

Report on Whooping Crane Recovery Activities (2013 breeding season-2014 spring migration)

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October 2014

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 2013, surveys of the AWB detected 74 nests (May) and 28 chicks (August) resulting in an average number of chicks fledged per nest (0.38) that was lower than the long term average of 0.48 but within the long term natural range of variation. In winter 2013 (Dec) the peak population size of the AWB on the primary wintering grounds was estimated as 304 birds (95% confidence interval [CI] 260–364) and additional birds were located outside the survey area. Whooping cranes faced challenging conditions due to forest fires during the 2013 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 2013, 68 whooping cranes had been marked on the breeding and wintering grounds and 40 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 2013 there were approximately 148 birds in reintroduced populations and 161 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 over 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.

2013 breeding season

For the full update, see the attached report prepared by Canadian Wildlife Service

Annual precipitation preceding the 2013 breeding season was 10 percent above the 60-year average and temperatures were at or above the long-term average throughout the breeding season. Fifty forest fires occurred in WBNP in 2013. Area affected by fires were 37,941 ha (0.78% of the park), on par with the 25-year average of 1%. Four fires occurred in the whooping crane nesting area, burning 3,678 ha or 0.89% of that area. Surveys to locate and count whooping crane breeding pairs and nests in and around WBNP were coordinated by the Canadian Wildlife Service in partnership with Parks Canada Agency. During surveys, 74 nesting pairs of whooping cranes were detected. The number of nests detected in 2013 represents the second highest count on record. In addition to nesting pairs, 21-25 territorial pairs were detected suggesting potential for substantial population expansion in upcoming years. Eight nests were found outside of WBNP (this is the highest count ever); two in the Lobstick Creek / Foxholes area, and six north of the Nyarling River. A single nesting pair was found in a previously undocumented nesting area; this pair was identified through regular review of locations of whooping cranes fitted with satellite transmitters. Surveys to locate and count fledged whooping cranes detected 28 fledged young; all family groups had a single offspring. The number of fledged young per nest was 0.38, lower than the 20-year average of 0.48 but within the long term natural range of variation.

Whooping Crane tracking partnership (WCTP)

Note: This is a summary of U.S. Geological Survey's March 2014 Remote tracking of Aransas-Wood Buffalo Whooping Cranes. The 2013 breeding season and fall migration update is available here: <http://www.cranetrust.org> (search under Research)

WCTP overview

The study was conducted by a partnership of researchers from multiple organizations using GPS devices to track individual whooping cranes of the Aransas –Wood Buffalo population.

Efforts focused on putting tracking devices on adult whooping cranes captured on Aransas National Wildlife Refuge NWR, where the birds winter on the Texas coast, and on chicks at Wood Buffalo National Park, the birds' nesting grounds in Canada.

The GPS units are attached to a bird's upper leg and record four to five locations every 24 hours, information that is uploaded to a satellite every two and half days. These data reveal migration routes, habitat use, nesting locations, and much more. Biologists in the United States and

Canada will use results of this work to identify management and conservation priorities in both countries.

The research partnership is made up of governmental and non-profit partners that include the U.S. Geological Survey, U.S. Fish and Wildlife Service, Canadian Wildlife Service, Platte River Recovery Implementation Program, Crane Trust, Parks Canada, Gulf Coast Bird Observatory, and International Crane Foundation.

2013 WCTP Breeding Season

Thirty-three marked whooping cranes provided >12,000 locations during the summer of 2013. Five marked subadults spent the entire summer in Saskatchewan and Alberta, south of Wood-Buffalo NP. Two birds spent a portion of June 2013 in North Dakota. Canadian Wildlife Service personnel confirmed that seven marked cranes successfully nested and were observed with young during August fledgling surveys (n=6) or fall staging surveys in Saskatchewan (n=1). In addition, comparison of nest locations and GPS data indicated that six additional marked birds may have nested. For marked cranes were sighted with young during fall migration in Saskatchewan. No mortalities were identified from the data prior to the onset of migration.

2013 WCTP Fall migration

During fall migration, transmitters from 30 marked whooping cranes provided location data. Three transmitters stopped providing data prior to the initiation of fall migration. Four transmitters provided intermittent data during migration. Whooping cranes began departing WBNP on 22 August 2013 and the last marked bird left on 31 October 2013, with the average departure date of 3 October 2013. Fall migration of marked birds took an average of 40 days during 2013, with a range of 12 to 78 days. During migration, the WCTP documented 260 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 Platte River in Nebraska, xiz birds stopping at or near Quivira National Wildlife Refuge in Kansas and three birds stopping at Salt Plains National Wildlife Refuge in Oklahoma. One marked subadult terminated its migration at Brazoria NWR in Texas, moving to Aransas NWR later in the winter. No mortalities of marked birds were detected during migration.

2013 Wintering grounds

Additional information from this past winter can be found here:

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

2013 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 14 October 2013. Drought conditions in the wintering grounds, which have been present off and on since 2008, somewhat subsided during the winter of 2013, but increased again in early 2014. A few timely rains in the late summer/early fall, both locally and in Central Texas, provided enhanced freshwater resources on and around the Refuge. While the 2013 precipitation total (22.52 inches recorded at Matagorda Island, data from Oct-Dec. not available for Aransas NWR RAWLS) was well below the annual average of 38 inches for the Refuge (USFWS Aransas NWRC CCP, 2010), nearly half (10.12 inches) of the annual total fell between August-October of 2013 (<http://www.wrcc.dri.edu/cgi-bin/rawMAIN.pl?sdTARA>). This trend of late summer/fall 2013 rainfall becomes apparent when considering the Palmer hydrological drought index, which was near normal (0) in October of 2013, but was -3.5 by April 2014, e.g. “severe drought” (<http://www.drought.gov/>). 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 2 or 3 precipitation events from November 2013 to April 2014 (<http://lighthouse.tamucc.edu/pq/127>). Thus, severe drought conditions have been in place of and on for the last 3 winters. Based on anecdotal reports and field observations, it did appear that blue crab numbers were higher in coastal marshes during the winter 2013 period when compared to the last few 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 6,391 acres treated. We observed whooping crane use of the burned areas, both during aerial surveys and by marked whooping cranes.

2013 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. During winter 2013–2014, the primary survey area (approximately 154,000 acres) was surveyed seven times between 11 December and 23 December 2013. During the same period, the secondary survey area (approximately 101,500 acres) was surveyed twice to monitor ongoing expansion of the whooping crane’s winter range. Wade Harrell and Diana Iriarte were the primary observers, with Beau Hardigree serving as an alternate observer during two flights. Preliminary analyses of the data indicated 304 whooping cranes (95% CI = 260–354; CV = 0.08) inhabited the primary survey area (see map). This estimate includes 39 juveniles (95% CI = 32–47; CV = 0.10) and 116 adult pairs (95% CI = 100–135; CV = 0.08). Recruitment of juveniles into the winter flock was 15 chicks (95% CI = 13–17; CV = 0.07) per 100 adults. The precision of this year’s estimates was improved and achieved the target set in the protocol (i.e., CV < 0.10). Improved precision is due to increased observer experience and refinement of methods.

Other winter 2013 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/

Long-term whooping crane followers likely remember that over the last couple of years many whooping cranes spent much of the winter outside of the primary survey area. This was likely due to a number of factors including overall population expansion and ongoing drought conditions.

This year was different. Biologists detected more whooping cranes in the primary survey area and documented fewer individuals outside the primary survey area. This geographic shift among years may be due to shifts in food resource availability. While it was still a relatively dry year, some timely rains this past summer and early fall may have contributed to greater food resource availability in area coastal marshes. This may indicate that whooping crane behavior is adaptable and individual birds are able to shift their habitat and food use in relation to local environmental conditions. It provides a continued hope that the whooping crane population is resilient in the face of fluctuating environmental conditions such as drought. Wintering in a variety of places across a broader geographic range reduces the risk that a single localized catastrophic event could cause extinction.

Between Texas Whooper Watch and the increasing number of birds marked with satellite transmitters via the tracking study, biologists are in a much better position to document geographic expansion of the wintering grounds. Conservation and restoration of high-quality whooping crane habitat in Texas needs to be emphasized in the future so the growing whooping crane population has places to forage and raise young successfully during the winter season. Protecting and conserving habitat that provides the resources the birds need on a broad, landscape-scale will help the population continue to grow and contend with ever changing conditions.

The tables below provide the best understanding of birds that were outside the primary survey areas during the mid-December survey period. Keep in mind some birds may have been missed. Also, we cannot ever be completely certain that individual birds did not move between these locations and to/from the primary survey area during the survey flights.

These are three different data sources that are used to document birds observed outside of the primary winter area during mid-December.

Table 1: Texas Whooper Watch

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

<u>General Area</u>	Adults	Chicks	Total	Notes:
Mad Island Area/Matagorda County	2	1	3	Observed several times in mid-December, including during the annual Christmas Bird Count.
Robertson County	1		1	Observed multiple times throughout December and into early January with Sandhill cranes
			4	

Table 2: Tracking Study

Birds documented outside of the survey area from Dec. 11th to Dec. 23rd via the tracking study

General Area	Adults	Chicks	Total	Notes:
North Matagorda Island (secondary survey area)	1	0	1	Marked as a chick in Canada in 2011. Detected via aerial secondary survey as well (see Table 3).
Calhoun County	1		1	Moved outside primary survey area on Dec. 14, 2013. Reported as a pair, but unconfirmed. Marked as a chick in Canada in 2012
			2	

Table 3: U.S. Fish and Wildlife Service Survey

Birds documented in the whooping cranes' secondary areas on Dec. 12th & Dec. 17th via aerial survey

General Area	Adults	Chicks	Total	Notes:
North Matagorda Island (secondary survey area)	1	0	1	* same individual reported in Table 2*

Documented mortality on wintering grounds

This season we documented four whooping crane mortalities on and around Aransas NWR. The first mortality was an injured subadult (amputated tarsus) that we captured on December 11, 2013 and transported to the San Antonio Zoo for treatment. Unfortunately, that bird died 30 days into treatment. The WCTP trapping crew collected an unmarked adult bird at a waterhole on the refuge in December 2013, and the necropsy identified bobcat predation as the likely cause of death. Two additional marked birds died on Aransas NWR in February 2014, but because carcasses were not located (only radios), necropsies could not be conducted. Thus cause of death is unknown but predation is suspected.

Ongoing wintering ground research efforts

WCTP 2013 wintering season

Note: This is a summary of U.S. Geological Survey's June 2014 Remote tracking of Aransas-Wood Buffalo Whooping Cranes. The 2013 wintering season and 2014 spring migration update is available here: <http://www.cranetrust.org> (search under Research)

The 2013 wintering season was the fourth and final year to capture and mark adult whooping cranes on the Texas wintering grounds on and around Aransas NWR for research purposes. The trapping team completed this field season marking 11 unmarked adult cranes and remarking 2 birds with new transmitters. The team also captured two cranes and released them with color bands (no transmitters). One crane had a lesion on its tarsus and the other bird was paired with a marked individual. The whooping crane tracking partnership has now met sample size criteria for marked birds as outlined in their study plan, thus no new capture activities are currently planned. Sixty-eight whooping cranes have been marked with GPS transmitters during the past four years. Currently, 32 of those birds are still being actively tracked.

GPS-marked cranes provided >11,000 locations during winter 2013, of which over >6,000 were within the boundaries of Aransas National Wildlife Refuge. The first date a marked bird arrived on the Texas coast, or nearby wintering areas, was 14 October 2013, with the last to arrive on 21 November 2013. Birds used a variety of ecologically distinct areas including coastal salt and brackish marsh communities, agricultural and ranching areas, and inland freshwater wetlands. The majority of locations were in Aransas, Calhoun, Refugio, Williamson, Wharton, and Colorado counties. We confirmed two mortalities of marked birds on Aransas Wildlife Refuge. One marked bird remained on the Texas Gulf Coast into early summer (as of 20 June 2014) accompanied by an unmarked individual.

Note: Summary of ongoing research at Aransas NWR provided by Dr. Elizabeth Smith, International Crane Foundation (ICF). A copy of the final summary and presentations from the referenced research symposium will be posted here: <http://www.missionaransas.org/index.php>

The 1st Aransas National Wildlife Refuge Research Symposium was hosted by and held at the Mission-Aransas National Estuarine Research Reserve in Port Aransas, Texas, on 10 September 2014. A broad diversity of projects are being conducted in and around the Refuge that require Special Use Permits, and the one-day presentations developed awareness and collaboration among researchers and also improved usefulness of results for Refuge management decisions. This summary highlights those projects which will be instrumental in developing management strategies, monitoring and decisions for the recovery of the endangered Whooping Crane. Broad-scale projects included understanding macroclimate controls on tidal wetland ecosystems within the Northern Gulf of Mexico estuaries (USGS), developing implementation of Texas Coastal National Wildlife Refuge Marsh monitoring plans (FWS), and tracking migrating Whooping Cranes through Texas environments (USGS, FWS). Multi-year projects effects of climate change included evaluating black mangrove establishment and effects on habitat change and faunal relative abundance (TAMU-G & RU, TAMU-CC). Impacts of sea-level rise on habitat availability for Whooping Cranes are being analyzed through models that project habitat shifts and loss and relate to long-term conservation planning (FWS, ICF & GCBO). Long-term programs have been established that will provide better information for these models focusing on measuring elevation and sediment changes and related vegetation shifts over time (MANERR, FWS).

One multi-year project (SHSU & ICF) initiated at the beginning of the 2011 drought addresses potential impacts on the coastal ecosystem at Aransas NWR and evaluates linkages between environmental drivers and habitat quality, ultimately relating to responses and health condition of wintering Whooping Cranes. The third year of sampling basic water quality parameters in coastal marsh ponds along Blackjack Peninsula is providing data that relates bay salinities to shallow depressions and tidal creeks. A one-year study on estuarine fish community dynamics among ponds of varying sizes and connectivity provides another metric to evaluate habitat health. Wolfberry (important food resource for Whooping Cranes) productivity has also been monitored and results being compared to historic information collected under more temperate

conditions. A new study initiated this past year is using presence of trematodes in the host, horned snails (another crane food resource), and developing models for using the parasite community in the host as indication of food web connectivity throughout the marsh system. Preliminary work was undertaken to assess blue crab mortality under short-term changes in salinity extremes; this work will provide the framework for developing a process to investigate preference/avoidance of certain ponds by migrating crabs. By monitoring Whooping Crane/habitat use through weekly boat surveys over the winter seasons, work continues to link environmental conditions and a fine scale to crane locations and behavior over the marsh landscape in relation to salinities and potential food availability.

