

RESEARCH ARTICLE

Population size and movements of the Greater Flamingo (*Phoenicopterus roseus*) in the Jaffna peninsula, Sri Lanka: Results from a long-term study

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Received: 12/05/2018; Accepted: 02/08/2018

Abstract: The Greater Flamingo (*Phoenicopterus roseus*) is an uncommon migrant bird species found in Sri Lanka, and is a major attraction among avitourists. Jaffna Peninsula, Mannar Island, and the southeastern coastal areas are the known strongholds of this species in Sri Lanka. Previous studies on this species in the Jaffna Peninsula are limited, most probably due to the inaccessibility of the area during the three-decade long civil war. Hence, the objectives of the present study were to determine the population size and movements of the Greater Flamingo in major flocking areas in the Jaffna Peninsula. The study used point counts to determine population size. Binoculars and spotting scopes were used for observations. Counts were taken monthly for five years from April, 2013 to April, 2018 to cover both migratory and non-migratory seasons. To determine their movements, we mapped the location of flocks using a GPS throughout the study period.

The estimated total population size for Greater Flamingo in the Jaffna Peninsula is 6245±300. The highest average count (1081) was recorded from Nagar Kovil area with mean flock size of 367±73. Flamingos were recorded during both migratory and non-migratory seasons. The highest number of birds was observed from June - August. During the height of the dry season, flamingos moved away from western parts of the Jaffna Peninsula and concentrate on eastern parts possibly due to the higher abundance of food. The wetlands are the highly preferred habitats of the flamingos. The year-round presence of flamingos indicates that they remain in Sri Lanka beyond the migratory season as summer loiterers. The present study shows that the Jaffna Peninsula is an important area for the Greater Flamingo, thus protecting their preferred habitats is critical for their survival.

Keywords: Greater Flamingo, Jaffna Peninsula, uncommon migrant, summer loiterer.

INTRODUCTION

The Greater Flamingo (*Phoenicopterus roseus*) is an uncommon migrant found in Sri Lanka, and is a major attraction among avitourists (Azcarate, 2006). It has a wide distribution in the Old World including southern and eastern Spain and southern France, parts of northern

and western Africa, from east Africa to South Africa and Madagascar, and east to Kazakhstan and through Middle East to India and Sri Lanka (Primack, 2010; del Hoyo *et al.*, 2017). In Sri Lanka, it is mainly found in the northern parts of the island (Wijesundara *et al.*, 2017b), where, in some areas such as Jaffna region, it is one of the most abundant migratory bird species (Wijesundara *et al.*, 2016). Even though it is generally recognized as a migrant species, a large number can be seen year-round in the Jaffna Peninsula (Wijesundara *et al.*, 2016; del Hoyo *et al.*, 2017; Wijesundara and Rajkumar, 2017; Wijesundara *et al.*, 2017a; Wijesundara *et al.*, 2017b). It is found in fluctuating numbers in the eastern and southeastern coastal areas (Warakagoda *et al.*, 2012).

Six species of flamingos are currently recognized (Lee *et al.*, 2011; Clements *et al.*, 2016; del Hoyo *et al.*, 2017). The Greater Flamingo was formerly considered as conspecific with American Flamingo, but now it is generally accepted as a distinct species (del Hoyo *et al.*, 2017) (Figure 1). Currently all flamingo species are listed in CITES Appendix II (CITES 2017). The world population size of the greater flamingo is estimated at 550,000-680,000 individuals (Wilson and Peter, 1988; BirdLife International, 2018).

Flamingos are among the most gregarious of birds (del Hoyo *et al.*, 2017), occurring in flocks of up to a thousand or more individuals in Sri Lanka (Legge, 1880; Henry, 1971), and up to a million in some other parts of the world (Hutchins *et al.*, 2002). They typically feed in saline lagoons and salt pans (del Hoyo *et al.*, 2017). Hence, the Jaffna region may be considered a stronghold of this species in Sri Lanka (Wijesundara *et al.*, 2017a; Wijesundara *et al.*, 2017b). The area has many brackish or salt water habitats suitable for flamingos. Apart from this area, considerable numbers of flamingos have also been recorded in Mannar (Wijesundara *et al.* 2017b), where the low gradients of the littoral region enables them to stand in the sea more than 1 km away from the shore.

