of Glossy Ibis

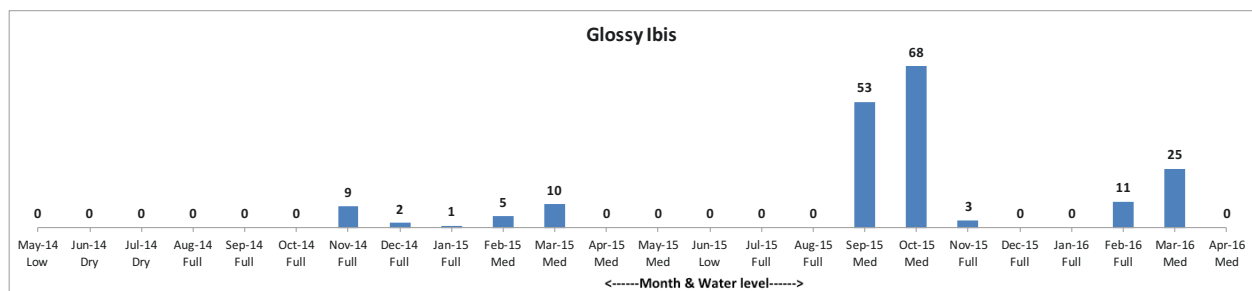


Figure 29b. Bar graph showing the occurrence trend (in numbers) of Glossy Ibis

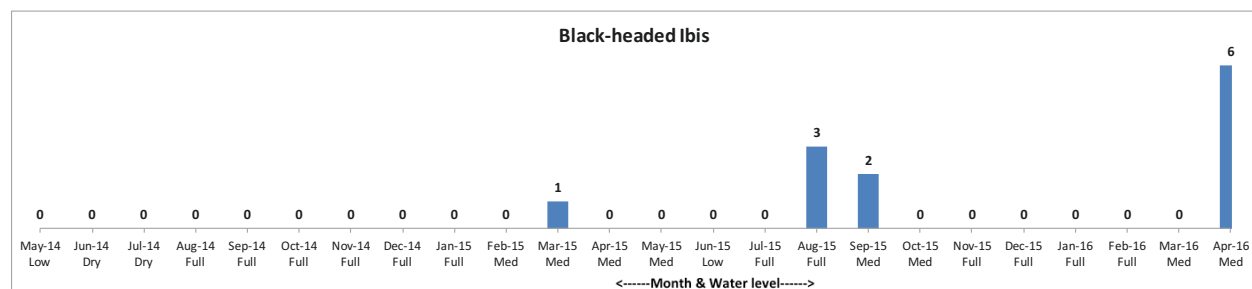


Figure 30. Bar graph showing the occurrence trend (in numbers) of Black-headed Ibis

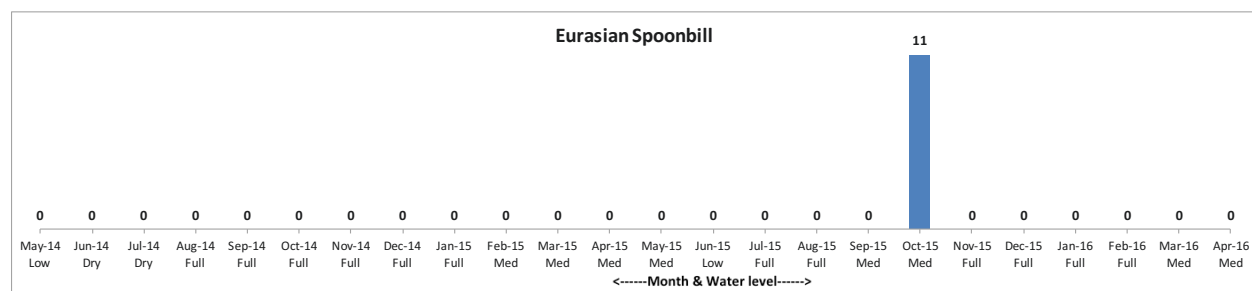


Figure 31. Bar graph showing the occurrence trend (in numbers) of Eurasian Spoonbill

inexplicable anomaly. It is not been recorded in the lake since then.

40. Bronze-winged Jacana *Metopidius indicus* is a local migrant species that is infrequently recorded in the lake, similar to Pheasant-tailed Jacana. A single individual

of this species was sighted in January and August 2015.

Charadriiformes: Scolopacidae

41. Common Sandpiper *Actitis hypoleucos* is a winter migrant species that was recorded from August to

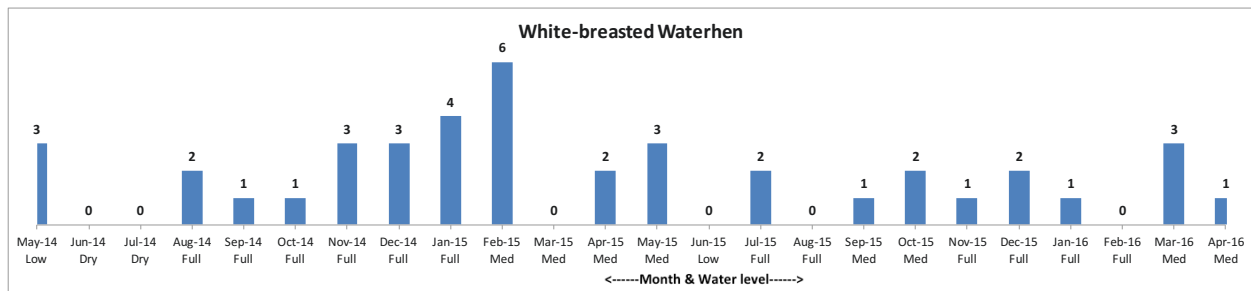


Figure 32. Bar graph showing the occurrence trend (in numbers) of White-breasted Waterhen

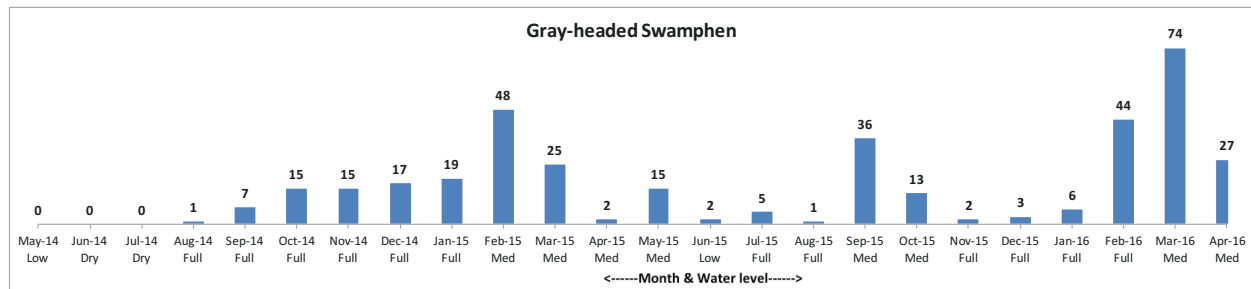


Figure 33. Bar graph showing the occurrence trend (in numbers) of Gray-headed Swampen