Whooping Crane health assessments were initiated during the capture of individuals for the purpose of banding and securing GPS transmitters for a continental-wide research project (USGS, FWS, GCBO, ICF, others). These assessments were expanded by the collaboration two projects (TAMU, ICF) for two years in the collection of fecal samples and assessment of parasites, bacteria, and stress hormone levels of individuals throughout the wintering season. These birds were located at fresh water ponds adjacent to the coastal marsh on Blackjack Peninsula where best results were confirmed by placement and monitoring of field scan game cameras. These data are being analyzed to determine timing and frequency of use of ponds for dietary drinking water in relation to bay and marsh conditions, and will be useful for determining the ecological importance of freshwater resources for cranes during drought conditions. The relationship between use of freshwater ponds and habitat affinity in coastal marshes by individually marked individuals from boat surveys is also being assessed to determine appropriate locations for well replacement and new well drilling and excavation of additional water resources (SABP, FWS, ICF).

The symposium was broadly attended and presentations included individuals representing the following agencies, organizations, and universities FWS – U.S. Fish & Wildlife Service, USGS – U.S. Geological Survey, MANERR – Mission-Aransas National Estuarine Research Reserve; ICF – International Crane Foundation, GCBO – Gulf Coast Bird Observatory, San Antonio Bay Partnership; Texas A&M University, Texas A&M University-Corpus Christi, Texas A&M University-Galveston, Rice University.

WCTP 2014 spring migration

Prior to migration, six transmitters stopped providing data (Table 1). Cranes departed wintering sites in Texas between 14 March and 3 May with an average departure date of 11 April. Thirty percent of the birds departed by 1 April and 52% departed by 10 April. Departure was approximately one week later than previous years. The first birds arrived at summer use sites on 24 April, and the last marked crane arrived on 23 May. Average arrival date was 8 May. Total time spent migrating between wintering and summering areas during spring 2014 ranged from 21 to 47 days and averaged 30 days. For comparison, we estimated average migration time during

spring 2011 at 31 days (25–38 days; $n = 10$), spring 2012 at 27 days (15–46; $n = 25$) and spring 2013 at 36 days (16–69 days, $n = 32$).

We monitored 32 birds successfully migrating to summer areas. We documented whooping cranes using 315 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 relatively similar use (Table 2). Cranes spent the most time at staging sites in Saskatchewan followed by North Dakota, Nebraska and South Dakota. Staging in the remaining states and provinces accounted for $<20\%$ of migration. The general migration corridor used by whooping cranes during spring 2014 was similar to past migrations and other published reports (Fig. 1). Three birds stopped at Salt Plains National Wildlife Refuge in Oklahoma; we observed no stopovers at Quivira National Wildlife Refuge in Kansas. Four birds used stopover sites along the Central Platte River between Lexington and Chapman, Nebraska. One crane terminated migration near Rumsey, Alberta.

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 an 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 Fifth Circuit heard oral arguments on August 8, 2013 and issued a 34 page opinion on June 30, 2014 that reversed the earlier District Court’s ruling. In summary, the Fifth Circuit found that “The District Court either misunderstood the relevant liability test or misapplied proximate cause when it held the state defendants responsible for remote, attenuated, and fortuitous events following their issuance of water permits.”

The US Fish & Wildlife Service was not a named party in the lawsuit and did not take a position on the issue, but still stands to assist all interested parties in developing strategies that provide adequate freshwater inflows to sustain coastal wintering habitat in Texas used by endangered whooping cranes.

Texas City Y oil spill

More information on this incident can be found here: <http://www.texascityresponse.com/go/site/6410/>

On March 22, 2014, at approximately 12:30 pm, the 585 foot bulk carrier M/V *Summer Wind* collided with the oil tank-barge *Kirby 27706*. The incident occurred in Galveston Bay near Texas City, Texas. The barge contained approximately 1,000,000 gallons of intermediate fuel oil in multiple tanks. The #2 starboard tank was punctured, spilling approximately 168,000 gallons of oil (<http://response.restoration.noaa.gov/oil-and-chemical-spills/oil-spills/kirby-barge-oil-spill-houstontexas-city-ship-channel-port-bolivar>).

Due to tide and wind conditions, a minimal amount of the spilled oil was contained at the site of the collision, and much of the product moved into the Gulf of Mexico via the Galveston Ship Channel. On about March 28, 2014, the oil began impacting the Matagorda Island Unit of Aransas National Wildlife Refuge, home to a large portion of the wintering whooping crane population and well as a number of other threatened & endangered species. Fortunately for the whooping cranes, the oil did not make it through any of the Gulf passes and make it into the coastal marsh habitat that is used by whooping cranes. The oil that did hit Matagorda Island was stranded on the Gulf-facing beach, below the dunes. While there was no direct impact to whooping cranes as they don't regularly use this portion of the island, the FWS was concerned that disturbance associated with the clean-up efforts may impact whooping cranes and other wildlife species. FWS worked closely with the Coast Guard, Texas General Land Office and the responsible party to avoid and minimize clean-up disturbance impacts to the Refuge's natural resources to the greatest extent possible. Part of that work involved having numerous U.S. Fish & Wildlife biologists and other staff members monitor cleanup crews and making sure best management practices were followed. Cleanup crews completed their work on Matagorda Island on about May 30, 2014. Investigations of the long-term impacts of the Texas City Y spill are ongoing.

Reintroduced flocks

Florida non-migratory flock

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 2002.

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 less than 14, however, only 8 birds (3 males and 5 females) were reported by the public in 2014. Two to 3 wild hatched chicks that fledged from this population still survive on the Florida landscape; the oldest fledged in 2004. Two nests were reported during 2014, with one colt still alive at the time of this report. The other reported nest also hatched one chick, however, it disappeared 3 weeks after hatching.

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

For the full report, see attached prepared by Louisiana Department of Wildlife and Fisheries

Executive Summary from full report:

This report covers the period 1 January 2013 to 31 May 2014. As noted in the previous report, 12 birds in the 2012 cohort were released at the White Lake Wetlands Conservation Area (WLWCA) on 17 December 2012. Heavy rains during January 2013 increased water levels in the pen area leaving only a small piece of land. The decision was made to remove food to disperse the birds; food was not replenished, so most birds dispersed the following day. On 11 December 2013, the 10 birds comprising the 2013 cohort were transferred to Louisiana and placed in the top-netted pen at WLWCA. Up to 10 older birds at one time visited the pen site and at times showed aggression toward the younger birds. Food was provided until 26 March; the longer time period necessary due to the recovery of a younger bird from an eye injury.

A total of 21,898 crane location GPS points were mapped between 1 January 2013 and 31 May 2014. For Louisiana, habitat use varied by cohort with the 2010 and 2011 cohorts primarily using agricultural habitats (rice/crawfish fields) and the 2012 and 2013 cohorts primarily using marsh habitats. In Texas, both 2011 and 2012 cohorts primarily used reservoirs/herbaceous wetlands, while secondarily using agricultural habitats for both 2011 and 2012 cohorts. Overall, 7 whooping cranes spent 6 months using mudflats and shallowly flooded areas with exposed emergent vegetation in Lake Ray Hubbard and Lewisville Lake near Dallas. LDWF coordinated with the Texas Parks and Wildlife Department (TPWD) and the U.S. Fish and Wildlife Service (USFWS) during the extended stay of the Louisiana birds in Texas. In summary, habitat use data from reintroduced Whooping Cranes continues to indicate that they are habitat generalists (i.e., utilizing different marsh types, wet agriculture, shallow segments of reservoirs, etc.), with likely generalized diets.

A total of seven birds died during the reporting period and two others are missing/presumed dead. Of the seven, three were shot, two were killed by predators, one died from a parasitic

infection/disease (Cyclocoelom), and one died from collision with a powerline; two of the three birds who were shot were a pair and were expected to nest this year. Unexpectedly, another pair (L7-11 and L8-11) built a nest in a crawfish field and their first egg was discovered on 24 March 2014 followed by a second egg on 26 March. This was the first active whooping crane nest in Louisiana in over 75 years. The pair incubated full term and incubation behavior was collected during this period. Unfortunately, both eggs were infertile. Later, a renesting attempt occurred with the same fate in a different crawfish field on the same farm outside the reporting period. We expect 3-6 pairs to potentially nest next year provided no pair separation or mortality.

Public education remains a high priority of the reintroduction program. LDWF staff participated in over 45 festivals and events, with a major focus of the education efforts centered on “Give a Whoop!” teacher workshops. A total of four workshops were conducted during the reporting period (78 middle/high school teachers from Louisiana and one from Ohio). In addition to the teacher workshops, a workshop was also provided to the New Orleans Master Naturalist group. The whooping crane public awareness media plan for 2013-14, funded by a grant from Chevron, included the use of billboard space provided by Lamar Advertising, radio commercial space purchased through Louisiana Network (LN), and television commercial space purchased on cable television systems in the Alexandria, Lafayette and Lake Charles metro areas. Billboards alone were estimated to reach almost 1 million viewers. Landowner relationships also remain a top priority and their positive support remains high. We have also initiated education efforts with the crawfish industry.

Throughout the year, there were highs and lows for our program, including the first nesting attempt and two additional shooting incidents. For the former, the pair incubated both their first and second nests to full term without complications from predators, biting insects, or from disturbance related to the crawfish farmer actively fishing the area around the nest. Predators or biting insects has been a major inhibitor for other reintroduction programs, so observing two, full-term incubation attempts for the first nest of this reintroduction is promising. To address our concern with shootings, we continue to provide significant efforts toward education and outreach with the general public, landowners, and farmers, with our region not exempt from shootings that have occurred throughout the country in the last five years. We will continue to find new and exciting ways to ensure that this reintroduction succeeds, including activities associated with our management, research, and education/outreach programs. However, the Louisiana Whooping Crane Team recommends to the Recovery Team that larger cohorts (>16) be provided in the future. Larger cohorts are more desirable because they are 1) more cost effective with the annual resources being invested into the program (for annual budget, see Appendix 1) and 2) better able to fill the vast amounts of suitable habitat in the region, increasing the probability of reintroduction success.

Eastern migratory population

For the full report, see attached 2103 Condensed Annual Report prepared by Whooping Crane Eastern Partnership

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, 228 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

Reproductive Success experiment

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). 2009 and 2013 were control, no-treatment years. *Bti* treatments resulted in significantly lower black fly abundance and improved hatching success when compared to control years. Unfortunately, reproductive success, as measured by the number of chicks fledged to fall migration per territory, remained too low to produce a sustainable population in the long term. Other factors, as stated above, that may influence reproductive factors are still under investigation.

In 2014, WCEP will begin two experiments in order to better understand whooping crane breeding ecology at Necedah NWR. The first experiment investigates the effects of forced re-nesting on reproduction. A sample of eggs from first clutch nests will be taken into captivity in order to force wild whooping cranes at Necedah NWR to re-nest. Similar nest manipulations have been conducted with wild populations of Mississippi Sandhill Cranes and Florida Sandhill Cranes, with second nests often having a significantly higher fledgling rate. Results from this study will focus on 1) determining if egg salvage induced nest failure can increase re-nesting rate 2) the ability to avoid peak black-fly levels with a modified nesting timing and 3) comparing the reproductive success of forced re-nests and first nests of whooping cranes. The second experiment at Necedah NWR will compare the breeding ecology and nesting success of Whooping Cranes and Sandhill Cranes. If black flies are the primary causal factor for low reproductive success in Whooping Cranes, it is expected that Sandhill Crane reproductive success at the same location may be low as well. If the study does not find this to be the case, other ecological, biological or behavioral differences may be important factors to consider in future research.

Impact of leg-mounted transmitters on crane copulation and incubation

Staff at Patuxent Wildlife Research Center began a two-year study in 2013 by fitting four pair of known self-fertile sandhill cranes with leg-mounted transmitters and four pair of self-fertile Sandhill Cranes were fitted with only a color band as a control. All eight crane pairs laid eggs (2 clutches of 2 eggs each). Copulation and incubation was similar across the control and treatment (transmitters attached to leg) groups, this study will continue in 2014.

Testing backpack harnesses and cell tracking devices

Staff at the International Crane Foundation and the University of Nebraska-Lincoln worked to test several factors of experimental cell transmitters and backpack harness attachment mechanisms. Backpack harnessed cell trackers were deployed on Sandhill Cranes. All birds survived well and acted normally. Cell devices failed at higher than acceptable rates. Four cell transmitters that were deployed on Ultra-Light Whooping Cranes in September 2013 produced unacceptable drag during flight and were removed after several days. Further testing and design modifications of the backpack attachment are needed.

Epigenetics

A researcher from the University of Wisconsin-Madison (Mark Berres) is examining the potential influence of diet and environmental contamination on epigenetic patterns in Whooping Cranes. The first examination is to compare how genomes from the AWBP and the EMP compare. Real differences in the genome between the populations, beyond that expected via mutation, could be due to environmental effects, such as diet and environmental pollutants. Preliminary testing of blood samples from four AWBP and three EMP whooping cranes is complete and researchers are considering increasing the sample size and scope of the study. Conclusions from this study could impact management of captive crane's diet and help understand impact of pollutants on breeding wild birds.

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. WCEP expanded its social media presence in 2013 via additional updates via Facebook and Twitter. Presentations were delivered throughout the year to partner organizations, schools, conservation and birding clubs, professional conferences, civic organizations and zoos. A number of regional and national outreach festivals were attended in 2013, reaching about 12,000 people.

A working group was established in 2013 to address illegal whooping crane shootings. Along with a number of agency and NGO partners, ICF developed two hunter education panels that were installed on kiosks at the Patoka River NWR in Indiana. These signs complement existing WCEP hunter education materials.

Current status and future plans

As of June 2014, there were 95 birds (55 males and 40 females) in the EMP.

2013 Breeding Season

A total of 21 chicks were into the EMP in 2013, nine eggs collected from wild nests at Necedah NWR and hatched/raised at Patuxent WRC were allocated to Ultralight-led migration and eight eggs hatched/raised at ICF were allocated to Direct Autumn Release (DAR) methods. An additional four hatched eggs were raised at Patuxent WRC and were dedicated to the new parent-rearing release technique. Twenty-one pairs of whooping cranes in the EMP initiated 23 nests in the spring experimental release (two re-nest attempts). For first nesting attempts, one nest hatched two chicks and one nest incubated past full term on nonviable eggs. Second nest attempts resulted in one nest hatching one chick. Of the chicks hatched in the wild, none survived to fledging and were incorporated into the population.

