



Diversity and Population of Ducks and Geese in Keibul Lamjao National Park (KLNP) in Manipur, India

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

As a part of the Asian Waterbird Census (AWC), surveys on ducks and geese were made at five (5) major waterbird congregation sites of Keibul Lamjao National Park (KLNP) during 2020-2024. A total of 18 species of ducks and two species of geese belonging to the family of Anatidae were recorded during the period. The duck species includes 14 migratory and 4 resident species and the two migratory geese species. Lesser Whistling Duck *Dendrocygna javanica* was the most abundant and dominant species in terms of population followed by Gadwall *Anas strepera* and Red - crested Pochard *Netta rufina* and minimum value was observed in Greylag Goose *Anser anser*. The

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Critically Endangered Baer's Pochard *Aythya fuligula* was recorded in the year 2023 at Pabot Chingmang site (2 individuals). Another two globally Near threatened (NT) Ferruginous Pochard *Aythya nyroca* and Falcated Duck *Anas falcata* have been recorded here.

Keywords: Waterfowl; wetland; Keibul Lamjao National Park; diversity.

1. INTRODUCTION

The Keibul Lamjao national park (KLNP) of Manipur State in NE India is eponymous with the rich cultural heritage and folklore of Manipur and the last habitat and home to the highly endangered Manipur Brow-antlered Deer *Rucervus eldi eldi*, one of the three subspecies of Thamin. KLNP was created to protect Manipur Brow-antlered Deer. It was reported to be extinct in 1951, but a survey conducted by IUCN revealed that a few animals exist in the park and necessitate the declaration of the area as a National Park in 1977 under the Wildlife (Protection) Act, 1972. It is one of the few floating parks in the world. KLNP as part of the Loktak lake was designated as a wetland of international importance under the Convention on Wetlands (Ramsar) on 23 March, 1990. Data on waterbirds of Loktak is poorly available except few works (Birjit and Sanajaoba 2014, Hume 1888, Kasambe and Singh 2014).

KLNP provides refuge to thousands of birds of at least 180 species, including 18 species of waterfowl. Therefore, it was included in the list of Important Bird and Biodiversity Area IBAs qualifying under criteria A1, A4iii when assessed in 2014 (Rahmani et al. 2016). The present study has been conducted as there was no or few reports on waterfowls in this key important park of the country.

1.1 Study Area

KLNP is located in the south-east fringe corner of Loktak Lake, Bishnupur district, Manipur State of Northeast India between 93.53° E – 93.55° E longitude and 24.27° N – 24.31° N latitude, covering an area of 40 sq.km. and at an elevation of 767 – 788 m asl. KLNP is a large continuous mass of swamp with floating mats of vegetation, locally known as phumdis, covering much of its surface. Phumdis are composed of decaying vegetation, up to 1.6 m thick and 80% submerged, and can support the weight of large mammals. There are small hillocks within Keibul Lamjao, namely Chingjao, Pabotching and Toyaching, which provide refuge for large mammals during high level of water (Scott 1989).

A total of five major congregation sites were identified and selected for the study of ducks and geese species. The study area spreads over an area of 40 sq.km within Keibul Lamjao National Park [Fig. 1].

2. METHODOLOGY

Surveys were made to identify major northern wintering and waterbird congregation sites in Keibul Lamjao NP. Five major congregation sites in KLNP have been identified using GPS coordinates namely Pabot Chingmang (24.294° N, 93.494° E), Chingmei (24.300° N, 93.516° E), Ngakrakom (24.295° N, 93.501° E), Hameiban (24.295° N, 93.500° E) and Thangbareil Yangbi (24.295° N, 93.504° E). The simultaneous one-day annual waterbird count was conducted during the month of January.

The first survey, conducted on 19th January, 2020, was aimed to collect preliminary data to better understand the current status of waterbirds in KLNP. The second survey studied on 16th March, 2021 was more specific, aiming to study distribution, identification and diversity of the species and their population thereof. The 3rd survey conducted on 21st January, 2022, focused on sites of high conservation importance identified during the earlier surveys and to confirm the continuous occurrence of the species and their global conservation status. The fourth survey was conducted on 5th February, 2023 and the final survey was made on 20th January, 2024 to study the impact of change in hydrological regime and ecology influence by Loktak Lake on KLNP on the distribution, diversity and population of waterbirds, particularly, waterfowl.

