

Report on Whooping Crane Recovery Activities (2012 breeding season-2013 spring migration)

**By Wade Harrell, Whooping Crane Recovery Coordinator, US Fish & Wildlife Service
and Mark Bidwell, Whooping Crane Recovery Coordinator, Canadian Wildlife Service**

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Executive Summary

Whooping cranes are one of the most rare, highly endangered and intensively monitored bird species in North America. The Aransas-Wood Buffalo population (AWBP), which breeds in northern Canada and winters in Texas, is the only remaining wild, self-sustaining migratory population of whooping cranes. In summer 2012, surveys of the AWB detected 66 nests (May) and 35 chicks (July) resulting in an average number of chicks fledged per nest (0.53) that was slightly higher than the long term average of 0.48. In winter 2012 (Nov-Dec) the peak population size of the AWB on the primary wintering grounds was estimated as 257 birds (95% confidence interval [CI] 178–362) and additional birds were located outside the survey area. Whooping cranes faced challenging conditions due to forest fires during the 2012 breeding season and continued drought during the wintering season. Several projects were undertaken by a variety of agencies to monitor and investigate the ecology of the AWBP population, including the continuation of an initiative to mark individual birds with satellite transmitters to track their movements during the annual cycle. By the end of 2012, 57 whooping cranes had been marked on the breeding and wintering grounds and 39 marked birds were continuing to provide data. In addition to the AWB, other populations of whooping cranes exist in Wisconsin, Florida, and Louisiana due to the efforts of many government agencies and non-governmental organizations, including the captive breeding centers where whooping cranes are reared for reintroduction. By the end of 2012 there were approximately 147 birds in reintroduced populations and 157 birds held in captivity.

Aransas-Wood Buffalo population

Overview

The Aransas-Wood Buffalo population (AWBP) of whooping cranes is the only remaining wild, self-sustaining, migratory whooping crane (*Grus americana*) population. The AWBP breed and summer in and around Wood Buffalo National Park (WBNP) in the Canadian jurisdictions of Alberta and the Northwest Territories and migrate >2,400 miles through the Canadian prairies and US Great Plains to the mid-coast of Texas to spend the winter. Whooping cranes from the AWBP was reduced to a mere 15 individuals in 1941 and has rebounded to nearly 300 this

winter, representing a > 4% annual growth rate. The ongoing recovery of this whooping crane population is perhaps one of the greatest endangered species success stories. A wide variety of local, state, federal and private conservation organizations are actively involved in planning and implementing whooping crane conservation efforts.

2012 breeding season

Habitat conditions at Wood Buffalo National Park (WBNP) during the spring of 2012 were near-normal, with higher than average water levels for nesting in the spring and slightly elevated temperatures. Significant portions (6%) of WBNP were impacted by forest fires in 2012, above the 25 year average of 1%. Whooping crane nesting surveys were conducted by Mark Bidwell, whooping crane recovery coordinator with Canadian Wildlife Service, and other staff from 18-21 May 2012. Surveys detected 67 whooping crane pairs, with 66 on nests, representing the 3rd highest nest detection on record. Five of the nests were found outside WBNP. Fledging surveys were conducted from 28-30 July 2012 and detected 35 fledged chicks from 33 family groups (i.e. 31 families had one chick, two families had two chicks). Thus, the number of fledged young per nest (35 chicks / 66 nests = 0.53) was slightly higher than the long-term average of 0.48 (current survey methodology does now allow the calculation of variance on these estimates). Observers noted that smoke from forest fires limited access at some nest sites, potentially underestimating actual nest success. The fledging surveys were conducted in association with chick trapping efforts led by the Whooping Crane Tracking Partnership (WCTP-see below), and represented the third time whooping crane chicks were captured and banded at WBNP in recent years.

Whooping Crane tracking partnership (WCTP)

Note: This is a summary of U.S. Geological Survey's February 2013 Remote tracking of Aransas-Wood Buffalo Whooping Cranes. The 2012 breeding season and fall migration update is available here: <http://www.cranetrust.org> (search under Research)

The 2012 breeding season was the third year to capture and mark fledged whooping crane chicks in WBNP for research purposes. Marked whooping cranes are banded with a satellite transmitter with Global Positioning System (GPS) capabilities. The transmitters record four locations daily, equally spaced over a 24hr period. This information allows researchers to garner information on habitat use across a broad temporal and spatial range, covering the entire whooping crane life cycle. This effort is a cooperative research initiative being carried out by the Canadian Wildlife Service (CWS), US Geological Survey (USGS), US Fish & Wildlife Service (USFWS), the Crane Trust and the Platte River Recovery Implementation Program. Additional support for the effort comes from Parks Canada (PCA), the International Crane Foundation (ICF) and the Gulf Coast Bird Observatory (GCBO). The partners involved have agreed upon three overall objectives 1) advance knowledge of breeding, wintering and migration ecology of whooping cranes, including threats to survival and population persistence; 2) disseminate research findings in reports, presentations and peer-reviewed literature to provide reliable scientific knowledge for

conservation, management and recovery of whooping cranes; and 3) minimize negative effects of research activities to whooping cranes.

Ten fledged whooping crane chicks at WBNP were captured and banded in 11 capture attempts on July 31 and August 1. Average handling time for captured chicks was 13 minutes. Blood, feather, cloacal swab samples and basic biometric measurements were collected during captures and the capture team's veterinarian performed a general health assessment of each captured bird before release. To date, 31 whooping crane chicks have been banded in WBNP. During the 2012 breeding season, 36 transmitters provided >30,000 locations for marked whooping cranes. The WCTP documented mortalities of two juveniles and two subadults on the breeding grounds. The chick marking portion of the WCTP study is now complete, and all remaining adult birds to be marked will be captured next winter on the Texas coast.

