

CRIP: THE CONSTANT DANCER

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Crip: The Constant Dancer is a biographical study of a captive Whooping Crane and, as such, it is concerned with the biological and behavioral problems related to the management and preservation of an endangered species. This study identifies persistent questions involving captive breeding, fertility/longevity, nesting vs. artificial incubation, parental care, filial and sexual imprinting, submissive-dominant behaviors, personal space and optimal enclosure area, and possible stress and effects that may be related to egg removal and other practices designed to increase egg production.

The life of the captive Whooping Crane Crip, rich and varied by any standard, encompasses the recent history of concerted efforts on the part of the American and Canadian governments and people to save his species from extinction. In fact, he is an embodiment of all such efforts being made during his lifetime, and he continues as a vital agent in the struggle to insure propagation of *Crus americana*. When Crip, who is the property of the United States Department of the Interior, was first observed at Aransas National Wildlife Refuge, Texas, in either 1946 or 1947, there were 31 migratory Whooping Cranes, plus 2 in captivity, in the world by official count during the latter year (See Note a), and only one or two remained of the non-migratory flock in Louisiana. Through conservation efforts, this number increased by 1979 to 74 wild migratory Whooping Cranes, to which can be added 8 or 9 from the Foster-Parent Experiment, Grays Lake, Idaho. Twenty-two Whooping Cranes reside at Patuxent Wildlife Research Centre,

Maryland, 2 at the International Crane Foundation, Wisconsin (one on loan from Patuxent and the other from the Audubon Park Zoo in New Orleans), and 2 at the San Antonio Zoological Gardens and Aquarium, bringing the world total to 108 or 109. The Louisiana non-migratory flock has disappeared, to survive in the mixed genes of Josephine and Crip's remaining offspring.

Today, Crip and his fifth known mate Ektu live peacefully and contentedly, unaware of his renowned fame and special mission, at the San Antonio Zoo. Cranes, and especially Whooping Cranes, always rare, have resided in zoos in the past, where they were available for research and study.^{7, 8, 19, 31} However, unlike Crip, none has attained such "star status." Although Crip has been a captive most of his life, he was once part of the migratory population that journeys 2400 miles from their breeding grounds at Wood Buffalo National Park, Northwest Territories, to spend the winter at Aransas National Wildlife Refuge, in Texas, raising the young they bring with them. In spring they return to Canada. Both phases of the journey are perilous and exhausting for the cranes. This might have been fatal for Crip, who survived the migration from his nesting grounds only to be denied a return because of an injury to his left wing, probably sustained during his southward flight.^{3, 20}

Crip's Age

Crip's exact age can only be guessed. Although Allen calls him "Old Crip," recalling an old friend

several years later, Crip was possibly in mature white plumage, though hardly more than a few years old, when first encountered by Allen at Aransas in the winter of 1947.⁴ Thus, at the time of writing (1979), Crip is about 34 years old, the "middle of the road" even for cranes, whose life expectancy, according to Erikson is probably over 60 years.¹³ Certainly, Crip is a tall, majestic bird who carries his age well, despite an obviously crippled wing. Now as always, he is inclined to stride gracefully and vigorously about his domain. He is easily over four and one-half feet tall, stalwart and proud, with a glittering eye and a sovereign mien.

Crip's Early Mates

Evidence suggests that Crip has had a series of mates. Although the precise number is unknown, five have been identified. Deriving the bulk of her information from Allen's various accounts, McNulty reports that Crip and his flightless mate, having spent the summer of 1947 in the Middle Pond Territory at Aransas, were evicted in the fall by the returning rightful owners.²⁰ They moved on to Rattlesnake Point Road, where they stayed until March 1948, when the female died a lingering death, shot by an unknown assassin. Evidently, Crip did have a female by his side in his early years at Aransas, not just a companion. However, since there is no evidence of nesting, possibly due to immaturity, it must be assumed that Crip and the female may not have mated at this time.²⁷

After the death of his first mate, Crip's resumed bachelorhood did not last long. On 17 April 1948 while at Rattlesnake Point Road Territory, Allen observed him calling to a lone migratory whooper who was flying north. This crane flew to his side, and remained with him at Aransas from April 1948 until October 1949, one

and a half years. Again, no nesting was observed, although it was assumed by Allen that this crane was a female.²⁰ Then, as now, sexing of Whooping Cranes is difficult and uncertain, Allen rarely made an error, but proof of accuracy depends on the results of pairing.

