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CRANE PROPAGATION AT MIAMI METROZOO, 1983-1987

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Abstract: Five species of cranes are bred at Miami Metrozoo. Few health problems have been encountered in raising a large number of chicks. Rearing cranes in close confinement, with limited resources, requires sound management and careful observation.

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Five of the 6 crane species at Miami Metrozoo successfully reproduced in 1987. The zoo maintains an off-exhibit breeding area where the majority of the cranes are housed, and although the zoo keeps some cranes on exhibit, all breeding occurred in this off-exhibit area. The breeding flock in 1987 consisted of demoiselle (*Anthropoides virgo*) (1 pair), Stanley (*A. paradisea*) (1 pair), wattled (*Bugeranus carunculatus*) (1 pair and a female duo), East African crowned (*Balearica pavonina gibbericeps*) (1 pair), Indian sarus (*Grus antigone antigone*) (2 pairs), eastern sarus (*G. a. sharpei*) (1 pair) and West African crowned (*Balearica pavonina pavonina*) (2 pairs) cranes. Most have been in the collection for several years and are mature (Table 1). Pairs may be reproductively dormant for several years, even though they are sexually mature. At Metrozoo, all fertility is achieved through natural copulation. We do not artificially inseminate.

All species produced viable young during the study years (1983-1987) except for the eastern sarus and West African (West African crowned cranes have bred at the zoo prior to 1983). Both egg production and successful hatchlings have increased significantly (Table 2). Infertility tends to be an individual problem rather than characteristic of the entire flock. However, both pairs of Indian sarus continue to have poor fertility. They have been paired for several years and share a very strong pair bond (frequent unison calling), are regular egg layers and share incubation duties.

Only 1 or 2 eggs per season produces chicks. The high percentage of infertile wattled crane eggs (Table 2), accounted for solely by the presence of the female duo. The breeding pair of wattled cranes has had 100% fertility since they first bred in late 1984.

The West African crowned crane eggs laid in 1987 were infertile. This pair shared a weak pair bond and these were the first eggs laid. They had a weak pair bond and all eggs laid were infertile. The East African crowned cranes have had 100% fertility since they first bred in 1985. The eastern sarus cranes were still young and had a weak pair bond. The breeding pairs of Stanley and demoiselle cranes were consistent breeders; infertility occurred infrequently, usually in the early clutches. A second pair of demoiselles was involved in the study from 1983-85, but they had a weak pair bond and produced only infertile eggs.

Husbandry Techniques

A combination of management techniques were employed to encourage some cranes to lay; strong pair bonds are a must for successful reproduction. Cranes with a strong pair bond will breed even under difficult circumstances. Cranes with a weak pair bond, although compatible, often need the encouragement of ideal nesting conditions to reproduce.

In the off-exhibit breeding area, the cranes were not isolated, being exposed to a good deal of routine traffic which they seemed able to tolerate. However, disturbances around breeding pairs were kept to a minimum, and any disruptive activities that could be were curtailed or discontinued.

Pens varied from 6.096 X 30.48 m to 15.24 X 30.48 m, depending on the species and their requirements (Table 1). Cranes were kept in pairs with the demoiselles in the smallest pens and the Indian sarus occupying the largest ones. Cranes need to be able to establish a breeding territory in

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their enclosure to promote natural behavior conducive to breeding (Archibald & Viess 1979). Nest-building cranes (wattled, sarus, crowned) often worked on several nests at scattered locations before egg laying. The wattled cranes generally worked on various nests until shortly before laying, when a main nest took form. The crowned cranes may lay nowhere near any of their working nests. The demoiselles and Stanleys exhibit little nest building behavior, but if a nesting site is danger of flooding, the Stanleys will build it up (Carl Burch pers. comm.).

Predators pose a serious threat to a captive collection. The Metrozoo crane pens have a 3.049 m high chain link fence, but are not "predator-proof." At Metrozoo, possible predators include bobcats (*Lynx rufus*), feral cats (*Felis domestica*), opossums (*Didelphis virginiana*), red rat snakes (*Elaphe obsoleta*), grey foxes (*Urocyon cinereoargenteus*) and raccoons (*Procyon lotor*). There was 1 predatory incident in the off-exhibit breeding pens. In 1986, a raccoon killed a juvenile Stanley crane and slightly injured another. In that pen, 4 juveniles were housed together—two hand-reared and two parent-reared cranes. The hand-reared cranes may be more prone to predatory attacks, as they were the ones attacked in this instance.

To keep predators under control, routine trapping is essential. The complex of pens was designed and made for hoofstock, and there are gaps along the gates and under the fence. In pens where parent-rearing occurs, chicken wire was attached over the chain link and flight netting covered the top. Securing the pens in this way, kept the chicks in and may have deterred predators.

Heat stress was a concern during the summer months. In addition to trees, shade tarps were placed over a portion of each pen to provide relief from the summer heat. A serious climatic threat comes from tropical storms and hurricanes. If a hurricane is imminent, the cranes are removed from their outside enclosures and housed elsewhere.

