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PROTOCOL AND RESULTS FROM THE FIRST SEASON OF CAPTIVE-REARING WHOOPING CRANES FOR A NON-MIGRATORY RELEASE IN LOUISIANA

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The principal historic range of the whooping crane (*Grus americana*) consisted of the tall grass prairies and wetlands of southwest Louisiana, Texas, and parts of Mexico (Allen 1952). Whooping cranes migrated there from Illinois, Iowa, Minnesota, Dakotas, Manitoba, Saskatchewan, Alberta, and breeding grounds of the remnant flock in and near Wood Buffalo National Park, Canada.

Louisiana was unique in that both resident and migratory populations existed there in historic times. Whooping cranes used marshes and ridges of Louisiana's Chenier Plain and upland prairie terrace (Allen 1952, Gomez 1998). The resident non-migratory whooping cranes in Louisiana centered on the White Lake Marsh area and what is today the White Lake Wetlands Conservation Area (WLWCA). Thirteen whooping cranes, including 2 young of the year, were found there on a survey in 1939 (Lynch 1956). In 1940 a hurricane reduced numbers to 6. This was followed by the loss of 1 bird per year, until in 1947 a single bird remained, and on 11 March 1950 the last remaining wild Louisiana whooping crane was captured and brought into captivity (Barrett and Stehn 2010). The area, once in private corporate hands, is now owned and managed by the Louisiana Department of Wildlife and Fisheries. That organization, along with Louisiana State University, and the U.S. Geological Survey (USGS) Louisiana Cooperative Fish and Wildlife Unit are our partners in this venture. Plans were formulated in 2007 at a meeting in Lafayette, Louisiana, to initiate releases in this area.

USGS Patuxent Wildlife Research Center, Laurel, Maryland, has used the costume-rearing technique (Nagendran et al. 1996) for rearing whooping cranes for release in Florida (1993-2005) and in Wisconsin for the Eastern Migratory Population (2001-2015). The Eastern Migratory Population currently numbers 100+ whooping cranes migrating between Wisconsin and southeastern states. Releases into the Eastern Migratory Population in Wisconsin required most chicks to be costume-reared and trained to follow ultralight aircraft.

To begin the Louisiana releases in the winter

of 2011, USGS Patuxent Wildlife Research Center hatched 12 whooping crane chicks in May and June 2010. All chicks were hand-reared by caregivers wearing complete white costumes and black boots. This is similar to techniques used to rear Mississippi sandhill cranes (*Grus canadensis pulla*) and whooping cranes for both the Florida non-migratory releases and the Whooping Crane Eastern Partnership releases in Wisconsin. Modifications were made in the earlier rearing protocols and medical care program. In addition, extensive behavioral observations were made starting in June and continuing through November 2010 on this group of cranes and compared to ultralight costume-rearing for the Wisconsin release.

Whooping cranes were released for the first time in Louisiana in the late winter of 2011. The reintroduction had the following objectives: 1) Establish a self-sustaining whooping crane population on and around WLWCA. A self-sustaining population is defined as 130 birds including 30 nesting pairs. 2) Maintain numbers for 10 years without restocking from captivity. 3) Raise and release 8 whooping crane colts during breeding season 2010. Move these whooping cranes to WLWCA in Louisiana in February 2011. 4) Monitor first-year survival and provide management remedies to increase survival if needed. 5) Release second and third cohorts of 8-14 birds each in 2012 and 2013.

All whooping crane chicks for this program were costume-reared at the USGS Patuxent Wildlife Research Center in Laurel, Maryland. In addition to Patuxent's own flock of whooping cranes, eggs came from various sources, including captive flocks at the Audubon Zoo and Species Survival Center, New Orleans, Louisiana; San Antonio Zoo, San Antonio, Texas; Calgary Zoo, Calgary, Alberta; International Crane Foundation, Baraboo, Wisconsin; and wild released whooping cranes in central Wisconsin that had abandoned their nests. All whooping crane eggs were naturally incubated for the first half to two-thirds of incubation under either whooping cranes or sandhill cranes at Patuxent and then transferred to artificial incubators and hatchers for the remaining incubation. After hatching, the whooping

crane chicks were moved from the hatchery to an intensive care incubator for approximately 24 hours until they were considered strong enough to be in a pen. All indoor pens used in this study were 3×3 m and equipped with a heat lamp, brood model, food, and water bowls. Substrate was indoor carpeting for the first week, then hardwood shavings (Beta Chips, Northeastern Products Corp., Warrensburg, NY; mention of trade name does not imply U.S. Government endorsement).

For the first week, chicks learned to eat and drink with the help of costumed human caregivers. During this period all chicks received daily health examinations. This was the time of the most intense contact with costumed caregivers, but all chicks were housed next to pens containing adult whooping crane imprint models.

Chicks were initially taken for walks during the latter part of the first week, following the costumed caregiver who led them with a whooping crane puppet head. Late in week 1, at mean age of 6.4 days (range 4-9 days, $n = 10$), the chicks were taken for foraging trips with a costumed person. During week 2, feeding with the puppet head continued, if needed, to reinforce self-feeding. Walks and foraging with a costumed caregiver continued in week 2. Also in week 2, swimming to increase exercise and prevent leg deformities began, with each chick engaging in a minimum of 20 minutes of this activity daily.

