

Population size and feeding habitat preference of Asian Openbill Stork *Anastomus oscitans* in relation to availability of prey at Sembanarkoil region, Nagapattinam District, Tamilnadu, India

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Abstract: Population size and feeding habitat preference of Asian Openbill Stork *Anastomus oscitans* in relation to prey availability at Sembanarkoil region, Nagapattinam District, Tamilnadu, India were studied during period from January 2017 to December 2018. During this study period 124 in 2017 and 156 foraging sites in 2018 were observed respectively. The population size was ranging from 9 to 143 birds. Maximum birds were observed in Keelaiyur to Vallam site. Maximum numbers of birds in all four sites were recorded in month of June to September and decline the population in month of March to May. Maximum availability of prey was observed during pre-monsoon and monsoon season. Most commonly sighted in agriculture and marshes habitats (58% in 2017 and 66% in 2018) and least sighted were observed in river bank and ponds (22% in 2017 and 21% in 2018). Variation found in the population size was availability of prey in different season and between the habitats. Relationship between availability of prey and population size was positively correlated in both years during study period. Present study reveals that variation of population size directly associated with availability of prey. Feeding habitat preferences depend upon the availability of prey was also recorded. These studies reveal that availability of prey is controlled by population size and habitat preference of Asian Openbill Stork in this region.

Index Terms- Asian Openbill Stork, population size, spatial, seasonal, prey availability.

LINTRODUCTION

The feeding habitat selection of the organisms is the individual ability to obtain food against inter, intra-specific and predator. Availability of food is an important role playing by biotic and abiotic factors. It is varying across numerous scales of space and time. Therefore, choosing of feeding habitat in life time is an important (Bjørneraas et al. 2012). Population size is one of the important tools for indicating the habitat quality (Munguia et al., 2005, Güitrón-López et al. 2018). Rich habitats give a higher fitness to the organisms living there, where as 'poor' habitats give lower fitness (Johnson 2007). How rich and poor are defined is also of importance for survival offspring and adult (Meganathan and Urfi 2009). Many studies have been focused on availability of prey in relation to habitat selection of birds (Hollander et al. 2013). The quality of the habitat has many variables such as food availability, water depth, vegetation cover, predator occurrence, easiness of defense, distance to human settlements and many other abiotic factors (Raynor et al.2017).

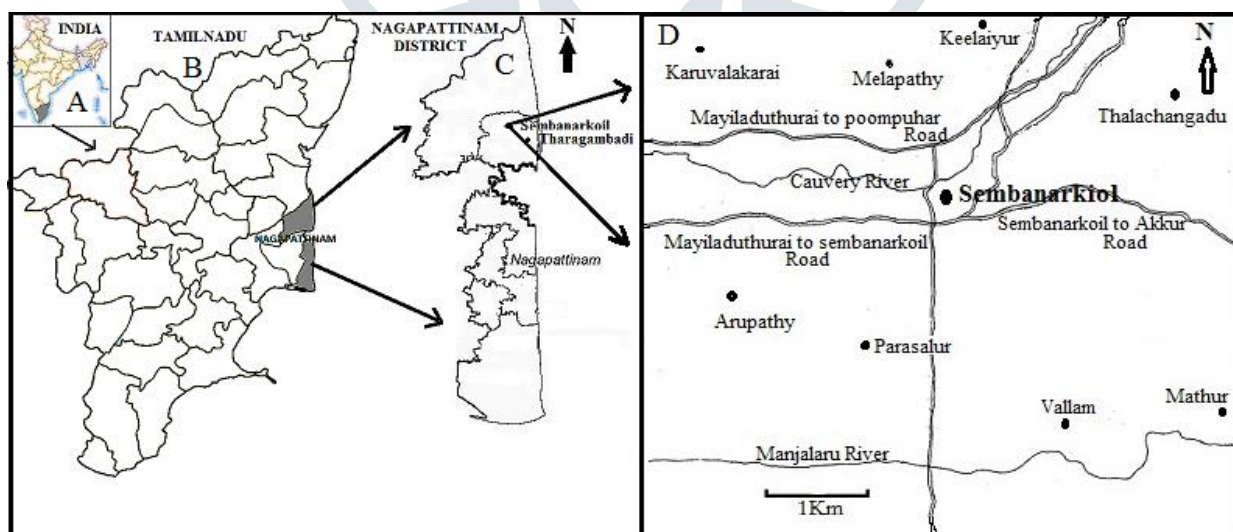
Nineteen species of storks are found globally (Hancock et al.1993). There are nine species of stork present in India (Ali and Ripley 1994). Asian Openbill Stork *Anastomus oscitans* is a large wading bird among the storks belong to the family of ciconiidae. It is found mainly in the Indian subcontinent and Southeast Asia (Hancock et al.1993). It is very commonest stork in India feeding on mollusks, crabs and small fishes (Anam et al.2016). In this paper the feeding habitat selection by Asian Open bill stork is discussed. Some studies have been focused with feeding habitat selection by this species in other region. But little is known about the Asian Openbill Stork feeding habitat selection in Nagapattinam District, TamilNadu, India. The main objective of this study was to determine the population size and describe feeding habitat selection pattern in relation to availability of prey of Asian Openbill Stork at foraging site and to suggest management and conservation action plan.

