The birds of Sambhar Lake and its environs

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Sambhar Lake, situated in the Nagaur, Jaipur and Ajmer districts of Rajasthan and spread over 190 km^2, is India's largest inland saline wetland. It has been recognised by Government of India as a wetland of international importance and has been accordingly designated a Ramsar Site. However, little information is available on the avifauna of the lake, as most published studies relate to impacts of algal growth on salt quality. This paper aims to present an updated, annotated checklist of the birds of the lake and its environs and to document changes in birdlife of the area since R. M. Adam's observations from the latter part of the nineteenth century.

Geography & climate

Sambhar Lake (26°52′–27°02′N 74°54–75°14′E) has a catchment area spread over 5,700 km^2 (Fig. 2). Its drainage pattern indicates that the western and southern parts of the catchment have a good concentration of streams whereas the northern and eastern parts are represented by poor drainage (Fig. 2). The streams originating from the western and southern catchments have a dendritic drainage system, cutting through hilly terrain (Jain 2006). Sambhar is essentially an ephemeral lake that remains dry during a greater part of the year, filling with water only during monsoons. Interestingly, Sambhar used to be a perennial lake till about 1000 BC after which it gradually became seasonal (Lahiri 2000). The periods of dryness and being full of water are quite irregular and the intervals between the two might be so short that one period of full water level merges almost into the other. Sometimes the periods of dryness (Fig. 1) or full water level are also extraordinarily prolonged.

The playa has a maximum depth of 3 m with average depth not exceeding 0.16 m. The lake basin is 22.5 km long while its width ranges from 3.2 to 11.2 km. The lakebed (360 m alt.) is almost flat with a slope of 10 cm per km. The lake was divided into two unequal parts by a 5.16 km long embankment erected in 1924 between the settlements of Jhapok in the south and Gudha in the north. The western part of the lake covering about 113 km^2 has almost no disturbance and is a natural continuous sheet of water. On the other hand, the eastern part of the lake, covering 77 km^2, is heavily used for salt extraction and comprises a mosaic of canals and saltpans (*kyars*). Four seasonal streams—Mendha, Rupangarh, Kharian and Khandel—besides numerous rivulets and surface runoff, feed the lake. With the onset of rains, the lake starts filling gradually and the water is almost fresh, with salinity less than 2 ppt. The salinity of the lake, however, increases through the winter due to evaporation and salt-encrustation of the lakebed. Salinity rises sharply during spring or early summer when salt crystallisation starts.

The climate of the lake is subtropical monsoonic (Gopal & Sharma 1994). The year is marked with distinct summer, rains and winter seasons. The mean monthly temperature during summer crosses 40°C whereas the mean minimum temperature remains about 11°C. The annual rainfall averages 54 cm, occurring almost entirely during the south-western monsoon between July and September. However, the precipitation record for a hundred years shows that both, the total and annual rainfall, and its period of occurrence and intensity during the season, exhibit wide variations, resulting in frequent spells of droughts and floods (Gopal & Sharma 1994).

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Fig. 1. The lakebed in summer (2000) covered with dry algae that turn black on drying. Palls of dust are caused by strong westerlies.

Conservation value, threats and outlook

Sambhar, being an inland salt lake, is a unique ecosystem that supports a highly specialised group of organisms, including the algae *Dunaliella salina* and the bacterium *Serratia sambhariana* (Gopal & Sharma 1994). In particular, flamingos (Phoenicopteridae) are the avian flagships of the lake. Both Greater *Phoenicopterus ruber* and Lesser *P. minor* Flamingo regularly visit the lake and this site is probably the most important area for flamingos on the Indian Subcontinent, outside the Rann of Kachchh (Sangha 1998). The Lesser Flamingo is a Near-threatened species (BirdLife International 2008) and Sambhar Lake supports one of its largest populations in the Subcontinent, estimated to number around 18,500 birds (Sangha 1998). Large numbers of waterfowl also occur on passage and in winter.

A growing need for water in the catchment of the lake has led to the construction of numerous check dams on the ephemeral rivers that flow into the lake. This has drastically reduced the natural inflow of water, accompanying nutrients and organic matter into the lake. According to data available with the irrigation department there are 675 check dams on

the inflowing rivers. Ensuring the free flow of water, as per the V. T. Krishnachari Award of 1961, has been neglected by government agencies including the forest department.

Precipitating matters is unchecked growth of private salt manufacturers, permitted by the state government to set up shop in the catchment area in the mid 1980s (Parihar 1999). These unauthorised salt manufacturers have encroached mainly on the northern periphery of the lake, towards Nawa in Nagaur district (Fig. 2). By pumping out the subsoil brine for salt production they have depleted the subsoil brine from the main lake area. They also excavate clay from the lakebed to spread it on their saltpans.

Whilst the manufacture of salt by Hindustan Salts Limited (a.k.a. Sambhar Salts), a public sector undertaking that has the sole rights to produce salt in Sambhar Lake, has had no adverse impact on the main lake, its decision to dig 25 bore wells and 50 surface wells is far more ominous than digging channels on the lakebed. Digging channels by Hindustan Salts Limited to facilitate the flow of water from the main lakebed to the eastern part (reservoir) even after it stops flowing naturally through sluice gates is detrimental to the waterfowl.

A recent study to put in place a conservation plan for the lake, using satellite remote sensing data from 2003, along with inputs from field observations, information collected from

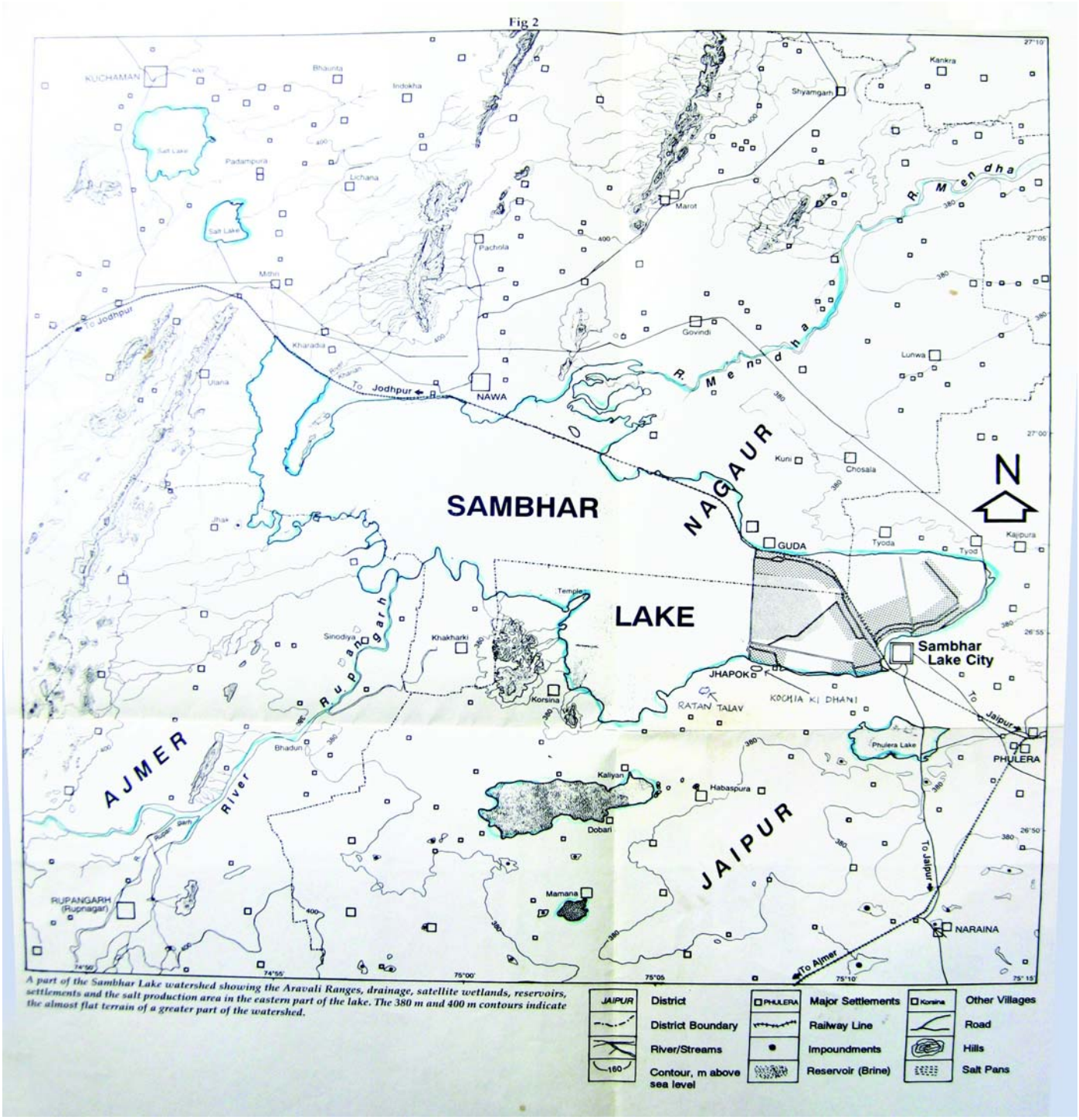


Fig. 2. Sambhar Lake (Source: Gopal & Sharma 1994)

various concerned department and local people, reveals that Sambhar Lake and its surrounding areas have been degrading for quite some time. The lake is under tremendous anthropogenic pressure due to wrong utilisation of its resources (Jain 2006).