2013 Fall migration

Fall migration in 2013 was variable, with only about half of the birds having left Wisconsin by mid-November. Four of the nice chicks from the 2013 DAR cohort died in November 2013 on and around Horicon NWR just prior to fall migration. An additional two of the nine chicks from the 2013 DAR cohort died in Illinois shortly after fall migration (January 2013).

Forty percent of the EMP had migrated by 1 November 2012 and an additional 51% left in November. The last birds in the population to migrate left Wisconsin on December 11, 2013

2013 wintering

Established, adult birds in the population overwintered in a broad geographic area; with December 2013 distribution estimated five cranes in Illinois, 37 in Indiana, ten in Tennessee, eight in Kentucky, 24 in Alabama, two in Georgia, six in Florida and the rest at unknown locations or missing.

Long-term survival

Long-term whooping crane survival in the EMP is estimated at 44.6%. As of December 2012, there have been 121 recorded mortalities. Cause of death was determined for 39% of mortalities, with leading factors including predation (47%), impact trauma (19%), gunshot (19%) and disease (9%). The majority of mortalities in 2013 were birds two years of age or greater (52%).

2013 Parent-rearing results

2013 was the first year of the planned parent-rearing experiment in the EMP. This experiment is designed 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. This year, 4 parent-reared chicks were placed in individual, temporary pens at Necedah NWR in late September 2013. The temporary pens were all located in areas with adult whooping crane pairs. After a few days of acclimation, the chicks were released. As expected, the chicks formed temporary and longer-term social bonds with adult whooping cranes. Two of the four chicks died at Necedah NWR before migrating (1 vehicle strike and 1 predation), and two chicks successfully completed fall migration. Behavior observations of all chicks was conducted throughout the first year and compared to behavior of similarly-aged costume reared chicks.

Captive population

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

2013 breeding season overview

Captive Breeding Facility updates

Patuxent Wildlife Research Center (PWRC) held 74 whooping cranes (37 males and 37 females), including 26 behavioral pairs. Sixteen of those pairs have laid eggs in the past, but only 10 pairs were productive in 2013. A 10 year old female laid eggs for the first time. This was a disappointing year for production, with 22 eggs laid and only 5 of them being fertile. Causes for the poor production are uncertain, but possibilities include ongoing disturbance of an electrical upgrade, ongoing research and an aging flock. Supplemented by eggs from other sources, Patuxent hatched and reared 30 whooping crane chicks. Eight chicks were sent to White River Marsh, WI in July for the ultra-light led migration release and 10 were sent to White Lake, LA in December for the LA non-migratory reintroduction. Patuxent led efforts in a new reintroduction project for WCEP. In September, four chicks parent-reared by captive adults were shipped to Necedah NWR in WI and released near adult pairs for adoption. Windway Capital donated flights for all chick transfers. Seven chicks died during rearing. In December, Patuxent hosted a Whooping Crane Captive Summit, with participation from all the captive breeding centers and other interested parties. Participants shared current knowledge and protocols and identified needs for improved captive management, including research and genetic management.

The International Crane Foundation (ICF) managed 36 whooping cranes (17 males and 19 females), which included 14 socialized pairs. Nine of the pairs produced 42 eggs total, of which 23 were fertile, 16 infertile, and 4 broken. Three of the fertile eggs resulted in dead embryos

while one egg was euthanized due to its small size and historical difficulty with hatching eggs less than 180 grams. Twelve fertile ICF eggs were transferred, 11 to PWRC and 1 to Calgary Zoo. Seven of the 11 fertile eggs laid at ICF hatched at ICF (63.6%). Fourteen total chicks hatched at ICF, seven from ICF produced eggs, four from the WCEP flock and three from Calgary. All of these chicks were isolation reared with two retained as genetic holdbacks and the remaining chicks as candidates for the Whooping Crane Eastern Partnership modified Direct Autumn Release (mDAR) program. Three chicks died prior to transfer to Horicon National Wildlife Refuge.

The Calgary Zoo (CZ) flock produced 6 fertile eggs that were transported to either Patuxent Wildlife Research Center or International Crane Foundation. CZ held back Cy and Wis's first ever fertile egg which successfully hatched and CZ also received one fertile whooping crane egg from the International Crane Foundation which successfully hatched.

The Audubon Species Survival Center managed 6 male and 5 female whooping cranes (one pair at Audubon Zoo) which produced 6 clutches for a total of 13 eggs (3 from the pair at Audubon Zoo). Only one of those eggs was fertile, which was from A.I. This egg was sent to PWRC, where it hatched. We had one male that was found dead in his pen on January 2. Necropsy results revealed that he had a liver carcinoma that spread to his lungs and kidneys. ACRES flock is still experiencing chronic dermatitis issues in 4 birds, with 2 females being the worst on the uropygial gland and cloaca. This year was also significant in the amount of staff changeover. Of three staff members in the crane program, one staff member was hired in July, and longtime (15 yrs.) manager of the crane program, Megan Savioe, resigned her employment with Audubon in August. A new Assistant Curator, Richard Dunn, was hired to manage the program and started on December 31st.

There were 4 male and 3 female whooping cranes housed at the San Antonio Zoo in 2013. There are two potential breeding pairs, one pair are older birds with declining productivity over the past few years, and the other pair are younger eight year old birds that have yet to show any interest in breeding. In 2013, two eggs were produced, one was fertile and one infertile. The fertile egg was shipped to Patuxent WRC at day 19 of incubation but died at pip.

2013 Captive Population

	Male	Female	Total	Breeding Pairs
Patuxent Wildlife Research Center (PWRC)	37	37	74	26
International Crane Foundation (ICF)	17	19	36	14
Calgary Zoo (Devonian Wildlife Conservation Center and downtown facility combined)	10	12	22	7
San Antonio Zoo (SAZ)	4	3	7	2
Audubon Center for Research on Endangered Species (ACRES)	5	4	9	2
Homosassa Springs Wildlife State Park	1	1	2	0
Lowry Park Zoo	1	1	2	0
Jacksonville Zoo and Gardens	1	1	2	0
Milwaukee County Zoo	1	1	2	0
National Zoological Park	1	1	2	0
Audubon Zoo (New Orleans)	1	1	2	0
Sylvan Heights Waterfowl Park	1	0	1	0
Subtotal in Captivity	80	81	161	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



Environment
Canada

Environnement
Canada

January 14, 2014

2013 WHOOPING CRANE BREEDING SEASON UPDATE CANADIAN WILDLIFE SERVICE

Authors: Mark Bidwell and John Conkin

The 2013 whooping crane breeding season was again productive with a high number of nests detected during the May survey in and around Wood Buffalo National Park (WBNP). Although the proportion of fledged young in August relative to May nests was reduced relative to previous years, it was well within the long-term natural range of variation. High numbers of non-nesting territorial pairs were observed this season suggesting potential for rapid population expansion in upcoming years.

HABITAT CONDITIONS

Annual precipitation (May 2012 to April 2013) preceding the 2013 breeding season was 10 percent above the 60-year average, however the majority of this precipitation accumulated during the summer and fall months of 2012 and was followed by a considerably dry winter and spring. During these seasons precipitation was 48% less than the long-term average. Despite below-average winter and spring accumulation, water levels during May surveys appeared adequate in most parts of the breeding range, giving birds many options for nesting. Surveys conducted during August surveys showed water levels that were noticeably lower. Temperatures were at or above the long-term average throughout the breeding season. Fifty forest fires occurred in

WBNP in 2013. Area affected by fires were 37,941 ha (0.78% of the park), on par with the 25-year average of 1%. Four fires occurred in the whooping crane nesting area, burning 3,678 ha or 0.89% of that area.

BREEDING PAIR AND NEST SURVEYS

Surveys to locate and count whooping crane breeding pairs and nests in and around WBNP were conducted in partnership by the Canadian Wildlife Service and the Parks Canada Agency. Surveys were performed over 27 hours using a Eurocopter 120 Colibri helicopter. During surveys, 74 nesting pairs of whooping cranes were detected. The number of nests detected in 2013 represents the second highest count on record. In addition to nesting pairs, 21-25 territorial pairs were detected suggesting potential for substantial population expansion in upcoming years. Because cranes may move over the duration of the survey, this range reflects the possible number of unique pairs. Eight nests were found outside of WBNP (this is the highest count ever); two in the Lobstick Creek / Foxholes area, and six north of the Nyarling River. A single nesting pair was found in a previously undocumented nesting area; this pair was identified through regular review of locations of whooping cranes fitted with satellite transmitters.

FLEDGING SURVEYS

Surveys to locate and count fledged whooping cranes were conducted over 25.2 hours using a Eurocopter 120 Colibri helicopter. In total, observers

detected 28 fledged young; all family groups had a single offspring. The number of fledged young per nest was 0.38, lower than the 20-year average of 0.48 but within the long term natural range of variation.

STATUS OF MARKED WHOOPING CRANES

In 2009, a multi-agency research project to capture and mark whooping cranes was initiated. Captured birds were fitted with a satellite transmitter (Platform Transmitting Terminal) with Global Positioning System capabilities mounted on a two-piece leg band. Transmitters were programmed to record the bird's spatial location four times daily, recording both daytime and nighttime locations. This schedule allowed for detailed information on diurnal and nocturnal (roosting) habitat use during all stages of the annual cycle, and on migratory behaviour in spring and fall. Through December 2009 to January 2013, 57 whooping cranes were captured and marked with satellite transmitters. Twenty-four adults and two juveniles were marked on the Texas Gulf Coast wintering grounds and 31 juveniles were marked during the breeding season in WBNP.

This ongoing project, carried out by the Whooping Crane Tracking Partnership (WCTP), represents a cooperative effort between five core agencies:

Canadian Wildlife Service, United States Geological Survey, United States Fish and Wildlife Service, Crane Trust, and Platte River Recovery Implementation Program, with support from Parks Canada Agency,

International Crane Foundation and the Gulf Coast Bird Observatory. Specific objectives of the research are to: 1) advance knowledge of breeding, wintering, and migration ecology 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.

During the 2013 breeding season, 34 transmitters provided positional data and aided searches for whooping crane nests and fledged young. Of these marked cranes, it was confirmed that six marked cranes successfully nested and were observed with young during August fledging surveys. In addition to confirmed nesters, comparison of survey data (i.e., nest locations) and satellite locations of marked birds leads us to believe that six additional marked birds likely nested. Observations of whooping cranes during fall staging in Saskatchewan confirmed that one additional marked crane bred in 2013 but was not identified during breeding ground surveys or through review of locations of satellite marked birds.

During the fall staging period in Saskatchewan, 30 transmitters remained active and offered location data. When possible, visual confirmation of marked birds provided information on the birds' status (i.e. with or without offspring or mate). Through September and October, visuals of 13 marked birds were

obtained in the province (six of these observations were of marked birds known or suspected to have nested); four of these were observed to have offspring suggesting that the WCTP's effort to mark birds has not interfered with reproduction. During surveys for marked birds, we observed 116 whooping cranes (110 adults and six juveniles). Of note, a group of 46 whooping cranes was observed northwest of Marcelin, Saskatchewan. To our knowledge, this represents the largest confirmed assembly of staging whooping cranes in Canada.



2013 Louisiana Whooping Crane Report

(Report covers 1 January 2013 through 31 May 2014)

Louisiana Department of Wildlife and Fisheries

Coastal and Non-game Resources



EXECUTIVE SUMMARY

This report covers the period 1 January 2013 to 31 May 2014. As noted in the previous report, 12 birds in the 2012 cohort were released at the White Lake Wetlands Conservation Area (WLWCA) on 17 December 2012. Heavy rains during January 2013 increased water levels in the pen area leaving only a small piece of land. The decision was made to remove food to disperse the birds; food was not replenished, so most birds dispersed the following day. On 11 December 2013, the 10 birds comprising the 2013 cohort were transferred to Louisiana and placed in the top-netted pen at WLWCA. Up to 10 older birds at one time visited the pen site and at times showed aggression toward the younger birds. Food was provided until 26 March; the longer time period necessary due to the recovery of a younger bird from an eye injury.

A total of 21,898 crane location GPS points were mapped between 1 January 2013 and 31 May 2014. For Louisiana, habitat use varied by cohort with the 2010 and 2011 cohorts primarily using agricultural habitats (rice/crawfish fields) and the 2012 and 2013 cohorts primarily using marsh habitats. In Texas, both 2011 and 2012 cohorts primarily used reservoirs/herbaceous wetlands, while secondarily using agricultural habitats for both 2011 and 2012 cohorts. Overall, 7 whooping cranes spent 6 months using mudflats and shallowly flooded areas with exposed emergent vegetation in Lake Ray Hubbard and Lewisville Lake near Dallas. LDWF coordinated with the Texas Parks and Wildlife Department (TPWD) and the U.S. Fish and Wildlife Service (USFWS) during the extended stay of the Louisiana birds in Texas. In summary, habitat use data from reintroduced Whooping Cranes continues to indicate that they are habitat generalists (i.e., utilizing different marsh types, wet agriculture, shallow segments of reservoirs, etc.), with likely generalized diets.

A total of seven birds died during the reporting period and two others are missing/presumed dead. Of the seven, three were shot, two were killed by predators, one died from a parasitic infection/disease (*Cyclocoelom*), and one died from collision with a powerline; two of the three birds who were shot were a pair and were expected to nest this year. Unexpectedly, another pair (L7-11 and L8-11) built a nest in a crawfish field and their first egg was discovered on 24 March 2014 followed by a second egg on 26 March. This was the first active whooping crane nest in Louisiana in over 75 years. The pair incubated full term and incubation behavior was collected during this period. Unfortunately, both eggs were infertile. Later, a renesting attempt occurred with the same fate in a different crawfish field on the same farm outside the reporting period. We expect 3-6 pairs to potentially nest next year provided no pair separation or mortality.

