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A study of seasonal abundance of aquatic birds including migratory birds with a special focus on population of Bar-headed geese at Magadi Kere, Shirahatti Taluk, Gadag district, Karnataka, India

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Abstract

A study of the seasonal abundance of aquatic birds, including migratory birds, focuses on the population of Bar-headed geese coming from Siberia and Tibet to Magadi Kere, Shirahatti Taluk, Gadag District, and Karnataka was conducted over five years spanning from March 2015 to March 2020. A total number of 34 aquatic bird species were observed and recorded. At different time intervals, the abundance and frequency of visits of migratory birds, especially of Bar-headed geese, were recorded and inferences were drawn. The Bar-headed geese followed a fixed migration pattern with the peak season starting from October-November, reaching the highest count in January-February and finally subsiding in March-April every year. The study also discerned that the feeding pattern of aquatic birds coincides with the local crops grown in the vicinity, which are at the harvesting stage during the peak season of migration.

Keywords: bar-headed geese, Magadi, Gadag, IBAs, migratory birds, seasonal abundance

Introduction

The migration concept in birds can be understood based on regular seasonal movement, in between breeding and wintering grounds along a flyway. It mainly occurs in the Northern Hemisphere, where birds are guided on to specific routes by natural barriers. An estimated 1855 bird species (which is 19% of world Avifauna) are migratory, making regular cyclical movements from their original native place to the migration site and back home (8). Threats to these migratory birds have grown with habitat destruction, especially at stopover and wintering sites and structures such as power lines and wind farms along the flyways.

Most of the stopover sites of these migratory birds are the wetlands found in tropical countries like India, which provide suitable conditions for roosting and wintering. Out of 310 species of wetland birds found in India, almost half are migratory and visit India from their breeding grounds in countries of central Asia like Russia, China, Tibet etc. and from across the entire range of the Himalayas^[1]. A wetland is a biologically distinct diverse ecosystem that is flooded by water, either permanently or seasonally. They play several functions, including water purification, water storage, processing of carbon and other nutrients and are home to a wide range of plant and animal life. Most of the wetlands are facing tremendous anthropogenic pressures such as urbanization, land-use changes, dumping of agricultural residue, municipal and industrial waste and climate change. Any damage or change in the properties of the wetlands directly affects the population of its flora and fauna including the migratory birds' population they support.

The water birds of the wetlands are not only the most prominent groups which attract nature lovers and bird watchers to wetlands but also are good bio-indicators and useful models for studying the heterogeneity of environmental problems.

Amongst the various migratory birds, the Bar-headed goose (*Anser indicus*), which is also a principal species of our study, breeds in Central Asia during summer.

They migrate to South Asia for roosting and wintering [10]. Bar-headed geese arrive in thousands from far off places like Mongolia and Tibet, flying long distances at great heights. Larger wing span and ability to absorb oxygen even on flying at great height make these birds super flying machines. They reach various locations in peninsular India to make it home until March and then fly back to their homelands only to return in the following winter. One such lake where migratory birds, especially Bar headed geese come in large numbers is the Magadi Kere in the Gadag district [13].

The migration of Bar-headed geese to Magadi Kere was first recorded and documented by the Indian Institute of Science researchers in 2004. Owing to the presence of a large number of migratory birds, the site was declared as International Bird Area (IBA) by the Bombay Natural History Society (BNHS) and BirdLife International under Criterion A4(iii). Subsequently, in order to improve the in-situ conservation efforts at this important bird habitat, the Government of Karnataka, vide Notification No. FEE 182 FWL 2015 dated 25-06-2015, has declared the site as a Conservation Reserve under Section 36A of the Wildlife (Protection) Act, 1972.

Materials and Methods

Study area

Magadi Kere (15.216647°N 75.511951°E) is an artificial lake situated in Shirahatti Taluk of Gadag District in northern Karnataka. Spread over an area of 54 hectares, Magadi Kere has a catchment area of 900 hectares. Rainwater is the main source of water for the lake. The lake's water has salinity and is therefore not fit for drinking or irrigation purpose. The local people however, use it to meet their other water needs. The mean annual rainfall of the area is 711 mm. A dry climate coupled with temperatures ranging from 20.2 °C to 34.8 °C in winters provides a suitable climate for migratory winged visitors to roost. The rainwater from the catchment area drains into the tank and is retained for about 8-9 months in a year except for occasional dry drought spells. During the drought of 2016-17, the lake dried up completely, resulting in the migratory birds shifting their base to a nearby tank Shettikere. Important tree and shrub species present in and around the lake are *Acacia nilotica*, *Phoenix sylvestris*, *Zizyphus jujuba* and *Prosopis juliflora*. The main wetland vegetation comprises of *Ipomea carnea*, *Typha angustata*, *Paspalum distichum*, *Cyperus rotundus*, etc. The Magadi Lake is situated near State Highway-6 and is approachable from this Highway by walk. A *kutch*a village road also runs around it on the other side. Under the Lake Development Project of the Government of Karnataka a watchtower, pergola and benches were provided by the State Forest Department in the year 2007. Recently, the Zilla Panchayat has fenced the lake to prevent any encroachment [9].