All species of flamingos show some long-distance

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movements (Hutchins *et al.*, 2002), and many of these are adaptations to changes in their habitat, rather than true seasonal migrations. The movements of the greater flamingos in Africa are the result of irregular patterns of drought and rainfall and associated water-level changes. These changes affect both the food supply and availability of suitable nesting areas (Hutchins *et al.*, 2002). The greater flamingo is partially migratory and highly dispersive (del Hoyo *et al.*, 2017). It is reported that northern populations may perform regular migrations but these hardly ever involve the entire population. In Asia many greater flamingos spend their winter south of the breeding range, reaching southern India and Sri Lanka (del Hoyo *et al.*, 2017). In Sri Lanka, large flocks overwinter in lagoons in the North and some reach even the Eastern and Southern Provinces, and some non-breeders are present year-round (Wijesundara and Rajkumar 2017; Wijesundara *et al.*, 2017b). Their nearest known breeding site is the Rann of Kutch at the India-Pakistan border (Ali and Ripley 2001), where one of the largest congregations of Greater Flamingos in the world can be seen (Shivraj Kumar *et al.* 1983). The unfavorable conditions for breeding at Rann seems to be a reason for their extended stays in Sri Lanka, though the exact reason is not known. One of the earliest records of this species staying on in Sri Lanka beyond the migrant season is from Legge (1880). He gives a record of a large flock of flamingos seen in Jaffna during June. Wait (1925) also records seeing a large flock in June in Kokkilai Lagoon. Henry (1998) reports that a considerable number of flamingos loiter through the south-western monsoon (May-September), and the building of nest mounds has occasionally been observed in the remote lagoons of the Eastern Province, though no definite indication of breeding in Sri Lanka. According to recent research, greater flamingos have been observed in large numbers (i.e. >1,000), and with sub-adults, in June and July in the Jaffna Peninsula (Wijesundara *et al.* 2016; Wijesundara *et al.* 2017a; Wijesundara *et al.* 2017b).

Previous studies on this species in the Jaffna Peninsula are limited, most probably due to the inaccessibility of the area during the three-decade long civil war (Wijesundara *et al.* 2016). Our objectives were to determine the population size and movements of the Greater Flamingos within the Jaffna Peninsula. The present study, according to our knowledge, is the first ever long-term study of the population of Greater Flamingos in the Jaffna Peninsula.

MATERIALS AND METHODS

The point counts method was used to determine population size of flamingos as described in Sutherland (2006) and Bibby *et al.* (2000). Binoculars (Nikon 8×40 Action Extreme and Nikon Monarch 10×42) and spotting scopes (Visionking 30-90×100 and Vixen 25×50) were used for observations. Counts were taken monthly from April, 2013 to April, 2018, to cover both migratory and non-migratory seasons. Peak observation times were mornings and evenings, thus on each counting day, about three hours were spent in mornings and as well as in the evenings. Each site was visited multiple times throughout the study period, and each received approximately equal number of visits. There were two counting days (consecutive) per month. If the first day was spent on the eastern parts of the peninsula, the second day was spent on the western parts and *vice versa*. To estimate the total population size, the cumulative count for each site was divided by the number of visits for that site, and the average counts were added. Descriptive statistics were obtained using Minitab 15 statistical software (Minitab 2010). To determine movements of Greater Flamingos, we mapped the location of flocks using a GPS (Garmin GPS 72H) throughout the study period. The major sites included Chundikkulam National Park, Nagar Kovil, Mamunai, Vallai, Thondamanaru, Avarankal East, Sarasalai, Anthanathidal, Kappoothu, Mandaitivu, Allaipiddy, Mankumban, Araly Junction, Saravanai, and Chavakachcheri (Figure 2).