Due to the sub-tropical weather, the breeding season may be extended. The wattled cranes lay almost year round, with seasonal laying roughly divided into two seasons—March-June and June-October (Table 3).

It may be important that visual barriers exist between pens (Johnsgard 1983). Ideally, conspecifics should not be in adjoining pens. Visual barriers consisted of plants, burlap, tennis netting, etc., and were in place by the start of the breeding season.

While having an enclosure of adequate size is important, the make-up of the pen is also important. Vegetation should be varied throughout the pen. Tall vegetation seems to be vital for some species to nest, particularly true for crowned cranes.

Supplemental nesting material never had to be provided since there was plenty of natural material available.

Incubation

Once a pair initiates egg laying, there are several options for incubation. Unless egg production is being maximized, parent-incubation is preferable over the use of artificial incubators. If the parents show acceptable incubation behavior, they may be allowed to incubate their eggs. Males and females share incubation duties. Crane eggs were artificially incubated as needed. Eggs were disinfected with a commercial egg wash (Russell Kleen-R-Egg Detergent-Sanitizer, KC, MO 64108 I.D. Russell Co. Lab.) before being incubated. Temperature inside the incubator was 37.5° C. Eggs were moved to incubators with the appropriate humidity throughout the incubation period, depending on rates of weight loss. The eggs were turned every 2h. Eggs should lose 17% or more of their fresh weight over the incubation period (Johnson 1984).

Eggs were transferred to a hatcher 4 days before hatching, where the humidity was near the saturation point, and the eggs were no longer turned. Newly hatched chicks remained in the hatcher until they were completely dried. Parent-incubation eggs were transferred to hatchery 48-72 h before hatching. Incubation periods varied from 27 to 35 days (Table 6).

Chick Rearing

During the study years, Stanley, demoiselle, and wattled cranes were given the opportunity to raise their young. Generally, the parents raised their last clutch, all previous clutches having been pulled for hand-rearing. Roughly 80% of the young were hand-reared and 1 to 5 chicks were parent-reared (Table 4), with 90.7% of the hand-reared chicks and 1 to 2 of the parent-reared chicks reaching fledging age.

Table 5 shows causes of chick mortality. Rain and cold often were problems for parent-reared chicks, especially during the first 2 weeks. The Stanley cranes had trouble rearing their young when the chicks hatched during periods of cold

and rainy weather. In 1987, parent-rearing was attempted in 3 species, but 4 out of 5 chicks were removed from their parents for various reasons during the chicks' first 2 weeks. The demoiselles had their chick pulled at 3 days due to the presence of a predator (red rat snake) in their pen.

The Stanleys had both chicks pulled. The first was found dead at 6 days, and the second one was pulled at 2 days because it was suffering from bacterial pneumonia and bird pox. The female wattled crane duo had their foster chick pulled at 8 days due to an eye injury. Barring complications, chicks stayed with their parents for 6 to 9 months. If the parents showed signs of reneating and attempted to push the chick away, the chick was removed.

If problems occurred that could not be treated by briefly removing the chick, it was pulled for hand-rearing. For minor medical problems, it was preferable to treat the chick and then return it to the parents. Parents accepted their chicks after absences of 2 to 3 h with no problems. Parent-reared chicks exhibited proper crane behavior and therefore were more likely to show normal social and sexual behavior at maturity (Derrickson 1985).

Initially, hand-reared chicks were maintained in brooder boxes (0.914 m³). Heat was provided by infrared bulbs to keep the temperature at 32.2°C. The temperature was gradually lowered as the chicks matured. When possible, clutchmates of Stanley, demoiselle and crowned cranes were raised together. These species exhibit minimal aggression toward their sibling(s) and can be safely reared together. When a chick was raised alone, a mirror was placed in the brooder box to encourage it to imprint on itself and not its human caretakers (Archibald & Viess 1979).

Ideally, chicks should get regular exercise within 5 days of hatching. However, in some institutions, this is not always possible. When rearing space is limited, the chicks should be monitored closely. Between 7 to 10 days, crane chicks were moved from the brooder box to a larger indoor pen with a pool (0.9144 X 2.438 m) where they remained for the next 3 to 5 weeks. The chicks were weighed daily for the first month and once a week thereafter, until 2 months old.

Some species are more prone to leg problems than others. Sarus chicks continued to develop growth problems, proving fatal in 2 cases during the study period.

Food intake was monitored in conjunction with weight gains and losses. Ideal weekly weight gains for crane chicks reared in close confinement should average 15% per day. Upon excessive weight gains

(greater than 20% per day), the food intake was decreased until weight gain stabilized. The growth of the legs was monitored also. If a crane grows too rapidly, excessive body weight may cause the legs to bow.

Chicks were started on a high protein diet (crane breeder: Zeigler Bros. Inc., Gardners, PA 17324) with a protein level of 22%. A vitamin supplement (Nekton S: Nekton-Produkte, F530 Pforzheim, West Germany) and an additive of Selenium/Vitamin E was added to their drinking water. To slow down growth, chicks were fed a lower protein diet (crane maintainer [14% protein]: Zeigler Bros. Inc.) when they were 2 weeks old. Between 4 to 6 weeks, chicks were moved to an outside yard (6.096 X 4.572 m).