Fig 1: Empty water pond during drought spell of 2016-17



Fig 2: Human Intervention:- Desilting 2016-17



Fig 3: Re-Filled Magadi full of birds again:- 2017-18

Instruments used in the study

Vanguard High Plains 460 Spotting Scope and Celestron Regal M2 100ED Spotting Scope were used to locate and observe birds as they are compact and high-power telescopes optimized for detailed observation of distant objects. These spotting scopes provide magnification up to 20X -60X.

NIKON Action EX 12X50 CF Binoculars (12 x 50 mm) with high magnifying power were used, which provide immense clarity in identifying the bird species.

The team also made efforts to take bird's pictures by Nikon 750D camera whenever possible.

Bird watching technique

The identification of birds is a very challenging process. The challenge enhances once the observation point is distant and fixed as in the case of water birds. During a short span of time, all the characteristics of the birds that are moving or stationary, have to be noticed and confirmed through valid sources. In this study, the help of an experienced local bird watcher, Mr. Somanna was taken. The first and the second authors were serving as the Deputy Conservator of Forests, Gadag Division during the study period (2015-19). They frequently visited the study area both in peak time as well as the lean time of the year to study the birds. The fourth author was serving as the Deputy Range Forest Officer-cum-Surveyor of the Lakshmeshwar Section. He visited the area and the local watcher to perform his regular patrolling duty. The data was recorded and compiled for the period of five consecutive years with a time interval of 15 days in the lean period and once a week in peak season. The lean/peak period for the presence of birds was drawn from the past studies of the area and local observations. The third author was the Chief Conservator of Forests, Dharwad Circle, Dharwad during the initial phase of the study (2015-16) who initiated and guided the project with his insights and the team started taking observations. Point Count Transect method and Directing Counting through Ocular Estimation were used. As the birds used to move to the farmlands for feeding in the

early dawn and late evenings [9] the observations were taken in between 1000 hrs. and 1730 hrs. Continuous observations recognized the birds by sighting and recording their movements, feeding habits, habitat, migration patterns, size as well as specific identification patterns such as a crown,

stripes, colors, positions of different organs, shape, size of the beaks, etc. The observations were confirmed with the help of the field guide “Birds of Indian Subcontinent” by Carol Inskipp, Richard Grimmett, and Tim Inskipp (2011) [2].



Fig 4-6: Bar Headed Geese at Magadi



Fig 7: Team members observing Birds from the watchtower



Fig 9: The signages at Magadi Kere depicting migratory birds.



Fig 8: The Watchtower constructed in 2007



Fig 10: Spot Billed Duck at Magadi



Fig 11: White Breasted Waterhen at Magadi



Fig 12: Western Swamphen at Magadi



Fig 13: Little Cormorant at Magadi



Fig 14: Brahminy Duck at Magadi



Fig 15: Black Headed Ibis at Magadi



Fig 16: River Tern at Magadi



Fig 17: Eurasian Coot at Magadi



Fig 18: Little Grebe at Magadi



Fig 19: Purple Heron at Magadi



Fig 20: Large Egret at Magadi



Fig 21: Sand piper at Magadi

Results and Discussion

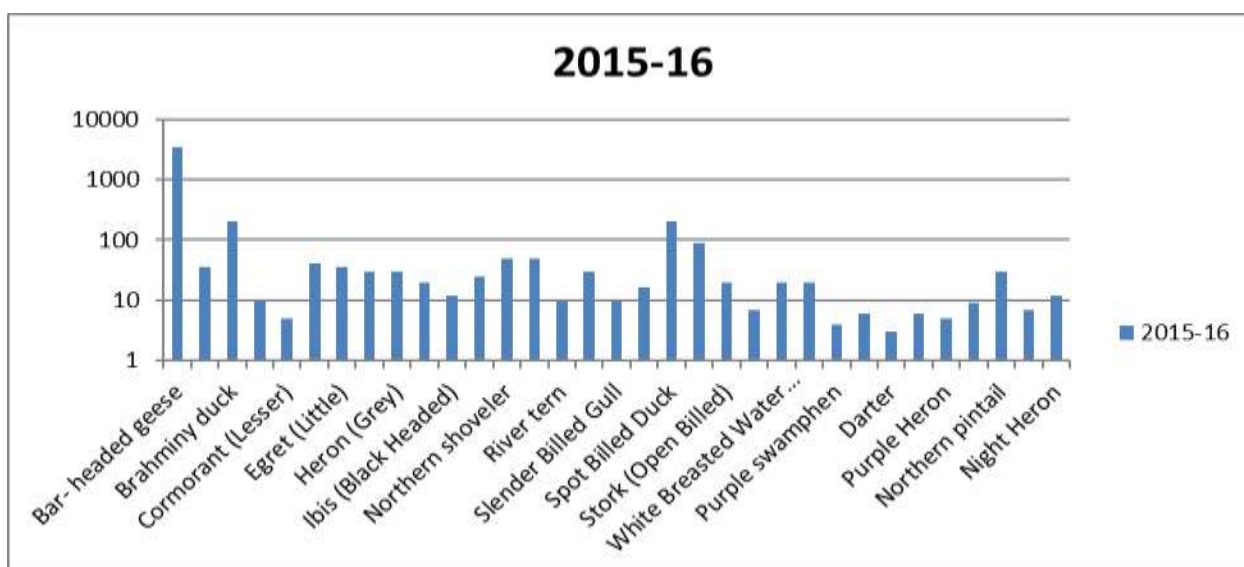
After the continuous observations during the study period, the