II. MATERIALS AND METHODS

1. Study Area:

Nagapattinam District is one among 32 Districts of Tamil Nadu, India. The District has an area of 2715.83 sq. km. It is bounded by Bay of Bengal on the east, the Palk Strait on the south, the Thiruvarur District on the west and Cuddalore District on the north. The present study was carried out in Sembanarkoil region (32sq. km) at Tharagambadi Taluk, Nagapattinam District (11° 06' N, latitude 79° 44' E longitude) in the Cauvery Delta of Tamil Nadu (Fig.1). Study was conducted more than 15 villages surrounded in Sembanarkoil. The area is dominated by wet agricultural lands with paddy (*Oryza sativa*) being the predominant crop cultivated. Other crops also cultivated include cotton, sugarcane, groundnut, banana, pulses and other cereals. Four seasons were distinguished at the study area based on rainfall viz., monsoon (October-December), post-monsoon (January-March), summer (April-June) and pre-monsoon (July-September). In general January is the coolest month and May is the warmest month in the study area (Meganathan and Jeevanandham 2017).

Figure-1 showing the map of India (A) followed by TamilNadu (B), Nagapattinam District (C) and Study Area (D) covered 32 sq km in Sembanarkoil region along with Cauvery and Manjalaru rivers.



2. Methods:

Present study was conducted from January 2017 to December 2018. Population size was estimated in first week of every month and avoids the overestimation of population we separated site with help of Google map. The study area was divided into four sites and each site was covering about 8 sq. km as follows i). Karuvalakarai to Arupathy, ii).Melapathy to Parasalur iii). Keelaiyur to Vallam and iv). Thalanchagadu to Mathur totally 32 sq. km were covered (Fig.1). Once in the day each site was counted number of individuals (population size). Site characteristics, date, time of day type of habitat, flock size, prey availability and other relevant parameters were recorded. Habitat type was categorized into five different habitats viz., river bank, stream, pond, agriculture and marshes followed by Pramanik et al. 2016. Observation was made throughout the day in foraging site by using binocular (7X50). The flock size was identified by pointing the binoculars towards the flock and by counting the number of individuals. At each foraging ground number of prey was estimated by sampling time ten 1 m² quadrat and each quadrat prey species including the number of mollusks, broken shell, live specimen and crab species were estimated.