Josephine and Crip

Only less famous than Crip himself was his third mate, Josephine, "Queen of the Whooping Cranes".⁶ She was believed to be one of the last survivors of the non-migratory Louisiana Whooping Cranes who lived in the quiet marshes around Lac Blanc in Vermilion Parish, southwest Louisiana, until this population disappeared. In the fall of 1940 a severe storm, at the fringes of a hurricane, inundated the marshland where Josephine lived. However, her subsequent injury was probably not the result of this cataclysm, but of a hunter's bullet.¹⁸ Allender and Archibald state that a farmer of Evangeline Parish after having captured an injured crane in a rice field, gave it to L. O. LaHaye of Eunice, who nursed it back to health.⁵ A year later this crane was formally recognized as a whooper and sent to Audubon Park Zoo, where she was introduced as Josephine. From the fall of 1941 until the fall of 1948, Josephine remained alone in her enclosure at the zoo. It became obvious to Allen and others that Josephine with a mate could participate in a captive breeding experiment, which was being inaugurated, to help insure survival of her species.³

Pete entered upon the scene, a male Whooping Crane that had been shot along the flyway in Nebraska during migration. He had been captured and sheltered by members of the Gothenburg Gun Club, in a fenced area on the Platte River since May 1936. Before joining Josephine, on loan from the Audubon Park Zoo, in a



*Figure 1. Josephine and Pete at Aransas National Wildlife Refuge, Texas, May, 1949.
L. H. Walkinshaw*

150-acre enclosure at Aransas in late 1948, Pete, blind in the left eye and missing his right wing primaries, was displayed at the St. Louis Zoo Bird House from 6 November to 19 December.³²

To everyone's delight, Josephine and Pete, danced and mated in March and April 1949, and eggs were discovered at Aransas on 30 April and 1 May. Unfortunately, chicks never emerged, the parents left the vicinity of the nest after smashing their infertile eggs on the 24th day of incubation. On the evening of 21 July or early the following morning, Pete died of natural causes. Allen dubbed him a "game old warrior," who had certainly done his best for his species, alas, with no viable results.²

Once again Josephine needed a mate. No time was lost, and Crip was so designated. Early in October 1949, a posse was organized at Aransas, and he was captured. Crip's second mate, who was with him, had flown off at the last moment, and he was apprehended.² Undaunted, Crip joined Josephine in the enclosure,

with no apparent clash of wills. From all accounts, these cranes, whose species usually pair for life unless the death of one intervenes, were ideally suited to one another, and seemed to sense their awesome responsibility.

Josephine and Crip danced, mated, and built a nest in the spring of 1950 at Aransas, and on 22 April an egg was laid. This egg had the distinction of being constantly observed from a 20-foot observation tower by the staff, and at different periods, the two leading authorities on Whooping Cranes, Robert Porter Allen and Lawrence H. Walkinshaw.^{2, 30} Despite these promising eventualities, there appeared in a New Orleans newspaper a report to the effect that Superintendent Douglas of the Audubon Park Zoo was at that time seeking a return of Josephine, perhaps, to swap her for a "Panda in a northern zoo".³³

The first Whooping Crane ever hatched in captivity, called Rusty because of his russet chick-down, emerged late on 24 May or early the next morning. Unfortunately, this ap-

parently healthy, tiny chick disappeared without a trace only 4 days after hatching, for reasons unknown.³ It seems, by all accounts, that even in so short a time, Crip was a solicitous and tender father.

Taking as failures the events of the previous year, in conjunction with the loss of her eggs in 1951, Douglas retrieved Josephine from the breeding experiment at Aransas on 13 December. In the confusion following his unannounced arrival at the Refuge, he managed not only to regain custody of Josephine, but also to grab Crip, taking them both back with him to the Zoo.²⁰ Three days later the cranes were formally welcomed to New Orleans.⁹

For the first 4 years at the Audubon Park Zoo nothing of consequence happened to further the propagation of Whooping Cranes in captivity. The situation changed dramatically in 1955, to inaugurate a decade of remarkable activity. Table 1 outlines the egg production and offspring of Josephine and Crip at the Audubon Park Zoo from 1955 to 1965. The only offspring surviving to maturity were George, Georgette, Pee Wee, and Pepper (Note b). Although many of the offspring of Josephine and Crip led short lives, the skins of several of them have been preserved; and through the art of the taxidermist, they subsist in life-like form, adding to the lore of the Whooping Crane. George H. Lowery, Jr., late director of the Museum of Natural Science at Louisiana State University, Baton Rouge, played a key role in this lasting achievement (Note c). For example, Josephine and Crip's chick that lived for 45 days in 1956 is part of an exhibit at the LSU museum, called, "The Louisiana Prairie Long Ago." The youngster is overshadowed by two adult whoopers, themselves preserved for many generations.