following species were observed at the study site

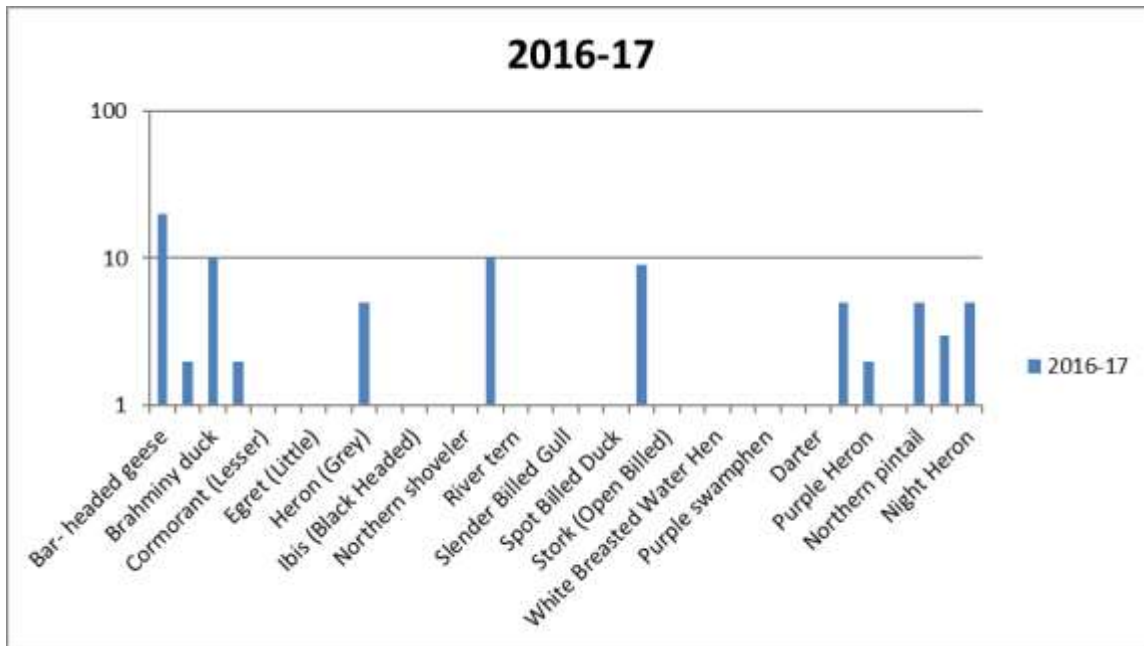
Table 1: Year-wise highest number of individuals recorded during the study (2015-2020)

S. No.	Bird species	Scientific Name	Highest Number of birds recorded in peak season				
			2015-16	2016-17	2017-18	2018-19	2019-20
1	Bar-headed geese	<i>Anser indicus</i>	3500	20	3500	5500	6000
2	Black Winged Stilt	<i>Himantopus himantopus</i>	35	2	40	50	60
3	Brahminy duck	<i>Tadorna ferruginea</i>	200	10	150	300	500
4	Cormorant (Greater)	<i>Phalacrocorax carbo</i>	10	2	20	8	30
5	Cormorant (Lesser)	<i>Microcarbo niger</i>	5	1	12	10	20
6	Egret (Large)	<i>Ardea alba</i>	40	0	60	25	80
7	Egret (Little)	<i>Egretta garzetta</i>	35	0	30	60	60
8	Garganey	<i>Spatula querquedula</i>	30	0	18	5	40
9	Heron (Grey)	<i>Ardea cinerea</i>	30	5	20	18	40
10	Heron (Pond)	<i>Ardeola grayii</i>	20	0	15	26	45
11	Ibis (Black Headed)	<i>Threskiornis melanocephalus</i>	12	0	11	40	60
12	Ibis (Red- Naped)	<i>Pseudibis papillosa</i>	25	0	40	50	60
13	Northern shoveler	<i>Spatula clypeata</i>	50	0	45	20	50
14	Lapwing (Red wattled)	<i>Vanellus indicus</i>	50	10	26	40	50
15	River tern	<i>Sterna aurantia</i>	10	0	10	8	20
16	Sand piper	<i>Actitis hypoleucos</i>	30	0	15	60	80
17	Slender Billed Gull	<i>Chroicocephalus genei</i>	10	0	5	2	12
18	Spoonbill	<i>Platalea leucorodia</i>	16	0	5	30	18
19	Spot Billed Duck	<i>Anas poecilorhyncha</i>	200	0	35	50	300
20	Stork (Painted)	<i>Mycteria leucocephala</i>	90	9	50	60	150
21	Stork (Open Billed)	<i>Anas tomusocitans</i>	20	0	8	10	40
22	Stork (White necked)	<i>Ciconia episcopus</i>	7	0	6	4	25
23	White Breasted Water Hen	<i>Amaurornis phoenicurus</i>	20	0	20	12	25
24	Common coot	<i>Fulica atra</i>	20	0	40	30	50
25	Purple swamphen	<i>Porphyrio porphyrio</i>	4	0	20	12	25
26	Little Grebe	<i>Tachybaptus ruficollis</i>	6	0	30	20	15
27	Darter	<i>Anhinga anhinga</i>	3	0	2	2	5
28	Demoiselle crane	<i>Grus virgo</i>	6	5	3	40	20
29	Purple Heron	<i>Ardea purpurea</i>	5	2	2	2	4
31	Common pochard	<i>Aythya ferina</i>	9	0	4	8	10
32	Northern pintail	<i>Anas acuta</i>	30	5	10	25	60
33	Lesser whistling duck	<i>Dendrocygna javanica</i>	7	3	3	4	20
34	Night Heron	<i>Nycticorax nycticorax</i>	12	5	10	20	30

