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Conservation of the threatened Sarus Crane *Grus antigone* (Linnaeus, 1758) around Alwara Lake in Kaushambi District, Uttar Pradesh, India

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Abstract: The present study deals with the distribution and conservation of the globally threatened Sarus Crane *Grus antigone* in Alwara Lake of district Kaushambi, Uttar Pradesh, India. It proved to be an important site since the lake under investigation was totally unexplored from the conservation point of view. Hence it was aimed at protecting the habitat of this threatened bird species by suggesting conservation measures through rural masses and policy makers. Birds were recorded in all the three transects of the lake surveyed by the authors, however, their relative abundance varied in each transect. A total of 487 cranes was actually observed, although more cranes were claimed to exist in this area by the local people. Cropland habitat harboured the maximum number of cranes. A positive correlation was observed between the crane numbers and the area of agricultural land. The authors recommend continuous population census of this species and declaration of the entire lake zone as a conservation area.

Keywords: Alwara Lake, conservation, distribution, Sarus Crane, wetland, threatened.

Sarus Crane *Grus antigone* is the state bird of Uttar Pradesh. Because of its declining numbers the species has been listed as globally threatened (Vulnerable) (BirdLife International 2012). It belongs to the order Gruiformes and family Gruidae. The highest population density of Sarus Crane is inseparably associated with wetland habitats. Several investigators have tried to study different aspects of Sarus Crane (Meine & Archibald 1996; Sundar 2000, 2006, 2011; et al. 2003, 2010, 2012; Borad et al. 2004; Mukherjee et al. 2002; Muralidharan 2004; Kaur & Choudhary 2008; Aryal et al. 2009; IUCN 2012; Clements et al. 2013). About 30% of the global population of this species is dependent on these wetlands. In addition an indulgent local population has insured the well being of the Sarus Crane. Excessive use of water for irrigation which converts agricultural lands to saline soil and indirectly builds pressure on wetlands for the fulfilment of community requirements, is a potential threat.

District Kaushambi of Uttar Pradesh comprises a vast range of flora and fauna and wetlands including Alwara Lake due to heavy rainfall and floodwaters from the rivers Yamuna and Ganga. Till now this lake was totally unexplored from the conservation point of view. If ecological importance is integrated with hydrological properties and community benefits of wetlands, it would be easier to convince the local population for the need for conservation of threatened species such as the Sarus Crane. Considering the above facts, we undertook these studies by suggesting measures to protect its habitat through continuous population census with the help of local masses, farmers and policy makers, i.e.,

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Government of India and Governtment of Uttar Pradesh.

Study area

The study area was divided into three major transects based on its vastness, diversity and habitat of Sarus Crane as indicated in the map of the area (Image 1). They are: (i) Paur Kashi Rampur, (ii) Tikara, (iii) Shahpur.

The lake is surrounded by agricultural fields and connected to the river Yamuna towards transect III and terminal part of Kishanpur lift canal towards transect I. Thus the habitat in the form of wetland is perennial, although during summer the water level falls. During the rainy season the water depth rises to about 20m and during summer (dry periods) the depth comes down to about 15m. The lake has derived its name from village Alwara. Locally it is called Alwara Taal. Alwara Lake is a naturally formed lake and covers about 40ha. The surrounding transects are Paur Kashi Rampur in the east, Tikara in the north Shahpur in the south and the river Yamuna in the west.

Materials and Methods

We used binoculars (7x35 and 8x40-BEZIF BM-9), camera, motorbike, chappu boat, field stick etc. for survey purposes. The findings are based upon the work conducted between September 2011 to December 2012. Surveys were conducted in the morning between 0600–0900 hr and evening 1400–1700 hr during our routine field trips. All the observations were made while moving in a chappu boat (Image 2) and walking along the croplands, marshlands, natural areas. Birds seen and heard were noted for the particular site. Identification of different species was aided by using standard guides such as Ali (1941), Wildlife Institute of India (1999) and Aryal et al. (2009). Juvenile, pairs and flocks were included during population census. Besides actual sightings, inquiries from local people were also made to ensure the estimate of existing population and their perceptions about the existence of the crane. Census was avoided during rainy days. The encounter rate of Sarus Crane population was calculated as the number of cranes counted over the area surveyed (in m^2).

