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# Nest sanitation in Sarus Cranes *Grus antigone* in Uttar Pradesh, India

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Nest sanitation, particularly disposal of nestling faecal sacs, is well-studied in altricial bird species (e.g. Morton 1979, McGowan 1995, Dell'omo *et al.* 1998), but there are few descriptions of this behaviour in precocial species (e.g. Littlefield 1978). Nest sanitation reduces the likelihood of infestation by parasites (fly maggots, fleas, ticks and mites) or pathogens (bacteria and fungi) by maintaining dryness in the nest (Welty and Baptista 1988, Ehrlich *et al.* 1994), and reduces the nest's conspicuousness to predators (Weatherhead 1984, Petit *et al.* 1989). After hatching, egg-shells are routinely carried away from the nest in most bird species (Welty and Baptista 1988). Several avian nest predators are known to use conspicuous shells to locate nests (Tinbergen *et al.* 1963). Removal of eggs with broken shells is carried out in most bird species and is thought to result from 'an ancestral, universal and continuing selection pressure' resulting from the threat that broken eggs pose to other eggs in a nest (Kemal and Rothstein 1988, Mallory *et al.* 2000).

Nest sanitation in Sarus Cranes *Grus antigone* has not been described specifically by previous workers on this species, all of whom have studied a population in Keoladeo National Park, Rajasthan (KNP: Ali 1958, Breeden and Breeden 1982, Ramachandran and Vijayan 1994). This species builds large, conspicuous nests in natural wetlands or paddy fields, and lays 1–2 eggs. The incubation period is 31 days (range: 27–35 days in the present study). The precocial chicks leave the nest permanently after two or three days, and never use the nest beyond a week after hatching (K. S. G. Sundar, personal observations). Nest sanitation is therefore only relevant during and immediately after incubation, in particular, immediately after hatching. Close observation of nests in the wild is difficult since most nests are surrounded by vegetation, and adults may abandon nests and eggs if disturbed (Ramachandran and Vijayan 1994; S. Sharma pers. comm. 2000).

Three possible types of material for nest sanitation were identified: (1) faeces of adult birds during and immediately after incubation; (2) egg-shell and other matter after hatching of the chicks, and (3) partially depredated and infertile eggs. Observations on all three are described and discussed in this note.

## METHODS

The breeding biology of Sarus Cranes was studied during two breeding seasons in June 2000–July 2002 in Etawah and Mainpuri districts, Uttar Pradesh, in north-central India. A total of 157 nests were observed, of which 145 were visited at least once during incubation or immediately after hatching. Sarus Cranes in the study area live alongside human settlements, and are accustomed to the presence of humans the year round. As a result, visiting nests never caused incubating birds to abandon the eggs. Adult birds were sexed by observation of unison calls, during which the male droops his primaries and touches the secondaries over the back (Archibald and Meine 1996). In addition, females in all pairs were considerably smaller than males, and the sexes could be readily differentiated when the birds were together.

## RESULTS

### Adult faeces

Each nest was visited 1–5 times during incubation to check for hatching success, and faeces were never found on the nests. Incubating adults were observed on several occasions to walk away from nests to defecate. Adults continued to use the nest after eggs hatched in eight nests, all of which were located in natural wetlands. On two of these nests adult faeces were found immediately after hatching of the second egg. In one, there was little

area left uncovered by faeces after three days, and the adults brooded their chick on the mess. No faeces were found on the other six nests.

### Hatched egg-shells

Observations were made on five nests as the eggs hatched, and on 32 nests a few hours after the chicks had hatched (as indicated by the weak movements of the chicks, presence of egg-tooth, and the first down plumage). In all five cases where hatching was observed, immediately after the chicks hatched, the male picked up the egg-lining and other material, wetted and swallowed it. The female picked up the larger shell fragments one by one and either threw them beside the nest (n=2), or flew up to 100 m before depositing the pieces in water (n=3). The smaller pieces were removed by brushing them off the nest with the beak. In two cases, the female offered a small piece of shell to the chick, which dropped it immediately. In the 32 nests visited a few hours after hatching, the egg-shells were always found to have been largely cleared away, with only a few pieces left lodged within the nest material.

### Depredated and infertile eggs

Observed natural egg predators in the study area were the Large-billed Crow *Corvus macrorhynchos* and the House Crow *C. splendens*. Depredation was observed only twice during this study, both on the same nest. In one case, Large-billed Crows broke part of the shell of both eggs on the nest and fed on the partially developed chick inside, leaving some yolk and albumen uneaten. The male Sarus Crane arrived, picked up both egg-shells, and threw them into the water beside the nest. The bird then churned the water using its beak with rapid sidewise motions of his head. A large quantity of nesting material was discarded into the water along with the egg-shell fragments. Further nest-building took place, and a replacement egg was laid 10 days later. The single egg was again depredated, this time by House Crows. The egg-shell was removed for measuring and preservation, and the adults were not seen to clean the nest or lay further replacement eggs.