2012 Fall migration

During fall migration, transmitters from 30 marked whooping cranes provided location data. Six transmitters stopped providing data prior to the initiation of fall migration (4 mortalities on breeding grounds and 2 failed antennas). One transmitter stopped providing data during migration. Whooping cranes began departing WBNP on 7 September 2012 and the last marked bird left on 26 October 2012, with the average departure date of 27 September 2012. Fall migration of marked birds took an average of 46 days during 2012, with a range of 21 to 67 days. During migration, the WCTP documented 261 stopover locations (sites where cranes stopped for >1 night) from every province and state in the Great Plains migration corridor. Whooping cranes spent the greatest amount of time at staging sites in Saskatchewan and the Dakotas during fall migration. Other significant stopover sites during fall 2012 migration included three sites along the Lexington-Chapman reach of the Platte River in Nebraska, five birds stopping at or near Quivira National Wildlife Refuge in Kansas and seven birds stopping at Salt Plains National Wildlife Refuge in Oklahoma. No mortalities of marked birds were detected during migration.

2012 Wintering grounds

Additional information from this past winter can be found here:

<http://www.fws.gov/refuge/Aransas/wwd/science/updates.html>

2012 winter habitat conditions

The first marked whooping crane to arrive on the Texas coastal wintering grounds in and around Aransas National Wildlife Refuge was on 19 October 2012. Drought conditions in the wintering grounds, which have been present off and on since 2008, persisted during the winter of 2012–2013. While the 2012 precipitation total (33.2 inches recorded at Aransas NWR) was near the annual average of 38 inches for the Refuge (USFWS Aransas NWRC CCP, 2010), the fall/winter season was particularly dry with only 12.2 inches recorded during the October 2012–April 2013

wintering season (<http://www.wrcc.dri.edu/cgi-bin/rawMAIN.pl?sdTARA>). Many traditional freshwater wetlands and ponds on and around Aransas NWR remained dry throughout much of the wintering season and San Antonio Bay salinities only fell under 20 parts per thousand (ppt) after precipitation events (<http://lighthouse.tamucc.edu/pq/127>). Further, the Palmer hydrological drought index, which indicates long-term moisture supply, was -3.8 during October 2011-April 2012 and -3.3 during October 2012-April 2013 (<http://www1.ncdc.noaa.gov/pub/data/cirs>). Thus, severe drought conditions have been in place the last 2 winters. Similar to past years, staff at Aransas NWR used prescribed fire to improve whooping crane foraging opportunities and overall prairie upland condition. The uplands adjacent to high-use salt marsh areas, both on the Blackjack and Matagorda Island Units of the Refuge were burned during the winter season, with a total of 8,770 acres treated. We observed whooping crane use of the burned areas, both during aerial surveys and by marked whooping cranes.

2012 winter abundance survey

We followed the draft whooping crane abundance survey methodology as described here: http://www.fws.gov/refuge/aransas/science/whooping_crane_surveys.html. Seven aerial surveys were conducted within the six primary survey areas between 28 November 2012 and 17 December 2012. Wade Harrell and Diana Iriarte were the primary observers, with Beau Hardigree serving as an alternate observer during one flight (14 December 2012). Aerial surveys were conducted in the six secondary survey areas (5 December 2012 and 13 December 2012). Preliminary analyses of the data indicated 257 (95% confidence interval (CI) = 178–362) whooping cranes inhabited the primary wintering grounds. Additional observations suggested that at least 22 whooping cranes were outside the primary wintering grounds during the survey period (see whooping cranes outside the primary survey area below). We estimated 105 (95% CI = 73–146) whooping crane pairs in the primary winter grounds and at least 33 (95% CI = 19–51) of those pairs arrived with at least one chick. We estimated the ratio of chicks to adults during the winter of 2012–2013 was 14 chicks (95% CI = 9–21) to 100 adults. As our new observers gain experience and we work out methodological details, we anticipate that precision in these estimates will increase.

Other winter 2012 whooping crane observations

Additional information from Texas Whooper Watch can be found here:

http://www.tpwd.state.tx.us/huntwild/wild/wildlife_diversity/texas_nature_trackers/whooper-watch/

In addition to the estimate of 257 whooping cranes within the primary survey area; approximately 6% to 11% of the whooping crane population was detected outside the survey area. This increasing use of “nontraditional” wintering areas is an interesting development and we are trying to get a better understanding of the expansion and use of whooping crane habitat via the WCTP, Texas Whooper Watch, and other partners. The tables below provide our best

understanding of birds that were observed outside the primary survey areas during mid-December. Observations documented in the table occurred during roughly the same time period as aerial surveys. Keep in mind that is a minimum estimate from observations; it is likely some birds were missed. Also, we cannot be certain that birds did not move between these locations and to/from the primary survey area while survey flights were being conducted. These tables include three different data sources that help document the proportion of the whooping crane population using areas outside of the primary wintering area during mid-December, which historically coincides with peak winter whooping crane abundance.

Table 1: Texas Whooper Watch

Birds documented outside of the survey area in mid-December via Texas Whooper Watch

General Area	Adults	Chicks	Total	Notes:
<i>Granger Lake</i>	6	2	8	<i>Includes 1 marked bird.</i>
N. of El Campo	2	1	3	<i>Includes 1 marked bird. One more pair was documented in the area but we do not have mid-December records.</i>
<i>Total</i>	8	3	11	

Table 2: Tracking Study

Birds documented outside of the survey area on 17 December 2012 via WCTP

General Area	Adults	Chicks	Total	Notes:
<i>Mission Bay (secondary survey area)</i>	1		1	<i>Marked as chick in WBNP.</i>
North Matagorda Island (secondary)	2	1	3	<i>Marked chick.</i>
<i>Holiday Beach (secondary)</i>	2	1	3	<i>Marked chick located on the edge of the primary survey area in early morning prior to the aerial survey & and in the secondary survey area twice in the afternoon.</i>
<i>Total</i>	5	2	7	

Table 3: U.S. Fish and Wildlife Survey

Birds documented in the whooping cranes' secondary areas on 13 December 2012 via aerial survey

