

SOME NESTING RECORDS OF THE SARUS CRANE IN
NORTH AMERICAN ZOOLOGICAL PARKS

BY LAWRENCE H. WALKINSHAW

Plate 23

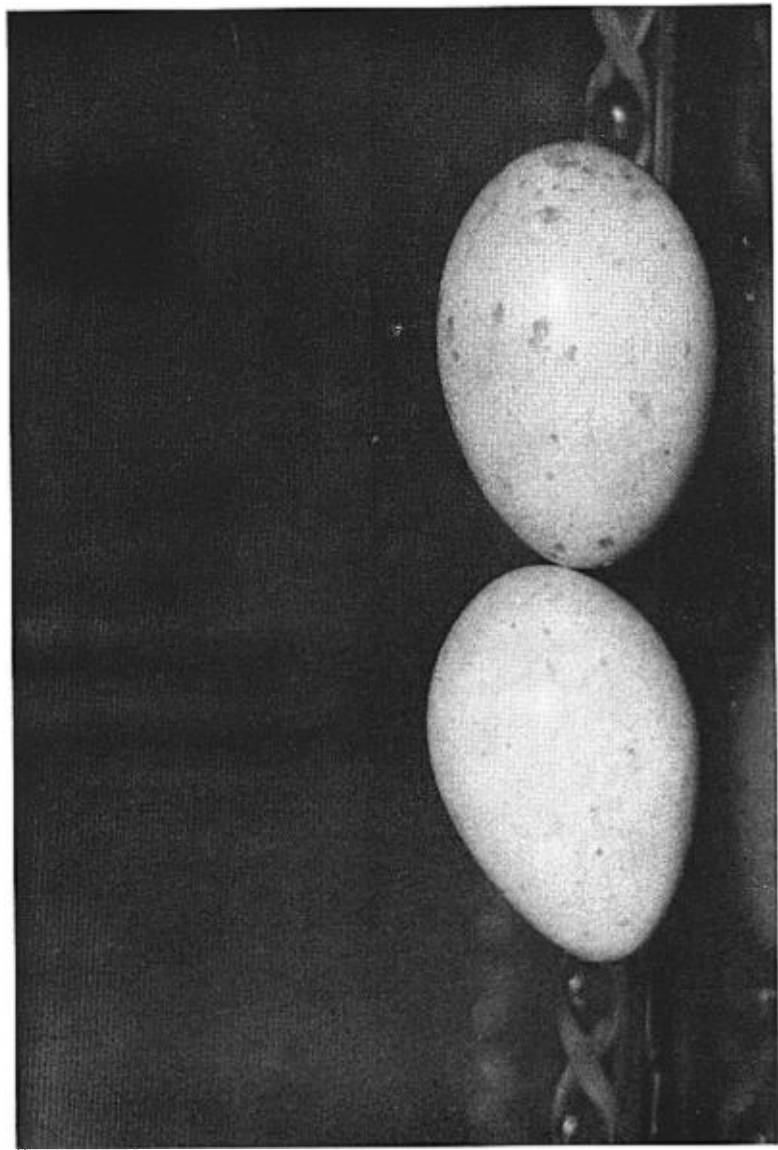
THE Sarus Crane [*Grus antigone antigone* (Linnaeus)] found in northern India, is non-migratory and breeds from the Indus River to Assam south to the Bombay Presidency and the Godavari River (Peters, 1934: 152). Colonel Ticknell (Blyth and Tegetmeier, 1881: 50) described seeing the Sarus Crane "in various parts of India—on the Nepal frontier, in Tirhoot, near Patna, Bhagulpoor, Rajmahal, Malda, Bankoora, Chota Nagpoor, Singbhoom, and near Sumbhulpoor, also in Arakan and Tenasserim."

An eastern race, the Burmese Sarus Crane (*Grus antigone sharpii* Blanford) is found in eastern Assam, Thailand, Burma and Cochin-China, French Indo-China. All of the breeding records at hand pertain to the typical Sarus Crane from India, the birds having the white neck stripe below the bare portion of the head and neck.

The Sarus Crane is generally bluish ash-colored in plumage with the tertials and a band below the upper neck white or nearly white. The primaries and secondaries are black or blackish. The iris is orange; bill greenish with darker tip; crown and upper neck bare, the skin on the crown pale ashy green; that on the head and neck orange red; that just above the feathers bright orange. The skin of the head and neck is covered with scanty black hair-like bristles. The auricular region is covered with patches of bluish ash feathers. The legs and feet are flesh-colored.