Public education remains a high priority of the reintroduction program. LDWF staff participated in over 45 festivals and events, with a major focus of the education efforts centered on "Give a Whoop!" teacher workshops. A total of four workshops were conducted during the reporting period (78 middle/high school teachers from Louisiana and one from Ohio). In addition to the teacher workshops, a workshop was also provided to the New Orleans Master Naturalist group. The whooping crane public awareness media plan for 2013-14, funded by a grant from Chevron, included the use of billboard space provided by Lamar Advertising, radio commercial space purchased through Louisiana Network (LN), and television commercial space purchased on cable television systems in the Alexandria, Lafayette and Lake Charles metro areas. Billboards alone were estimated to reach almost 1 million viewers. Landowner relationships also remain a top priority and their positive support remains high. We have also initiated education efforts with the crawfish industry.

Throughout the year, there were highs and lows for our program, including the first nesting attempt and two additional shooting incidents. For the former, the pair incubated both their first and second nests to full term without complications from predators, biting insects, or from disturbance related to the crawfish farmer actively fishing the area around the nest. Predators or biting insects has been a major inhibitor for other reintroduction programs, so observing two, full-term incubation attempts for the first nest of this reintroduction is promising. To address our concern with shootings, we continue to provide significant efforts toward education and outreach with the general public, landowners, and farmers, with our region not exempt from shootings that have occurred throughout the country in the last five years. We will continue to find new and exciting ways to ensure that this reintroduction succeeds, including activities associated with our management, research, and education/outreach programs. However, the Louisiana Whooping Crane Team recommends to the Recovery Team that larger cohorts (>16) be provided in the future. Larger cohorts are more desirable because they are 1) more cost effective with the annual resources being invested into the program (for annual budget, see Appendix 1) and 2) better able to fill the vast amounts of suitable habitat in the region, increasing the probability of reintroduction success.

COHORT SUMMARIES, PEN MANAGEMENT, AND SOFT RELEASE

As with the first cohort of whooping cranes the subsequent groups of birds were transported from Patuxent Wildlife Research Center (PWRC) in Maryland to Louisiana in individual crates by airplane, truck and trailer, and finally by boat. Once at the White Lake Wetlands Conservation Area (WLWCA) release site each bird was unloaded and examined by state wildlife veterinarian, Dr. Jim LaCour, before being carried and placed into the 100 foot diameter top-netted pen.

2012 Cohort

On 17 December 2012, 14 juvenile whooping cranes were released into the 1.5 acre open pen at which time they were free to fly in and out of the pen and begin exploring the surrounding marsh. As with the previous cohorts, food was provided in the open pen and the birds were checked each day. Evening roost observations were conducted for two weeks after the birds were released, but similar to the 2011 birds, very little effort was made to encourage them to roost inside the pen. Instead we simply observed and documented where the birds settled down to roost in the evenings. Through the end of 2012 the birds were often observed both inside the release pen as well as foraging and roosting outside the pen in the surrounding marsh.

Heavy rains in January 2013 resulted in flooding and high water levels in the WLWCA refuge marsh. Efforts were initially made to pump the excess water out of the unit to maintain suitable depths for the cranes. Unfortunately, as flood waters continued to flow south, the pressure on the levees was too great and the water could not be pumped out. Cranes continued to use the pen but the usable areas became limited to the elevated island and the floating platform and they were observed swimming between the two. However, they were also observed flying into the pen site from other areas of the surrounding marsh that apparently were still suitable.

By 19 January, two birds (L3 and 5-12) left the release site even though food was still being provided. Data from their transmitters indicated they had moved ~45 miles east to a privately owned coastal marsh location. They remained at that location for several months and were periodically checked from the air as the area was not easily accessible from the ground (see Texas section below for additional information about movements of this group).

With the water remaining high and showing no signs of dropping to appropriate depths, the provision of food at the pen was discontinued by 25 January to encourage the birds to disperse to more suitable habitat. On 26 January 2013, eight birds left and moved ~10 miles north to private property. The four youngest males remained at the pen site until 1 February when they flew north to Avoyelles and West Feliciana Parishes where they spent two weeks (including some time on the Angola Prison property). Thereafter, they moved back south and joined the group of eight birds who had remained just north of the WLWCA property. The following week the group of 12 birds flew south to the Rockefeller Wildlife Refuge (RWR) where the large group dissolved into several smaller groups.

A lone female remained on RWR until she disappeared in August. A group of four birds moved west and settled in a private marsh for ~1.5 months before L4-12 died and the remaining three females moved ~13 miles east to another privately owned marsh near Creole. These three females remained together at this location through the end of the reporting period. Two males moved north into Acadia Parish where L10-12 disappeared, leaving L13-12 by himself. He then moved north into Evangeline Parish where he remained until moving to Jefferson-Davis Parish in mid-September and then Calcasieu Parish in late March 2014. The remaining five birds initially moved north and settled in agriculture fields in Jefferson-Davis Parish for several weeks before moving to a section of leased WLWCA ag property in mid-April where they remained until the end of May 2013 (see Texas section below).

2013 Cohort

On 11 December, the 2013 cohort arrived (n = 10, 7 males, 3 females) and were placed in a small section of the top-netted pen. On 15 December the birds received their transmitters and were banded. Each bird was fitted with a 22 g Microwave Telemetry solar powered GPS satellite transmitter; six birds also received a VHF transmitter to allow real time tracking and observations. After the banding the temporary fence was rolled back and the birds were given access to the entire top-netted pen. Food was provided and the birds were checked each day.

On 2 January 2014, the birds were released into the 1.5 acre open pen and allowed to begin exploring the surrounding marsh. Food was provided in the open pen and the birds continued to be checked each day. Evening roost observations were conducted for two weeks after the birds were released, but similar to the previous two cohorts, very little effort was made to encourage them to roost inside the pen. Instead we simply observed and documented where the birds settled down to roost in the evenings.

Numerous older birds returned to the release site starting in late December 2013 with as many as 10 present in the immediate area around the pen at one time. There appeared to be some interest, as well as some aggression, between the juveniles and the older birds through the fence, in addition to aggression displayed between the different groups of older birds. All older birds had left by 30 December except for a single adult male (L5-11) who remained in the vicinity of the pen and joined the 2013 cohort.

Initially the juveniles were aggressive to L5-11 and kept him from the feeders. As time went on he began to form a bond with one of the young females, L9-13, and as a result became more aggressive to the other juveniles. Small groups of older birds returned throughout the winter for short periods of time but did not cause a problem with the exception of L1 and 6-11. L1 and 6-11 returned in late January 2014 and were successful in driving L5-11 and the 10 juveniles from the pen. Food was removed to discourage them from remaining and they left after four days, at which time food was returned and the juvenile cohort and L5-11 returned to the pen. A third feeder was set up in the release pen in early February as L5-11's aggression and guarding of the feeders from some of the juveniles had increased. Due to a injury to L5-13's eye and his need to recover and reintegrate into the cohort, food was provided in the release pen longer than planned (Planned date: ~25 February; Actual date: 25 March) but it was more intermittent and was ultimately discontinued after 25 March. Water levels and the condition of the marsh were excellent and resulted in the birds remaining in the refuge impoundment at WLWCA after food was no longer provided. Unfortunately, L2-13 was predated in early April and L5-11 was predated in mid-May. A group of three males (L1, 3, & 6-13) began to separate from the other yearlings and have made several excursions away from WLWCA including a brief trip into eastern Texas and back. The rest of the cohort survived and remained in the WLWCA refuge impoundment through the end of this report period.

2012 Birds in Texas

Starting with the first cohort of whooping cranes released in Louisiana, some individuals have made short, exploratory trips into eastern Texas but always returned within several days. In 2013, seven members of the 2012 cohort spent approximately six months in areas around Dallas. As with all previous border crossings, we informed our USFWS and TPWD colleagues, but the lengthy stay of the birds in 2013 raised some concerns, as the birds are considered fully endangered while in Texas. One site visit was conducted by the LDWF whooping crane biologist to view the locations and assess the possibility of retrieving the birds if necessary. Because of the logistics of monitoring these groups, we relied heavily on TPWD colleagues, USFWS Whooper Watch volunteers, and private citizens to monitor the birds along with the data from their transmitters.

More specifically, L3 and 5-12 arrived at Lake Ray Hubbard (LRH), on the east side of Dallas in early May and remained there through early June. They then moved northwest to private land in Wise County for a short time before moving to Lewisville Lake (LL). Both LRH and LL are large reservoirs that would normally be unsuitable habitat, but with the extensive drought in Texas, portions of the reservoirs provided suitable habitat for cranes in the form of mudflats and shallow marsh. When L3 and 5-12 arrived at LL, they found five additional cranes (L1, 6, 7, 8, and 14-12) who had separately travelled to Texas and arrived at LL in early June. The group of five had left Louisiana at the end of May 2013, stayed briefly at a location in Polk County, Texas, and then moved up to Lewisville Lake (LL) on the northwest side of Dallas. All seven birds remained together, but only loosely associated at LL for approximately three weeks. On 17 July 2013, both groups of birds left LL and separated from each other.

The pair returned to LL several days later and except for a brief trip back to LRH, remained there until returning to Louisiana in late October. The pair spent several days at WLWCA before moving on to private agriculture fields in Acadia Parish. In early November, L3-12 died after colliding with a powerline. This was the first mortality associated with a power line strike. L5-12 remained at this location until early-mid January before moving back to her previously used

marsh location in St. Mary Parish. She remained there until early February when she moved to the WLWCA marsh. Interestingly, she was never seen at the release pen and only loosely began to associate with some of the recently released juveniles in the WLWCA refuge in April, but by 5 May 2014, she had returned to her previously used area on LL. She remained there for two weeks before moving ~5 miles west to a different section of the lake where she remained through the end of the report period.

After leaving LL the group of five birds moved to a private ranch on the southeast side of Dallas (Ellis County) where they remained until returning to Louisiana in mid-November. Similar to L3 and 5-12, once back in Louisiana this group of birds returned to the WLWCA for several weeks before moving east to the Audubon Paul J. Rainey Wildlife Sanctuary by early December. The group remained at this location until mid-March 2014 when three of the birds moved back to WLWCA. Ultimately, two of these birds (L1 and 7-12) stayed and remained at the WLWCA through the end of the reporting period. The third bird (L14-12) returned to the Rainey Sanctuary but then came back to the WLWCA area the following week with L8-12 leaving L6-12 alone at Rainey. L6-12 rejoined the group on 11 April on the WLWCA leased property they had all previously used. One month later, L8 and 14-12 departed the WLWCA property and returned to Texas. They moved around for several weeks before settling down on private property in Kaufman County, about 8 miles east of where they spent last summer and fall. Finally on 31 May 2014, L6-12 also left WLWCA and ultimately moved to private property in Ellis County, Texas, very close to where she spent last summer and fall and within 7-10 miles of the two birds in Kaufman County.

Additional information (e.g., individual band colors, radio frequencies, etc.) on surviving reintroduced Whooping Cranes is summarized in Appendix 2.

COHORT DISTRIBUTION AND HABITAT USE

Crane movements were monitored weekly to document distribution and habitat use of individuals and flocks. All cranes are initially equipped with either a Northstar or Microwave GPS satellite transmitter; currently no cranes carry a functional Northstar transmitter, but during this reporting period, several were still active. Northstar transmitters were programmed to transmit every 72 hours, over an 8 hour period. Therefore, there is a 3 day lag time between data downloads, resulting in GPS locations that are not real-time data. Microwave transmitters are programmed to transmit every 48 hours, over an 8 hour period reducing the lag time to 2 days. For both transmitter types, location data were collected at three time periods: 8 AM, 4 PM, and midnight. Location point data from 1 January 2013 through 31 May 2014 have been assessed for each crane outfitted with a GPS satellite transmitter to illustrate the difference in habitat utilization between cohorts (Fig. 1).

A total of 21,898 crane location GPS points were mapped between 1 January 2013 and 31 May 2014. Of these points, 19,069 (87%) were in Louisiana (Fig. 2) and the remaining 2,829 (13%) were in Texas (Fig. 3). 539 points (2%) were for two cranes from the 2010 cohort, 8,953 points (41%; 14 from TX) for 11 cranes in the 2011 cohort, 9,774 points (45%; 2,815 TX) for 14 cranes in the 2012 cohort, and 2,632 points (12%) for 10 cranes in the 2013 cohort. Habitat classifications for Louisiana include defined agricultural land (rice/crawfish) and herbaceous wetlands/marsh. Texas habitat classifications include undefined agricultural land and reservoirs/herbaceous wetlands/marsh. The following results will cover GPS points within Louisiana and Texas separately.

Louisiana

Of the 539 points for the 2010 cohort, 99.8% were in agricultural land (rice/crawfish) and 0.02% were in herbaceous wetlands/marsh. Of the 8,939 points for the 2011 cohort, 81% were in agricultural land (rice/crawfish) and 19% were in herbaceous wetlands/marsh. Of the 6,959 points for the 2012 cohort, 42% were in agricultural land (rice/crawfish) and 58% were in herbaceous wetlands/marsh. Of the 2,632 points for the 2013 cohort, 1% were in agricultural land (rice/crawfish) and 99% were in herbaceous wetlands/marsh.

Location point data for Louisiana within this timeframe suggests that cranes in the 2012 and 2013 cohorts are utilizing herbaceous wetland and marsh habitat more than agricultural land (Fig. 4). Despite the downward trend of agricultural

land utilization, it should be noted that the 2010 location point data is only represented by two cranes covering 2% of all Louisiana GPS points. Also, yearling cranes of the 2013 cohort have not yet begun to explore habitat away from the WLWCA marsh, resulting in high herbaceous wetland/marsh habitat utilization.

Texas

A total of 2,829 crane location GPS points were mapped in Texas. Of the 14 points for the 2011 cohort, 29% were in undefined agriculture and 71% were in reservoirs/herbaceous wetlands/marsh. Of the 2,815 points for the 2012 cohort, 17% were in undefined agriculture and 83% were in reservoirs/herbaceous wetlands/marsh (Fig. 5).

Landowner Sentiment

We continue to be pleased by landowner cooperation and enthusiasm for the project and thus far, no landowner has denied our request to access their property. The vast majority of landowners have been fully engaged and excited about cranes on their land. Once a crane is located on a new property and remains there for several days, we attempt to find the owner or farmer for the property, then contact them and set up a meeting to discuss the project. We discuss the individual bird or birds that are on their property, as well as our needs or requests for accessing their property in order to monitor the birds. Additionally, we gather information on the management activities in their fields (to assist with habitat evaluations), while providing them with information about the project and landowner appreciation gifts (e.g., coffee mugs and t-shirts). Additionally, a thank you card from LDWF's administration is sent to the landowner or farmer thanking them for their support of the project and our efforts. To date, we have met and worked with over 80 landowners and farmers.