General Area	Adults	Chicks	Total	Notes:
<i>Powderhorn Lake (secondary survey area)</i>	2		2	<i>Pair located on Myrtle-Whitmire Foester Unit of refuge.</i>
Guadalupe Delta (secondary)	2		2	Two pairs, total of 4 birds, were seen during the Christmas bird count on the 20th.
<i>Total</i>			4	

Texas Whooper Watch winter 2012 summary

Texas Whooper Watch (TXWW) was formally initiated by Texas Parks & Wildlife (TPWD) in 2012 to address the need to monitor whooping cranes that utilize wintering sites well away from Aransas NWR and in areas beyond USFWS primary and secondary aerial survey areas. TXWW use citizen scientists to identify both whooping crane migration stopover sites and non-traditional wintering areas. Additionally, information on whooping crane habitat use, behavior and potential threats is gathered to assist with conservation efforts. The stated goals of TXWW are as follows:

- To increase public awareness of the need to report whooping crane sightings
- To more systematically share sighting information among resource managers
- To increase consistency and value of observational data collected
- To track sightings for early detection of unusual movements or habitat use, especially for wintering in non-traditional areas
- To gather behavioral and habitat use data in order to gain insights on non-traditional wintering areas

Noted in the table above, documenting whooping crane presence outside the primary survey area via TXWW provided information on habitat use and behavior at new wintering locations. Information was gathered on whooping cranes spending at least a portion of the winter at the following sites:

- Matagorda County, in coastal salt marsh and freshwater wetland habitats on the state managed Mad Island Wildlife Management Area (owned and managed by TPWD) and Clive Runnels Mad Island Marsh Preserve (owned and managed by The Nature Conservancy)
- Aransas County, in a variety of habitats in and around the communities of Holiday Beach and Lamar
- Refugio County, in freshwater and estuarine wetlands on the state managed Guadalupe Delta Wildlife Management area and surrounding private lands
- Wharton County, in freshwater wetlands and agricultural areas on private lands

- Jackson County on private lands
- Williamson County, in freshwater wetlands on the US Army Corps of Engineers managed Granger Lake and agricultural areas on surrounding private lands

TXWW volunteers were trained to use focal scan sampling techniques to provide consistent and objective observations of whooping crane behavior. Observational data collected at the Granger Lake location indicates an overall trend for increasing use of agricultural habitats and declining use of lake habitats as the winter progressed. This trend may be related to rising lake levels and a subsequent decrease in shallow, mud flat habitat availability.

Overall, TXWW documented over 150 observations of whooping cranes. This information was used in a variety of ways, including outreach to the public on ways to avoid disturbing whooping cranes while still enjoying viewing opportunities at a safe distance.

Documented mortality on wintering grounds

During the winter of 2012-2013, US Fish & Wildlife Service documented two whooping crane mortalities. The first mortality was due to an accidental shooting and the other to presumed natural causes (inconclusive necropsy report).

On 12 January, 2013, Worthey D. Wiles III, a Dallas waterfowl hunter hosted by the St. Charles Bay hunting club, accidentally shot a juvenile whooping crane in the coastal marsh off San Jose Island. Mr. Wiles was intending to take a sandhill crane, and was unaware that the area was closed to sandhill crane hunting to minimize conflict with wintering whooping cranes. Once Mr. Wiles realized he had shot a whooping crane, he went to the local TPWD game warden in Rockport, TX and provided the carcass and a statement. On 6 March 2013, Mr. Wiles plead guilty in federal court to a Migratory Bird Treaty Act violation and was ordered to pay a \$5,000 fine and make a \$10,000 community service payment to the Friends of Aransas and Matagorda Island National Wildlife Refuges. USFWS and TPWD are working together to on several outreach strategies aimed at minimizing future waterfowl hunting conflicts on the wintering grounds.

On 7 February, 2013, staff from Aransas NWR collected the carcass of an adult whooping crane from the Matagorda Island Unit. The carcass was sent to the National Wildlife Health Center in Madison, WI for necropsy and analysis. The cause of death could not be determined due to decomposition and scavenging of the carcass. Bone marrow was submitted for West Nile virus and routine bacterial cultures however no pathogenic organisms were detected.

Ongoing wintering ground research efforts

Whooping Crane tracking partnership (WCTP) 2012 wintering season

Note: information provided by Dr. Aaron Pearse, US Geological Survey, Northern Prairie Wildlife Research Center

A total of 12 whooping cranes were trapped and marked with GPS transmitters during the winter, including four adults from established family groups (i.e. family group with juvenile), 5 adults from established pairs, 2 subadults and 1 hatch-year juvenile. 39 marked birds provided >15,000 locations from November 2012 through April 2013. The first date a marked bird arrived on the Texas coast, or nearby wintering areas, was 19 October 2012, with the last to arrive on 27 November 2012. The date the last bird left the wintering grounds area was 4 May 2013. Birds used a variety of ecologically distinct areas including coastal salt and brackish marsh communities, agricultural and ranching areas, and inland freshwater wetlands while overwintering in Texas. GPS-marked bird locations were collected in 27 Texas Counties. The majority of locations were in Aransas, Calhoun, Refugio, Williamson, Wharton, and Colorado counties. Approximately 60% of recorded locations were within the boundaries of the Aransas National Wildlife Refuge. One mortality was confirmed on Aransas NWR.