This crane is larger than the Greater Sandhill Crane (*Grus canadensis tabida* Peters). The measurements of one male from the American Museum of Natural History and four males and one female from the University of Michigan, all taken by Walter Koelz in Punjab, are here recorded. One female: Wing, 601 mm.; tarsus, 307 mm.; exposed culmen, 165 mm.; bare tibia, 182 mm.; middle toe, 136 mm. Five males: Wing, 645 mm. (625–675); tarsus, 333 mm. (299–352); exposed culmen, 177 (163–187); bare tibia, 200.2 mm. (185–210); middle toe, 140 mm. (128–152).

Evidently the first record of the Sarus Crane nesting and rearing young in captivity was made by the Moghul Emperor, Jehangir (1603–1627 A. D.; Journ. Bombay Nat. Hist. Soc., 32: 57–60, 1927) also recorded by Rothschild (1930: 67–68). Rothschild also described the nesting of Sarus Cranes in captivity at Tring, where a pair raised young after many failures. The female was about 20 to 25 years of



EGGS OF SARUS CRANE; LINCOLN PARK ZOO, CHICAGO, ILLINOIS, 1946.

age and the male, three to seven years. The first successful nesting in the United States apparently occurred in the Frank Vanderlip aviaries in southern California (Wigley, 1931: 54-56).

During 1946, Charles Coffman wrote me that the Sarus Crane was nesting at Lincoln Park Zoological Gardens, Chicago, Illinois. Thanks to Mr. R. Marlin Perkins, Director of the Zoo, I was able to spend a few days watching and photographing these birds at their nest. Mr. Perkins also gave me the records of two other zoological collections where he had known of the Sarus Crane nesting, and I have been able to get considerable information on the nestings from the three zoo officials. For the material which they have forwarded me, I wish to thank especially Mr. Perkins and Mr. George Irving of the Lincoln Park Zoological Gardens, Mrs. Belle J. Benchley, Executive Secretary of the Zoological Society of San Diego, California, and Mr. Fred Stark, Director and Mr. R. H. Friedrich, President, of the San Antonio Zoological Society, Inc., San Antonio, Texas. Most of the following material is what they have sent to me. I wish also to thank Robert Jickling of Chicago for preparing the eggs which are now in the University of Michigan Museum, Ann Arbor.

THE NEST

In the Lincoln Park Zoo the Sarus Cranes built their nest of straw (picked up from the ground), dead leaves, and twigs and small branches which had blown off neighboring trees. George Irving said they had nested for five successive years. The birds were procured in 1940 and kept in a rather large enclosure with a pool of fresh water through the center, extending from one end of the pen to the other. During 1942, 1943, and 1944, the cranes nested on a little stony island, about three feet across, out in a shallow portion of the pool, about 75 feet from shore. During 1945 and 1946, they nested on the shore two or three feet from the water's edge and only some 40 feet from where crowds of spectators passed daily.

At the San Antonio Zoological Society gardens, the Sarus Cranes were first obtained in 1939, began to nest during 1943, and have nested each summer since then. A photograph of the 1945 nest taken by R. Marlin Perkins showed the nest to be about 15 feet from the water. Mr. R. H. Friedrich and Mr. Fred Stark wrote that the first two nests were about 40 feet from the shore of the stream running through the enclosure, while the 1945 and 1946 nests were 15 feet from the shore. Hay, placed in the enclosure, was used for nest material.

The San Diego nest was placed on dry ground in a small enclosure within which the birds were kept. A similar nest was described by

Hartert and Young (1928: 75) who discussed the nesting of Lord Rothschild's cranes at Tring, England.

The 1946 nest at the Lincoln Park Zoo was 79 x 121 cm. in diameter and about 10 cm. deep, hollowed in the center for the eggs. The parents brought material to this nest even after September 1, working on it a certain amount each day that they were observed. With their bills they broke small twigs and branches off the larger ones that were blown from a near-by tree and threw them into a pile in the direction of the nest. The next time the incubating crane left the nest it would go to this pile and throw many of the branches again toward the nest which the materials eventually reached. Occasionally they would stand and work the twigs, grasses and leaves into the edge of the nest as they stood over the eggs.

Lord Rothschild (1930: 67) stated that the first nest that his pair built during 1925 was started on July 17 and the first egg laid July 20. Another nest built by this pair required two days during 1925 (Hartert and Young, 1928: 75-76), September 22 and 23. During 1926 a nest was hurriedly built on June 28 and an egg laid the same day, and a similarly carelessly constructed nest was built on August 29 of that year. On July 8, 1927, an egg was laid on the bare ground. The next day, July 9, a slight nest was built and the second egg laid in it the following day.

In the wild, Colonel Ticknell (1881: 49) quotes Jerdon as saying that the Sarus Crane nested "on some island or spot nearly surrounded by water, and that the nest is sometimes made in the water, and raised some inches above the surface." These nests were constructed of layers of grass.