Table 1 further indicates by asterisk other chicks of this pair also available for viewing at the museum.

During the early years at the Audubon Park Zoo several eggs were broken by the cranes themselves, for reasons unknown, causing the Bureau and the Zoo officials to consider some precautions. Thereafter, many of the eggs were removed as soon as possible and artificially incubated or placed in the care of expert crane-egg hatchers. The record shows that conditions did not improve, and to this day, hatching healthy chicks is risky, laden with biological and psychological problems yet to be solved by research. "Pulling" the eggs, however, did increase egg production. Cranes typically lay a two-egg clutch, but if the eggs are systematically removed, the female often will continue to lay.

The spring before Josephine died, 1964, she had laid 10 eggs. Two of them hatched, but the chicks did not live long. Following this "ten-egg-tragedy," the Bureau began to wonder if Josephine and Crip were too old to produce healthy chicks.²⁰ No one has yet addressed the effects of psychological and physiological stress possibly resulting from these procedures.

Josephine, the last of the non-migratory Whooping Cranes, died on 13 September 1965. Five days earlier, Hurricane Betsy hit New Orleans and in its wake there was the usual aerial survey of damage. A helicopter flying low came too close to Josephine's enclosure and in her fright [possibly coupled with stress and exhaustion] she was fatally injured.⁵ After a series of events, Lowery was able to get Josephine's skin. She stands alone at the LSU museum against the day she will return to Audubon Park Zoo to take part in a special exhibit.

TABLE 1 — Egg Production and Offspring of Josephine and Crip at the Audubon Park Zoo : 1955-1965

Year	Date Laid	No. Eggs	Nested/ Incubate	Condition	Date Hatch	Name	Date Died	Cause/ ^a Death	Life-span
1955	5/29	1	Nested	Broken					
1956	4/28	1	Nested		5/29		7/13	A	45 days*
	5/02	2	Nested		6/01		6/02	B	2 days
1957	4/18	1	Nested		5/18	George	11/8/78	C	21 years
	4/21	2	Nested		5/21	Georgette			
1958	3/28	1	Nested		4/30	Pee Wee	6/20/70	C	12 years
	3/30	2	Nested	Burst					
	5/21	3	Nested	Infertile					
	5/24	4	Nested	Infertile					
1959	2/14	1	Nested	Broken					
	2/17	2	Nested	Broken					
	3/06	3	Incubate	Infertile					
	3/09	4	Incubate	Dead chick					
	3/12	5	Nested	Addled					
	5/05	6		Broken					
	5/08	7		Dead chick					
1960	2/13	1	Incubate	Infertile					
	2/16	2	Incubate	Infertile					
	2/19	3	Incubate	Infertile					
	4/16	4			5/17		6/02	A	16 days*
	4/18	5			5/18		5/18	G	8 hours*
1961	2/25	1	Incubate						
	2/28	2	Incubate						
	3/12	3		Broken					
	3/15	4			4/18	Pepper	2/14/74	D	12 years*
1962	3/05	1			4/08		4/19	E	11 days
	3/08	2	Nested	Infertile					
	5/01	3		Fert/dead					
	5/04			Fert/dead					
	5/23	5			6/25		7/02	G	7 days*
	6/26	6	Nested	Broken					
1963	3/12	1	Nested	Broken					
	3/22	2	Nested	Broken					
	3/25	3	Nested	Hole					
	4/08	4	Incubate	Infertile					
	4/11	5	Nested	Broken					
	5/01	6	Incubate	Infertile					
	5/05	7	Incubate	Infertile					
	5/17	8	Incubate	Broken					
1964	3/28	1	Incubate	Premature				G	40 hours
	3/31	2	Incubate		5/02	Zoe	5/20	F	18 days
		3	Incubate	Infertile					
		4	Incubate	Infertile					
		5	Incubate	Infertile					
		6	Incubate	Infertile					
		7	Incubate	Infertile					
		8	Incubate	Infertile					
		9	Incubate	Infertile					
		10	Incubate	Infertile					
1965		1	Incubate	Infertile					
		2	Incubate	Infertile					
	5/13	3	Incubate	Fert/dead					

Note: Fifty-two eggs were laid, 12 hatched, 4 lived to adulthood, 1 remains alive.