MOLTING

Seven birds from the 2011 cohort were documented in 2013 undergoing the first molt of their flight feathers; the other two and three year old birds (5 from the 2011 cohort and 2 from the 2010 cohort) were confirmed as not molting in the spring of 2013. Molting of the seven birds was confirmed between 10 and 14 June by visual observations, though at this point the birds already had new feathers growing and had likely begun molting 1.5-2 weeks earlier. A group of seven birds who normally resided in agriculture fields in Avoyelles and Rapides Parishes returned to the WLWCA marsh prior to four members of that group molting. The group of seven split up into several smaller groups while the birds were molting, but all seven rejoined and returned to their previously used farm locations once molt was completed. Also, a separate group of three birds that normally resided in rice and crawfish fields in Jefferson-Davis Parish underwent their first molt. These birds remained in the same agricultural region in Jefferson-Davis Parish, but they moved several miles north to a larger, more remote rice field prior to molting their feathers. All birds survived and were confirmed able to fly again after approximately six weeks.

In spring 2014, we anticipated some of the 2012 and the remaining 2011 birds would undergo molt with specific efforts made to monitor these birds. Four birds — two 3-year olds and two 2-year olds — were documented molting during the spring. Other birds who could have molted this spring did not, though the status of three of the four birds who returned to Texas this spring is unknown. Unlike last year, these birds all remained at their current or normal home areas to undergo molt: two molted in crawfish fields, one in a private marsh, and one in the WLWCA refuge marsh. Unfortunately, L5-11 was predated in the WLWCA marsh while he was vulnerable and unable to fly; his new feathers were ~1/3-1/2 emerged upon collection of the carcass. The other birds recently completed their molt and are flying, though all of the details have not been compiled and will be summarized in the next report.

PAIRING AND REPRODUCTION

Due to the poor survival of the 2010 cohort only two birds reached breeding age (3 years old) in 2013: L5-10, a solitary female, who had been alone since leaving the pen site after being released and who seemed unlikely to pair. Unfortunately, she did not have a chance as she was shot and killed in May 2013. The second bird, L3-10, a male, had been alone for more than a year before he paired with a 2011 female in the fall of 2012. However, chances of

reproduction were still limited due to the young age of the female. All other birds in the population were under three years of age and remained in their sub-adult groups throughout the spring of 2013.

In late December a group of seven 2011 birds who normally resided in agriculture fields in Rapides and Avoyelles Parishes, returned to the release pen. Additionally, a trio of 2011 birds from Jefferson-Davis Parish also returned to the release pen. As a result of these flocks interacting, the groups began to dissolve and pairs were formed. L7 and 8-11 who were from separate groups immediately paired, established a territory in a new location, and nested twice in the spring of 2014. The other pairs that formed were monitored closely for signs of breeding but no nesting behavior was observed.

L3-10 & 4-11 - L3-10 separated from his juvenile group in the summer of 2011 and remained alone for over a year until he joined a trio of 2011 birds in Jefferson-Davis Parish in October 2012. Several months later, L4-11, a lone female, joined the group. She and L3-10 immediately paired, although they remained, and were most often seen, with the trio as a loose group of five. L3-10 and L4-11 remained in the area as the winter progressed but were more often seen separate from the trio. Due to their young age no breeding was expected from them in 2013 and we were therefore surprised when a farmer mentioned they had built a nest in his crawfish field (~22-23 February; Fig. 6). The birds were seen on and near this platform for about a week but no eggs were produced due to the young age of the female and the pair did not defend the platform from other birds. Several weeks later on 18 March, the birds were observed building a new platform in a different crawfish field, but again, no eggs were produced and the pair did not remain in the area or defend the nest. The pair separated for unknown reasons in early May and remained apart until reuniting in late October. Similar to the previous winter they loosely associated with the trio during the fall, but they spent more time separate as winter progressed. Unfortunately, both birds were shot in early February 2014; L4-11 was killed and L3-10 was injured and later had to be euthanized.

L1 & 6-11 – Originally part of a group of seven birds that left the release site and settled in agriculture fields in Avoyelles and Rapides Parishes in summer 2012. The group returned to the WLWCA refuge in spring 2013, but these two birds separated from others in the group who were molting. Once the birds had completed their molt and were able to fly again, all seven birds returned to their previous location. The group of seven remained together until December when they once again returned to WLWCA and the group began to dissolve. Although clearly a pair, these two birds continued to loosely associate with three other members of their former flock as they moved back and forth between WLWCA and their Avoyelles Parish location until mid-April. After that time they remained at WLWCA and the other three birds returned north. The pair remained in the WLWCA refuge through the end of the reporting period with no nesting behavior observed.

L7 & 8-11 – L7-11 was originally part of a flock of seven birds that inhabited mainly rice and crawfish fields in Avoyelles and Rapides Parishes. L8-11 was originally part of a trio of birds who inhabited rice and crawfish fields in Jefferson-Davis Parish. This pair formed immediately when both groups were present at the release pen in late December 2013. After leaving the marsh the pair moved north and set up a territory on a private farm in Avoyelles Parish, ~10 miles south of the area previously used by the female and ~50 miles northeast of the area previously used by the male. Detailed nesting information for the first nest follows.

L10 & 11-11 – Originally part of a trio of birds that lived in agriculture fields in Jefferson-Davis Parish. Observations made during a capture of the third member of this trio in April 2013 indicated these two were dominant and showed signs of becoming a pair. The trio returned to WLWCA in December 2013 and encountered the Avoyelles flock. The extra male from this trio (L8-11) immediately paired with a female from that flock (L7-11) leaving these two as a pair. The pair continues to spend most of their time in agriculture fields in Jefferson-Davis Parish, with repeated trips back to WLWCA throughout early 2014. No nesting behavior has been observed.

L7 & 8-11 Nest Monitoring

On 7 March 2014 a farm manager in Avoyelles Parish notified us about a possible nest platform that had been constructed in a crawfish pond. On 10 March, the reported nest platform was confirmed, but the adults (L7-11 and L8-11) were not defending it. The pair and the nest platform were checked a week later on 17 March, but the pair continued to

not guard the platform and no eggs were observed. On 24 March, the farm manager notified us that the pair had built a new platform in a different crawfish pond and that this nest contained one egg. The reported nest was checked the following day and the male (L8-11) was observed incubating the egg as the female (L7-11) foraged nearby (Fig. 7). On 28 March, the farm manager reported that a couple days earlier, on 26 March, he had observed a second egg in the nest. This was the first nest with eggs produced by whooping cranes reintroduced to Louisiana and the first active whooping crane nest in the Louisiana wild in 75 years. The pair successfully incubated this nest beyond term, but after being collected, the eggs were determined to have been infertile. Thereafter, they re-nested and again incubated two eggs past term that were also infertile, but at this point, that data has not been compiled or analyzed yet and therefore is not included in this report. Thus, the pair incubated both their first and second nests to full term without complications from predators, biting insects, or from disturbance related to the crawfish farmer actively fishing the area around the nest. Disturbance by predators or biting insects has been a major inhibitor for other reintroduction programs, so observing two full-term incubation attempts is promising for the first nest of this reintroduction.

Methods

The nest was monitored two times per week during the incubation period from a camouflaged blind placed along a tree line approximately 300 meters from the nest. Monitoring was randomly alternated among three time periods: morning (7:00 am – 10:00 am), midday (11:00 am – 2:00 pm), and afternoon (3:00 pm – 6:00 pm). The amount of time an adult spent on the nest was recorded and detailed notes were made on the behavior of the incubating adult, as well as that of the non-incubating adult and its approximate distance from the nest. General habitat conditions, weather conditions, predators seen in the area, bird species in the nest vicinity, and various behaviors displayed by the nesting pair were also documented.

Results

Incubation Behavior

A total of seven nest monitoring sessions (21 observation hours) were completed while the nest was active consisting of three morning, two midday, and two afternoon periods. The monitoring occurred from 3 April until 25 April 2014. The average nest attendance period (time spent on the nest) was greater for the male (107.4 min) compared to the female (69.1 min). The eggs were incubated 98.1% of the time, and the pair averaged 1.4 nest exchanges per 3-hr monitoring period. When the adults were away from the nest, the male and female spent similar amounts of time, on average, at distances greater than 50 m from the nest (64.7 min and 59.0 min, respectively) and most of that time was spent foraging. The female, however, spent considerably more time within 50 m of the nest when not incubating (avg. = 48.9 min) compared to the male (avg. = 7.8 min).

Nest Site and Nest Dimensions

Both nest platforms were constructed in flooded crawfish ponds on the same farm but in separate impoundments. Based on observations made by the farm manager, each nest was completed in approximately 1-2 days. Crawfish were being actively harvested by the farmer in a crawfish boat on a regular basis (initially every second morning and later every morning) during the entirety of the incubation period; the whooping cranes tolerated this disturbance with proximity of boat passage on either side of the nest approximately 5-10 meters. However, 35 days after the laying of the second egg (30 April 2014) and without evidence of hatched chicks, the nest was visited and the eggs were collected. At this time, several measurements were collected at each nest. The first nest measured 1.5 m x 1.6 m and the second nest, which contained the eggs, measured 1.1 m x 1.1 m. The height of the first nest from its base to its apex was 40 cm and it protruded 12 cm from the surface of the water, while the second nest was 39 cm tall and also protruded 12 cm from the surface of the water. Mean water depth taken 1 m from the nest in each cardinal direction was 29.8 cm around the first nest and 29.5 cm around the second nest. Percent open water within 1 m, 5 m, and 10 m of the first nest was 100%, 100%, and 99%, respectively, and of the second nest was 100%, 100%, and 90%, respectively.

On the day the eggs were collected, three costumed biologists approached the nest, with this endeavor also used as an opportunity to capture and replace the poorly functioning transmitter of L8-11. Both adults were aggressive and attempted to defend the nest from us. Once the male was captured, a noticeable 'rotten egg' smell was detected on him and was also detected from the eggs at the nest. The eggs were refrigerated and taken for examination by Dr. LaCour the

following day. Weights and measurements were recorded for each egg before they were opened. The eggs weighed 173 and 188 g and measured 105.4 x 58.7 mm and 112 x 60.1 mm. The contents of each egg were broken down and there was no evidence of either of them having been fertile. The contents were cultured and revealed heavy growth of the bacterium *Burkholderia cepacia* in one egg and *Aeromonas hydrophila* in the other. Both bacteria are associated with aquatic environments and both are capable of causing disease. It is likely that these bacterium were in the aquatic environment, but entered the infertile eggs after normal defense mechanisms of the egg were compromised; this is not anticipated to occur with fertile eggs.

MORTALITY, MORBIDITY, AND HEALTH ISSUES

To date, we have experienced mortality in all crane cohorts. Total survivorship for all cohorts is 58%, with 0% survivorship for the 2010 cohort, 63% for the 2011 cohort, 71% for the 2012 cohort, and 90% for the 2013 cohort. Survivorship has increased dramatically since the first cohort with one year survival increasing from 30% with the 2010 cohort to 75% and 71% for the 2011 and 2012 cohorts, respectively. Five mortalities are attributed to wanton shooting by people (24% of mortalities), 4 to presumed predation (19%), 2 to disease (9%), 1 to power line collision (5%) and 9 for unknown causes (43%). Even though shooting has contributed significantly to our mortality numbers, Louisiana has not been the only region with wanton shooting of whooping cranes and it unfortunately appears to be an increasing problem nationwide.

Whooping cranes that are handled for any reason (primarily transmitter change) receive a cursory physical examination and samples are obtained for the following routine tests: fecal parasite examination, cloacal culture, complete blood count, serum chemistry, and serological testing for Inclusion Body Disease of Cranes (IBDC). To date, fecal examinations have detected *Capillaria* spp. (nematodes). Neither *Salmonella* sp. nor other pathological bacteria have been found upon cloacal culture. IBDC tests have been negative and the only hematological abnormality detected has been an eosinophilia possibly attributable to parasite infestation. The number of birds recaptured and sampled thus far has been small, but we have saved extra serum for potential future research or disease screening; in the future, we plan on saving whole blood samples.

Mortality (Mortality Table – see Appendix 2.)

Overall survival continues to be satisfactory and appears to level off after the initial months following release of a new cohort of juveniles (Table 1). Unfortunately, there were two additional shooting incidents that resulted in the deaths of three birds and gunshot now accounts for 24% of the mortality in this population. Both cases remain open and unsolved with large financial rewards offered for information leading to the arrest and conviction of the person(s) responsible. Predation or suspected predation, particularly of newly released birds, remains a high cause of mortality including an older bird that was predated while molting in May 2014. Below is a summary of mortalities observed throughout the reporting period with a summary of all mortalities to date in Appendix 2.

L10-12 - Mortality for this bird has not been confirmed but he is missing and presumed dead. Last seen alive on 1 February 2013 at the release pen with three other birds. Transmitter data indicated he left with other birds later that day and group moved extensively over the next two weeks, meeting and splitting up from other cohort members. He and one other juvenile separated from others and moved to a new location in Acadia Parish by late afternoon of 17 February. The GPS transmitter stopped working after providing an 8 AM location on 18 February, and the companion bird moved to a new location after this time but was found alone indicating something had happened to L10-12. Area of last location was searched from the air and ground but nothing was found. Local landowners indicated there have been problems with poachers in the area.

L5-10 - Last seen alive on 26 March 2013 in normal home area and GPS data indicated she remained there through the morning of 29 March. Thereafter, she left and made significant movements around the state over the next week, eventually ending up in NW Louisiana using fields in the vicinity of the Red River. By 8 April she was using fields east of the river and transmitter data indicates she was alive through 9 April. Unfortunately GPS data is missing until the next point at 1600 on 14 April at which time she was already dead (based on additional GPS points on the 15th that did not change). Given the relatively fresh condition of the carcass, she was probably killed late on the 13th or earlier on the 14th.

The carcass was collected from the bank of the Red River on 16 April 2013. The carcass had been scavenged so predation was initially thought to be the cause of death, but the necropsy revealed she had been shot. A \$15,000 reward was raised and offered for information but this case remains open and unsolved.