A nest described by Marshall (Blaauw, 1897: 27) measured, after the rainy season, nine feet in diameter at the base and three feet in height, after settling a foot.

THE EGGS

Most cranes lay two eggs, sometimes one and rarely three. Colonel Ticknell (Blyth and Tegetmeier, 1881: 49) stated of the Sarus Crane: "The eggs are almost invariably two in number, somewhat slender, oviform in shape, and of a dull yellowish white, sprinkled with small patches or drops of very pale brown, most thickly scattered over the big end. In some the brown marks are almost entirely absent, and the shell is thickly beset with porous indentations. The average size of the egg of the male chick is 4 in., and $2\frac{1}{2}$ in. across; of the female $3\frac{3}{4}$ in. by $2\frac{1}{2}$ in."

Two of the eggs (the third disappeared) in the 1946 Lincoln Park

Zoo nest are almost pure white (Plate 23). One is marked sparsely with lavender and brownish spots from 2 to 6 mm. in diameter mostly near the larger end. The other egg is much less marked and the spots are smaller, none exceeding 3 mm. in diameter, most of them 1 or 2 mm. Both eggs are pitted over the entire surface with very narrow pits about 1 mm. in length and mostly in rows along the long axis. On one egg several irregularly shaped pimples of egg-shell material are present; otherwise the shells are largely smooth with a hard and strong texture. The eggs are differently shaped; one is much more pointed at the smaller end.

After they had been incubated about 70 to 72 days these infertile eggs weighed and measured: (1) 101.0 x 65.5 mm.; wt., 142 grams; (2) 97.0 x 63.9 mm.; wt., 113 grams. After the eggs were blown, the shells weighed 24.5 and 21 grams, respectively.

Two Greater Sandhill Crane eggs, similar in size to the larger Sarus Crane egg, were found in Sharon Township, Washtenaw County, Michigan, May 5, 1940, and, when about half incubated, measured and weighed: (1) 101 x 64 mm., wt., 197.4 grams; (2) 103 x 65 mm., wt., 213.4 grams.

A newly laid Sandhill Crane egg found in Convis Township, Calhoun County, Michigan, on May 1, 1941 (the day it was laid or the day after) measured and weighed: 95.5 x 63 mm., wt., 200.0 grams.

Another set of two Sandhill Crane eggs taken in Johnstown Township, Barry County, Michigan, May 7, 1942, three days before hatching, measured and weighed: (1) 108 x 62 mm., wt. 166.5 grams; (2) 103 x 64 mm., wt. 174.8 grams.

One individual Sarus Crane at Tring (Hartert and Young, 1928: 75-76) laid nine eggs in one year. On several occasions she laid four or more eggs in two sets. Two eggs were usually laid at the San Antonio Zoo, except one year when only one egg was laid, and two in the case of the bird in the San Diego Zoological Collection. At the Lincoln Park Zoo, during a five-year period, sets numbered five, three, four, three and three eggs respectively, indicating that both the birds there were females.

The dates of first eggs laid at Tring, as recorded by Hartert and Young (1928: 75-76) and Rothschild (1930: 67-68) were as follows: 1925, July 20 and 22; 1926, June 28 and 30; 1927, July 8, 10 and 13; 1929, July 2 and 5.

In the Lincoln Park Zoo, the eggs were usually laid about mid-July; in the San Antonio Zoo, two eggs were laid during 1943 of which one hatched only to be lost in high water; one egg was laid during July, 1944, and the young were reared to maturity; two eggs were laid during

July, 1945, and both eggs hatched and the young were raised to maturity. During 1946, two eggs were laid during July and both hatched. One young died from pneumonia when three weeks old; the other is still alive. In the San Diego Zoo, two eggs were laid during August, 1943. The parents incubated them for a period of 35 days and then deserted them; the eggs apparently were not fertile. Mrs. Benchley wrote that on August 11, 1944, she "noticed they were nesting again; they probably had been on the eggs more than a day at that time. Thirty-one days later on September 11, one of the babies hatched and was moving out to the side of the mother; it might have been hatched 24 hours before. The next day I saw her off the nest with two babies." This would give an incubation period of about 32 days which is the approximate period given by Fred Stark of the San Antonio Zoo. Rothschild (1930: 67-68) gave the incubation period at one nest at Tring as 36 days, but incubation did not start when the eggs were first laid.

Hume and Marshall (1881: 9) told of Captain Butler taking eggs from nests where the cranes laid eggs later in the same nest. An example was given of a nest from which two eggs were taken on the 24th of August, another was taken on September 19. From a different nest he took an egg on September 19 and another from the same nest on September 23.