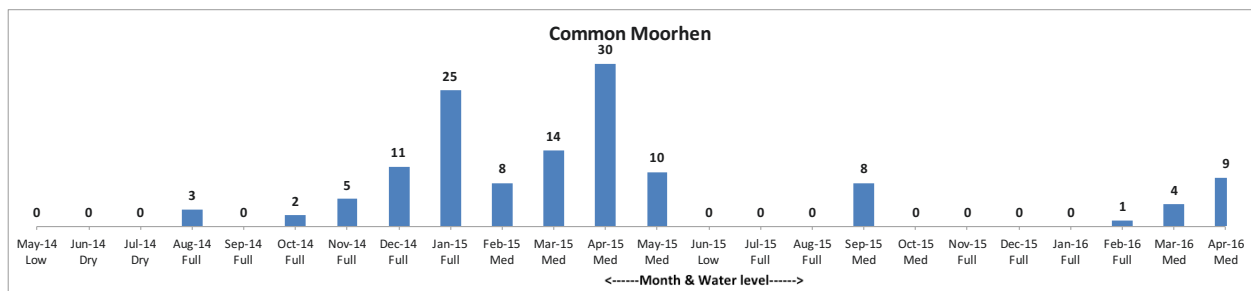


Figure 34. Bar graph showing the occurrence trend (in numbers) of Common Moorhen

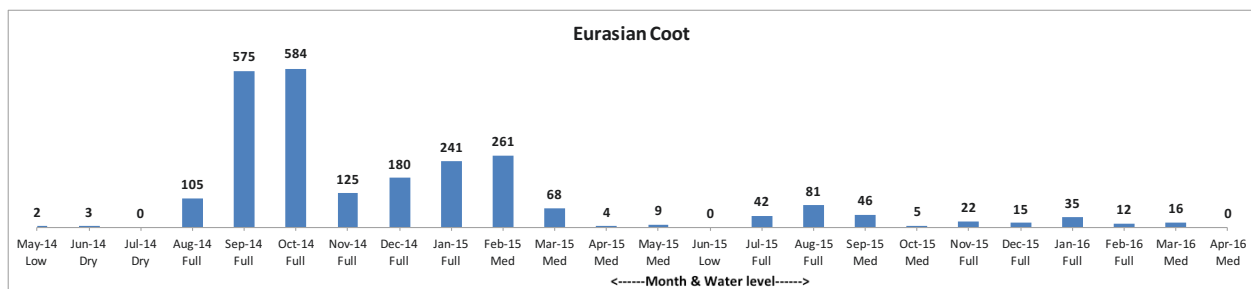


Figure 35. Bar graph showing the occurrence trend (in number) of Eurasian Coot

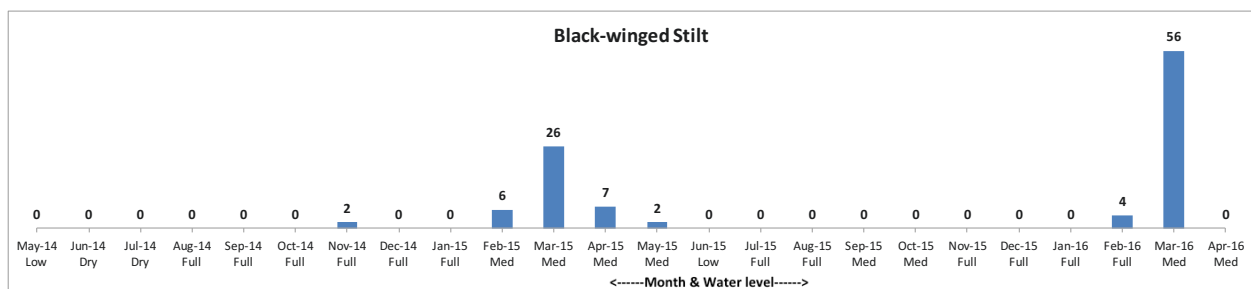


Figure 36. Bar graph showing the occurrence trend (in numbers) of Black-winged Stilt

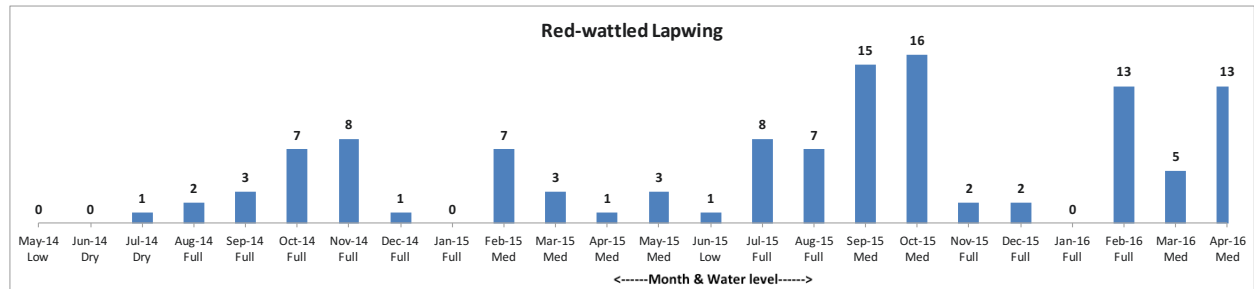


Figure 37. Bar graph showing the occurrence trend (in numbers) of Red-wattled Lapwing

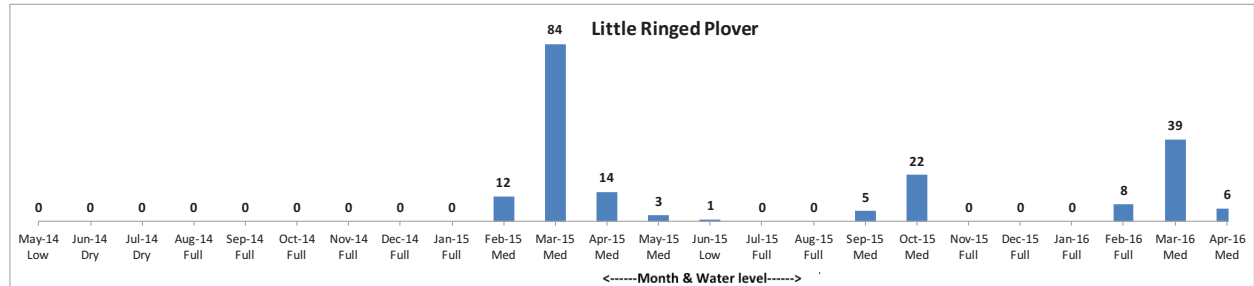


Figure 38. Bar graph showing the occurrence trend (in numbers) of Little Ringed Plover

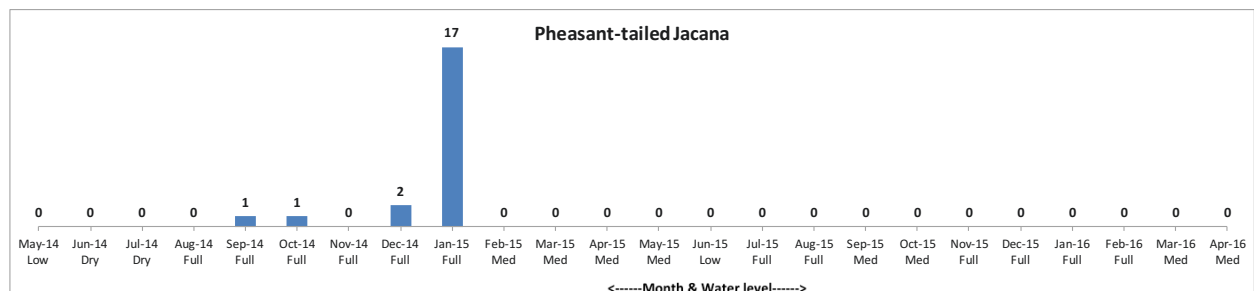


Figure 39. Bar graph showing the occurrence trend (in numbers) of Pheasant-tailed Jacana

