MANAGEMENT AND MONITORING OF CAPTIVE BREEDING OF PAINTED STORK AND EURASIAN SPOONBILL IN ZOO AVIARY

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Abstract

Breeding biology of Spoonbill and Painted Stork has not been documented in detailed in captivity. This inventory unravels some of the aspects of their reproduction in captivity and generates useful baseline data for further studies in detail. The study was conducted in aviary of Sakkarbaug zoo, Junagadh, Gujarat. The alterations in artificial nesting platforms (ANPs), use of supplementary nesting material, behavioural changes of birds in anthropogenic environment and the factors affecting breeding success of both species of birds has been monitored and documented. Ample availability of food and lack of predators has positive effects on their breeding success. Changes in dimension of ANP greatly improved the breeding success of Spoonbill. Both male and female birds were seen foraging together often leaving the eggs/chicks along on ANP, contrary to its behaviour in wild.

Keywords

Captive breeding, monitoring, Painted Stork, Spoonbill

Painted Stork (*Mycteria leucocephala*) occurs only in South and Southeast Asia in countries like India, Sri Lanka, Nepal, Myanmar, Cambodia and Vietnam. In India, Painted Storks are found virtually in the entire subcontinent except for some areas of western Rajasthan, snow clad mountains of Jammu and Kashmir, Himachal and northeast regions. The Eurasian Spoonbill (*Platalea leucorodia*) is not so common as the Painted Stork as it is restricted to western, central, southern and some parts of northern India. Both are resident birds that generally inhabit mainly inland wetlands and their distribution is widespread (Grimmett *et al.*, 1999).

Spoonbills form a natural group, Plataleinae, allied to the Ibises (Ibididae), and somewhat more distantly to the Storks (Ciconidae). Abundance of food allows a wide variety of water birds to breed during monsoon season (Kazmierczak & Perlo, 2000). The nesting colonies of Ciconiiform and Pelecaniform water birds, popularly known as heronries or egretries (Ali, 1996) are spatio-temporal aggregation of nests at favourable locations during the breeding season. Both, spoonbills and Painted Storks are commonly sighted water birds in the wetlands of Gujarat. Spoonbills are categorized in Schedule I whereas Painted Stork in Schedule IV of the Wildlife (Protection) Act, 1972 as their population estimates are important in determining the density, diversity and health of a wetland ecosystem (Kazmierczak & Perlo, 2000). In unmanned areas, the nesting colonies are selectively attacked by natural predators and late nesters are more susceptible to predatory loss of nestlings, the birds thus tend to form nesting colonies near human habitations (Perins & Birkhead, 1983). Nesting of Reef Heron (*Egretta gularis*) in crowded city areas (Parasharya, 1984) and White Ibis (*Threskiornis melanocephalus*) in zoo aviary are some examples of adaptations of these birds to newer nesting habitats (Singh & Singh, 1995; Devkar *et al*., 2005). Failure to protect at-risk species may result in an accelerated loss of biodiversity (Terborgh & Winter, 1980) at a regional perspective.

Drastic changes in their populations in a particular area or wetland can seriously alter the density and biodiversity index of that wetland. There have been incidences of these birds breeding in captive environs of some zoos (Dash & Mohanty, 2002) but such reports do not elaborate the details regarding its dimension and type of artificial nests/nesting platforms and other factors affecting breeding in captivity. This inventory is an effort to understand the breeding of these two birds and their requirements like an ideal artificial nest, nesting material, and other factors affecting breeding in captive environs. Since there are no reports on breeding of these two species in captivity from western India, the information generated herein can ultimately be important in management of this species and in developing a conservation-breeding programme.

Study area

This study was conducted at Sakkarbaug Zoo Aviary in Junagadh, Gujarat, India. Junagadh town ($21^0$31'N & $70^0$49'E, 82-92m, rainfall 35-40in) is located in the Saurashtra region of Gujarat state. Sakkarbaug Zoo is the largest in Gujarat and the third oldest zoo in India that attracts thousands of tourists every year.