Blaauw (1897: 26) stated that the Sarus Crane nests during the rainy season, starting to nest at the end of June, then through July, August and September.

It is noted in the case of the Sarus Cranes at Tring that during 1925, when the two eggs were taken September 8, two more were laid September 23 and 27; during 1929, two eggs laid on July 2 and 5 were eaten but were replaced by the same female July 12 and 14, and these second eggs hatched August 19 and 20. More than 25 eggs were laid by this female during a five-year period and only two young produced. Eighteen eggs were laid by the Lincoln Park Zoo birds and no young produced, while four eggs in the San Diego Zoo produced two young. From seven eggs in the San Antonio Zoo, six hatched (the other was broken by the parents). Messrs. Friedrich and Stark write that both adults incubated the eggs, with the female evidently incubating at night; the male remained in the near vicinity all night but did not roost in the water which ran through the enclosure. He helped during the daytime. Lord Rothschild mentioned that the male alternated in incubating the eggs. At the Lincoln Park Zoo, both birds incubated, changing at irregular intervals. On the morning of September 1, the bird that did not incubate during the night was observed as it started

walking toward the nest. It had roosted in the shallow pond about 100 feet from the nest beneath the overhanging branches of a tree growing on the shore. The following notes were taken at this nest on August 11, 1946:

- 8:20 a. m. One Sarus Crane was feeding about 100 meters from the nest. The other, which we will call Parent 1, was sitting on the eggs.
- 8:40 a. m. Incubating bird left the eggs, walking out about 35 meters into the duck pond.
- 8:45 a. m. Parent 2 walked up through the water to the nest. Parent 1 stood in the water with wings half outspread as though begging for food. Parent 2 did not have any food so walked by to the nest, then repeatedly tried to work the nest material and eggs into a comfortable position, raising and lowering itself several times before finally settling down to incubation. It rolled the eggs about with the base of the lower mandible. Parent 1 was away inspecting all of the small chicken houses in the yard, going from one to another.
- 9:05 a. m. Parent 1 returned through the water to within 40 feet of the nest where it stood preening. It drank once much like a Sandhill Crane but stood preening for a long time. Parent 2 pecked at the nest material, working it around closer to its body, sometimes slightly raising its breast to tuck some underneath its body. It did not, however, raise up enough to show the eggs. Other birds gave it a wide berth as they passed by the nest. Even the gray squirrels, which were common in the park, kept their distance as they scampered by.
- 9:35 a. m. Parent 1 came out of the water toward the nest, then walked up to it and around the other bird which rose and stood for a minute. Parent 2 walked away to feed on some fish which the keeper had just thrown on the dry cement about 20 feet from the nest (although two had been thrown at the very edge of the nest, it had not offered to touch them.). It pecked the fish, thrashing it around on the ground, and ate a few portions which were broken off. Parent 1 sat on the eggs facing in the opposite direction or west. Parent 2 went south from the nest following along the water's edge where it stood 100 meters away preening its wing and body feathers.
- 10:05 a. m. Parent 2 came back to 25 meters from the nest where it stood preening its feathers.
- 10:14 a. m. Parent 2 walked up to the nest and Parent 1 left. Parent 2 spent two minutes rearranging the eggs before settling down onto them, facing east. Parent 1 came back to the nest where it picked up one of the two fish thrown there by the keeper and, carrying it into the water, thrashed it around in the water as if washing it, then ate small portions of it, leaving the remainder in the water. It finally waded to a spot about 12 meters from the nest and started preening.
- 10:30 a. m. Parent 2 incubated with eyes nearly closed while Parent 1 waded about in the water, stopping at times to preen.
- 10:40 a. m. Parent 1 came to the edge of the nest where it stood preening while Parent 2 pecked at the material on the edge of the nest as it sat on the eggs.
- 10:41 a. m. Parent 2 rose and walked away. Parent 1 walked onto the nest and immediately began to incubate.