3. Data Analysis:

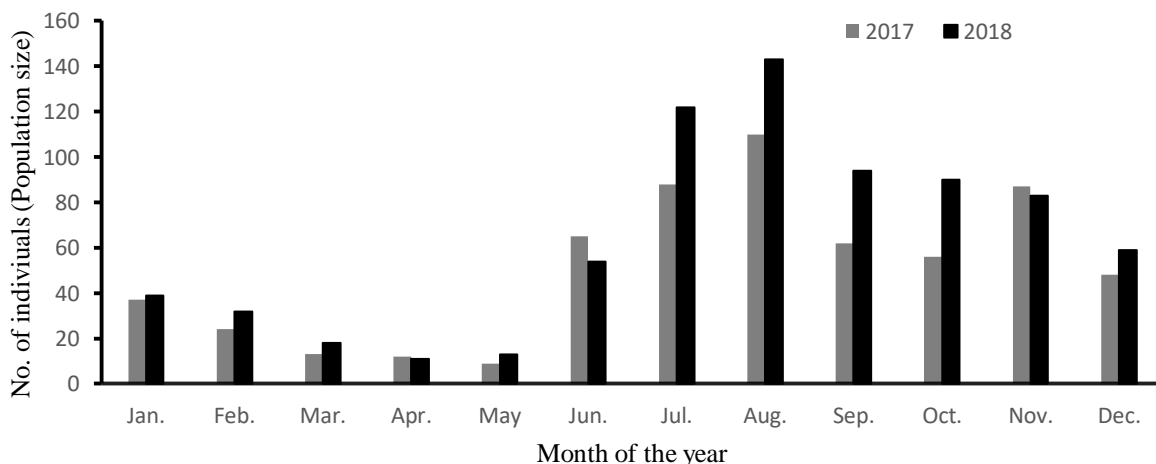
Descriptive statistics were computed for all relevant data. Percentage of feeding habitat preferred by Asian Openbill Stork was represented by bar diagram (2017 and 2018). Spatial and seasonal variation of prey availability pooled data for five different habitat viz., river bank, streams, ponds, agriculture, marshes and four seasons such as pre monsoon, monsoon, post monsoon and summer were also been recorded (2017 and 2018). Prey availability compared with seasonal and habitat variation was studied using a One-way ANOVA test. Student t-test was used for comparing means between habitats. Pearson correlation was calculated for analyzing the relationship between prey availability and population size in during study period.

III. RESULTS

1. Population size

During the study period 124 foraging sites in 2017 and 156 in 2018 of Asian Openbill Stork were observed. The population size ranged from 9 to 110 in 2017 and 11 to 143 birds in 2018 were recorded. Maximum birds were observed in Keelaiyur to Vallam site. A mean of population size was 50.9 ± 33.24 (n=12) in 2017 and 63.20 ± 43.5 (n=12) in 2018. The pooled data for the four sites data were completed and maximum population was observed in the month of June to October and minimum in the month of March to May were observed Fig.2.

Figure.2. Seasonal variation of Population size of Asian Openbill Stork during study period 2017-2018.