^aCause of death: A = Aspergillosis; B = Disappeared; C = Injury; D = Infection; E = Operation; F = Defect; G = Unknown



Figure 2. Josephine and Crip with George and Georgette at Audubon Park Zoo, 24 May 1957. Parker's

Rosie and Crip

The migratory Whooping Crane Rosie, on loan to the Audubon Park Zoo at the time, became Crip's fourth mate. Sometime after 3 May 1956, she and a former mate had left Aransas on their flight to Wood Buffalo, but went no farther than Lampasses County, Texas, because Rosie had crippled a wing on a high wire. Her mate stayed with her until a need for

water prompted him to resume his migration. Following her capture, Rosie was taken to the San Antonio Zoo, where she was accurately identified as a female by the late director, Fred Stark, who immediately advised the Service of her availability.²⁰

During the 8 years of Rosie's solitary residence at the San Antonio Zoo, George and Georgette, offspring of Josephine and Crip, reached

maturity at Audubon Park Zoo. Rosie was brought from San Antonio to New Orleans to pair with George in April 1964, thereby augmenting the reproductive efforts of Josephine and Crip. In the spring of 1965, in their newly constructed pens, they danced and mated but did not nest. It should be noted that during the winter of 1964-65, Roxie Laybourne, employing her own technique, was able to sex Josephine and Crip's four offspring, determining George, Georgette and Pepper to be male, and Pee Wee to be female. Georgette was now called George I.²⁰ Consequently, Pee Wee and George I were paired, but did not prove compatible. The reason is not far to seek. An autopsy performed on Pee Wee in 1970 disclosed that he was a male.

About this time, in 1964, Can-Us, the property of the Canadian and American governments, was captured in Canada, and, at first, taken to Monte Vista National Wildlife Refuge, Colorado. Later in 1966 he was transferred to Patuxent. Can-Us, yet another migratory whooper in captivity, eventually will play a role in the captive-breeding experiment and indirectly in the life of Crip.

As noted above, following Josephine's death and the realization that the union of Rosie and George was unproductive, the Bureau and the Audubon Park Zoo decided to place Rosie with Crip. Evidently well-suited to each other temperamentally, the pair, nevertheless, failed to nest in the spring of 1966. This fact, in connection with previous arrangements and agreements between the Bureau and the Audubon Park Zoo, prompted the former to recommend transfer of Rosie and Crip to the San Antonio Zoo (Notes d and e). The move was accomplished on 5 January 1967; hopefully, it would stimulate reproduction, and such proved to be the case. Table 2 outlines the egg

production and offspring of Rosie and Crip at the San Antonio Zoo from 1967 to 1970. Tex, named after her native state, was the only offspring surviving into maturity.

The first chick hatched in 1967 had suffocated or been stepped on inadvertently by the parents. This accident may have resulted from the fact that the cranes had minimal personal space in captivity. Inasmuch as each crane family in the wild claims large territories, the question of space appears to require further study. Consequently, Stark, concerned about the safety of Tex, the second chick hatched in 1967, reared her in his own home for the first several days of her life. As a result, she became imprinted upon human beings rather than cranes, and this would have far-reaching effects later on. Tex, who weighed a pound and was fourteen inches tall at 16 days, flew by jet to Patuxent secure on the lap of R. C. Erickson, Assistant Director for Endangered Wildlife Research. Patuxent had been in operation for only a year, but its concern for Whooping Cranes, among other endangered species, was evident in their many efforts on their behalf.

