COMPARATIVE ACCOUNT OF POPULATION AND BREEDING PAIR DENSITY OF THE INDIAN SARUS CRANE (*GRUS ANTIGONE ANTIGONE*) IN KHEDA DISTRICT, GUJARAT

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Abstract

Population estimation of the Indian Sarus Crane was carried out in Kheda District, Gujarat during 1998 and 2000. The data obtained was compared with the findings of 1989. An attempt was also made to correlate various factors affecting the distribution of the population. Using the equation of depreciation the rate of decline (10.22% per year) in the number of Sarus Crane was found in the last ten years. Overall decline was 62%. Main emphasis was given during the breeding period (both pre and post) to identify the fresh recruitment rate in the population in terms of adult - juvenile ratio.

Keywords

Sarus Crane, Grus antigone antigone*, population, breeding period, decline, fresh recruitment, juvenile*

Introduction

The Sarus Crane *Grus antigone* (Linn.) is one amongst the fifteen species of cranes existing in the world. It belongs to the order Gruiformes and family Gruidae. There are two subspecies of Sarus Crane, The Eastern Sarus Crane *Grus antigone sharpii* which was distributed in the eastern states of India, Myanmar and Cambodia where it has become extinct. However a small population was recently discovered in Vietnam. The other subspecies, the Indian Sarus Crane *Grus antigone antigone* (Linn.), is chiefly distributed in a few northern states of India, including the plains of Jammu. Its density is relatively more in Gujarat, eastern Rajasthan and Gangetic plains than elsewhere, but decreases towards south to a diagonal line from Surat (Ali & Ripley, 1983). Even in Gujarat, the Indian Sarus Crane is sparsely distributed all over with major concentration in Kheda and Ahmedabad districts (Vaishnav, 1985; Parasharya *et al.*, 1989). Vaishnav (1985) estimated 19,659 Sarus in entire Gujarat with the highest number (2741) in Kheda district. However, Gole (1989) estimated only 13,000 Sarus Cranes in the entire country. Recently, breeding of Sarus Crane on the plains of Jammu (Purshottam Singh, pers. comm.) and Himachal Pradesh (M.L. Narang, pers. comm.) was also reported.

The Sarus is considered to be the hardiest species of all the cranes and it thrives well in harmony with man and in agricultural landscape that has been transformed by human activities (Sawhney & Mulla, 1988). Though, once wide spread, its population is now chiefly concentrated in Uttar Pradesh, Rajasthan, Gujarat and Madhya Pradesh (Gole, 1989). Due to the rapid decline in population, several other threats (Gole, 1989, 1991; Parasharya *et al.*, 1989, 1996; Ramachandran & Vijayan, 1994; Mukherjee, 2001) and restricted distribution with small population size, the species is considered globally threatened (Meine &Archibald, 1996).

Earlier, two large scale attempts were made to estimate the Sarus Crane population in Gujarat State (Vaishnav, 1985), and in the whole country (Gole, 1989). In both the attempts, population size was estimated on the basis of a few actual counts, local inquiry, and presence of wetland and cropped area available. Since no research team had conducted any intensive ground survey of a single district, actual head count was not available. The difference in the relative abundance of the Sarus Crane in different tahsils of Kheda District was established and the percentage of land under paddy crop was considered to be a determining factor (Parasharya *et al.*, 1989). The distribution of

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the Sarus Crane along the roadside of the study area was determined during May, August and December 1998-2000 and was compared with the previous data of 1989 (Parasharya *et al.*, 1989). The study was aimed to collect information about
1. distribution of potential breeding pairs along the route, their density, important breeding area and ultimately the resultant success in breeding during December, and
2. Population composition.

The present study was therefore warranted to determine the present population size and its decline over the last few years in a district which is known to hold the largest crane population in the agricultural landscape of Gujarat State.