International Crane Foundation wintering ground monitoring

Note: information provided by Dr. Elizabeth Smith, International Crane Foundation (ICF)

Dr. Liz Smith continued her wintering Whooping Crane distribution and activity budget monitoring on Blackjack Peninsula during the winter of 2012-2013. This survey encompasses the core habitats inhabited by wintering cranes, and provides an indicator of coastal marsh use during continued drought conditions. Overall, use of the marsh habitat was lower (<20 individuals) from December-January, than in late February (>40 individuals) following local rain events. Generalized movements of cranes across the marsh landscape and re-establishment of territories by whooping crane groups was documented in March and April 2013. A collaborative project with Dr. Jeffrey Wozniak, Sam Houston State University, continued to provide salinity data from the same habitat area by monitoring water salinities in the marsh and adjacent bays, as well as evaluating wolfberry fruit production, a key food resource. Dr. Smith also initiated a study monitoring freshwater pond availability in the uplands of Aransas National Wildlife Refuge (ANWR) and Lamar Peninsula collecting water quality data and documenting crane use from game cameras. Data indicated that salinities in the estuaries remained high (30-45 ppt in marsh interior ponds) and whooping cranes regularly visited upland freshwater ponds through the winter 2012-2013.

This project was part of a larger collaboration with Drs. Sarah and Gabriel Hamer, Texas A&M University Veterinary Medicine Program, as well as Dr. Barry Hartup, ICF Director of Veterinary Services, to initiate a two-year, Whooping Crane wintering population health assessment project funded by USFWS migratory birds program. Dr. Hartup assisted in refining research design and training to the team for the collection of fecal samples from wintering

Whooping Cranes at freshwater ponds for parasite load assessment (TAMU) and cortisol and bacteria level assessment (ICF). These data will add to the longer-term health assessment program on wild Whooping Cranes initiated by the Veterinary Services Department at ICF. Dr. Hartup has cooperated since 2009 to help capture, mark and tag whooping cranes from this population with satellite telemetry via the WCTP. Several health measures and samples are gathered during these events, such as a physical examination, blood sample, swabs for culture, scat and feathers.

International Crane Foundation habitat assessment and sea level rise study

Note: information provided by Dr. Elizabeth Smith, International Crane Foundation (ICF)

The International Crane Foundation (ICF) is leading a multi-disciplinary team to develop conservation planning maps for the existing and future population of wild Whooping Cranes in south Texas. Collaborators on the project funded by Gulf Coast Prairie Landscape Conservation Cooperative (LCC) Program include ICF (Dr. Liz Smith, ICF Whooping Crane Conservation Biologist) and Gulf Coast Bird Observatory (Dr. Felipe Chavez-Ramirez, Director of Conservation Programs) serving as Co-Principal Investigators, the Harte Research Institute for Gulf of Mexico Studies (Dr. James Gibeaut, Endowed Chair, Coastal and Marine Geospatial Sciences), Conrad Blucher Institute for Surveying and Science (Dr. Gary Jeffress, Director), and The Nature Conservancy of Texas (Mr. Kirk Feuerbacher, Coastal Prairies Project Director). The LCC project objectives include defining the area and quality of habitat needed to support the recovery of the wild population of whooping cranes in their wintering range. Preliminary results substantiate that over half of the current population is using habitat outside the Aransas National Wildlife Refuge boundaries. We have also determined that about 60,000 acres are available in the current area, which is less than half of the 125,000-acre target to accommodate 1000 birds and 250 nesting pair as dictated in the 2007 International Whooping Crane Recovery Plan. We expanded our scope to include areas inland from ANWR in Mission/Copano bays and northward in Lavaca/Matagorda bays to identify additional habitat that should be targeted for conservation. Our initial results indicate that about 120,000 acres of coastal habitat are available in the current and expanded area, without considering quality of that habitat, although ground-truthing efforts are indicating much of the habitat is unaffected by current development or fragmentation. We have already begun using the Sea Level Affecting Marshes Model (SLAMM) within most of the study area for effects of sea-level rise, and results appear to show a decrease in habitat area for Whooping Cranes at one-meter of change, followed by an increase of area at two-meters. Recommendations will be summarized with a final report that can be used to address information gaps and promote collaborative efforts among researchers and conservation planners.

Blue Crab study

Note: information provided by Dr. Zachary Darnell, University of Texas Marine Science Institute

We are working with researchers from the Mission-Aransas National Estuarine Research Reserve to begin studying blue crab population dynamics in the greater Mission-Aransas ecosystem. As a primary winter food source for whooping cranes as well as numerous other fish and wildlife species, blue crabs are an important component of coastal marsh habitats. Long-term declines of blue crabs have been documented in Texas and recent information indicates that high juvenile mortality may be a factor. Information on the early life history stages of blue crabs in coastal Texas is lacking. Thus, the primary goal of this project is to determine what environmental factors influence recruitment of blue crabs into the local estuary and how juvenile blue crabs disperse and use habitat throughout the estuary. Starting this spring, researchers will begin collecting blue crabs in various life history stages throughout the Mission-Aransas estuary using various sampling techniques. At Aransas NWR, several sites will be sampled for juvenile blue crabs over the next two years.

2013 Spring migration

Whooping Crane tracking partnership (WCTP) 2013 spring migration

Note: information provided by Dr. Aaron Pearse, US Geological Survey, Northern Prairies Research Center

Prior to migration, five transmitters stopped providing data. Cranes departed wintering sites in Texas between 24 February 2013 and 4 May 2013 with an average departure date of 5 April 2013. Forty-two percent of the birds had departed by 1 April 2013 and 67% had departed by 10 April 2013. The first birds arrived at summer use sites on 4 May, and the last marked crane arrived on 24 May. The average arrival date was 11 May. Total time spent migrating between wintering and summering areas during 2013 ranged from 16 to 69 days and averaged 36 days. For comparison, we estimated average migration time during spring 2012 at 27 days (15–46; $n = 25$). Thirty-three birds successfully migrated to northern summer areas. We documented whooping cranes using 409 stopover locations (geographic areas where cranes remained ≥ 1 night), which occurred in every state and province in the Great Plains. As in other years, Saskatchewan contained the majority of sites used, and other northern Great Plains states and provinces received similar use as past years. Cranes spent the most time at staging sites in South Dakota followed by Nebraska and North Dakota. Staging duration in Saskatchewan was reduced substantially compared to previous years. This coupled with increased staging duration in Nebraska and the Dakotas likely reflected winter-weather conditions encountered during spring migration. The general migration corridor used by whooping cranes during spring 2013 was similar to past migrations and other published reports. Six birds stopped at Salt Plains National Wildlife Refuge in Oklahoma and eight birds stopped at or near Quivira National Wildlife

Refuge in Kansas. Five birds used stopover sites along the Central Platte River. We confirmed one mortality in South Dakota during spring migration.