Study on the diversity and population of the waterfowl species were made with simultaneous Total Count Method (Javed and Kaul 2002, Bibby et al. 1992) at the 5 congregation sites using dugout canoes by a team consisting of 5 people for each congregation sites. Birds were observed by using Olympus Binoculars (10x50) approaching nearby possible distance from the flock without disturbing them and photographed using Nikon DSLR with 150 – 500mm zoom lens

from 5 am. to 1 pm and 2 - 5 pm at the time of return from the roosting sites on the same day. Identification and recording and evaluation of the species has been done with the help of field

guides (Rahmani et al. 2016, Ali and Ripley 2001, Grimmett et al. 1999). A standardized check list of the ducks and geese has been prepared (Manakandan and Pittie 2001).

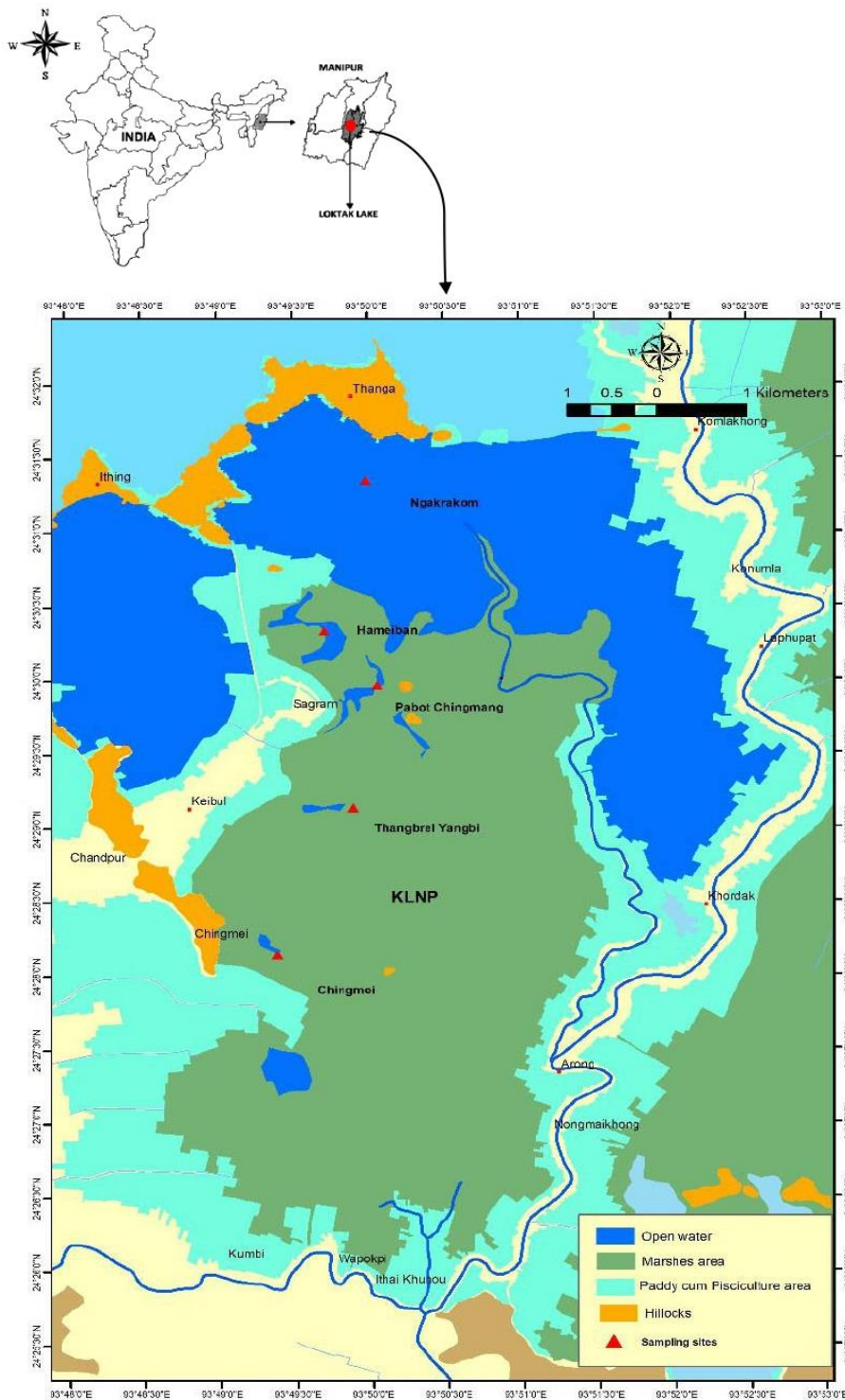


Fig. 1. Map with five major waterbird congregation sites in Keibul Lamjao National Park, Manipur (2020 – 2024)

