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A REINTRODUCTION EXPERIMENT INVOLVING MATED PAIRS OF PARENT-REARED GREATER SANDHILL CRANES IN NORTHERN ARIZONA

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Abstract: In April 1997, 4 mated pairs of adult greater sandhill cranes (*Grus canadensis tabida)* were abrupt-released at Mormon Lake, Arizona. Five of 8 adult cranes died within 10 days of release. One crane flew from the release area within 10 days after release and was never relocated. One pair of cranes, with 1 pair member sustaining a broken wing 4 days after release, survived for 4 months and demonstrated the importance of maintaining pair bonds after release. The cause of death of at least 5 birds was predation. The high immediate mortality and complete long-term mortality experienced in this pilot project suggests that adult cranes are poor candidates for release. These poor results encourage that, in future release attempts with mated pairs or other adult cranes, it is important to provide the cranes with roosting habitat while still in captivity and to hold the cranes in an acclimation pen at the release site for several days prior to release.

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Recovery of the whooping cranes (*Grus americana*) in the wild depends upon creating additional wild populations of breeding adults (U. S. Fish and Wildlife Service 1994). Introduction into the wild of captive-reared individuals has been recommended as a way to either establish additional populations or help augment existing populations (Nesbitt and Carpenter 1993, Nagendran et al. 1996). Before captive cranes can be used to establish additional breeding populations of whooping cranes, successful reintroduction techniques need to be developed.

Previous attempts at establishing additional populations of cranes have had varied success. Cross-fostering attempts, where whooping crane eggs were placed in the nests of wild sandhill cranes that then reared the chicks as their own, were believed to be unsuccessful due to poor survival and to imprinting problems that prevented the whooping cranes from breeding with conspecifics (Drewien et al. 1989 unpublished, Nagendran et al. 1996). Costume-rearing has had varied success with 1-year survival ranging from 29% (2 out of 7 [Nagendran 1992]) to 94% (15 out of 16 [Urbanek and Bookhout 1992]). Similarly, parent-rearing has had varied success, with 8% (1 out of 12 [Drewien et al. 1982]) of the cranes surviving in Idaho to 68% of cranes surviving in the Mississippi sandhill crane (*G. c. pulla*) experiment (Ellis et al. 2000). Method of release is also a factor that can influence survival rates of released cranes in introduction experiments. There have been several abrupt releases where birds were released without an acclimation period to the new environment. Those that have been conducted with more than 1 individual have had low survival rates ranging from 0% (0 out of 17 [Nesbitt 1979]) to 19% (4 out of 21 [Bizeau et al. 1987]). Several experiments that used gentle-releases (those with an extended acclimation period at the release site) have had survival rates that met or exceeded 80% (Urbanek and Bookhout 1992, Ellis et al. 2000).

Age is a factor that has been given little consideration in release experiments involving cranes. Of 14 experimental releases of sandhill cranes that included 339 birds (Nesbitt 1979, Drewien et al. 1982, Zwank and Derrickson 1982, Bizeau et al. 1987, Leach 1987, Nesbitt 1988, Horwich 1989, Archibald and Archibald 1992, Ellis et al. 1992, Nagendran 1992, Urbanek and Bookhout 1992, Nagendran et al. 1996, Nesbitt et al. 1997, Ellis et al. 2000), only 13 cranes were older than 2 years. Authors who did acknowledge the age factor felt that cranes older than 2 years were less suitable to introduction experiments because the birds had more time to become permanently accustomed to captivity and socially attached to penmates. Such cranes were therefore less likely to associate with wild sandhill cranes at the release site (Drewien et al. 1982, Bizeau et al. 1987).

Although previous experiments have favored the release of juveniles, one distinct disadvantage to releasing juveniles of a k-selected taxon, such as cranes, is that such individuals must survive for several years before they reach sexual maturity. We believed that experimentation with mated pairs of sandhill cranes had been underemphasized and was necessary to determine whether or not future releases should

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incorporate mated pairs. The main purpose of such releases would be to have the mated pairs augment a previously established flock. If mated pairs were able to survive after release it was thought that these birds would, within 1 year, procreate and thereby institute a breeding population. Our objective was to release pairs of parent-reared greater sandhill cranes from captivity and follow their movements and determine their survival.