Current conservation measures are quite inadequate in dealing with various threats to the lake, and there is every need to increase protection efforts, if the unique habitat is to be saved. Designating it a Ramsar Site in 1990 has not been followed up by any concrete measures towards conservation of the ecosystem. The proposal of the Rajasthan State Forest Department to create a two kilometre wide eco-sensitive buffer zone around the main lake, banning all activity within two kilometres of the lake's periphery remains a non-starter. More important than establishing a buffer zone would be to curb the growth of check dams on rivers throughout the catchment. Already about 250 check dams have been constructed on rivers, substantially reducing the inflow of water.

According to a recent study for conservation planning of the Sambhar Lake using the satellite remote sensing data of the year 2003 the future of the lake looks bleak. The data reveal that already water spread has reduced considerably. The study suggests dividing the entire eco-sensitive area into three important priority zones for carrying out conservation planning. The areas, which require immediate attention for conservation fall into first category. The second category, which is otherwise, an intermediate area between the first and third may be considered for prioritisation after the first prioritisation work is over. The land use / land cover classes falling in the third and the outermost zone are recommended for eco-restoration in the final stage. The suggested three-kilometre buffer zone covers an area of 550 km^2 out of which the lake itself covers c. 230 km^2 (Jain 2006).

History

The lake has been worked for salt for at least a thousand years. It was however not till the rule of the Mughal Emperor Akbar (1542–1605[1]) that a settled system of working the lake was introduced. In his days the income from the lake was about Rs 250,000 per annum. The income had gradually increased to Rs 1.5 million when Aurangzeb ascended the throne (1658[2]). With the decline of the Mughals the revenues declined and about 1770, confederates of Jaipur and Jodhpur appropriated the lake without a struggle. During the next epoch the management of the lake passed backwards and forward between the Rajputs and Mahrattas. History is silent as to what revenue was realised in those days (1770–1834) till the British assumed charge of the lake in 1835. The *Shamlat,* the joint government of Jaipur and Jodhpur, worked the lake from 1844 onwards (Gopal & Sharma 1994). At that time Nawa and Gudha were insignificant hamlets, but gradually developed into salt markets. When Jodhpur began to develop salt works at Nawa and Gudha, Jaipur become envious. This led to constant friction and discord between the two states. The Holkar and Scindia families too got mixed up with these events (Aggarwal 1951). This went on till the lake, including Nawa and Gudha, were taken over by the British in 1870—on lease from Jodhpur and Jaipur and worked till 1947 (Sarkar 1984). The ownership of the lake passed onto the Rajasthan state government in 1950 on the integration of the Indian states after independence. Today its land tenure has been leased to Sambhar Salts, a joint venture of Hindustan Salts with Rajasthan government.

Early avian studies

Surprisingly, the lake has received very little attention from ornithologists. R. M. Adam, who was Assistant Commissioner at Sambhar, was the first to publish ornithological records of the lake and its surrounding areas including Kuchaman and Nawa (Adam 1873, 1874a–b). His detailed notes on the birdlife of the lake still remain the only authentic source of information and provide an invaluable benchmark against which changes in population size and bird diversity can be compared today. World Wide Fund for Nature-India's booklet on the lake, authored by Gopal & Sharma (1994), contains a brief account of its avifauna. Save for a checklist of waterfowl prepared mainly for foreign birdwatchers (Sangha 1998b), other published accounts relate only to the two species of flamingos (Alam 1981; Sangha 1998a).

Bhatnagar & Shukla (2005) is rife with erroneous and doubtful records such as describing the Great White Pelican *Pelecanus onocrotalus* and Black-bellied Tern *Sterna acuticauda,* which are both locally rare, as common, and the Black Stork *Ciconia nigra,* a winter migrant, as resident and common. Similarly, another recent publication on birdlife of Sambhar Lake by Zoological Survey of India (Anonymous 2005) contains several dubious records like stating that the Ibisbill *Ibidorhyncha struthersii* winters in Sambhar Lake.

Historical changes in Sambhar landscape

During Adam's stay in Sambhar, cultivation was sparse. Although some of the low hills were all but destitute of vegetation some patches of dense scrub jungle did exist. While wild boar *Sus scrofa* was very common, small herds of sambar *Cervus unicolor* and nilgai *Boselaphus tragocamelus* were sparingly met with. Though he has not mentioned the presence of antelopes in the area, blackbuck *Antilope cervicapra* and Indian gazelle *Gazella gazella* were reported around the lake well up to the mid 1970s (Digvijay Singh Dhamotar, *verbally*). While blackbuck and Indian gazelle have since become extinct in the study area a small population of nilgai has colonised the area in recent years.

Nawa *beed* (forest), which belongs to Sambhar Salts, on the periphery of the lake from where Pied Tit *Parus nuchalis* was reported (Tiwari 2001), has vanished in the absence of effective control. There was long grass or scrub jungle in the area and Adam often flushed Short-eared Owls *Asio flammeus* when beating for game. I have only one record of the species. A dead bird was found near Sambhar town in 1990 (Dhirendra Devarshi, *verbally*). Over the last six–seven years, the exotic *Prosopis chilensis* has spread in the vicinity of the lake. Up to the 1990s there were no roads around the lake. Now a road connects Sambhar town with Shakambri Mata Temple *via* Korsina village. The open wells used for irrigation, about Sambhar and frequently mentioned by Adam, are no longer found. These were excavations in the fields, about 10–12 m in diameter and six meters deep. The sides of these wells were densely clothed with grass and were favourite haunts of numerous birds like Brown Crake *Amaurornis akool*.

Methods

After an initial reconnaissance in 1990 the main areas of the lake were identified and surveyed over the years. The records span a period of over 18 years (1990–2009). Bird observations were carried out at Sambhar Lake and satellite wetlands covering all seasons. During field visits, the focus was mainly

[1] Source: http://en.wikipedia.org/wiki/Akbar_the_Great.
[2] http://en.wikipedia.org/wiki/Aurangzeb.

on waterfowl. Nevertheless, land birds were also recorded and these are listed in the Appendix. The habitats covered during visits include the main lake, reservoir and satellite wetlands including Ratan Talav, Kochia ki Dhani and Phulera Lake.

Results & discussion

A total of 83 species of waterfowl were recorded. The highest number of species was recorded from September to December. Many of the species frequent the lake soon after rains when its salinity is low. They leave as soon as the specific gravity of the lake brine increases after November. However, both the species of flamingos stay through winter when the lake contains only a concentrated solution of brine.

During years of normal monsoon, water is present from August to March. On the contrary, the records of Adam seem to indicate that during his stay at Sambhar the lake was drying by summer as he shot many birds as late as May. Probably the rivers flowed regularly and supplied more water to the lake to last up to summer. The lake in the recent years has dried up suddenly on many occasions when sluice gates were opened to drain the water to saltpans. In such situations the birds have had to abandon the lake en mass. More than 20,000 birds including *c*. 10,000 Lesser and *c*. 5,000 Greater Flamingos were present on 19th September 2001 and after the release of water by Sambhar Salts I found only 200 Greater Flamingos!

The chemistry of the lake is strange and needs to be studied. On 4th December 1994, 8,500 Lesser Flamingos were seen on the lake, but no Greater Flamingos. Similarly, on 31st January 1995 there were *c*. 5,000 Lesser Flamingos but Greater Flamingos and other species were missing, probably due to high level of salinity.

Despite the claims of Kumar (1996) and Kumar & Bhargava (1996, 1998), there is no evidence that substantiates the nesting of Greater or Lesser Flamingos, or both, at Sambhar Lake. Any claims of breeding based on nests, eggs and young of the two species, must be ratified by rigorous morphometric data like measurements of the nest mounds, eggs or detailed notes of plumage and bill/leg colouration of the chicks and juveniles, as these parameters are superficially similar for both species. In the Zoological Survey of India's publication (Anonymous 2005), the population estimate of 100,000 Lesser Flamingos in the years 1995 and 1996 is obvious hyperbole. Moreover, concluding on the basis of eggshells, "the bird has certainly bred," raises doubts about the veracity of the record.

The fact remains that neither species has ever bred successfully in Sambhar Lake. Downy young or non-flying juveniles of either species have never been recorded. However, in December 1993 V. D. Sharma, Chief Wildlife Warden, Rajasthan and this author found eight or nine damaged or incomplete nest mounds on the dry lakebed but mating and initial nest-building activities can occur at lakes other than on which the birds subsequently breed. Birds may change grounds overnight and begin their breeding efforts elsewhere (Mari & Collar 2000). On 2nd November 2001 when B. C. Choudhury of Wildlife Institute of India, K. K. Sharma of Rajasthan Forest Department and this author visited the lake, an egg (84 x 53 mm) was found on the dry lakebed near the embankment but there was no nest mound. The dimensions of the egg would indicate it belonged to a Greater Flamingo. We do know that occasionally birds drop their eggs without having made a nest, which go to waste on the dry surface of the lakebed (Mari & Collar 2000). Therefore, in the absence of a nest it is difficult to confirm breeding.