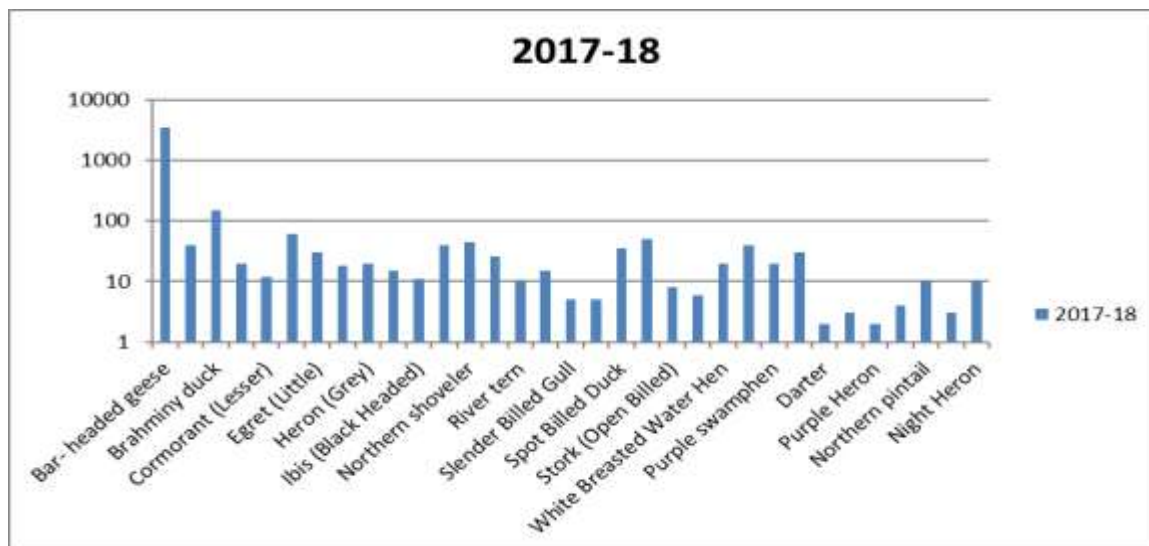
Note: While rounding off to the nearest ten if the digit in the units place is between 0 – 4 i.e., < 5 then the unit digit is replaced by 0, wherever birds count is >50.



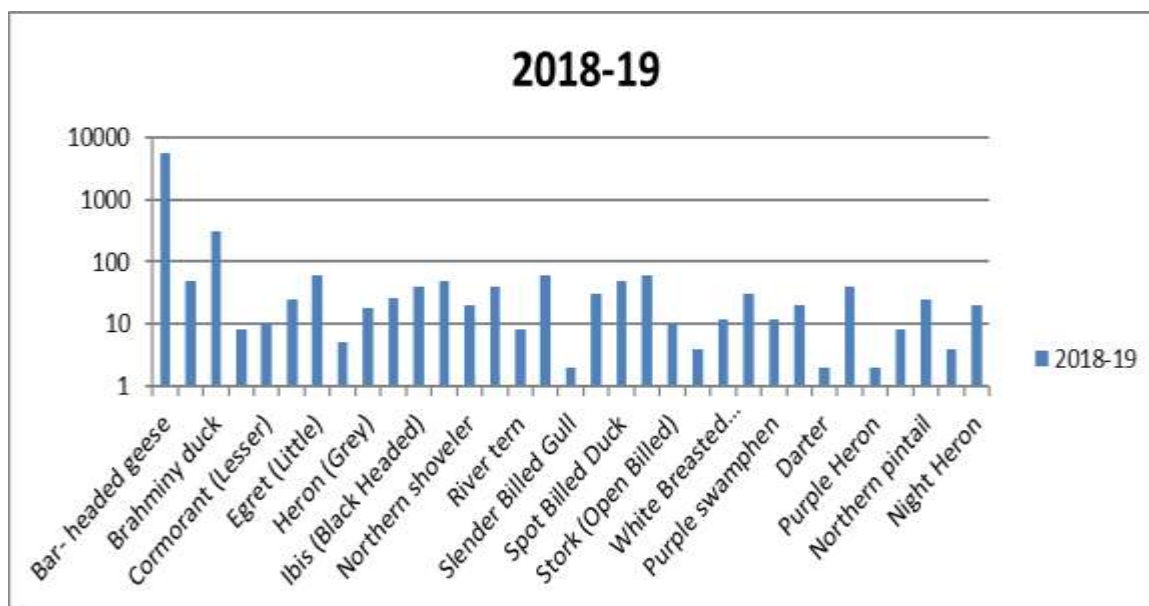
(a)