During week 3, socialization with other chicks was initiated at a mean age of 15.5 days (range 8-22 days). Exposure to ponds and marshes during the foraging walks occurred at this time. Health examinations continued daily until day 10, then twice weekly. During weeks 3-5, foraging and walking trips continued until mean age of 46.1 days (range 39-57 days). Swimming continued to 20-25 days of age, then stopped. Socialization with other chicks began at an early age during the initial walks and continued through week 5. Formal socialization activities ended at mean age of 49.7 days (range 40-65 days) in 2010 when the chicks were considered socialized and housed as 1 group. Health examinations continued twice weekly and included vaccinations for eastern equine encephalitis and West Nile virus.

During week 6 and beyond, the chicks were moved to outdoor pens. At first these were dry pens, but later pens with small wetland ponds (10-m-diameter) were used. Whooping cranes were introduced to the ponds at mean age 53.2 days (range 48-59) in 2010. At first the chicks were only in the pond pens during the day

and under supervision of a costumed caregiver, but eventually birds were left in the pens with ponds all day and night. The chicks were observed and monitored for social interactions using video cameras. Health examinations were conducted at weekly intervals until 60 days of age, then every 2 weeks thereafter.

Pre-shipment health examinations occurred in early January and included complete blood count, serum chemistries, radiographs, examination of feces for parasites, and testing for *Salmonella*, Inclusion Body Disease of Cranes, and Infectious Bursal-like Disease. Shipment was delayed 2 weeks because of adverse weather, but the whooping cranes were finally flown to Louisiana in mid-February for release in early March 2011.

During the period when the whooping crane chicks were being reared at Patuxent, chicks were randomly chosen for behavioral observations. The costume-rearing technique was originally established with whooping cranes introduced into a non-migratory flock in Florida (Nagendran et al. 1996) and is now used for the Louisiana reintroduction. The modifications to enable training with an ultralight aircraft (Operation Migration 2008) were developed by Patuxent personnel in consultation with Operation Migration, our partner in the ultralight aircraft-led reintroductions. From each release project, 6 chicks were randomly selected for observations. Five-minute focal observations were done at randomly selected times during daylight hours. No observations were made at night. All crane chicks were observed primarily by use of cameras, but secondarily by observers in costume and working from a distance so as not to influence the chick's behavior. Repeated measures analysis of variance was performed on the resulting data by using a Statistix 8 software package (Analytical Software, Tallahassee FL).

Whooping crane chick behavioral observations were divided into 2 categories: a locomotion category (Figure 1) and a behavior category (Figure 2). For example, a chick could be standing (locomotion category) and foraging (behavior category), walking and foraging, walking and vigilant, or walking and non-vigilant. Walking movement was observed $10.1 \pm 1.1\%$ (mean \pm SE) of the time for Louisiana costume-reared birds and $7.3 \pm 1.9\%$ for ultralight-trained birds. Standing was observed $50.8 \pm 3.5\%$ for Louisiana crane chicks and $49.9 \pm 7.3\%$ for ultralight crane chicks. Running was only observed $0.3 \pm 0.1\%$ of the time for Louisiana chicks and $0.2 \pm 0.2\%$ for ultralight chicks. Hock-

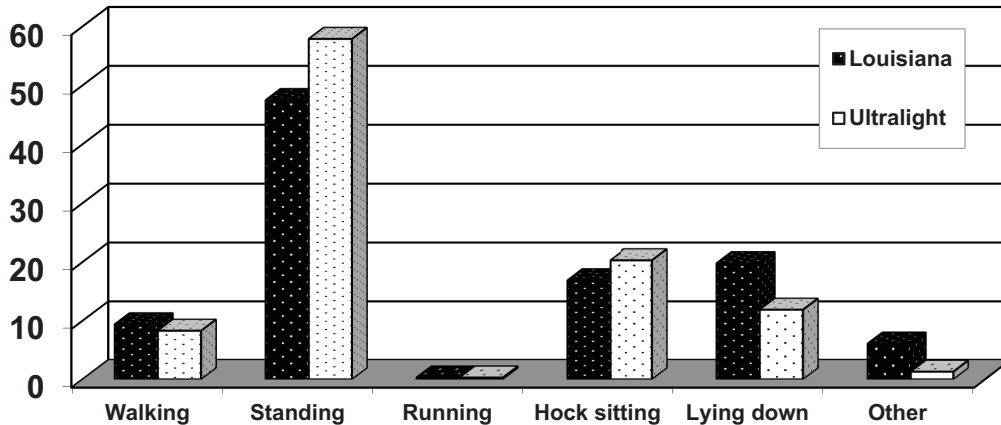


Figure 1. Observed movements (locomotion) of ultralight-trained, costume-reared whooping cranes for release in Wisconsin ($n = 6$) and costume-reared whooping cranes for release in Louisiana ($n = 6$), at USGS Patuxent Wildlife Research Center, Laurel, Maryland, 2010. Only the “Other” category was significantly different at the $P < 0.05$ level.

sitting was observed $17.7 \pm 2.5\%$ for Louisiana chicks and $19.2 \pm 4.3\%$ for ultralight chicks. Lying down was observed $10.8 \pm 2.3\%$ of the time for Louisiana chicks and $13.0 \pm 3.7\%$ for ultralight chicks. Other types of movements were observed $6.1 \pm 2.5\%$ of the time for Louisiana chicks and $1.0 \pm 0.6\%$ for ultralight-trained chicks. Other movements included such activities as stretching wings, stretching legs, short flights, jumping and dancing. Louisiana ultralight chicks were out of view $9.4 \pm 1.5\%$ of the time.