Other ongoing AWBP issues

The Aransas Project v Bryan Shaw et al.

On 10 March 2010, The Aransas Project, a 501-(c)-3 organization, filed suit against the Texas Commission on Environmental Quality (TCEQ) for illegal harm and harassment of whooping cranes in violation of the Endangered Species Act. The Aransas Project alleged that TCEQ was responsible for the take of 23 whooping cranes during the winter of 2008-2009 via their permitting of surface water rights from the San Antonio and Guadalupe river basin. The Aransas Project claims that over-allocation of surface water led to decreased freshwater inflows into San Antonio Bay, leading to increased salinity levels and declines in food and water resources for whooping cranes, causal factors implicated in the “taking” of 23 whooping cranes. A bench trial was held in December 2011 in US District Court, Corpus Christi with Judge Janice Jack presiding. Judge Jack issued a ruling in favor of The Aransas Project on 11 March 2013, which included an order preventing TCEQ from approving or issuing new water permits affecting the Guadalupe or San Antonio Rivers “until the state of Texas provided reasonable assurances that new permits would not result in harm to whooping cranes.” TCEQ was ordered to seek and incidental take permit from US Fish & Wildlife Service. TCEQ appealed the decision and the Fifth Circuit Court of Appeals in New Orleans granted an emergency stay and agreed to hear oral arguments in August 2013. Appellant briefs were provided to the Fifth Circuit in May 2013.

The US Fish & Wildlife Service was not a named party in the lawsuit and has not taken a position on the issue, but is prepared to assist all interested parties in developing strategies that enhance whooping crane conservation regardless of the outcome of the lawsuit.

Habitat Conservation Plans

Mortality factors associated with collisions during migration has long been considered a threat to the continued recovery of the AWBP. Collision risks encountered by whooping cranes during their spring and fall migration events include electric transmission and other overhead utility lines, communication towers, fences, wind turbines and other overhead obstructions. Recently, the AWBP migration corridor through the US Great Plains states has seen considerable growth in wind power facility development. Given the potential for whooping crane mortalities (i.e. “take”) associated with wind power facilities, a group of 19 wind power development companies (coined the wind energy whooping crane action group or WEWAG) began working with state wildlife agencies and the USFWS to develop a Habitat Conservation Plan (HCP) in 2008. This HCP is referred to as the Great Plains Wind Energy (GPWE) HCP (<http://www.greatplainswindhcp.org/>). A HCP is designed to avoid, minimize and mitigate to the greatest extent possible, any take of threatened and endangered species that occurs incidentally to an otherwise legal activity. Specifically for whooping cranes, the ultimate outcome of the GPWE

HCP is intended to increase conservation benefits to the AWB flock throughout the breeding grounds, migration corridor and wintering grounds while reducing potential impacts from wind power facilities throughout the migration corridor. The USFWS is currently working to develop an environmental impact statement (EIS), as required via the National Environmental Policy Act (NEPA) concurrent with WEWAG's development of the GPWE HCP. Once the process is complete, there will be an opportunity to improve whooping crane habitat conditions both in the migration corridor and the wintering grounds. Public input has been and will continue to be considered via scoping meetings and federal register notices.

Other HCPs related to collision threats in the migration corridor, such as electrical transmission lines, are in the early development stages. These HCPs have the potential of providing conservation benefits to whooping cranes while minimizing incidental take.

Reintroduced flocks

Florida non-migratory flock

Overview

Downlisting criteria for whooping cranes include the establishment of up to two separate populations apart from the AWBP (USFWS 2007). Under a USFWS approved plan, numerous conservation partners released 289 captive-reared whooping cranes in central Florida from 1993 through 2006 in an attempt to establish a self-sustaining, non-migratory flock. Whooping cranes in the Florida non-migratory flock are classified as an experimental, non-essential population. The project faced numerous challenges from the start, with survival and productivity of released whooping cranes being low. In 2008, an analysis was conducted by project partners that indicated there was a maximum probability of 41% that the Florida flock would ever be self-sustaining. Given this information, the International Whooping Crane Recovery Team made a recommendation that no further releases of captive-reared birds take place in Florida. The project was ultimately discontinued, however information garnered from the project has increased our knowledge of best management practices tied to whooping crane reintroductions. The knowledge gained from the Florida reintroduction project will undoubtedly continue to provide long-term benefits to the overall recovery effort. Over 33 abstracts and scientific journal articles have been published as a result of research related to this project.

Major research findings/lessons learned

Several studies were conducted to provide basic whooping crane life history information and to investigate problems with survival and productivity of the reintroduced flock. For example, a study of copulation behavior, the first ever conducted on a crane species, demonstrated increased whooping crane copulation activity in wet years compared to years with normal or low precipitation (Dellinger et al. 2013). This result provides evidence that a series of drought years in Florida may have been partially responsible for low productivity of the flock. Another study

on flock behavior revealed that males tend to lead flock movements, both in flight and walking (Folk et al. 2013). This information provided an understanding of unequal sex ratios post-release, as males tended to collide with obstructions such as power line collisions during flight at a greater rate than females. Intensive studies of nesting behavior began in 2010, when project partners began gathering data on nest attendance, incubation behavior, predator pressure and nesting crane response to predators and disease transmission between eggs and incubating adults. Results from this study will be presented in upcoming scientific publications.

Disease issues have always been a major consideration with reintroduction projects, and the Florida project dealt with mortality related to Infectious Bursal Disease (IBD), a viral disease for which little is known in wild crane populations. Samples from local birds that detected positive antibodies indicated that whooping cranes were likely exposed to the disease via association with wild birds post-release.