After Rosie and Crip's propagation failure in 1968, questions again arose concerning the fertility of Rosie and, especially, Crip. A biologist from Patuxent was sent to the San Antonio Zoo to conduct tests on the cranes.³⁴ In 1969 Rosie began laying eggs again. Interestingly, when a decoy egg was placed in the nest as a substitute for one of her own removed eggs, she rolled it away, and built another nest.²³ Variations of this practice occur from time to time. Walkinshaw recalls that a Sarus Crane in September 1965 was found incubating 2 crane eggs plus 1 large snail shell (Note f). Today, decoys are rarely, if ever, used because the crane continues to lay without them.²⁵

TABLE 2 — Egg Production and Offspring of Rosie and Crip at the San Antonio Zoo : 1967-1970

Year	Date Laid	No. Eggs	Nested/ Incubate	Condition	Date Hatch	Name	Date Died	Cause/ ^a Death	Life-span
1967	6/7	1	Nested		7/6			A	1 day
	6/9	2	Nested		7/9	Tex			
		3							
		4							
1968	6/2	1	Nested	Infertile					
1969	4/25	1		Broken					
	4/29	2	Incubate	Infertile					
	5/6	3	Incubate	Infertile					
	5/12	4	Incubate	Infertile					
	5/16	5	Incubate	Fert/dead					
	6/6	6	Nested		7/5	Firecracker	7/11	B	6 days
1970	3/20	1	Incubate	Fert/dead					
	3/22	2	Incubate	Fert/dead					
	3/29	3	Incubate	Infertile					
	4/3	4	Incubate	Fert/dead					
	4/9	5	Incubate	Infertile					
	4/13	6	Incubate	Fert/dead					
	4/24	7	Incubate		5/27		5/29	C	2 days
	5/11	8	Nested	Flooded					

Note: Nineteen eggs were laid, 4 hatched, 1 lived to adulthood and remains alive.

^aCause of death: A = Suffocated or stepped on; B = Defect; C = Infection.

Toward the end of May after having laid the fifth egg of the season, Rosie was given a rest.²² Later, on 5 July the chick from her sixth egg hatched, and it was aptly called "Firecracker." At this time, celebrated Crip had offspring everywhere. George, George I, Pee Wee, and Pepper at the Audubon Park Zoo, Tex at Patuxent, and now Firecracker at the San Antonio Zoo. The largest number of Whooping Cranes ever held in captivity were sired by Crip. Sadly, Firecracker lived only 6 days. Death resulted from slipped tendons in the knees.

With the exception of Griswold's research, little had been done on rearing Whooping Cranes in zoos, and in the late 1960's Audubon Park and San Antonio came to rely, more and more, on Patuxent for guidance.¹⁴

Furthermore, Whooping Cranes were the property of the United States Department of the Interior, on loan to the zoos, so ultimately the zoos were in a subordinate position. Recent captive whoopers are the joint property of the Canadian Wildlife Service and Interior. Patuxent agreed to provide the zoos with detailed instructions concerning daily care, diet and diet supplements, medical treatment, handling pairs or singles, artificial light stimulation, retrieval of eggs, disposition of eggs, incubation, brooding, rearing, and autopsy reports (Note g).

Pee Wee, offspring of Josephine and Crip, died on 20 June 1970, at the Audubon Park Zoo, of air sacculitis and pneumonia, resulting from injuries sustained when he "flew against

the pen in an effort to fight a neighboring sandhill crane" (Note h). His death was to a large extent ignored in the public press and related comment; and no records presently exist at the Audubon Park Zoo.

The spring before Rosie died, 1970, she had laid eight eggs. One of the chicks hatched at Patuxent but it did not survive. Rosie did not appear to be herself in the spring of 1971; she did not lay any eggs. On 16 June she was found in her enclosure unable to stand and evidently seriously ill. All efforts failed to save her, and she died in the hands of zoo officials at 17:55. The autopsy that was performed at Patuxent revealed that Rosie had succumbed to a tumor in the liver plus other complications [possible stress and exhaustion] (Note i).

Crip, again alone, remained at the San Antonio Zoo. At this time, he seemed destined to remain an old widower.

Essential to any captive-breeding program is the successful sexing of the principals involved. This proved crucial to the Audubon Park Zoo where, despite various efforts, they still wished to verify the sexes of the cranes they held. Safe methods of sexing were also sought. George Archibald of the recently established International Crane Foundation, Baraboo, Wisconsin, visited the zoo for 4 days in February 1972 to test his method for sexing cranes (Note j). His preliminary attempt to determine the sexes of Crip's three offspring by studying their unison calls was partially successful. According to Kepler the behaviour of a dominant female may be so similar to that of a male that unison calls may be the only way of sexing.¹⁷ Now firmly established, this safe method of sexing should prove very valuable. By 1974 the Audubon Park Zoo found out through chromosome Karotypy, performed by

Tulane University Medical Center, that all three of their cranes were, indeed, males (Note k). The San Antonio Zoo had their lone, male Whooping Crane, Crip, while Audubon Park held his three male offspring. Shopping around for captive female Whooping Cranes of breeding age in order to continue the breeding experiments at the zoos was going to be a difficult task. Related to this at Audubon Park Zoo and elsewhere was a persistent, yet, pulsating emphasis on the possibility of re-establishing the non-migratory Whooping Cranes in Louisiana. As noted above, the surviving offspring of Josephine and Crip constituted the only gene bank of the lost flock.