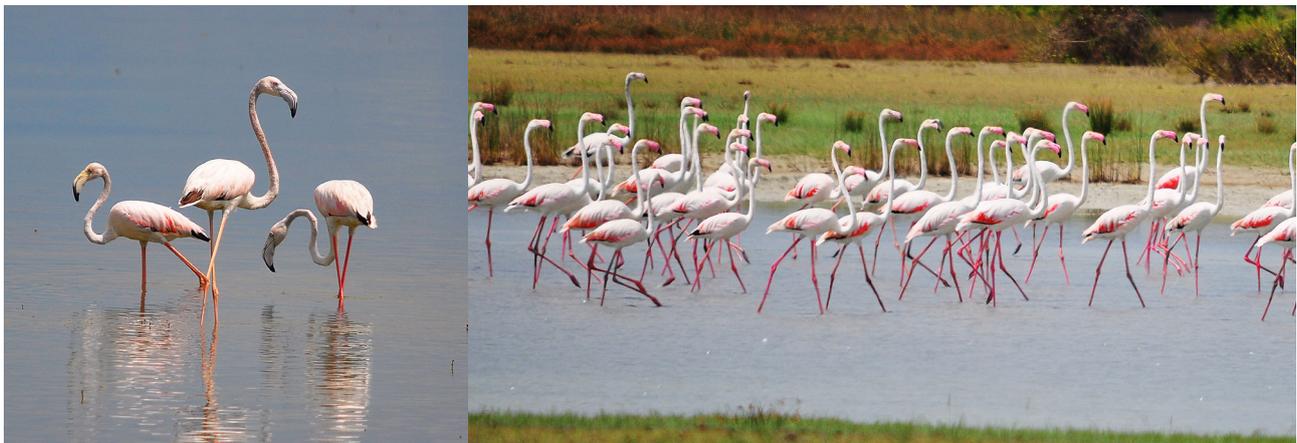


Figure 1: Flocks of Greater Flamingos in Mankumban (9° 38' N; 79° 56') and Vallai (9° 47'; 80° 08') in the Jaffna Peninsula; May 2017. Photo Credit: Chaminda S. Wijesundara.

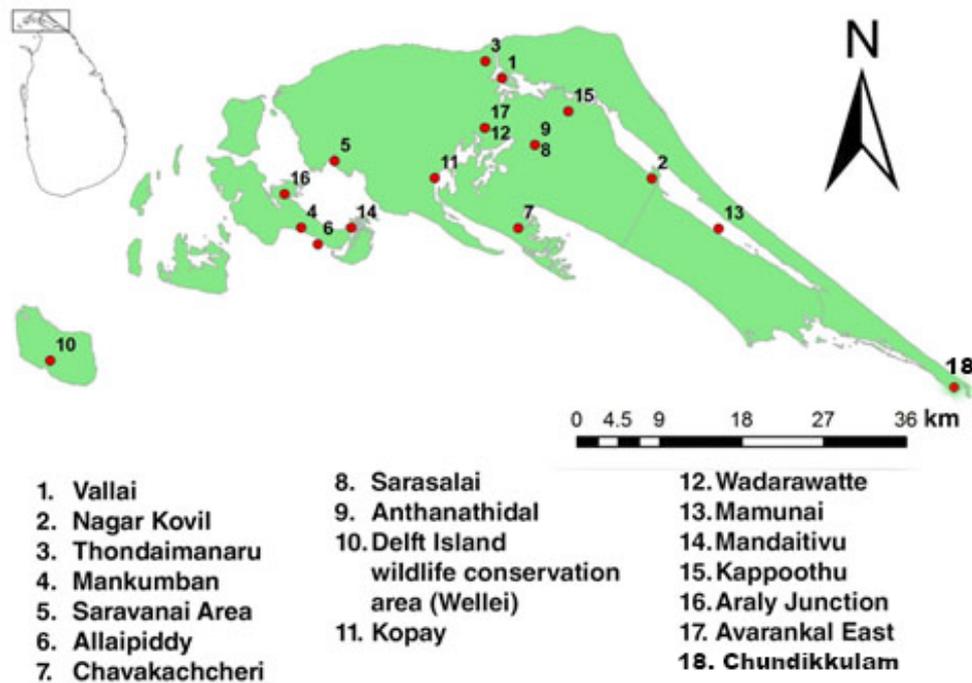


Figure 2: Map of Jaffna Peninsula showing the locations of major flocks of Greater Flamingo.

RESULTS

The total population size estimate for the Greater Flamingo in the Jaffna Peninsula (including Chundikkulam National Park) is 6245 ± 300 . The highest average count (1081) was recorded from Nagar Kovil area whereas Vallai area consistently had counts of over 700. Chundikkulam National Park had an average count of over 800, based on a lesser number of occasions than Vallai (Figure 3). Mean flock size was 367 ± 73 . Flamingos were recorded year-round during the study period. Sub-adults were observed mostly in June, July, and August, and during other months they were observed from time to time among the adults. The highest total numbers were observed in June, July, and August (outside the migratory season) (Figure 4). During the height of dry season (June to August), flamingos were observed to move away from the western parts of Jaffna Peninsula and concentrate on the eastern parts (Nagar Kovil and associated areas). During the first half of the year (approximately February - May), higher counts were recorded from Chundikkulam National Park, and lower numbers from elsewhere in the Jaffna Peninsula except Vallai. At the beginning of 2018, flamingos were not seen in many of the locations at which they frequented in the Jaffna Peninsula. Only a handful (12) was observed in Thondamanaru in January 2018. However, in January 2018, a flock of about 177 individuals was observed in Mannar, about 100 km south of Jaffna. Apart from this, a single individual (whose one leg was missing below the 'knee') was observed among a group of other waterbird species in Chundikkulam National Park in March 2018. Several subsequent searches covering the entire Jaffna peninsula failed to find individuals of this species in the locations at which this species was commonly observed during the last five years.