- 10:45 a. m. I entered the Duck Pond enclosure and Parent 1 left the nest immediately but returned almost as soon as it noted that I was not going to bother it. Parent 2 picked up dead sticks as it walked away from the nest, tossing them back toward the nest with its bill. It did not actually carry the materials to the nest but each time threw them closer. It went to the south end of the enclosure.
- 11:45 a. m. Parent 2 wandered back within 4 meters of the nest and preened.
- 11:47 a. m. Parent 1 rose and left the nest as Parent 2 immediately sat on the eggs. Parent 1 went to the south end of the enclosure.
- 11:55 a. m. A Canada Goose approached within a few meters of the nest and the incubating crane rose and walked slowly toward the goose with a threatening attitude, head down and wings slightly out from body.
- 12:05 p. m. Parent 1 approached within 32 meters of nest, then left again.
- 12:25 p. m. Parent 1 back, walking on the rocks again. It walked to the nest and the other crane rose, whereupon both stood examining the eggs with their heads down. Parent 2 left. Parent 1 settled down on the eggs.
- 1:05 p. m. Parent 2 back within 16 meters of the nest; preened.
- 1:15 p. m. Parent 2 within about 3 meters of the nest. Keeper came in with food but neither bird moved. Parent 2 viciously chased several other birds. Geese, especially, were chased—Canadas, Blues, Snows, and White-fronted, beside Mallards, Black Ducks, Red Jungle Fowls, and even Starlings and English Sparrows left hurriedly.
- 1:23 p. m. Parent 2 went to the nest and Parent 1 left, throwing sticks back toward the nest and wandering about in the nest vicinity. It then went to where the birds were eating the mash which the keeper had thrown them, and chased all of them away, starting to eat. From here it went into the water where it flapped its wings and jumped crazily about.
- 1:55 p. m. Parent 1 returned to the rocky shore where it stood preening and scratching its head. It drank from the water, then waded into deeper water until this reached the feathers of the tibiae.
- 2:07 p. m. Parent 1 picked up a dead fish and thrashed it back and forth in the water, finally thrashing it into shreds, whereupon it swallowed it entire.
- 2:13 p. m. Parent 1 back to the nest. Parent 2 rose and moved away from the eggs as Parent 1 started incubating. Both worked with nest material.
- 2:20 p. m. Crane's nest was entirely in the sun for the first time today. Parent 1 incubating; Parent 2 wandering in the south end of the enclosure.
- 2:30 p. m. Parent 1 rose and turned the eggs, then faced west. I left the enclosure but the parent did not leave the eggs. The following table (Table 1) summarizes periods of attentiveness for August 11:

TABLE 1
ATTENTIVE PERIODS OF SARUS CRANE AT NEST, LINCOLN PARK ZOO,
CHICAGO, ILLINOIS, AUGUST 11, 1946

	<i>Parent 1</i>		<i>Parent 2</i>
Before			
8:20-8:40 a. m.	20+	8:45-9:35 a. m.	50
9:35-10:14 a. m.	39	10:14-10:41 a. m.	27
10:41-11:47 a. m.	66	11:47-a. m.-12:25 p. m.	38
12:25-1:23 p. m.	58	1:23-2:13 p. m.	50
2:13-after 2:30 p. m.	17+		
Eggs unattended for 5 minutes	200+		165
<i>Total 370 minutes.</i>			

On September 1, 1946, I again visited the Sarus Cranes at the Lincoln Park Zoological Gardens. I arrived at the enclosure before daylight. It was warm and semi-cloudy and had rained hard for a few minutes but had cleared before daylight. The following notes were taken:

- 5:32 a. m. Incubating Sarus Crane was sitting on the eggs with head up even in the dark. First goose called; ducks were quacking.
- 5:40 a. m. Rooster crowed and pigeons started cooing.
- 5:42 a. m. Parent 2 was found roosting in the water about 35 meters from the nest under a low overhanging branch from a near-by tree. The water was about ankle deep, and the crane started wading toward the nest but passed by it in the water, then returned but did not go on shore.
- 5:50 a. m. Parent 2 started feeding along shore. Parent 1 still on the nest.
- 5:54 a. m. Parent 2 walked out of the water to the edge of the nest. Parent 1 rose and both looked at the eggs for about 90 seconds, then Parent 1 started working with nest material for 3 minutes, so that it was 5:58 before Parent 2 walked onto the nest. When Parent 1 left the nest, it went only about 1 meter away where it stood; then it started picking up sticks with its bill and threw them in the direction of the nest, sometimes carrying them within about a meter of the nest. A Canada Goose came within about 13 meters of the nest and the crane made a dash in its direction, making it run away. Then the crane worked with a large dead branch about 6 meters away, breaking off large and small twigs, throwing them in a pile in the direction of the nest. Finally it went to the southward.
- 6:04 a. m. Parent 1 returned, wading in the water to the northward. The pigeons were all out on the roost now. The first African Crowned Crane [*Balearica pavonina pavonina* (Linnaeus)] called near by at 6:09—a loud, ringing *Kronk-kronk-kronk-kronk-kronk*. It called again at 6:25, 6:50 and 7:11 a. m. No other cranes called.
- 6:09 a. m. Parent 1 started for the feeding pen where grain was placed, and entered the small enclosure where it fed continuously until 6:25 a. m. While it was feeding, the other birds—Canada and other geese, Black Ducks, Red Jungle Fowl—moved swiftly just out of reach, waiting and watching for it to leave. When it turned in their direction, all but the Jungle Fowl dashed quickly away a few feet farther. The Jungle Fowl also was prepared to leave hurriedly.
- 6:25 a. m. The feeding crane walked out of the food pen and waded into the water where it started pecking at something. It suddenly raised up and jumped crazily about with wings half outspread.
- 6:30 a. m. The crane came out of the water to the edge of the nest. Parent 2 pecked at the nest material as it sat on the eggs. At 6:31, Parent 2 rose and left the nest, starting to peck the twigs in the vicinity of the nest, then throwing them back toward the nest. The other parent went away for a short distance and pulled several sticks closer to the nest. Parent 2 pecked at twigs and sticks until 6:40 a. m. and then started suddenly for the grain feeding pen. All of the other birds left the food swiftly again, even though the crane showed no tendency to dominate. During one minute it ate 59 kernels of grain, raising its head twice to

