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RESULTS OF THE SECOND (1996) EXPERIMENT TO LEAD CRANES ON MIGRATION BEHIND A MOTORIZED GROUND VEHICLE

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RESULTS OF THE SECOND (1996) EXPERIMENT TO LEAD CRANES ON MIGRATION BEHIND A MOTORIZED GROUND VEHICLE

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Abstract: Fourteen greater sandhill cranes (Grus canadensis tabida) were trained to follow a specially-equipped truck and 12 were led along a ca 620-km route from Camp Navajo in northern Arizona to the Buenos Aires National Wildlife Refuge near the Arizona/Mexico border. Ten survived the trek, 380 km of which were flown, although only a few cranes flew every stage of the route. Major problems during the migration were powerline collisions (ca 15, 2 fatal) and overheating (when air temperatures exceeded ca 25°C). The tenacity of the cranes in following both in 1995 and 1996 under unfavorable conditions (e.g., poor light, extreme dust, or heat) demonstrated that cranes could be led over long distances by motorized vehicles on the ground.

In an attempt to develop techniques for establishing additional migratory flocks of whooping cranes (Grus americana), 2 truck-led migrations of sandhill cranes, as research surrogates, were conducted. The first of these was reported earlier (Ellis et al. 1997). The second experiment is described below (Fig. 1). Various experiments to lead cranes by ultralight aircraft and other means have been reported earlier or are reported in this volume. A brief summary of the various experiments is also found in this volume (Ellis et al. 2001a).

METHODS

The Rearing and Training Process

Birds used in the 1996 experiment were generally reared as described for hand-reared Mississippi sandhill cranes (G. c. pulla) (Ellis et al. 1992) as modified for the 1995 trucking migration (Ellis et al. 1997, Ellis 2001). All birds were again reared at the Patuxent Wildlife Research Center (Patuxent). A major deviation from the 1995 rearing regime was a costume change from the red cap and blue and white jacket used in 1995 to a gray poncho that fell to mid-thigh and a gray hood. Another deviation was that birds in 1996 were reared from hatching with a gray plastic crane decoy in their pen. Details in rearing are illustrated in Fig. 2. During our 1996 training at Camp Navajo, we added an electric (anti-predator) fence circling our netted crane pen.

Deviations during the 1996 migration were as follows. In 1996, the birds were never penned overnight: they merely wandered around and roosted around camp at will. However, they normally roosted near our 2 plastic crane decoys. In

Fig. 1. The 1996 trucking migration in progress. (Photo by Joseph W. Duff.)
1996 TRUCKING MIGRATION • Ellis et al.

Fig. 2. Sandhill crane training time line. Plastic decoy was left in pen of youngest crane chicks when not in use with a group.

The Migration

Because of our difficulty controlling the 2 groups when flown together, we decided to keep the groups separate for the first day of the migration. From experience in 1995, we reasoned that once the cranes were far from the familiarity of the camp, they would be more anxious to stay close to the cranemobile (i.e., our army ambulance) and therefore more willing to tolerate birds from the other group. For both groups, a plastic crane decoy was attached to the rear of the cranemobile to help lure the birds along.

RESULTS

The 1996 migration took fewer days (8 days [Table 2] compared to 13 days) than in 1995. It began on 12 October and ended on 19 October (Table 3). Flights totaled ca 380 km in 1996 compared to 495 in 1995. Details of the migration flights of the separate (older and younger) groups and later their joint flights are reported in Table 3. The route south

Table 1. Details of the flight training of sandhill cranes flying behind motorized ground vehicles at the Navajo Army Depot, Belmont, Arizona.

