SOC - RE
BIR- 008

THE STATUS AND ECOLOGICAL REQUIREMENTS OF SARUS CRANE

PHASE I

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MINISTRY OF ENVIRONMENT & FORESTS, GOVERNMENT OF INDIA.

The Perspective

Sarus is the tallest flying bird. Two subspecies of Sarus are found in India. They are: Grus antigone antigone, called Indian Sarus and Grus antigone sharpii, called Eastern or Burmese Sarus. The former is confined to India while the latter ranges from eastern India to Australia. One is tempted to speculate how such a large bird came to be evolved in this landmass. It is a bird of marshes and wet areas, as it breeds in swamps and finds its food there and in agricultural fields. It probably evolved when much of the sub-continent was covered with marshes. We do not know the exact age of this era. It may have happened during the Pleistocene, 500,000 years ago. When the Himalaya began to rise, the sea that covered the gap between the two ancient continents began to recede, leaving behind large marshes. It is probable that the present marshland fauna evolved during those times.

But we do not have fossil evidence to support the above statements. Fossilized eggshells of the Ostrich are the only avian fossil remains commonly found in India. No crane fossil has as yet been identified in India. The emergence of Sarus thus remains confined to the speculative realm. One may conclude that as both cranes and ostriches prefer wide open areas, they might have existed side by side.

That such a large bird fascinated man seems not unnatural. We have references to Sarus in the epics of India. But the

relationship is anything but one way. As we shall see later, Sarus depends to a large extent on man's agricultural practices. It would have been most interesting to know when and how Sarus came to be associated with the agricultural scene in India. But without any substantive data, we again will have to step into the realm of speculation. The preference for wide open areas together with easier availability of food must have drawn the crane into the vicinity of the agriculturist's homestead.

We enter the realm of the facts about Sarus as late as the 16th century. The Mughal emperor Jehangir, who must have kept cranes in his animal collection, made some interesting observations about the breeding of Sarus[1]. Apparently northern India, the home of Sarus, still retained extensive marshes in the 16th century, when the Mughal emperors used to hunt rhinos near Peshawar, now a very dry region in Pakistan. Later in the 18th and 19th centuries when Britons came to India and started collecting birds and facts about birds, Sarus crane ranged from the land of five rivers and Sind, to Assam and Burma and south from Bombay to the Godavari floodplains[2]. According to Whistler, in the 1940s, Sarus was common throughout U.P. and upper Bengal and in smaller numbers in the Punjab south of Chenab, in east Rajasthan and parts of Central Provinces[3]. It may be noticed that Whistler did not mention it occurring in Sind and northern Punjab. Even in Central Provinces (now Madhya Pradesh), Sarus seemed to be restricted to certain areas only. In their Handbook the late Dr. Salim Ali and S. Dillon Ripley appear to repeat the distribution given by the earlier authors

when they said that Sarus was distributed throughout the northern parts of the sub-continent, from Sind and Punjab eastwards through U.P. Bihar and northern Bengal, south through east Rajasthan, Gujerath and northern M.P., in smaller numbers from Surat in the West to the Godavari delta in the east [4].

No effort appears to have been made to be more specific about the numbers of Sarus to be found distributed all over this area, and no statements were forthcoming about the exact areas where it was more numerous and the exact limits of its distribution. The urgency for precise information was felt more recently when keen observers began to suspect the disappearance of Sarus from many of its former haunts. The present study was commissioned to fill these gaps in our knowledge about Sarus and to provide as exactly as possible, its distributional range and an estimate of its numbers based on field counts.

A Closer Look

When the study was commissioned the first thing I did was to search for the literature already published. But I found precious little of it. Besides the references already quoted, and information appearing in bird field guides, a few notes on the occurrence of Sarus published in the Journal of Bombay Natural History Society in the early years of this century, was all the material I could find. In more recent times (late 70s and early 80s) the only research works on Sarus appeared to be a dissertation for the degree of Master of Philosophy (M. Phil) by a researcher from Gujerath and my own study of Sarus in Keoladeo Ghana National Park [5]. The Bombay Natural History Society

research group stationed at K. G. National Park now studies and monitors Sarus in the Park and their findings appear in their reports[6]. A Sarus count in the Park and its vicinity was also organized in 1983[7]. To my knowledge, Sarus from other regions have not been studied in depth. When I considered the kind of information available on Sarus, the goals of the present study became self-evident.

The Goals

1. The first goal was to ascertain the exact limits of distribution of Sarus.

It would not do to say that Sarus was to be found from Gujerath in the west to Assam in the east, and from Himachal Pradesh in the north to Maharashtra in the south. We need to know the areas where it is numerous, the areas where it is less numerous and the fringe areas beyond which it does not occur. We also need to know from which areas it has disappeared and why. Lastly we need to know why it is now found in certain areas of its former range and why it is not found in certain areas where formerly it did occur.

2. The next goal was to find out the crane's requirement of habitat. What habitat-types does it use? What components of those habitats are essential for its survival, and what factors affect it adversely? This would help us to find out how to ensure the well-being of Sarus; how to ensure its survival amidst increasing human population and expanding human activity.

3. We also need an estimate of the total Sarus numbers in the country. No such estimate had been attempted in the past. When I consulted some knowledgeable bird-watchers, they invariably remarked, "Oh! Sarus is everywhere." Yet they also felt that it was less common than before. During the Waterfowl Counts in winter not more than 300-400 Sarus were counted.* An estimate based on field counts in different areas was an urgent necessity to determine the status of this crane.

4. To ensure the crane's survival, it is also necessary to find out what people feel about Sarus. It is often pointed out that Sarus is protected by popular sentiment as it is considered a sacred bird. Is this sentiment strong yet? Where is it strong and where is it eroded? It would be useful to be more definite.

5. The last goal was to record information about migratory cranes that spend the winter in India. The extensive coverage of area under the present study offered an excellent opportunity to do this.

Methodology

To find out answers to the questions posed above, it became imperative for investigators to cover an extensive area. To collect information over such a wide area, observations along linear transects was thought to be the best method. Accordingly a questionnaire was designed to help investigators record details while doing a line transect. The pro-forma of the questionnaire is given as Appendix 1. The investigators recorded the numbers of pairs and families and flocks of Sarus and details of the

habitats in which they were seen. They also recorded the adult/juvenile ratio in Sarus flocks. If nests were found they recorded the numbers of nests and eggs per nest as well as ecological details such as the major plant communities of the nesting area. People's attitudes towards Sarus were also recorded. In addition, observers reported on the numbers of migratory cranes seen by them.

The accompanying map shows the area in which line transects were taken and the main centers from which investigators fanned out to observe and count Sarus cranes. As Sarus is known to be a bird of wetlands and wide open areas, transects were taken in plains and in regions where wetlands abounded. Uplands, ravinous areas and arid zones were excluded from the transects. Particular attention was paid to the fringe areas to ascertain the exact limits of the occurrence of Sarus.

It is however, not easy to count Sarus in a particular area as they are mostly found in widely scattered pairs. Actual hearing, sighting and count of each pair would have involved visits to every farm and wetland which is hardly practicable. The method here adopted was to travel on roads and rough tracks in agricultural areas avoiding highways and trunk routes. Local people were consulted about locations of wetlands and these were scanned carefully through telescopes. In fringe areas it is hardly possible to meet Sarus along roads and tracks. In such areas we consulted local people and slogged through many a field to locate a pair. Where communal roosts were reported we made it

a point to visit them to count Sarus.

From the total number of Sarus seen along transects the estimate of the Sarus numbers for a particular area was derived as under:

Area covered in sq. kms = number of kms covered in linear transects x range of visibility in kilometers on both sides of the transect.

No. of Sarus per sq. km. = No. of Sarus counted along the transect/Area covered in sq. kms.

While doing a transect the nature of habitat in which each pair etc. of Sarus was encountered. was also noted. The percentage of Sarus seen in different habitats was then calculated. The estimate of the numbers of Sarus for a particular area was derived by making use of the density figure (Sarus per sq. km.) and the habitat preference percentage. The extrapolation is done in the following manner:

As fields of foodgrains and wetlands are the two most favoured Sarus habitats, the total areas under foodgrains and under wetlands in each state where Sarus occurred were found out from government sources such as the Census Handbook and the Wetland Directory. From these areas under foodgrains and wetlands were computed for each district in states where Sarus occurred. The total Sarus nos occurring in area under foodgrains in a district =Area under foodgrains x Sarus density found in the district transect.

Likewise the total Sarus numbers occurring in wetland areas in the district = area under wetlands in the district x Sarus

density found in the district transect.

The estimated Sarus nos occurring in foodgrains area in a district = total Sarus no.s occurring in foodgrains area x percentage seen in foodgrains area in the state/100.
The estimated no. of Sarus occurring in wetlands in a district = total Sarus no.s occurring in wetlands area x percentage seen in wetlands in that state/100.

The estimates for all districts when totaled give the estimate for the state.

Obviously transects were not taken in all districts in each state. The Sarus density for a district in which there was no transect, was taken as an average of the densities obtaining in nearby areas. It was assumed that numbers of Sarus grew less and less as the distance from the transect area grew. One half, one fourth and even one eighth of the transect densities were applied to districts farther removed from the transect areas.

The Plan of Work

The members of India Crane Working Group were collecting information about the distribution of cranes in India since 1986. Range maps of cranes occurring in India began to be published since 1987. But their coverage was partial as the members lacked resources to cover all the areas where Sarus occurred.

When it was decided to undertake the project, and a questionnaire was designed as an aid to fieldwork, the effort

began more systematically. The questionnaires were distributed to members from early March 1988. The first set of questionnaires returned provided data on the Sarus situation in Feb-March 1988 in Kota district of Rajasthan. The fieldwork continued during the monsoon breeding season and returns came from the Terai area of Uttar Pradesh and from south-eastern parts of Haryana.

With the project sanction received in October 1988, fieldwork began in right earnest. By this time certain other agencies such as the Centre for Wildlife and Ornithology at Aligarh University and individual researchers from Bombay Natural History Society agreed to undertake fieldwork for the project. The work was organised in the following manner:

Members of ICWG did fieldwork in the undermentioned areas:

1. Rohtak, Sonipat and Gurgaon districts and adjacent areas in Haryana.
2. The Terai region in Pilibhit, Kheri and Bahraich districts in U.P.
3. Areas around Bharatpur, Jaipur, Ajmer, Pali and Kota in Rajasthan.
4. Areas in Bhandara and Chandrapur districts in Maharashtra.

The Centre for Wildlife and Ornithology undertook to survey areas around Aligarh. Individual BNHS researchers agreed to survey areas in east U.P. and north M. P.

As the Principal Investigator I decided to explore many of the remaining areas of the known Sarus range. More specifically I

also tried to ascertain the exact limits of the occurrence of Sarus. My exploration included the following areas:

1. South-east M. P. i.e. areas and wetlands in Raipur, Bilaspur districts and adjoining areas.
2. West and north Orissa.
3. South Bihar.
4. East, southwest, west and north U. P.
5. West M. P.
6. South and central Gujerath and north and north-east Saurashtra.

In addition, I also visited Kota area in Rajasthan, wetlands in Gurgaon, Rohtak and Sonipat districts in Harvana and Aligarh and Mathura areas in the company of ICWG members to get a first hand feel of those regions. We decided to exclude Punjab and Kutch as wildlife officials and observers reported that they had not seen Sarus there in recent years.

Time Schedule of Work

As it was important to collect information on the status of Sarus, i.e. its numbers, recruitment of juveniles in the total population and its spatial distribution, investigators were asked to do fieldwork in Oct.-November and again in January-February. As Sarus breeds during the monsoon months and in the beginning of winter, the breeding pairs were expected to have fledged chicks with them. This would help us to find out how many pairs in the total population were successful breeders and what was the

adult/juvenile ratio in the total population.

The fieldwork actually covered a wider span of time. In some areas it began in February 1988 and continued all through the year as Sarus was found to be breeding in those areas throughout the year. In certain other areas it extended beyond the stipulated period as nests were found in April. It was not possible to explore areas in north and northeast Bihar and adjacent areas in West Bengal during the above time span. It is proposed to investigate those areas in Phase II of the project.

The Sample Population

Principally the fieldwork covered areas in four states, viz. Haryana, Uttar Pradesh, Rajasthan and Gujerath. Though parts of Madhya Pradesh, Orissa, Bihar and Maharashtra were also covered, Sarus were not seen in them except 2 pairs in M. P. and 4 individuals in Maharashtra. We therefore, concern ourselves with over 1200 Sarus encountered in the 4 states mentioned above.

Let us now examine the characteristics of this sample population.

Table 1

Numbers and Composition of Sarus encountered in Different States.

State	No of Sarus	No of Pairs	No of Families	Pairs with 1 Juven.	Pairs with 2 Juven.	Single Sarus	Flock
Haryana	53	21	8	7	1	2	-
U. P.	660	260	59	43	16	12	53
Rajasthan	431	127	43	29	14	11	109
Gujerath	103	32	12	8	4	2	21
Total	1247	440	122	87	35	27	183(14)

As the table shows Sarus were seen in pairs(440), as single individuals(27), and in flocks(183). Of the Sarus pairs 122 or 27.72% had juveniles with them. These pairs thus indicate the successful breeders in the population. 87 pairs or 71.32% of the successfully breeding pairs carried only 1 juvenile per pair and 35 or 28.68% of the successful breeding pairs carried 2 juveniles with them. Thus 157 juveniles were seen with their parents. in addition, 14 juveniles were seen in Sarus flocks. They are shown in brackets in the last column of the table. In the total sample population 13.71% were the juveniles.

If the adult/juvenile ratio is examined for different states, it turns out that Haryana(17%) and Gujerath(16%) show a greater percentage of juveniles than U.P. and Rajasthan. But far greater numbers of Sarus were seen in the two latter states. In Rajasthan most of the pairs that were observed outside the Kota area did not have juveniles. If Kota area is excluded the adult/juvenile ratio in Rajasthan will fall further. In U. P. juveniles formed only 11.36% of the total population. This is

even less than the average of 13.71% for the sample. It appears that Sarus who breed in U. P. and Rajasthan are less successful in rearing their chicks than those in Haryana and Gujerath.

The adult/juvenile ratio or the rate of recruitment in the population for Sarus may be compared with 43% to 60% observed among Common Cranes (Grus grus) in West Germany[8], (1972-82). 10 to 19% for Red-crowned Cranes (Grus japonensis) observed in Hokkaido, Japan during 1966-79[9] and 20 to 50% observed for Mississipi Sandhill Cranes(Grus canadensis) in U.S.A. during 1952-73[10]. It must therefore, be said that compared to other well protected populations of cranes in different countries, Sarus, though protected by sentiment, is not faring well.

We will now try to find out why this is so by examining the living conditions of Sarus.

The Habitat-use by Sarus

The table below shows the habitats in which Sarus were encountered in the field.

Table 2

The Habitat-use by Sarus

State	Type of Habitat(wet)														
	Marsh					Pond					River				
	Pa	Fam	Juv	Si	Fl	Pa	Fam	Juv	Si	Fl	Pa	Fam	Juv	Si	Fl
Haryana	15	4	5	1	-	3	2	2	1	-	-	-	-	-	-
U. P.	57	22	28	2	-	15	9	12	-	-	13	9	12	-	-
Rajasthan	67	30	42	4	52	4	2	2	-	-	13	6	6	1	57
Gujerath	9	3	4	-	-	7	4	6	-	21	-	-	-	-	-

State	Type of Habitat(dry)														
	Cultivation					Fallow					Waste				
	Pa	Fam	Juv	Si	Fl	Pa	Fam	Juv	Si	Fl	Pa	Fam	Juv	Si	Fl
Haryana	2	1	1	-	-	-	-	-	-	-	1	1	1	-	-
U. P.	152	17	21	6	28	14	1	1	4	-	9	1	1	-	25
Rajasthan	25	3	5	1	-	3	2	2	1	-	15	-	-	4	-
Gujerath	12	4	5	1	-	2	1	-	-	-	-	-	-	1	-

Pa = Pairs, Fam = Families, Juv = Juveniles, Si = Single, Fl = Flock.

The table shows that Sarus pairs used agricultural, semi-wet and dry areas more than wet areas like marsh, pond and river. But Sarus families, i.e. pairs with juveniles used wet areas more than dry and semi-wet areas. Juveniles probably were given food-items that were available more in marshy areas than in agriculture. Proteinous food required by juveniles for their

growth should be available in greater quantities in wet areas than in dry ones.

It will be also clear from the table that the greater use of agriculture by Sarus pairs is mainly due to the peculiar habitat-use in the state of Uttar Pradesh. For in the remaining states even pairs used marshy areas more than agriculture. The data presented in this table confirm that Sarus is predominantly a bird of wetlands. Let us now consider in detail the habitat-use in different states.

Haryana

In Haryana Sarus was found to be breeding in marshy areas around lakes such as the Sultanpur jheel, now a bird sanctuary and marshy areas surrounded by agriculture. Pairs and families appeared to spend a great deal of time around big lakes such as Sultanpur and Bhindwas even after the breeding season. Though a part of the day must be spent in agricultural fields for foraging, they congregated in and around lakes during the warmer parts of the day and roosted there at night. Such spots are however, few in Haryana. As such this state provides restricted area for Sarus to breed.

Another favoured habitat was found to be wetlands along canals created by the seepage. These were important mainly as foraging and roosting spots as breeding in such areas was not reported in Haryana. Many of the seepage wetlands are threatened by reclamation for cultivation. If they are reclaimed there will be a significant loss of habitat for Sarus. Some of the larger

wetlands like Bhindwas need protection urgently: for these provide potential breeding habitat for Sarus. If these are not protected Haryana may lose Sarus as a breeding species.

Rajasthan

Many more Sarus were seen on lakes and rivers in Rajasthan than in agriculture. Rajasthan is not a major producer of foodgrains. It is likely that less food is available for Sarus in agriculture in this state than in wet areas. The greater use of wet areas here is also due to the peculiar situation prevailing in Kota district. Sarus in Kota are concentrated in a small area along canals where they use wetlands created by canal seepage. These are used for nesting and foraging. Indeed due to the year-round availability of shallow water, Sarus here breeds almost throughout the year. When the daily activity pattern was examined, it became clear, that though some time was spent in nearby agriculture, pairs and families tended to stick to their wetland territories throughout day and night.

While Sarus in Haryana used lakes for resting and roosting, those in Rajasthan used rivers for these purposes and to a less extent lakes. In Kota large riverine roosts were located, especially in the Kali Sindh river where Sarus gathered in large numbers in late evening. In other parts of Rajasthan where there are no large rivers, Sarus used lakes for resting and roosting.

