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PAST, PRESENT, AND HYPOTHETICAL METHODS FOR CRANE REINTRODUCTION AND MIGRATION

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Abstract: In the early 1980’s the technique of releasing yearling parent-reared cranes was perfected with the Mississippi sandhill crane (Grus canadensis pulla). In the late 1980’s, we discovered that hand-reared yearlings could also be released with good expectation of survival in both migratory and nonmigratory situations. In the mid-1990’s, efforts expanded in many directions including (1) the use of various types of motorized vehicles to lead migrations, (2) the release of juveniles one by one into wild flocks in autumn or winter, and (3) the release of adult pairs. Here I outline new and proven techniques and those likely important in future reintroduction and migration projects.

PROCEEDINGS NORTH AMERICAN CRANE WORKSHOP 9:197-202

Key words: crane, endangered species, reintroduction, release

Over the course of many years, there have been a few small releases of captive-reared cranes to the wild (e.g., Hyde 1968, Bartlett and Bartlett 1975). However, our concern here is to review and provide a theoretical framework for the releases and migration training techniques involving larger numbers of birds. Several reviews of crane reintroduction methods have been published (see Nagendran et al. 1996), and progress with the recent motorized migrations have been summarized by Ellis et al. (2003). A broad range of recent projects (reintroduction and migration) were detailed in 15 papers in the proceedings of the most recent North American Crane Workshop (Ellis 2001a). These, and a few hypothetical methods, are discussed and presented schematically here.

RELEASE TECHNIQUES

These techniques are introduced below in the order presented in Table 1.

Translocation

For non-migratory flocks, the simplest of all reestablishment techniques is the translocation of wild-caught birds. Such birds, if released in habitat similar to their place of origin, are typically predator wary and already able to use local foods, even when such occur only seasonally. Although most crane reintroductions do not have the possibility of drawing from abundant self-sustaining populations from other regions, for the Florida sandhill crane (G. c. pratensis) this condition can be met.

The recent experiment to establish a population at Grand Bay, Georgia is an example. Abler and Nesbitt (2001) translocated almost 40 subadult Florida sandhill cranes. Then, after holding them for about 4 weeks released them to the wild. Some of these birds bred during their first year after release and most birds were located alive several months after release. No release birds were known to have returned to their trapping location nor were any known to disperse widely from their release location. Finally, none were believed to have migrated north with the local wintering cranes, a flock of several hundred greater sandhill cranes (G. c. tabida).

Although we know of no effort to translocate large numbers of cranes of an endangered species, a single wild whooping crane (Grus americana) was translocated from White Lake, Louisiana, to Texas in 1950 (Doughty 1989). There is less likelihood for success in translocating adult or subadult migratory cranes, but the translocation of juveniles will be discussed later.

Exchanges of Chicks or Eggs

Until recently, the crane reintroduction program that involved the most “potential cranes” was the Grays Lake experiment led by R. Drewien. In this project, 289 whooping crane eggs were placed in sandhill crane nests in Idaho (Drewien et al. 1989 unpublished). Although the idea of cross-fostering (i.e., rearing the young of one species by another species) is now in disfavor (because of low survival and imprinting problems), there is still a possibility that the technique may prove useful to supplement the productivity of a species. This could be accomplished by placing eggs or tiny chicks of the same species in nests of unproductive parents. Below we describe our first efforts with chick exchanges, but first it deserves mention that the benefits of providing a good egg to whooping crane pairs with infertile or otherwise nonviable eggs led Kuyt (1996) to regularly make these exchanges during the later egg-harvest years at Wood Buffalo National Park, Canada. However, the first scientific treatment of the results of these egg trades (Boyce et al. under review) suggest that such trades did not have a positive effect. We suspect that egg trades under some conditions would be beneficial.

The occasional reproductive failure of some captive pairs of cranes at Patuxent and some wild pairs of Mississippi sandhill cranes prompted the development of techniques to supplement failed parents, either with a good egg or a recently hatched chick. In captivity, chicks were exchanged for eggs in 38 trials over a 10-year period (J. M. Nicolich, USGS Patuxent Wild-
life Research Center, personal communication). In 28 of these tests, the chick survived; in 10 the chick died. In nearly all failures, the timing was wrong for the natural appearance of a chick, so failure was likely. We know of only 3 attempts to exchange chicks for eggs in the wild: all were at the Mississippi Sandhill Crane National Wildlife Refuge. All 3 failed (S. G. Hereford, U.S. Fish and Wildlife Service, personal communication). However, R. C. Drewien (personal communication) saw some chicks fledge successfully after he opportunistically took 1 small chick from each of several pairs of greater sandhill cranes with 2 young and gave the chicks to failed pairs. More experimentation is necessary before this technique can be fairly evaluated.

Abrupt Releases

When juvenile captive-reared cranes are not acclimated to the release site and are released as a group, high mortality results (Nesbitt 1979, Drewien et al. 1982, Bizeau et al. 1987, Nagendran et al. 1996). This technique (abrupt release, group) has largely been abandoned in favor of acclimated release.