- look around. It ate continuously and at 6:52 still ate 54 kernels of grain during one minute. It left at 6:57 after feeding for 17 minutes, and started feeding outside on some mash.
- 6:59 a. m. The crane jumped crazily about, flapping its wings; then went into the water for about 12 meters where it stood preening its wing and body feathers, flapping its wings occasionally. At 7:03 it called a low *Garooo*.
- 7:10 a. m. Parent 2 came to the nest, stopping about 4 meters away. Parent 1 rose and walked away, and Parent 2 went onto the eggs at 7:11. Parent 1 went to the large branch and started throwing twigs back toward the nest until 7:18. Then it went to the south of the enclosure, chasing a Blue Goose and several Black Ducks on the way, even wading into and out of the water to do it.
- 7:27 a. m. The crane was still preening as it stood in the water, and it remained there until 7:46.
- 7:46 a. m. Parent 2 rose as Parent 1 approached 60 meters away.
- 7:50 a. m. Parent 1 walked onto the nest and turned the eggs several times while Parent 2 threw sticks back toward the nest. Parent 1 incubating; Parent 2 to the south, then to the north.
- 8:10 a. m. Parent 2 struck at a passing butterfly but missed it.
- 8:18 a. m. Parent 2 went to the feed box again, feeding until 8:28; then it preened.
- 8:32 a. m. Parent 2 jumped crazily about in the shallow water; then at 8:38 went to the nest.
- 8:38 a. m. Parent 2 went to the nest; Parent 1 left, starting to throw sticks. (One crane has a lighter ear patch than the other.)
- 8:47 a. m. Parent 1 went to the feed box, leaving at 9 a. m. when the caretaker arrived. It walked away with head erect.
- 9:02 a. m. Crane went to the nest as Parent 2 went to the southward.
- 9:55 a. m. Parent 2 came back and Parent 1 rose from the eggs. Parent 2 started to incubate as I entered the enclosure. I went within 5 meters of the nest. Both cranes stood about 6 meters away from it. One, with wings half outspread, jumped about in the water. When I approached within 1 meter of the nest, both birds ran back onto it and stood with beaks and wings ready to attack; one had its wings half outspread. Parent 2 uttered a low guttural *Purrrrr* just like that given by adult Sandhill Cranes at the nest when they call young to them or when one approaches the nest to incubate. Parent 1 began dancing about the nest and into the water with wings outspread. I did not bother them any more.

Mr. Perkins wrote me that they took the eggs from the cranes late in September. The birds had been incubating these since mid-July—a period of 70 to 72 days. On the opposite page is Table 2 giving the behavior of the Sarus Cranes at the nest on September 1.

THE YOUNG

The young are covered with a yellowish brown down when they hatch. Mrs. Belle J. Benchley wrote that they reared one by hand, leaving the other with its mother. The father died about this time. She could see no difference in the rate of growth of the two, both maturing at the same time. Fred Stark wrote that one of the young

TABLE 2

BEHAVIOR OF SARUS CRANES AT NEST, CHICAGO, ILLINOIS, SEPTEMBER 1, 1946

PARENT 1				
<i>Incubated</i>	<i>Fed</i>	<i>Preened</i>	<i>Worked with nest material</i>	<i>Other activities</i>
All night until 5:54 a.m.	6:09-6:25 a.m.		5:54-6:01 a.m.	6:01-09 a.m. 6:25-31 a.m.
6:31-7:10 a.m.		7:25-7:46 a.m.	7:10-7:18 a.m.	7:18-7:25 a.m. 7:46-7:50 a.m.
7:50-8:38 a.m.	8:47-9:00 a.m.		8:38-8:45 a.m.	8:45-8:47 a.m. 9:00-9:02 a.m.
9:02-9:55 a.m.				
All night; 39, 48, 53 minutes	16, 13 minutes	21 minutes	7, 8, 7 minutes	29 minutes
PARENT 2				
5:58-6:31 a.m.	6:40-6:57 a.m.		6:31-6:40 a.m.	5:54-5:58 a.m. 6:57-6:59 a.m. 7:03-7:11 a.m.
7:11-7:50 a.m.	8:18-8:28 a.m.	6:59-7:03 a.m.	7:50-7:52 a.m.	7:52-8:18 a.m. 8:28-8:38 a.m. 9:02-9:55 a.m.
8:38-9:02 a.m.				
33, 39, 24 minutes	17, 10 minutes	4 minutes	9, 2 minutes	103 minutes