In any case, the Audubon Park Zoo went directly to the Secretary of the Interior, Rogers C. B. Morton, and their own Louisiana Senator J. Bennett Johnston with their requests for a suitable female Whooping Crane. The San Antonio Zoo targeted Patuxent with the same request. Early in the negotiations the replies to the Audubon Park Zoo were not encouraging, whereas, those to the San Antonio Zoo were. Always uppermost in the minds of those concerned with Whooping Crane welfare at the Department of the Interior, however, was the fact that at Audubon all three cranes could be lost at one time, if any catastrophe hit the Zoo. The intention to separate the cranes eventually seemed justifiable. The wild Whooping Cranes are similarly threatened by natural or man-made calamity.

The sudden death of 12-year-old Pepper, the offspring of Josephine and Crip on 14 February 1974, at Audubon Park certainly did not help the zoo's request for additional cranes. Pepper's cause of death was never firmly established; it was believed to be caused by a bacterial infection, but duck plague virus could not be ruled out (Note l). Following a

second autopsy at the Smithsonian Institution in Washington, D.C., the body of Pepper was sent on to the LSU Museum of Zoology, where it could only be salvaged as a skeleton (Note m).

Following Pepper's death, there were renewed efforts at the Zoo and elsewhere concerning prospects for re-establishing the Louisiana non-migratory Whooping Cranes in their former marshland or some similar setting. There remained at Audubon, now, only George and George I, descendants of Josephine.

Although Crip was unaware in late 1975 that he would shortly meet his fifth mate, the San Antonio Zoo was not. Patuxent and Canadian Wildlife had agreed on the choice of a likely distaff for Crip, recognizing his exceptional value in their propagation efforts and research.

Ektu and Crip

The female that was selected as Crip's mate had been taken from a wild nest designated EK-2, at Wood Buffalo National Park, Canada, on 2 June 1967, and hatched at Patuxent on 11 June. It is interesting to note that this egg, which produced a healthy chick, was taken from a wild nest and artificially incubated for only the last 9 days before hatching, while captive crane eggs are removed almost immediately and placed in incubators, and often fail to hatch or to survive, though fertile. According to Rahn, Ar, and Paganelli research focusing on parent functions during incubation, that is, warming the eggs to the optimal temperature and maintaining the humidity of the nest air, among other factors, must be undertaken to insure critically close duplication of the natural process in artificial incubation.²¹ Therefore, careful study of the behavior and biology of nesting cranes in captivity seems imperative.

EK-2, says Kepler (Note n) was raised alone in an enclosure to avoid imprinting, yet adjacent to others of her species.¹⁶ On 8 October 1968 she was placed with EK-4, EK-1, and Tex, the female offspring of Rosie and Crip who was a little over a year old then. EK-2 formed a pair-bond with the large male EK-4 and together these birds dominated EK-1 and Tex. Following a severe thunderstorm on 4 November, only 27 days after these cranes had been placed together, EK-4 died. Tex was removed from the pen, but EK-1 and EK-2 remained together. Although EK-1 was a male, he remained subordinate to EK-2 for the 7 years they were together. Consequently, they did not mate. Kepler seems to suggest that EK-1 assumed his submissive role following earlier encounters with EK-4 and EK-2, both markedly dominant.¹⁶ In the wild, a subordinate crane has the opportunity to escape (Note f). The interaction between the genetic program and the environment here as elsewhere is open to further investigation.¹ These cranes were separated on 1 August 1975. EK-2 was placed together with another male, whom she attacked almost at once, and, in consequence, had to be removed from the enclosure.