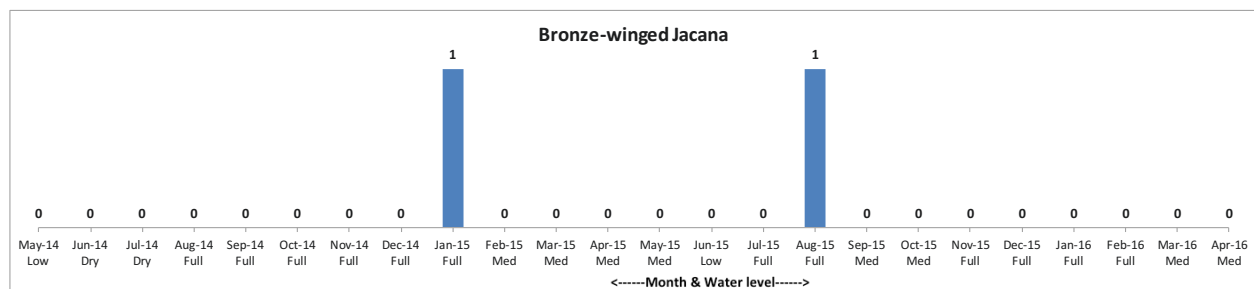


Figure 40. Bar graph showing the occurrence trend (in numbers) of Bronze-winged Jacana

April. Its highest count was recorded in March 2015 when 21 individuals of this species were sighted. According to Ali (2002), it is one of the earliest wader migrants to arrive (August) and also one of the last to leave (May). The sightings of this species in this lake match this statement to a large extent.

42. Green Sandpiper *Tringa ochropus* is a winter migrant species that was recorded during the period of

January to March of 2015 and 2016 and additionally in November 2014 and April 2016. The highest counts were five and six recorded in February 2015 and March 2016, respectively, during the spring migration season.

43. Common Greenshank *Tringa nebularia* is a winter migrant species that was recorded in February–April 2015, October 2015, and March & April 2016 in the lake when the water levels were favourable with adequate

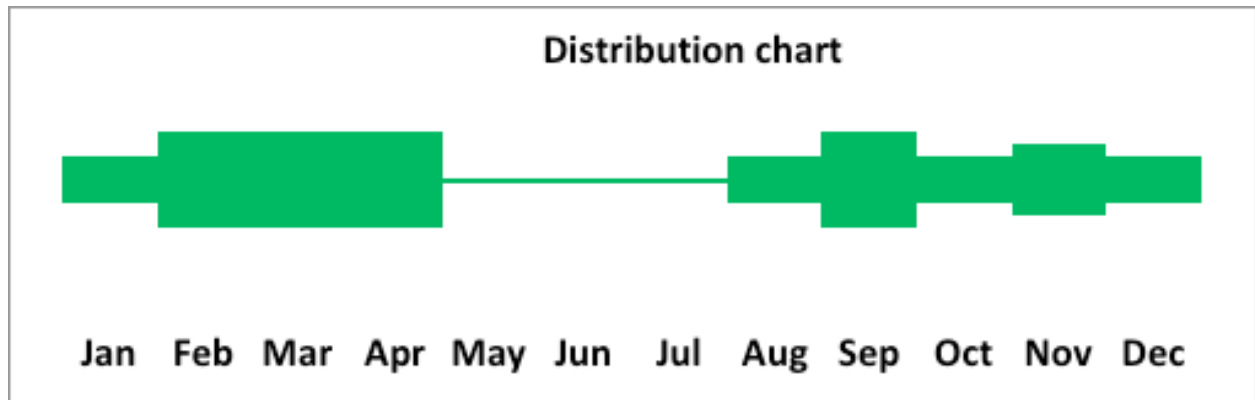


Figure 41a. Distribution chart of Common Sandpiper

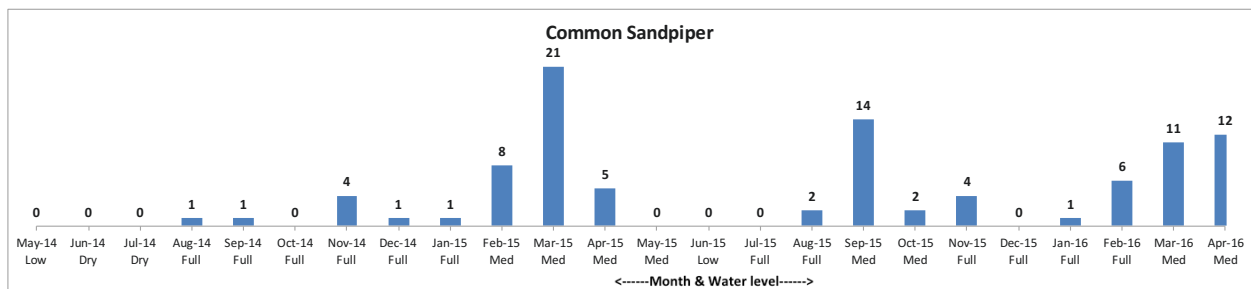


Figure 41b. Bar graph showing the occurrence trend (in numbers) of Common Sandpiper