Gujerath

In this state Sarus was seen in agricultural areas to a slightly greater extent than in wet areas. Sarus was found to be concentrated in Kheda and Vadodara districts of Gujerath. In both these districts cultivation thrives on canal irrigation. Sarus was observed to be feeding on grains from standing cobs, on fallen grain as well as in flooded fields. Here also during the hot hours of the day Sarus were seen to resort to lakes and lakeside marshes for resting. They roosted nearby for the night. Besides wheat Sarus were found to glean jowar and groundnut. An exceptional sighting was in Bharuch district where some of the pairs were observed having a siesta under the scant shade of acacia trees in cotton fields. In these fields pairs and families were searching for groundnut which was harvested before cotton was sown. The region was quite dry but the local people reported that those pairs were so faithful to that region that they stayed on even after all the pools and ponds had dried. The only water nearby was some collected in roadside ditches from a leaking pipe line. The pairs had nested during the monsoon months when the ponds were full.

Uttar Pradesh

In November and December 1988 when I was doing transects in east, south and west U. P., most of the Sarus were seen in agricultural fields where paddy was harvested; so much so that I was led to believe that Sarus was associated with paddy. In many of these areas mustard and potato were the next crops. Sarus was

pointedly absent from mustard and potato. Where rice crop was still standing Sarus even attacked the cobs and ate the grain. Where wheat was the next crop it mainly gleaned fallen rice harvested before.

U. P. was once a land of jheels (wetlands) small and big, some with spectacular assemblages of birds. A map of the Lucknow area published in 1867 shows over 200 jheels in a small area of as many sq. kms. Now many of these jheels have gone under the plough. Those that remain but tend to dry progressively are also cultivated. Sarus that nested and roosted in a wetland may find themselves surrounded by cultivation. We did come across cases where we found Sarus remaining faithful to the nesting area which was cultivation in March and April but was a wetland in July-September.

Even Terai which was once a huge marsh, has gone under the plough. Sarus in Terai now nests in patches of marsh surrounded by agriculture.

Due perhaps to the heavy use of chemical fertilizers and irrigation, large tracts in some parts of UP have turned saline. Water collected in shallow areas in such tracts has given rise to salt marshes overrun by Typha angustata. Sarus was seen to use such areas for nesting.

Sightings of Sarus in agriculture related mainly to pairs and not families. 76% of the families were sighted in marshy areas. For families i.e. pairs with juveniles, more food was apparently needed from wet areas, than from semi-wet and dry

agriculture. The disappearance of many wetlands did however, have an adverse effect on breeding pairs as we saw earlier.

The Activity Pattern

For Sarus families the day began with feeding in marshy areas, while most of the pairs without chicks went to fields for food. In late mornings a few pairs were seen to come together in fallow fields and wasteland where bouts of unison-calling, dancing and running about, were noted. As already described the noon hours were spent either in and around lakes (Haryana, Gujerath), or in rivers (Rajasthan, UP) or in agriculture (UP). In the early evening there was another session of feeding in agriculture or marshes. In late evenings gatherings of 20 or more Sarus were seen again in fallow or waste land where a lot of activity was evident in terms of bowing, dancing and running about.

In a typical Sarus day of 12 hrs.(6 a.m. to 8 p.m.), 58% of the time was devoted to feeding, 25% to resting and the remaining 17% to social activities, i.e. coming together for intermingling, dancing, calling etc. It is during this period that pairing probably takes place for recently recruited adults. Unison-calling observed during such gatherings appeared to resusticate the pair bond between mated pairs.

In May and June when most of the farms lie fallow, when the temperature crosses 40 C over much of the Sarus range and when lakes and ponds and marshes dry up, scattered pairs and subadults come together at a few spots which still retain water. Large

gatherings of Sarus are then seen, ranging from a few score to a couple of hundred cranes.

Let us now relate the habitat-use of Sarus to its activity pattern. The table below gives this information.

Table 3

Habitat-use and Daily Activity Pattern of Sarus Crane.

Activity	Type of Habitat																							
	Marsh				Pond				River				Cultivation				Fallow				Waste			
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Feeding	+	+	+	+	+	-	+	+	+	-	-	-	+	+	+	+	+	+	-	+	-	-	-	-
Nesting	+	+	+	+	+	-	+	+	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Resting	+	+	-	+	+	+	+	+	-	+	+	-	-	+	-	+	+	+	+	-	+	+	+	-
Roosting	+	+	+	+	+	+	+	+	-	-	+	-	-	+	-	-	-	-	-	-	-	-	-	-
Loafing	-	-	-	+	+	-	-	+	-	-	+	+	-	-	-	+	+	+	+	+	+	+	+	+

1 = Haryana, 2 = U. P. 3 = Rajasthan, 4 = Gujerath

The table shows that marshes sustained a total of 16 Sarus activities in different states. Ponds sustained 16 activities also. The other habitats then follow. It is interesting to note that cultivation, so important for feeding, becomes less important if all the Sarus activities are considered together. The ideal habitat combination for Sarus appears to be marshes, ponds, fallow land and cultivation, in that order. The spread of cultivation may benefit Sarus in terms of feeding but it will hamper some of its other activities and as a whole he will not be better off.

In the present study the movements of individual pairs were not observed, though from the reports of local people Sarus pairs

appeared to move over an area of a few sq. kms only.

The Breeding Areas of Sarus

As the purpose of the present study was to assess the status and ecological requirements of Sarus, facts about its breeding biology were not collected. Instead we focused on the location and size of nesting areas, the number of nests they supported, the major plant communities of those wetlands and threats if any, they faced.

Sarus nests were seen during July to September, i.e. the monsoon months and again from December to April. Though in some areas Sarus apparently nested throughout the year, except May and June, we do not know whether the same pair renests. Probably if the first brood is not successful, the pair may renest. Information available on the nesting season of Sarus in different states is given in the table below.

Table 4

Sarus Reproduction and Feeding during the year in different States.

State	Month of the Year																							
	1		2		3		4		5		6		7		8		9		10		11		12	
	R	F	R	F	R	F	R	F	R	F	R	F	R	F	R	F	R	F	R	F	R	F	R	F
Haryana	-	F	-	F	-	F	-	F	-	F	-	F	R	F	R	F	R	F	-	F	-	F	-	F
U. P.	-	F	R	F	R	F	R	F	-	F	-	F	R	F	R	F	R	F	-	F	-	F	-	F
Rajasthan	R	F	R	F	R	F	R	F	-	F	-	F	-	F	R	F	R	F	R	F	R	F	R	F
Gujerath	R	F	-	F	-	F	-	F	-	F	-	F	R	F	R	F	R	F	-	F	-	F	R	F

The table shows that Sarus breeds during 3 and 5 months in Haryana and Gujerath while in U. P. and Rajasthan it breeds

during 6 and 9 months of the year.

The nesting of Sarus was observed in Sultanpur Bird Sanctuary in Haryana, in the Terai region and west Aligarh district in U. P., and Keoladeo Ghana National Park and Kota district in Rajasthan. In all 29 nests were observed in these areas. The table below gives details of these nesting sites.

Table 5
Characteristics of Sarus Nesting Sites in different Regions.

Nesting Location	Habitat Type	Area (ha.)	No. of Nests	Major Plants
Sultanpur Bird Sanctuary	Lake & Marsh	300	2	Scirpus sp.
Garhi Bala (Haryana)	Flooded field and Marsh	50	2	Rice, Typha & Scirpus
Terai	Flooded field and Marsh	240	15	Sugarcane, Hygrorvza.
Aligarh	Pond	10	1	Eichhornia crassipes
Kota	Marsh	100	8	Typha, Scirpus
K. G. National Park	Pond	5	1	Scirpus, Paspalum

In Sultanpur the nesting pairs were disturbed by the tourist inflow. In other areas farming and movement of men and cattle were the disturbing factors. In Kota a large industrial plant is planned to be set up not far from the breeding area of Sarus. If it comes up the movement of construction labor, their settlements near the canal are the potential threats. The pairs breeding in the National Park are relatively safe from disturbance. The size of the nesting territory varied from 10 to 27 hectares. In winter the same breeding area supported less number of pairs.

During the fieldwork following are the important breeding

areas that were identified:

Breeding Areas in U. P.

1. Wetlands east and south of Rae Bareli
2. Wetlands southwest of Haidergarh
3. Wetlands north and northwest of Gorakhpur
4. Wetlands north of Bahraich
5. The stretch of Ghagra river west of Bahraich
6. The stretch of Ghagra river east and north of Lakhimpur
7. Wetlands northwest of Lucknow near Sandila
8. Wetlands around Hardoi
9. Wetlands around Fatehgarh
10. Lakh Bahosi Bird Sanctuary near Kanauj
11. Wetlands near Kishni on Bewar-Etawah road
12. Wetlands northwest of Mainpuri
13. Wetlands around Jhansi
14. Wetlands south of Hamirpur

The Breeding Areas in Rajasthan

1. Keoladeo Ghana National Park near Bharatpur
2. Water-logged areas along canals south of Kota

Breeding Areas in Gujerath

1. Narda tank in Kheda district
2. Ponds around Navsari

In the rest of its range Sarus must breed in a scattered fashion because of a scattering of the habitat. For example, in east Rajasthan and west U. P. any sizeable pond or lake is likely to support a Sarus nest. The breeding areas identified above are

either large marshlands and lakes or a group of smaller wetlands affording favorable nesting conditions.

Let us now see what these conditions are.

• Shallow water was perhaps the first favourable condition noted as most of the nests were surrounded by water 30 to 60 cms in depth. The plants that were associated with the breeding marshes are listed below. They are grouped into 2 categories: plants used as nesting material by the pairs and plants used as food. In some cases it was possible to identify the nesting material. Information on nesting material was also provided by a member of ICWG who had done his M. Phil. dissertation on Sarus*. Information on food plants is not based on analyses of gut contents or of faeces. The list enumerates plants with tubers and seeds that can be utilized by Sarus as food and that were in feeding areas.

Plants utilized as nesting material	Plants that can be used for feeding
Acacia arabica	Aeschynomene
Aeginetia indica	Carex speciosa
Alysicarpus hamosus	Coix Lachryma jobi
A. longifolius	Cyperus rotundus
Asteracantha longifolia	Ipomoea aquatica
Ceratophyllum demersum	Jussia repens
Cyperus pumilus	Limnanthemum indicum
Eichhornis crassipes	L. crispum
Elytrophorus spicatus	Nelumbium speciosum
Eriocaulon dianae	Nymphea sp.
Fimbristylis dichotoma	Ottelia
F. siberiana	Oxalis corniculata
Hydrilla verticillata	Panicum miliare
Hygrorhiza aristata	Paspalum compactum
Ipomoea aquatica	Potamogeton indicus,
Jussia repens	P. pectinatus
Limnanthemum indicum	Sagittaria
L. crispum	Scirpus sp.
Limnophylum aquatica	Scleria hebecarpa
L. obtusifolium	Trapa bispinosa
Myriophyllum	Vallisneria sp.
Nymphea nucifera	Zizania aquatica
Pistia stratiotes	
Polygonum barbatum	
Scirpus articulatus	
Scleria tessellata	
Sesbania bispinosa	
Sopubia delphinifolia	
Themeda sp.	
Trapa natans	
Typha angustata	
Vallisneria spirallis	
Vondellia	

The plants utilized by Sarus can be grouped under fully aquatic, marsh and amphibious categories. Among the plants used as nesting material there are 11 aquatic plants, 10 marsh plants, 4 amphibious plants and the rest can be amphibious as well as marsh plants. Among the probable food plants there are 7 aquatic, 7 marsh, 3 amphibious and the rest both amphibious and marsh plants. Except a few like Eichhornia crassipes, most of the plants belong to freshwater and will not thrive in polluted waters. The maintenance of freshwater wetlands is very important

for the well-being of Sarus.

Ensuring the Sarus Well-being

It is interesting to note that where shallow, freshwater wetlands are available all the year, Sarus breeds almost throughout the year. Availability of water in the nesting area appears to be the critical factor inducing Sarus pairs to nest. The pairs breed in a scattered fashion and even if a large area is available (such as K. G. National Park), pairs maintain a nesting territory and remain spaced out. Creation and maintenance of large nesting areas do not seem to be the prime need for ensuring the successful nesting of Sarus. Even small wetlands such as village ponds, if maintained in good condition as freshwater reservoirs, can support one or two nesting pairs. Such ponds can be used by human beings as well as Sarus and will be far cheaper to maintain than a large reserve. Villagers can be encouraged to maintain freshwater ponds and regulate their use so that while benefiting themselves they will also offer shelter to wild birds and animals.

The two essential conditions for maintaining such wetlands as favourable areas for Sarus are: 1. the wetland should be a freshwater wetland and the water quality will not be allowed to grossly deteriorate and 2. the movement of people and their cattle around the wetland should not be such as to drive away the nesting pair.

Sarus is a part of the Indian village scene and should be allowed to remain so. A little care and restraint by villagers

appear to be sufficient to ensure its survival and welfare.

Peoples' Attitude towards Sarus

Sarus come into direct conflict with the cultivator when they consume foodgrains and other agricultural produce. It was therefore, useful to gauge the cultivator's reaction to this damage. It was gratifying to note that in all the four states the cultivators on the whole, did not register any serious complaints against Sarus. As a pair or two could not possibly eat a large amount of grain, the people seemed to tolerate them. Of course, though we did observe certain pairs feeding on standing crops, the majority of Sarus were seen to consume grain fallen in the fields after the harvest. The damage by Sarus did not appear to be of such magnitude as to alarm the cultivator.

Certain cases of people showing resentment, especially if the Sarus pair tried to nest in standing paddy, were reported from the Terai region and Bhandara district of Maharshtra. Yet on the whole, people did not react unfavourably to the presence of Sarus in cultivation.

The Present Sarus Range

To find out how far Sarus range today, we made it a point to consult local people and birdwatchers about the occurrence of Sarus in their areas. Coloured photographs of the crane were used to ensure correct identification. On entering a new region the first sighting of Sarus was carefully noted. Let us now discuss the findings about the limits to the Sarus range.

1. The known and oft-quoted limit to the southern range of Sarus

was the Godavari flood plains (17 N 82 E). There are however, no recent reports of the occurrence of Sarus in those areas. Our enquiries with local birdwatchers and wildlife officials evoked not a single positive response. Sarus no longer occurs as far south as the Godavari flood plains.

2. In recent years Sarus was observed to be breeding in the vicinity of Navegaon National Park in Bhandara district of Maharashtra and also in the adjoining Chandrapur district.(20-21 N 80 E). In 1988 a juvenile and 4 adults were seen in that area. The southern limit of Sarus range appears to be Bhandara and chandrapur districts of Maharashtra.

3. Formerly Sarus was seen near Bombay [11]. To find out the western limit to the range I explored the districts immediately north of Bombay. I did not get any reports of Sarus till I reached Valsad in south Gujerath (see map). At Valsad I was shown some wetlands where Sarus usually occurred during the monsoon. I actually encountered a Sarus pair about 20 kms north of Valsad. The southwestern limit to the Sarus range appears to be Valsad (21 N 73 E).

4. To the west in Saurashtra, Sarus was found to be resident and breeding at a few places like Gondal, Lakhtar and Surendranagar. During the monsoon with suitable habitat conditions occurring at many places, Sarus pairs range widely and can be found as far as Porbandar on the west coast of the Saurashtra peninsula. West coast of Saurashtra (22 N 69E) may therefore, be considered as the western limit of Sarus range.

5. To the north of Saurashtra lies the Indus delta now in Pakistan. Formerly Sarus ranged as far as the Indus delta. It is no longer found anywhere in Pakistan. It does not occur in the Thar desert adjoining the Pakistan border. But it was occasionally sighted near Jodhpur on the eastern border of the desert. The line of occurrence of Sarus runs therefore, from Porbandar to Jodhpur in Rajasthan.

6. In Haryana Sarus was seen to occur near wetland areas. Away from these to the west and north it is rarely seen and in Punjab it is not recorded in recent years. To the west therefore, its range limit is taken to run along a line which joins Jodhpur with Hissar in Haryana.

7. Sarus had been seen in Ambala district, i.e. the northern part of Haryana at one time[12]. But even during the forties it had become rare in those parts[13]. Now it appears to rarely range beyond Panipat in Haryana. The northern range limit is thus taken to be just north of Panipat on to Pantnagar in U. P. (30 N 80 E).

8. By and large Sarus is not resident in the foot hills of the Himalaya. A pair might be seen in the Kulu valley and might stray even to the vale of Kashmir. There are no recent reports of Sarus breeding in the foothills region.

9. Sarus is found in good numbers in the Terai. Researchers from Nepal also reported some occurring along the India-Nepal border in west and central Nepal. To the east it becomes rare.

10. Sarus was found to be very well distributed in west and

central U. P. To the east however, we did not encounter Sarus till we reached the vicinity of Rae Bareli. To the east of Rae Bareli, in the adjoining Sultanpur district, local people told us that they had not seen Sarus in recent years. A wildlife official told us that east of Allahabad Sarus was not to be found. To the northeast in Gorakhpur district* Sarus had been sighted in good numbers in recent years. Thus the line of the eastern limit of the Sarus range appears to run from Gorakhpur south to Sultanpur in U. P. (27 N 83 E).

Sarus had been reported from Purnea district in northeast Bihar. Fieldwork in this area will be undertaken in Phase II of this study.

11. We searched for Sarus in south Bihar and Orissa but without sighting it. Indeed in some areas especially in Orissa, though the habitat looked good no Sarus could be found. Same was the case in southeastern parts of M. P. Though occasional sightings of Sarus cannot be ruled out in these areas, as a resident bird Sarus is not to be seen. the limit of its range appears to run therefore, from Sultanpur to Raipur in south M. P.(21 N 82 E).

The Estimate of Sarus Numbers

How many Sarus occur at present in this range? It will be very time-consuming and expensive to make a total count of Sarus over this extensive region as pairs remain scattered over a wide area. One can however, make an intelligent estimate based on

sample counts. I have taken the following into account to prepare such an estimate:

1. Densities (Sarus per sq km) obtained during transect surveys;
2. Extent of major habitats used by Sarus and
3. The actual percentage of Sarus encountered in major habitats.

Let us now examine the available data for each of the four states considered here.

In each of these states there are certain areas such as the Thar desert in Rajasthan, the Himalayan districts in U. P. and districts outside the present range of Sarus where the crane does not occur or occurs only as a vagrant. We have excluded these areas in preparing the estimate.

Transects were carried out in regions where we felt Sarus numbers were concentrated. The figures of transect density apply only to these regions. In areas adjacent or distant from these areas of concentration we assume that Sarus occurs in lower densities. To such areas we have applied 1/2 or 1/4 or even 1/8 of the densities obtained in transect surveys depending on the distance at which that particular area lies from the transect area.

The major habitats used by Sarus were seen to be wet, i.e. marsh, pond and river and dry i.e. cultivation and fallow, more especially, area under foodgrains. Figures of the extent of wetland habitat and of the area under foodgrains in different districts of the four states have been obtained from the wetland Directory and agricultural data published by Government of India.