A note on systematic waterfowl list

A compilation of bird records gathered from 1990 to 2009 is given, together with information on status and abundance. All observations and records are the author's, unless otherwise mentioned. The following checklist includes species of waterfowl recorded at the lake, reservoir and the satellite wetlands up to January 2009. Taxonomy and nomenclature follow Manakadan & Pittie (2001).

Each species' abundance may vary according to season, salinity, and level of water in the lake. Thus the details given here are to an extent subjective and only an approximate guide to the likelihood of seeing the species in an appropriate location and season.

Some of the species mentioned in the list as 'uncommon' or 'rare' for the main lake are very common in the satellite wetlands. The Brahminy Shelduck *Tadorna ferruginea*, for example, is quite common on most freshwater wetlands in the area, but it is rare in Sambhar Lake. On the other hand, Lesser Flamingo, which is usually uncommon to rare everywhere is not only common at Sambhar Lake but is also the most abundant species on the lake.

Waterfowl records are listed below with comparisons to Adam's (1873, 1874a–b) records where necessary. Species status follows the scientific name and is indicated by the following abbreviations:

* = New record
? = Status uncertain
M = Monsoon visitor (July–September)
PM = Passage migrant
R = Resident
V = Vagrant
W = Winter visitor (October–March)

Little Grebe *Tachybaptus ruficollis* R: Absent from the main lake but regular on Ratan Talav, Kochia ki Dhani and wetlands in its vicinity.

Great Crested Grebe *Podiceps cristatus* W: Rare. A single bird sighted on Ratan Talav on 11th January 1996.

Great White Pelican *Pelecanus onocrotalus* PM, W: Only four sightings from the lake—one bird on 4th December 1994; one on 10th March 1996; three on 6th April 1996 and two on 25th April 1997. All these birds were resting on the edge of the lake. Adam only saw "flocks flying overhead" except "one specimen" which had "met with an accident of some sort and could not fly." 40 birds were seen at Phulera on 1st April 1996.

Little Cormorant *Phalacrocorax niger* W: Rare on the main lake. A flock of ten was seen on 13th September 1996. Adam did not record the species on the main lake, for he writes, "small parties are now and then seen about the ponds." Fairly common on satellite wetlands.

Great Cormorant *P. carbo* W: Rare on the main lake. I saw it there only twice—five on 11th January 1996 and more than 20 on 13th November 1996. Adam also described it as rare, having seen one party of about ten on 30th March 1871.

Darter *Anhinga melanogaster* W: Never recorded on the main lake but occasionally seen at Ratan Talav.

Little Egret *Egretta garzetta* R: Common. Breeds in the area.

Grey Heron *Ardea cinerea* W: Occasionally one or two birds were seen on the lake during winter months. One straggler was seen as late as 3rd May 1997. Four were observed on 5th

September 1997. Adam recorded it as very rare and had only three undated sight records.

Large Egret *Casmerodius albus* W: Recorded on the main lake—two on 16th October 1991; one on 2nd January 1996 and eight on 13th November 1996 towards the deepest area of the lake near the Gudha-Jhapog embankment.

Cattle Egret *Bubulcus ibis* R: Resident. Usually found in attendance on grazing sheep and cattle in the fields surrounding the lake. For past fifteen years the species has been breeding on the grand banyan tree at Ratan Talav. Adam found it "very common" and breeding in a village (?) during June and July.

Indian Pond-Heron *Ardea grayii* R: Although never seen on the lake, the species is fairly common on saltpans of Sambhar, Ratan Talav, Kochia ki Dhani, Phulera lake and small ponds in the area. Adam found it "very common" and breeding in a village (not mentioned) "closer to Sambhur during June and July."

Little Green Heron *Butorides striatus* V: One sighting from Ratan Talav on 24th November 1993. Adam obtained one specimen during the rains of 1871.

Black Stork *Ciconia nigra* W: Uncommon winter visitor. Four sightings—two on 5th February 1994, eight on 24th December 1994 and one on 2nd January 1996. During all sightings the birds were resting in the middle of the lake. Adam (1873) saw "pair of young birds" and shot the female on 26th March 1873".

Eurasian Spoonbill *Platalea leucorodia* W: Although Adam met with small flocks during rains (1873). On the lake I observed 25 on 10th August 1996, 30 birds on 13th November 1996, and 20 on 3rd April 1997.

Greater Flamingo *Phoenicopterus ruber* W: Regular and common winter visitor. They usually arrive by the second week of August and their stay at the lake is largely dependent on the water availability. In normal rainfall years they abandon the lake by February, when the lake starts drying up due to high level of evaporation and diversion of water for salt production. However, during 'flood' years (e.g., July 1977–June 1978), when the lake remains wet even in summer, both Greater and Lesser Flamingos were recorded throughout the year (Sangha 1998). The extreme dates of arrival and departure are 10th August 1996 and 6th April 1996 respectively. During several visits to the wetland between 1991 and 2009 complete flamingo censuses were carried out and distribution of the two species plotted. Greater Flamingos were always less numerous than Lesser Flamingos, contrary to recent published literature (Gopal & Sharma 1994). More than 10,000 were counted on 25th January 1998. Although an egg was found near the embankment on the lakebed on 2nd November 2001, the species has never bred successfully at Sambhar, as ideal water conditions are not available to them.

Lesser Flamingo *P. minor* W: Globally classified as Near-threatened (BirdLife International 2008), it is very common and the most abundant species on the lake (Sangha 1998). Strangely, Adam did not observe it "during the first two years" of his residence at Sambhar. He adds that the "oldest inhabitant informed me that they have noticed more or less of the small flamingos, which they state visit the lake after six or seven years." Since 1990 I have regularly observed the Lesser Flamingos. Flocks appear after the first heavy showers of rain, and the duration of their stay depends upon the amount of water in the lake. The earliest arrival date recorded was 7th August 1998 when 7,000+ were observed. They usually leave by the end of March, but the extreme date recorded is 6th April 1996. Record numbers were observed on 23rd September 1995 when more than 20,000 were estimated. From early January to end March 1996 about 18,000 were present. On 4th January 2009 *c.* 15,000 were there.

Greylag Goose *Anser anser* * W: Not recorded by Adam. I have seen the species twice on the lake—about 50 on 11th January 1996 and four on 29th November 1997. However, on the fresh water bodies in the vicinity of the main lake, they are occasionally seen.

Clement Francis

Lesser Flamingo *Phoenicopterus minor*

Bar-headed Goose *A. indicus* W: One record from the lake—five birds on 29th February 1997. Fairly common at Kochia ki Dhani and Ratan Talav and Phulera. The species was perceptibly uncommon during Adam's period, as it was "only met with in small flocks".

Brahminy Shelduck *Tadorna ferruginea* W: Rare winter visitor to the lake. There are only three records—12 on 14th February 1993; five on 10th March 1996 and three on 13th September 1996. However, the species is quite common at Kochia ki Dhani, Ratan Talav and Phulera. On the contrary, Adam found it "very rare about Sambhar" and never saw the species "except on the Kuchaman jheel."

Common Shelduck *T. tadorna* * W: Rare. A new record for the site. Adam did not mention the species from Sambhar. On 24th December 1994 I scoped a maximum of 25 and again saw three on 5th February 1999.

Comb Duck *Sarkidiornis melanotos* M ?: Recored only once—two at Ratan Talav on 20th September 2003. Adam saw a bird during the rains of 1871 and a fine male was shot for him in September.

Gadwall *Anas strepera* W: Not observed on the lake but not uncommon on the fresh water ponds in the area.

Eurasian Wigeon *A. penelope* W: Quite uncommon on the lake. Eight birds were observed on 21st November 1992 and seven on 24th March 1993. Not uncommon on the fresh water ponds in the area.

Spot-billed Duck *A. poecilorhyncha* V: Only one record from Ratan Talav. One bird was seen on 20th September 2003. Adam "met with it throughout the year but in greater numbers during rains." The species has obviously declined like other resident ducks.

Northern Shoveller *A. clypeata* W: Common. Appears in immense flocks in some years on the lake. Up to 8,500 were recorded on 29th February 1997, more than 6,000 on 14th October 1995 and about 5,500 on 2nd January 1996. Extreme arrival and departure dates being 19th August 2001 and 9th April 1996. Unlike other ducks they do not shift to fresh waterbodies when the lake turns brackish. Adam also found the species "very common during the winter on the lake and about all patches of fresh water in the neighbourhood." The species is also common on Phulera Lake—*c.* 5,000 were observed on 18th September 2001 and *c.* 1,500 on 4th January 2009.

Northern Pintail *A. acuta* W: Uncommon on the lake but common on surrounding waterbodies including Kochia ki Dhani and Ratan Talav. A straggler female was observed at Ratan Talav on 6th April 1993. Surprisingly Adam did not record it in 1873. He shot one on 18th January 1874.

Garganey *A. querquedula* W: Not uncommon in small numbers on the lake during autumn passage. 150 were observed on 15th September 1995. Three on Phulera Lake on 3rd May 1998. Adam saw only a few small flocks on the lake during the cold weather.