Species diversity was calculated by using Shannon diversity index (Magurran 2004) as:

$$\text{Shannon-Wiener Index, } H' = - \sum p_i \ln p_i$$

where, H' = Shannon index of general diversity,

p_i = proportion of density value of the species (density of the species/total no. of individual).

$$\text{Dominance} = \frac{\text{No. of individual species in a sample}}{\text{Total no. of species in the population}}$$

3. RESULTS AND DISCUSSION

A total of 18 species of ducks and 2 species of geese belonging to 8 genera of Anatidae family have been recorded. Lesser Whistling Duck *Dendrocygna javanica* was the most abundant (9504 individuals) and dominant species in terms of population followed by Gadwall *Anas strepera* and Red-crested Pochard *Netta rufina* and minimum value was observed in Greylag Goose *Anser anser* with only single individual [Table 1]. The maximum dominance percentage was observed in Lesser Whistling Duck (70.5%) followed by Gadwall (17.4%), Red-crested Pochard (2.9%) and minimum value was observed in Greylag Goose (0.007%). The duck species includes 14 migratory and 4 resident species and the two geese are both migratory. Out of the 4 resident duck species, Lesser Whistling Duck *Dendrocygna javanica*, Cotton Teal *Nettapus coromandelianus* and Spot-billed Duck *Anas poecilorhyncha* can be seen all the year round and have been confirmed to breed in KLNP and Loktak. They breed in the floating vegetation of KLNP and other areas of Loktak Lake. The status of breeding of the remaining resident species Large Whistling Duck *Dendrocygna bicolor* could not be confirmed due to their rare presence and local migration movements.

The average highest population of duck species during the last five years has been recorded in Pabot Chingmang followed by Chingmei, Ngakrakom, Hameiban and Thangbarei Yangbi [Table 2]. A Critically Endangered (CR) Baer's Pochard *Aythya fuligula* was recorded in the year 2023 at Pabot Chingmang site (2 individuals). Two globally Near Threatened (NT) Ferruginous Pochard *Aythya nyroca* and Falcated Duck *Anas falcata* has also been recorded. Ferruginous Pochard has been protected under Conventions of Migratory Species (CMS). Large whistling duck has been

protected under WildLife Protection Act, 1972 Schedule I and the rest of all ducks and geese has been protected under Schedule IV. During the last five years, Pabot Chingmang contributed a higher percentage of ducks and geese comparatively with the rest of the congregation sites. Chingmei recorded a decreasing pattern of species occurrence in the last five years of study period which may be due to human interference from the adjoining Keirenphabi village. Shannon-Wiener diversity index ranged from 0.21 to 1.50 in the study sites. Maximum diversity (1.50) was observed in Pabot Chingmang followed by Ngakrakom, Thangbarei Yangbi and minimum was observed in Chingmei despite having high population density (highest count) which may be due to maximum occurrence of lesser whistling duck in this spot.

Prolonged inundation and maintaining water level beyond 768.4 m asl and total dictation of the hydrological regime of the KLNP by the Ithai Barrage of NHPC as there is no judicious allocation of water for biodiversity services of the lake and KLNP has seriously affected the natural hydrological regime of the KLNP thereby dwindling the waterfowl abundance and diversity (Trisal and Manihar 2004). It leads to the reduction of diversity and density of wetland invertebrates which are the major source of food for waterfowl species. Many species of emergent, floating and submerged plants which are also important food plants of the waterbirds had been disappeared after the commissioning of Ithai Barrage (Singh and Shyamananda 1994).

Water level fluctuations induce boom to bust in aquatic life therein. In deeper marshes or shallow lakes, drying allows decomposition of bottom organic deposits that provides nutrients for a new surge of vegetation that germinate under low water conditions. But such kind of seasonal fluctuation of water level could not be observed anymore in the study period.

Other key factors which are responsible for the observed decline of population and diversity of waterfowl species in KLNP are:

1. Heavy human presence for fishing in KLNP thereby giving intensive pressure to waterfowl population to shift to other less ideal marginal habitats.
2. Indiscriminate encroachment of shoreline areas and conversion into private fish farm.

3. Proliferation of phumdi (floating biomass) thereby reducing the habitat area of duck and geese in the open water body of the park.
4. Indiscriminate killing and poaching of waterbirds by poisoning and netting.
5. Disturbance of natural phum (floating biomass) cycle of rising and landing in the bottom by the Ithai Barrage.