Systat 12 (Wilkinson 1982) software was used for the statistical analysis of data. The data of cropping pattern and agricultural land were collected from district Kaushambi headquarters.

Location and access to Alwara Lake: By road the lake is 85km away from Allahabad District, 45km from Manjhanpur headquarter of district Kaushambi and 290km from Lucknow, capital of Uttar Pradesh. Its nearest railway station is Bharwari at a distance of 50km and nearest airport Bamrauli. Allahabad is at a distance of 75km. It is situated between $25^0$24'05.84" – $25^0$25'10.63"N & $81^0$11'39.49''–$81^0$12'57.95"E.

Climate: Winter - occurs between the months of late October to early March, mid December to mid January is the season of severe cold; spring - mid February to the end of April; summer - approaches in the month

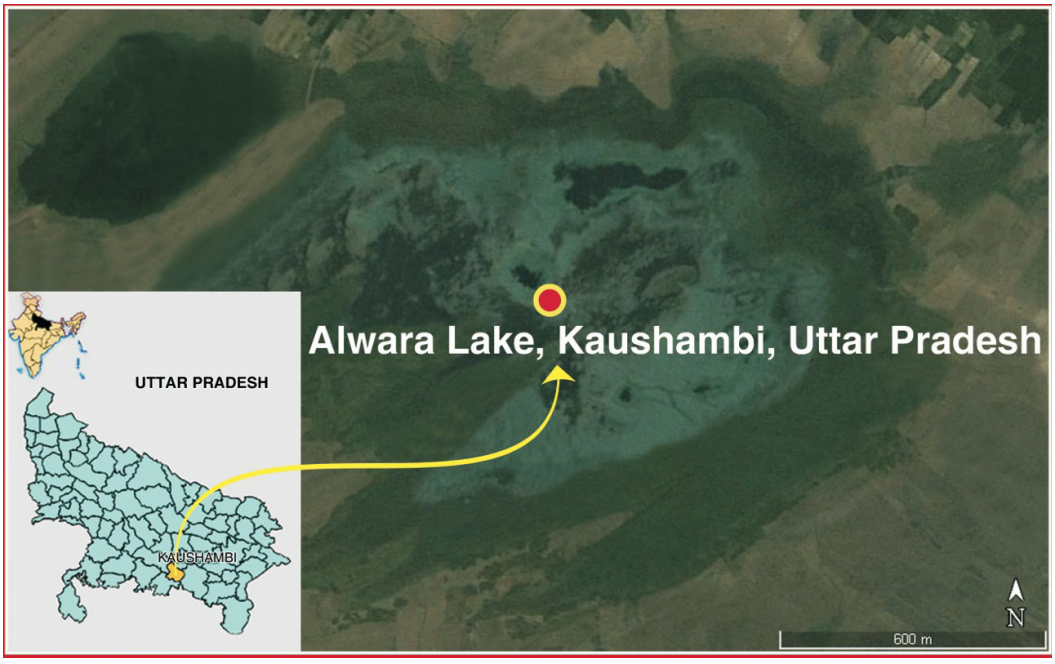

Image 1. The location of the study area.

of April and ends in late June, it is marked by high velocity of winds in the months of May and June; rainy - approximately 350mm rainfall observed annually from July to October; autumn - it commences in mid October and ends in late November. Maximum temperature is 48–50 ^{0}C during summer and minimum 1–3 ^{0}C during winter season.