Common Teal *A. crecca* W: Commonly seen on the lake during September–February, after which it shifts to surrounding waterbodies as the lake becomes brackish. Extreme dates from the lake being 17th September 1995 and 14th February 1996 (1st April 1996 on Phulera Lake, where water was less brackish). 1,000+ were recorded on 14th October 1995. Adam noted it as "Very plentiful in the cold weather, and is to be found in the lake until the water becomes very salt," (*sic*).

Mohan Kemparaju

Common Pochard *Aythya ferina*

Red-crested Pochard *Rhodonessa rufina* W: Rather uncommon. Recorded irregularly at Ratan Talav.

Common Pochard *Aythya ferina* W: Adam "observed a few small parties of this species during the cold weather." They were 'on a jheel' near Sambhar. As it prefers deep water, it is rare on the lake, which is quite shallow. Five birds were observed on the lake on 21st November 1995.

Ferruginous Pochard *A. nyroca* W: Only one record from Ratan Talav of a single bird seen on 24th March 1993. Adam described it as "not common."

Tufted Pochard *A. fuligula* * W: Uncommon on the lake but common on the deep and freshwater ponds. Surprisingly, Adam does not mention the species.

Demoiselle Crane *Grus virgo* W: A flock of 30 birds was seen near the lake on 10th March 1996. Adam saw large flocks in cold weather in "the neighbourhood" and on 13th March 1873 observed a flock in a field near Nawa.

Common Crane *G. grus* W: Occasionally small parties are seen about the lake from October to March. They come to roost on the dry lakebed. one bird was seen on 16th October 1991, six on 19th December 1993, eight on 24th December 1994, 40 birds including three juveniles on 29th January 1996, 15 on 29th February 1997, 26 on 25th January 1998. Extreme dates were 14th October 1995 and 24th March 1996.

White-breasted Waterhen *Amaurornis phoenicurus* R: Common at Ratan Talav.

Purple Moorhen *Porphyrio porphyrio* ?: Rare. Two birds were observed on 25th January 1998 at Ratan Talav. Also observed at Punya Talab adjoining Phulera Lake.

Common Moorhen *Gallinula chloropus* R ?: Small numbers are seen at Ratan Talav. Adam observed a number of these birds around open wells.

Common Coot *Fulica atra* W: Quite common on the satellite wetlands and occasionally on the lake. Observed in good numbers—200+ on 25th October 1991 and 300+ on 20th January 1993. Adam did not observe the species on the lake and called it somewhat rare except on the ponds.

Pheasant-tailed Jacana *Hydrophasianus chirurgus* ?: One bird was seen on 3rd May 1998 at Ratan Talav. Adam shot a bird in full breeding plumage on 5th June 1873.

Greater Painted-Snipe *Rostratula benghalensis* M ?: Uncommon during monsoon on small water bodies but never on the lake. Three birds were observed on 3rd May 1998 at Ratan Talav.

Pacific Golden-Plover *Pluvialis fulva* * PM: Rare. One bird in breeding plumage was observed on 3rd April 1997. Not recorded by Adam.

Grey Plover *P. squatarola* PM: Rare. Recorded twice during autumn and late summer. Two adults were recorded on 29th February 1997 and two in breeding plumage on 3rd May 1998. Adam reports of a specimen in breeding plumage, "shot on the 25th September."

Little Ringed Plover *Charadrius dubius* R W: Small numbers were irregularly sighted on the lake—45 on 19th December 1993. Not uncommon on the satellite wetlands.

Kentish Plover *C. alexandrinus* W: Common. Usually 300–500 birds are recorded. In January 1996 more than 2,000 were observed and about 700 remained up to the end of March 1996. On 10th February 2000 there was no water in the main lake but the moist lakebed was full of flies / insects and c. 100 birds were feeding there. On 14th November 2003, *c*. 5,000 were seen. On 15th August 2007 the dry lakebed did not have any species except nine Kentish Plovers. About 3,000 were observed feeding on the recently dried margins of the lake on 4th January 2009.

Lesser Sand Plover *C. mongolus* PM: Uncommon. Seen in small numbers during August / September. One bird was recorded on 13the August 1994, six on 3rd May 1998 and five on 10th September 1998.

Greater Sand Plover *C. leschenaultii* PM: Although Adam shot "several specimens" about the middle of August and first week of September, I have observed the species only once—five birds in partial breeding plumage on 10th September 1998.

Yellow-wattled Lapwing *Vanellus malabaricus* R: Two birds observed near Ratan Talav on 3rd May 1998. Used to be regularly seen near a railway crossing on Sambhar-Narayana road.

Red-wattled Lapwing *V. indicus* R: Common about the lake especially around Ratan Talav.

White-tailed Lapwing *V. leucurus* W: Not uncommon on Ratan Talav and Kochia ki Dhani.

Common Snipe *Gallinago gallinago* W: Uncommon on Ratan Talav and Kochia ki Dhani but never on the lake. Adam rarely met with it but "shot one or two about the banks of the open wells."

Black-tailed Godwit *Limosa limosa* W: Although Adam observed the species in large numbers, only small flocks of 15–30 birds have been seen during the study period except once—on 14th October 1994 more than 500 birds were observed on the southern edge of the lake.

Eurasian Curlew *Numenius arquata* PM, W: Common. Usually two–three birds are encountered. However, 27 birds were observed feeding on the main lake on 14th October 1995. Usually arrives by the first week of August and leaves by April. Stragglers have been observed up to May. Two birds were observed feeding on the grassy edge of the lake on 3rd May 1998.

Spotted Redshank *Tringa erythropus* W: Not very common on the lake. More than 100 in breeding plumage were observed at Phulera on 8th April 1996 and two in full breeding plumage on 3rd May 1998.

Common Redshank *T. totanus* W: Small numbers are commonly seen on the lake, the highest numbers recorded being *c*. 200 birds on 13th November 1996. Adam wrote that the species is sparingly met with during the cold weather.

Marsh Sandpiper *T. stagnatilis* W: Not very common on the lake but common on the satellite wetlands.

Common Greenshank *T. nebularia* W: Uncommon on the lake—the maximum being *c*. 50 on 16th November 1996. Adam found it very rare and shot a female on 4th May 1873.

Green Sandpiper *T. ochropus* W: Not recorded on the lake but common on the satellite wetlands.

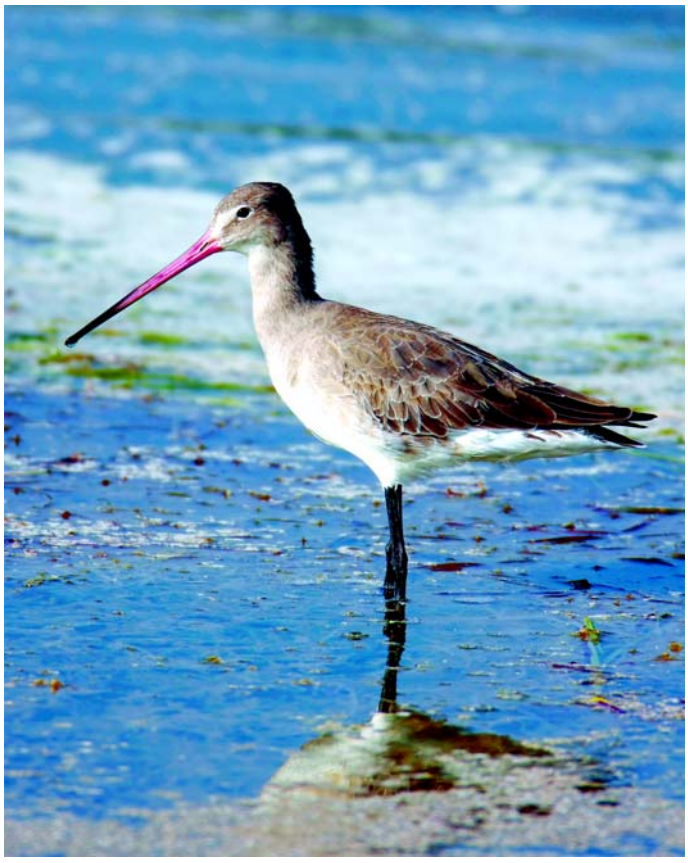
Wood Sandpiper *T. glareola* W: Not very common on the lake but common on the satellite wetlands.

Terek Sandpiper *Xenus cinereus* PM: Rare. An individual was observed on 10th September 1998 at Kochia ki Dhani.

Common Sandpiper *Actitis hypoleucos* W: Adam found it very rare and obtained only one specimen. Not so rare now, and I once observed more than 100 birds on 4th December 1994.

Ruddy Turnstone *Arenaria interpres* PM: Rare. A male in breeding plumage was observed on 5th September 1995 at Phulera (Sangha & Vardhan 2002). During September Adam obtained three specimens on the lake.

Little Stint *Calidris minuta* W: Common; extreme dates of arrival and departure being 10th August 2003 and 3rd May 1998 respectively. In some years 500–1,000 birds are not uncommon. Adam collected the species up to 25th May.