Based on these we have prepared two sets of estimates: higher and lower. The final estimate is taken to be the mean of these two. Let us now work out the estimates for each of the four states.

Haryana

In Haryana transects were carried out in Rohtak, Sonipat and Gurgaon districts. A total area of 500 sq kms was covered during the transects in which 53 Sarus were seen. The densities worked out for these three districts are as follows: Sonipat: 0.05 per sq km; Rohtak: 0.065 and Gurgaon 0.05. The table below gives the higher estimate worked out for this state. Some districts of this state are obviously excluded for reasons stated before.

Table 6

The Estimate of Sarus Numbers Occurring in Major Habitats

District	Total Area (in sqkm)	Foodgrains Area(sqkm)	Wetland Area)	Density	Sarus No.s FG	WL
Sonipat	2206	1976	209.57	0.05	99 + 10	9+8
Rohtak	3841	3785	364.89	0.065	246 + 24	23+19
Gurgaon	2716	2676	258.02	0.05	133 + 12	12+11
Hisar	6315	5149	599.92	0.016	83 + 9	8+8
Jind	3306	3258	314.07	0.032	105 + 10	10+8
Karnal	3740	3570	355.30	0.007	25 + 2	2+2
Total	22124	20414	2101.77		691 + 67	64+56 = 120

The higher estimate for Haryana works out to 758. To prepare the lower estimate, we now consider that in Haryana only 9.43% of

Sarus were seen in agricultural habitat and 84% were seen in wet areas; i.e. 71 in foodgrains or dry habitats and 56 in wet areas. The lower estimate comes to 127 Sarus only. The mean of these two estimates is 442 which is our estimate for Haryana.

Uttar Pradesh

In this state the transects were carried out in the Terai region, in central UP and in west and northwest UP. Our transects in east UP did not yield any Sarus. An estimated area of 4000 sq kms was scanned and 660 Sarus were encountered. The Sarus density per sq km varied from 0.008 to 0.333. The table below gives the working of the higher estimate for the state of U. P.

Table 7

The Estimate of Sarus Numbers Occurring in Major Habitats

District	Total Area (in sq. km)	Foodgrains (sq km)	Wetland (sq km)	Density	Sarus No.s FG	WL	
Agra	4805	3660	22.58	0.0775	283 +	3	167 + 0.60
Aligarh	5019	3412	23.58	0.0775	264 +	2	156 + 0.62
Bahraich	6877	5785	32.32	0.325	1880 +	10	1109 + 3.50
Bara Banki	4401	3608	20.68	0.040	144 +	1	85 + 0.28
Bareilly	4120	3466	19.36	0.083	287 +	2	169 + 0.54
Basti	7228	4915	84.28	0.020	98 +	2	58 + 0.57
Badaun	5168	4123	24.28	0.040	164 +	1	97 + 0.33
Bulandshr	4352	4055	20.45	0.017	69 +	1	41 + 0.11
Etah	4446	3961	20.89	0.090	356 +	2	210 + 0.63
Etawah	4326	3175	20.33	0.580	1841 +	12	1086 + 4.00
Farrukhabad	4274	2859	20.08	0.155	443 +	3	261 + 1.05
Gonda	7352	6544	34.55	0.080	523 +	3	309 + 1.00
Gorakhpur	6272	4268	29.47	0.040	170 +	5	101 + 0.40
Hamirpur	7165	4709	33.67	0.0125	59 +	1	34 + 0.14
Hardoi	5986	4013	28.31	0.042	168 +	1	99 + 0.40
Jalaun	4565	3302	21.45	0.082	270 +	2	160 + 0.59
Jhansi	5024	3022	24.61	0.041	123 +	1	73 + 0.34
Kanpur	6176	4394	29.02	0.039	171 +	1	101 + 0.38
Kheri	7680	4253	76.80	0.169	718 +	12	424 + 4.41
Lucknow	2328	1592	11.88	0.039	62 +	1	37 + 0.16
Mainpuri	4343	3484	20.41	0.36	1254 +	8	740 + 2.40
Mathura	3811	3427	17.91	0.038	130 +	1	77 + 0.23
Meerut	3911	2311	18.38	0.019	44 +	1	26 + 0.12
Moradabad	5967	4360	20.39	0.008	34 +	0	21 + 0.05
Pilibhit	3499	2524	16.44	0.333	840 +	5	495 + 2
Rae Bareli	4609	3378	21.66	0.050	168 +	1	100 + 0.37
Shahjahanpr	4575	3538	21.50	0.166	587 +	3	346 + 1.21
Sitapur	5743	4137	26.99	0.084	347 +	3	205 + 0.77
Unnao	4558	3530	21.42	0.159	561 +	3	331 + 1.15
							7118 + 28.35
Total	148580	109805	708.61		12060 +	90	

The higher estimate for UP is 12150 Sarus. Of the total number of Sarus seen in UP 59% were seen in agriculture and 34% in wet habitats, i.e. 7162 Sarus in foodgrains area and 30 in wet areas. The lower estimate works out to 7192 Sarus. The mean of these two estimates is 9671 Sarus which is our estimate for UP.

Rajasthan

During the transects in this state an estimated total area of 2834 sq kms was covered. The Sarus densities worked out for different districts range from 0.011 to 0.19. The table below gives the working out of the higher estimate of Sarus numbers.

Table 8

The Estimated Numbers of Sarus Occurring in Major Habitats

District	Total Area (in sq km)	Foodgrains Area(sqkm)	Wetland Area(km)	Density	Sarus FG	No.s WL
Ajmer	8481	3878	169	0.016	64 +	2 9+2.08
Alwar	8380	3184	41.9	0.041	130 +	3 20+1.32
Banswara	5037	2334	50.37	0.031	72 +	2 11+1.20
Bharatpur	8100	4729	81.00	0.071	335 +	5 50+4.42
Bhilwada	10455	2983	104.55	0.037	110 +	4 17+2.97
Bundi	5550	2109	111.00	0.037	79 +	4 12+3.16
Chitaurgarh	10856	3399	54.28	0.018	62 +	1 9+0.75
Dungarpur	3770	1586	37.70	0.031	49 +	1 7+0.90
Jaipur	19527	7309	195.00	0.020	146 +	4 22+3.0
Jhalawad	6219	2766	31.00	0.038	105 +	1 16+0.90
Kota	12436	4853	124.36	0.155	752 +	19 113+15.0
Pali	12387	3448	61.93	0.011	37 +	1 6+0.52
S. Madhopur	10527	4828	52.63	0.044	212 +	2 32+1.78
Tonk	7194	4046	36.00	0.027	109 +	1 16+0.75
Udaipur	17279	4228	172.79	0.011	46 +	2 7+1.46
Total	146198	55680	1323.51		2308 + 52	347+36.31

FG = Foodgrains area WL = Wetland area

The higher estimate of Sarus numbers for Rajasthan comes to 2360. But in this state only 15% Sarus were seen in agriculture and 77% in wet areas, i.e. 346 in foodgrains and 40 in wet areas giving a lower estimate of 386. The mean of these two estimates is 1373 which is the estimate for Rajasthan.

Gujerath

In Gujerath an estimated total area of 2787 sq kms was covered during transects which were mainly carried out in south, central and west Gujerath. The Sarus densities varied from 0.005 to 0.119. The table below shows the higher estimate worked out for this state.

Table 9

The Estimate of Sarus Numbers Occurring in Major Habitats

District	Total area (in sq kms)	Foodgrains Area(sq km)	Wetland Area(km)	Density	Sarus No.s FG	WL	
Ahmedabad	8707	3336	261.24	0.0595	198	+ 15	66+9.48
Amreli	6760	1690	270.40	0.0297	50	+ 8	17+4.89
Bharuch	9038	2259	632.66	0.0350	79	+ 22	26+13.50
Bhavnagar	11155	247	557.75	0.0297	70	+ 4	24+10.10
Gandhinagar	649	322	19.47	0.0590	19	+ 1	6+0.70
Jamnagar	14125	1439	565.00	0.0035	7	+ 3	2+1.72
Junagadh	10607	2652	424.28	0.0297	78	+ 16	26+7.68
Kheda	7194	3517	576.00	0.119	418	+ 68	138+41.8
Panchmahal	8866	4331	265.00	0.034	147	+ 9	49+5.49
Rajkot	11203	2801	560.00	0.010	28	+ 5	9+3.41
Sabarkantha	7390	2386	222.00	0.0297	70	+ 6	23+4.02
Surat	7657	2290	536.00	0.0430	98	+ 23	32+14.05
Surendranagar	10489	2420	314.00	0.0297	71	+ 9	24+5.68
Vadodara	7794	2229	390.00	0.0670	149	+ 26	49+15.93
Valsad	5244	1727	367.00	0.0860	148	+ 31	49+19.25
							540+157.71
Total	126878	35872	5960.80		1630	+248	

The higher estimate for Gujerath works out to 1878 Sarus. But in this state only 33% Sarus were seen in agricultural areas and 61% were seen in wet areas, i.e. 538 in agriculture and 151 in wetlands giving a lower estimate of 689 Sarus. The mean of these two estimates will be 1283 which is the estimated number of Sarus for Gujerath.

The Present & the Future

Let us have a close look at the areas in which Sarus is found today. If we look at the physical map of India it will be evident that Sarus is resident in the flood plains of certain major rivers of the country such as Yamuna, Ganga and Ghagra(in UP), Sindh, Betwa and Ken (on the border of UP and MP), Banas, Chambal and Kali Sindh (in Rajasthan) and the Mahi and Sabarmati (in Gujerath). It resides in areas at or near the sea-level. In Gujerath it occupies areas close to the sea-shore and visits beaches for loafing. In the east, in Burma, Vietnam and Australia, the eastern sub-species of Sarus also occupies areas at or near the sea-shore. One wonders if this has something to do with the evolutionary history of Sarus.

Yet Sarus is neither a coastal bird nor is it found in all the low-lying areas. We have already seen that Sarus utilizes wet areas and agricultural areas; yet Sarus is not found wherever fields and marshes are found. While doing transects in UP in November, it was impossible to avoid the impression that Sarus was associated with paddy. Yet Sarus is not found in all the paddy-growing areas. Sarus is never far away from human beings; yet it is resident only in a handful of states of India. There must be some reasons why Sarus is found in certain areas and why it does not occur in other areas.

India is a developing country. There are certain indices which signify the pace of development. Urbanisation, industrialisation and modernisation of agriculture including

greater use of fertilizers and machinery, spread of irrigation, are some of the indices of development. Enhanced production in agriculture and industry are the products of development. As Sarus is closely associated with human beings, this "development" is bound to affect it for good or for worse. Let us now examine if this has indeed happened. Let us see how the areas in which Sarus is resident in good numbers, have so far fared in terms of development.

Let us take industrialisation first [14].

In Haryana Sarus is mainly found in Gurgaon, Rohtak and Sonipat districts. Due to the proximity of the capital Gurgaon is economically and industrially developed. While Sonipat is not as industrialised as Gurgaon. Rohtak comes under the category of 'backward districts' in terms of industrial development. Even though Gurgaon and Sonipat are industrially developed Sarus exists in fair numbers because of certain special factors such as maintenance of large wetlands.

In UP Sarus is mainly found in Bahraich, Kheri, Etawah and Mainpuri districts. None of these can claim to be industrially advanced. Indeed Bahraich, Etawah and Mainpuri fall under the category of backward districts. Paradoxically enough in Rajasthan and Gujerath Sarus appears to be concentrated in districts that are industrially very advanced, e.g. Kota, Kheda and Vadodara. Again some special factors are responsible for this curious situation. The canal seepage wetlands, the proliferation of irrigated agriculture and maintenance of ponds and lakes have all

contributed to the well-being of Sarus. If the situation changes and there are indications in Kota for example, that wetlands may be threatened, the future of Sarus will not be secure in these districts.

If the rate of urbanisation is considered, in the districts of Haryana it is high but in Kota, Kheda and Vadodara districts between 1971-81 there has been no increase in urbanisation. In UP except Unnao all the other districts in which Sarus occurs record only a gradual increase in urbanisation.

If the density of human population is considered, while Haryana shows a rapidly increasing density, Kota and Vadodara show a more gradual increase. Kheda surprisingly shows no increase in the density of population. In UP while Kheri and Bahraich have recorded a gradual increase, Pilibhit, Etawah and Mainpuri have recorded no increase in human density.

Now consider agriculture with which Sarus is so intimately concerned. Is the agriculture in Sarus districts 'modern' in terms of mechanisation, use of fertilizers etc.? The number of tractors per 1000 human population is as low as 1 to 3 in all states (except Haryana) in which Sarus is resident. Only in Haryana it is 7.47 per 1000 human beings. In all 'Sarus' states the consumption of plant nutrients is also low, between 6 kg (Rajasthan) and 45 kg (UP) per hectare compared to 93 kg in Punjab. The consumption of fertilizers is 50-75000 tonnes for the whole distirct in Kheda, 25-50000 tonnes in Vadodara, Pilibhit, Kheri, Bahraich and Etawah districts, 15-25000 tonnes in the

districts of Mainpuri, Rohtak and Sonipat and still lower in the other Sarus districts such as Kota, Bharatpur and Gurgaon. In all the Sarus districts the production of rice and wheat is only 1 to 3 tonnes per hectare far lower than in Punjab. One reason for the low production, especially in the districts of UP, is the high percentage of salt-affected and water-logged land in many of the districts in which Sarus occur.

On the whole Sarus appears to reside in areas where industrialisation is localised and has not led to a great increase in urbanisation and population density; where agriculture is of low intensity and not sufficiently modernised; where yields are low due probably to low consumption of fertilizers and where due to salt-affected and water-logged conditions, no large-scale investment in agriculture is made and where agriculture may be more or less practised as subsistence farming.

If the above reasoning is correct, i.e. Sarus seems to be numerous in the so-called backward areas of the country, the threats to its future become self-evident. They are: a great increase in industrialisation leading to destruction of Sarus habitat; rapid increase in urbanisation and population density; rapid modernisation of agriculture leading to uniformity of habitat, reclamation of wetlands, greater use of machinery, fertilizers and insecticides, in effect intensification of all the indices of economic development. It appears that all these factors or indices are operating with greater intensity in Haryana than in the other Sarus states. Unless special efforts are

therefore, taken to protect the habitat of Sarus, its future in Haryana will not be secure. Indeed it may already be on the retreat from that state as was the case in Punjab a score of years ago. In UP the destruction of wetlands appears to be affecting Sarus in its reproduction and may in the long-term threaten the crane. In Rajasthan and Gujerath the wetlands do not appear to be threatened immediately. Greater spread of industry and intensification of agriculture may pose a threat to the future of Sarus in these states if proper care is not taken.

One last factor that might have been instrumental in the disappearance of Sarus from Orissa, south Bihar and south MP is the lack of positive sentiments towards the crane among certain sections of the population such as the tribals. In Orissa and south Bihar the tribals are hunter-gatherers and will shoot any wild bird and animal. Such tribes also reside in certain parts of Gujerath and MP. Hunting might have been responsible for the disappearance of Sarus from these areas.

Maintenance of wetlands and well-watered areas and the positive sentiment of human population towards the ancient, epical and the largest flying bird are the prime factors that will decide the future of this magnificent avian.

Acknowledgements

Many persons helped in the work on Sarus cranes. Keen interest was shown by Dr M. K. Ranjitsinh, the then Jt. Secretary(WL), Government of India, who encouraged me to take up this research. In the fieldwork I was helped by many Crane Working Group members notably Prof R. M. Desai of Navsari,Shree Bharatsinh of Kota, Shree Sharma of Sonipat, Prof Singh of Kheri, Shri Urfi of New Delhi, Shri Ladkhedkar of Nagpur, Prof Mahajan of Kolhapur and my son Tejas and his friends. Prof Musavi and researchers from the Centre for Wildlife and Ornithology, Aligarh University and Dr Rehmani of Bombay Natural History Society also helped in the fieldwork. Prof Mahajan accompanied me in my transects in the Sarus area and helped me by identifying wetland and other flora. The late Shree Sumant Moolgaokar of TELCO, took personal interest in my work and provided a rugged vehicle which enabled me to cover extensive areas in the field.

The Chief Wildlife Wardens of Maharashtra, Orissa, Bihar, Rajasthan, M. P.and Gujerath made fieldwork in their respective areas easy and I could move in the interior areas with minimum discomfort because of their assistance.

In writing the report I was benefited by discussions with Dr George Archibald and Jim Harris, Director and Dy Director of International Crane Foundation, U. S. A. both of whom made valuable suggestions. Dr Anil Gore of the Department of Statistics, Pune University, gave useful advice on statisitical methods.

My daughter Rajas helped me put the data on the computer and then typeset and print it.

This research was sponsored by the Ministry of Environment and Forests, Government of India.

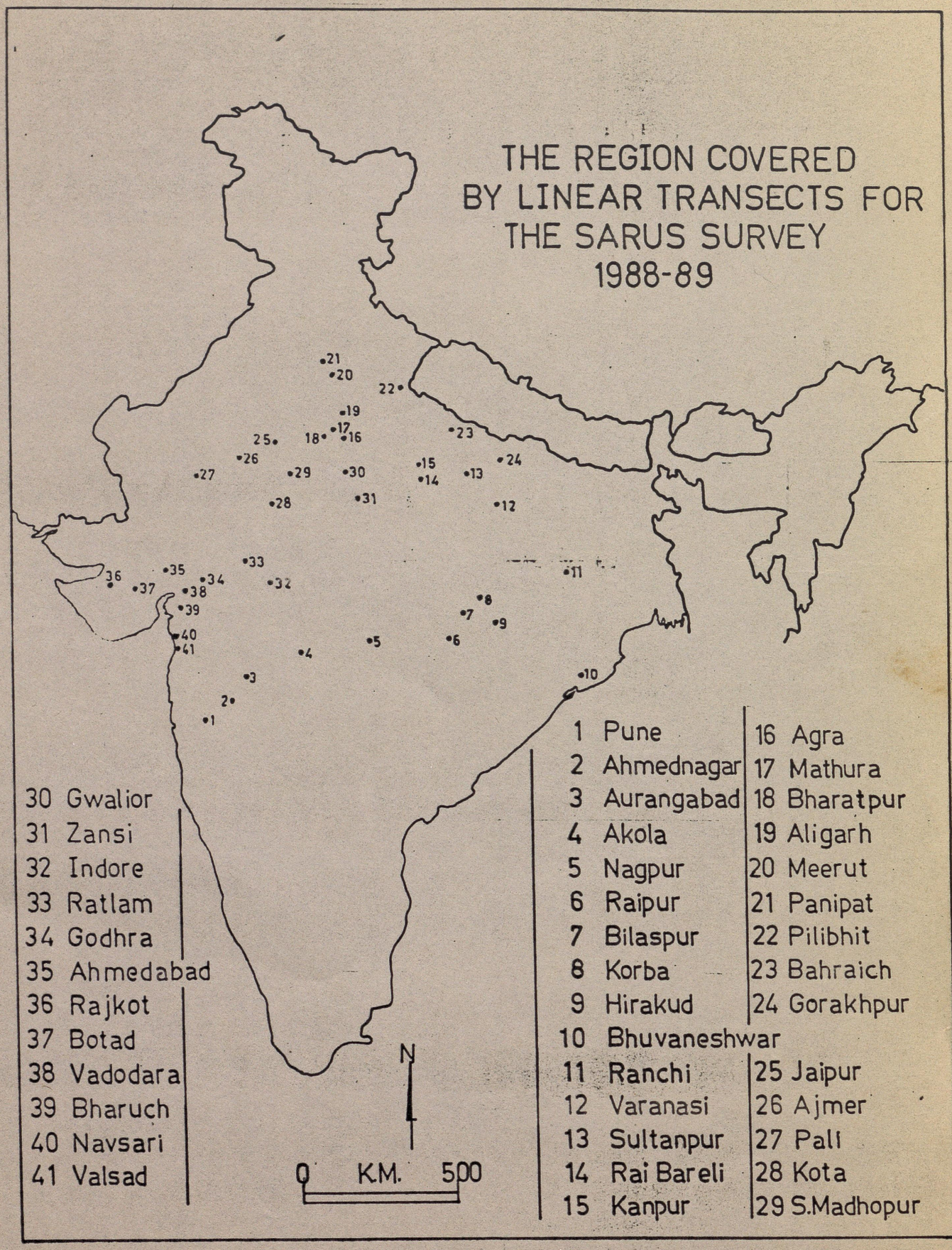
To all these persons and institutions I wish to express my sincere gratitude.