<table>
<thead>
<tr>
<th>Age in Days (Hatch Day = 0)</th>
<th>-3</th>
<th>-2</th>
<th>-1</th>
<th>0</th>
<th>1-10</th>
<th>11-20</th>
<th>21-30</th>
<th>31-40</th>
<th>41-50</th>
<th>51-60</th>
<th>61-70</th>
<th>71-80</th>
<th>81-90</th>
<th>91-100</th>
<th>101-110</th>
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<td>Taxidermic brooder model &amp; head</td>
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<td>Stand in stationary truck</td>
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<td>Whistle exposure begins</td>
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<td>Riding in truck begins</td>
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<td>Follow truck - run-flap</td>
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<td>Follow truck - fly (Maryland)</td>
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<td>Plastic decoy</td>
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<td>Flight training - Arizona</td>
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<td>Migration begins</td>
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</tr>
</tbody>
</table>

All birds of this age performed or exposed

Some birds of this age performed or exposed

1996 we used battery-powered (not solar-powered) leg-band transmitters. Four motor vehicles were used in 1996 (versus 3 in 1995). More persons (8) attended the 1996 migration, and we did not force the cranes to migrate during hot weather. This last change made it unnecessary for us to flush our cranes into flight as we so often did in 1995.

In 1995, 4 of our cranes were trucked west to Arizona. The remaining 1995 birds and all of our 1996 birds were crated and flown west. Flight training is summarized in Table 1. As is evident there, we had some difficulty fusing the older and younger groups, so most (all but 5 flights on all but 3 days) of our flights were with the 2 groups separate. By the time of the migration, the older group had flown 133 km in 25 flights on 12 days, while for the younger group, these values were 117 km in 41 flights on 18 days.

Table 1. Details of the flight training of sandhill cranes flying behind motorized ground vehicles at the Navajo Army Depot, Belmont, Arizona.

<table>
<thead>
<tr>
<th></th>
<th>Older Group</th>
<th>Younger Group</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total number of flights</td>
<td>25 on 17 days over 30 days</td>
<td>41 on 18 days over 30 days</td>
</tr>
<tr>
<td>Total flight distance</td>
<td>133.3 km</td>
<td>117.1 km</td>
</tr>
<tr>
<td>Total flight time</td>
<td>3 hr 2 min</td>
<td>2 hr 28 min</td>
</tr>
<tr>
<td>Flock size: number (total)</td>
<td>6 (6)</td>
<td>5 (8)</td>
</tr>
</tbody>
</table>
Table 2. A comparison of the 1995 and 1996 sandhill crane migrations behind motorized ground vehicles.

<table>
<thead>
<tr>
<th></th>
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</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(Older)</td>
<td>(Younger)</td>
<td></td>
</tr>
<tr>
<td>Duration: calendar days</td>
<td>13</td>
<td>8</td>
<td>6</td>
</tr>
<tr>
<td>Number of flights</td>
<td>29</td>
<td>24</td>
<td>22</td>
</tr>
<tr>
<td>Total distance flown</td>
<td>495 km</td>
<td>378 km</td>
<td>382 km</td>
</tr>
<tr>
<td>Total distance trucked</td>
<td>124 km</td>
<td>237 km</td>
<td>235 km</td>
</tr>
<tr>
<td>Total flight time</td>
<td>11 hr</td>
<td>8 hr</td>
<td>8 hr</td>
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<tr>
<td></td>
<td>37 min</td>
<td>39 min</td>
<td>13 min</td>
</tr>
<tr>
<td>Average altitude</td>
<td>28 m</td>
<td>39 m</td>
<td>38 m</td>
</tr>
<tr>
<td>Average speed</td>
<td>46.3 km/hr</td>
<td>46.9 km/hr</td>
<td>48.5 km/hr</td>
</tr>
<tr>
<td>Fastest speed</td>
<td>78 km/hr</td>
<td>75.7 km/hr</td>
<td>75.7 km/hr</td>
</tr>
<tr>
<td>Longest flight</td>
<td>77 km</td>
<td>55 km</td>
<td>55 km</td>
</tr>
<tr>
<td>Length of the migration</td>
<td>619 km</td>
<td>614 km</td>
<td>617 km</td>
</tr>
</tbody>
</table>

(Fig. 3) in 1996 closely paralleled the 1995 route (illustrated in Ellis et al. 1997). For only about 13 km (immediately south of the Gila River) were the routes not identical. The differences between route length were 619 in 1995 and about 616 in 1996 (Table 2). In all, the older group flew 377 km; the younger group flew 382 km (although only 4 birds in each group flew all segments).