Mohan Kemparaju

Black-tailed Godwit *Limosa limosa*

Temminck's Stint *C. temminckii* W: Common, but in smaller numbers than the previous. About 440 birds were observed on 23rd September 1996.

Dunlin *C. alpina* ?: Although Adam reported "large flocks" in winter, I have observed only occasional small flocks. The biggest flock of 25 birds in breeding plumage was observed on 10th September 1998. Eleven in breeding plumage were observed on 5th September 1999 and three on 19th September 2001 at Kochia ki Dhani. A flock of 87 birds was observed at Deedwana on 1st February 1998.

Curlew Sandpiper *C. ferruginea* ?: Contrary to Adam's observation that the species "visits the lake in only small numbers during the cold weather," all my records are during autumn passage. Adam shot a female on 21st May in full breeding plumage.

Broad-billed Sandpiper *Limicola falcinellus* * PM: Rare. Two birds were observed at Kochia ki Dhani on 7th March 1999; three at Phulera and one at Kochia ki Dhani on 19th September 2001 (Sangha & Kulshreshtha 2004)—a new record for the area and Rajasthan. Not recorded by Adam.

Ruff *Philomachus pugnax* PM, W: Maximum numbers were seen during autumn passage, September–November—more than 5,000 on 17th September 1995; *c.* 2,500 on 19th September 2001. The extreme arrival and departure dates were 10th August 2001 and 3rd May 1998.

Black-winged Stilt *Himantopus himantopus* R, W: Common. The influx in winter months indicates that the migrants augment the resident population. A maximum of 3,000+ birds was recorded on 17th September 1995. The species bred on the lake in August 1994 and at Phulera 23 birds were observed incubating on 9th April 1996. On the main lake the species has been observed from August to May but in the neighbouring waterbodies, which retain water, it is present throughout the year. Although Adam observed that "immense flocks" frequent the lake from the commencement of rains till the beginning of summer, the usual numbers in winter have varied between 100–500 during 1990–2008.

Pied Avocet *Recurvirostra avosetta* W: Common and regular on the lake and Phulera Lake in variable numbers. In some years birds arrive by mid July–early August and stay as long as water is available. Extreme dates of arrival and departure are 11th July 1997 and 1st April 1996 respectively. Unusually large flocks were sometimes observed: *c.* 450 on 14th October 1994, 150 on 1st April 1996, 600+ on 23rd September 1996, and *c.* 1,100 on 13th December 1996. Adam found it "rare about the lake," but in additional notes he has written that "during the last cold season this appeared in large flock about the lake."

Red-necked Phalarope *Phalaropus lobatus* PM: Uncommon. 27 were observed at Kochia ki Dhani foraging with Little Grebe on 9th September 1998 and four on 5th September 1999. 17 were observed on 5th February 1999, sticking in two–three groups around Northern Shoveller and picking off flies disturbed by the swimming ducks (Sangha 2002), and five birds including one juvenile were observed on 2nd November 2001. 13 were observed foraging on 21st September 2008 on the lake. Adam obtained specimens on 22nd and 25th September.

Stone-Curlew *Burhinus oedicnemus* R: Adam met with the species only near Nawa. During 1990s the species was sighted only near Kochia ki Dhani. However, since 1996 I have observed the species quite regularly at Ratan Talav. The recent growth

Clement Francis

Indian Courser *Cursorius coromandelicus*

exotic of *Prosopis chilensis* seems to have provided safe shelter to the species. Three-four young birds were also seen 5. ix. 1999.

Great Stone-Plover *Esacus recurvirostris* R ?: Nine birds were observed on 29th January 1996 resting under a *Prosopis chilensis.* Irregularly sighted on Phulera lake.

Oriental Pratincole *Glareola maldivarum* ?: Three–four sightings on Kochia ki Dhani and Phulera.

Small Pratincole *G. lactea* ?: Uncommon. One on 16th October 1991, five on 21st November 1992 near the lake, 15 at Phulera on 17th September 1995 and nine on 15th August 2007 at Kochia ki Dhani.

Indian Courser *Cursorius coromandelicus* R: Adam found the species abundant about the lake frequently in company with *C. cursor* during the entire cold season, but did not record it breeding. I observed the species only occasionally in small numbers varying from four to nine. However, more than 40 birds were observed in a harvested field near the lake on 20th September 2003. The species seems to have declined. It breeds in small numbers in the Sambhar area. At Julga, on the dry lakebed, six breeding pairs were observed on 5th June 2004 and nine breeding pairs were seen at Vala on 10th June 2004.

Pallas's Gull *Larus ichthyaetus* W: Rather uncommon although *c.* 350 birds were recorded on 20th February 1993

Brown-headed Gull *L. brunnicephalus* W: Common in small numbers on the lake, although Adam found it "very plentiful" during the whole cold weather and till the beginning of hot weather.

Black-headed Gull *L. ridibundus* W: Almost rare on the lake. Six were observed on 21st November 1992, 25 on 25th January 1993 and seven on 14th October 1995. On the contrary Adam found it plentiful during the cold weather.

Gull-billed Tern *Gelochelidon nilotica* W: Common in small numbers. Up to 100 were observed on 23rd September 1996, its extreme arrival and departure dates being 30th September 1992 and 3rd May 1998 respectively. On 16th January 1996 13 birds were hawking insects over a gram field, flying about 3m above the un-ripened crop. More than 100 were observed on 19th September 2001 at Phulera.

River Tern *Sterna aurantia* M: Uncommon. All three records are from the monsoon period—three on 30th August 19992, five on 17th September 1995 and three on 23rd September 1996.

Little Tern *S. albifrons* * ?: Two at Kochia ki Dhani on 19th September 2001, a new record for the area. Not recorded by Adam.

Whiskered Tern *Chlidonias hybridus* W: Not uncommon on the lake. However, when salinity increases, moves to the satellite wetlands. Up to 250 birds were observed on 23rd September 1996 on the lake and 150 on 24th March 1993 at Kochia ki Dhani. Adam found it very common.

White-winged Black Tern *C. leucopterus* * PM: Only one record. Four birds in breeding plumage were observed on 9th April 1996 at Phulera (Sangha & Vardhan 1998), which is a new record for the area and Rajasthan. Not recorded by Adam.

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Dhirendra Devarshi, Digvijay Singh of Dhamotar, Nandi Vardahan Rathore and Somendra Singh supplied their unpublished records. Ashok Jain supplied satellite remote sensing data of the year 2003. Shantanu Kumar read an early version of the paper and made helpful comments. Harsh Vardhan cast his gimlet eye on the revised version of the paper and sent extensive comments. I am thankful to all of them.

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Appendix

The following list includes all records, including historical, of the birds of Sambhar Lake, its vicinity and satellite wetlands, with brief notes. Where necessary, I have included notes on the general present day status of a species in Rajasthan. Species' English and scientific names are followed by their abbreviated species status. On the next line I have summarised Adam's (1873, 1874a–b) notes, followed by my comments within square brackets. The species mentioned under 'systematic waterfowl list' (above) are merely listed to avoid repetition. The taxonomy and scientific nomenclature follow Manakadan & Pittie (2001).

Abbreviations

* = New record. Species not previously reported from Sambhar Lake and its vicinity by Adam, or inadvertently omitted.
? = Status uncertain.
AL = Already listed in the 'systematic waterfowl list' section of this paper.

M = Monsoon visitor (July–September).
PM = Passage migrant.
R = Resident.
S = Summer visitor (April–July).
V = Vagrant.
W = Winter visitor (October–March).

Checklist

Little Grebe *Tachybaptus ruficollis* AL

Great Crested Grebe *Podiceps cristatus* AL

Black-necked Grebe* *P. nigricollis* V
Not recorded by Adam. [Rare. Only one record from Sursura village water body near Rupangarh. A bird was seen with Little Grebe on 30th January 1996.]

Great White Pelican *Pelecanus onocrotalus* AL

Little Cormorant *Phalacrocorax niger* AL

Great Cormorant *P. carbo* AL

Darter *Anhinga melanogaster* AL

Little Egret *Egretta garzetta* AL

Grey Heron *Ardea cinerea* AL

Large Egret *Casmerodius albus* AL

Cattle Egret *Bubulcus ibis* AL

Indian Pond-Heron *Ardeola grayii* AL

Little Green Heron *Butorides striatus* AL

Painted Stork *Mycteria leucocephala* AL

Black Stork *Ciconia nigra* AL

White-necked Stork *C. episcopus* AL

Greater Adjutant-Stork *Leptoptilos dubius*
Adam observed only two pairs during the rains. [Ali & Ripley's (1978) claim that it was not uncommon in northern India, chiefly during rains, seems to have been based on very old records. Although Hume (in Whistler 1938) found it scarce in Jodhpur except during rains, Whistler (1938) did not record it. In the years when desert locust swarms were heavy the species arrived in good numbers. About 2,000 were observed feeding on locusts and grasshoppers from *c*. 14–21 August 1956 in Rayanwali, Thukrana, Freedsar and Kardoo villages in Suratgarh, north Rajasthan (Singh & Singh 1960). In the last few years the species has been more or less restricted to Assam (Hancock *et al*. 1992). All the recent records in Rajasthan are from Bharatpur and none after 1990 (Devarshi 2004).]