(b)



(c)



(d)

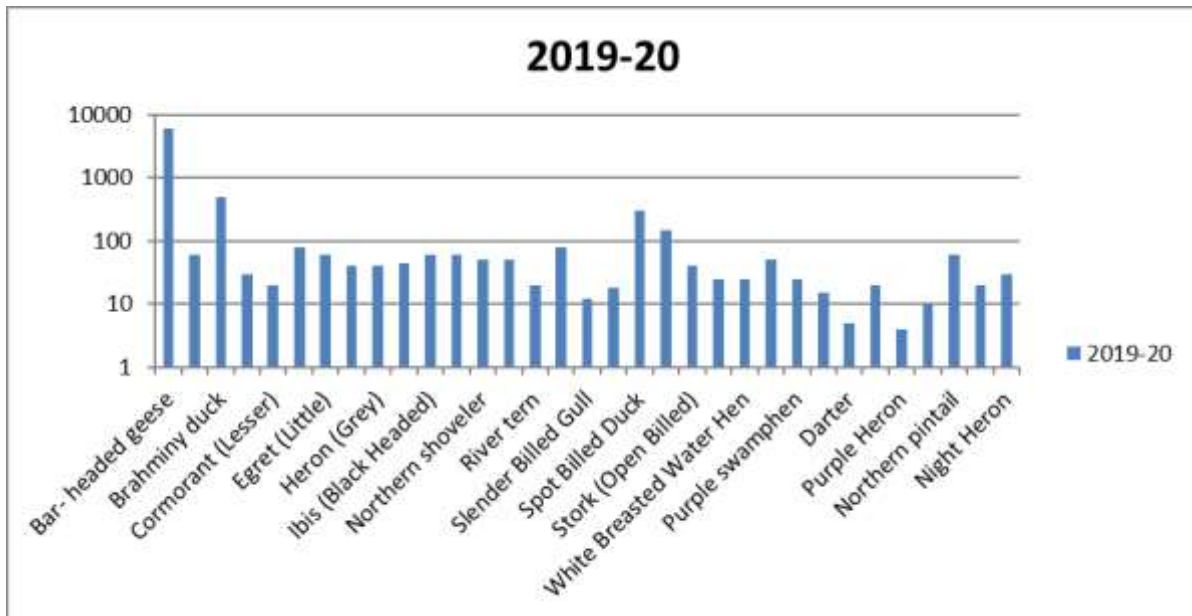


Chart 1a – 1e: Year-wise highest number of individuals recorded during the study (2015-2020) x-axis represents species name while y-axis represents log₁₀ number of individuals

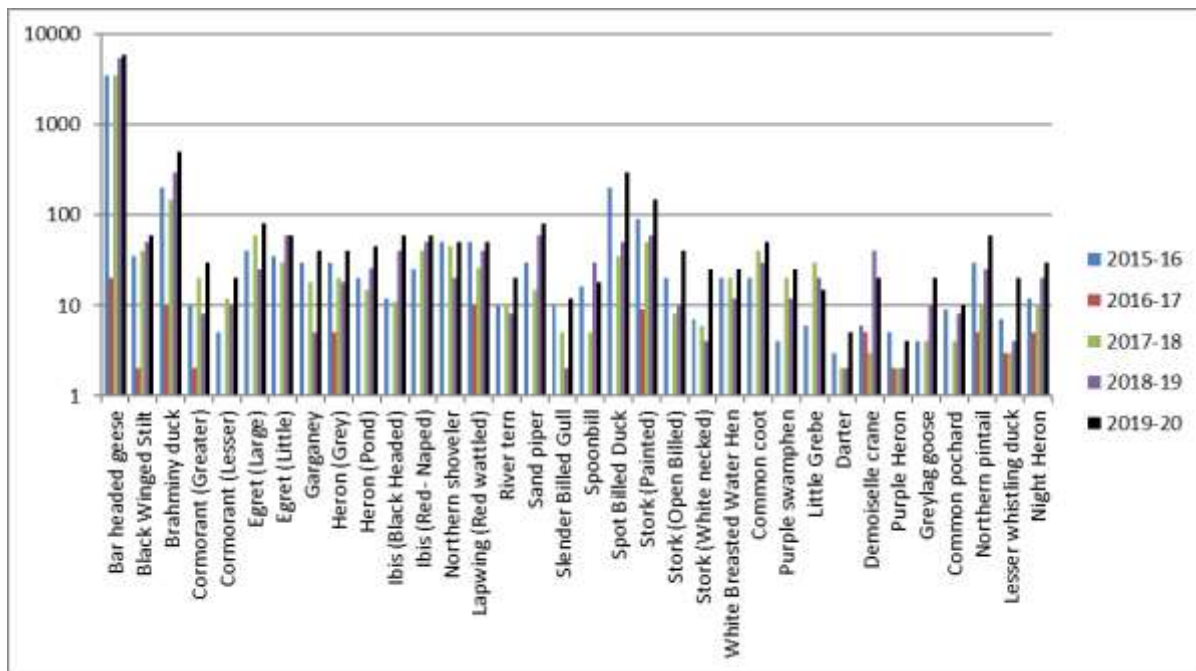


Chart 2: Year-wise highest number of individuals recorded during the study (2015-2020) x-axis represents species name while y-axis represents log₁₀ number of individuals

The highest numbers of individuals of different species were recorded during the study period annually as shown in Chart 1. Owing to drought during the year 2016-17, very few birds were sighted. Interestingly, during the drought year, most of the migratory birds shifted to a nearby lake Shettikere. Under normal circumstances, the migratory birds used to visit Shettikere but not in that large numbers.