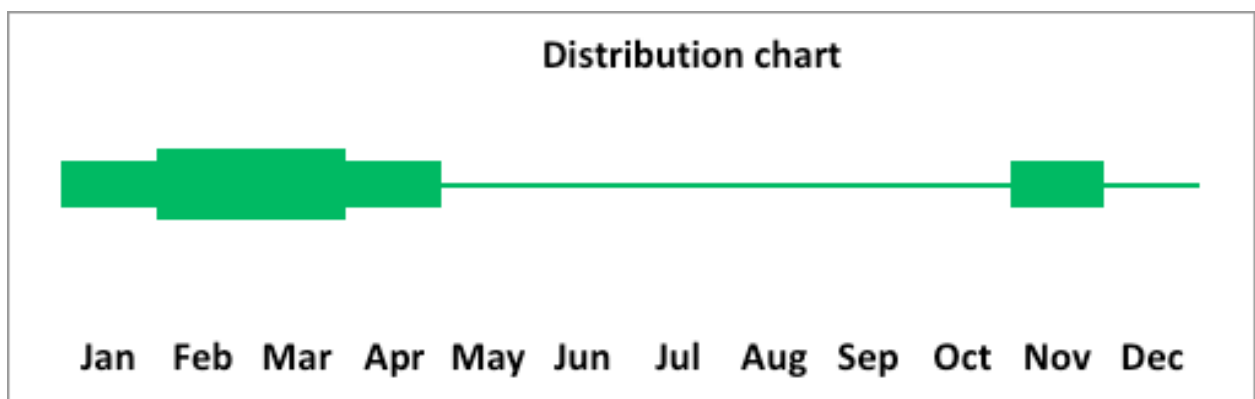


Figure 42a. Distribution chart of Green Sandpiper

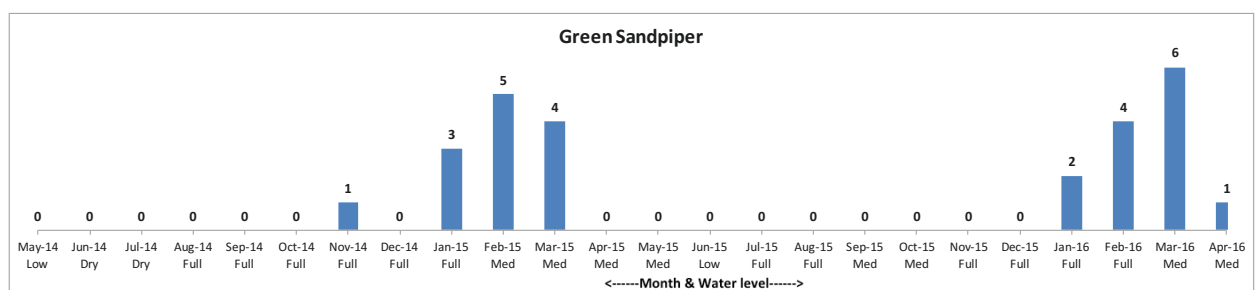


Figure 42b. Bar graph showing the occurrence trend (in numbers) of Green Sandpiper

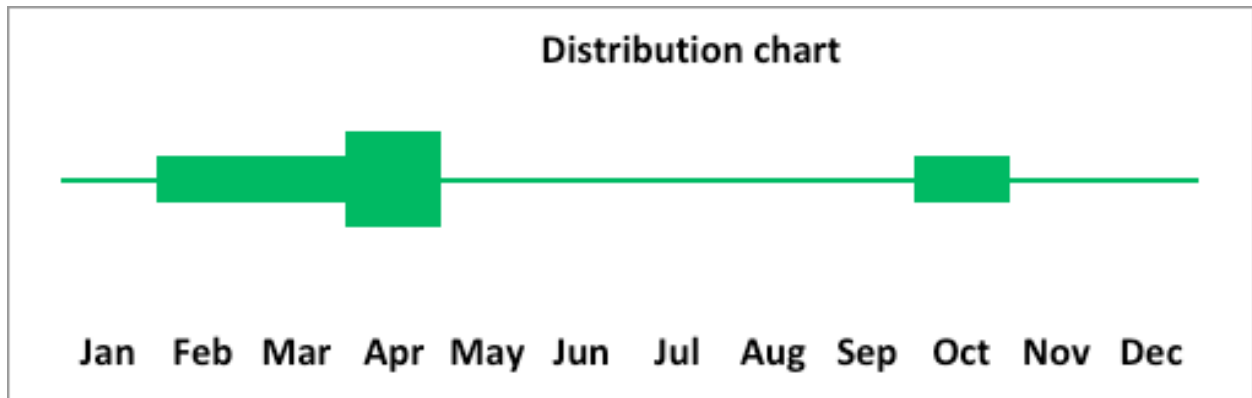


Figure 43a. Distribution chart of Common Greenshank

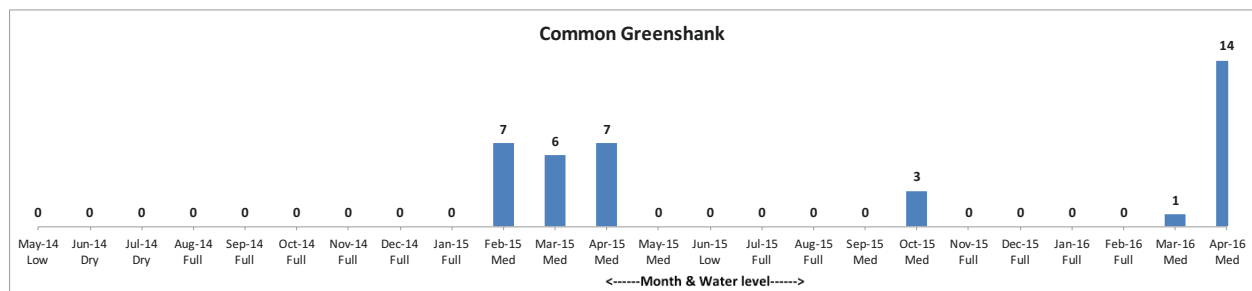


Figure 43b. Bar graph showing the occurrence trend (in numbers) of Common Greenshank

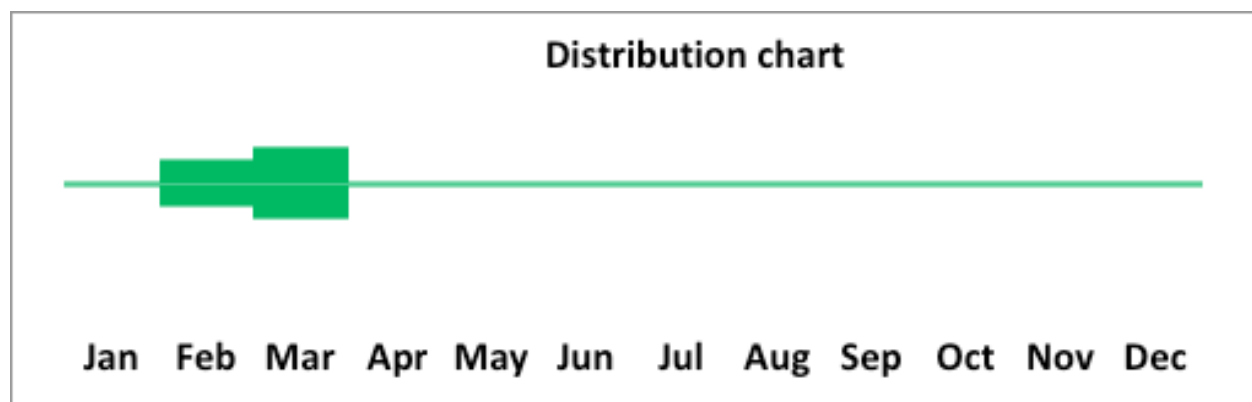


Figure 44a. Distribution chart of Marsh Sandpiper

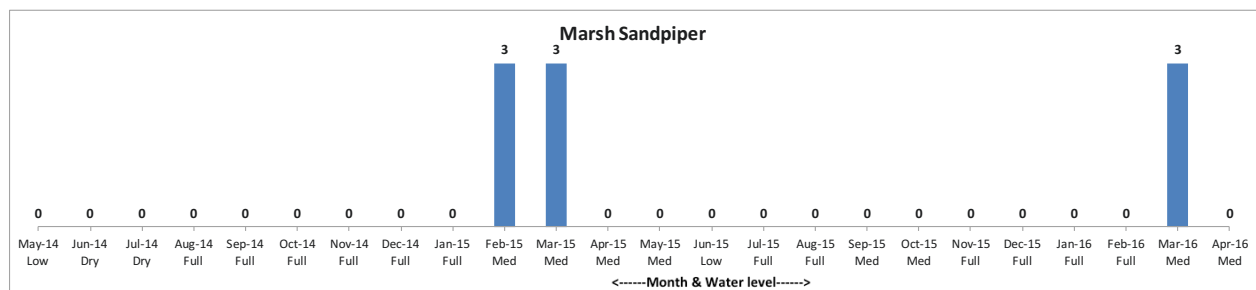


Figure 44b. Bar graph showing the occurrence trend (in numbers) of Marsh Sandpiper