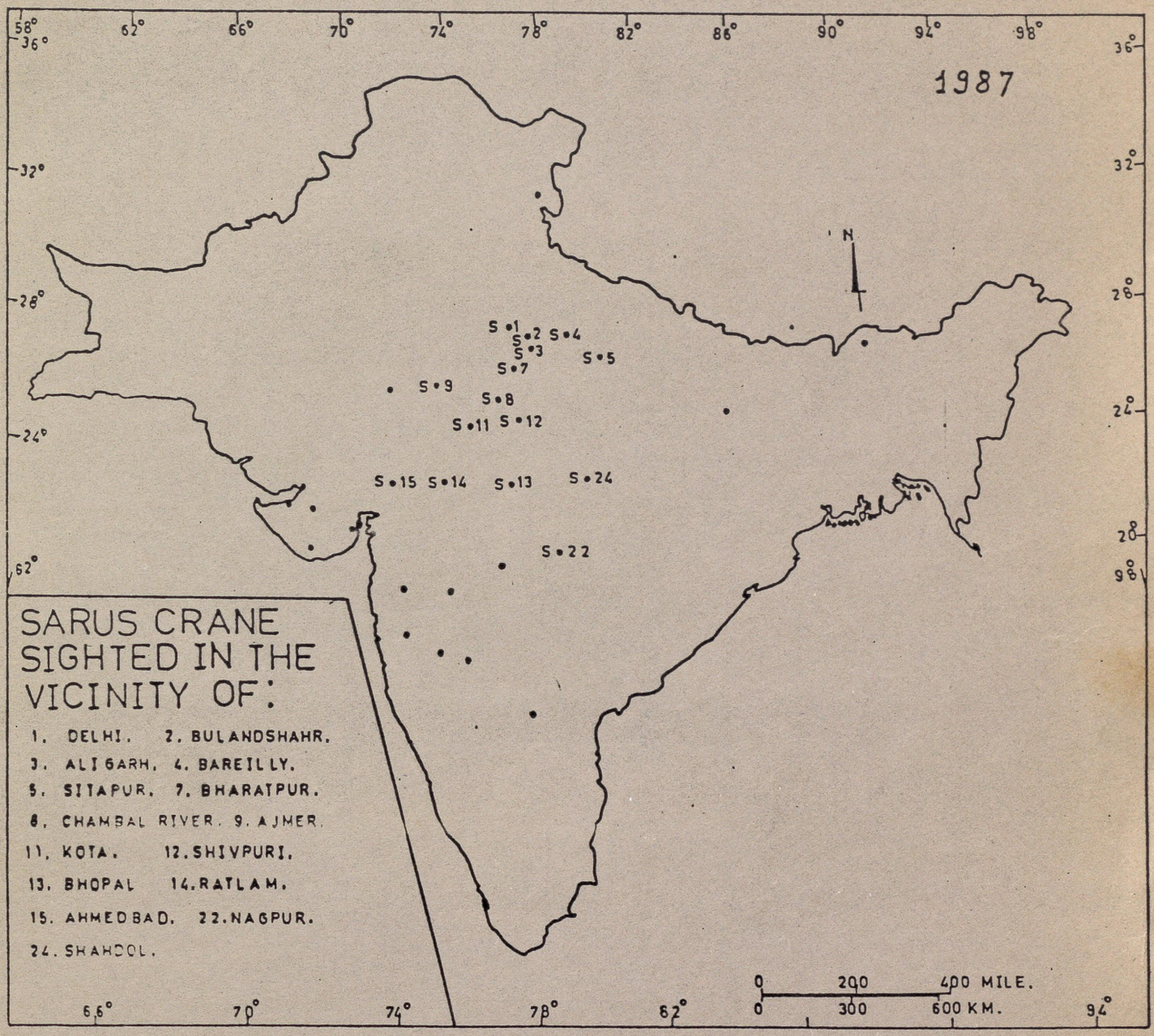
Prakash Gole.

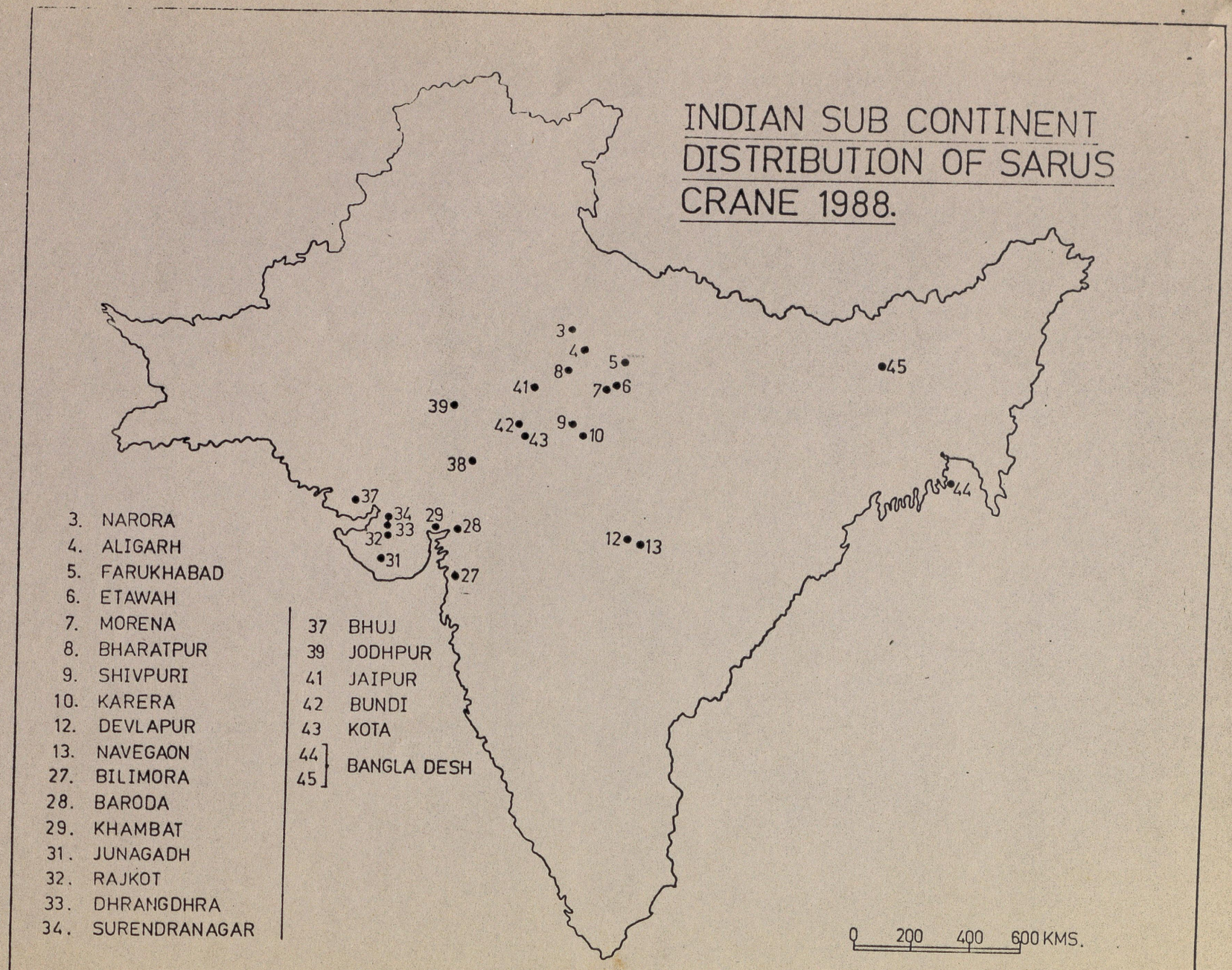
Recommendations

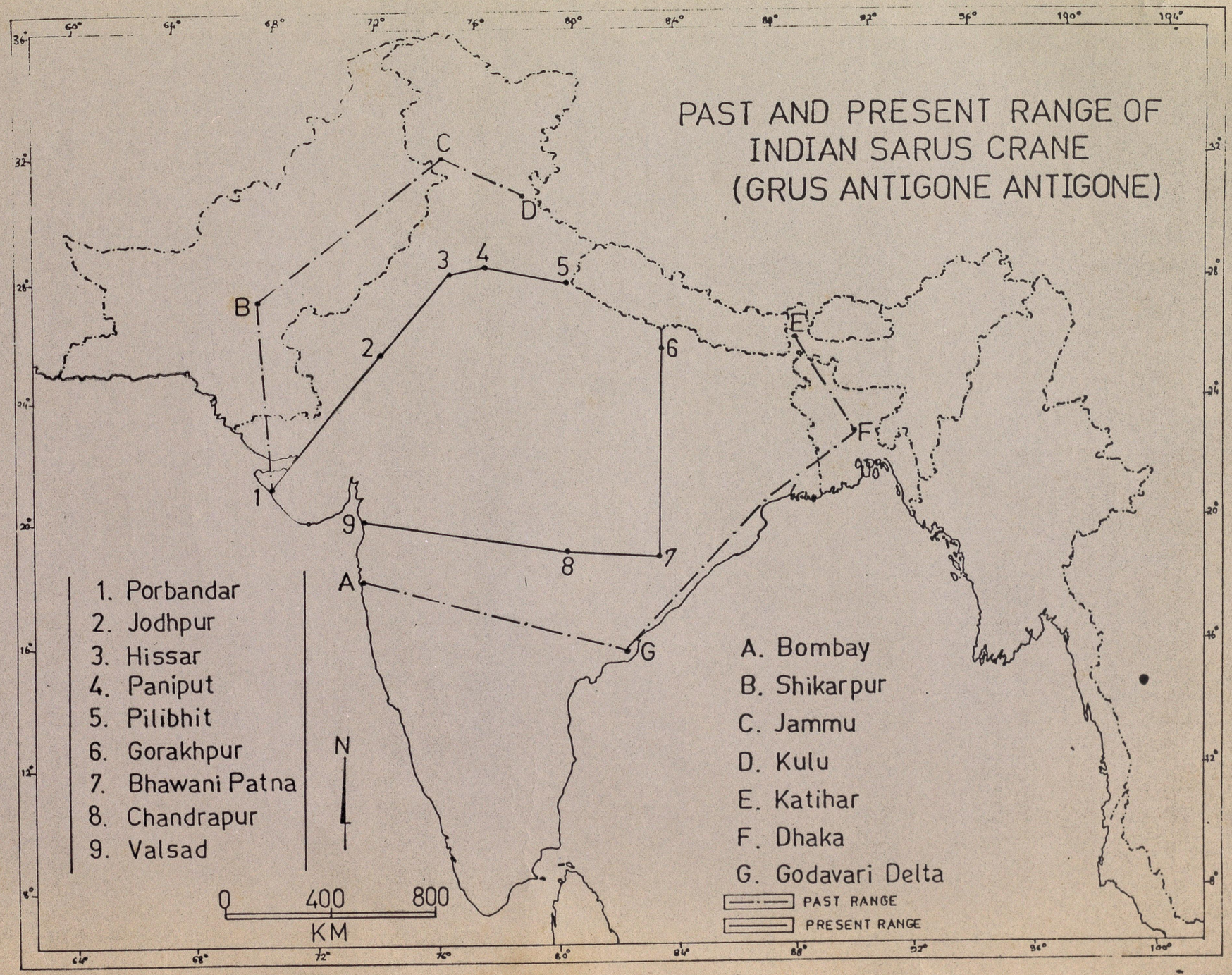
1. The survival and well-being of Sarus depends on the protection and maintenance of its wetland habitat. The major breeding areas and other wetlands identified in this study as important for the activities of Sarus should be protected. Hunting and such other disturbance in and around them should be banned and they should not be allowed to be converted to other uses such as cultivation, industry, settlement, road-building, release of effluents etc. Human activities around them need not be eliminated but should be carefully regulated.
2. This I believe, can be effectively done by making the protection of wetlands an integral part of the village development programme. I do not want to recommend the creation of sanctuaries or large reserves to protect Sarus; instead village panchayats should be encouraged to maintain village ponds and surrounding marshlands in good condition and to regulate their use. This will be far cheaper than creating and maintaining reserves, and will benefit Sarus as well as human beings. Villages that do not have village ponds should be encouraged to dig ones as water storage reservoirs. If the tank is properly used wetland vegetation will be established & there will be favourable habitat for Sarus.
3. Wetland creation, restoration and maintenance should be included in the programmes such as the 20-point programme of human welfare. From the point of view of alleviating the acute scarcity of water felt by many villages, this is a prime necessity.

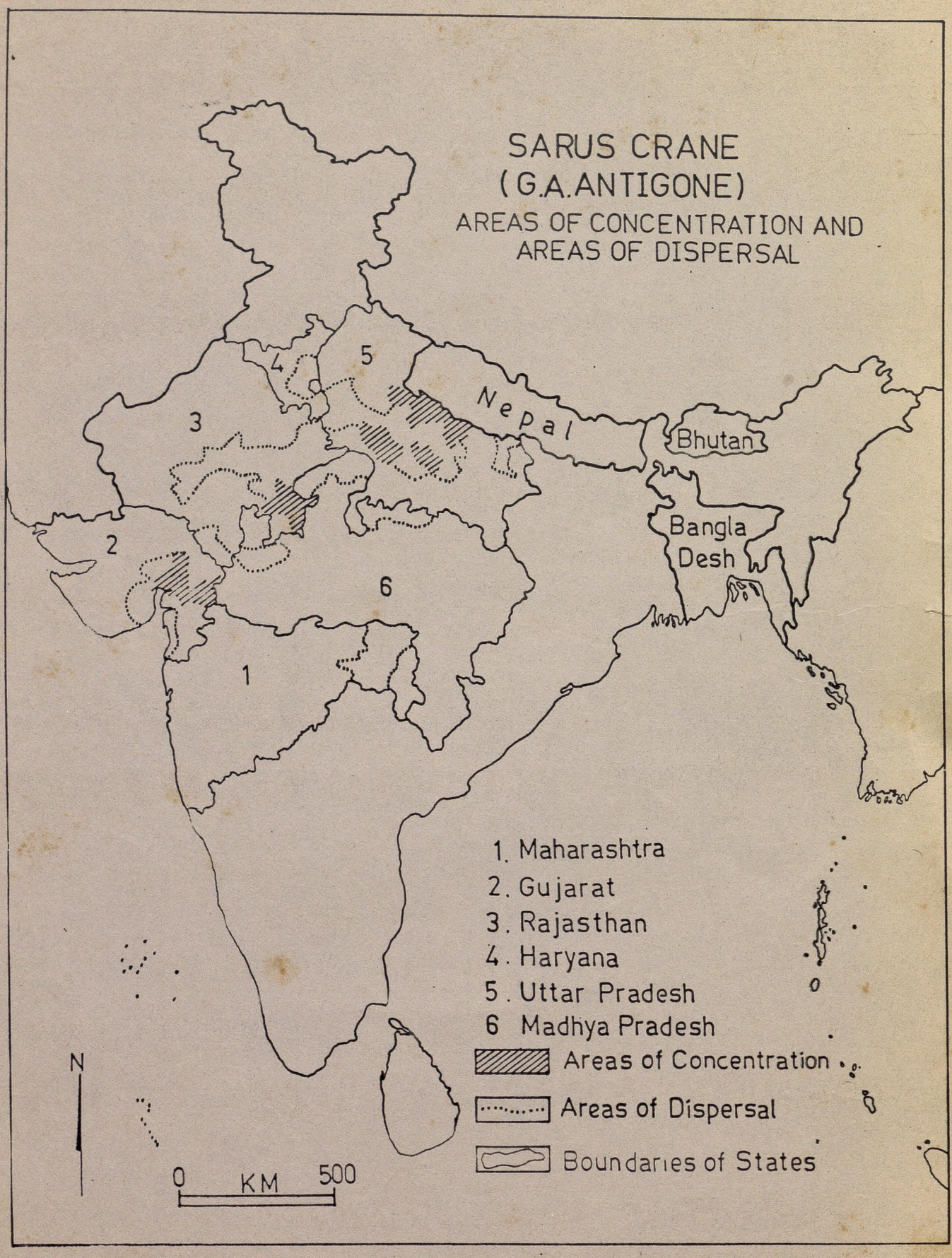
4. Educational efforts through media, school curriculum, slide shows etc. should emphasize the importance of wetlands and their flora and fauna. If the religious sentiment in favour of Sarus is being eroded, a positive sentiment can still be encouraged by appealing to people to protect the largest flying bird in the world.
5. The intensification of economic development appears to be an indirect threat to Sarus. More research in this aspect is necessary to find out the effects on Sarus of the increased use of machinery, fertilizers, insecticide, etc. in agriculture. Such research should be mounted in areas where Sarus is at present concentrated.
6. While the study and research in individual birds and their ecology are important, I would like to emphasize the necessity of regularly monitoring the numbers of such large birds as Sarus. The estimates of Sarus no.s given in the present study are tentative. To gauge the population trend study and monitoring should be carried out in sample areas in each of the 4 Sarus states every year. Sarus as an indicator species of the health of wetlands needs to be studied regularly.
7. It may not be improper to suggest the introduction of Sarus in areas from where it has recently disappeared. Again this should be entrusted to local initiative. The Wildlife Departments may encourage village students and young men's associations in villages to look after Sarus. If Sarus chicks are adopted, they will probably stay in and around the villages and eventually establish a breeding territory.