Material and Methods

Crane count was made from 3-29 August 1998 in different tahsils of Kheda District. Census route was decided on the basis of tahsil road map ensuring maximum coverage (approx. 75%) of each tahsil travelling a minimum distance of 250km. Census was avoided on rainy days. Similar counts were made during May, August and December of 1998 and 2000.

The cranes sighted while driving the vehicle at a slow speed (15 km/hr) were recorded and their numbers confirmed using 10 x 50 binoculars. Periodically, the vehicle was stopped to scan the area for the presence of cranes.

Besides actual sightings, inquiry from local people was also made to ensure the estimate of the existing population size and their perception about the existence of the crane.

Since the vegetation structure varied in each tahsil, the visibility ranged from 50m-800m on either side of the road. The distance at which the cranes were sighted varied in different tahsils depending on the vegetation profile and the crop pattern of the area. Based on this, a visibility index (range 1-5) was developed. Depending on the openness of the area in different tahsils the visibility index (V.I.) given are as follows: distance of vertical visibility from ground surface in meter: 0-50 = 1; 50-200 = 2; 200-500 = 3; 500-700 4; > 700 = 5. The data of the cropping pattern and land under irrigation was collected from the District Statistical Officer, Kheda District.

Road transect on a fixed route encompassing the study area was traversed in a vehicle at a speed of 15-20km per hour to determine the breeding pairs along the road side at a visibility range of 400m on either sides of the road. Cranes sighted within the range of 400m using a pair of binocular were recorded. The population composition was determined as 'single, pair, pair with one juvenile, pair with two juveniles and flock comprised of adults and juveniles.

The rate of decline in Sarus number every year was calculated based on the following equation of depreciation:

$$A = \frac{P\,(1 - r)^{n}}{100}$$

Where, A is rate of decline; P is the principal value; r is rate per annum; n is the number of years

Results

Population estimation

The cranes were recorded in all the 10 tahsils of Kheda District, however their relative abundance varied significantly in each tahsil both during 1989 and 1998. Census across Kheda District (Table 1) showed that maximum number of cranes was sighted in Matar (554 in 1989; 166 in 1998) followed by Thasra (136 in 1998) and Khambhat (251 in 1989). On the contrary a few cranes were sighted in Borsad (02), Mahemadabad (14) and Balasinore (16) tahsils during 1998 survey. A total of 573 cranes were actually sighted, however 627 cranes were claimed to exist in this area in 1998 by the local people. The survey done by the village level worker (VLW) represented a total of 1508 cranes to have existed in Kheda during 1989. Looking at the two figures (1508 and 573) it shows a rate of decline of 38% in 10 years.

No trend could be established between the actual number of cranes sighted and the number claimed by the local people. However, claimed number was slightly inflated than the actual sightings (Table 2). Further, a positive correlation (r = 0.82) was

Table 1. Comparative account of cranes recorded during 1989 and 1998.

Tahsil	No. of cranes recorded during	
	1989	1998
Anand	22	27
Balasinor	88	16
Borsad	66	2
Kapadvanj	64	44
Khambhat	251	53
Mahemdabad	159	14
Matar	554	166
Nadiyad	101	84
Petlad	52	31
Thasra	151	136
Total	1508	573

Note: The cranes number reported during 1989 was from the village level workers.

Table 2. The Sarus Crane population estimation in Kheda District and factors affecting its distribution.

Tahsil	No. of cranes Actually seen	Claimed by locals	% Land under paddy	% Land under irrigation	V.I.
Anand	27	51	2.81	42.71	2
Balasinor	16	6	11.98	0.03	4
Borsad	2	2	32.91	20.23	1
Kapadvanj	44	42	7.63	0	3
Khambhat	53	49	31.65	48.79	5
Mahemdabad	14	44	0.01	2.33	2
Mater	166	246	42.73	36.84	4
Nadiyad	84	47	32.58	12.82	3
Petlad	31	25	38.41	33.1	3
Thasra	136	97	22.04	18.85	3
Total	573	627			

V.I. - visibility index

Table 4. Population composition and status of Sarus Cranes during three different period of the year 1989, 1998 and 2000.