2. Feeding Habitat

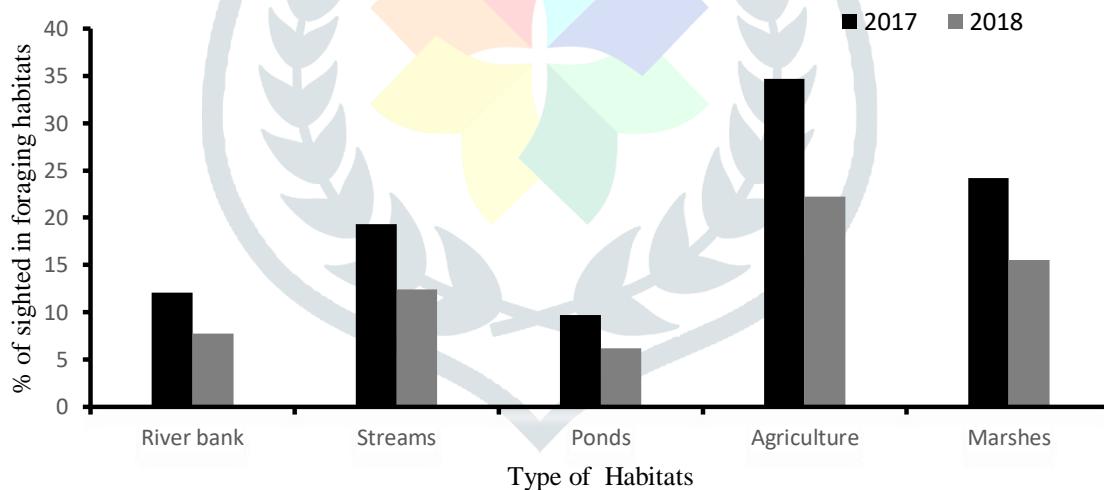
Most commonly sighted in agriculture and marshes habitats were 58% in 2017 and 66% in 2018 and least sighted were observed in river bank and ponds 22% in 2017 and 21% in 2018 (fig.3). The high value of availability of prey (10.58 ± 6.38 n=43 in 2017 and 9.64 ± 5.70 n=62 in 2018) recorded in agriculture habitat. The mean of availability of prey between river bank, stream and pond was 6.86 ± 4.4 (n=51) in 2017, 6.64 ± 4.4 (n=54) in 2018 and agriculture, marshes was 9.54 ± 5.8 (n=73) in 2017, 9.12 ± 5.4 (n=102) in 2018 found to be significantly different between habitat t-test =2.77, P=0.05 in 2017 and t-test= 2.86, P=0.05 in 2018 (Table -1).

Table-1. Prey availability of Asian Openbill Stork at foraging site in different habitats

during study period 2017-2018.

S.No	Habitat Type	2017	2018
		Mean \pm SD(N)	Mean \pm SD(N)
1.	River Bank	7.13 \pm 4.49(15)	7.0 \pm 4.17(18)
2.	Streams	7.67 \pm 4.94(24)	8.19 \pm 4.82(21)
3.	Ponds	4.91 \pm 3.02(12)	4.06 \pm 2.96(15)
4.	Agriculture	10.58 \pm 6.38(43)	9.64 \pm 5.70(62)
5.	Marshes	8.06 \pm 4.54(30)	8.3 \pm 4.92(40)

Figure -3. Showing the feeding habitat preferred by Asian Openbill Stork during study period 2017-2018.