Several new best management practices related to trapping, transport, handling and release of whooping cranes were developed over the years of the project. These innovations led to an increase in safe and effective husbandry techniques that are now used by other crane breeding and reintroduction project across the US.

Current status and future plans

Reproduction milestones for the Florida project include the first nest established in 1996, the first eggs laid in 1999, the first egg hatched in 2000 and the first chick reared to fledging in 2006. Intensive monitoring of the flock was discontinued in June 2012 by the Florida Fish and Wildlife Commission. Since then, monitoring efforts have been opportunistic and have relied heavily on public observations. At this time, the flock size is estimated at 16 adults (7 males, 9 females).

The International Whooping Crane Recovery Team will soon be evaluating how eggs and adult whooping cranes from the Florida non-migratory flock may be integrated into other existing recovery efforts.

Louisiana non-migratory flock

Overview

In 2010, the International Whooping Crane Recovery Team recommended that an additional non-migratory, experimental flock of whooping cranes be established in southwestern Louisiana to further whooping crane recovery goals. US Fish & Wildlife Service published the final rule to establish a nonessential, experimental population of whooping cranes in southwestern Louisiana in February 2011. Three cohorts of whooping cranes (2010, 2011 and 2012), totaling 40 individuals, have been released via a soft release pen located at the state owned and managed White Lake Wildlife Conservation Area (WLWCA) in Vermillion Parish. A wide variety of partners actively contribute to this reintroduction project, although the Louisiana Department of

Wildlife and Fisheries (LDWF) along with the USGS have been the lead agencies. The landscape around WLWCA historically supported wild whooping cranes as late as 1950. Significant area of freshwater and estuarine marsh provides suitable habitat for a non-migratory whooping crane flock throughout southwestern Louisiana and the released whooping cranes have already utilized a wide variety of habitat types over parts of thirteen Louisiana parishes, encompassing a core use area of over 3.5 million acres. Survival of released whooping cranes was low the first year, but has improved since. Most of the released whooping cranes have not reached breeding maturity yet, but the first nest was documented in the spring of 2013. As of May 2013, 25 of 40 whooping cranes released in southwestern Louisiana are still alive and being actively tracked via telemetry. Three of the mortalities to date were associated with illegal shootings.

Major research findings thus far

Thus far, the primary focus of research efforts for this reintroduced flock has been to identify bird movement, habitat use, behavior within each habitat type and sources of mortality. GPS tracking of released whooping cranes is providing over 10,000 individual whooping crane locations annually, helping researchers understand whooping crane use of this landscape. Preliminary results indicate that marsh water levels and seasonal agricultural practices likely influence whooping crane movement and use of habitat. For example, when marsh conditions at the WLWCA tend to be either too dry or flooded, released whooping cranes tend to disperse north and utilize rice and crawfish dominated agricultural areas that have abundant forage and preferred water levels. When marsh water levels at WLWCA are at optimal levels for whooping cranes, released birds tend to stay near the release site. Birds using agricultural habitats north of WLWCA have tended to move during times of active farm management (i.e. rice planting preparation in April and harvest in July). Other aspects of whooping crane biology that are being investigated in conjunction with this reintroduction project include diurnal and nocturnal habitat use patterns, time activity budgets and rearing method impacts on post-release behavior.

Education and outreach efforts

Partners involved in the Louisiana non-migratory whooping crane reintroduction effort are actively working to educating the public about the project and the value of the species and its Louisiana heritage. Outreach on the project has included radio and television advertisement, placement of billboards along interstate corridors, presentations at community festivals and a development and deployment of an educational module for adult and youth audiences. Chevron and other corporate entities have been significant sponsors of these outreach efforts. Private landowner acceptance of whooping crane presence has been overwhelmingly positive, with all landowners granting researchers access to areas being used by whooping cranes.

Current status and future plans

As the whooping cranes in this reintroduction project mature, we expect nesting to begin in earnest. Once this occurs, partners will work closely to investigate incubation behavior, nest site selection and nest success in order to determine factors related to reproductive success. Any nesting studies will ensure that nest disturbance is minimized.

Human interactions with this reintroduced flock will only increase as more birds are released and they move into new habitats. The outreach efforts that are being undertaken are helping to assure that the public understands the value of the species and treats the birds with respect. In particular, we hope that these efforts will reduce mortalities due to shooting in the future. Additionally, we hope that whooping cranes using agricultural areas will not become habituated to humans, but rather continue to exhibit “wild” behaviors. Over the past year, we have seen several birds move into various parts of eastern Texas, and for the most part staying from a few days to several weeks before eventually moving back to Louisiana. Both state wildlife agencies (LDWF & TPWD) and US Fish & Wildlife Service have been in close communication to ensure the public is well informed and any conflict with existing human activities is minimized.

Useable habitat for whooping cranes appears to be abundant and available in southwestern Louisiana and all partners involved have high hopes for the continued success of this project. Our hope is to increase the number of whooping cranes released at WLWCA on an annual basis, depending on productivity in the captive flock and other factors.

Eastern migratory population

www.bringbackthecranes.org

Overview

The eastern migratory population (EMP) of whooping cranes was established in 2000 with the goal of establishing a migratory, self-sustaining population in Eastern North America. This fits into the overall recovery strategy of working to establish one or more additional whooping crane flocks that are distinct from the AWBP as outlined in the International Whooping Crane Recovery plan (USFWS 2007). More specifically, the initial goal of this reintroduction project was to establish a minimum of 120 adults consisting of at least 30 breeding pairs. Since the initiation of this project, 207 whooping cranes have been released into the wild, with around half of those surviving to date. Significant milestones in this reintroduction effort include the establishment of two nests established in 2005 and the first fledged chick in 2006. Since 2006, only 4 additional chicks have been fledged in the wild. Overall, survival of released whooping cranes has been acceptable, but successful reproduction of released cranes has been too low for the flock to be considered self-sustaining.