Eurasian Spoonbill *Platalea leucorodia* AL

Greater Flamingo *Phoenicopterus ruber* AL

Lesser Flamingo *P. minor* AL

Greylag Goose *Anser anser* AL

Bar-headed Goose *A. indicus* AL

Brahminy Shelduck *Tadorna ferruginea* AL

Common Shelduck *T. tadorna* AL

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Greater Flamingo *Phoenicopterus ruber*

Comb Duck *Sarkidiornis melanotos* AL

Gadwall *Anas strepera* AL

Eurasian Wigeon *A. penelope* AL

Spotbilled Duck *A. poecilorhyncha* AL

Northern Shoveller *A. clypeata* AL

Northern Pintail *A. acuta* AL

Garganey *A. querquedula* AL

Common Teal *A. crecca* AL

Red-crested Pochard *Rhodonessa rufina* AL

Common Pochard *Aythya ferina* AL

Ferruginous Pochard *A. nyroca* AL

Tufted Pochard *A. fuligula* AL

Oriental Honey-Buzzard *Pernis ptilorhynchus* ?
Very rare; noticed only twice. [Only one sighting.]

Black-shouldered Kite *Elanus caeruleus* R
Not common. [Not uncommon.]

Black Kite *Milvus govinda* R
Very common. [Not uncommon.]

Pallas's Fish-Eagle *Haliaeetus leucoryphus* ?
Occasional. Saw it perching on stakes in the lakebed. [No recent sighting except at Bharatpur.]

Egyptian Vulture *Neophron percnopterus* R
Very common all around the lake; took nests from walls of the Sambhar Fort, from the top of the temples and peepul trees. [Occasional.]

Indian White-backed Vulture *Gyps bengalensis* R
Very common…Dying camels and bullocks attracted these birds in great numbers. [Common in 1990s, now occasional. Three–four bred at Ratan Talav and Ranian in 2004. Their absence is noteworthy, presumably related to the catastrophic declines of *Gyps* vultures in the Indian Subcontinent owing to diclofenac poisoning (BirdLife International 2004).]

Long-billed Vulture *G. indicus* R
Common. [Quite rare after the recent plummeting of population.]

Eurasian Griffon *G. fulvus* W
The migrant vulture is not uncommon, in winters. [Not uncommon.]

Cinereous Vulture *Aegypius monachus* W
Met with in the cold weather. [Occasional.]

Red-headed Vulture *Sarcogyps calvus* R
Common; saw a nest in the face of a rock in the hills near Nawa. [Occasional. Surrounding area much disturbed, for it to breed, due to lopping of trees.]

Short-toed Snake-Eagle *Circaetus gallicus** W
Not recorded by Adam. [Occasional in winter.]

Western Marsh-Harrier *Circus aeruginosus* W
Young birds of this species are very common during the cold season. [Quite common; rare on the lake.]

Pallid Harrier *C. macrourus* W
Very common. [Not uncommon.]

Montagu's Harrier *C. pygargus** W
Not recorded by Adam. [Occasional.]

Shikra *Accipiter badius* R
Not common. [Not uncommon.]

Besra Sparrowhawk *A. virgatus* ?
Very rare, but collected two specimens. [No recent record.]

Eurasian Sparrowhawk *A. nisus* ?
Rare; saw it once or twice at the lake. [No sighting in the study area. Otherwise most sightings of the species are during spring passage in Rajasthan.]

White-eyed Buzzard *Butastur teesa* R
Pretty common. Collected a nest and saw a pair in coitus on the top of one of the salt heaps on 26th April 1870. [Rare. Only two or three sightings.]

Long-legged Buzzard *Buteo rufinus** W
[Fairly common.]

Tawny Eagle *Aquila rapax* ?
Very common; found nests. [No sighting.]

Steppe Eagle *A. nipalensis** W
[Fairly common. Treated as race of the earlier species in older works but Adam has not mentioned it.]

Bonelli's Eagle *Hieraaetus fasciatus* ?
Obtained one specimen at Sambhar. [Rather uncommon, three sightings.]

Booted Eagle *H. pennatus** W
Not recorded by Adam. [Uncommon. A bird was observed attacking Pied Avocets at Phulera on 14th October 1995.]

Common Kestrel *Falco tinnunculus* W
Very common. [Common.]

Red-headed Falcon *F. chicquera* R
Not common; saw a few pairs about the lake. [Four sightings. On 1st February 1998 a pair was observed hunting Kentish Plovers on the dry lakebed after sunset.]

Laggar *F. jugger* ?
Very common about the lake; found it breeding. [No sighting. Seems to have drastically declined all over Rajasthan except western districts of the state.]

Peregrine Falcon *F. peregrinus* W
Found frequenting the lake; pouncing on waders. [Rare. Recorded once on 4th January 2009, hunting Kentish Plovers on the dry lakebed at dawn.]

Grey Francolin *Francolinus pondicerianus* R
Very common. [Very common.]

Common Quail *Coturnix coturnix* W
Often met with in grasslands or near cultivation. [Rather uncommon.]

Rain Quail *C. coromandelica* M
Nowhere common. [Rather uncommon.]

Jungle Bush-Quail *Perdicula asiatica* R
Not common. [Uncommon.]

Indian Peafowl *Pavo cristatus* R
Very common. [Common.]

Yellow-legged Buttonquail *Turnix tanki* ?
Obtained a number of specimens about the setting in of the rains. [Not uncommon.]

Sarus Crane *Grus antigone* ?
Adam found it very common and saw as many as thirty young and adult birds feeding together. He collected eggs on 23rd August from a nest, which was in a patch of grassland flooded by the rains. [Rare. A pair was seen at Chhomora Nala near Dudu in December 1988.]

Demoiselle Crane *G. virgo* AL

Common Crane *G. grus* AL

Brown Crake *Amaurornis akool* ?
Not common. It frequented the long grass on the banks of open wells. [No record.]

White-breasted Waterhen *A. phoenicurus* AL

Purple Moorhen *Porphyrio porphyrio* AL

Common Moorhen *Gallinula chloropus* AL

Common Coot *Fulica atra* AL

Great Indian Bustard *Ardeotis nigriceps* ?
Although Adam never saw this species during his stay in Sambhar, he mentions that some Railway Engineers had shot it. [No recent sighting. The species has declined drastically all over its range in Rajasthan.]

Houbara *Chlamydotis undulata* ?
Adam saw the species on 'three occasions during winter. On one occasion shot two birds from a party of six. [No recent record.]

Lesser Florican *Sypheotides indica* ?
Shot one male at Sambhar on 19th July and later a female at the beginning of rains. [No recent record from Sambhar]

Pheasant-tailed Jacana *Hydrophasianus chirurgus* AL

Greater Painted-Snipe *Rostratula benghalensis* AL

Pacific Golden-Plover *Pluvialis (dominica) fulva* AL

Grey Plover *P. squatarola* AL

Little Ringed Plover *Charadrius dubius* AL

Kentish Plover *C. alexandrinus* AL

Lesser Sand Plover *C. mongolus* AL

Greater Sand Plover *C. leschenaultii* AL

Northern Lapwing *Vanellus vanellus* ?
Very rare. Saw it twice near Kuchaman and obtained one specimen. [No record from Sambhar. However, a small flock was observed regularly at Ramchandrapura near Jaipur in the 1980s.]

Yellow-wattled Lapwing *V. malabaricus* AL

Red-wattled Lapwing *V. indicus* AL

Sociable Lapwing *V. gregarius* ?
Although Adam collected four specimens, he found it was not very common and met with it sparingly about the plains. [No record from Sambhar. All recent records are from Bharatpur, Churu, Hanumangarh, Jaisalmer and Sikar districts (Sangha 2005). There is a very recent record from Nimaj, Pali of a single bird on 3rd March 2008 (Sumendra Singh, *verbally*).]

White-tailed Lapwing *V. leucurus* AL

Common Snipe *Gallinago gallinago* AL

Jack Snipe *Lymnocryptes minimus* W
Very rare; procured only one specimen. [Only one sight record from Kuchaman. Per Undeland and I scoped a bird on 1st February 1998.]

Black-tailed Godwit *Limosa limosa* AL

Eurasian Curlew *Numenius arquata* AL

Spotted Redshank *Tringa erythropus* AL

Common Redshank *T. totanus* AL

Marsh Sandpiper *T. stagnatilis* AL

Common Greenshank *T. nebularia* AL

Green Sandpiper *T. ochropus* AL

Wood Sandpiper *T. glareola* AL

Terek Sandpiper *Xenus cinereus* AL

Common Sandpiper *Actitis hypoleucos* AL

Ruddy Turnstone *Arenaria interpres* AL

Sanderling *Calidris alba* AL

Little Stint *C. minuta* AL

Temminck's Stint *C. temminckii* AL

Dunlin *C. alpina* AL

Curlew Sandpiper *C. ferruginea* AL

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Cream-coloured Courser *Cursorius cursor*.