Earlier studies carried out in this particular area have concentrated only on the status, diversity and other qualitative aspects of migratory birds. In the present study, the statistical analysis shows the number of the different aquatic birds present in the study area during winter season. Apart from enumeration of all species present, the special weightage has been given to Bar Headed Geese and their presence is

evaluated in quantitative terms.

Besides Bar-headed geese, Brahminy duck and Spot-billed duck have been observed in large numbers. The Painted Stork, Demoiselle Crane and Northern Pintail were the other species which have shown significant abundance during the study period.

As per Chart 2, the relative abundance of Brahminy duck, Spot-billed duck, Painted Stork, Demoiselle Crane and Northern Pintail can be deciphered that shows that a similar pattern for all the species with minimum number of individuals during 2016-17. However, human intervention by way of desilting of the tank resulted in enhanced rainwater storage in the tank that led to notable improvement in the population of these species in subsequent years.

Table 2: Year-wise highest number of individuals recorded during the study (2015-2020)

Species	Highest Number of birds observed in peak season				
	2015-16	2016-17	2017-18	2018-19	2019-20
Brahminy duck	200	10	150	300	500
Spot Billed Duck	200	0	35	50	300
Stork (Painted)	90	9	50	60	150
Demoiselle crane	6	5	3	40	20
Northern pintail	30	5	10	25	60

Note: While rounding off to the nearest ten if the digit in the units place is between 0 – 4 i.e., < 5 then the unit digit is replaced by 0, wherever birds count is >50.

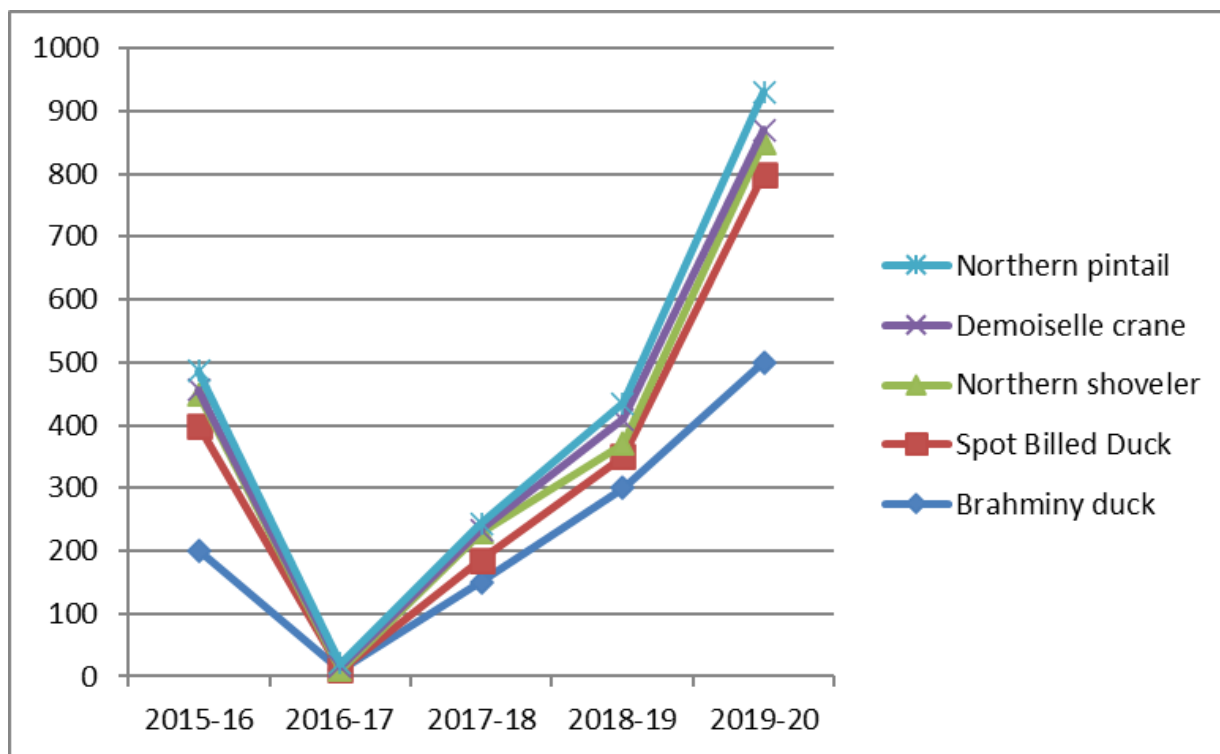


Chart 3: Year-wise highest number of individuals recorded during the study (2015-2020)

Periodical observations during the study period reveal the exact pattern of the migration of various bird species especially the Bar-headed geese. As per table 3, the Bar Headed Geese start visiting the roosting ground in October-November and head their way back to their respective native places at the end of March. It is also observed that they

congregate in the tank for shelter during the day. During the early dawn and late evening hours, the flock raids the agricultural fields in the neighboring areas in about 30 km radius and feeds on the produce such as wheat, jowar, pulses, ground nut, bengal gram, etc., before returning to the lake for night shelter.