THE REGION COVERED
BY LINEAR TRANSECTS FOR
THE SARUS SURVEY
1988-89
1 Pune
2 Ahmednagar
3 Aurangabad
4 Akola
5 Nagpur
6 Raipur
7 Bilaspur
8 Korba
9 Hirakud
10 Bhuvaneshwar
11 Ranchi
12 Varanasi
13 Sultanpur
14 Rai Bareli
15 Kanpur
16 Agra
17 Mathura
18 Bharatpur
19 Aligarh
20 Meerut
21 Panipat
22 Pilibhit
23 Bahraich
24 Gorakhpur
25 Jaipur
26 Ajmer
27 Pali
28 Kota
29 S.Madhopur
30 Gwalior
31 Zansi
32 Indore
33 Ratlam
34 Godhra
35 Ahmedabad
36 Rajkot
37 Botad
38 Vadodara
39 Bharuch
40 Navsari
41 Valsad
N
0 K.M. 500


1987
N
S•1
S•2
S•3
S•4
S•5
S•7
S•9
S•8
S•11
S•12
S•15
S•14
S•13
S•24
S•22
SARUS CRANE SIGHTED IN THE VICINITY OF:
1. DELHI. 2. BULANDSHAHR.
3. ALIGARH. 4. BAREILLY.
5. SITAPUR. 7. BHARATPUR.
8. CHAMBAL RIVER. 9. AJMER.
11. KOTA. 12. SHIVPURI.
13. BHOPAL 14. RATLAM.
15. AHMEDBAD. 22. NAGPUR.
24. SHAHDOL.
0 200 400 MILE.
0 300 600 KM.


INDIAN SUB CONTINENT
DISTRIBUTION OF SARUS
CRANE 1988.
3. NARORA
4. ALIGARH
5. FARUKHABAD
6. ETAWAH
7. MORENA
8. BHARATPUR
9. SHIVPURI
10. KARERA
12. DEVLAPUR
13. NAVEGAON
27. BILIMORA
28. BARODA
29. KHAMBAT
31. JUNAGADH
32. RAJKOT
33. DHRANGDHRA
34. SURENDRANAGAR
37 BHUJ
39 JODHPUR
41 JAIPUR
42 BUNDI
43 KOTA
44 BANGLA DESH
45
0 200 400 600 KMS.


PAST AND PRESENT RANGE OF
INDIAN SARUS CRANE
(GRUS ANTIGONE ANTIGONE)
1. Porbandar
2. Jodhpur
3. Hissar
4. Paniput
5. Pilibhit
6. Gorakhpur
7. Bhawani Patna
8. Chandrapur
9. Valsad
A. Bombay
B. Shikarpur
C. Jammu
D. Kulu
E. Katihar
F. Dhaka
G. Godavari Delta
N
0 400 800
KM
PAST RANGE
PRESENT RANGE


SARUS CRANE
(G.A.ANTIGONE)
AREAS OF CONCENTRATION AND
AREAS OF DISPERSAL
Nepal
Bhutan
Bangla
Desh
1
2
3
4
5
6
1. Maharashtra
2. Gujarat
3. Rajasthan
4. Haryana
5. Uttar Pradesh
6 Madhya Pradesh
Areas of Concentration
Areas of Dispersal
Boundaries of States
N
0 KM 500

Notes And References

Page 2

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Page 3

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Page 5

* Since 1987 IWRB(International Waterfowl & Wetlands Research Bureau) is sponsoring an Asian Waterfowl Count in winter in many Asian countries. In India the work is coordinated by BNHS & Ecological Society. 1987 and 1988 reports are published.

P. 13

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THE STATUS AND ECOLOGICAL REQUIREMENTS OF SARUS CRANE

PHASE II

PRAKASH GOLE



SPONSORED BY
MINISTRY OF ENVIRONMENT & FORESTS, GOVERNMENT OF INDIA.

THE STATUS AND ECOLOGICAL REQUIREMENTS OF SARUS CRANE

PHASE II

PRAKASH GOLE



SPONSORED BY
MINISTRY OF ENVIRONMENT & FORESTS, GOVERNMENT OF INDIA.

THE ABSTRACT

Name of the Principal Investigator	Shree Prakash Gole
Date of Start	1st November 1989
Staff	
Research Assistant	One
Research Scientist	None
TA/LA	None
Driver/Watchman	None
Title of the Project	An Investigation into the Status & Ecological Requirements of Sarus Crane (Grus antigone) Phase II
Sanctioned Amount	Rs. 45,300/-
Objectives of the Project	1. To prepare a map of the present range of Sarus based on field-work. 2. To identify areas that need protection 3. To gain knowledge of the ecological requirements of Sarus 4. To record information about other cranes occurring in India. 5. To record information on some rare storks occurring in India.
Area of Work	Map of the area is enclosed.

Results of Practical Importance

1. Sarus Crane (both sub-species) has disappeared as a resident bird from regions east of Bihar.
2. In the east, in particular in the Brahmaputra, valley, extensive wetland habitat however, is available for its rehabilitation.
3. Its rehabilitation will be successful if conscious efforts are made to develop positive sentiments towards waterfowl among the people of this area.
4. The condition and numbers of Blacknecked Stork are precarious in India. Its breeding habitat is threatened. Strict protection and ban on the trade in this species are essential for its survival.
5. Both the Adjutant storks are now confined to the Brahmaputra valley. Their numbers need to be closely monitored.
6. A few pairs of the rare Blacknecked Crane are rediscovered to be wintering in India.

Results of Academic Importance

1. The eastern part of India is excluded from the range of the distribution of Sarus crane.
2. Wetlands of eastern India are greatly threatened by the spread of weeds such as Eichhornia crassipes.
3. The Brahmaputra valley provides refuge to a concentration of the endangered Anser indicus second only to that found in Rajasthan.
4. Anthocephalus kadamba and Bombax ceiba are the trees that need to be looked after and protected as useful to rare, large birds such the Blacknecked and Adjutant storks.
5. The benigh Buddhist culture appears to be essential for the survival of the rare Blacknecked Crane in India.

RECOMMENDATIONS

1. Sarus Crane has disappeared from the eastern part of India. But extensive and breeding and foraging habitat exists in the Brahmaputra valley for its rehabilitation. A programme to rehabilitate both the sub-species of Sarus should therefore, be undertaken immediately. Latest captive-breeding & isolation-rearing techniques should be used. An outline of the programme is included in the report.

2. As the success of the programme depends upon the favourable sentiments of the population towards waterfowl, it is necessary to mount an educational campaign through media, posters, talks, slide-shows etc. to make people aware of the importance of waterfowl in general and Sarus crane in particular.

3. It is necessary to conserve wetland habitats in the Brahmaputra valley. Their water-table, inflows and outflows, their vegetation and animal life and birds should be studied and an action plan made to control weeds, human encroachment, grazing and other biotic factors with a view to reconcile the interests of wildlife and human beings.

4. The Wildlife Department of Assam should identify sites critically important for Adjutant storks outside protected areas and develop a plan to conserve them in collaboration with NGOs. Their numbers should be monitored carefully at the time of the waterfowl count.

5. The endangered Barheaded Goose (Anser indicus) should be given full protection in Assam as the Brahmaputra valley harbours a significant wintering population of this goose.

6. The rare Blacknecked Crane (Grus nigricollis) is found to be wintering once again in India. Its wintering habitat in the Sangti and adjacent valleys (Lat. 27-26 N and Long.93-18 E) in Arunachal Pradesh should be fully protected.

ACKNOWLEDGEMENTS

1. I am grateful to the Ministry of Environment & Forests for sponsoring this research.

2. The Chief Wildlife Wardens of Gujerath, M. P., U. P., Bihar and Assam and the Conservator of Forests, Udaipur, Tripura, assisted in the field-work by providing letters to their staff. I gratefully acknowledge their help.

3. I am very grateful to the Commanders of Indian Army units stationed in the border and other sensitive areas for facilitating movements in those parts.

4. I am grateful to Ramesh Ladkhedkar, Admiral Awati (Retd.), Prof. S. D. Mahajan and other members of the India Crane Working Group for helping me during the field-work and providing help and advice whenever called for.

5. Special thanks are due to Dr P. C. Bhattacharjee and Prasanta Saikia of Animal Ecology Laboratory of Gauhati University for their assistance in Assam.

6. This search for rare birds would not have been possible without ready cooperation and help from various local people too numerous to be mentioned here. I am grateful to all of them.

Prakash Gole.

THE STATUS AND ECOLOGICAL REQUIREMENTS OF SARUS CRANE

(Grus antigone)

Phase Two

Introduction

Phase II of the Sarus Project is concerned with the status and ecological requirements of the Sarus, especially the Eastern or Burmese Sarus (Grus antigone sharpii) in India. In this phase the eastern region of India was covered with a view to ascertain the status of Sarus. During the course of my travels to study Sarus, I was also asked to observe other endangered species such as Blacknecked Stork (Ephippiorhynchus asiaticus) and Greater and Lesser adjutants (Leptoptilos dubius and javanicus). A part of the present report is devoted to my observations of these birds.

The Eastern Sarus

The sub-species 'sharpii' was first described by Blanford in 1895 in the Bulletin of British Ornithologists' Club Vol V, page vii. Previous to this description all Sarus were deemed to belong to Grus antigone. (Oates and Blanford 1899).

Let us see how and to what extent the sub-species sharpii differs from the nominate form. The main points of difference between the two are the overall smaller size of sharpii and absence of white feathers on its neck (the white neck-band), giving it a uniform grey visage.

According to Blanford the Eastern or Burmese Sarus occurred from the plains of Burma through Siam (now Thailand) to Cochin China (now Vietnam). (Oates & Blanford ibid). Formerly Sarus was

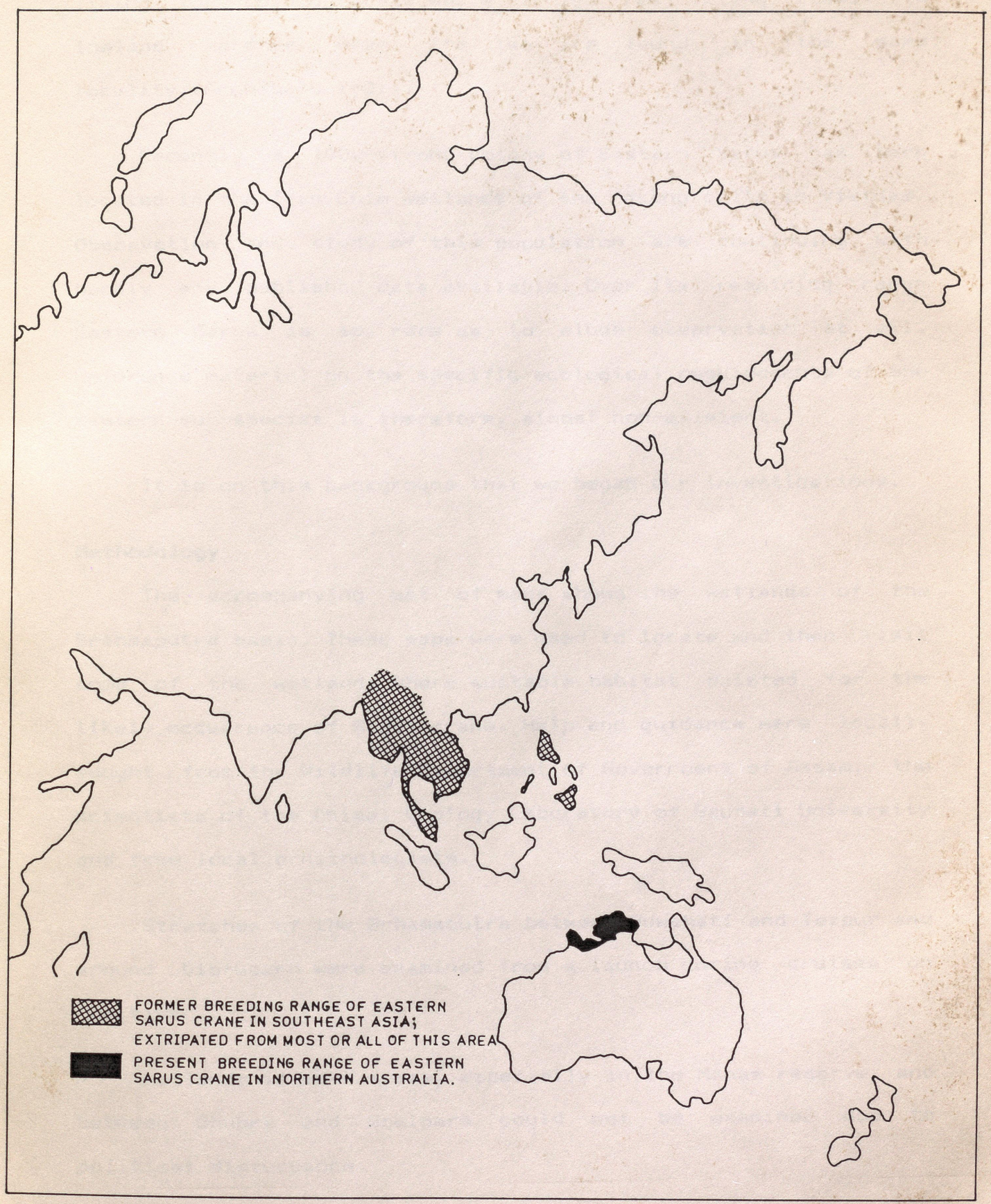
reported from Philippines also (Madsen K. 1981). It was probably the Eastern Sarus which was resident in those islands. The present distribution of Eastern Sarus is shown in the map on the next page. Eastern Sarus is now numerous in northern Australia (about 800 cranes in 1988) where it is breeding successfully and even inter-breeding with the Brolga (Grus rubicundus), i.e.the resident Australian crane. (Archibald G. 1985). It was first discovered from Australia in the fifties. Recently a 1000 strong colony was discovered in the Tram Chim Nature Reserve in the Mekong Delta in Vietnam.(Gnaedinger R. 1989). There are no recent reports from Burma and a search for Sarus in Philippines in recent years produced negative results. From Thailand it had disappeared and a reintroduction programme is under way in that country.

Observers did see Sarus in east India during the last century. A book published in 1841 included Grus arcuatus in the list of birds occurring in Assam.(Robinson W. 1841). As subspecies of Sarus were not described then, it is not clear whether the author observed G. a. sharpii or G. a. antigone. Oates and Blanford stated that Hume once saw several Sarus in Manipur which they believed, probably were sharpii. After Hume no other observer seems to have mentioned the occurrence of cranes in eastern India till Stuart Baker's revised Fauna of British India (Birds). Baker noted that eggs of sharpii were collected from a nest near Margherita, a town near Burmese border in the far east of Assam.(Baker S. 1929). The evidence was probably enough to make sharpii a resident bird of India.

Again I could not find any mention of the occurrence of

sharpii within Indian limits after Stuart Baker. In Vol II of their Handbook of the Birds of India, Pakistan, Bangla Desh and Sri Lanka, Ali and Ripley also grant sharpii the status of a resident bird of India. This apparently was based on Stuart Baker's discovery of a nest within Indian limits, for the two authors do not provide additional evidence to substantiate their claim.

Though the two sub-species are dissimilar in such important respects, it is believed that their ecological requirements are similar. Indeed in describing breeding biology, habitat requirements etc. many authors have treated Sarus as a single species. Paul Johnsgaard in his cranes of the World does not treat Eastern Sarus separately though the two sub-species now occupy two completely different ecological zones, viz. G. a. antigone remaining confined to the Indian sub-continent while G. a. sharpii colonising northern Australia.(Johnsgaard 1983). Though Ali and Ripley treat the sub-species separately, they provide little information on how the two sub-species differ in their ecology.I am not aware of any study of the Sarus in Australia apart from Dr Archibald's articles describing Sarolga, the product of inter-breeding between Sarus and Brolga and narrating his efforts to collect eggs from Sarus nests. (Archibald G. 1981 and 1985). Apparently Sarus in Australia occupies the same habitat preferred also by Brolga. It successfully competes with the latter being larger in size and the mating is also successful as the two species are genetically similar. The only difference noted by Archibald was sharpii's


FORMER BREEDING RANGE OF EASTERN SARUS CRANE IN SOUTHEAST ASIA; EXTRIPATED FROM MOST OR ALL OF THIS AREA
PRESENT BREEDING RANGE OF EASTERN SARUS CRANE IN NORTHERN AUSTRALIA.

liking for upland areas while Brolga restricting itself to lowland marshes when the two are found in the same locality.(Archibald 1981).

Recently a 1000-strong colony of Eastern Sarus has been located in the Tram Chim wetlands of the Mekong delta in Vietnam. Observation and study of this population are continuing with hardly any published data available. Over its remaining range Eastern Sarus is so rare as to elude observation at all. Reference material on the specific ecological requirements of the eastern sub-species is therefore, almost non-existent.

It is on this background that we began our investigations.

Methodology

The accompanying set of maps shows the wetlands of the Brahmaputra basin. These maps were used to locate and then visit some of the wetlands where suitable habitat existed for the likely occurrence of Sarus crane. Help and guidance were locally sought from the Wildlife Department of Government of Assam, the scientists of the Animal Ecology Laboratory of Gauhati University and from local ornithologists.

Stretches of the Brhamaputra between Guwahati and Tezpur and around Dibrugarh were examined from a launch during cruises on the river.

Wetlands in some areas, especially in the Manas reserve and between Dhubri and Goalpara could not be examined due to political disturbance.

To locate Greater Adjutant storks (Leptoptilos dubius) garbage dumps and other likely areas were visited. On the basis of information provided by local ornithologists, the storks' nesting and roosting areas within cities and in the reserves were examined. Likewise information about the recent sightings of Blacknecked Stork (Ephippiorhynchus asiaticus) was obtained from local scientists and those areas were visited.

In addition, the kind help extended by Indian army made it possible for us to visit certain inner line areas where the possibility of finding the rare Blacknecked Crane (Grus nigricollis) wintering within Indian limits existed.

The recent report of the occurrence of Sarus crane in Tripura was examined by visiting the state and investigating the wetlands from where Sarus was reported. Our plans to visit wetlands in north Cachar and Manipur were not successful as we were advised against going there by the authorities.

While looking for cranes, storks and other birds, botanical observations were also made on the wetlands and their surroundings.Plants from the wintering areas of Blacknecked crane and the faeces of the crane were collected for laboratory analysis.