The Whooping Crane Eastern Partnership (WCEP) was formed at the onset of this project to guide and implement all aspects of the reintroduction effort. Founding members of WCEP include the International Crane Foundation (ICF), Operation Migration Inc., Wisconsin

Department of Natural Resources, US Fish & Wildlife Service, the US Geological Survey's Patuxent Wildlife Research Center (PWRC) and National Wildlife Health Center, the National Fish and Wildlife Foundation, the Natural Resources Foundation of Wisconsin and the International Whooping Crane Recovery Team. WCEP has established several project teams that guide various aspects of the reintroduction effort. The teams established within WCEP with a set of specific tasks include the Research & Science Team, Rearing & Release Team, Monitoring & Management Team and Communications & Outreach Team. The team leaders serving on the aforementioned teams all serve on the Operations Team, which provides overall oversight and direction for the reintroduction project. The Operations Team provides regular updates on decisions, needs and operations to the Guidance Team, which assists in making decisions that cannot be settled at a lower level.

WCEP utilizes two primary methods when releasing captive-reared birds into the wild, Ultralight-led Migration and Direct Autumn Release. Chicks born in captivity and assigned to the Ultralight-led Migration release method are imprinted on costumed caretakers and conditioned to follow one of the Operation Migration aircraft at PWRC. The imprinted chicks are then transported to a release site in Wisconsin. There they continue training in preparation for a fall migration led by the Operation Migration Ultralight aircraft. The terminus for the fall migration is St. Marks National Wildlife Refuge in Florida. Chicks assigned to the Direct Autumn Release method begin at ICF in Baraboo, WI and are moved to Necedah NWR and then to Horicon NWR in Wisconsin, where they are released in late October. While in training at Necedah NWR, costumed caretakers work with chicks in a natural environment to encourage foraging and socialization with other cranes in the area. The chicks are moved to Horicon NWR in early September, where costumed caretakers encourage flight, eventually migrating south with adult cranes.

Major research findings thus far

The WCEP research and science team has established research projects aimed at understanding factors that limit the reproductive success of the EMP. Hypotheses being investigated include harassment of nesting adult whooping cranes by black flies leading to nest abandonment, nest predation, parental age and experience impacts on nest success and limited crane energy reserves resulting from low wetland productivity. To compare overall reproductive performance, data from the EMP is compared to historical data from the AWBP and Florida non-migratory populations. In order to test the black fly harassment hypothesis, black fly larvae in several targeted river segments in Wisconsin were treated with *Bti* over two years (2011 and 2012). These treatments resulted in significantly lower black fly abundance when compared to pre-treatment years. While preliminary results from this ongoing experiment suggest that black fly harassment likely negatively impacts nest success, other factors such as whooping crane parent age, nest predation and local weather impacts interact with the effects of black fly parasitism. This makes it difficult to single out one variable in the ongoing issues with low EMP nest

success. Ongoing research continues to increase our understanding of the factors associated with the successes and failures of this reintroduction project.

Education and outreach efforts

The WCEP communication and outreach team issued numerous press releases and statements highlighting major reintroduction activities such as spring and fall migration, ultralight-led migration, hatching and survival of wild-born chicks and updates on illegal shooting cases. These events were communicated through a variety of venues including print and television media, internet and social media and directed outreach. The team has developed over 900 media contacts in Wisconsin alone. Presentations were delivered throughout the year to partner organizations, schools, conservation and birding clubs, professional conferences, civic organizations and zoos. The ICF installed cameras at their chick-rearing facility, providing the public an opportunity to watch live, streaming video of whooping crane chicks being raised for the DAR project (www.cranechickcam.org).

Current status and future plans

As of June 2013, there were 106 birds (55 males and 51 females and one chick) in the EMP.

2012 Breeding Season

A total of 12 chicks hatched in captivity were released into the EMP in 2012, six allocated to both Ultralight-led migration and Direct Autumn Release methods. Twenty-two pairs of whooping cranes in the EMP initiated 29 nests in the spring of 2012 (seven re-nest attempts). For first nesting attempts, five nests hatched one chick each, one nest hatched two chicks and three incubated past full term. Second nest attempts resulted in two nests hatching one chick each, two nests incubating past full term and one of undetermined fate. Of the chicks hatched in the wild, only two survived to fledging and were incorporated into the population.

2012 Fall migration

Fall migration was spread out more than usual in 2012, starting in late October and continuing into early December. Forty percent of the EMP had migrated by 1 November 2012 and an additional 51% left in November.

2012 wintering

Established, adult birds in the population overwintered in a broad geographic area, with December 2012 distribution estimated 42 cranes in Indiana, 16 in Florida, 16 in Alabama, 11 in Tennessee, eight in Illinois, three in Kentucky, three in Georgia and the rest at unknown locations or missing.

Long-term survival

Long-term whooping crane survival in the EMP is estimated at 53.8%. As of December 2012, there have been 98 recorded mortalities. Cause of death was determined for 42% of mortalities, with leading factors including predation (49%), impact trauma (22%), gunshot (15%) and disease (7%). The majority of mortalities in 2012 were birds two years of age or greater (86%).

Future plans

In 2013, a parent-rearing experiment will begin in the EMP. This experiment will begin to test the hypothesis that captive reared whooping crane chicks raised in the most natural setting possible (i.e. raised by adult whooping cranes in captivity rather than a costumed caretaker) will be more fit when released into the wild. Five chicks have been allocated to this research project in 2013, with the project to be carried out at Necedah NWR for at least two years. Given the history of nest failures at Necedah NWR, a new nest salvage protocol was put into place for 2013. The protocol calls for eggs from abandoned, wild nests to be collected and brought into captivity after a minimum of 10 hours post-abandonment. This new protocol has the potential to greatly increase the production of chicks available for reintroduction in the future.