Results

Sarus Crane was recorded in all the three transects of the lake as shown in Images 3–5. Population comparison was determined as a single, pair, pair with one juvenile, pair with two juveniles and flocks comprising adults and juveniles. Their relative abundance varied in each transect as shown in Fig. 1, Tables 1,2. Transect II harboured the maximum number of cranes (207), while it was minimum in Transect III (104). A total of 487 cranes were actually sighted, however more cranes were claimed to exist in this area by the local people. Crop land vegetation was abundant in Transect II (Image 4), while mainly marshland habitat was noticed in Transect I (Image 3) with anthropogenic activities. Transect III mainly included littoral zone of the lake with emergent vegetation which remain firmly rooted in shore substratum (Image 5).

Seasonal variations in the distribution pattern of the Sarus Crane were also recorded as shown in Tables 1, 2 and Fig. 1. A higher number of cranes was recorded during winter compared to summer. A positive correlation was observed between the crane numbers and the area of agricultural land, e.g., paddy field, sugarcane field, kharif field etc. During the survey upto 165 Sarus Cranes were observed along the roadside transect of the lake. By this time, the cranes had established their territories and were likely to breed.

Table 1. The overall month-wise distribution of Sarus Crane and their mean numbers in different transects of Alwara Lake in district Kaushambi.

Sno	Months	Transect I	Transect II	Transect III	Total	Mean+ range
	2011					
1	September	12	19	07	38	12.6 (07–19)
2	October	15	21	08	44	14.7 (08–21)
3	November	11	17	07	35	11.7 (07–17)
4	December	12	16	06	34	11.3 (06–15)
	2012					
5	January	12	15	09	36	12.0 (09–15)
6	February	08	14	11	33	11.0 (08–16)
7	March	07	15	07	29	09.6 (07–15)
8	April	06	10	06	22	07.3 (06–10)
9	May	04	03	02	09	03.0 (02–04)
10	June	05	04	03	12	04.0 (03–05)
11	July	13	09	05	27	09.0 (05–13)
12	August	08	10	06	24	08.0 (06–10)
13	September	13	13	08	34	11.3 (08–13)
14	October	13	16	09	38	12.7 (09–16)
15	November	11	12	12	35	11.7 (11–12)
16	December	15	13	08	36	12.0 (08–15)
	Total	165	207	114	487	

Discussion and Conclusions

Wetlands are more valuable economic resources when retained in their natural or semi-natural state since they support a wide variety of flora and fauna. Alwara Lake is an old marshy natural wetland situated in the tropical part of India. From the ecological point of view the site is very favourable for Sarus Crane *Grus antigone* distribution.

The highest population of Sarus Crane was reported in Transect II (207) during the survey probably due to availability of sufficient food, mainly small molluscs, crustaceans, worms and grains present in cropland vegetation, e.g., paddy fields and other kharif crops.

Table 2. Descriptive statistics on the variation of Sarus Crane population in the study area during September 2011 to December 2012.

	Transect I	Transect II	Transect III
Minimum	04.00	03.00	02.00
Maximum	15.00	21.00	12.00
Range	11.00	18.00	10.000
Sum	165.00	207.00	114.00
Median	11.50	13.50	07.00
Mean	10.31	12.94	07.13
Std. Error	0.87	01.22	0.65
Standard Dev	3.50	04.90	02.60
Skewness	-0.47	-0.60	-0.13
Kurtosis	-1.01	0.22	0.40
Coef. of Variance	0.34	0.38	0.36