DISCUSSION

The Jaffna Peninsula, with a total area of $1,023 \text{ km}^2$, holds a significant population of the Greater Flamingos in Sri Lanka. Our observations in other areas of the Northern Province (e.g. Mannar) have revealed much lesser numbers of Greater Flamingos. According to Wijesundara *et al.* (2016, 2017b), Greater Flamingo is the second most abundant migrant bird species in the Jaffna Peninsula. It appears that for decades, about 10,000 flamingos have been gathering more or less regularly in the Chundikkulam Lagoon around May (Wijesundara *et al.*, 2017b). According to the present findings, the major flocking areas in the Jaffna Peninsula include Chundikkulam National Park, Nagar Kovil, Mamunai, Vallai, Thondamanaru, Avarankal East, Sarasalai, Anthanathidal, Kappoothu, Mandaitivu, Allaipiddy, Mankumban, Araly Junction, Saravanai, and Chavakachcheri. In particular, in and around Nagar Kovil has a large expanse of mangroves. The reason for the mass movements of flamingos from western to eastern parts of the Jaffna Peninsula during the dry season may be due to the changes in the water quality and higher abundance of food. A recent study showed a positive correlation between the abundance of Greater Flamingo with the abundance of zooplankton in the Jaffna Peninsula (Dilrukshi 2017). Hurlbert *et al.* (1986) also found that the Chilean Flamingos were usually absent in lakes with fish but present in large numbers where fish are absent. According to Hurlbert *et al.* (1986), lakes with high population of fish have low abundance of zooplanktons, thus suggested that the distribution of Chilean Flamingo is largely determined by the distribution of fish, its main competitor for invertebrate prey.

The lowering of water levels in lagoons can lead to hyper-salinity affecting food resources (Nasirwa, 2000;

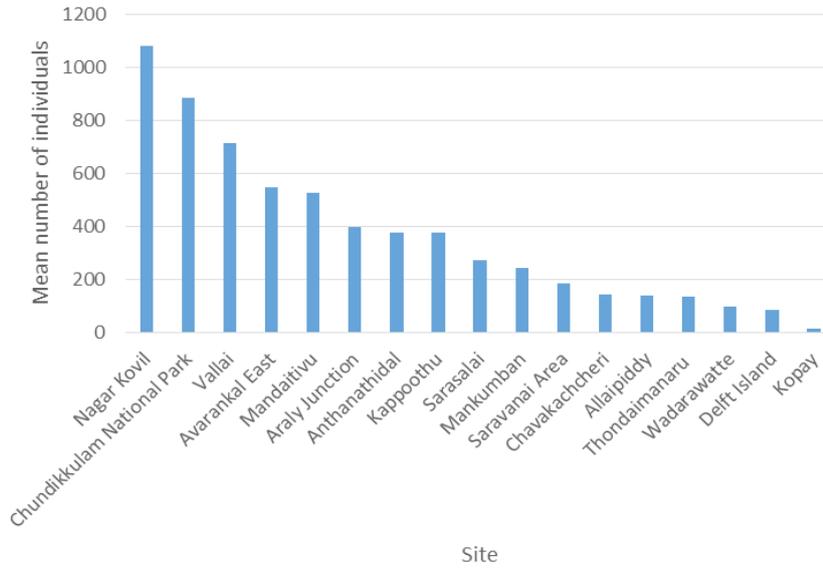


Figure 3: Mean number of Greater flamingo at each study site (2013-2018).