	Crane seen in Single	Pair	Pair + 1J	Pair + 2J	Flock Adult	Juvenile	Total
1989							
September	12	47	17	1	113	0	274
December	13	44	1	6	132	28	282
1998							
August	4	36	2	0	82	4	168
December	1	11	10	4	87	7	163
May	2	8	4	2	230	19	287
2000							
August	7	53	5	1	132	3	267
December	4	21	19	3	154	9	278
May	3	17	16	3	312	12	414

J - Juvenile

established between the crane number and the percent land under irrigated paddy in 1989; which was also slow but weak during 1998 (r = 0.50). However, a poor correlation (r = 0.26) was established between the crane number and the percent land under canal irrigation during 1998. In addition to this, even some of the tahsils did not show positive correlation, which compelled us to test the visibility index as an additional factor which was taken into account during 1998.

Table 3. Density of breeding pairs during breeding and post breeding season.

Month	Distance traveled (km)	Area scanned	Density (Breeding pair / sq. km)
1989			
September	233	372	0.13
December	233	372	0.06
1998			
August	177	141.6	0.25
December	126	100.8	0.11
2000			
August	182	146.5	0.36
December	154	110.3	0.19

When visibility index was considered as a factor in the distribution of cranes in each tahsil (Table 2), it showed a positive correlation (r = 0.46). The result possibly suggests that openness of the habitat is a requirement for the existence of crane. While conducting the census we realized that the presence of inundated paddy field or the land under irrigation were not the only factors determining the distribution of Sarus Crane. The vegetation on the edges of the crop field and the type of crop grown had certainly affected our ability to detect the cranes.

Hence such areas were scanned carefully to detect the presence of cranes and we realized that the cranes did not prefer such habitats.

Breeding pair density: All the cranes sighted during the breeding period (August-December) were observed along with their breeding status. In the year 1989, 47 pairs were observed during September with a density of 0.13 pair per km^2 (Table 3). However, during December the resultant density of these breeding pairs was reduced to 0.06 pair per km^2. As of the 44 pairs, only 22 of them were under the breeding status either with eggs or with juveniles.

During the roadside transect in August 1998, 38 pairs were observed with a density of 0.25 pair per km^2. By this time the cranes were just establishing their territories and were likely to breed. In our recent study we also tried to show the approximate location of the important breeding areas, which was Limbasi

cross to Valotri where 10 pairs were observed. During December the density of successful breeders was 0.11 per km^2 (Table 3). Compared to 36 pairs seen during August, the resultant successful breeders were only 14 (38.88%). Atleast 11 pairs were found without any juveniles during December (Table 4).

During August 2000, we found a rise in the density of breeding pairs (0.36 pair per km^2), while the density of successful breeders was 0.19 pair per km^2. However, the number of juveniles was highest in the flock (28) during 1989, which had reduced to seven and nine during 1998 and 2000 respectively.

Population composition: In 1989, the total number of cranes recorded during September and December were not very different. However, 17 pairs with one juvenile were recorded during September while only one pair with a juvenile was seen during December. Finally, we recorded 28 juveniles as fresh recruitment to the existing population.

In 1998, maximum numbers of the cranes were seen during May and most of them were in flock (86.76 %). Eight pairs without juveniles moved alone, four pairs had one juvenile each and two pairs with two juveniles remained away from the flock (Table 4). As evident from Table 4, a few pairs with juveniles had joined the flock. During August, 36 pairs were recorded moving in isolation to establish their territory. Only two of them had established nest. Two pairs with one juvenile indicated that they had bred in the preceeding summer. Four cranes observed singly could be the counterpart of a breeding pair. As many as 86 cranes (including 4 juveniles) moved in flock. The flock might be of immature birds, that had not yet paired. Presence of four juveniles in the flock indicated that the summer breeders had also joined the flock. During December, a total of 25 pairs were seen, of which 44% were not accompanied by juveniles. Out of the 14 pairs observed with juveniles, ten pairs, had only one juvenile each and remaining four had two juveniles. Most of the pairs thus could raise only one juvenile. Compared to August the flock size had slightly increased and it seemed that few successful breeders had joined the flock.