Both migrations presented hazards. Indeed, our route was chosen to give the cranes many (over 120) sets of powerlines to cross (to assess risks to surrogate sandhill cranes before we work with whooping cranes). In 1995, 1 crane died from a powerline collision. In 1996, 2 died and we observed ca 15 non-injury collisions.

Our 1996 migration proceeded much faster than in 1995 partially because we had no eagle attacks and partially because midday temperatures were lower in the Sonoran Desert, so we were able to fly the birds with less overheating. As in 1995, we sprayed the legs of our birds (for cooling purposes) whenever we detected panting.

We had another curious difference between years. In 1995, all 10 birds transported west for training began the migration and participated regularly. In 1996, 2 (of 14) birds proved unruly during training and would not participate with the flock. A third bird flew only the beginning and ending flights (3 of 22 flights). One of these 3 actually left on migration on its own and was retrieved only after the migration was completed.

An overview of 1996 was that 11 of 14 birds participated well, but 2 of these later died on powerlines, so 9 completed the migration having flown nearly all segments.

**DISCUSSION AND CONCLUSIONS**

The primary hazard during both migrations was powerlines. Many near and minor collisions were observed. Two were fatal. Future routes for endangered cranes should minimize powerline crossings and the team should stop when approaching a powerline if the cranes are at the altitude of the conductors.

Because of the difficulty in 1995 of keeping the birds in view while following winding roads through dense, tall forests, in 1996, we trucked our birds past most of the pine forests near Camp Navajo and recommend avoiding dense forests in the future.

A big difficulty in 1995 was eagle attacks. In 1996, we had no attacks, but this was at least in part due to our more aggressive actions. Namely, where eagle attacks were most likely, we sent a vehicle ahead to fire several warning shots before the flock arrived. On our only encounter with an eagle in 1996, our flock flushed an eagle from a powerpole; it was the eagle that moved aside until our cranes passed. From trucking and ultralight migrations in the West, we recognize...
Table 3. Details of the 1996 trucking migration (distances in km) of sandhill cranes behind motorized ground vehicles in Arizona.

<table>
<thead>
<tr>
<th>Date</th>
<th>Group</th>
<th>Flock size</th>
<th>Flights</th>
<th>Transport in truck</th>
<th>Total distance</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Number</td>
<td>Duration</td>
<td>Day progress</td>
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<tr>
<td>12 Oct</td>
<td>Older</td>
<td>5-6</td>
<td>5</td>
<td>1 hr 41 min</td>
<td>58.8</td>
</tr>
<tr>
<td>13 Oct</td>
<td>Older</td>
<td>5</td>
<td>1</td>
<td>17 min</td>
<td>12.6</td>
</tr>
<tr>
<td>14 Oct</td>
<td>Younger</td>
<td>5-6</td>
<td>4</td>
<td>1 hr 33 min</td>
<td>76.3</td>
</tr>
<tr>
<td>14 Oct</td>
<td>Old./Yng.</td>
<td>10</td>
<td>2</td>
<td>21 min</td>
<td>17.1</td>
</tr>
<tr>
<td>15 Oct</td>
<td>Old./Yng.</td>
<td>10</td>
<td>3</td>
<td>1 hr 54 min</td>
<td>97.1</td>
</tr>
<tr>
<td>16 Oct</td>
<td>Old./Yng.</td>
<td>10</td>
<td>2</td>
<td>1 hr 8 min</td>
<td>60.5</td>
</tr>
<tr>
<td>17 Oct</td>
<td>Old./Yng.</td>
<td>10</td>
<td>3</td>
<td>1 hr 42 min</td>
<td>70.7</td>
</tr>
<tr>
<td>18 Oct</td>
<td>Old./Yng.</td>
<td>9-10b</td>
<td>5</td>
<td>1 hr 11 min</td>
<td>46.0</td>
</tr>
<tr>
<td>19 Oct</td>
<td>Old./Yng.</td>
<td>10c</td>
<td>3</td>
<td>24 min</td>
<td>14.3</td>
</tr>
<tr>
<td>Totals</td>
<td></td>
<td></td>
<td>24</td>
<td>8 hr 39 min</td>
<td>377.1</td>
</tr>
<tr>
<td>6 days</td>
<td>Younger</td>
<td>4-6</td>
<td>22</td>
<td>8 hr 13 min</td>
<td>382.1</td>
</tr>
</tbody>
</table>