Both, Painted Stork and Spoonbill, were initially housed in the same aviary. The cages made of wire mesh and iron angles were open to sky and from all the sides. Each aviary measured 15.31x9.60x6.0m. The aviaries had artificial ponds, each measuring 9.90x5.40x0.30m filled with water whenever required so that the water level could be maintained as much as possible. One of the corners of each cage had a feeding tray (0.97x0.67m) in which the birds were fed daily at 1100hr and 1600hr with Tilapia fish (*Oreochromis mossambicus*) and beef khima (minced meat of Buffalo) *ad libitum*. The aviary consisted of four artificial nesting platforms (ANPs), two of them were wielded to the wall of the cage at a height of 3.87m from the ground and the distance between two artificial nests was 4.14m. The other two cages were tied to branches of trees at a height of 3.87m from the ground level in the same cage. Each had a dimension

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of 120x75x10cm depth and made up of iron frame and iron mesh. Due to fierce territorial conflicts and competition for ANPs and nesting material the Spoonbills were later shifted into an adjacent aviary of same dimension having two ANPs. These ANPs were modified and a 9cm raised border (made of wire mesh) was welded on its periphery making the total depth 19cm. This was done to prevent the eggs and chicks from falling off the nest.

The Spoonbill aviary consisted of Banyan tree (*Ficus bengalensis*) (4.80 m ht.; 1.26m GBH) and Bamboo (*Bambusa bambus*) (each was 5.10m ht.; 15cm GBH). The bunch of bamboo shoots occupied a sizable of space in the aviary, as their entire circumference was 4.20m. The aviary that housed Painted Storks had Banyan tree (7.50m ht.; 0.81m GBH), Umbro (*Ficus racemosa*) (7.50m ht.; 0.84m GBH) and Peepal (*Ficus religiosa*) (7.50m ht.; 0.43m GBH).

Materials and Methods

The pilot observations of nidification activities revealed that the birds were most active during morning and evening. Initially, nest building behaviour of Spoonbill and Painted Stork was studied by monitoring the activities continuously for 15min with a gap of 15min daily from 0800hr to 1000hr and from 1600hr to 1800hr. Observations revealed that fresh leaves and dry twigs of plants inside the aviary were inadequate. Dried twigs having an average length of 30-75cm were randomly collected and supplied inside the aviary for nest building. The diameter of nest was measured across the middle part of the nest periphery from one end of the edge to the widest edge of the other end. Sticks extending beyond the cup of the nest were excluded from the measurement (Sykes, 1987). The depth of the nest cup was measured from the centre of the nest bottom to the horizontal plane of the rim. Data collected from the abandoned nests were discarded. The average diameter of nest of Spoonbill was 50cm, whereas the cup (central portion) was 15cm in diameter and 7.5cm deep. The average diameter of nest was 90cm whereas the cup was 30cm diameter and 15cm deep. During the entire period of study, both Spoonbill and Painted Stork built three successful nests each and several unsuccessful attempts made by them that have not been considered in the present protocol. The design of ANPs was based on pilot observations of nesting behaviour of White Ibises in aviary and literature survey (Li & Martin, 1984; Singh & Singh, 1995). A pair of Olympus™ binocular (7x21) was used for daily observations.

The observations for both Painted Stork and Spoonbill were made from August 2003 to November 2004 and the data collected has been divided into four phases of study as follows.

August 03 to November 03:	Phase I
December 03 to March 04:	Phase II
April 04 to July 04:	Phase III
August 04 to November 04:	Phase IV

The nests were monitored regularly and the following parameters were recorded during the period of study: number of eggs laid; number of eggs broken during incubation; number of eggs hatched; number of eggs not hatched; mortality of chicks; and, natality of chicks.

Observations and Results

Painted Stork

Phase I: During this phase the breeding pair laid only one egg that was broken as it fell off from the nest. Occasional courtship behaviour was seen but it did not result in any further breeding activity. Lot of territorial conflict was seen with Spoonbills. Stealing of nesting material from the Spoonbill nest was a frequent behaviour observed during this phase.

Phase II: There was no breeding activity seen during this phase. Intense territorial conflict was seen with Spoonbills as well as with the member of same species. Stealing of nesting material from the Spoonbill nest was a frequent behaviour observed. The courtship behaviour virtually came to a standstill and the birds were seen to be less active during the latter part of this phase.