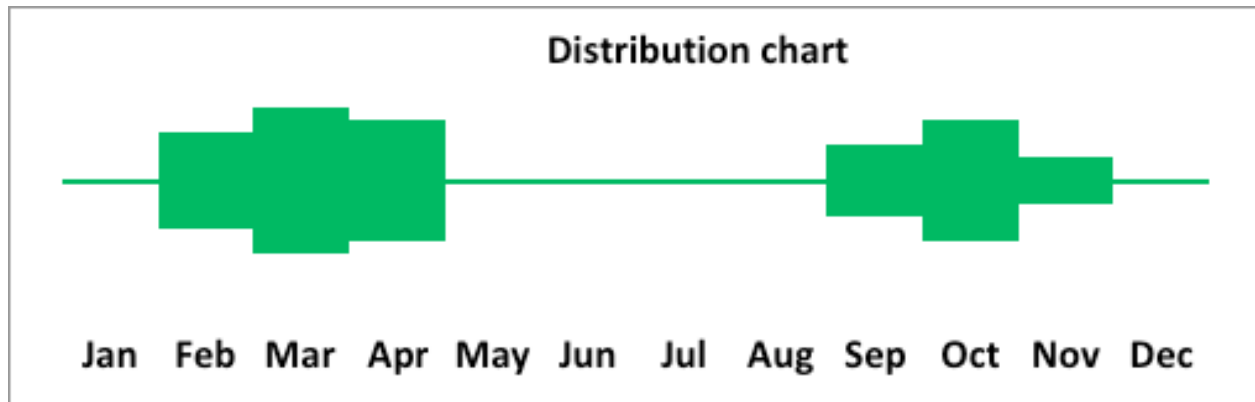


Figure 45a. Distribution chart of Wood Sandpiper

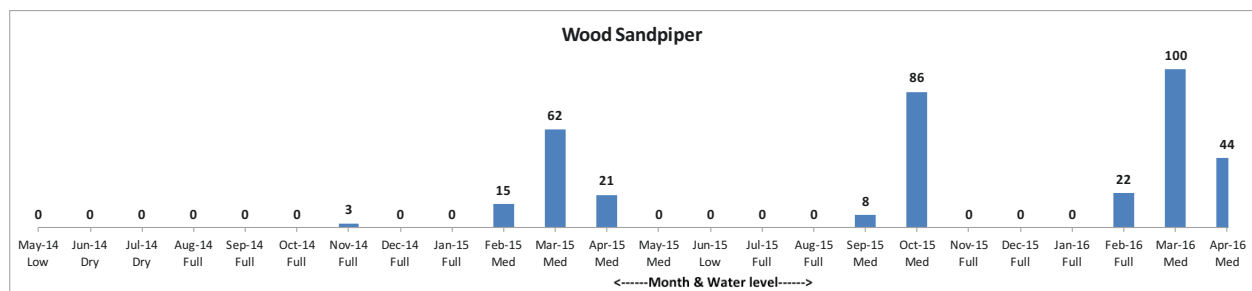


Figure 45b. Bar graph showing the occurrence trend (in numbers) of Wood Sandpiper

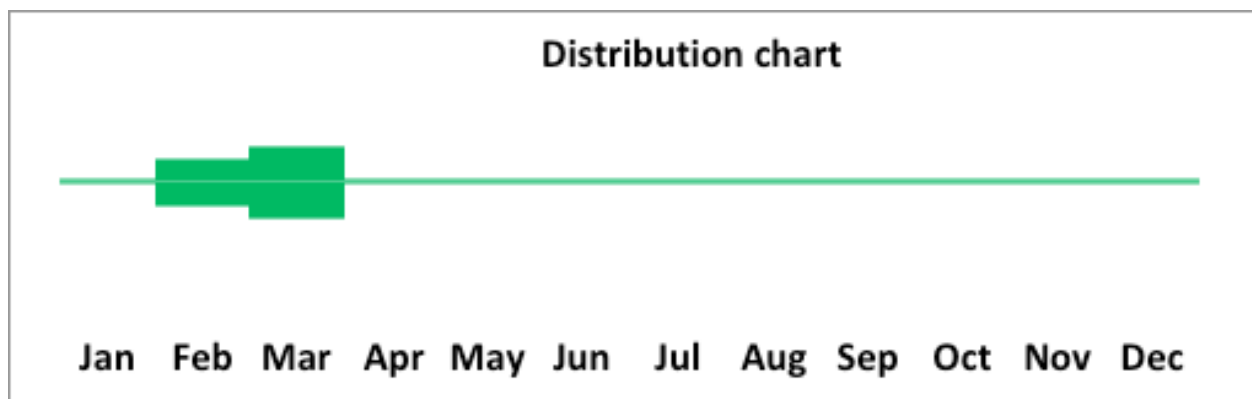


Figure 46a. Distribution chart of Temminck's Stint

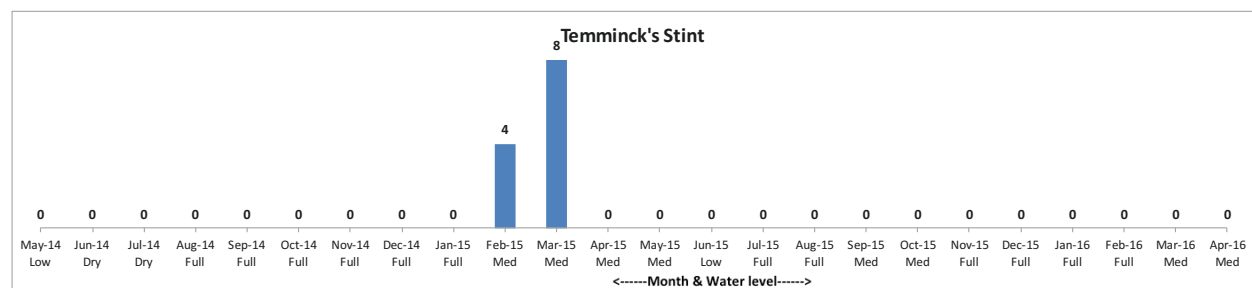


Figure 46b. Bar graph showing the occurrence trend (in numbers) of Temminck's Stint