Greylag Goose *Anser anser*



Mallard *Anas platyrhynchos*



Baer's Pochard *Aytha baeri*



Brahminy Duck *Tadorna ferruginea*



Northern Pintail *Anas acuta*



Lesser Whistling Duck *Dendrocygna javanica*



Gadwall *Mareca strepera*



Ferruginous Duck *Aythya nyroca*

Plate 1. Ducks and Geese of KLNP

Table 1. Numbers of Ducks and Geese in Keibul Lamjao National Park, Manipur (2020-2024)

Common Name	Scientific name	Local Name	M/R ¹	IUCN Status ²	Population					Max
					2020	2021	2022	2023	2024	
Baer's Pochard	<i>Aythya baeri</i>	Sadang mitngou	M	CR	0	0	0	2	0	2
Bar-headed Goose	<i>Anser indicus</i>	Kangsel	M	LC	0	2	0	1	0	2
Brahminy Duck	<i>Tadorna ferruginea</i>	Nganu -thangong	M	LC	0	0	0	0	2	2
Common Pochard	<i>Aythya ferina</i>	Eruppi-chamda	M	LC	12	41	2	106	18	106
Common Teal	<i>Anas crecca crecca</i>	Surit	M	LC	120	86	43	83	58	120
Cotton Teal	<i>Nettapus coromandelianus</i>	Nganu pedagot	R	LC	0	3	0	2	3	3
Eurasian Wigeon	<i>Anas penelop</i>	Thangongmal	M	LC	114	23	4	5	63	114
Falcated Duck	<i>Anas falcata</i>	Thoidingnum manbi	M	NT	0	0	1	3	0	3
Ferruginous Pochard	<i>Aythya nyroca</i>	Nganu mitngoubi	M	NT	0	59	3	81	69	81
Gadwall	<i>Anas strepera</i>	Thoidingnum	M	LC	606	82	950	192	510	950
Garganey	<i>Anas querquedula</i>	Surit angouba	M	LC	0	6	6	6	2	6
Greylag Goose	<i>Anser anser</i>	Lam Kanga	M	LC	0	0	0	1	0	1
Large Whistling Duck	<i>Dendrocygna bicolor</i>	Tingee Achouba	R	LC	2	2	1	0	0	2
Lesser Whistling Duck	<i>Dendrocygna javanica</i>	Tingi	R	LC	2600	2375	4100	141	288	4100
Mallard	<i>Anas platyrhynchos</i>	Meitunga-meikon	M	LC	0	1	0	2	0	2
Northern Pintail	<i>Anas acuta</i>	Meitunga	M	LC	0	41	15	20	3	41
Northern Shoveler	<i>Anas cluypeata</i>	Nganu khara	M	LC	0	20	4	4	8	20
Red-crested Pochard	<i>Netta rufina</i>	Thoidingnam Kokngangbi	M	LC	6	21	0	47	320	320
Spot-billed Duck	<i>Anas poecilorhyncha</i>	Nganu- pirel	R	LC	0	5	4	0	0	5
Tufted Duck	<i>Aythya fuligula</i>	Sadang	M	LC	0	16	0	2	54	54
					3460	2783	5133	698	1398	

Notes: 1 – M – Migrant, R – Resident

2 – IUCN Red List Status- CR - Critically Endangered, NT – Near Threatened, LC – Least Concern

Table 2. Ranking of population of ducks and geese at five different sites

Rank	Site name and Location	GPS Coordinates	Year					Average
			2020	2021	2022	2023	2024	
1.	Pabot Chingmang	24.294° N 93.494° E	50	938	1412	348	967	743.0
2.	Chingmei	24.300° N 93.516° E	2008	477	701	61	71	663.6
3.	Ngakrakom	24.295° N 93.501° E	852	641	1523	191	78	657.0
4.	Hameiban	24.295° N 93.500° E	500	567	300	82	242	338.2
5.	Thangbarei Yangbi	24.295° N 93.504° E	50	160	1197	16	40	292.6

4. CONCLUSION

Education and awareness programme for the conservation and protection of waterbirds should be encouraged in and around the KLNP. Measures should be taken up to control the rapid proliferation of floating biomass and to create open water area as a part of habitat development of waterbirds as the park locates in the Central Asian Flyway of migratory birds. Annual monitoring of waterbirds particularly duck and geese should be taken up besides Annual mid-Winter waterbird Census. Conservation of KLNP and wise use of Loktak is hinged on harmonising water allocation for human purpose (i.e hydropower generation, agriculture and domestic use) with ecological demands for the maintenance of KLNP habitat and biodiversity service of the Loktak (Wetland International-South Asia. 2011). Therefore, a judicious water allocation policy must be adopted for the conservation of waterbirds and other charismatic species dwelling in the park besides strict enforcement of Wildlife Protection Act, 1972.

DISCLAIMER (ARTIFICIAL INTELLIGENCE)

Author(s) hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc.) and text-to-image generators have been used during the writing or editing of this manuscript.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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