cranes raised by their birds stood ten inches taller than his 'daddy' and that all of the young became larger than their parents.

Mrs. Benchley wrote that the young remain in the nest from 24 to 48 hours after hatching, like Sandhill Cranes, and it was mentioned also by Rothschild (1930: 67-68). Rothschild further noted that the young picked up insects and worms for themselves for the first time when eight and nine days old, and that they remained with their parents until they were full-grown. At the San Antonio Zoological Park, young have been hatched four successive years. When a new nest was started the adult Sarus Cranes would not tolerate the young of the previous year in the same enclosure. Prior to that they watched over them assiduously. Mr. Stark said that the young were fed by the adults until about six months old. Rothschild (1930: 67-68) stated that the young cranes that had hatched August 19 and 20 were fully feathered by November 30 and that they began to fly December 19. Between January 30 and February 24 they began to molt their first plumage.

A young Sandhill Crane which we raised was born May 10, 1942. It began to molt August 1 and started to fly July 8, clearing the ground by 12 inches (30.5 cm.) for a short distance. It could fly about 200 feet (69 meters) by July 20 when 71 days old.

The plumage of the young bird during the first few months is brownish and, as Mrs. Benchley wrote, is scalloped in appearance, with the plumes of the down remaining on the tips of many of the feathers, especially the tertials and rectrices.

BEHAVIOR OF ADULTS

When adult Sarus Cranes become mated they remain together as long as both are alive. Colonel Ticknell (Blyth and Tegetmeier, 1881: 50) stated: "Such, indeed, is the affection and constancy of these noble birds to each other, as well as towards their young, that throughout India it is considered by both Hindoos and Mahomedans almost a crime to destroy them; and, indeed, I doubt whether an English sportsman, even of the most unsentimental kind, after killing one of a pair, or of the little family group, would have the heart ever to repeat the experiment, so grievous are the cries raised by the unhappy survivors." Hume and Marshall (Blaauw, 1897: 26) stated that if one bird of a pair was accidentally killed, the other bird died almost immediately, evidently by starvation. The natives of India also claimed this to be the case.

Usually the pairs of Sarus Cranes are found feeding in the wild in open fields, and if approached too closely, fly a short distance to another field. They have a dance similar to that of other cranes. In the Detroit Zoo on two occasions, I watched a pair perform quite a dance. They started by facing each other, then bowed and raised their heads, repeating this several times. Finally one or both jumped into the air with wings half outspread.

Sarus Cranes are strongly territorial, even in respect to other Cranes. The male of a pair kept in the San Diego Zoo tried repeatedly to attack a male Manchurian Crane in a neighboring enclosure (Mrs. Belle Benchley, letter), and finally went over a seven-foot fence, almost killing the Manchurian Crane. When the two young hatched, he again tried to attack this male and fractured both of his mandibles, dying a few days later from starvation and loss of blood.

Similarly they attack the young Sarus Cranes when they are ready to nest the following year, according to Fred Stark of the San Antonio Zoo. One of the two young raised by hand in the San Diego Zoo, when returned to the enclosure where the mother and other young were kept, after the young were full-grown, was immediately attacked by the mother and the other youngster. It was necessary to remove it from the enclosure. Similar behavior was noted in the New York Zoological Park with a male Wattled Crane when a new female was introduced. Finally, the female was placed in an adjoining pen and

even then the better part of a year passed before the two birds would tolerate each other (Crandall, 1944: 126).

The Sarus Crane evidently prefers to nest in an enclosure where other cranes are not present and where there is some water as well as a place to hunt for insects.

VOICE

The call of the Sarus Crane, like that of other cranes, is very loud—a penetrating trumpet, shriller than that of the Sandhill Cranes. Two cranes in the Detroit Zoological Park have been heard calling on numerous occasions, often in unison. Usually when two cranes call this way, one is shriller than the other, as was the case with these Detroit cranes. Standing side by side with bills pointed toward the sky, they uttered the loud *Gar-ooo-o-o-a—gar-ooo-o-o-a—gar-ooo-o-o-a*, often repeating it several times.