In August 2000, 53 pairs were observed and five pairs with one juvenile were seen in the total population of 267 cranes. During December census there were 19 pairs with one juvenile and three pairs with two juveniles. To determine the final population composition, the count was taken in May, the hottest month during which cranes tend to congregate thus making the count perfect. We found 414 cranes and 12 juveniles.

Juveniles in the population: During September 1989, 6.93% of the cranes were juveniles and the adult: juvenile ratio was 1 : 0.07 while in December the ratio was 1 : 0.17. During August 1998, 3.57% of the cranes were juveniles and the adult: juvenile ratio was 1 : 0.03. During December 1997, the juvenile percentage was 15.34 with the ratio was 1 : 0.18 (Table 5). During May 1998, 9.4% of the cranes were in juvenile plumage. In the year 2000, 3.74% of the population were juveniles with a ratio of 1 : 0.04 while the final recruitment was 1 : 0.14. Thus the data indicated that for confirmation of population composition and breeding performance, December is the most appropriate period.

Table 5. Estimation of juveniles in the population during 1989, 1998 and 2000.

Month	Adult	Juvenile	Total
1989			
September	255	19	274
December	241	41	282
1998			
August	162	6	168
December	138	25	163
May	260	27	287
2000			
August	257	10	267
December	244	34	278
May	380	34	414

Discussion

Sarus Crane distribution in all the tahsils of Kheda District is not uniform but selective. The census efforts showed that minimum population size in Kheda District was 1508 during 1989 and was 573 birds during 1998. Though eight tahsils were intensively surveyed, efforts made were relatively less in Mahemdabad and Khambhat tahsils. If we had made equal efforts in these two tahsils, actual sightings would have been certainly higher.

The census was carried out in the month of August, which is also the beginning of the crane breeding season (Ali & Ripley, 1983; Gole, 1989; Parasharya *et al.*, 1989, 1996; Borad *et al.*, 2001). Cranes disperse over agricultural landscape, particularly the paddy fields, during breeding rituals. Due to the dispersal and crop growth, lesser number of cranes could be detected from a moving vehicle. Moreover, even in the open habitat, crane detection was not possible beyond 800m vertical distances from the observer. Hence in the tahsils like Matar, Thasra and Khambhat, several cranes could have been missed. Therefore it could be presumed that the existence of the actual number of cranes in Kheda District would be much higher than the number reported here or the numbers must have declined. Parasharya *et al.* (1989) had estimated 1508 Sarus Cranes in Kheda District. They had not counted the cranes themselves but had collected

information through village level workers (VLW) of the state agricultural department. The crane numbers claimed by the local people during the current census is comparable with the numbers claimed by the VLW in 1989. However, the number estimated by VLW is generally inflated, so one should go for actual sightings and census. The state forest department had estimated 2741 Sarus Cranes in Kheda District during 1984 (Vaishnav, 1985). Compared to 1984 data, current estimate is 79% less. An alarming decline in the distribution (revealed from the V.I.) was the major limiting factor for the crane distribution. A combination of high V.I. with greater percent land under irrigated paddy showed greater number of crane sightings. Both the parameters indicated that Sarus Cranes prefer comparatively open habitat.

In the open habitat it is also convenient for the crane to take off or to land. The increased height of vegetation on the edges of the field hampers their movement. Moreover, scanning for predators within dense vegetation becomes difficult thus openness of habitat being preferred over dense vegetation.

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