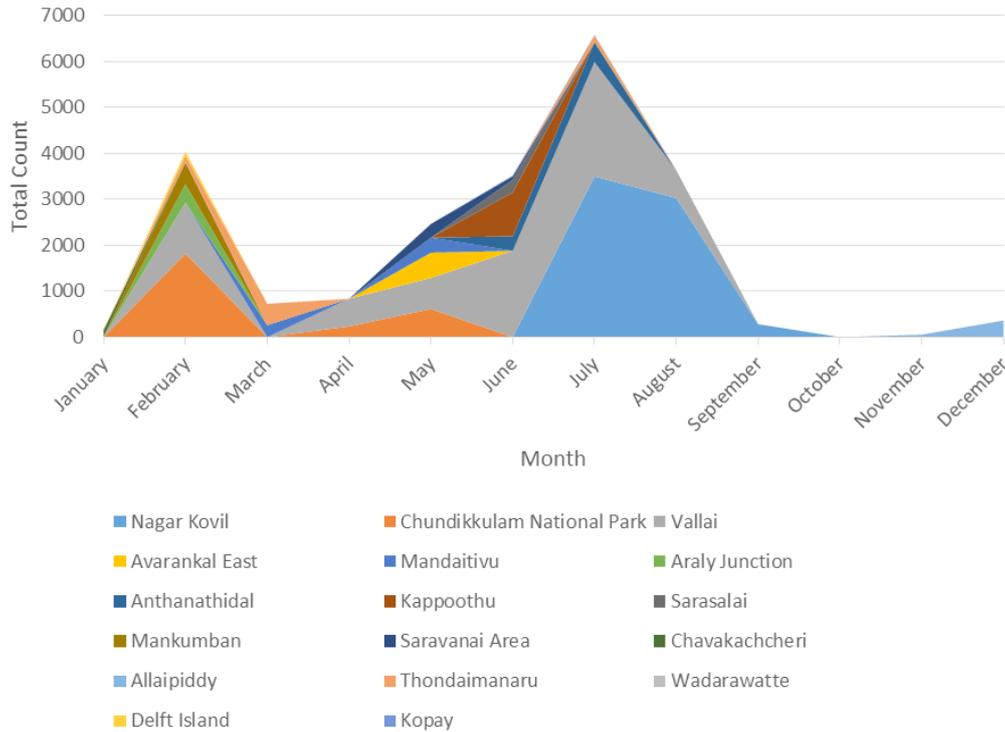


Figure 4: Monthly variation in the number of greater flamingo at each study site.

Abdulali 1983). In the present study, Vallai recorded consistently higher counts over 700 indicating higher abundance of food sources for flamingos. As wetlands dry out and/or as food becomes scarce, flamingos are forced to move to another area, either to permanent water bodies nearby or to places in longer distances. A study confirmed that some flamingos seen in Sri Lanka originate in Iran (Balkız *et al.* 2007).

In the present study, it was observed that flamingos move from the western parts of the Jaffna Peninsula to the eastern parts during the height of the dry season. In

areas such as Vallai, located in the eastern parts of the peninsula, flamingos were observed in large numbers from June to August, when the water levels are very low due to the prevailing dry conditions. The reason may be that flamingos may find it easier to forage in the lowered water levels with higher concentrations of food items. Therefore, when the water level rises dramatically during the rainy season (from November to January), flamingos tend to move away from these areas (on the eastern parts of the peninsula) and take refuge in Chundikkulam area (towards the south of the peninsula), where they can find suitable habitats with plenty of food. Balkız *et al.* (2007) found

that in Spain, most foraging sites used by the colonies of breeding adults of flamingos are within the range of 200 km from the colony site, though some individuals sometimes move 400 km. Balkız *et al.* (2007) further report that, after the breeding season, the adults remained for several weeks in specific wetlands, before moving to other areas located 280 – 2,100 km away to overwinter. For the population of greater flamingos in Sri Lanka, the nearest known breeding site is the Rann of Kutch at the India-Pakistan border. The linear distance from this area to the Jaffna Peninsula is roughly 1,900 km. Hamidan *et al.* (2011) found that some individuals of Greater flamingos even travelled distances more than 2000 km.

The year-round presence of flamingos in the Jaffna Peninsula indicates that they stay on in the island beyond the migratory season (Legge 1880; Henry 1971; Wijesundara *et al.* 2017b). Greater flamingos show a complex pattern of movements in the western Palearctic, where they are described as migratory, partially migratory, dispersive and sometimes even with erratic movements (Primack 2010). The presence of few individuals of flamingos at the beginning of 2018 indicates that they may have finally migrated back to their breeding grounds after an extended stay in the island for nearly five years.

CONCLUSIONS

The present study shows that the Jaffna peninsula is providing suitable habitat conditions for the migratory Greater Flamingos. The study also showed their seasonal movements within the Jaffna Peninsula, possibly to locate more suitable habitats for their foraging activities. Chundikkulam National Park and Nagar Kovil Nature Reserve have been identified as important areas in the region for the Greater Flamingos, thus highlighting their conservational value.

ACKNOWLEDGEMENTS

This research was funded by two research grants secured by the first author (CSW) from the University of Peradeniya, Sri Lanka (Grant Nos. RG/2014/41/S and URG/2016/57/S). We thank the Department of Wildlife Conservation, Sri Lanka for granting us permission to carry out this research in protected areas in the Northern Province (Permit No. WL/3/2/59/17). We also thank Ms. K. T. Dilrukshi for her help in preparing the map.

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