Broad-billed Sandpiper *Limicola falcinellus* AL

Ruff *Philomachus pugnax* AL

Black-winged Stilt *Himantopus himantopus* AL

Pied Avocet *Recurvirostra avosetta* AL

Red-necked Phalarope *Phalaropus lobatus* AL

Stone-Curlew *Burhinus oedicnemus* AL

Great Stone-Plover *Esacus recurvirostris* AL

Cream-coloured Courser *Cursorius cursor* ?
Abundant all over the sandy plains during the cold weather. Adam sent three parties in three different years to obtain the eggs. [No recent sighting. All winter records are from western Rajasthan. On what basis Adam postulated that the species bred it is difficult to say.]

Indian Courser *C. coromandelicus* AL

Oriental Pratincole *Glareola maldivarum* AL

Small Pratincole *G. lactea* AL

Pallas's Gull *Larus ichthyaetus* AL

Brown-headed Gull *L. brunnicephalus* AL

Black-headed Gull *L. ridibundus* AL

Gull-billed Tern *Gelochelidon nilotica* AL

River Tern *Sterna aurantia* AL

Little Tern *S. albifrons* AL

Whiskered Tern *Chlidonias hybridus* AL

White-winged Black Tern *C. leucopterus* AL

Chestnut-bellied Sandgrouse *Pterocles exustus* R
Great numbers. Collected nests in April–May. [Commonly seen in small flocks.]

Black-bellied Sandgrouse *P. orientalis* ?
Very large numbers during the cold weather. The bird catchers were netting these birds. [The species has greatly declined in numbers. Now known to occur no further east than Jodhpur. Former ruler of Kishengarh shot it at Rupangarh up to late 1950s (Shantanu Kumar, *verbally*).]

Painted Sandgrouse *P. indicus* R
Common all about the low ranges of hills. [Not uncommon.]

Blue Rock Pigeon *Columba livia* R
Abundant. [Very common.]

Oriental Turtle-Dove *Streptopelia orientalis* W
Very rare; collected a specimen on 10th May 1873. [Not recorded in Sambhar but there is a recent record further west from Bikaner (Sangha & Naoroji 2002).]

Little Brown Dove *S. senegalensis* R
Very common. [Very common.]

Spotted Dove *S. chinensis* ?
Uncommon. Obtained specimens (?) only during the rains. [No sighting.]

Red Collared Dove *S. tranquebarica* R
Very common. [Less common than *S. senegalensis* and *S. decaocto*.]

Eurasian Collared-Dove *S. decaocto* R
Very common. [Very common.]

Yellow-legged Green-Pigeon *Treron phoenicoptera* R
On his arrival at Sambhar Adam shot these birds (*chlorigaster*) for the table but also noted that lately the bird has almost disappeared. Also observed it in Nawa. Found the nominate race very rare, obtaining a single specimen. [*T. p. chlorigaster* is not uncommon. The status of the nominate race is unclear. However, there is a confirmed recent record, as a bird was shot on 11th December 2004 at Nimaj, Pali district (Nandi Vardhan Rathore, *verbally*).]

Rose-ringed Parakeet *Psittacula krameri* R
Very common. [Very common.]

Blossom-headed Parakeet *P. cyanocephala* R
Common. [Common.]

Pied Crested Cuckoo *Clamator jacobinus* M
Very rare. [Occasional in monsoon.]

Brainfever Bird *Hierococcyx varius* M
Very rare. [Occasional.]

Common Cuckoo *Cuculus canorus* ?
Observed only twice. [No sighting.]

Asian Koel *Eudynamys scolopacea* R
Rare. [Not uncommon.]

Sirkeer Malkoha *Phaenicophaeus leschenaultii* R
Very rare. Adam shot a pair near Marot. [No sighting but not unlikely as the suitable habitat is present.]

Greater Coucal *Centropus sinensis* R
Adam found the species very rare but shot one in his garden. [Common.]

Barn Owl *Tyto alba* R
Very rare. [Not sighted but likely to occur.]

Dusky Eagle-Owl *Bubo coromandus* ?
Not common, but noted that a pair were generally to be found in some of the topes of trees. [No sighting. Suitable trees for roosting hardly exist.]

Mottled Wood-Owl *Strix ocellata* ?
Very rare; seen twice. [No sighting. Densely canopied trees are few and far between in the area. People lop every tree to feed their goats.]

Spotted Owlet *Athene brama* R
Very common. [Very common.]

Short-eared Owl *Asio flammeus* W
Not very common but occasional. [Rather uncommon. A dead bird was found near Sambhar in December 1990 (Dhirendra Devarshi, *verbally*).]

Common Indian Nightjar *Caprimulgus asiaticus* ?
Not common. [Very uncommon.]

Franklin's Nightjar *C. affinis* ?
Not common. Generally found it in the low-lying hills towards Nawa. [Uncommon.]

House Swift *Apus affinis* R
Very common. [Very common.]

Small Blue Kingfisher *Alcedo atthis* R
Very rare. [Occasional at Ratan Talav and Kochia ki Dhani.]

White-breasted Kingfisher *Halcyon smyrnensis* R

Very common; found it breeding on the banks of open wells. [Very common.]

Lesser Pied Kingfisher *Ceryle rudis* R
Very rare. [Uncommon.]

Small Bee-eater *Merops orientalis* R
Very common. [Very common.]

Blue-cheeked Bee-eater *M. persicus* S
Very common near Mata Pahar and Marot hills. [Common summer migrant. Breeds in the area.]

European Roller *Coracias garrulus** PM
Not recorded by Adam. [A few birds are regularly seen during autumn passage.]

Indian Roller *C. benghalensis* R
Very common. [Not uncommon.]

Common Hoopoe *Upupa epops* R
Uncommon. [Not uncommon.]

Indian Grey Hornbill *Ocyceros birostris* ?
Not recorded by Adam. [Very uncommon.]

Coppersmith Barbet *Megalaima haemacephala* R
Very common. [Common.]

Eurasian Wryneck *Jynx torquilla* W
Very rare; shot it on two occasions. [Uncommon.]

Yellow-fronted Pied Woodpecker *Dendrocopos mahrattensis* R
Not common but occasional. [Uncommon.]

Lesser Golden-backed Woodpecker *Dinopium javanense* R
Saw only at Kuchaman. [Uncommon.]

Black-shouldered Woodpecker *Chrysocolaptes festivus* ?
Adam collected a single specimen from Kuchaman. [No record. Suitable trees are not present in the area.]

Singing Bush-Lark *Mirafra cantillans* ?
Not very common. [No sighting.]

Red-winged Bush-Lark *M. erythroptera* R
Common about the scrub jungle. [Common.]

Ashy-crowned Sparrow-Lark *Eremopterix grisea* R
Plentiful. [In small numbers.]

Rufous-tailed Finch-Lark *Ammomanes phoenicurus* M
Very common about the fields after rains. [Present in small numbers.]

Eastern Calandra-Lark *Melanocorypha bimaculata* W
Not very common. [Occasional.]

Greater Short-toed Lark *Calandrella brachydactyla* W
Abundant. [Very common. Flocks of 300–400 birds not uncommon.]

Common Crested Lark *Galerida cristata* R
Very common. [Quite common.]

Eastern Skylark *Alauda gulgula* ?
Abundant; flocks all over the plains in winter. [Uncommon.]

Plain Martin *Riparia paludicola*
Very common [Very common.]

Dusky Crag-Martin *Hirundo concolor* R
Not common. [Not uncommon.]

Common Swallow *H. rustica* W
Plentiful. [Common in winter.]

Red-rumped Swallow *H. daurica* ?
Not very common. [Not uncommon.]

Streak-throated Swallow *H. fluvicola* ?
Very common. [Not uncommon.]

White Wagtail *Motacilla alba* W
Common. [Common.]

Large Pied Wagtail *M. maderaspatensis* R
Very common. [Common.]

Citrine Wagtail *M. citreola* W
Common. [Not uncommon.]

Yellow Wagtail *M. flava* W
Very common. [Common.]

Grey Wagtail *M. cinerea* W
Common. [Common.]

Paddyfield Pipit *Anthus rufulus*
Common. [Common.]

Tawny Pipit *A. campestris* W
Not very common. [Not uncommon.]

Oriental Tree Pipit *A. hodgsoni* ?
Not very common. [No record.]

Black-headed Cuckoo-Shrike *Coracina melanoptera* M ?
Obtained two specimens in June 1871. [No record from Sambhar but I have observed it breeding in Jaipur.]

Small Minivet *Pericrocotus cinnamomeus* R
Common. [Not uncommon.]

White-bellied Minivet *P. erythropygius* ?
Shot the species near Marot and Kuchaman. [Only one sighting near Phulera.]

Short-billed Minivet *P. brevirostris* R
Small parties in winter. [No sighting. Small parties of the species seen in winters by Adam were actually *P. ethologus* (Rasmussen & Anderton 2005), which is not unlikely to occur in this part of India during winter.]

Common Woodshrike *Tephrodornis pondicerianus* R
Not very common. [Uncommon.]

White-eared Bulbul *Pycnonotus leucotis* R
Abundant towards Marot and Nawa. [Not uncommon.]

Red-vented Bulbul *P. cafer* R
Very common. [Very common.]

Common Iora *Aegithina tiphia* R
Very rare. [One or two sightings in Sambhar town. Probably not rare.]