METHODS

Study Area

The release site was Mormon Lake (34°52' N, 112°30' W) in northern Arizona. This shallow, bulrush (*Scirpus* sp.) marsh reaches a maximum area of ca 400 ha after the spring snowmelt and gradually decreases in size until completely dry in late fall. We chose this lake because we hoped to create a breeding population where sandhill cranes bred 100 years ago (Phillips et al. 1978). Also, because sandhill cranes did not recently breed near the release site, we considered the area appropriate to approximate the release situation of future whooping crane reintroductions. This is because future experiments attempting to create disjunct, migratory populations of the whooping crane will not have other whooping cranes available to lead them along a desired migration route. Mormon Lake also had several advantageous habitat characteristics for sandhill cranes as described by McMillen et al. (1992) and Faanes et al. (1992). Favorable characteristics for sandhill cranes that we found at Mormon Lake include (1) a fine substrate (i.e., clay or sand), (2) unobstructed visibility from bank to bank and unobstructed visibility of several hundred meters from bank across land, (3) width of lake > 55 m for optimal predator avoidance at night, (4) open overhead visibility (i.e., no tall trees, tall and dense shrubbery, or high banks near the roost site), (5) feeding sites close to roost sites, (6) little or no human disturbance, (7) large expanses of water < 30 cm deep, (8) shallow slope at lake's border, and (9) little or no aerial hazards (i.e., power lines).

Approximately 300 m from the eastern border of the lake is a 50-m tall bluff vegetated with one-seed juniper (*Juniperus monosperma*), Gambel oak (*Quercus gambelii*), Utah serviceberry (*Amelanchier utahensis*), and quaking aspen (*Populus tremuloides*). To the north and west is a wide border of herbaceous vegetation surrounded by a mixed forest of ponderosa pine (*Pinus ponderosa*) and Gambel oak. Mormon Lake Village, a small town with a seasonally-dependent population is 2 km south of the lake. Southeast of the lake was a field dominated by grasses and other non-woody vegetation along with several cabins inhabited in the summer.

Release Birds

The 4 pairs of sandhill cranes in this experiment were parent-reared at USGS Patuxent Wildlife Research Center (Patuxent), Maryland. At approximately 6 months of age the cranes were moved from a pen with their parents to a social pen with several conspecifics of similar age. The cranes were kept with social groups until 3 to 4 years of age when they were relocated to a pen with a mate. The 4 pairs were maintained in pens with their mates for 2 or 3 years and 2 of the pairs had produced offspring. When 6 to 8 years of age, the pairs were transported to Mormon Lake.

In mid-April 1997, the first 2 pairs of adults (first pair: #95 male and #16 female, second pair: #09 male and #52 female) were flown from Patuxent to Phoenix, Arizona. We then transported the cranes 400 km by truck to the release site, about 100 m from the north edge of Mormon Lake (Table 1). At the release site, we placed these pairs of adult cranes in a single, netted, temporary, holding pen to place radio transmitters on their legs. While in the holding pen, we observed strong aggression between the pairs (predominantly males attacking the heads of their respective mates). Approximately 2 hours after placing the cranes in the holding pen, we released them in a single abrupt release. The 2 pairs quickly dispersed from the holding pen as single birds that had disassociated from their mates. Within an hour after release, no members of previous pairs were within 200 m of their respective mates.

In late April 1997, we transported the second 2 pairs of adults (third pair: #51 male and #53 female, fourth pair: #58 male and #56 female) to the same release site. Because of poor results on the previous release, we did not use a holding pen but instead placed the radio transmitters on the birds while in the back of the transport vehicle. The weather was sub-optimal at 0° C, with 2 cm of recently fallen snow on the ground and high winds. We released each of the 2 pairs separately with 45 minutes between releases. Both pairs were freed close to a feeding station we established at the perimeter of Mormon Lake. After release the pairs walked from the release site toward the lake and remained paired.

RESULTS

The first 2 pairs did not use the marshes surrounding the lake after their release but instead walked into the forest and rocky terrain several hundred meters from the lake's edge. The pairs also did not use the lake for roosting at night.

Within 24 hours of release, we found #52 dead and cached underground in the forest 0.5 km from the release site and 1 km from the lake. Three days after release, we found #95 dead and cached underground in a similar location.

Table 1. Timeline of reintroduction of mated adult parent-reared pairs of greater sandhill cranes, Mormon Lake, northern Arizona, 1997.[a]

Dates	Mormon Lake	Unknown location	Crane death
8 Apr–16 Apr	4		2
16 Apr–24 Apr	2		2
24 Apr–31 Apr	4		
1 May–8 May	2	1	1
8 May–24 Aug	2	1	
24 Aug–31 Aug	2	1	1
1 Sep–8 Sep	1	1	1
8 Sep–16 Sep		1	

[a] Values represent the number of adult cranes in a given category.