L4-12 - Last seen alive on the morning of 1 May 2013 in a private marsh near Cameron. At that time the bird was with three other cranes and appeared to be acting and behaving normally. Transmitter data over the next few days appeared normal and indicated all four birds remained together through the morning of 4 May. However, by the afternoon of 4 May, the rest of the group had moved ~13 miles to the east while *L4-12* stayed behind. The area was checked on 5 May and while the VHF signal could be heard, the bird was not seen or found. On 7 May the GPS transmitter failed to turn on as scheduled, further confirming a problem. A flight was conducted over the area and from the air the bird was seen in the middle of a dense patch of bulrush about 400 yards SW of the last GPS point. The emaciated and intact carcass was recovered the next day and the extremely fresh condition suggested the bird had probably only died the previous day. Necropsy results determined cause of death was due to Trematodiasis (*Cyclocoelum* sp.) resulting in hepatitis and bacterial septicemia and emaciation. This is the first time this parasite has been identified in whooping cranes and we will continue to screen for it when samples are collected.

L9-12 - Mortality for this bird has not been confirmed, but she is missing and presumed dead. Last seen alive on 7 August 2013 during a flight over the area of the Rockefeller Refuge where she had been since mid-February. Her transmitter had not functioned well, often missing GPS points. She is believed to have died or been predated ~10 August, the date of the last data received from her transmitter. Multiple searches of the area from the air and from the ground were not successful in locating her remains. Starting in March 2014, several Doppler data points have been received from her transmitter and additional searches have been conducted with these still not successful in locating the transmitter. However, the additional data in the same location without a sighting of the bird is further proof she is indeed dead.

L3-12 - Last seen alive on private property in Acadia Parish on 1 November 2013. Had spent previous six months in Texas with another yearling bird from its cohort. Returned to Louisiana on 20 October and moved around to several different locations before arriving at this location by the afternoon of 30 October. GPS transmitter turned on as scheduled on 4 November and data looked normal through the afternoon of 2 November with two points after that missed due to low battery. The transmitter turned on again, as scheduled on 6 November, but this time new data indicated a problem with the GPS points remaining stagnant after 1600 on 3 November. The carcass was collected on 7 November from directly beneath a power line and had a badly broken left leg and an almost completely severed left wing. Necropsy confirmed the cause of death as power line collision.

L4-11 - Last seen alive in normal use area in Jefferson-Davis Parish on 26 January 2014. Transmitter data in the following days appeared normal. When next checked on 7 February, she was found dead; mate was alive but injured with a broken wing. The fresh condition of the carcass as well as an observation relayed to us from a local landowner in the area suggested the bird had been killed the previous day (6 February). Wounds on the carcass and the injured mate suggested the bird had been shot which was later confirmed on necropsy. The final report has not been received and the case remains open with a \$20,000 reward for information leading to the arrest and conviction of the perpetrator(s).

L3-10 - See morbidity section below for additional details about injury and treatment. Last seen alive in normal use area in Jefferson-Davis Parish on 26 January. Did not have a functional PTT, but the data from mate's PTT was normal in subsequent days. When next checked on 7 February, bird was found alive but with a broken left wing and mate was dead. Bird was captured, held overnight, and taken to the LSU School of Veterinary Medicine the next morning. Surgery to repair the broken wing was performed on 9 February and initially the bird appeared to be stable but with a very guarded prognosis. On 18 February, his condition began to decline, and by the following morning he was unable to stand so he was euthanized.

L2-13 - Last seen alive at the release pen on 25 March with *L5-11* and other members of 2013 cohort. Possibly in group of juveniles seen flying over release pen on 26 March and VHF signal later heard to the S/SW of pen with other juvenile VHF signals. VHF signal not heard from pen site on 1 and 3 April even though most/all other juvenile signals heard. PTT failed

to turn on after 1 April and remains were recovered on 7 April in a small, deep pool of water, surrounded by thick vegetation at the west end of the refuge. Remains were not complete, but predation is suspected and a bite mark attributable to a coyote was found on one of the femurs.

L5-11 - Last seen alive in the WLWCA refuge with another bird during an aerial survey on 7 May, though positive identification could not be confirmed from the air and was assumed based on location, number, and identity of other birds seen in the area. GPS transmitter failed to turn on as scheduled after 11 May and remains were picked up on 19 May. Bird was likely killed late on 11th or 12th; additional data from transmitter indicates he was definitely dead by 17 May PM. Bird was molting (new feathers 1/3 – 1/2 emerged) and apparently unable to escape suspected coyote predation.

Morbidity

L10-13 - Towards the end of January 2014, well over a month after she was banded, L10-13 appeared to have a sore on the front of each hock where her transmitter bands rested. It is normal for the birds to develop a small callus at this location, but from a distance hers looked more like a wound rather than a callus similar to what other birds developed. She was picked up on the 30 January 2014 to be examined. Luckily, there were no infected wounds, just slightly larger and discolored calluses. As a precaution, the VHF transmitter was removed from her left leg that appeared slightly more irritated.

L3-10 - On 7 February 2014, L3-10 was found alive but with a broken left wing after having been shot. He was captured and transported to a temporary pen set up at the WLWCA lodge. He was given pain medication and provided with food and water for the night before being taken to the LSU School of Veterinary Medicine the following morning. Examination and radiographs revealed an open fracture of the left humerus as well as a fractured radius. Surgery to repair the humerus was scheduled for the next day. A pin and external fixator were placed to stabilize the bone and although the surgery went well, the recovery period would be long and the eventual outcome very uncertain. The bird tolerated captivity and initially tolerated an IV catheter in his leg for antibiotics. On 11 February 2014, he was moved to a temporary pen set up in a back pasture of the vet school property and was briefly handled/restrained twice daily for medication. A variety of live food items were offered to stimulate his appetite and he began to show some interest in eating. However, on 18 February, he seemed weaker and became exhausted after repeatedly falling and struggling to get back up. By the next morning he was unable to stand and the decision was made to euthanize him.

L5-13 - On 27 February 2014, L5-13 was found with his right eye scabbed and swollen shut as well as abrasions on the cranial portion of his neck just below the head. Examination the following day revealed that the eye itself was not injured but the nictitating membrane and lower eyelid had moderate to severe injury (Fig. 8). The necrotic tissue was debrided and the bird received long-acting antibiotics as well as topical antibiotics while being kept in a temporary pen over the next four days. Although his eye improved, he was stressed and would not eat. He was then moved to a small section of the top-netted pen on 5 March, but escaped his temporary enclosure the next day and was ultimately released into the open pen with the other birds. Unfortunately, the other cranes chased him and he flew off by himself; later he returned to the pen and began to loosely associate with the other birds again by 13 March. On 25 March he was briefly restrained so his eye could be examined and although much improved the tissue above his eye remained drooped down resulting in his eye not appearing fully open and likely decreasing the range of vision out of that eye (Fig. 8, second and third photos). Despite this he appeared to eat, drink, forage, fly, and interact with the other birds normally. Since that date, with food having been discontinued at the pen, a close view of the eye has not been obtained and it is unknown if the drooped tissue has fully retracted or will always remain. L5-13 has remained in the WLWCA refuge, separate from the other members of his cohort, but several times he has been observed with a pair of older birds.

EDUCATION, OUTREACH, AND MEDIA

Teacher Workshops

As with the previous year's whooping crane education and outreach program, the 2013-2014 season was similar with a large portion of outreach centered around hosting "Give a Whoop!" educator workshops. In total, four workshops were

hosted between 14 September 2013 and 11 February 2014 in different locations across Louisiana. A total of 78 educators from Louisiana and one individual from Ohio participated in these professional development workshops. The majority of these educators were middle and high school teachers.

As before, each day-long educator workshop featured an overview of the LDWF whooping crane reintroduction program presented by an LDWF biologist. Participants were given a historical overview of the cranes, reasons for their near extinction, information about the various recovery efforts that have taken place across North America, as well as the current reintroduction effort in Louisiana. Participants of each workshop were required to take a pre- and post-test, with questions comprised of topics discussed throughout the course of the workshop. Additionally, each participant completed an evaluation form, rating their “Give a Whoop!” workshop experience.

Similar to the 2012-2013 “Give a Whoop!” workshops, every participant engaged in a structured field activity where participants learned how to plot points using a GPS, measure, and enter coordinates for potential whooping crane habitat. This field activity allowed participants to become familiar with their GPS units prior to utilizing the devices in their respective classrooms, which is where they will ultimately incorporate these engaging GPS lessons. The “Give a Whoop!” binder provided to each participant included the following lessons:

High School

1. Taxonomy: *It’s a Big White Bird!* - Students make dichotomous key for big white birds found in Louisiana
2. Ecosystems: *A Whooping Good Place to Live* - Students create a Cajun Prairie Newsletter featuring stories about the Whooping Crane
3. Reproduction: *It Starts with a Song and a Dance* - Students compare life cycle, embryonic development of Whooping Crane
4. Adaptation: *Craning to Survive* - Students compare crane leg, skull, and wing to other organisms

Middle School

1. Endangered Species: *Where have all the Whoopers Gone? A Webquest* - Students research crane facts, conservation efforts, & habitat needs
2. Adaptations: *What do Whoopers Eat?* - Students compare bird beaks via Bird Beak Buffet activity
3. Current Events: *Whooping Crane Weekly* - Students produce a newspaper on the crane
4. PSA: *It Takes Us to Save the Whoopers: Creating a Public Service Announcement* - Students produce a PSA on the reintroduction program

Technology

1. GPS: *Where do Whoopers Live? Using GPS and GIS* - Students are introduced to using GPS & participate in a school ground scavenger hunt
2. QR Codes: *Decoding Cranes* - Students learn how to create a QR code using Whooping Crane information.

In summary, each participant of the “Give a Whoop” workshops received the following workshop deliverables:

- Workshop binder containing whooping crane factsheets, high school, middle school, and technology-based lesson plans, black line masters, rubrics, and additional resources
- USB memory stick containing all lessons within the binder, PowerPoints presented, electronic version of poster, Whooping Crane video footage, a large number of whooping crane photos, and related factsheets
- Garmin Etrex 20 GPS Unit
- Life sized “How Do You Measure Up” poster

In addition to the traditional educator workshops, LDWF staff also conducted a Master Naturalist whooping crane workshop for the New Orleans Master Naturalist certification program with the agenda modified to reflect the needs of this specific group.

Several new items were created to help promote the project and spread our message and these items were used during the “Give a Whoop!” educator workshops as well as various outreach events around the state. LDWF staff participated in

over 45 different festivals and events talking about or displaying information about the project to the public (~5,400 people).

A small Louisiana crane ID card (Fig. 9) was created to illustrate and describe the differences between whooping cranes and sandhill cranes, both of which can now be found in Louisiana. Four retractable banner stands with the “How Do You Measure Up” life size whooping crane image were created (Fig. 10). These attractive banners are easy to use at festivals and events and allow participants to see “how they measure up” to a whooping crane. A mannequin (Fig. 10) was also purchased to display the costume that is worn while rearing and working with the whooping cranes.

Public Awareness - Media

The LDWF public outreach media plan included the use of billboard space provided by Lamar Advertising, radio commercial space purchased through Louisiana Network (LN), and television commercial space purchased on cable television systems in the Alexandria, Lafayette, and Lake Charles metro areas.

11 vinyl signs (ranging from 10 x 36 to 14 x 48 feet) are displayed in five markets around the state on billboard space donated by Lamar. The targeted markets included Alexandria, Houma, Lafayette, Lake Charles, and Shreveport -- resulting in an estimated 979,751 weekly views by the traveling public. The new design (Fig. 11) featured a photo of two Whooping Cranes from the Louisiana reintroduction in flight (photo donated by photographer Steve Uffman). Weekly estimated views of each sign is depicted in Table 2.

The 30-second LN radio ad was broadcast 1,992 times in the Alexandria, Lafayette, and Lake Charles markets in two flights including fall 2013 dates and winter-spring 2014 dates. The message again stressed the presence of cranes now in the state, the need to observe them from a distance if encountered, and a call to action to alert LDWF’s Enforcement Division if anyone was observed harming Whooping Cranes.

Cable television viewers were targeted with a 30-second ad that re-enforced the same message of the radio ads. Time was purchased on cable systems in the targeted areas of Alexandria, Lafayette, and Lake Charles. A total of 4,933 television spots were scheduled on cable networks including Arts & Entertainment, County Music Television (CMT), Discovery Channel, ESPN, ESPN2, Fox Sports South, FX, Headline News, History Channel, MTV, NBC Sports, National Geographic Channel, Spike, and The Weather Channel, TNT, Tru TV, USA and VH-1.

During 2013, LDWF partnered with Louisiana Public Broadcast (LPB) to produce a 27 minute video documenting the reintroduction of Whooping Cranes back into Louisiana. Louisiana has a long rich history of Whooping Cranes, and due to their absence of over 60 years, the Department felt it was important to partner with LPB to document both the national and Louisiana efforts being invested to restore this species. This particular video is part of the *Alive in America’s Delta* series and called, “The Whooping Crane’s Majestic Return.” This wonderful video is available for purchase from LPB at www.lpb.org.

RESEARCH PRODUCTS

Along with formal and informal public outreach, our program has also produced several peer-reviewed publications and presented to the scientific community. Topics primarily focused on the whooping crane reintroduction into southwestern Louisiana and the suitability of Louisiana marsh habitat for whooping cranes. In addition to these published articles, we also have several manuscripts in preparation, particularly two manuscripts regarding the habitat use and movements of reintroduced Whooping Cranes. We hope that both of these will be submitted and *in review/in press* by the next reporting period.

Publications

Kang, S. R., and S. L. King. 2012. Influence of salinity and prey presence on the survival of aquatic macroinvertebrates of a freshwater marsh. *Aquatic Ecology* 46:411-420.

- Kang, S. R., and S. L. King. 2013. Influence of Hydrologic Connectivity on Pond Environmental Characteristics in a Coastal Marsh System. *Southeastern Naturalist* 12:568-578.
- Kang, S. R., and S. L. King. 2013. Effects of hydrologic connectivity and environmental variables on aquatic macroinvertebrate assemblages in different marsh types. *Aquatic Biology* 18:149-160.
- Kang, S. R., and S. L. King. 2013. Effects of hydrologic connectivity and environmental variables on nekton assemblage in a coastal marsh system. *Wetlands* 33:321-334.
- Kang, S. R. and S. L. King. 2013. Nekton assemblage structure in a flooded coastal freshwater marsh. *Wetlands* 33:321-334.
- Kang, S. R. and S. L. King. 2013. Seasonal comparison of aquatic macroinvertebrate assemblages in a flooded coastal freshwater marsh. *Open Journal of Ecology* DOI: 10.4236/oje.2013.32014
- Kang, S. R., and S. L. King. *In Press*. Suitability of Coastal Marshes as Whooping Crane Foraging Habitat in Southwest Louisiana, USA. *Waterbirds*.
- Zimorski, S., T. Perkins, and W. Selman. 2013. Chelonian species in the diet of reintroduced Whooping Cranes (*Grus americana*) in Louisiana. *The Wilson Journal of Ornithology* 125:420-423.

