Health Management for the Reintroduction of Eastern Migratory Whooping Cranes *(Grus americana)*

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Introduction

The remnant migratory whooping crane (*Grus americana*) population in North America declined to a low of 15 birds in 1941 due to over-hunting and habitat loss (Cannon 1996). This population, which breeds in Alberta, Canada, and winters on the Gulf coast of Texas, has slowly increased to over 215 this past winter. The International Whooping Crane Recovery Plan stipulates creation of two additional breeding whooping crane populations to achieve recovery of the species. To achieve this goal, the Whooping Crane Eastern Partnership (WCEP) is attempting to create a second migratory flock of whooping cranes in eastern North America, using ultra-light aircraft to teach a migratory pathway to the cranes.

Methods

A team of veterinarians has been established to provide health care and disease monitoring for the WCEP project. The goals of the health management program are: 1) prevent introduction of disease from captivity to the wild; 2) provide individual care and screening to maintain the level of bird fitness needed for this reintroduction effort; 3) gather information on the potential health risks associated with the rearing, training, and assisted migration techniques used; and 4) provide health monitoring of the cranes following release. The cranes were assessed using observation, physical examination, routine clinical pathology, radiography, fecal microbiology, serology, and necropsy, from hatch at the captive facility through flight training in Wisconsin, along the ultra-light led migration, shortly after arrival at the Florida release sites, and during recapture events (Figure 1). A network of zoo and private avian practice veterinarians was established along the migration pathway to provide emergency care for the cranes if necessary.

A 2000 pilot project to test rearing techniques was conducted with sandhill cranes (*Grus canadensis*). The chicks were hatched and reared to approximately 50 days at United States Geological Survey (USGS) Patuxent Wildlife Research Center, Laurel, MD (PWRC), using hand-held puppets and costumes to prevent imprinting on humans. Training with ultra-light aircraft was initiated at PWRC with the help of Operation Migration, Inc., and continued after the cranes were transferred to Necedah National Wildlife Refuge, WI (Necedah), where the cranes lived in large wetland pens (Figure 2). Eleven of 18 (61%) cranes survived to intended release in Florida.

Results

All surviving sandhill cranes showed normal weight gain and maintenance of body condition throughout the study period. A variety of clinical ailments common to captive cranes was documented, such as minor bill and leg injuries. There was no evidence of exposure to several viral diseases (avian influenza, Newcastle disease, eastern equine encephalitis [EEE], West Nile virus [WNV], or crane herpesvirus), but four cranes exhibited lesions suggestive of avian poxvirus infection prior to migration in late summer. Disease-causing bacterial infections (such as *Mycobacterium avium*) were not observed in the sandhill cranes but three serotypes of Salmonellae were isolated from six cranes while in captivity at PWRC. Because these serotypes (*S. infantis*, *S. lexington*, and *S. muenster*) had been documented in free-ranging Wisconsin avifauna, and because they are generally considered of low pathogenicity, a decision was made that there was low risk associated with transferring the cranes to Necedah. No Salmonellae were detected in September before migration or on arrival in Florida. Nematode parasites were detected in the cranes at vari-

Figure 1. Examinations of whooping cranes in the WCEP program are provided to ensure individual fitness and promote flock health at several points prior to release. Handlers wear costumes to hide their human form when interacting with the cranes. The cranes are hooded during any procedure to reduce stress and keep them from seeing humans.

ous times; preventive deworming was used to suppress individual worm burdens and decrease risk of transfer of potential non-native species. Coccidian parasites were observed in feces collected during flight training and likely reflected a decrease in the consumption of coccidiostat-containing pelleted feed (i.e., monensin in Zeigler crane diet, Gardners, PA) as the cranes were allowed to forage in natural wetlands during most days. Radiographs showed that all cranes were free of metallic foreign bodies (a common problem encountered in captive cranes) and blood lead and zinc levels were within normal limits for the species prior to migration and at arrival in Florida. Fecal corticosterone monitoring suggested the cranes were not experiencing chronic or unusual acute stressors related to the aircraft training or other manipulation (Hartup et al 2004).

Recommendations from the pilot project included re-evaluation of pen design, changes in daily bird management, improvement of cleaning/disinfection procedures, refinement of the health examination schedule to minimize impact on training and socialization goals while meeting the fitness objectives above, and improvement of communications within a large project involving multiple organizations. All indications from the pilot project suggested that with slight modification, the techniques were suitable to apply to the reintroduction of endangered whooping cranes.

In 2001, the first cohort of 11 whooping cranes was prepared for reintroduction. Eight cranes began the ultra-light-led migration in October. Fifty days and 1,227 miles later, seven cranes arrived at Chassahowitzka National Wildlife Refuge (Chassahowitzka), the chosen wintering site along the Gulf coast of Florida. After losing two cranes to bobcat predation early in the winter, the remaining five cranes started the northward migration on their own in April 2002 and survive in the wild to this day. Other causes of mortality included acanthocephalan-induced peritonitis, peracute capture myopathy during a routine health exam, and power line strike after a crane escaped during a storm that had blown down the holding pen used at daily migration stopover points. Another whooping crane was removed from the release due to a handling-related wing injury that ultimately disrupted the normal development of the flight feathers of one wing (Figure 3). Clinical problems included gapeworm (*Cyathastoma coscorobae*) parasitism that resulted in persistent or recurrent exercise-associated wheezing despite regular treatment with anthelminthics in food items. Coccidia and *Hexamita* sp. were also detected in the feces but were not associated with clinical signs. Because of an unusual outbreak of EEE in horses in Wisconsin and the known susceptibility of whooping cranes to this virus, the cranes were vaccinated for EEE while at Necedah (Dein et al 1986; Olsen, Turrell et al 1997).