After this time, radio telemetry indicated that the surviving 2 birds continued to use the wooded areas several hundred meters from the lake even though we had set up 2 feeding stations along the perimeter of the lake. Six days post-release, we found #16 dead and cached underground. Nine days post-release, we found #09 dead approximately 3 km east of Mormon Lake in mixed forest.

The latter 2 pairs maintained close contact with their respective mates and stayed in the grassy habitat along the edge of the lake. By dusk on the release day, both pairs were at the edge of the lake. Pairs remained together for several days. Mates #51 and #53 used the grasses surrounding the lake during the day and roosted in the water at night. Four days after release, we found #53 with a broken left wing. We captured the bird and amputated the wing at the wrist. Although #53 could no longer fly, she survived 4 months before we found her dead along the edge of the lake. A necropsy revealed that blood had flowed from several punctures on the bird's neck, an indication that predation was the cause of death. We found her mate dead from predation 8 days later also in the grasses surrounding the lake.

In one instance, we observed a coyote (*Canis latrans*) approach this our longest surviving pair. As the coyote approached the pair, the disabled crane with the partially amputated wing crouched in the vegetation while her mate walked away from the coyote. The coyote followed the walking crane for several minutes until the crane was approximately 150 m from his mate. At this point the crane flew and landed about 20 m from his mate and the coyote did not continue the pursuit.

Pair #58 and #56 maintained close contact with each other for only the first 4 days after release. We did not see the pair together after this time. Twelve days after release we found #58 dead and partially consumed along the edge of the lake. We never located #56 again.

DISCUSSION

These results support the notion that abrupt-releasing captive-reared, adult pairs of cranes into the wild is not advisable. However, we should not reject the idea of adult releases without further proof. The birds used in our experiments were not given many of the advantages routinely afforded captive-reared juveniles. These pairs were not held long term at the release site prior to being freed. Nor were they introduced to pond roosting or the natural foods they would encounter at Mormon Lake. They were not trained to avoid predators or dangerous habitat. In fact, the birds for the experiment were chosen largely on the basis that they were surplus to our needs in the captive flock. Further, upon release, none were found to be capable of sustained flight. Our experiment was conducted merely as a pilot study, designed only to tell us how to better proceed in subsequent attempts.

Lessons from this study are as follows. First, the extreme aggression observed when we put the first 2 pairs together in a single pen at the release site probably resulted in the pairs separating when released and never reestablishing themselves as pairs thereafter. The longer survival of the 2 pairs released later suggest that this bond between mates is significant for survival.

While together, our most successful pair survived for 4 months even though the female was unable to fly 4 days after release. Only 8 days after the crippled bird died from predation, we found her mate dead, also from predation. For the first 2 pairs, we did not see such pair bonds after release and we found all 4 dead within 9 days of release.

To help maintain pair bonds, we advise keeping pairs penned together but separate from other pairs for at least 2 weeks. Such acclimation has proven to be fundamental to the survival of released cranes elsewhere (Horwich 1989). The pens should be in optimal crane habitat and should include roosting ponds. A feeding station should be established in an open area within view of the acclimation pen and near optimal roosting habitat. A method of opening the pen without people frightening the birds would help avoid scattering the birds during the release.

With evidence suggesting that most of our cranes died from predation, we advise the use of some form of predator avoidance training while the cranes are in captivity. Reintroduction experiments with masked bobwhites (*Colinus virginianus ridgwayi*) (Ellis and Serafin 1977) and New Zealand robins (*Petroica australis*) (McLean et al. 1999) have

shown that anti-predator training can alter behavior and presumably improve survival. Limited predator avoidance training with sandhill cranes appeared to have immediate results in making the cranes wary and in teaching them to avoid brushy habitat (Ellis 2001). We suggest that such techniques be generally applied to future releases of cranes.

We observed that 6 of the released cranes did not roost in water and 5 of these cranes died within 10 days after release. This emphasizes the importance of exposing cranes to ponds while they are in captivity. This practice will hopefully encourage the birds to roost in water after release and thereby reduce predation. Gee et al. (2001) found that cranes exposed to ponds while in captivity had better survival after release (85% first year survival) than control birds released without such ponding experience (60% first year survival).

In conclusion, although our mistakes on this first experiment with paired adult sandhill cranes led to the rapid demise of all but 1 pair, we learned from that pair, and a second pair that also retained pair bonds after release, that under certain conditions it may be practical to establish or build wild flocks by such releases. The propensity of survivors to breed under conditions very unlike their former captive situation, even years after release, is still hypothetical.

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