Phase III: There was no egg laying recorded during this phase as well. Intense territorial conflict was seen with Spoonbills as well as with the member of same species. SStealing of nesting material from the Spoonbill nest was a frequent behaviour observed. There was no courtship behaviour and the birds were seen to be less active.

Phase IV: This phase saw elaborate courtship behaviour that was followed by hectic nest building activity. The breeding pair was seen to be active throughout the day. The birds collected nesting material (twigs provided) and then flew in circular fashion inside the aviary or took short distance flights. This exercise although appears futile initially, may however be assumed to be symbolic of its foraging behaviour that is mandatory in its natural habitat for searching nesting material and locating favourable feeding ground. Two eggs were during this phase and one of them hatched whereas the second egg failed to hatch and was eventually destroyed by the parents. The egg that had hatched successfully resulted in a healthy chick that is still surviving in the aviary. The second pair of storks laid a single egg that failed to hatch and was later destroyed by the parents (Table 1).

Spoonbills

Phase I: There was no breeding activity recorded during this phase. The pair of Spoonbill was rather inactive and showed no interest towards the artificial nesting material provided or towards each other.

Phase II: Elaborate courtship behaviour was seen during the initial and mid phases of study followed by nest building. Both male and female participated in nest building and the nest was ready in about six days. The birds collected the nesting material (twigs provided) and then flew in circular fashion inside the aviary or took short distance flights. Four eggs were laid during the latter part of this phase. Some repair and restoration of the nest however continued even after egg laying. Two eggs were

Table 1. Date wise breeding score of a pair of Spoonbill and 2 pairs of Painted Stork in captivity during different phases of study.

Parameters & date	Spoonbill				Painted Stork			
	I	II	III	IV	I	II	III	IV
Total No. of eggs laid	—	4 2.2.04	3 24.5.05	3 19.9.04	1 3.10.03	—	—	3 13.8.04
Total Eggs broken / not hatched	—	2 3.2.04	3 26.5.05	00	1 4.10.03	—	—	2 18.8.04
Total Hatchability	—	2 1.3.04	00	3 15.10.04	—	—	—	1 9.9.04
Total Mortality of chicks	—	1 6.3.04	1 prev. phase	00	—	—	—	00
Total Natality of chicks	—	1 next phase	00	**3** till todate	—	—	—	1 till todate

incubated and hatched successfully whereas the remaining two eggs failed to hatch and were later found broken. One of the two chicks that had hatched was able to survive whereas the second chick died as it fell off the nest. This phase was also marked by territorial conflicts, aggressive vociferous displays and frequent stealing of nesting material by Painted Storks that often disturbed the harmony of Spoonbills. These observations revealed that the Spoonbills were not able to adapt to the presence of Painted Storks in the same enclosure. Hence it was thought pertinent to shift the pair of Spoonbills to an adjacent enclosure.

Phase III: The surviving chick of phase II also died during the beginning of this phase, as probably it was a weakling. The pair of Spoonbills regrouped and pair-bonded in the new abode. During the mid part of this phase the breeding pair continued its courtship behaviour and rearranged the nesting material in the artificial nest. Three eggs were laid during the mid part of this phase and were incubated by the female bird. However, all the three eggs perished at different times as they rolled off from the artificial nest. Although, the new enclosure was ideal for the Spoonbills as there was no competition for space and nesting material, it was clear from the observations that loss of eggs was because the Spoonbills were not able to build a nest that could prevent the eggs from rolling off from the nest. Initially it was thought that it was due to lack of nesting material but later it was confirmed that the artificial nest needed modification to suit the Spoonbill. The modified nest was provided with a raised border to avoid eggs / chicks falling off from the nest.

Phase IV: The modifications of nest and new aviary proved to be ideal for the birds to breed. Elaborate courtship behaviour was recorded followed by rearranging the modified nest by both. The male initiated courtship by preening the female's cheek, head and neck. His mate responded by rubbing the his head and neck. This continued for 4-5min, after which the male raised his head plumage, grasped the female's bill about the mid-point and initiated copulation for 7-8sec. This courtship behaviour and copulation continued until the day before the final egg was laid. Three eggs were laid and incubated for 26 days. All the three eggs hatched and the chicks are surviving till date (Table 1).