Table 3: Monthly Abundance of Bar headed Geese for study period of five years

Month	Number of birds at peak				
	2015-16	2016-17	2017-18	2018-19	2019-20
August	0	0	0	0	0
September	0	0	0	0	0
October	3	0	5	8	10
November	12	3	24	150	200
December	250	6	2000	2500	5000
January	3500	12	3500	5500	6000
February	1500	3	2500	3000	3000
March	35	2	50	140	38
April	2	2	3	5	6
May	0	0	0	0	0
June	0	0	0	0	0
July	0	0	0	0	0

Note: While rounding off to the nearest ten if the digit in the units place is between 0 – 4 i.e., < 5 then the unit digit is replaced by 0, wherever birds count is >50.

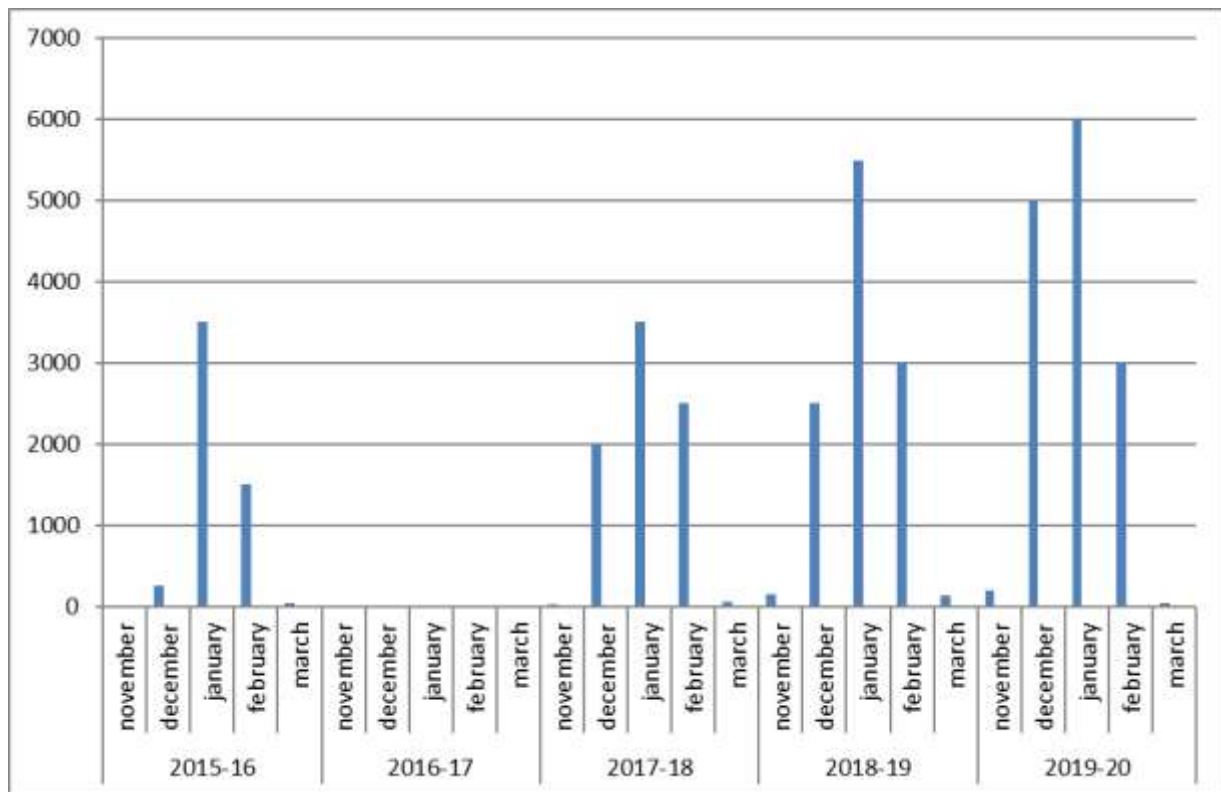


Chart 4: Number of Bar headed Geese for study period of five years

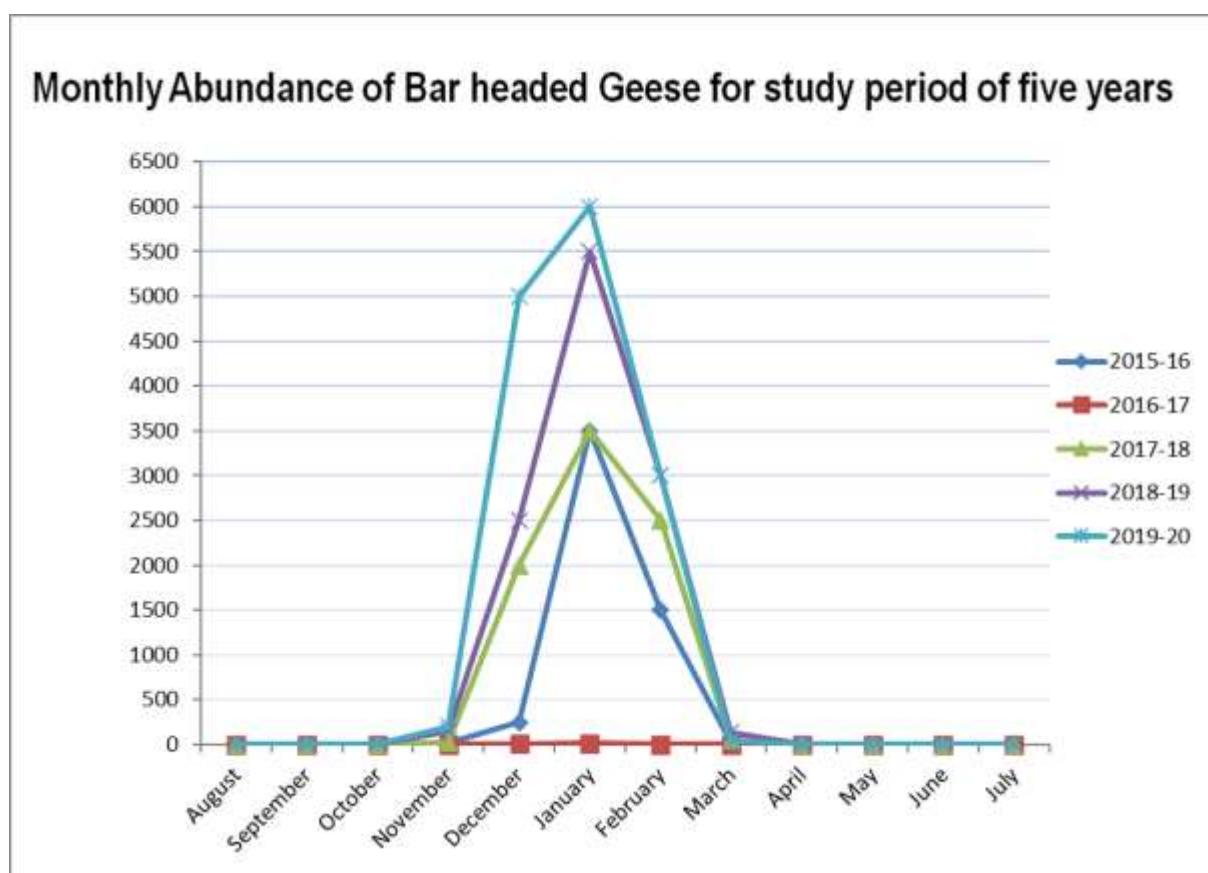


Chart 5: Comparative line chart for Monthly Abundance of Bar Headed Geese for study period of five years

Conclusions

The data analysis clearly shows that the maximum number of migratory birds, specifically the Bar-headed geese visit the lake during December to February, because the weather conditions in Indian Peninsula are favorable for them. The harsh winters in the Northern Hemisphere compel these birds

to move as far as the southern tip of India where better resources of food and shelter are available. When the summer approaches in these parts and the temperature reaches beyond 38° these birds fly back to their native places hence showing zero presence in the study area.

The migratory birds did not come to Magadi Kere in large

numbers during the drought spell and shifted to another non-descript lake Shettikere, about 5 Km away from the site of study.

After the desilting of lake during 2016-17, the water storage improved resulting in increased number of migratory birds in the subsequent years.