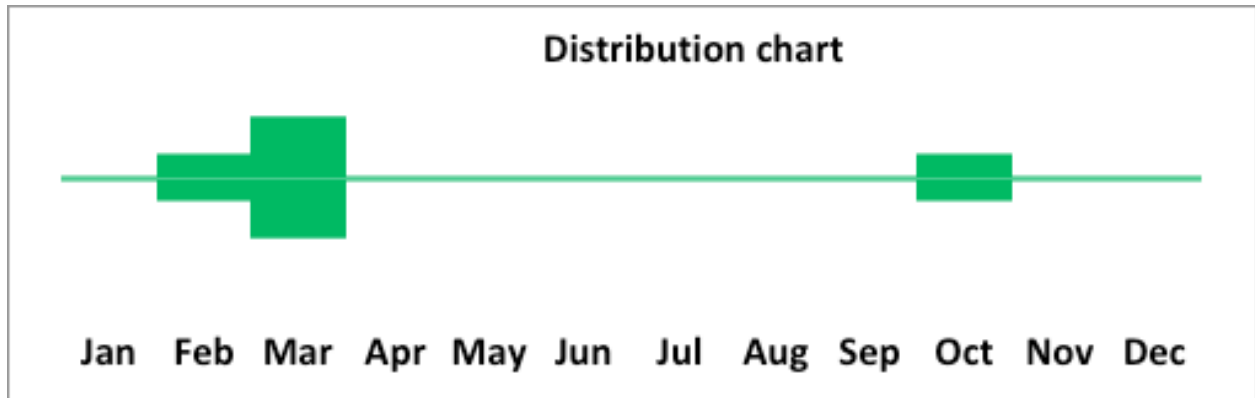


Figure 47a. Distribution chart of Little Stint

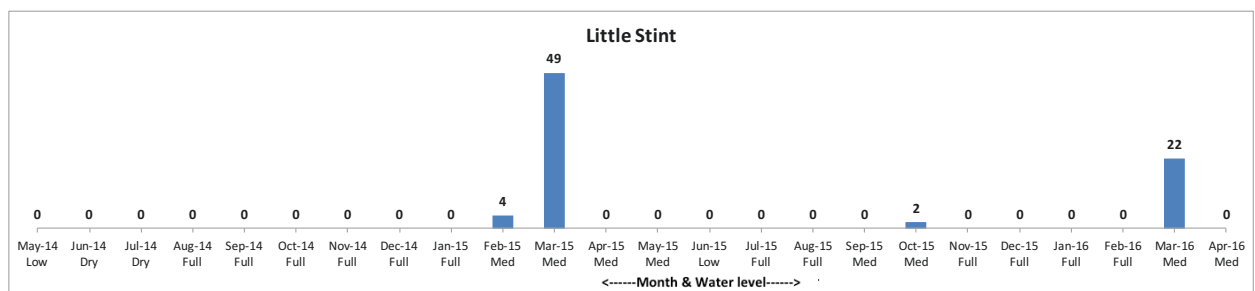


Figure 47b. Bar graph showing the occurrence trend (in numbers) of Little Stint

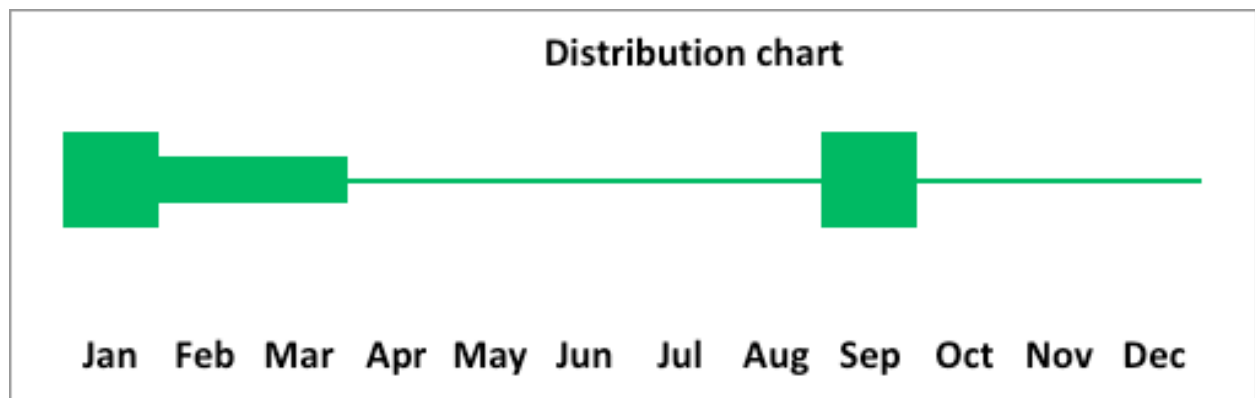


Figure 48a. Distribution chart of Whiskered Tern

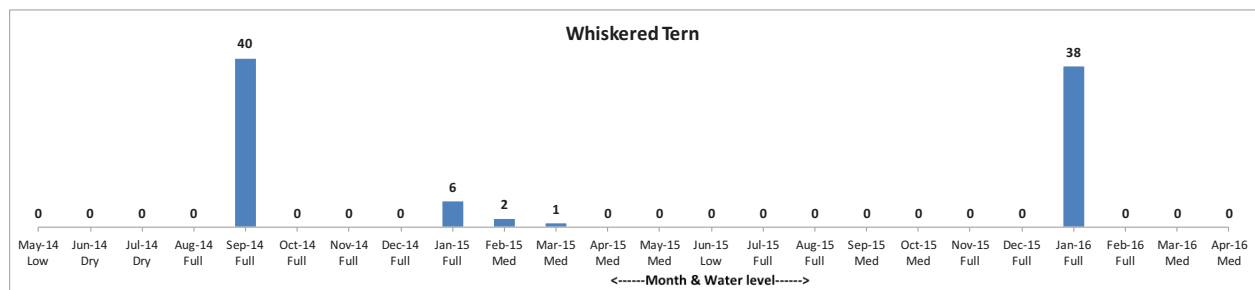


Figure 48b. Bar graph showing the occurrence trend (in numbers) of Whiskered Tern

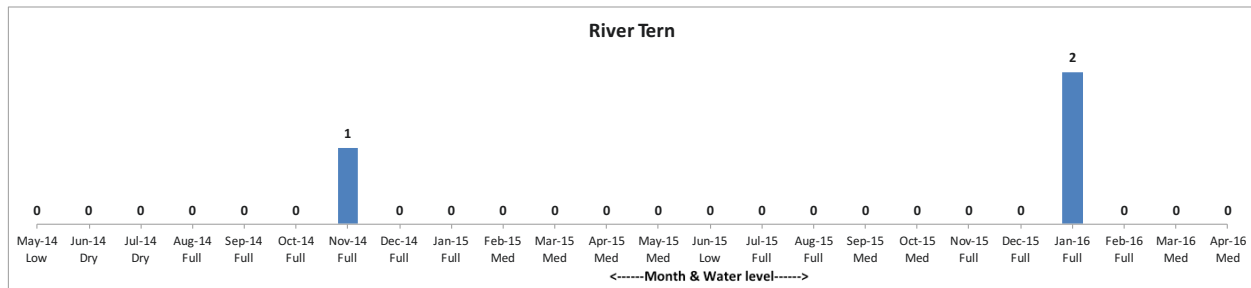


Figure 49. Bar graph showing the occurrence trend (in numbers) of River Tern

shoreline exposure. This pattern usually happens during the spring migration months from February to April. Its highest counts were recorded in February to April 2015 and April 2016, when seven, six, and 14 of this species were sighted, respectively.

44. Marsh Sandpiper *Tringa stagnatilis* is a winter migrant species that was sighted sparsely in the lake. Most of the sightings were during the spring migration months of February and March 2015 and March 2016 when three individuals were sighted on each occasion.