Captive population

**Note: This section was prepared by Bill Brooks, USFWS SE Region*

2012 breeding season overview

There were 157 (79 males and 78 females) whooping cranes at the Captive Breeding Centers (5) and at zoological display facilities (8) as of December 2012, (see 2012 Captive Population Table below). This number includes 57 socialized breeding pairs at the Captive Breeding Centers. The captive breeding production in 2012 included 36 fertile eggs that resulted in a total of 29 chicks for the captive flock maintenance and for reintroduction into the wild. This includes two chicks as genetic hold backs for the captive flock, six chicks for the ultralight release technique, seven direct autumn release technique, and 14 chicks that were released into the Louisiana nonmigratory population. Fertile eggs produced by the Captive Breeding Centers were shipped to Patuxent Wildlife Research Center and International Crane Foundation to be hatched and reared for the reintroduction programs. This included eggs from the Calgary Zoo (five) and San Antonio Zoo (one). Four fertile eggs came from wild nests abandoned in Wisconsin by the Eastern Migratory flock. Patuxent Wildlife Research Center and International Crane Foundation also made egg shipments between the two facilities so that similar-aged eggs could enter the same reintroduction program. All egg shipments were coordinated on weekly conference calls in the spring with the flock managers. One cohort of chicks was shipped in July from Patuxent Wildlife Research Center to White River Marsh WMA in Wisconsin with Windway Corporation providing air transport in their aircraft; and a second cohort of chicks was shipped in November from Patuxent Wildlife Research Center to White Lake Wetlands Conservation Area in

Louisiana with Windway Corporation providing air transport. Two chicks of high genetic value were held back to become captive breeders at International Crane Foundation.

Captive Breeding Facility updates

Patuxent Wildlife Research Center was in the midst of a center wide electrical upgrade through much of 2012. The upgrade improved the reliability of service to the crane area, but the disturbance likely had a negative impact on whooping crane production. Several experienced females did not lay at all and 9 females laid only 12 fertile eggs. Supplemented by eggs from other sources, Patuxent Wildlife Research Center hatched and reared 23 whooping crane chicks. Six chicks were sent to Wisconsin in June for the ultralight led migration release and 14 chicks were sent to Louisiana in late November for release with both cohorts being transported by flights donated by Windway Aviation. Three chicks died. One technician spent a week in White Lake, LA, assisting the Louisiana Department of Wildlife and Fisheries with the arrival and banding of the release chicks. A research project to determine the underlying causes of poor reproduction in captive whooping cranes through hormone analysis was ongoing in 2012. On 31 December 2012 Patuxent Wildlife Research Center held 74 after hatch year (AHY) (37 males and 37 females) and no hatch year (HY) whooping cranes.

In 2012, International Crane Foundation managed 34 (16 males and 18 females) whooping cranes, which included 15 socialized pairs. Eleven of the pairs produced 44 eggs, of which 18 were fertile, 20 infertile, and six broken (broken eggs result in 'unknown' fertility status). Thirteen of the eighteen fertile eggs hatched (72.2%). Four of the fertile eggs resulted in early dead embryos, and one of the fertile eggs resulted in a late dead embryo. Ten chicks hatched at ICF, six from International Crane Foundation produced eggs, three from the wild Eastern Migratory Population and one from Calgary Zoo. Two of these chicks were isolation reared and maintained as genetic holdbacks. The remaining eight chicks hatched were candidates for the Modified Direct Autumn Release program as part of the Whooping Crane Eastern Partnership. One chick died prior to transfer to Necedah National Wildlife Refuge (NNWR) in Juneau County, Wisconsin. Seven of these chicks were successfully transferred to NNWR on 24 July 2012. One chick was brought back to ICF due to a chronic leg condition before the remaining six chicks were then transferred to Horicon National Wildlife Refuge in Dodge County, Wisconsin, where they were released on 29 October 2012.

In 2012, the Calgary Zoo flock produced 5 fertile eggs that were transported to either Patuxent Wildlife Research Center or International Crane Foundation and the San Antonio Zoo pairs produced one fertile egg that was transported to Patuxent Wildlife Research Center. Audubon Center for Research on Endangered Species completed the addition of 2 more breeding pens and completed maintenance and upgrades to the existing breeding pens with funding support from a USFWS grant.

2012 Captive Population

	Male	Female	Total	Breeding Pairs
Patuxent Wildlife Research Center (PWRC)	37	37	74	25
International Crane Foundation (ICF)	16	18	34	15
Devonian Wildlife Conservation Center (CZ)	9	9	18	7
San Antonio Zoo (SAZ)	4	3	7	2
Audubon Center for Research on Endangered Species (ACRES)	5	4	9	2
Calgary Zoo	1	1	2	0
Homosassa Springs Wildlife State Park	1	1	2	0
Lowry Park Zoo	1	1	2	0
Jacksonville Zoo	1	1	2	0
Milwaukee County Zoo	1	1	2	0
National Zoological Park	1	1	2	0
New Orleans Zoo	1	1	2	0
Sylvan Heights Waterfowl Park	1	0	1	0
Subtotal in Captivity	79	78	157	51

Acknowledgments

No one organization or individual is capable of providing all the necessary elements to recover the magnificent whooping crane. We see this recovery effort not only successful due to the great increase in the whooping crane population over the last 60 + years, but also the great deal of cooperation and collaboration that takes place amongst a wide variety of private, state and federal organizations alongside a slew of highly dedicated individuals. If not for everyone's continued effort to assist in the recovery of this species, it is likely that the species would have been extinct long ago. Our hope, as the biologists tasked by our respective agencies with the coordination of the recovery of this revered species, is that we can all continue to work together to ensure that the species is able to be removed from the endangered species list as recently occurred for the US national bird, the bald eagle. As the population continues to grow, a greater portion of the public will have opportunities to view and appreciate the majesty of the species. We want to thank all the organizations and individuals that contributed to this report along with the wide range of recovery efforts being undertaken.

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APPENDICES