Contrary to what was stated about abrupt group releases above, experiments begun in 1996 showed that the most abrupt releases of all had the highest survival rates. Favorable results were achieved by releasing juveniles at about 5 months of age one by one into flocks of wild cranes (Ellis et al. 2001b). The reasons for higher survival with this technique (now termed abrupt release, one-by-one or merely one-by-one release) are at once obvious when we consider that the behavior of an entire group of naive birds would actually invite predation. By contrast, a naive juvenile joining a wild flock is protected as it mimics the behavior of the adoptive flock. The juvenile forages, roosts, and flies at appropriate times according to the social signals received from the group. The benefits of using wild birds of several species to condition young birds for release are discussed at length by Price (2002).

Of nearly 50 cranes so far released one by one (Ellis et al. 2001b), all survived the interval between release and migration, and many have completed 2 or more migrations with their adoptive flock. It deserves emphasis that this simplest of all methods (i.e., no advance training and no large pens are required at the release site for the long-term acclimation of the birds) has so far proven to have the best survival rates.

Release of paired adult cranes has been tried only once, and only in a perfunctory fashion. In Arizona, we released 4 pairs of greater sandhill cranes but achieved, at best, marginal success (Mummert et al. 2001a). Lacking holding pens, the birds were processed and released immediately after arrival. All but 1 pair immediately split, and all but this same pair, were very quickly killed by predators. Although our results were poor, the survival for a few months of 1 pair suggests that the technique may be successful (especially in nonmigratory situations) if the birds were held for a few weeks to acclimate them to the site before release.

Prolonged Releases

The method wherein cranes are held in large pens at the release site for 2 or more weeks (generally 4 weeks is the preferred duration: Ellis et al. 1992), is termed prolonged release (also called acclimated, gradual, or gentle release and more often, but less appropriately, soft release). The two largest crane

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Table 1. Reintroduction/Release Techniques for Cranes.

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<thead>
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<th>I. Translocations of wild birds</th>
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<tr>
<td>A. Breeding pairs</td>
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<td>B. Yearlings or older</td>
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<td>C. Fledged chicks</td>
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| II. Insertion of eggs or neonatal young in wild nests |

<table>
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<th>III. Release of captive-reared birds</th>
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<tr>
<td>A. Abrupt release (often termed hard release)</td>
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<td>1. Group release of adults</td>
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<td>2. Group release of juveniles</td>
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<td>3. One-by-one release of juveniles</td>
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<td>4. Pair-by-pair release of adults</td>
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<tr>
<td>B. Prolonged release (acclimated, gradual, gentle, or soft release)</td>
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<td>1. Group release of adults</td>
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<td>2. Group release of juveniles</td>
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<td>5. Pair-by-pair release of adults</td>
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reintroduction efforts in the world involve prolonged releases. The whooping crane reintroduction program in Florida has involved about 250 juvenile or subadult birds since 1993 (Nesbitt et al. 2001, unpublished data). In the Mississippi sandhill crane reintroduction program, about 320 birds were released since 1980 (Ellis et al. 2001c, S. G. Hereford, U.S. Fish and Wildlife Service, personal communication).

Early release efforts in Mississippi involved parent-reared chicks. Once it was learned that hand-reared chicks survived better than parent-reared chicks (Ellis et al. 2000, Ellis et al. 2001c), a shift was made to releasing mostly hand-reared juveniles. The advantages of acclimated releases are that birds, once freed, tend to remain near the release site; they also survive better if allowed to adapt to the climate and natural foods, and, if they quickly join wild cranes after their wing brails are removed, they receive a degree of protection from predators (true in Mississippi). The primary disadvantage to releasing naive birds in groups (as compared to the abrupt one-by-one releases described above) is that, if the social unit does not mingle quickly with wild cranes, the release birds are very vulnerable to predation. First year mortality of whooping cranes released in Florida was about 50% and nearly all of this was due to predation, primarily by bobcats (*Lynx rufus*) (Nesbitt et al. 2001). It is expected that the one-by-one method, discussed earlier, could greatly reduce mortality, but, of course, there must be a core group of “educated” survivors available to provide an adoptive flock. That Mississippi sandhill crane mortality for group releases is much lower than for whooping cranes (Ellis et al. 2001). If captive-reared cranes are integrated into a migratory flock on the breeding grounds or at staging areas near the northern terminus, such birds may survive and expand the flock. We know of 4 variants of this method. Two adult female whooping cranes were released on territories held by adult survivors of the Grays Lake experiment. Although the pairs formed by this method appeared compatible, such females never completed a migration with their mates which unfortunately had been reared by sandhill cranes (Drewien et al. 1989 unpublished). More experimentation with this technique is warranted.

The second variation involves the one-by-one release of captive-reared juveniles. This variation (Mumment et al. 2001b) was tried with 8 parent-reared juvenile sandhill cranes released into a 5 bird “flock” of survivors from the second truck migration (Mumment et al. 2001c). Although all juveniles survived to migrate south, none arrived on the wintering grounds with their adoptive flock and none returned to the release area the following spring. An experiment using 8 costume-reared juvenile sandhill cranes in Wisconsin, autumn 2000 (Urbanek 2005) was very successful with all birds surviving to migrate and all birds completing additional migrations unassisted.