For the behavior categories, we observed Louisiana

chicks foraging $19.9 \pm 2.9\%$ of the time while ultralight chicks foraged $23.4 \pm 5.1\%$ of the time. Louisiana chicks were vigilant $2.7 \pm 0.8\%$ of the time, and ultralight chicks were vigilant $3.8 \pm 0.8\%$ of the time observed. Non-vigilant behavior was observed $24.5 \pm 1.8\%$ of the time for Louisiana chicks and $22.5 \pm 3.3\%$ of the time for ultralight chicks. Comfort behavior (e.g., preening, grooming, bathing) was observed $20.5 \pm 2.6\%$ of the time for Louisiana chicks and $23.1 \pm 2.9\%$ of the time for ultralight chicks. Sleeping was observed $3.4 \pm 1.0\%$ of the time for Louisiana chicks and $4.3 \pm 1.1\%$ of the

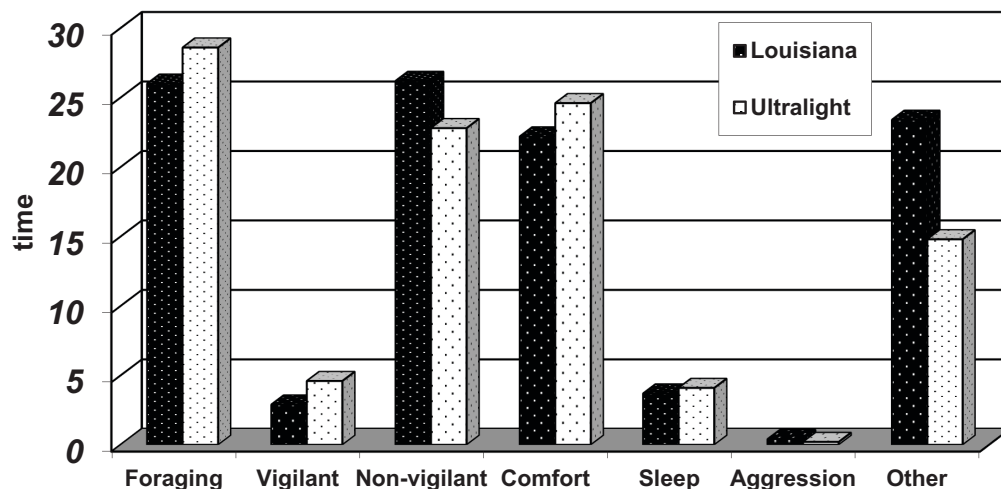


Figure 2. Behaviors observed in whooping cranes costume-reared and trained with ultralight aircraft for release in Wisconsin ($n = 6$) and whooping cranes costume-reared for release in Louisiana ($n = 6$), at USGS Patuxent Wildlife Research Center, Laurel, Maryland, 2010. Only the “Other” category was significantly different at the $P < 0.05$ level.

time for ultralight chicks. Delivering aggression was seen $0.4 \pm 0.4\%$ of the time and receiving aggression was seen $0.003 \pm 0.003\%$ of the time for Louisiana chicks. Delivering aggression was seen $0.2 \pm 0.1\%$ of the time and receiving aggression was seen $0.1 \pm 0.1\%$ of the time for ultralight chicks. Other types of behavior (e.g., eating pelleted food, pecking at brood models) was seen $21.5 \pm 3.0\%$ of the time for Louisiana chicks, but only $13.5 \pm 1.4\%$ of the time for ultralight chicks. We observed no statistical differences ($P > 0.05$) in any of the locomotion (movements, Figure 1) or behavior categories (Figure 2) when comparing whooping cranes trained with ultralight aircraft for release in Wisconsin and whooping cranes raised for release in Louisiana without ultralight training except in the category "other" for both the movement category and the behavior category. This was a large category and in the future we may consider including some of the behaviors grouped under this category as separate behaviors.

Time spent in active movements such as walking and running was similar for the 2 rearing methods (Figure 1). Time spent in survival behaviors such as being vigilant and foraging for food was also similar for the 2 rearing methods (Figure 2). The use of these observations helps confirm that the methods used for the Louisiana release of whooping cranes were producing chicks with similar behavioral patterns that had proved successful for survival in the Wisconsin releases. Ten chicks reared for release in Louisiana were successfully released there in early March 2011, while 1 chick was euthanized because of severe scoliosis and 1 chick remained in captivity for genetic reasons.

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