Presentations

- Perkins, T. and S. King. 2014. The spatial and temporal use of habitats by a reintroduced population of Whooping Cranes in Louisiana. 13th North American Crane Workshop, Lafayette, Louisiana. Oral Presentation.
- Zimorski, S., T. Perkins, V. Dinets, and S. King. 2014. Whooping Cranes return to Louisiana: the first three years. 13th North American Crane Workshop, Lafayette, Louisiana. Oral Presentation.
- Zimorski, S., J. LaCour, J. Nevarez, K. Saile, J. Wignall, J. Brandão, A. Granger, P. Queiroz-Williams. 2014. Recovery and management in a field environment of a juvenile Whooping Crane following surgery to repair a fractured left coracoid. 13th North American Crane Workshop, Lafayette, Louisiana. Poster Presentation.

Table 1. Post-Release Survival of Each Cohort (Table is current thru 27 June 2014). Green shaded cells represent current survivorship of last three cohorts.

Post-release Survival	2010 Cohort (3/14/11)	2011 Cohort (12/27/11)	2012 Cohort (12/17/12)	2013 Cohort (1/2/14)
3 months	8/10 = 80%	15/16 = 93.75%	13/14 = 92.9%	9/10 = 90%
6 months	7/10 = 70%	14/16 = 87.5%	12/14 = 85.7%	
9 months	3/10 = 30%	12/16 = 75%	11/14 = 78.6%	
12 months	3/10 = 30%	12/16 = 75%	10/14 = 71.4%	
15 months	2/10 = 20%	12/16 = 75%	10/14 = 71.4%	
18 months	2/10 = 20%	12/16 = 75%	10/14 = 71.4%	
21 months	2/10 = 20%	12/16 = 75%		
24 months	2/10 = 20%	12/16 = 75%		
2.5 years	1/10 = 10%	10/16 = 62.5%		
3 years	0/10 = 0%			

Table 2. Weekly estimated people viewing billboards that advertise the Whooping Crane reintroduction program.

Size	Metro Area	Location	Estimated Weekly Views
10 x 36	Alexandria	I-49 and Hwy 71	44,088
10 x 36	Houma	700 W. Tunnel Blvd.	106,195
10 x 36	Houma	960 Grand Caillou Rd.	101,150
10 x 36	Houma	616 Grand Caillou Rd.	69,960
10 x 36	Lafayette	Hwy 167 @ Elias G. Rd.	60,869
12 x 40	Lafayette	US 90 @ Morgan Rd.	105,899
12 x 40	Lake Charles	I-10 @ Hwy 97	74,307
12 x 40	Lake Charles	I-10 @ Exit 7	51,113
14 x 48	Lake Charles	I-210 @ Hwy 90	39,948
10 x 40	Shreveport	I-20 @ Jewella Ave.	165,457
14 x 48	Shreveport	I-49 @ West 70 th	160,765
Totals			
11 Billboards	5 metro areas		979,751

Figure 1. GPS transmitter locations for 2010, 2011, 2012, and 2013 cranes between 1 January 2013 and 31 May 2014.

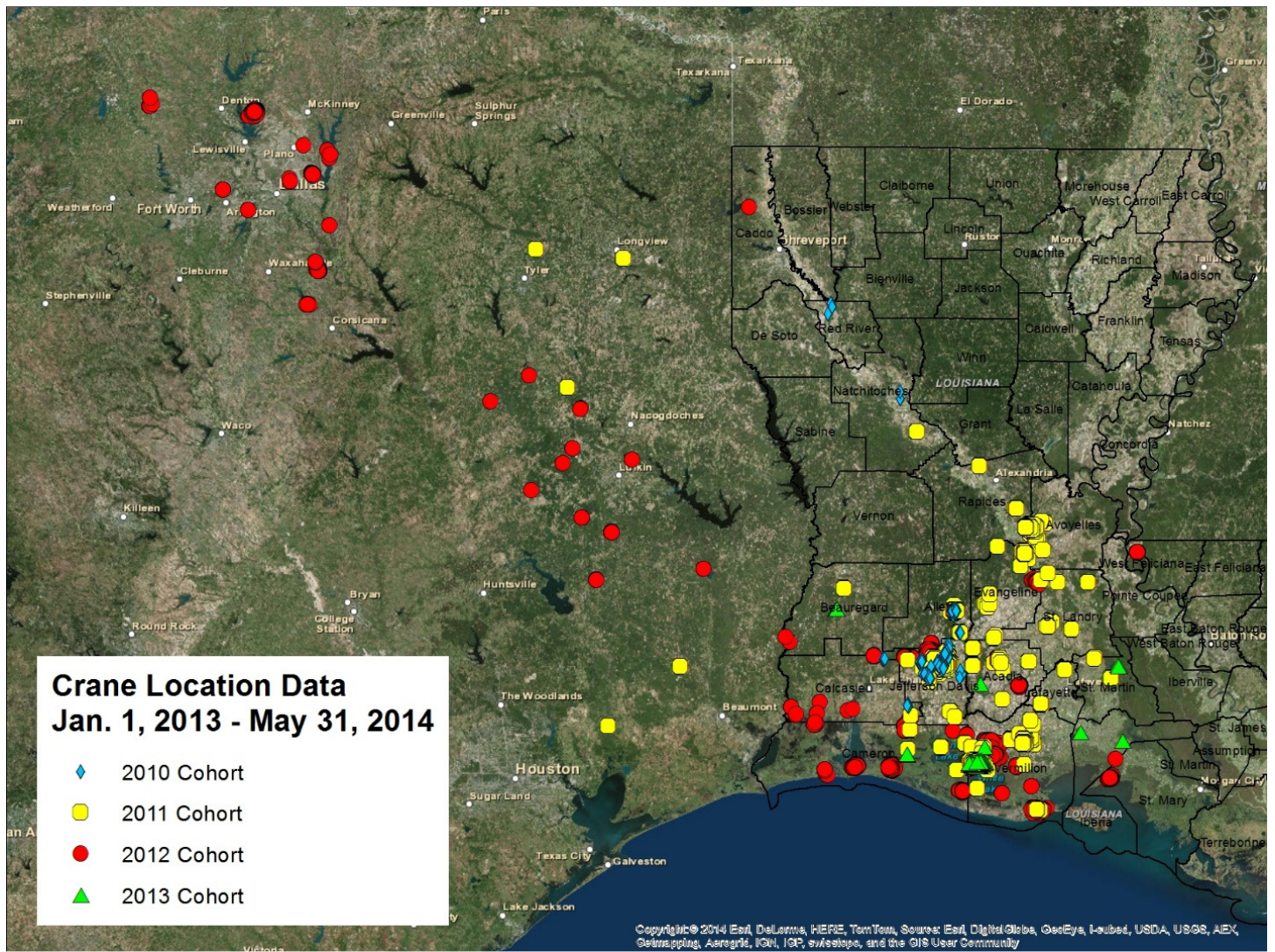


Figure 2. GPS transmitter locations in Louisiana for 2010, 2011, 2012, and 2013 cranes between 1 January 2013 and 31 May 2014.

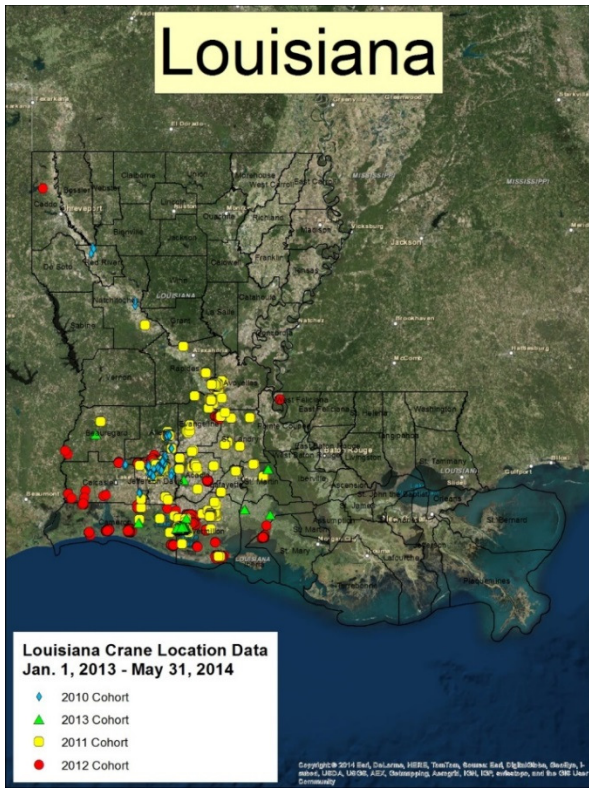


Figure 3. GPS transmitter locations in Texas for 2011 and 2012 cranes between 1 January 2013 and 31 May 2014.

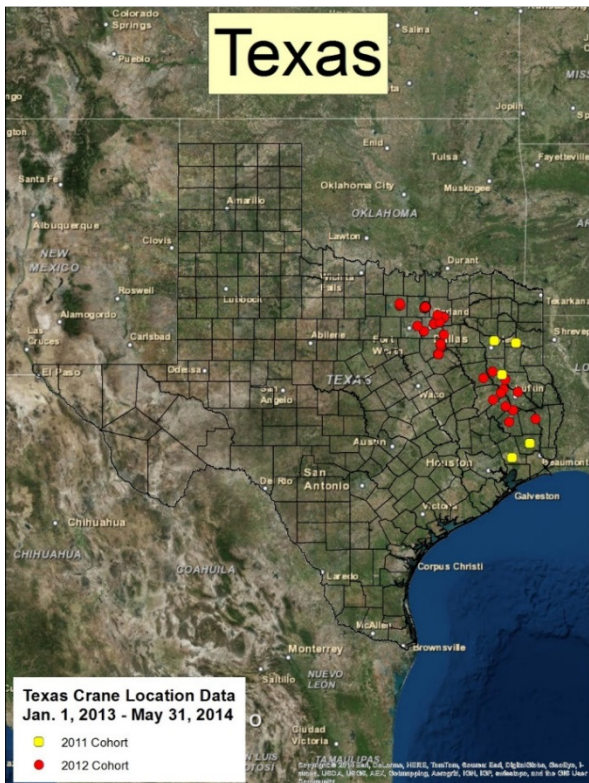


Figure 4. Breakdown of habitat use by cohort for the state of Louisiana from 1 January 2013 through 31 May 2014.

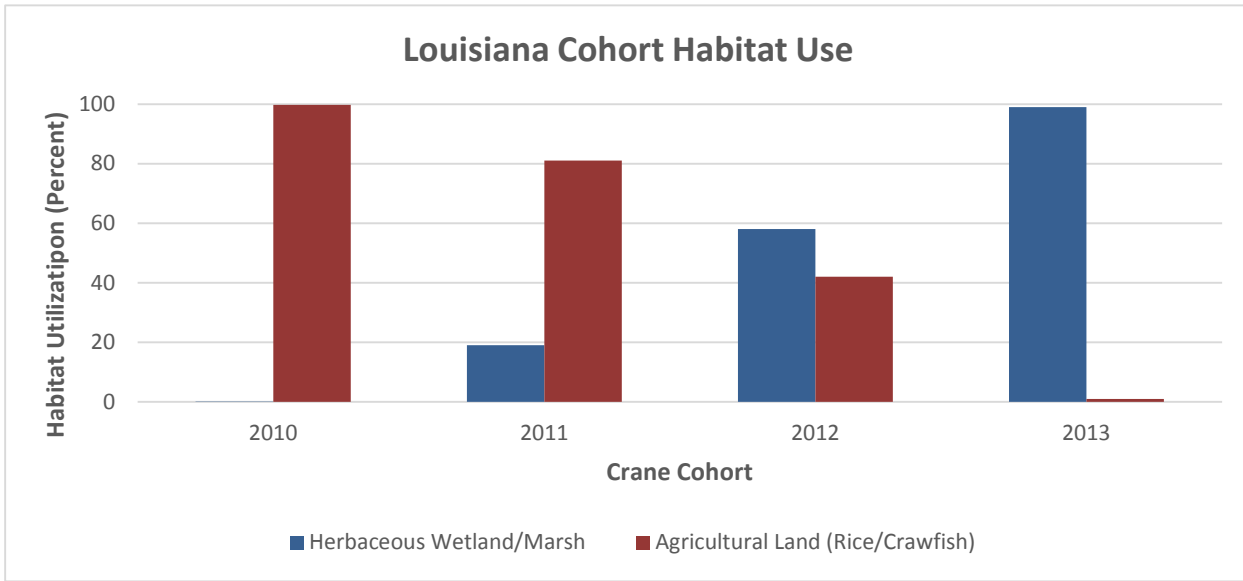


Figure 5. Breakdown of habitat use by cohort for the state of Texas from 1 January 2013 through 31 May 2014.