The presence of many migratory and resident birds recorded in our study shows that Magadi Lake is an important habitat for migratory birds, used for stopover and as a wintering site. During the dry spell, the number of birds reduced considerably. Improvement of islands and planting of species like *Acacia nilotica*, Bamboo species taken up by the Forest Department have also provided extra roosting sites for these birds. The effect of anthropogenic interference was minimal as the local populace lives in harmony with these migratory birds and considers them the pride of their village. No cases of poaching are reported here during the study period.

It is suggested that Shettikere, which serves as a transient site to the birds during the drought should also be studied at a regular basis. The quantitative analysis can be compared with the present study to assess the pattern of this type of transient migration.

It is also suggested that similar studies for a period of 5-10 years can be carried out at various locations in India visited by the Bar-headed geese along their routes from Central Asia and Tibet to the southern-most tip of India, including resting places at Nepal and other Trans-Himalayan Countries and compile the data of the entire migration process.

Acknowledgements

This study is incomplete without mentioning the name of Shri Somanna Pashupatihal, the local bird watcher and enthusiast who helped in taking observations for the study period tirelessly and continuously for five years. The authors are also thankful to Shri Satish Pujar, the then Range Forest Officer, Shirahatti Range for agreeing to share the pictures of the birds taken by him. The contribution made by each author is significant and equal.



Fig 22: Shri Somanna, local birdwatcher observing birds at Watchtower, Magadi Kere

Author Contributions

The third author conceived the idea and designed the methodology along with first author; first, second and third authors collected the data; after analysis and interpretation of data, first and second authors led the writing of the manuscript. Third author contributed substantially for proof reading and critically revised the draft. All authors contributed critically to the drafts and gave final approval for publication.

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