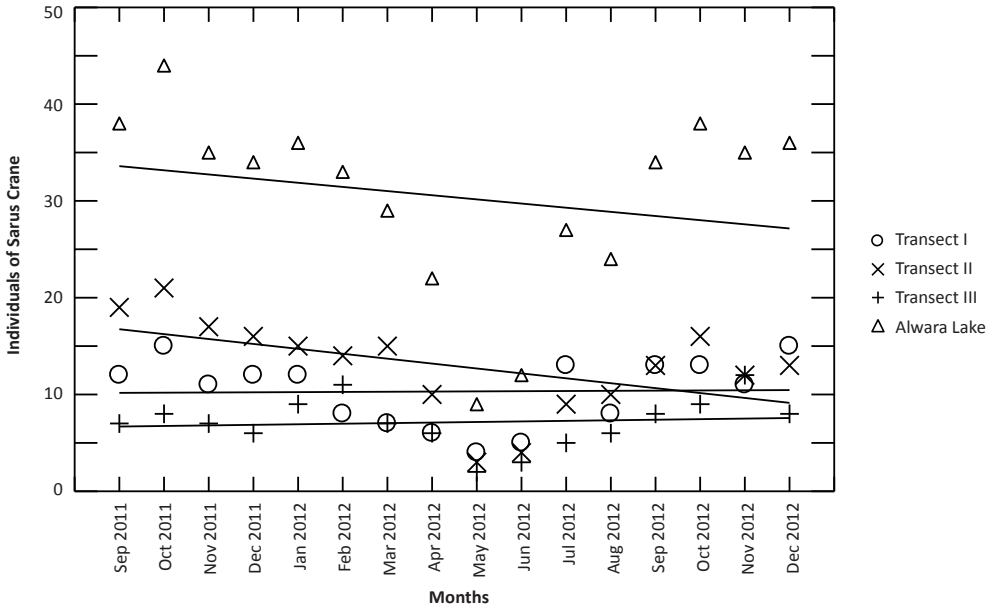

Figure 1. Scatter plot with linear line, showing the differential distribution of Sarus Crane in study area of Transect I, II, III.

Borad et al. (2004) and Sundar et al. (2010) also found paddy fields favourable for this species. Littoral zone (Transect III) of lake harboured fewer cranes due to the less favourable habitat. Although marshland (Transect I) is known as the optimum habitat for the cranes (Nandi 2006) the present investigation showed that Transect I had fewer individuals (116) as compared to Transect II. This may be due to anthropogenic activities. Moreover, during the dry season (high temperatures) the number of cranes decreased in the survey area compared to the wet season since the scarcity of food compels them to move and search for better feeding zones. While estimating the population of Sarus Cranes, Mukherji et al. (2002) observed that openness of habitat is a requirement for the existence of the crane. Further, during population census they realized that the presence of inundated paddy fields or land under irrigation were not the only factors determining the distribution of Sarus Crane, but the vegetation at the edge of the crop field and the type of crop grown also affected the availability of the cranes. In our observation also, the openness of habitat was a major factor for the existence of Sarus Crane.

The study of literature indicates that the future of the Indian Sarus Crane is closely tied to the quality of small wetlands in India that are exposed to heavy human use and suffer from high rates of sewage inflow, extensive agricultural runoff, high level of pesticide residues and intensification of agricultural system (Nandi 2006; Aryal et al. 2009; Sundar 2012). They have further reported that the magnitude of decline in Sarus Crane population

Image 2. Survey of lake by Chappu Boat

is such that it has been categorized as a threatened species. There are proposals to move this species from Schedule IV to Schedule I of the Wildlife (Protection) Act and take some special measures for its conservation (Nandi 2006). As such the authors have initiated a public awareness campaign through farmers to save this species from going extinct and recommend the declaration of the entire lake zone as a conservation area through policy makers (Lok Sabha and Rajya Sabha). There should be protection of wetlands to provide additional habitat for Sarus Cranes by controlling sedimentation of the wetlands. Sundar (2006, 2011), Clements et al. (2013) and Gulland (2013) have conducted, detailed studies on this threatened species and proposed direct reward for the protection of biodiversity as an effective

Images 3–5. Sarus Crane in Transect I, II, III.

tool for delivering conservation outcomes in a way that also delivers developmental benefits to the local people. Sundar (2011) based on his studies on the conservation potential of an agricultural landscape in two districts of Uttar Pradesh, where agricultural intensification and altered rainfall patterns are predicted, further emphasized that in countries like India, with a high human population, using agricultural areas as multifunctional systems to produce food for humans and retaining wildlife may be an efficient conservation strategy for many species. Similar strategies may be adopted in this area to effectively save the threatened Sarus Crane which is the pride of Uttar Pradesh.

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