Migrations Led by Motorized Craft

Juvenile cranes have now been led on 9 migrations by ultralight aircraft and 2 flocks were led by an army ambulance (Mirande 2002, Ellis et al. 2003, J. W. Duff, personal communication). These techniques involve 2 months or more for training and extensive rearing and training facilities in the field. Also, about 20% of the birds die, are lost, or otherwise fly only part of the migration due to training accidents, uncooperative behavior, or hazards on migration (Ellis et al. 1999, 2001a). Even with
these difficulties, the ultralight technique has had high enough survival and return rates that it has been chosen for use in restoring an eastern population of the whooping crane.

In addition, geese and cranes have been led by various other terrestrial craft, and swans have been trained to follow a boat (Ellis 2001b) and aircraft (Ellis et al. 2003). Many other types of craft could be used to lead cranes, but any such machine must be able to travel at optimum crane flight speeds (i.e., ca 45–60 km/hr).

**Passive Migrations**

Because of moderate loss rates for cranes in the motorized migrations (Ellis et al. 2001a, 2003) and because the ultralight migrations are so expensive, alternate methods have been sought. In 1998 and 1999, 2 small flocks of sandhill cranes were transported south in a horse trailer and released at ca 30 km intervals in hopes they would learn the route (Ellis et al. 2001d). Mortality from this method, stage-by-stage migration, was low (except for 1 disease- or contaminant-caused mortality event that killed 5 cranes), and, following one-by-one release, overwinter survival was 100%. However, this technique has been abandoned for now because only about half of the birds retraced their training route (and those returning showed obvious confusion) and all surviving birds eventually chose either a wintering or a summering ground at locations not of our choosing.

Experiments are now underway to train birds to accept being caged and transported south suspended from an airship (Ellis et al. this volume). Pilot work is also underway toward a swan (Cygnus sp.) migration with lighter-than-air craft. This work is led by William Sladen’s team at Airlie, Virginia. In 2001, that team caught 10 wild, juvenile Canada geese (Branta canadensis), surrogates for the swans, and acclimated them to plastic pipe cages which were then hoisted up a flagpole. After a few such training sessions, and lacking an airship, the team did a 113-km “migration” with the geese suspended beneath a lighter-than-air balloon. The geese were released while still aloft and floated down to join other wild geese (W. J. L. Sladen, Airlie Center, personal communication).

**CONCLUSIONS**

Each reintroduction effort poses unique problems. Tables 1 and 2 can be used to overview the tools available and choose the ones most applicable. For non-migratory cranes from Africa and southern Asia, the primary limiting factor is loss of habitat due to conflicts with expanding human populations. Here reintroduction efforts may be unnecessary if habitat can be secured. For non-migratory whooping cranes in Florida, the inordinately high mortality due to bobcat predation during the first year post-release could, if juvenile whooping cranes behave like juvenile sandhill cranes, be greatly reduced by releasing cranes one by one into established flocks of juvenile and subadult survivors of earlier group releases. Cranes could also be trained to avoid predators and habitats frequented by predators (Hartley, J. 2005 unpublished data), or territorial predators could possibly be trained to avoid cranes. In other situations, with other species, unique, but often simple, solutions may solve complex problems.

For example, the western populations of the Siberian crane (Grus leucogeranus) have been reduced to 2 tiny, almost extirpated, groups in western Siberia, while a large population in eastern Siberia numbers about 3,000 birds (Meine and Archibald 1996). With the western populations almost gone and the eastern population large but facing future threats due to potential loss of winter habitat, some drastic action is needed. From 1991 to 2002, many efforts have been underway (with marginal success) to supplement the western populations from captive production (see periodic articles in The Bugle, the newsletter of the International Crane Foundation). What may be needed now is a major shift toward the translocation of yearlings or subadults from the large eastern population to summering areas in western Siberia. Of course, such an effort should start small.
(i.e., with ca 20 birds), but, if successful, modifications could hopefully result in the movement of 50 or 100 birds in a “last ditch effort” to preserve the western “culture,” (i.e., the cumulative knowledge of migration routes, seasonal food supplies, etc., now retained by only a few birds).

In situations where suitable habitat is available, the plethora of reintroduction “tools” developed over the last 2 decades and some techniques now under experimentation are likely to solve most of the crane restoration needs far into the future.

ACKNOWLEDGEMENTS

I express appreciation to the many biologists, pilots, conservationists, and others who have devoted so much thought, time, and money toward developing techniques to save the cranes of the world. USGS Patuxent Wildlife Research Center has been the point of origin for so much of this work. I express deep appreciation for their financial support for my efforts. Jane Nicolich and Scott Hereford kindly allowed me to overview their unpublished experiments with chick adoptions. All of my own work and several of the other projects mentioned herein (but led by other scientists) included satellite telemetry aspects supported by the National Aeronautics and Space Administration.

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