Officials at the San Antonio Zoo, having waited for several years for a suitable mate for Crip, a crane of unusual equanimity, must have received the news of the arrival of the imperious EK-2 with a touch of apprehension. Director Moore of Audubon Park had his concerns, too, at the time, but they were of a decidedly different nature. To set the record straight Moore wrote to Linda Scarbrough, whose article in the New York Times entitled, "The Ugly Duckling Updated" contained a gross inaccuracy. She had failed to state that the first chick ever conceived by two Whooping Cranes in captivity was

hatched by the Audubon Park Zoo in May 1950 (Note o). Although he did not specify that the egg in question was actually hatched at Aransas under Audubon Park auspices, he did imply that the Zoo would probably not receive from Interior sufficient females to continue their breeding program. As it turned out, Moore was correct, the International Crane Foundation was authorized on 21 April 1976, a 2-year loan of a pair of breeding-age Whooping Cranes — a female from Patuxent (Tex) and a male from Audubon Park (George I, later Tony), “for the purpose of propagation and research in artificial insemination techniques” (Note p). The airline that took George I and Moore to Baraboo, listed the bird as George Crane on the passenger list and assigned him a seat in the non-smoking section. Tex, who had arrived on 15 April, and Tony were received at the Foundation with jubilation.²⁸ Since Tex was known to be sexually imprinted upon humans rather than cranes, the pairing of Tex and Tony at the International Crane Foundation was destined to be remarkable.

Two months earlier, EK-2, subsequently called Ektu, arrived at the San Antonio Zoo to be placed with Crip on 11 February 1976. The first meeting was not a blissful one. Experienced Crip must have sensed something different about his fifth mate's behavior because he, uncharacteristically, attacked her right away by giving her several hard thumps on the head while chasing her around the enclosure.¹⁰ Separation was immediate. Several months later, in order to help the cranes finally adjust to one another, the gates between their adjacent enclosures were left open during the day.²⁴ Ektu would wander into Crip's territory and, although he did not touch her, he would run past her at an alarming

pace so that she had no other alternative but to retreat. With time, Ektu and Crip became adjusted to each other and a pair-bond was established. Ektu and Crip were observed dancing and mating in the spring of 1977, but no eggs were laid.

Imprinting

As noted above, Tex had become imprinted on humans rather than cranes. Imprinting begins in birds as they fix on the first moving object encountered after hatching; this principle was established by Konrad Lorenz, and subsequent investigations of imprinting usually follow where he leads. Summarizing his discussion of imprinting, Dewsbury says:

One can demonstrate a complete gamut of phenomena, from a lack of preference for the imprinted object to a life-long atypical mating preference. As with virtually any well-analyzed behavioural phenomenon, the determinants are complex.

To offset the effects of Tex's imprinting on humans and to insure propagation, Archibald undertook a unique experiment at the International Crane Foundation during the spring of 1977.

Some years earlier, the male Can-Us and Tex had been paired at Patuxent. Artificial insemination techniques were employed when Tex did not respond to Can-Us' displays. This procedure, it was hoped, would result in an egg, indisputable evidence of Tex's being a female, in view of the fact that her sex was still uncertain (Note q). This experiment proved negative; however, attention was now directed to the ritual dance, the necessary prelude to mating.

In consequence, Archibald assumed the role of Tex's companion during the mating season. They danced together, she became sexually active, and Tony's semen was ar-

tificially administered to her on 1, 4, and 7 April. Tex laid an egg on 9 April, but it proved infertile. This procedure and related research should contribute to further understanding of Whooping Crane behavior and biology. It is interesting to note that Archibald costumed himself in a red ski cap and white suit for the dance with Tex. Inasmuch as imprinting is generally considered irreversible, one must assume that his role remained essentially human. The costume served, perhaps, as an intermediary between human and crane in Tex's perception. This might lead to consideration of possible step-by-step reversibility of imprinting from humans to cranes, in line with the results of Archibald's role-playing as human-crane.

Only future research can determine whether these procedures reinforced the sexual imprinting on a human, initiated the reversal back to cranes, or confused the preference behavior altogether.²⁶ In their study of filial imprinting on ducks, Hoffman and DePaulo state that an imprinted organism is not doomed permanently. "Nature can in fact repair some of the unfortunate vagaries of environmental experience. Apparently it does so through the continually expanding and adjusting effects of learning".

Walkinshaw recalls the story of a Sandhill crane, originally imprinted on cranes, who became sexually imprinted on one particular man, and for 5 consecutive years laid two infertile eggs on a neighbor's front porch (Note f). Miller, who has done considerable research on imprinting says,

"My thesis is that imprinting is the study of laboratory artifacts and not the study of how animals come to identify conspecifics in nature" (Note r).