In 2002, health monitoring was focused on minimizing invasive procedures to lessen handling related morbidity. Arrival health examinations at Necedah and pre-migration evaluations were limited or hands-off. Evaluation of birds at arrival in Chassahowitzka was limited to a subset of birds with histories of past medical problems or positive test results that might affect future fitness. A total of 18 whooping cranes were assigned to the 2002 cohort; 16 were released at Chassahowitzka and migrated north the following spring. One crane was removed from the project for a

wing injury sustained in captivity that was expected to compromise its flight ability and one crane was euthanatized after developing severe myopathy following a collision with the ultra-light aircraft during migration.

The cohort presented a number of new health-related challenges. Ingested hardware (a drywall screw and washer) was retrieved with endoscopy in one crane (Figure 4). A non-pathogenic strain of *Salmonella typhimurium* was detected in six of the cranes on arrival at Necedah (all had tested negative at PWRC 14 days prior to shipping). Four of the birds apparently self-cleared prior to migration, while two remained positive. As WNV expanded its range throughout the midwestern United States in 2002, the risks associated with the virus for the whooping cranes were extensively discussed. The birds were tested three times for evidence of exposure; one crane was antibody positive in late August in Wisconsin and at arrival in Florida. There was no evidence of clinical disease in this bird, nor other flock members, that could be linked to WNV infection. A decision was made not to vaccinate the flock primarily due to risks of morbidity from repeated handling when compared to risks from the disease.

Figure 2. Interior view of crane pens used in Wisconsin. Pen features include: upland dry interior adjacent to wetland pen for roosting, chain link and electric fencing and flight netting cover for protection from predators, basins with flowing fresh water, two gravity feeders for crane pellets separated by a divider to allow access by all birds regardless of dominance status, and camouflage painting to diminish the appearance of a human dwelling.

The whooping crane cohorts for the past two years have continued to engage the health management team of the WCEP project. Most of the mortality factors for the project cranes have been typical of other wild and reintroduced crane populations: neonatal parasitism, power-line strike and other accidental trauma, predation, and capture myopathy (Langenberg 1992). Some cranes, however, have been injured after collision with the ultra-light aircraft. Developmental wing or leg problems were noted in several cranes, which is a common problem in captive-reared cranes (Olsen, Taylor et al 1997). WNV and EEE vaccinations are now provided at an early age to minimize the risks from these diseases prior to release. Regular water quality monitoring and prophylactic deworming also occur.

CONCLUSION

The health data collected from the sandhill crane pilot project and the first four cohorts of whooping cranes have provided tremendous information about the health risks associated with this unique reintroduction technique. Health screening has identified exposure of the cranes to new, potentially pathogenic organisms, whose risk is as yet undetermined and of which knowledge from both captive and wild crane populations is limited. As the WCEP project moves ahead, more emphasis is being placed on monitoring the disease issues of released birds in order to gauge their effects on long-term survival.

As of this writing, there are currently 45 free-ranging whooping cranes in the eastern migratory flock.

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Figure 3. Poor feather condition along the left wing of a whooping crane with a history of injury during initial feather development. Note the crimping of the feather shafts and numerous stress bars.

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Many additional organizations and individuals have played an important role in the reintroduction, and the efforts of all participants should be acknowledged as vital to the project's success. For further information, please see: < http://www.bringbackthecranes.org >, < http://www.operationmigration.org >, or < http://www.savingcranes.org >.

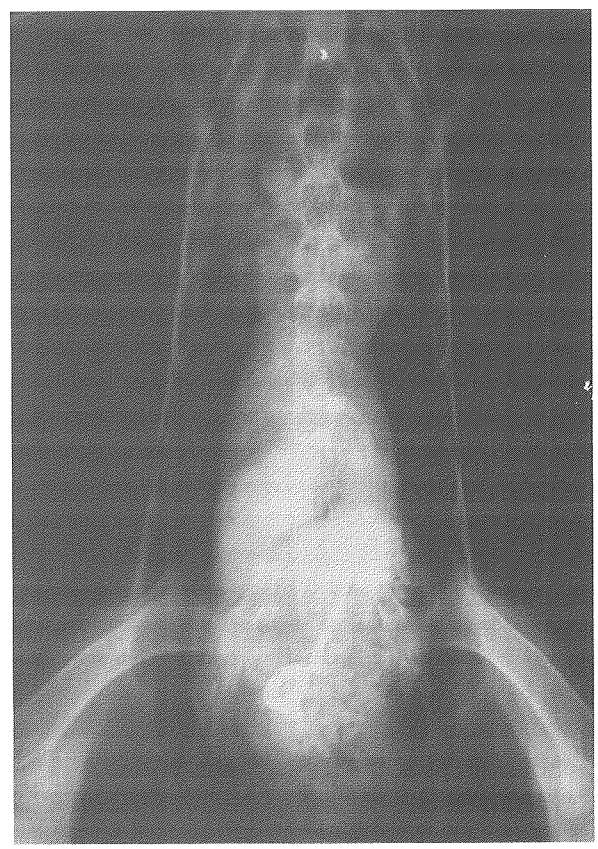

Figure 4. Ventrodorsal radiograph of whooping crane with ingested hardware (screw and washer) in the ventriculus. The items were free within the lumen of the ventriculus and were retrieved with an endoscope.