Infertile eggs were observed in four nests. In one, the first egg laid continued to be incubated after the second egg hatched. Three days after hatching, the addled egg, which had begun to smell badly, was pushed into the water beside the nest, and the chick was brooded on the nest for a further two days. In a second nest, both eggs of the clutch were infertile, and were incubated for 41 days, after which the eggs were confirmed to be infertile and were collected. In a third nest, the first of an unusually large clutch of four eggs was smelling badly just prior to the expected hatching of the second egg, but the adults continued to incubate the clutch. The egg was removed from the nest at this stage. After the second and fourth eggs hatched, the adults abandoned the otherwise healthy third egg. In a fourth nest, adults continued incubating one egg for 40 days. The egg was collected after confirming that it was infertile.

## DISCUSSION

The ubiquitous absence of faeces on nests with eggs suggests that Sarus Cranes, as with other crane species (G. W. Archibald *in litt*. 2002) normally practice nest sanitation, presumably to avoid infecting the egg and/or attracting predators during incubation. In most pairs, this also continued after hatching. The immediate disposal of the egg-shell, egg-lining and other material were probably carried out to minimise detection of newly born chicks by predators. A strong smell of yolk was present immediately after the chick hatched out, and it is possible that both visual and olfactory cues stimulate nest-sanitation by adults. Both sexes participated, with the male disposing the egg-lining and the female taking care of the shell fragments. In precocial species, faecal sacs of nestlings afford nutrition to parent birds in some species (McGowan 1995, Dell'omo *et al.* 1998), while in others, adult birds are thought to ingest the faecal sacs as an economic alternative to the costs of transporting waste and leaving the nest unattended (Hurd *et al.* 1991). In birds of the dry areas, faecal sac consumption is sometimes even linked to water conservation (Calder 1968, Morton 1979). As Sarus Cranes nest near water and there was no apparent paucity of food, disposal of faecal sacs of newly hatched chicks by parent birds is therefore probably an adaptive feature to reduce predator attraction, but the adults may also derive some nutrition.

In KNP, Rajasthan, a female Sarus Crane was seen to eat egg-shell pieces and the egg lining (Ali 1958). In another observation in the park, the male ate the membrane and part of the egg-shell of the first egg, while both adults swallowed small portions of the egg-shell of the second egg and the male carried off the egg-shell and disposed it a few meters away from the nest (Breeden and Breeden 1982). Consistent sharing of duties, as recorded in this study, was not noted in KNP. Sarus Cranes during the present study were never observed to eat egg-shell as has been seen in KNP. In some crane species, the adults feed the egg-shells to the newly hatched chick (Archibald and Meine 1996). Differences between crane species, and between different Sarus Crane populations are likely to be a result of individual differences, predation pressure and perhaps levels of human disturbance.

After eggs were partly depredated, Sarus Cranes may have attempted to remove traces of egg material, both in water and on the nest, to avoid attracting predators by sight and smell. A similar case was reported from KNP, in which the adult Sarus Crane ate the broken egg after depredation by crows (Ramachandran and Vijayan 1994). Similar behaviour has been reported in Sandhill Cranes *Grus canadensis* (Littlefield 1978), and in many precocial birds (Kemal and Rothstein 1988, Mallory *et al.* 2000). Adult Sarus Cranes apparently could not recognise infertile eggs or determine the usual incubation period, perhaps because the incidence of infertile eggs is too low for there to be a strong selective pressure for recognition.

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# Surveys for Greater Adjutant *Leptoptilos dubius* in the Brahmaputra valley, Assam, India during 1994–1996

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The Greater Adjutant *Leptoptilos dubius* is considered to be globally threatened (Endangered: BirdLife International 2001). It formerly occurred in much of South and South-East Asia from Pakistan through northern India, Nepal and Bangladesh to Myanmar, Thailand, Laos, Vietnam and Cambodia. However, only two small and highly disjunct populations remain: in Assam and Cambodia (Rahmani *et al.* 1990, BirdLife International 2001). Prior to Rahmani (1989) and Saikia and Bhattacharjee (1989a, 1989b), there was little information about the status and distribution of Greater Adjutant in Assam. More recently, Bhattacharjee and Saikia (1996) presented information on the population size and trend between 1989 and 1994. This paper adds to these surveys, and reports on breeding season surveys in 1994–1995, and non-breeding surveys in 1996.

The study was confined to the Brahmaputra Valley, Assam (25°44´–27°55´N 89°41´–96°02´E). The valley is c.720 km long, c.80 km wide, covers 56,274 km$^2$, and is demarcated by the Eastern Himalaya, Patkai hills, Naga hills, Garo-Khasi-Jaintia hills and the Mikir hills (Singh 1991). The valley covers more than 60% of the area of Assam (Choudhury 1994). There are many river islands (including the 929 km$^2$ Majuli island: the largest river island in the world). Innumerable meandering tributaries form ox-bow lakes and huge marshy tracts.

## METHODS

We surveyed Greater Adjutants in the Brahmaputra Valley during the breeding season in 1994–1995 (and occasionally during 1995–1997), and during the non-breeding season in 1996. The breeding season survey was carried out from November 1994 to March 1995, with roadside counts made from motorbike and other means of transport, searches at wetlands, and searches by boat. Colonies were also identified from information from local people, and from the literature (Saikia and Bhattacharjee 1989a,b, Saikia and Bhattacharjee 1990a,b, Barooah 1991). All 18 districts in the Brahmaputra valley in Assam were covered, except Sonitpur (Table 1). During the non-breeding season, we surveyed sites near slaughterhouses, garbage dumps and fish and meat markets in nine towns (Table 3). These sites were chosen because they were known to be