Hand-raised chicks need to socialize with other cranes to lessen their imprinting on humans and to learn how to get along with conspecifics. Socialization can be gained by being raised with another chick(s) or visual contact. Chicks that socialize with each other tend to be less aggressive than chicks that are raised isolated from other cranes. Cranes with social experience were able to be introduced to other chicks with very few problems as early as 40 days old, whereas chicks that had no interaction with other chicks still showed an intense level of aggression at 100 plus days (Hesch 1985).

Behavior problems may occur in chicks raised alone with some afraid of conspecifics, resulting in introduction being a slow process. The best time for introductions to other chicks is post-fledge. For first time introductions, a large pen was used which none of the chicks had occupied. Aggression was still high, but there was no dominant chick defending its own pen. Some minor aggression occurred, but the chicks soon sorted out their place among their cohorts.

CONCLUSION

A number of factors lead to the eventual hatching of a healthy chick. For some cranes, it is a slow process. Aspects of captive crane management that result in young can be classified as follows: solid pair bond, egg laying, pair fertility, live hatch and fledged chicks. Some pairs achieve success in a short time, while it may be years before others can achieve complete success. However, with proper management techniques, an institution can achieve a successful breeding program.

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Table 1. Cranes Maintained at the Miami Metrozoo, 1983-1987.

Species	Age*		1st egg	1st chick	Pen Size(m)
	Male	Female			
Demoiselle	18	33	1984	1984	15.24x13.71
Stanley	16	29	1978	1978	15.24x15.24
Wattled (1.1)	14	12	1984	1984	15.24x30.48
Wattled (0.2)	15	15	1984	-	15.24x30.48
1. Sarus 1	12	13	1978	1983	15.24x30.48
1. Sarus 11	8	9	1983	1986	15.24x30.48
East African	9	NA	1985	1985	11.28x30.48
West African 1	7	NA	1987	-	9.14x30.48
West African 1I	NA	NA	-	-	6. 10x30.48
Eastern sarus	3	3	-	-	15.24x30.48

*as of 5-5-87

Table 2.

Species	# of eggs	# fertile	# hatched	# fledged
1983				
Demoiselle ^b	0	0	0	0
Stanley ^c	8	8	8	7
Indian Sarus ^d	6 ^a	2	2	2
Wattled ^e	0	0	0	0
East African ^c	0	0	0	0
West African ^d	<u>2^a</u>	<u>1</u>	<u>0</u>	<u>0</u>
Total	16	11	10	9
1984				
Demoiselle	5	2	2	2
Stanley	8	4	4	4
Indian Sarus	10 ^a	3	1	0
Wattled	6 ^a	1	1	1
East African	0	0	0	0
West African	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>
Total	29	11	9	7
1985				
Demoiselle	9 ^a	4	4	3
Stanley	8	7	7	6
Indian Sarus	10	3	2	2
Wattled	9	6	5	4
East African	3	3	3	2
West African	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>
Total	39	23	21	17
1986				
Demoiselle	4	4	2	2
Stanley	6	5	4	3
Indian Sarus	12	4	1	0
Wattled	6	2	2	2
East African	6	6	6	6
West African	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>
Total	34	21	15	13
1987				
Demoiselle	4	4	2	2
Stanley	10	9	9	8
Indian Sarus	16	4	2	0
Wattled	11	5	5	5
East African	7	7	7	7
West African	<u>2</u>	<u>0</u>	<u>0</u>	<u>0</u>
Total	50	29	25	23
*broken egg(s); ^b 1984-85: 2 females, 1986-87: 1 female; ^c one pair; ^d two pairs; one male and three females.				

Table 3. Length of breeding season.

Species	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Demoiselle			X	X	X							
Stanley		X	X	X	X	X	X	X	X			
Wattled	X	X	X	X	X	X	X			X	X	
East African							X	X	X	X		
West African								X				
Sarus						X	X	X	X	X		

Table 4. Comparison of hand-reared and parent-reared chicks.

	# Chicks		# Fledged	
	Hand-reared	Parent-reared	Hand-reared	Parent-reared
1983	8 (80%)	2 (20%)	8 (100%)	1 (50%)
1984	8 (88.8%)	1 (11.1%)	7 (87.5%)	1 (100%)
1985	19 (90.5%)	2 (9.5%)	15 (78.9%)	2 (100%)
1986	13 (86.6%)	2 (13.3%)	12 (92.3%)	0
1987	20 (80.0%)	5 (20.0%)	19 (95.0%)	1 (20%)

Table 5. Chick mortality, 1983-1987.

Causes	1983	1984	1985	1986	1987
Crane attack			1		
Complications from leg fractures				1	1
Salmonella	1				
Ventricular foreign body		1			
Unknown			2	1	1
Accident			2		1
Predation				1	

Table 6. Incubation periods (days).

Species	1st egg	2nd egg	3rd egg
Demoiselle	28-31	27	
Stanley	31-33	29-31	
Indian sarus	33-34	32-33	
Wattled	33-35		
East African crowned	31-33	28-31	27-29