Discussion

The Spoonbills were seen to be comparatively less active, relatively silent and less aggressive than their vociferous companion; two pair of Painted Storks. Both were put in the same aviary with an idea that both are colonial nesters and prefer large crowded colonies (Ali & Ripley, 1983; Hancock *et al*., 1992; Dharmakumarsinhji, 1955). This idea was not successful initially as both the species often had aggressive territorial conflicts and raucous displays affecting their reproductive success. These observations were in stark contrast to their coexistence in wild. Spoonbills failed to breed successfully in Phases I and II whereas, Painted Storks (2 pairs) also were not able go adapt to the captive environs probably due to lack of adaptability with Spoonbills in Phases I, II and III. Hence it was thought relevant to shift the Spoonbills to an adjacent enclosure.

This change worked as the pair of Spoonbills was seen actively involved in nest building activity thereafter. Duties of nest building activity and later on incubating eggs were shared by both parents. Spoonbills continued to add more sticks in their nests even during incubation. Chong *et al*. (2000a) has reported similar behaviour of Black-faced Spoonbill in captivity. In captivity, both parents fed the chicks and left the nest together for feeding. That is contrary to their behaviour in the wild, as male birds usually brood the chicks during the day while females forage and feed the chicks, (Chong *et al*., 2000a,b). Lack of natural predators also contribute tremendously to the breeding success in captivity as the same often results in increased breeding success as has been observed in case of breeding of White Ibis in captivity (Devkar *et al.,* 2005). Eggs and chicks falling from the ANP in phases II and III are comparable with observations of Chong *et al*. (2000a) on Black-faced Spoonbills breeding in captivity wherein, the mortality rate is greatly affected in this manner. The change in dimension of the artificial nesting platform for Spoonbill resulted in successful breeding as seen in phase IV is especially noteworthy. One pair of Painted Storks had constructed a nest on the ANP, whereas another pair had built a nest on the ANP amidst ficus tree. The latter effort was the only success achieved during the entire period

of study. The incubation period of 26 and 27 days in Spoonbill in Painted Stork respectively was couple of days faster than reported in wild (Ali & Ripley, 1983). These observations are in accordance with reports of Chong *et al.* (2000 a,b) on breeding of Black-faced Spoonbills who had reported shorter incubation period in captivity. It can be assumed that lack of predator and plentiful food shortens the incubation period as both the parents invest most of the time in incubation unlike foraging in wild.

Conclusion

Reports on breeding biology of Spoonbills and Painted Storks are scant and there is no systematic documentation on its captive breeding behaviour in India. The observations recorded in Sakkarbaug Zoo aviary do not clearly indicate a specific breeding season of Spoonbills or Painted Storks in captive environs, and the smallest possible sample size in form of only one breeding pair of Spoonbills and erratic breeding due to lack of adaptability of both pairs of Painted Storks in the initial period of study made the task of data interpretation even more difficult. Zoos like Nandankanan (Dash & Mohanty, 2002) and Arignar Anna Zoological Park (Manimozhi, 2004) in India have reported the breeding success of storks and spoonbills in captivity, but their details in form of its breeding score and factors affecting its breeding pattern like type of artificial nest, nesting material, behavioural changes etc are not elaborated. Since, Painted Stork is an important schedule IV wetland bird whereas Spoonbill is a Schedule I species any information regarding their breeding would be of great interest to ornithologists and conservationists. This inventory unravels some of the aspects of their reproduction in captivity and generates useful baseline data for further studies in detail. The captive breeding program provided us with valuable insights about the breeding biology of these ecologically important waders that enrich biodiversity of Indian wetlands. Much planning is required to enhance the captive breeding program that includes efforts such as obtaining wild birds to avoid inbreeding depression and to retain healthy lines of captive birds, as well as to develop reintroduction techniques such as returning young birds to flocks in the wild.

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