The Field-work

Except the flood plain of the Brahmaputra, the eastern part of India (beyond Bangla Desh), is a hilly land. At one time extensive marshlands bordered the river in many places overran by reeds and cane. The old Gazetteers of Assam record impenetrable tracts of jungle and reedbeds in which all sorts of small and big

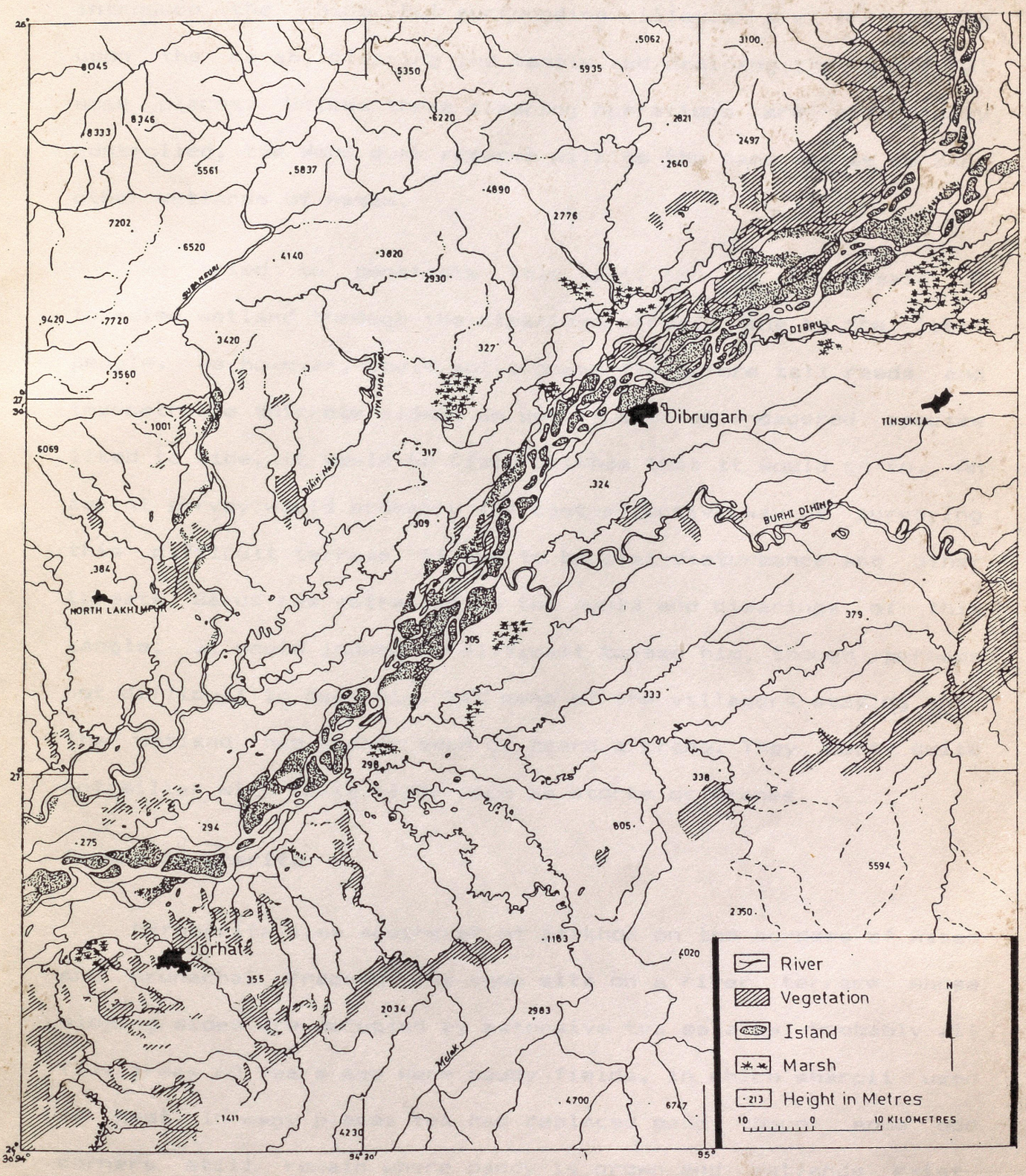
animals and birds were plentiful. Among the bigger animals tiger, rhinoceros, elephant, leopard, wild boar, sambar, cheetal etc. were mentioned and wild birds included wild ducks and geese, junglefowl, partridges, quails, plovers, floricans, herons etc. I could find no mention of cranes except in the district of Eastern Duars bordered by the Sankosh river on the west and the Manas river on the east. Today cultivation has been extended to most of the areas which were formerly marshes. Yet at many places excellent waterfowl habitat is still to be found. Field investigations were therefore, carried out in the plain areas of Assam, in particular the flood plain of the great river. The accompanying set of maps show the major wetland areas along the Brahmaputra and in the interior.

Investigating the Wetlands of Assam

The last authentic report of the occurrence of Grus antigone sharpii or the Eastern or Burmese Sarus came from Margherita (Lat. 27° 17″ N and Long. 95° 40″ E) not far away from Digboi, the famous oil town of Assam. We therefore, begin our investigation from the far eastern limit of Assam where the great river enters the province between Sadiya and Saikhoa Ghat. (See map).

The Marsh of Dibru-Saikhoa

Northeast of Dibrugarh the road goes as far as the Saikhoa Ghat on the southern fringe of this great marsh.These extensive and almost impenetrable tangle of phragmites, cane and saccharum interspersed with wet meadows and sheltered pools surrounded by tall evergreen trees, is recognised as the last refuge of the endangered White-winged Wood Duck (Cairina scutulata). Here a



Dibrugarh
TINSUKIA
NORTH LAKHIMPUR
Jorhat
DIBRU
BURHI DIHING
River
Vegetation
Island
Marsh
Height in Metres
10 0 10 KILOMETRES
N

properly constituted reserve for this endangered species is on the anvil.Elephants and tigers also occur and there are plans to introduce the rhino. But surrounding villages are encroaching upon the marsh, clearing the tangle and draining the water at some places. Unless these clearing operations are effectively controlled, the Wood duck reserve will go the same way as do many other wetlands of Assam.

We tried to penetrate this vast, 650 sq km mosaic of forested wetland through the clearings already made by the local people. We however, could not proceed far before tall reeds and impenetrable thickets closed on us. If ever an endagered species liked to hide, it would be Dibru-Saikhoa that it would go to. An aerial survey would probably the cost-effective way of surveying this difficult terrain. If due to habitat-disturbance and other threats Sarus has retreated to the pools and clearings of this tangle, it would indeed be difficult to see him, though perhaps not difficult to hear him. Yet none of the villagers staying near the wetland had either seen or heard a crane. They were quite unfamiliar with large birds such as storks or cranes.

Around Margherita

Margherita lies southeast of Saikhoa on the borders of Assam and Arunachal Pradesh. The town sits on a river terrace whose sloping sides are occupied by extensive tea estates. Probably all flat areas 60 years ago were paddy fields, in which sharpii used to nest. In many places tea has replaced paddy though some odd corners still remain where paddy is grown and wetlands exist.

Sarus however, has ceased to breed or visit this area.

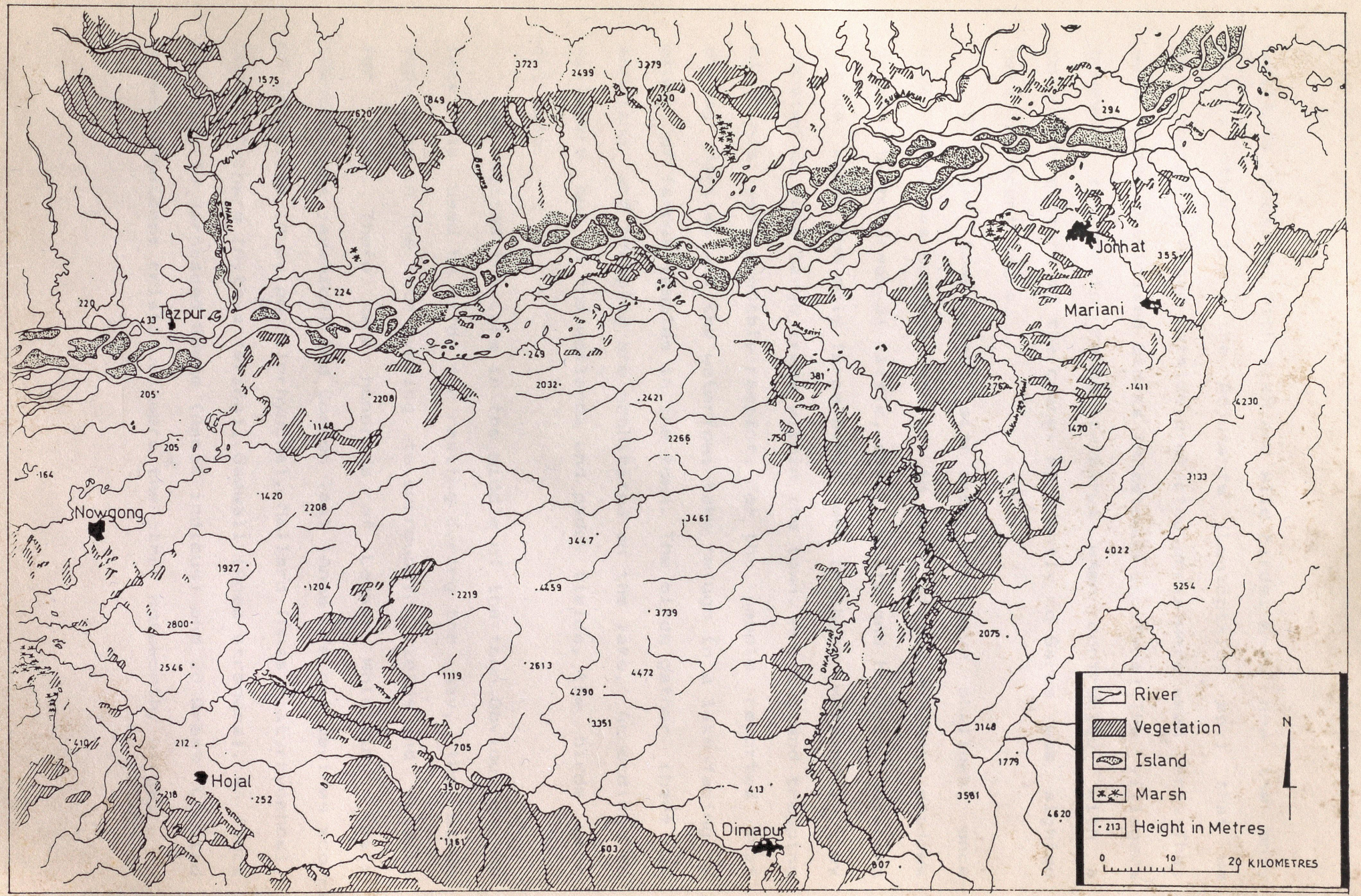
Wetlands around Dibrugarh

The Brahmaputra is probably at its widest near Dibrugarh, its two banks almost 8 kms across. The river has practically devoured all flat land and deposited loads of silt to create sandy islands in its course. Above the river the land slopes upwards towards the hills. These uplands are all occupied by tea estates. There are therefore, no wetlands around Dibrugarh except the river basin itself. The islands in the river provide refuge to birds such as Brahminy Duck (Tadorna ferruginea), Large Cormorant (Phalacrocorax carbo), River Terns (Sterna aurentia) and Spotbilled Ducks (Anas poecilorhyncha). 2000-2500 strong flocks of T. ferruginea were observed on some of these islands. A few islands were either grassy or covered with phragmites.

On the north bank we could examine a promising wetland near Dhemaji town. Tall phragmites covered parts of this wetland while sedges such as scirpus grew all over. We could observe egrets and Purple Moorhen (Porphyrio porphyrio) in flocks while teals (anas crecca) flew overhead. No crane was to be found.

Wetlands between Dibrugarh and Sibsagar

Tea estates and paddy fields alternate as one travels south from Dibrugarh towards Sibsagar. While tea estates occupy uplands, shallows on both sides of the road are either wet meadows or paddy fields that stretch right upto the horizon. When the pressure of population was low, these shallows must be


Tezpur
Nowgong
Hojal
Dimapur
Jorhat
Mariani
River
Vegetation
Island
Marsh
Height in Metres
N
0
10
20 KILOMETRES

wetlands teeming with fish and wild birds. Even now the only storks other than the Adjutants (Leptoptilos sp.) that we encountered in Assam outside protected areas were seen here. They were a few Openbilled Storks (Anastomus oscitans).The villagers however, failed to recognize Sarus when confronted with a coloured picture of the crane. Apparently no Sarus was sighted here in recent years.

Sibsagar town itself sits among extensive shallows, once great wetlands but now reduced to paddy fields and wet meadows grazed by hundreds of cattle, sheep, goats and horses. Adjutant storks were the only large birds seen in these wetlands. They roosted on some large trees within the town. Hunting and trapping of birds was probably rampant. For the people reported that during daytime all the waterfowl take refuge in a lake facing a group of famous temples in the town. The birds gather there as shooting and trapping are prohibited on the lake. According to villagers out in the wetlands and paddy fields, the birds were not safe.

We visited the lake in the middle of the town.Obviously the lake was used by birds for resting during the day, the birds departing in the late evening to surrounding fields and meadows for food. There were hundreds of Lesser Whistling Teals (Dendrocygna javanica) and Common Teal (Anas crecca) besides scores of Spotbills (Anas poecilorhyncha), Mallard (Anas platyrhynchos), Common Pochard (Aythya ferina), Gadwall (Anas strepera). A flock of about 30 Barheaded Geese (Anser indicus) and 20 Great Crested Grebes (Podiceps cristatus) were the other noteworthy birds.

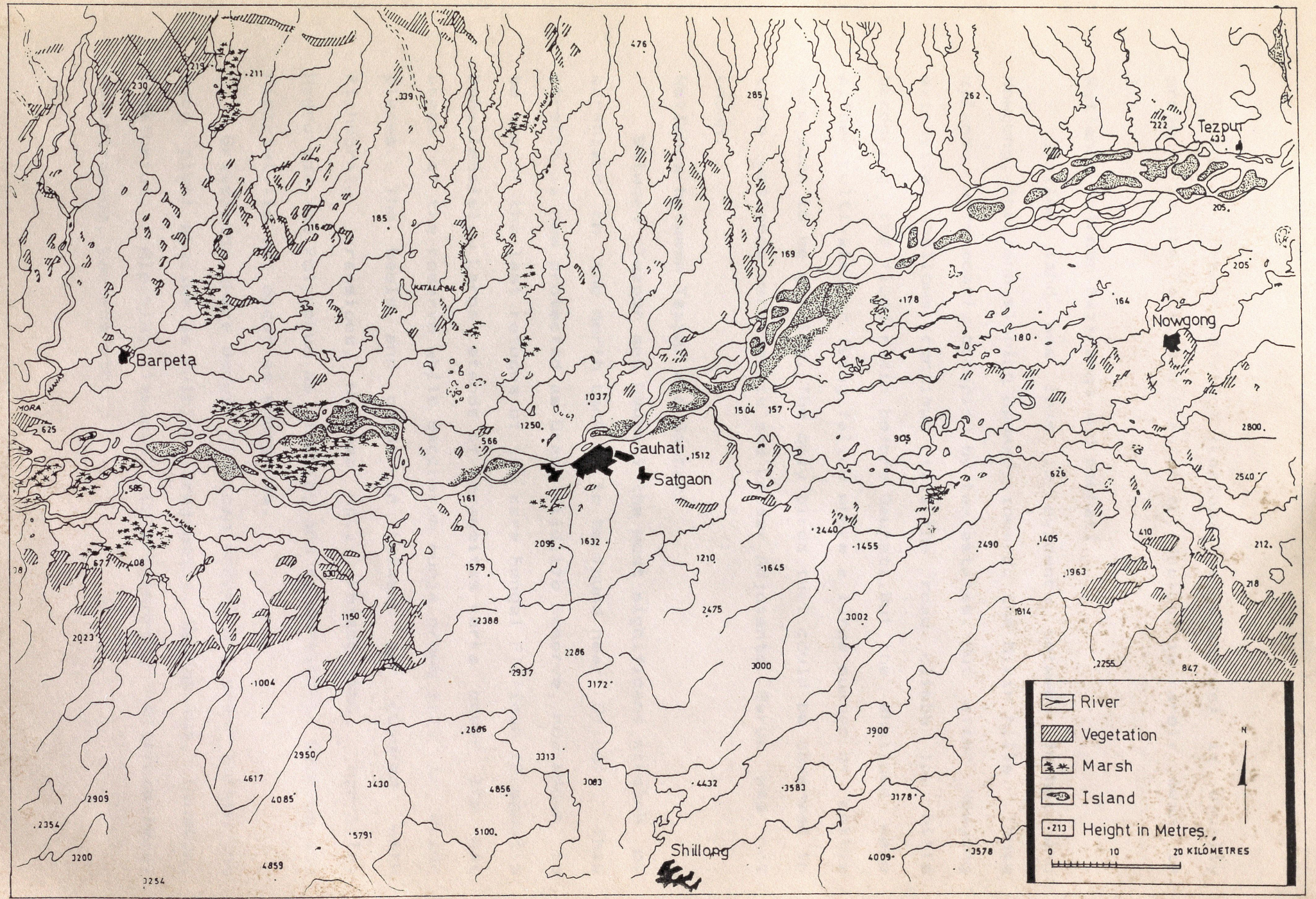
Between Sibsagar and Jorhat also there were extensive shallows but now converted to meadows and paddy fields in which thousands of cattle were grazing. Besides egrets and cormorants we could notice no other bird. Sarus was unknown to local people.

Wetlands between Tezpur and North Lakhimpur

In this region on the north bank of the river also, shallow areas occur on both sides of the road. Most of the shallows were converted to paddy cultivation. But in this region, the people did not appear to take the rabi crop. As such the fields were lying fallow. These wet, fallow fields provided excellent habitat for waterfowl. But large parts of these wetlands were found to be covered by Eichhornia. After Narayanpur Eichhornia was less evident yet we did not see waterfowl except egrets.

Wetlands of Kaziranga National Park

According to Park authorities Sarus has not been recorded in Kaziranga though beels and extensive wet meadows provide excellent habitat. The protection that the park affords makes it possible for large birds such as Blacknecked (Ephippiorhynchus asiaticus) and Openbill (Anastomus oscitans) storks and Barheaded Geese (Anser indicus) to stay on in the Park and the rare Spottedbilled Pelican (Pelecanus philippensis) to breed in it. It would not be wrong to say that the Park holds the largest wintering population of the endangered Anser indicus in east India.