A call of one adult, given when approaching another at the nest, was a low, barely audible *Purrrr*. This same call is given in similar circumstances by Sandhill Cranes which also use it to call the young to them. On many occasions I have called the young Sandhill Cranes from hiding in sedges and grasses by giving this call.

The young Sarus Crane, according to Blyth and Tegetmeier (1881: 50), has a querulous, whistling note, a kind of long trill, which is constantly repeated when they are expecting food. Fred Stark of the San Antonio Zoological Society gave the call of the two-months-old crane as between a chicken-like *peep* and a whistle. This call was given until the young were about ten months old when they began to call like the adult.

I have heard the young of the Sandhill Crane give the *peeeep* or *peeeer* call even into the following April. The bird that we raised, hatched on May 10, 1942, started giving the adult call when ten months old, the middle of March, 1943.

OTHER NESTINGS

There are many records of certain cranes breeding in captivity. Blyth and Tegetmeier (1881: 6) record the Manchurian Crane [*Grus japonensis* (P. L. S. Müller)] nesting at the Zoological Gardens in Regents Park as described in 1861 by Bartlett. Blaauw (1897: 12) stated that the Manchurian Crane nested commonly in captivity and that a pair hatched two young during 1892, thirty and thirty-one days after the eggs were laid.

The White-necked Crane (*Grus vipio* Pallas) has bred many times in captivity. Blaauw (1897: 50) stated that it had bred repeatedly in the Zoological Garden of Amsterdam and that incubation lasted 30

days. In the United States it has bred in the New York Zoological Park where one young was raised in 1916 and another in 1943 (Crandall, 1944: 125). Kieth Kreag (1946) described the nesting of the species in the Detroit Zoo in 1946 when they raised a single young. Another record, from Germany, by Hagenbeck (1940: 348-354) discusses a pair brought from Japan in 1933 which hatched in 30 days, two young in 1933, one each year in 1935, 1936 and 1937, four in 1938 (two killed by hail), and two in 1939.

Blaauw (1897: 24) stated that the Sandhill Crane often bred in captivity but that as yet they had not reared any young. They have bred also in the New York Zoological Park (Crandall, 1944: 125). Jean Delacour (verbal) had several members of the genus *Grus*, including *canadensis*, nest in captivity at Clères, France. Frank W. Robl (letter) had a pair of *Grus canadensis* breed in semicaptive conditions at Ellinwood, Kansas, hatching a young July 12, 1939, when the thermometer registered 112° F. The young died before the first night. Sibley (letter) has written that *Grus canadensis* has raised young in captivity for him in Connecticut.

The Wattled Crane (*Bugeranus carunculatus* Gmelin) has nested during 1944, 1945 (Crandall, 1944: 125-127; 1945: 119) and during 1946 at the New York Zoological Park. They raised one young during 1945.

Demoiselles (*Anthropoides virgo* Linnaeus) and Stanley Cranes (*Anthropoides paradisea* Lichtenstein) have both bred in the New York Zoological Park (Crandall, 1944: 124). The Stanley Crane has nested at the Detroit Zoo (Theodor Schroder) but did not raise any young; also at the San Diego Zoo (Mrs. Benchley). Stanley Cranes did raise one young at the Brookfield Zoo, Chicago, in 1943 (Karl Plath, 1943: 383-385).

O. A. Maine (The Providence, Rhode Island, Evening Bulletin, August 26, 1938) described a pair of African Crowned Cranes (*Balearica pavonina*) nesting at Roger Williams Park, which hatched three young 29 days after the eggs were laid.

SUMMARY

The Sarus Crane has bred in captivity in recent years in three zoological parks in the United States: San Antonio, Texas; San Diego, California; and Chicago, Illinois. Young were reared during three years and hatched a fourth year in San Antonio; in San Diego, young were reared one year; in Chicago, eggs were laid five years but none hatched, since both birds evidently were females.

Nests were built on dry ground but near to water where available. Materials at hand were used in the construction. Eggs were laid from

late June until September, usually July and August. Two eggs were laid as a rule, but one nest in Chicago (probably two females) contained as many as five eggs. The eggs are white sparsely spotted with brownish and are similar in size to the eggs of the Greater Sandhill Crane. Both parents incubate.

Incubation requires approximately 32 days. Young are covered with yellowish brown down at hatching and remain with the parents until the following summer, but when the parents are ready to nest again they will not tolerate the young of the previous year in the same enclosure.

The young are able to fly when four months of age.

Records are now available of the nesting of each genus of cranes in captivity, showing that if conditions are proper, probably any crane will breed in captivity.

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Battle Creek
Michigan