45. Wood Sandpiper *Tringa glareola* is the most numerous winter migrant sandpiper species in the lake. Even though it was recorded from September to April, it is primarily a species that is sighted during the spring migration months from February to April. Its highest counts during this season were in March 2015 and 2016 when 62 and 100 individuals were sighted, respectively. When water level conditions are favourable with shoreline exposure, as was the case in October 2015, 86 individuals of this species were recorded.

46. Temminck's Stint *Calidris temminckii* is a winter migrant species that was recorded only twice in the lake during the count period of February and March 2015 when four and eight of this species were sighted, respectively; this correlates with the spring migration season.

47. Little Stint *Calidris minuta* is a winter migrant species that was recorded primarily during the spring migration months of February & March 2015 and March 2016. Its highest counts were recorded in March 2015 and 2016 when 49 and 22 of this species were sighted, respectively.

Charadriiformes: Laridae

48. Whiskered Tern *Chlidonias hybrid* is a winter migrant species that was recorded sporadically in September 2014, January–March 2015, and January 2016. Its highest counts of 40 and 38 were recorded in September 2014 and January 2016, respectively, when the water level was high.

49. River Tern *Sterna aurantia* is a winter migrant species that was recorded only twice in the lake when a single bird in November 2014 and a couple in January 2016 were sighted. The water levels of the lake during both the sightings were full.

TYPES OF ENCROACHMENTS

Waterbirds usually avoid areas with extensive disturbance, choose roosting or foraging sites with fewer disturbances, and generally prefer wetlands with features that maximise the abundance and accessibility of their food (Khan et al. 2016). The types of habitat encroachments in Perur Lake that impair its functionality are road construction and its use for motor vehicles, illegal and unauthorised dumping of waste material, conversion to an artificial reservoir for agricultural use, and establishment of hutments.

For instance, road construction was carried out on the eastern bund of the Perur Lake covering the entire eastern border of 2km for use by motor vehicles. The probable effect of road construction on bird population and species diversity can be interpreted from the graphs given below. The road building activity appears to have reduced the sightings of the number and diversity of birds during the construction period, which lasted from March to August 2014.

DISCUSSION

From the analysis of the data collected from May 2014 to April 2016, it is clear that it is the resident/ local migrant birds that utilise this wetland throughout the year (Figs. 50–53). In addition, this wetland complex is also home to at least 17 species of winter migrant birds. Relations between habitat characteristics and waterbird abundances are often difficult to interpret as different factors act simultaneously, confounding the effects of individual ones, as birds frequent wetlands not only for food but also for rest and shelter. Migratory waterbirds

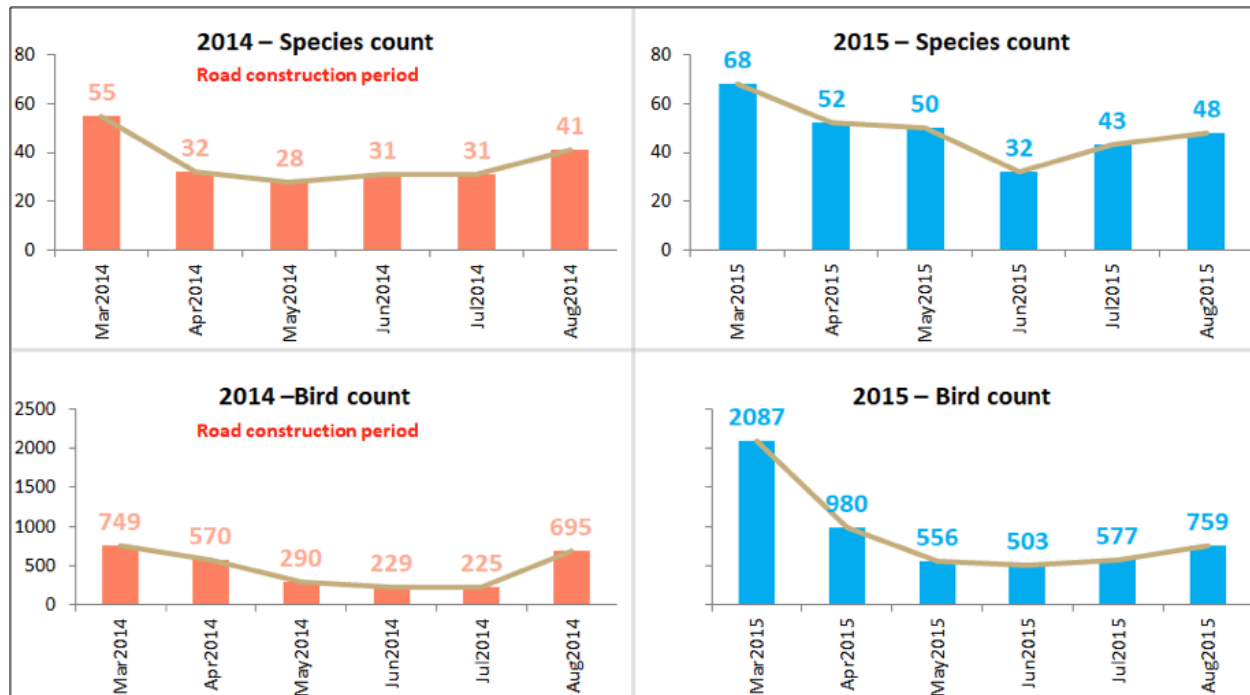


Figure 50. Bar graphs showing the comparison of bird species and population trends (in number) during and after the road construction period

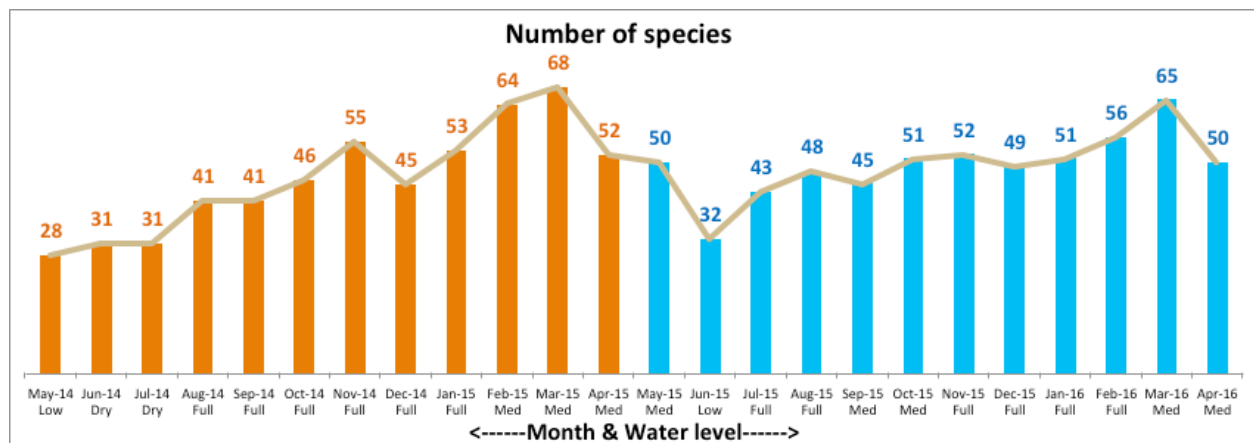


Figure 51. Bar graph showing the occurrence trend (in numbers) of bird species in Perur Lake during the count period

are, however, opportunistic and adapt to utilise various habitat types during migration and colonisation (Khan et al. 2016).