Tezpur
Nowgong
Barpeta
Gauhati
Satgaon
Shillong
River
Vegetation
Marsh
Island
Height in Metres
N
0 10 20 KILOMETRES

Though Lesser Adjutant (Leptoptilos javanicus) is usually present in the Park, the Greater (L. dubius) is rarely seen in it.

Wetlands between Kaziranga and Gauhati

Shallow land was less in evidence between Jorhat and Nowgong, the land sloping upwards towards the Mikir hills. Those uplands were mostly occupied by tea estates. But after Nowgong extensive shallows continue till the road climbs low hills bordering the flood plain before Gauhati.But the shallows were either cultivated or lying fallow where a large number of cattle were seen to be grazing. The only birds that could be observed in those wetlands were egrets and Lesser Adjutants. Sarus was not known.

Wetlands between Tezpur and Gauhati

Between Tezpur and Gauhati the most significant stretch of marshland on the north bank is to be found near Silbori. This stretch is now protected as Orang Wildlife Reserve, now known to be one of the last refuges of the rare Bengal Florican (Eupodotis bengalensis). Large stands of Phragmites karka cover the wet areas of the reserve while Saccharum munja grows tall in drier places. The beels and ponds in between are covered with Eichhornia crassipes, Nymphea sp., Potamogeton, Hydrilla, Hygroryza and Polygonum as floating and submersibles. Cyperus and Fimbristylis sp. occur as emergents.

Grasslands where Bengal Florican occurs are drier harbouring such plant species as Eulalea, Eragrostis, Sporobolus, Cynodon, Eupatorium, Alpinia, Tamarix, Chlerodendron, Alternanthera, Heliotropium, Lantana etc.

The reserve provides nesting habitat for Spottedbilled Pelican and Lesser Adjutant Storks. Blacknecked and Openbilled Storks have occurred while Black Stork (Ciconia nigra) is a winter visitor. In 1988 Demoiselle Cranes were seen in Orang (Choudhury 1990) though Sarus is not known.

Wetlands west of Gauhati

We examined certain wetlands northwest and west of Gauhati. Around Gauhati brick-making activities are widespread and brickmaking plants were observed on all the wetlands examined. Eichhornia crassipes was in profuse growth almost choking the wetlands in many parts.Grazing and removal of grasses and sedges were the other activities extensively carried out on the wetlands. Through another wetland, viz Dipor beel, a railway line has been planned. This has prompted outsiders to encroach upon the surrounding land. Local people were opposing the plans as it would, according to them, disturb the ecology of the wetland beyond repair.

Lesser Adjutants were observed in some strength on all the wetlands around Gauhati. Egrets, Little Cormorants (Phalacrocorax niger), a few Grey (Ardea cinerea) and Purple Herons (Ardea purpurea), Pied (Circus melanoleucos) and Marsh Harrier (Circus aeruginosus) and Bronzewinged Jacanas (Metopidius indicus) were the other birds noted on these wetlands. Ducks and waders were conspicuously absent. Probably they spent the day on the Brahmaputra nearby.

The Course of the Brahmaputra

To ascertain the nature of habitats in and around the river, we carried out cruises upstream and downstream of Gauhati and Dibrugarh. Islands of silt obstruct the river flow everywhere with the river meandering through several channels around them. Some of the islands are under cultivation, while the largest, Majauli, has permanent settlements on it. The channels of the river are shallow, the depth varying between 1 and 2.5 meters.

The islands have created sheltered pools and bays, mudflats and sandspits, and grassy areas all of which are used by waterfowl. During daytime thousands of migratory ducks were seen resting in sheltered pools and bays. They included Pintail (Anas acuta), Common Teal (A. crecca), Mallard (A. platyrhynchos) and Gadwall (A. strepera). Spotbills (A. poecilorhyncha) were also present in good numbers. Huge concentrations of Lesser Whistling Teal (Dendrocygna javanica) rested in the main channel of the river. Brahminy Duck (Tadorna ferruginea) were also numerous, though only a few small flocks of Barheaded Geese (Anser indicus) were noticed. Waders were few and large birds like Grey Heron (Ardea cinerea) were sparse. Lesser and Greater (Leptptilos javanicus and dubius)Adjutants were seen occasionally.

Ducks and geese were seen on the stretches of the river between Goalpara and Gauhati and Gauhati and Tezpur. Near Dibrugarh Terns, Cormorants, Herons and a few waders only were evident. Freshwater Dolphins were met with on all the stretches

of the river that we examined.

Fishing activity and cultivation in February and March were not seen on a scale that would seriously disturb the birds.

Some observers have noted the occurrence of Demoiselle and Common cranes (Anthropoides virgo and Grus grus) on islands in the river (Bhattacharjee and Chaudhury 1990) but Sarus remains unknown.

Wetlands of Tripura

The most recent report of the occurrence of Sarus in the eastern states comes from the state of Tripura. It is claimed that Sarus was seen during the winter waterfowl count of 1989 though its report does not find mention in the Asian Waterfowl Count 1989 published by International Waterfowl and Wetlands Research Bureau England. The number of Sarus seen and the exact location where they were seen could not be ascertained till we reached the area itself, south of Agartala, the capital of the state.

When we met the Chief Wildlife Warden of the state and asked him about the occurrence of Sarus, he too was unable to state the number and exact location. He however, directed us to certain wetlands which according to him, offered a good waterfowl habitat.

Low hills and undulating landscape characterize much of Tripura. Flat land is to be found in valleys carved out by streams and rivers. Much of it is paddy cultivation as in many places 3 paddy crops are grown. As in Assam extensive tracts of

land lying fallow were therefore, not to be seen.

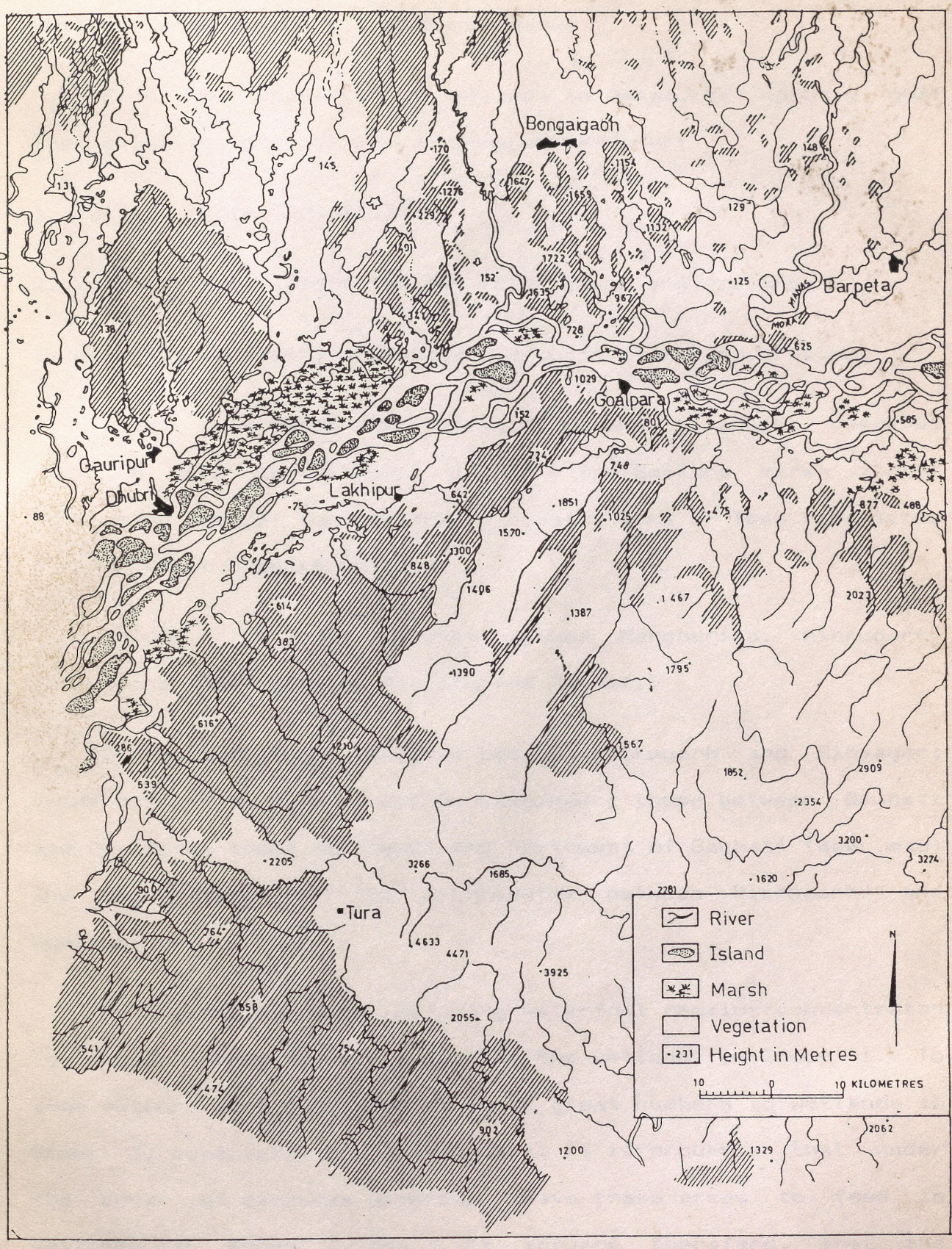
Some of the wetlands that the Chief Wildlife Warden asked us to examine turned out to be village ponds surrounded by dense habitation where not a single bird could be seen as there was absolutely no suitable habitat for them (Amarpur, Udaipur towns). Some lakes surrounded by gardens and away from dense habitation provided refuge for flocks of Lesser Whistling Teal (Dendrocygna javanica) as in Agartala and Sipahi jhala. A big shallow lake south of Agartala with a picturesque lake palace had good aquatic vegetation but except a few Grey Herons (Ardea cinerea) and Openbill Storks (Anastomus oscitans) no other waterfowl could be seen. Heavy fishing pressure was probably the cause of the absence of birds. Openbill storks, Greyheaded Lapwings (Vanellus cinereus) and a few waders such as the Eastern Golden Plover (Pluvialis dominica) were the only birds seen in paddy fields. The villagers when shown the photograph of Sarus could not recognize the bird.

On further enquiries we learnt the Conservator of Forests at Udaipur knew about the occurrence of Sarus. When contacted he directed us to Kakadbandh about 16 kms west of Udaipur. On the way whenever we found flat land covered with paddy we stopped to enquire and to show Sarus photographs to local people to help them identify the crane correctly.

A kilometer before Kakadbandh we met Shri Sarkar, a teacher in the primary school. He appeared to recognize Sarus which, according to him was usually to be seen in June and July on a zheel named Rudrazhala or Rudijhala. He told us that he had seen

a pair last June. A fisherman whom we met immediately afterwards however, said that the birds were present even then. We followed him to Rudijhala which turned out to be a fairly large marsh with aquatic vegetation such as Azolla, Pistia, Nelumbium, Nymphea, Eichhornia, Potamogeton, Trapa, Cyperus, Scirpus, Polygonum, Fimbristylis, Hydrilla etc. For the first time in Tripura we saw, besides Lesser Whistling Teal and Openbill Storks, other waterfowl such as Bronzewinged jacanas (Metopidius indicus) and Indian Moorhen (Gallinula chloropus) and also a Pied Harrier (Circus melanoleucos). The fisherman however, was unable to show us the promised Sarus. Enquiries in the huts on the banks of the marsh also revealed that Sarus was not present then. Whether it could be seen during June and July remains to be verified. The school teacher has promised us to send the information during the forthcoming monsoon.

Though the occurrence of Sarus in Tripura could not be verified, Rudijhala impressed us as the most likely place where it could occur. Together with paddy fields the extent of wetland habitat in Tripura is not insignificant. The local people too appeared to be not as prolific harvesters of waterfowl as the people of Assam. Yet the only large birds that were seen on wetlands in some numbers were Openbill storks. Perhaps cranes have so far failed to take root here though a straggling pair from nearby eastern Bangla Desh could be a possibility.


Bongaigaon
Barpeta
Goalpara
Gauripur
Dhubri
Lakhipur
Tura
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Marsh
Vegetation
Height in Metres
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Wetland Conservation Situation in Assam

From an examination of wetlands in Assam, it appears that the existing wetlands can be grouped as under:

1. Totally protected wetlands;

2. Wetlands fully exploited for cultivation and grazing;

3. Wetlands partially exploited for cultivation and grazing.

Group 1 includes wetlands in Orang and Kaziranga reserves and the lake in Sibsagar town. Dibru-Saikhoa marsh though encroached upon at the peripheri, remains more or less protected through sheer impenetrability.

Group 2 includes wetlands around Margherita, Dibrugarh, Jorhat and those between Nowgong and Gauhati.

Group 3 includes wetlands between Dibrugarh and Sibsagar; those between Narayanpur and N. Lakhimpur; those between Gauhati and Goalpara; those northeast and northwest of Gauhati (see map) and the stretch of the Brahmaputra between Dibrugarh and Goalpara.

At present wildlife including waterfowl remains concentrated in wholly protected areas such as the wetlands in Group 1. To some extent waterfowl also resort in great numbers to wetlands in Group 3, especially the Brahmaputra. It is probable that under the cover of darkness waterfowl leave these areas to feed in wetlands in Group 2 and 3. It appears therefore, that the available wetland habitat is fully utilised by the waterfowl in

Assam.

If however, the size of the wetland habitat is considered, the number and variety of waterfowl could have been much greater. The lack of large birds such as herons, storks, ibises, spoonbills, not to speak of cranes, is strikingly evident. Why is this so? Our enquiries among the local people revealed that there is a general lack of positive sentiment towards waterfowl and all are treated as legitimate quary if means are available to hunt or trap them. Large birds provide, of course, a very attractive target and are therefore, extremely scarce outside protected areas. The only exception are the two Adjutants that are scavengers (as are vultures among birds other than waterfowl) and hence considered unclean.

No wonder we did not find Sarus in the Assam wetlands--neither sharpii nor antigone. Enquiries among local people and ornithologists did not even reveal any stray occurrences in recent years. The only exception was the sighting in 1974 near Gauhati of a Sarus by a competent bird-watcher(Belinda Wright, personal communication). Local ornithologists, some of them frequent travellers, have failed to notice the existence of Sarus in Assam.

It appears therefore, that Sarus (both sub-species) has disappeared from regions east of Bihar.

The habitat however, remains hospitable, especially wetlands not yet fully exploited for cultivation, grazing, grass

collection, brick-making etc. Islands in the great river may still provide the much-needed seclusion to Sarus pairs. Indeed migratory cranes have recently been sighted on some of these islands (Chaudhury 1990). The islands are of course inundated during the rainy season and will not be able to provide breeding habitat for Sarus. Excellent breeding habitat is however, available in partially exploited wetlands which, in some areas, abound in freshwater marsh vegetation which provides nesting material and food for Sarus. Wetlands between Dibrugarh and Sibsagar, those between Tezpur and N. Lakhimpur can be cited in this connection. But it will be necessary to protect the breding pairs through a mass education and awareness creation campaign mounted through TV, radio and newspapers. As suitable habitat exists in many places, a Sarus ré-introduction programme in Assam possesses good chances of success. Both the sub-species of Sarus can be introduced in Assam. I therefore, feel that such a programme should be undertaken at the earliest so that the eastern part of India does not lose the tallest flying bird in the world.

A SCHEME TO REHABILITATE SARUS IN ASSAM

Here it is worthwhile to give the bare essentials of the scheme. The time-table and the budget can be worked out at a later point of time.

Pre-requisites

As the scheme involves certain new techniques it is

necessary that researchers are trained to carry them out. People who will work this scheme need to be trained in:

1. Captive breeding of cranes; 2. Isolation-rearing of crane chicks and 3. their introduction into suitable habitats. International Crane Foundation, Baraboo, Wisconsin, USA is the agency which is in a position to impart training in these techniques. Secondly a programme to reintroduce the Eastern Sarus is well underway in Thailand. Wildlife Department of the Royal Government of Thailand is in charge of the programme. Field experience for our scientists can be gained by working with Thai scientists in their country.

Initially Sarus cranes for captive breeding will have to be procured. G. a. antigone pairs may be available with Indian zoos or will have to be procured from bird markets. International Crane Foundation may be in a position to donate pairs of G. a. sharpii as they have a few breeding pairs of this species. These will have to be flown to India from USA. Generally airlines make available this service free of charge if correctly approached.

Nodal Agency in India

The Ministry of Environment & Forests should be the nodal agency in India and should obtain the cooperation from US and Thai agencies by approaching their counterparts in the respective countries. The agencies that should carry out the scheme in India will be : The Wildlife Department of Govt. of Assam and the Gauhati University. The Chief Wildlife Warden of Govt. of Assam and Head, Animal Ecology Laboratory of the University should be

the Principal Investigators of the Scheme.

The Crane Working Group of the Indian sub-continent will help the scientists in obtaining scientific contacts, literature, references etc.

The Working of the Scheme

Birds of the two sub-species obtained as described above will have to be kept in separate, roomy enclosures with visual barriers. Land for the enclosures may be available in the campus of the University. The upkeep and maintenance of the birds should be the responsibility of the Wildlife Department whose personnel will work under the guidance of researchers especially trained for the Scheme. Students of Animal Ecology Lab. can help them to get experience for themselves of handling large birds.

At the same time the University and WL Department will chalk out and mount a campaign to make the general public aware of the importance of the cranes and their rehabilitation. The campaign may be mounted through the media and posters, talks, slide-shows, documentaries etc.

The isolation-reared juvenile Sarus will have to be released in a suitable habitat preferably in a protected area. These sites will have to be determined after proper habitat surveys.