Questioning Tony's fertility, the Foundation successfully negotiated the loan of George, renamed Angus,

from the Audubon Park Zoo, in June 1977, on a one-year trial basis. Angus, who arrived in Baraboo in the fall of that year, seemed, by all accounts, to have the temperament and dignity of his sire Crip. He and Tony were to serve as sperm donors to inseminate artificially Tex.²⁹

Crip, in the spring of 1978, could have had the singular distinction of being both father and grandfather at the same time. Ektu laid her first egg on 18 April, at the San Antonio Zoo, while Tex laid an egg on 27 April, at the International Crane Foundation. Alas, neither hatched. Ektu's egg had been fertile, but the embryo died at about 10 days due to bacterial contamination. Tex's chick died during pipping due to an abnormal eye condition.

As with his mother Josephine and, later, his brother Pee Wee, a freak accident contributed to Angus' death. On 24 May 1978, several hot-air balloons flew over the International Crane Foundation site, at Baraboo, Wisconsin, and unwittingly terrified the cranes assembled there. According to Archibald (Note s), Angus flew in panic against the fence and "completely broke off the outer 1½" of his upper mandible." Intensive care was given Angus, but he was unable to eat and had to be force fed. During a forced-feeding session on 16 August, he shifted position and somehow broke the proximal end of his left tibia. All that could be done for this valuable crane was done; however, he never recovered and died on 7 October 1978. The Audubon Park Zoo received the news, as so often in the past, with sadness but with renewed dedication to the cause of *Grus americana* and to the re-establishment of the non-migratory flock in Louisiana.

Epilogue and Conclusions

Artificial light stimulation, egg

removal, and other procedures probably resulted in increased egg production for Crip and Ektu in the spring of 1979. As a result, 8 eggs were laid, the first discovered on the morning of 12 March. Others followed on 14, 18, 21, and 26 March. Before artificial incubation was attempted, each egg remained a short period with the parents. During this time, Crip was observed doing most of the incubation. In fact, he was busy with egg number 5 in the early afternoon of 27 March, when he got up from the egg, walked to the stream at the far end of the enclosure for a sip of water, and suddenly fell over and died. The necropsy report, from Madison, Wisconsin, at the request of the Department of the Interior, attributed Crip's death to a cardiovascular accident.

Ektu laid three more eggs following Crip's death, on 29 March and 2 and 8 April. Five of the eight eggs proved to be fertile. Two of these were shipped to Patuxent and three were retained by the San Antonio Zoo. On 19 April a crane chick was hatched stillborn. However, a week later, at 07:00, on 26 April another chick hatched, was promptly dubbed Criptu, and still survives. This chick is the sole survivor of the 8 eggs laid by Ektu during the spring of 1979.

The uniquely long period of captivity encompassed by the life of the single whooper Crip provided many fruitful opportunities for direct observation over the years and, thus, enhanced accumulated knowledge of an endangered species, hopefully to promote its propagation and survival both in and out of the wild.

Several possible conclusions concerning captive breeding programs involving Whooping Cranes emerge from this biographical study:

1. That male crane fertility may exceed 35 or more years.

2. That crane longevity varies in captivity subject to differing conditions and trauma.

3. That the advantages of nesting over artificial incubation or vice versa cannot yet be determined.

4. That parental care, even in cranes, may involve some learned behaviors.

5. That filial and sexual imprinting are very complex, and possibly subject to variation.

6. That submissive-dominant behaviors of specific cranes may exist apart from sex-role factors.

7. That personal space and optimal enclosure area are important factors in crane management.

8. That the psychological and physiological stress imposed on captive cranes may contribute to poor health and even early death. The suddenness and the nature of Crip's death, perhaps due to overexertion in advanced age, and the earlier deaths of Josephine and Rosie, lead to a persistent question: Do artificial light stimulation, egg removal, and related procedures, which often result in increased production, cause significant stress in the lives of captive cranes, to the extent that such egg production exceeds normal expectations in the wild?

9. That the deaths of Pete and Angus may have been the result of stress arising from different conditions.

Additionally, crane diet, intraindividual and interindividual behavior of cranes in captivity, crane relocation and accompanying stress, and human interactions merit further investigation.

Finally, as a general impression resulting from this biographical study, there is a need to expand current research in captive breeding procedures and programs, to meet present and future objectives.

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