Marshall's Iora *A. nigrolutea** R ?
Not recorded by Adam. [Rare. One sight record. A pair was seen at Sursura near Rupangarh on 30th January 1996.]

Rufous-tailed Shrike *Lanius isabellinus* PM, W
Frequently seen. [Occasional in winter.]

Bay-backed Shrike *L. vittatus* R
Very common. [Not uncommon.]

Rufous-backed Shrike *L. schach* R
Not very plentiful. [Occasional.]

Southern Grey Shrike *L. meridionalis* R
Very common. [Quite common.]

Blue-headed Rock-Thrush *Monticola cinclorhynchus* W
Adam shot one on 18th September. [No record from Sambhar.]

Blue Rock-Thrush *M. solitarius* W
Met with it only on two occasions. [No record from Sambhar.]

Orange-headed Thrush *Zoothera citrina* V
Shot a female on 10th March. [No recent records except from Bharatpur.]

Tickell's Thrush *Turdus unicolor* V
Very rare. [Not recorded in the study area. Two or three birds are quite regularly seen in Bharatpur.]

Bluethroat *Luscinia svecica* W
Common. Frequenting the long grass about the open wells and the fields adjoining the wells. [Uncommon. For a species, which only winters, in plains of the subcontinent, Adam mistakenly felt that it breeds in Sambhar although he had never obtained a nest!]

Oriental Magpie-Robin *Copsychus saularis* R
Not common. [Uncommon.]

Indian Robin *Saxicoloides fulicata* R
Plentiful. [Common.]

Black Redstart *Phoenicurus ochruros* W
Not very common. [Fairly common.]

Common Stonechat *Saxicola torquata* W
Not very common. [Fairly common.]

Pied Bushchat *S. caprata* R ?
Not very plentiful. [Quite common.]

Variable Wheatear *Oenanthe picata* W
Not common—*O. p. opistholeuca*; common—*O. p. picata*. [Very common. The three regional forms—variously considered morphs, races or distinct species—occur in Rajasthan, *capistrata* being the most uncommon. In Sambhar *picata* is the most common like elsewhere in Rajasthan.]

Desert Wheatear *O. deserti* W
More plentiful. [Very common.]

Isabelline Wheatear *O. isabellina* W
Very common. [Not uncommon.]

Indian Chat *Cercomela fusca* R
Very common. [Very common.]

Yellow-eyed Babbler *Chrysomma sinense* R
One specimen was obtained. [Only two–three sight records.]

Common Babbler *Turdoides caudatus* R
Very common. [Very common.]

Large Grey Babbler *T. malcolmi* R
Very common. [Very common.]

Jungle Babbler *T. striatus* R
[A very common and distinctive bird possibly overlooked by Adam.]

Streaked Fantail-Warbler *Cisticola juncidis* ?
Not common. [No recent record from Sambhar.]

Rufous-fronted Prinia *Prinia buchanani* R
Very common. [Common.]

Franklin's Prinia *P. hodgsonii* R
Pretty common in the hills towards Kuchaman. [Common.]

Graceful Prinia *P. gracilis* R
Very common about the grassland and low scrub jungle. [Common.]

Ashy Prinia *P. socialis* R
[Uncommon.]

Plain Prinia *P. inornata* R
Not very common. [Fairly common.]

Blyth's Reed-Warbler *Acrocephalus dumetorum* PM
Not often met with. [Not uncommon during spring/summer passage.]

Indian Great Reed-Warbler *A. stentoreus* ?
Collected three specimens in April–May 1873. [No record.]

Booted Warbler *Hippolais caligata* ?
Not very common. [Rather uncommon.]

Common Tailorbird *Orthotomus sutorius* R
Very common. [Very common.]

Common Chiffchaff *Phylloscopus collybita* W
Very rare. [Fairly common.]

Olivaceous Leaf-Warbler *P. griseolus* ?
Very rare. [No record.]

Greenish Leaf-Warbler *P. trochiloides* PM
Very rare. [Not uncommon during autumn passage.]

Common Lesser Whitethroat *Sylvia curruca* W
Very common. [Very common.]

Hume's Lesser Whitethroat *S. althaea** W
[Common. Now considered a distinct species from *S. curruca*.]

Orphean Warbler *S. hortensis* PM ?
Adam met with the species once. [One or two sightings in September.]

Spotted Flycatcher *Muscicapa striata* PM
Only one specimen was obtained. [Uncommon autumn migrant mostly seen in western Rajasthan.]

Red-throated Flycatcher *Ficedula parva* W
Somewhat rare. [Uncommon.]

Verditer Flycatcher *Eumyias thalassina* V
A male was collected in November 1873. [No record.]

Grey-headed Flycatcher *Culicicapa ceylonensis* W
Very rare, obtained one specimen on December 1870. [Rare in the area.]

Asian Paradise-Flycatcher *Terpsiphone paradisi* ?
Not very common. [Uncommon.]

White-browed Fantail-Flycatcher *Rhipidura aureola* R
Very rare but saw few pairs at Nawa and Marot. [Rare.]

Great Tit *Parus major* R
Very rare. [Rare.]

Pied Tit *P. nuchalis* R
Common about Marot jungle; Adam collected 12 specimen. [Six birds were seen in 1996 at three different sites—two each at Maroth, Panchotia near Nawa and Sambhar Salts *beed* (forest) near Nawa (Tiwari 2001).]

Spotted Creeper *Salpornis spilonotus* R
Adam had two specimens shot for him near Kuchaman. [Rare. A pair was seen at village Sursura near Rupangarh on 30th January 1996.]

Purple Sunbird *Nectarinia asiatica* R
Very common. [Very common.]

Oriental White-eye *Zosterops palpebrosus* R
Adam saw a small party once in his garden. [Presumably this fairly common species seems to have been overlooked.]

Crested Bunting *Melophus lathami* ?
Very rare; collected only two from Sambhar but number of males from Kuchaman. [No recent records.]

Grey-necked Bunting *Emberiza buchanani* W
Obtained the specimens on two–three occasions close to Nawa and Kuchaman. [No record from Sambhar. However, there is a very recent record from Nahargarh, Jaipur. A single bird was recorded on 24th April 2008. Used to be found 'in huge flocks' at Pali (Whistler 1938).]

Striolated Bunting *E. striolata* R ?
Scrub jungles about the hills of Nawa and Marot; was certain that it bred about the hills near the lake. [Uncommon. Recorded from Nahargarh near Jaipur.]

Red-headed Bunting *E. bruniceps* ?
At times saw the species in large numbers; on 15th April 1873 saw males in breeding plumage. [No sighting.]

Common Rosefinch *Carpodacus erythrinus* W
Very rare and observed it on one or two occasions. [No recent records.]

White-throated Munia *Lonchura malabarica* R
Very common. [Very common.]

Spotted Munia *L. punctulata* ?
One sighting during rains. [No record.]

House Sparrow *Passer domesticus* R
Very common. [Common.]

Spanish Sparrow *P. hispaniolensis* W
Plentiful in *Prosopis cineraria* jungle near Kuchaman. [Rather occasional in winter.]

Yellow-throated Sparrow *Petronia xanthocollis* ?
Very common. [Rather uncommon. About 80 were observed feeding near Bichoon on 10th February 1999.]

Baya Weaver *Ploceus philippinus* R
Very common. [Rather uncommon. Depletion of suitable grasses for nest building could be the reason.]

Brahminy Starling *Sturnus pagodarum* R
Not very common. [Fairly common.]

Rosy Starling *S. roseus* PM, W
Large flocks during cold weather. [Occasional in winter. Common during passage in April.]

Common Starling *S. vulgaris* W
Often met with in pairs. [Rather uncommon. However, more than 100 were sighted near the lake on 8th February 1995.]

Asian Pied Starling *S. contra** R
Not recorded by Adam. [Common. The species was almost absent west of Jaipur up to the 1980s. Although its distribution is given east of 76ºE by Ali & Ripley (1978) the species has crossed 74ºE longitude in Rajasthan and likely to advance further west (Sharma 2004).]

Common Myna *Acridotheres tristis* R
Very common. [Very common.]

Bank Myna *A. ginginianus* R
Very common. [Very common.]

Eurasian Golden Oriole *Oriolus oriolus* S
Common. [Occasional.]

Clement Francis

Lesser Flamingo *Phoenicopterus minor*

Black Drongo *Dicrurus macrocercus* R
Very common. [Very common.]

Indian Treepie *Dendrocitta vagabunda* R
Very rare. [Occasional.]

House Crow *Corvus splendens* R
Abundant. [Common.]

Common Raven *C. corax subcorax* W
Pretty common during cold weather, but pairs are seen throughout the year. Collected a nest with three eggs. [Occasionally in small flocks near Shakambri Mata Temple during winters. Two birds were observed feeding on a dead dog near Bichoon on 8th February 1995. The species is now confined to extreme western Rajasthan and seems to have declined. It used to be very common and LaPersonne (in Whistler 1938) has remarked on the tameness of the bird in desert towns. In Phalodi they actually entered bungalow verandas (Whistler 1938)! All recent breeding records are from Bikaner and Jaisalmer (Sangha & Naoroji 2004).]