* No. 40 hit a powerline and died.
* No. 98 hit a powerline and died.
* This value remains at 10 (rather than 9 as might be expected following the powerline death on 18 October) because 1 crane (an unruly bird) that had only flown on 1 prior day was also allowed to fly on this day.
* Four cranes in the older group flew every flown segment and a fifth survivor flew all but 4 segments.
* Four cranes in younger group flew every flown segment and a fifth survivor flew only 3 segments.

urge that, in the future, routes be chosen to minimize the potential for eagle attacks.

Our greatest difficulty in 1995 was the unseasonably warm temperatures encountered as we traversed the Sonoran Desert. This was much less of a problem in 1996 because we departed later. We recognize that the problem can be avoided entirely by having motorized migrations simulate what the cranes do naturally. Namely, they move from summering areas to pool up at staging areas until environmental cues push them further south.

Because of overheating and eagle attacks, our 1995 migration required 13 calendar days. In 1996, we were able to shorten this to 8 days for the older group and 6 days for the younger group. Other year comparisons are in Table 2. Both years, but especially 1996, prove that it is possible to efficiently lead cranes long distances in unforested areas. We had 100% success keeping the cranes alive (10 in 1995 and 14 in 1996) during training and had only 2 or 3 of 24 birds prove uncooperative by the time of migration.

By the end of our migrations, all of our cranes both years had enough experience with uncostumed (or partially costumed) humans that they were acclimated to humans and were prone to become nuisance birds (Ellis 2001, Mummert et al. 2001). With further changes in rearing, training, and migration, we are confident that such birds can be made to avoid humans (see Urbanek and Bookhout 1992, Clegg et al. 1997, Duff et al. 2001, Ellis et al. 2001a). We overcame this tameness in 1996 by releasing our birds 1 or 2 at a time into a wild flock (Ellis et al. 2001b) near Gila Bend, Arizona. Just as for the 1995 ultralight experiment (Clegg et al. 1997), once the experimental cranes integrated into the wild flock, they no longer approached humans.

In the final analysis, this technique must be evaluated on the basis of the cranes’ ability to migrate to and from our chosen summering and wintering areas. This propensity is treated in detail elsewhere (Ellis 2001, Ellis et al. 2001a; Mummert et al. 2001), but briefly, we now have good evidence that many of the trucking and ultralight-led cranes did learn appropriate cues to lead them to and from our chosen termini. However, they seem to follow their own (not our)
Motorized ground vehicles proved to be a practical means for leading cranes long distances. We recommend use of the technique for migrations where there is good expectation of long bouts of foul weather, frequent windy weather, or other serious flying hazards. Leading cranes by ground vehicles may also be the most efficient method for crossing unforested habitat where fuel and landing strips for aircraft are scarce or marginal.

ACKNOWLEDGMENTS

We greatly appreciate Colonel L. Triphahn for allowing our use of a remote corner of the Navajo Army Depot near Belmont, Arizona, to train our birds. Sergeant D. Hack coordinated our activities on the depot. W. Shifflett and his staff at the Buenos Aires National Wildlife Refuge hosted our wintering cranes and assisted with bird care. The Arizona Game and Fish Department (AGFD) greatly assisted us by passing along locations of wayward birds and often helped transport birds. J. G. Goodwin, Jr. and P. Smith, both of AGFD, coordinated many of these efforts. C. Van Cleave helped care for wayward cranes during and after our odyssey. We thank NASA-Goddard Space Flight Center for support in monitoring our birds by satellite. Most fundamental of all, we thank G. F. Gee, T. Fontaine, K. O’Malley, J. Nicolich, and all of the Patuxent Wildlife Research Center rearing staff for supporting the project. Thanks to Heather Ray of Operation Migration for preparing our map.

The senior author extends his great appreciation to Brian Clauss who led the training teams both years and, at great personal sacrifice, insisted on always assuming the dusty and dangerous role of riding in the open back of the cranemobile, calling to the cranes during migration.

LITERATURE CITED