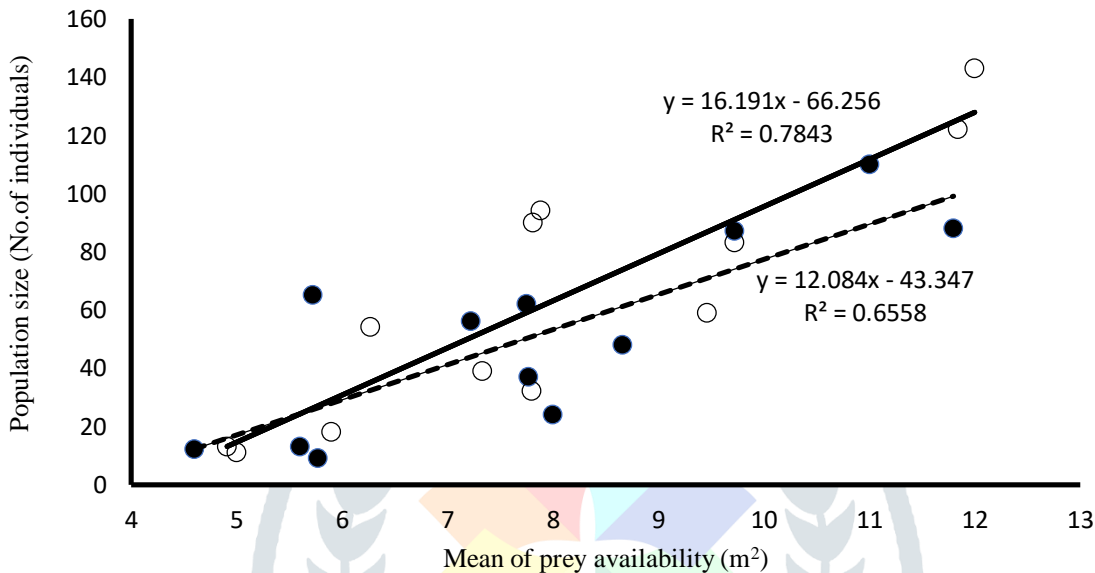
3. Prey availability

Variation of prey availability was found to be significantly different among the season (One-way ANOVA: F= 5.93, P = 0.001 in 2017 and F=10.25, P = 0.000). The high mean value of prey availability was recorded during pre-monsoon and monsoon season (Table-2). The mean prey availability values between year was not significant (8.44 ± 5.44 (n=124)) in 2017 and (8.26 ± 5.26 (n=156) in 2018 respectively (F=0.07, P=0.78). Similarly, spatial variation of the prey availability was statically significant between the habitats given in table 1. (One-way ANOVA: F= 3.57, P = 0.009 in 2017 and F=2.55, P= 0.005 in 2018). The relationship between the availability of prey and population size was positively correlated (Pearson correlation r=0.81, P=0.001 in 2017 and r=0.886, P=0.000 in 2018 (fig.4).

Table -2. prey availability of Asian Openbill Stork at foraging site in different season during study period 2017-2018.

S.No	Season	2017	2018
		Mean ± SD (N)	Mean ± SD (N)
1.	Pre monsoon	10.89±7.41(38)	11.09±7.31(44)
2.	Monsoon	8.81±3.88(32)	9.05±3.97(37)
3.	Post monsoon	7.36±4.40(25)	7.03±3.88(32)
4.	Summer	5.75±2.76(29)	5.62±2.37(43)

Figure-4. Showing the relationship between the prey availability and Population size of Asian Openbill Stork during study period 2017-2018.



IV. DISCUSSION

The population size of Asian Openbill Stork was fluctuating throughout the year of study period. Variation in population density was found to be low in the breeding season i.e. October to March as reported by Subramaniya (2005) and increased in month of June to September. No nesting site was reported in the study area during study period. The limitation of prey availability is the major preventing factor for nesting (Urfi et al. 2005). Ali and Ripley (1987) and Urfi (1998) also suggest that monsoon pattern linkage with availability of prey in storks. Evaluating foraging habitat selection, population size and foraging success of wading birds in a system with controlled prey availability is a powerful tool in understanding how seasonal changes as India.

Most commonly sighted in agriculture and marshes habitats and least sighted were observed in river bank and ponds. The high value of availability of prey recorded in agriculture and marshes habitat in Sembanarkoil region. Group size and habitat use by Black-necked Storks (*Ephippiorhynchus asiaticus*) in agriculture dominate landscape in Uttar Pradesh (Sundar 2004). Sundar (2006) reported that flock size and population density were strongly correlated in four species of stork including the Asian Openbill Stork at Uttarpradesh, India. Increasing wetland size and extent of wetlands in the landscape affected flock size of Asian Openbill Stork implying that prey availability may be the most important factor affecting population size in this species.

Seasonal and habitat variation of flock size of Asian Openbill Stork in relation to availability of prey was observed by Meganathan and Jeevanandham (2017). This variation was found in large wading birds in relation to water level of foraging sites (Gimenes and Anjos 2011). Many studies

of large wading bird foraging investigated the effects of water depth or vegetation on wading bird foraging site selection (Lantz et al.2011) and foraging success (Maheswaran and Rahmani 2002, Kalam and Urfi 2006). This study mainly focused on the importance of foraging sites for the stork family and variations of population size among the habitats between seasons. This study revealed that availability of prey is controlled by population size and feeding habitat preference. This information may be further useful for conservation, since the study animal is categorized as the Least Concern (Birdlife International 2001).

V. ACKNOWLEDGEMENT:

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