Our conclusions from the observations can be stated as follows:

⌚ As far as Perur Lake is concerned, the presence or absence of water and its levels is a key determining factor of the avian species composition, the details of which are discussed in the individual species accounts.

⌚ It appears from the data collected so far that

the bird species diversity and actual numbers are at their highest (Figs. 51, 52 & 53) during the months of February, March, and April, thus possibly pointing towards the highest avian diversity and numbers during their northward migration in spring.

A mere two years' set of data, however, is simply insufficient to substantiate this possible pattern. Nevertheless, it behoves us to maintain adequate water levels in these wetlands for all birds, especially for migrant birds, during the critical months of March, April, and May. Local communities too might derive benefits

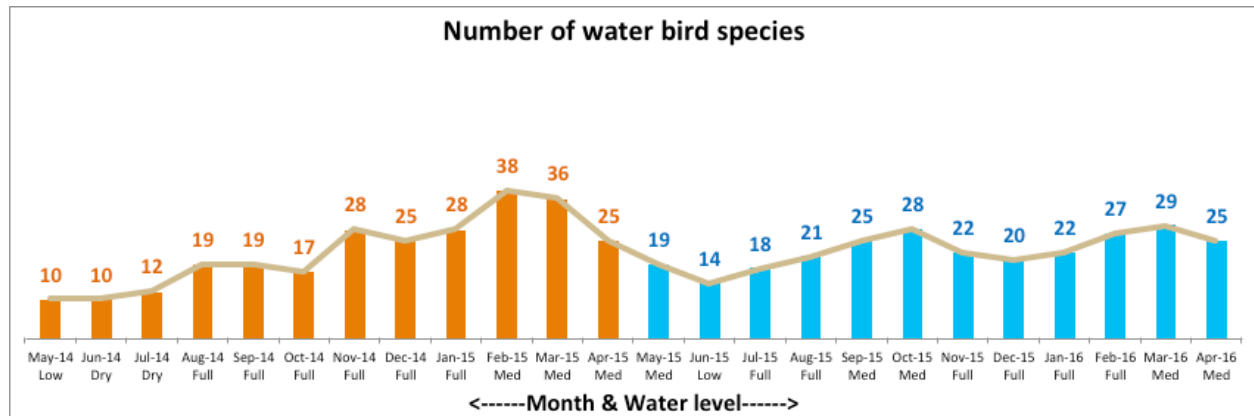


Figure 52. Bar graph showing the occurrence trend (in numbers) of waterbird species in Perur Lake during the count period

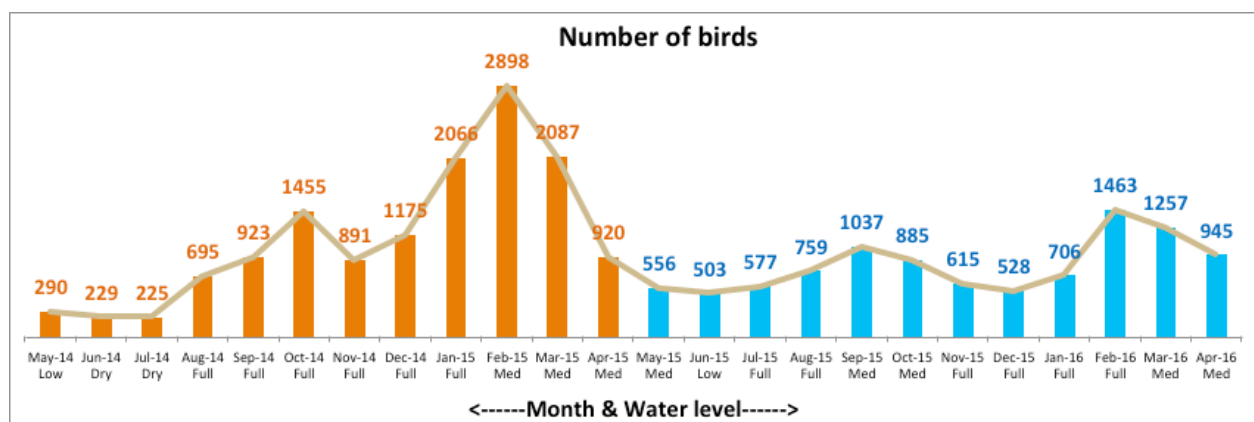


Figure 53. Bar graph showing the bird population trend (in numbers) in Perur Lake during the count period

from this practice as it allows more time and opportunity for groundwater recharge.

Finally, looking at the larger picture, it is extremely important that similar studies be conducted in some of the adjoining wetlands of the area in a synchronous manner. Only an analysis of such a comprehensive collection of data can provide a better understanding of the subtlety of avian movements and their population in the area.

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Communications

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-- Shaheer Khan & Orus Ilyas, Pp. 12459–12463

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-- G. Parameswaran & R. Sivashankar, Pp. 12464–12488

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-- Sangay Tshewang & Letro Letro, Pp. 12489–12498

The Odonata (Insecta) of Dhofar, southern Oman
-- Elaine M. Cowan & Peter J. Cowan, Pp. 12499–12514

New kissing bug (Hemiptera: Reduviidae: Triatominae) records from Napo and Morona-Santiago provinces with distribution updates in Ecuador
-- Ana Soto-Vivas, Sandra Enríquez, Ernesto Villacrés, Jazmin Arrivillaga, Martín Hinojosa & Jonathan Liria, Pp. 12515–12522

Orchid diversity in two community forests of Makawanpur District, central Nepal
-- Bijaya Pant, Mukti Ram Paudel, Mukesh Babu Chand, Shreeti Pradhan, Bijaya Bahadur Malla & Bhakta Bahadur Raskoti, Pp. 12523–12530

Habitat distribution modeling for reintroduction and conservation of *Aristolochia indica* L. - a threatened medicinal plant in Assam, India
-- Bhaskar Sarma, Prantik Sharma Baruah & Bhaben Tanti, Pp. 12531–12537

Pollination ecology of *Synedrella nodiflora* (L.) Gaertn. (Asteraceae)
-- B. Usharani & A.J. Solomon Raju, Pp. 12538–12551

Review

Status of studies on zooplankton fauna of Arunachal Pradesh, India
-- Bikramjit Sinha, Pp. 12552–12560

Short Communications

First record of the endangered Arabian Tahr *Arabitragus jayakari* (Thomas, 1894) in the Hatta Mountain Conservation Area, Dubai, United Arab Emirates
-- Jeruel Cabadonga Aguhob, Junid N. Shah, Esmat Elfaki Mohammed Elhassan, Aisha Almurr Al Muhery, Mohamed Mustafa Eltayeb Mohamed, Juma Abdulla Saeed Mohammad Al Omairi, Hamad Hashim Mohammed Khalaf Albedwawi, Obaid Mohammed Salem Mohammed Al Bedwawi, Hassan Zain Alsharif & Afra Mahmood Mohammad Ali Haji, Pp. 12561–12565

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