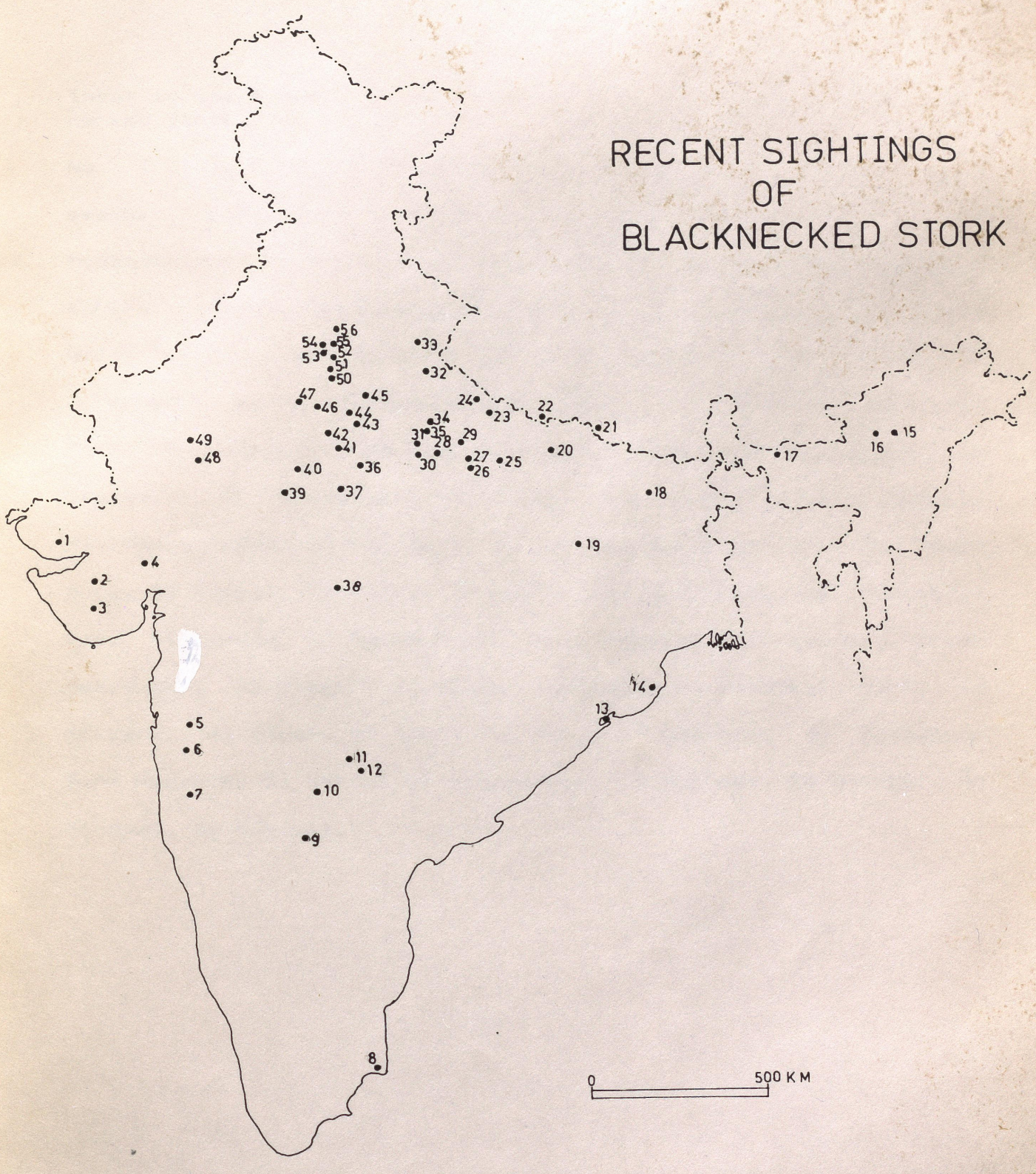
The time-span between the procurement of cranes for captive-breeding and actual release in the wild of isolationreared juveniles may be 7 to 10 years.

If undertaken in 1990, Assam may usher in the new century with the calls of the Sarus bugling in the wild.

Observations of Blacknecked Stork (Ephippiorhynchus asiaticus)

Of late the decline in Blacknecked Stork numbers has been causing concern. During the Waterfowl Count the successive years have seen a decline from 50 in 1987 (this figure has been challenged : see Rehmani 1989) to 33 in 1989. Even in the past, though distributed throughout the country, it was nowhere numerous. Hugh Whistler in the fourth edition of his Popular Handbook of Indian Birds (1949) merely stated that "In India it is very generally distributed in suitable areas as a resident species(Page 502). Likewise the late Dr Salim Ali and S. Dillon Ripley in their first volume of the Handbook had said, "Resident. Widespread but sporadic and nowhere abundant." They further stated that it was rare in the south (Page 104).

In recent years Dr A. R. Rehmani of Bombay Natural History Society has been collecting information about the past and present distribution of this stork and has published his review in Forktail, the magazine of Orient Bird Club (Forktail 5 {1989} pp. 99-110) and the Newsletter of ICBP-IWRB Specialist Group on Storks, Ibises and Spoonbills (Vol 2, No. 1/2, Dec. 1989).The map of distribution he has published in Forktail shows that the stork is distributed all over India except the states of Jammu and Kashmir, Kerala and the eastern part excluding Assam. In recent years however, there are no sightings from Punjab, West Bengal,


RECENT SIGHTINGS
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Index to the Numbers Given in the Map: Recent Sightings of Black-necked Stork.

No. 1 Bhuj, 2 Rajkot, 3 Sasangir, 4 Nal Sarovar, 5 Nandur Madh-meshwar, 6 Khamgaon, 7 Mayani, 8 Point Calimere, 9 Raichur, 10 Mehboobnagar, 11 Medak, 12 Dandi River, 13 Chilka Lake, 14 Bhitar Kanika, 15 Kaziranga National Park, 16 Orang Reserve, 17 Manas Wildlife Reserve, 18 Kavar Lake, 19 Palamau National Park, 20 Gorakhpur, Sukla Pantha reserve, Nepal, 22 Chitawan National Park, 23 Bahraich, 24 Dudhwa National Park, 25 Sultanpur, 26 Samaspur, 27, Nawabganj, 28 Kanpur, 29 Lucknow, 30 Lakh Bahosi, 31 Farrukhabad, 32 Pilibhit, 33 Corbett National Park, 34 Main-puri, 35 Etawah, 36 Datia, 37 Madhav National Park, 38 Hoshanga-bad, 39 Sarson, 40 Ranthanbhor Tiger Reserve, 41 Chambal River Sanctuary, 42 Dhopur, 43 Bayana, 44 Keoladeo National Park, 45 Aligarh, 46 Alwar, 47 Bundi, 48 Pali, 49 Jodhpur, 50 Sultanpur Bird Reserve, 51 Okhla, 52 Bulanshahr, 53 Sonipat, 54 Sonipat, 55 Sonipat, 56 Panipat.

Tamilnadu and Orissa (doubtful records).

During the Sarus field-work I was asked to keep a lookout for this stork. I was able to observe this stork at the following places:

Table 1

Sightings of Blacknecked Stork during the Sarus survey(1988-90)

Place where seen	State	Month & year	Numbers seen Adults	Juveniles	Nesting or not
Bhindwas	Haryana	Apr 89	2	-	Possible
Gadhiwala	"	"	1	-	No
Bambhewa	"	"	2	4	Possible
Bharatpur	Rajasthan	Dec 88	12	1	3 nests
Sarson	"	Apr 89	2	-	No
Dhakwa	U. P.	Dec 88	1	-	No
Gauriganj	"	Dec 88	1	1	Possible
Shahjehan--pur	"	Jan 90	1	-	No
Lakh	"	"	2	-	Possible
Farrukabad	"	"	2	-	No
Kaziranga	Assam	Feb 90	1	-	Possible
Bhuj	Gujerath	Jan 88	1	-	Possible

The accompanying map shows the places where this stork was seen in recent years. It combines Dr Rehmani's information and my own observations.

Between November 1988 and March 1990 I must have examined

over 500 wetlands from Maharashtra, M. P., Orissa, Bihar, West Bengal, U. P., Delhi, Haryana, Rajasthan and Gujerath in the north and Assam and Tripura in the east. That the stork was seen only on 12 wetlands may be taken as a measure of its scarcity. Probably the waterfowl count of 1990 may report further decline in its numbers.

According to Dr Rehmani the decline in numbers of this stork is due to a)loss of breeding habitat; b) excessive trapping for zoos and export and c)pesticide poisoning. He feels that hunting is not an important threat for this species as hunters consider its flesh to have a fishy smell and not good food.

In recent years this stork was observed to be nesting in Keoladeo National Park, Bharatpur and Dudhwa National Park, UP. I was told that 2 pairs are usually to be seen in Palamau National Park, Bihar, where they could breed but no nest has been located as yet. I had seen a pair and a juvenile in Chandwa Taal near Gauriganj and a pair and 4 juveniles in Bambhewa near Sonipat, Haryana. It appears however, that a concerted search is necessary to locate the existing nesting sites of this stork to determine the annual rate of recruitment to the species. As zoos have not been successful as yet in breeding this stork, all their replacement must come from the wild. The annual relacement figures may give some idea of the juveniles that are being trapped for this purpose.

My observations of this stork point to the following two things:

1. Its breeding places appear to be restricted mainly to

protected areas such as national parks and sanctuaries.

2. In non-breeding season the storks wander a good deal in search of food. As the wetlands begin to dry up in April and May, the fish are exposed and die which attracts a number of storks, egrets and herons.This assemblage invariably contains one or two Blacknecked storks and Lesser or Greater Adjutants.

Outside already designated reserves, there are no more than 22 places (see map) where this stork has been seen in recent years. If these are protected, these storks are likely to stay on for longer periods and if suitable nesting trees and availability of food are there, they may breed also. Well-equipped and progressive zoos in the country should undertake a scientific breeding programme of this species to maintain a captive stock. A strict watch needs to be kept on bird markets to examine the annual turnover in this species. Especially is it necessary to know the number of juveniles brought to the market every year. Under its Endangered Species Programme Bombay Natural History Society should undertake a comprehensive study of this stork, locate its nesting areas so that they may be protected.

Recently this bird has been recommended to be included in schedule I of the Indian Wildlife Protection Act. I do not know whether this has been as yet gazetted. The recommendation should however, be sufficient to control and regulate the numbers with various bird dealers so that future trade in these storks can be stopped forthwith once this recommendation becomes law.

Observations of Adjutant Storks : Leptoptilos dubius and L. javanicus

Outside the eastern part of the country both these storks have rarely been recorded in recent years. During the field work for Sarus I saw Lesser Adjutants (L. javanicus) only at two places viz. Bhitar Kanika in Orissa and Madhav National Park, M. P.; while the only sighting of Greater Adjutant (L. dubius) outside Assam was from Bambhewa lake in Haryana.

Formerly their distribution was probably somewhat different. Hugh Whistler states that the Greater was a winter visitor to Bengal and Assam probably from Burma where large nesting colonies existed and the Lesser was resident in southern and eastern India. Today however, there are no records of Lesser from the south. Recently a few Greater were seen in Keoladeo National Park, Rajasthan and there are some records from Bihar and Madras.

Dr Rehmani of Bombay Natural History Society and Dr P. C. Bhattacharjee and Prasant Saikia of Gauhati University have studied and collected information on the distribution of these storks. They have published it in the Newsletter of ICBP/IWRB Specialist Group on Storks, Ibises and Spoonbills(Vol 2, No. 1/2, Dec.1989).

According to these researchers both the Adjutants can be seen in some numbers in the Brahmaputra valley only, within Indian limits. Dr Rehmani saw 80 Greater in 10 locations in Assam between 29th April and 9th May 1989. Dr Bhattacharjee and Saikia estimate that the total strength of the Greater in the valley (25°

41" to 27° 55" N and 89° 41' to 96° 02" E) should be around 300. It is more common outside reserves and national parks. According to them the estimated number of the Lesser in the valley is around 400. The Lesser breeds in the reserves as well as in some numbers around villages. They located 82 nests of the Lesser 53 of them outside protected areas.

According to Dr Rehmani the Greater is threatened due to destruction of breeding sites, pesticides poisoning and competition from vultures. The Greater spends a great deal of time in agricultural fields and Dr Rehmani feels that he must be imbibing large amounts of pesticides. Dr Bhattacharjee feels that destruction of large (nesting) trees is the major cause of decline in its numbers. The Lesser is threatened due to over-exploitation of its feeding habitat viz. wetlands, by human beings and destruction of large trees.

I agree with these researchers that both the Adjutants are extremely rare outside E. India. The Lesser may be still breeding in such places as Bhitar Kanika and some large National Parks such as Kanha, Corbett and Dudhwa. The Greater I feel, is both a resident and winter visitor. Dr Bhattacharjee and Saikia had noticed an increase in the number of Greater Adjutants during winter also. The sightings outside Assam pertain mainly to the period April-May when the wetlands begin to dry, fish are exposed and dying attracting many storks including scavengers. The Greater must be wandering a great deal during those times. Yet their numbers arriving west of Assam are quite low and perhaps

declining. The Lesser is more of a wetland bird than a scavenger. In and outside Assam it is usually seen on or near wetlands.

In Assam I observed the Greater on garbage dumps in Gauhati- and on the Brahmaputra river near the town. I also saw them in agricultural fields near Sibsagar and Tezpur. The lesser was seen sporadically throughout Assam on wetlands. A large roost of the Greater on Anthocephalus kadamba was seen in the midst of Gauhati town and their nests were seen on a Bombax ceiba tree in the densely populated areas of Nowgong town. I also saw a nesting colony of the Lesser in Orang reserve.

A single visit to the Brahmaputra valley is not enough to formulate any opinion about the status of these storks. In the valley they are still more numerous than in the rest of the country. Monitoring of their numbers every year is necessary to determine if they are declining. Likewise a deeper study must be undertaken to gauge the threat of pesticides poisoning. The numbers of vultures, the main competitors of scavenging storks, is no doubt increasing due to the sprawling garbage dumps around our cities and towns. It is surprising why the number of storks is not increasing. Probably an increase in their numbers will follow soon. It is anybody's guess. At least the food remains abundant for them. In Assam I saw that the Greater was not afraid of Whitebacked and Longbilled vultures (Gyps bengalensis and indicus)and could even snatch a piece of carrion from them. The large Himalayan Griffon (Gyps himalayensis) was however, successful in keeping at bay the Greater Adjutant.

I therefore, feel that both these storks merit a deeper study and monitoring of their numbers and strict protection to their roosting and nesting trees. A census of the remaining large trees in the villages and towns of Assam should be carried out by NGOs to identify trees useful to storks and indeed to other birds so that villagers and townspeople are persuaded to protect these.

The Discovery of a Wintering Area of Blacknecked Crane(Grus nigricollis) **within Indian Limits.**

I have been studying the rare Blacknecked Crane since 1976. In 1978 I located its nesting area near Chushul in Ladakh. It was then known that these cranes spend the winter in Apa Tani valley in Arunachal Pradesh. But Lavkumar Khacher who went in search of them in 1978 could not find them and was told that as the birds were hunted they had stopped wintering in the valley. Since then it was believed that these cranes no longer winter in India. Phase II of the Sarus survey provided me an opportunity to verify this. My diversion into Arunachal Pradesh was made possible because of the generous help extended by the Indian Army. The report of this investigation follows.

The Apa Tani valley of Arunachal Pradesh shot to fame in mid-fifties when Col. Betts reported a small flock of Blacknecked Crane wintering there (Betts 1955), the only flock then known wintering outside China. But for the unfortunate cranes, the scene around them was changing faster than what many of their admirers would have liked. Col. Betts wrote again in 1971, " The cranes were comparatively fearless of the 20,000 Apa Tanis who lived and worked in the fields, but even then anyone not in Apa

Tani dress could not get within 0.8 km of them. With the appearance of outsiders and soldiers with fire-arms, aircraft and motor transport, there is a very grave risk that the birds have either been shot or scared away." (Betts 1971).

What actually happened to the Apa Tani flock is nowhere documented. When Lavkumar Khacher went to the valley in search of the flock in 1978, he could not find a single crane. He was told that the last pair was shot and eaten two years before (Lavkumar 1981). Blacknecked cranes had apparently stopped wintering in India.

Then came the discovery of large numbers wintering in Bhutan(Gole 1989). The occurrence of substantial numbers in Bumdiling at an altitude of 1500 meters and lower than that of Apa Tani valley(1830 meters), rekindled the hopes that valleys in India adjacent to the Bhutan border might still harbour a few pairs of Blacknecked crane. Lavkumar had also expressed the hope that these cranes could be found in valleys where similar habitat conditions prevailed. His probables were the lowland marshes in Lohit division and the marsh south of Seppa in west Kameng division (Lavkumar ibid).

I got an opportunity to make a diversion to Arunachal Pradesh while looking for the Sarus in Assam. I went to Apa Tani valley in late February 1990. The valley is a wide, shallow basin flanked by low hills clothed with dense pine forests. Rice fields occupy almost the whole valley. In one corner is an airfield where small planes land. In late February the rice crop was

harvested long back and preparations were on for the spring crop. The whole valley was the picture of bustling activity. Rice fields were full of people and their animals. There were scooters, cars and trucks on the road and Apa Tanis in traditional dress were hard to find. Elections for the legislative assembly were due. Processions and motorcades were moving on the road and loudspeakers were blaring the merits of the contestants.

The wet rice fields looked very promising and tempting. But no decent crane would have landed there with so much human noise and movement surrounding him.

I showed Blacknecked pictures to many Apa Tanis, now in modern dress and riding scooters. But they said they had never seen such birds in the valley. Finally I found an Apa Tani in traditional dress complete with bow and arrow and his "dah" (a short sword) slung at his waist. When he looked at the picture, he exclaimed, "Kendah!" the local name for the crane. Many years ago they used to visit the valley, he told me. "We never used to kill them", he added.

It was the entry of the outsiders in the valley that probably sealed the fate of the Blacknecks.

I also visited Tawang which sits high on a mountain. Tawang is a district headquarters with all the hustle and bustle of modern times. But its lower reaches are broad and gently sloping. Naturally villages and terraced cultivation occupied these broad

slopes. The ever-smiling Monpas, the local tribe practising Tibetan Buddhism, immediately recognised the picture of Thung Thung Karma, the name given to these cranes in Ladakh, Tibet and Bhutan. "A pair or two sometimes comes to our fields," they told me. The broad terraces indeed looked a promising habitat.

But the inihibiting factors operating in the Apa Tani valley were present in Tawang also and probably deterred the Blacknecks. Though the Buddhist culture in the region was a welcome sign. Now I had to find a valley that retained Buddhist culture but was still away from the hurly burly of modern civilization.

It was while returning from Tawang that I happened to look into a quiet valley. A dirt track connected it to the main road. Hardly any vehicles plied over the track. The valley was sparsely populated and the main crop was paddy.

As we started on the dirt track, I showed the picture to a passing Monpa. He recognised the Thung Thung and said that last year two pairs had come to the valley. We approached the village and stopped to enquire at a small hut. A man who was cleaning some fish came out to say that only two days ago he had seen a pair. This was the first positive statement that Blacknecks were indeed present this year.

We went beyond the village and I scanned the sprawling rice fields. Far away I immediately recognised the familiar black and white forms quietly moving in harvested fields. The Blacknecked Crane had returned to winter in India!

The place was Sangti valley(Lat 27 26 N, long. 93 18 E) not far from Dirang, a charming town on the main road to Tawang. We found the cranes on 15th February at 1430 hrs. in bright sunlight with moderate easterly winds at temperature around 15 C. The cranes were searching for food in flooded fields, looking for frogs, shrimps and such other animal food. We did not find any fallen grain in those harvested fields. Najas, Cyperus sp., and Myriophyllum were the other plants growing in those fields. I was accompanied by Vice Admiral M P Awati(Retd.) and Prof S. D. Mahajan from Kolhapur who share with me the (re)discovery of wintering Blacknecks on Indian soil.

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