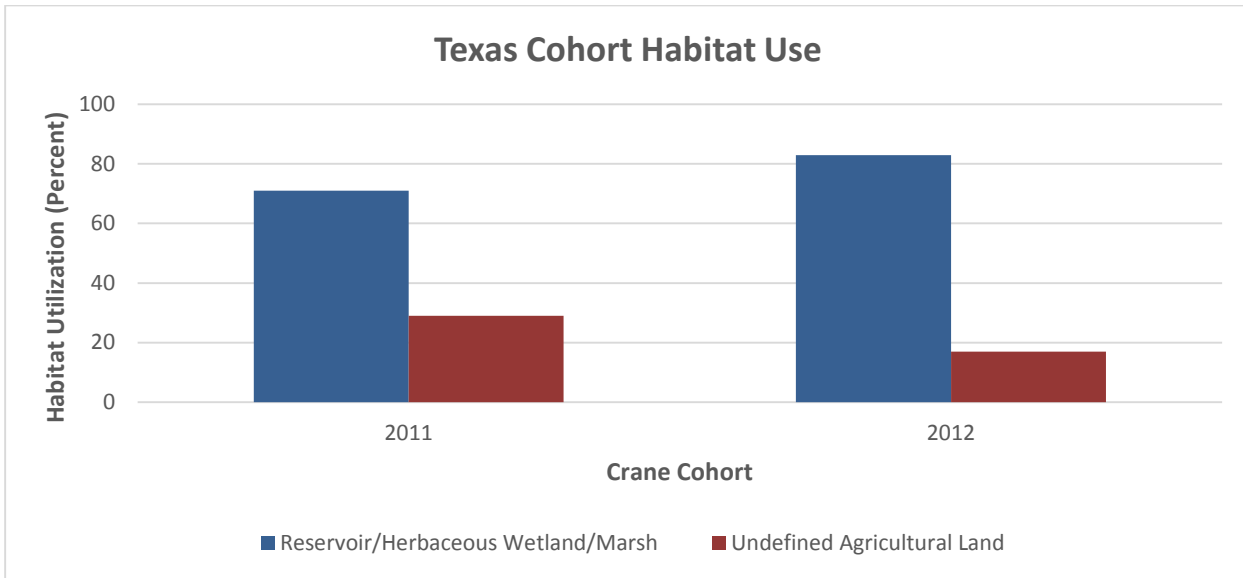


Figure 6. First nest platform of L3-10 and L4-11, February 2013.



Figure 7. First nest with eggs produced by L7 and 8-11 in a crawfish field, on private property in Avoyelles Parish, April 2014. These are the first Whooping Crane eggs produced in the wild in Louisiana since 1939.



Figure 8. L5-13's injured right eye on 28 February 2014 and then again on 25 March 2014.



Figure 9. New Louisiana Crane Identification Cards. Front



Back



Figure 10. Typical education and outreach display used at area events.



Figure 11. New billboard design used in 2013. Eleven of these billboards were produced.



Appendix 2. ID sheet for Louisiana whooping cranes. Birds in gray are missing and presumed dead but no remains to confirm their death have been recovered.

Louisiana Whooping Cranes May 2014

Hatch year	Crane no.	PWRC ID	Sex	BBL Band no. Below left hock	Color code (left:right) T=long band with transmitter	VHF Frequency	PTT ID	Studbook no.			Mate
								Own	Sire	Dam	
2010	L1	19	F	1098-00872	Y/B/Y : T R (PTT)	-	N: 104981	2032	1147	1119	
2010	L6	24	F	1098-00877	Y/B : T R (PTT)	-	N: 104975	2037	1712	1698	
2011	L1	8	M	1098-00882	T B/Y (VHF) : T B/R (PTT)	165.530	M: 112456	2103	1254	1156	6-11
2011	L2	11	M	1098-00883	T B/R (PTT) : B/Y/B	-	(N: 104976)	2106	1702	1904	
2011	L3	14	F	1098-00884	T B/R (PTT) : T Y (VHF)	165.399	M: 112457	2109	1717/1420	1168	
2011	L6	18	F	1098-00887	T B/R (PTT) : T B/Y (VHF)	164.703	M: 112459	2113	1127	1154	1-11
2011	L7	19	F	1098-00888	T B/R (PTT) : T R/Y (VHF)	165.331	M: 112460	2114	1254	1156	8-11
2011	L8	20	M	1098-00889	T B/R (PTT) : B/Y/R	165.042	-	2115	1147	1119	7-11
2011	L10	22	M	1098-01101	T B/R (PTT) : T Y/R (VHF)	164.333*	M: 112462	2117	1147	1292	11-11
2011	L11	23	F	1098-01102	T Y (VHF) : T B/R (PTT)	164.595*	(M: 112463)	2118	1717/1165	1164	10-11
2011	L13	29	F	1098-01104	T B/R (PTT) : T Y/B (VHF)	165.482	M: 112464	2124	1147	1210	
2011	L14	30	F	1098-01105	T B/R (PTT) : R/Y/B	-	M: 112454	2125	1133	1135	
2012	L1	9	F	1098-01109	B/Y/R : T Y/B	-	M: 121403	2149	1127	1154	7-12
2012	L2	12	F	1098-01110	T Y/B (PTT) : T R (VHF)	165.357	M: 112455	2152	1674	1679	
2012	L5	15	F	1098-01113	T Y/B (PTT) : T R/B (VHF)	164.823	M: 112465	2155	1731	1219	
2012	L6	17	F	1098-01114	T Y/B (PTT) : T Y/R (VHF)	164.458	M: 112466	2157	1267/1386	1261	
2012	L7	18	M	1098-01115	T Y/B (PTT) : Y/R/Y	-	M: 121395	2158	1127	1154	1-12
2012	L8	19	F	1098-01116	T Y/B (PTT) : B/R/Y	-	M: 121396	2159	1267/1386	1261	
2012	L9	21	F	1098-01117	T Y/B (PTT) : R/Y/B	-	M: 121397	2161	1189/1182	1195	
2012	L10	22	M	1098-01118	R/B/R : T Y/B (PTT)	-	M: 121398	2162	1775/1737	1593	
2012	L11	23	F	1098-01119	T Y/B (PTT) : Y/R/B	-	M: 121399	2163	1133	1135	
2012	L12	24	F	1098-01120	T R (VHF) : T Y/B (PTT)	165.546	M: 121400	2164	1127	1154	
2012	L13	25	M	1098-01121	T R/Y (VHF) : T Y/B (PTT)	164.384	M: 121401	2165	1199/1138	1193	
2012	L14	28	M	1098-01122	T Y/B (PTT) : B/R/B	-	M: 121402	2176	1794	1900	
2013	L1	10	M	1098-01123	T R/Y (PTT) : T B (VHF)	164.913	M: 112461	2195	1138	1440	
2013	L3	12	M	1098-01125	T R/Y (PTT) : R/B/R	-	M: 132302	2197	1422	1366	
2013	L4	13	F	1098-01126	T B (VHF) : T R/Y (PTT)	165.142	M: 132303	2198	1991	2011	
2013	L5	14	M	1098-01127	Y/B/Y : T R/Y (PTT)	-	M: 132304	2199	1672	1904	
2013	L6	15	M	1098-01128	T R/Y (PTT) : B/Y/B	-	M: 132305	2200	1147	1119	
2013	L7	18	M	1098-01129	T R/Y (PTT) : T R/B (VHF)	165.021	M: 132306	2202	1731	1219	
2013	L8	25	M	1098-01130	T R/Y (PTT) : T B/Y (VHF)	164.214	M: 132307	2208	1439	1818	
2013	L9	26	F	1098-01131	B/R/B : T R/Y (PTT)	-	M: 132308	2209	1731	1219	
2013	L10	29	F	1098-01132	- : T R/Y (PTT)	-	M: 132309	2211	1100	1263	

Appendix 3. Post-release mortalities of free-flying Whooping Cranes in the reintroduced non-migratory Louisiana population.

Hatch year	Crane	Sex	Studbook no.	Mortality Date	Location	Months Survived	Primary contributing factor
2010	L1	F	2032	~9 Oct 2011	Jeff-Davis Parish	7	Mortality unconfirmed (likely related to gunshot of L8 & 10-10, transmitter stopped working, no carcass found)
2010	L2	F	2033	~21 Nov 2011	Jeff-Davis Parish	8	Unknown (scavenged)
2010	L3	M	2034	19 Feb 2014	Jeff- Davis Parish	35	Gunshot – broken wing, later euthanized
2010	L4	M	2035	~15 May 2012	WLWCA refuge	14	Unknown (scavenged)
2010	L5	F	2036	~14 April 2013	Red River Parish	25	Gunshot
2010	L6	F	2037	~22 May 2011	St. Martin Parish	2+	Mortality unconfirmed (transmitter stopped working, no carcass found)
2010	L7	F	2038	23 June 2011	Captured N of WLWCA	3+	Euthanized due to left leg nerve degeneration and left lung pneumonia
2010	L8	M	2039	9 Oct 2011	Jeff-Davis Parish	7	Gunshot
2010	L9	F	2041	~27 May 2011	West Feliciana Parish	2+	Unknown (scavenged – only feathers found)
2010	L10	F	2043	9 Oct 2011	Jeff-Davis Parish	7	Gunshot
2011	L4	F	2110	~6 Feb 2014	Jeff-Davis Parish	25+	Gunshot
2011	L5	M	2111	~12 May 2014	WLWCA refuge	28.5	Predation of molting bird – probably coyotes
2011	L9	F	2116	~29-30 March 2012	Just S of WLWCA Release Pen	3+	Not predated, cause of death unknown, not determined from necropsy
2011	L12	M	2119	3 Feb 2012	Just S of WLWCA Release Pen	1+	Unknown (no remains found, only transmitter)
2011	L15	F	2126	1 July 2012	S Kaplan Vermilion Parish	6+	Predation – not bobcat so coyote?
2011	L16	M	2127	12 August 2012	NE Kaplan Vermilion Parish	7+	Predation – possible raptor or owl - fatal skull wound
2012	L3	M	2153	~3 Nov 2013	Acadia Parish	10.5+	Powerline collision – severed wing, broken leg
2012	L4	M	2154	~7 May 2013	Cameron Parish	4.5+	Trematodiasis (Cyclocoelum sp.) resulting in hepatitis and bacterial septicemia Emaciation
2012	L9	F	2161	~10 August 2013	Rockefeller Refuge	7.5+	Mortality unconfirmed (transmitter stopped working, no carcass found)
2012	L10	M	2162	18 February 2013	NE Rayne Acadia Parish	2	Mortality unconfirmed (transmitter stopped working, no carcass found)
2013	L2	M	2196	~1-2 April 2014	WLWCA refuge	3	Unknown (scavenged) – likely predation – coyote bite mark in femur

Whooping Crane Eastern Partnership

2013 Condensed Annual Report



TABLE OF CONTENTS

Preface	3
<i>Barry Hartup, International Crane Foundation & Peter Fasbender, U.S. Fish & Wildlife Service</i>	
Operations Team	5
<i>Billy Brooks, U.S. Fish & Wildlife Service</i>	
Rearing & Release Team	7
<i>Terry Peacock, St. Marks National Wildlife Refuge</i>	
Monitoring & Management Team	13
<i>Davin Lopez, Wisconsin Department of Natural Resources</i>	
Research & Science Team	15
<i>Jeb Barzen, International Crane Foundation</i>	
Communications & Outreach Team	18
<i>Joan Garland, International Crane Foundation</i> <i>Heather Ray, Operation Migration</i>	
<i>Research & Science Team - Appendix 1</i>	22

PREFACE

The Whooping Crane Eastern Partnership (WCEP) enters its 14th year of work to restore Whooping Cranes to eastern North America this coming season. We appear to be on the cusp for good things to come, but many challenges remain. This past year marked the completion of a structured decision making process within WCEP to help update our existing 5-year strategic plan, address ongoing questions, and chart a course for successful reintroduction of a self-sustaining population. Much of this process benefitted from excellent work by WCEP's operational teams and leadership and is reflected in plans for 2014.

Our research team, through painstaking field work and detailed analysis over the past three years, has confirmed that parasitic black flies are the leading cause of nesting failures of Whooping Cranes in central Wisconsin. In response, partners at the Necedah NWR are developing a nest management plan to interrupt Whooping Cranes before black fly emergence and incite the cranes to re-nest at times with fewer flies on the landscape. To date, all previous nests that fledged chicks resulted from the pair's second nesting attempt. We believe this management effort will increase hatching success for many of the pairs remaining in this region, and may also provide additional fertile eggs for use by WCEP, or in other Whooping Crane recovery efforts elsewhere.

In concert with these efforts, since 2011 we have pursued a strategy of releases of captive-reared cranes in east-central Wisconsin at the Horicon NWR and White River Marsh SWA to improve initial nesting success. Whooping Cranes that were released in these areas should begin to express nesting behavior in 2014. Our monitoring team will be engaged in tracking this effort closely this year. Our rearing team will again coordinate the captive upbringing and release of Whooping Cranes with ultralight aircraft and by direct release in the fall to augment the presence of birds in east-central Wisconsin. Lastly, we will continue with a valuable new experiment on release of crane-reared juveniles after the initial release of four birds in 2013 at Necedah NWR, and successful social integration and migration of two of them. We hope that this technique will result in acceptable assimilation rates to be useful in the future.

Restoring extirpated wildlife populations to their former range is extremely complex and fraught with challenges, none more so than the loss of our reintroduced Whooping Cranes to shootings by vandals. These tragic deaths are needless. They rob all of the partners, our supporters, and the public, of a piece of our collective natural heritage. WCEP will continue to place great effort at pursuing outreach activities and collaboration with other organizations to prevent these occurrences, and to seek applicable remediation and restitution from convictions.

Cranes are in their own category - no crane reintroduction has ever been successful. Nobody said this was going to be easy – but we think it can be done. We need to keep making steps in the right direction. As the Guidance Team co-chairs, we speak on behalf of the project leadership team in expressing our sincere gratitude for the sacrifices you all make for Whooping Crane restoration. We have come a long way since 2001. If we focus on the future and the areas where improvements are needed, we will be closer to our goal of establishing a self-sustaining flock of Whooping Cranes in eastern North America.

Whooping Crane Eastern Partnership founding members are the International Crane Foundation, Operation Migration USA Inc., Wisconsin Department of Natural Resources, U.S. Fish and Wildlife Service, the U.S. Geological Survey’s Patuxent Wildlife Research Center and National Wildlife Health Center, the National Fish and Wildlife Foundation, the Natural Resources Foundation of Wisconsin and the International Whooping Crane Recovery Team.

Guidance Team: Bill Brooks, U.S. Fish and Wildlife Service; Joe Duff, Operation Migration; Pete Fasbender, U.S. Fish and Wildlife Service; John French, USGS Patuxent Wildlife Research Center; Barry Hartup, International Crane Foundation; Davin Lopez, Wisconsin Department of Natural Resources; Doug Staller, Necedah National Wildlife Refuge

OPERATIONS TEAM

Each WCEP operational team has a team chair or co-chairs. These team leaders make up the Operations Team and include: Operations Team Chair: Billy Brooks – USFWS; Rearing and Release Team Chair: Terry Peacock – USFWS; Monitoring and Management Team Chairs: Davin Lopez - WI DNR and Anne Lacy – ICF; Research and Science Team Chairs: Jeb Barzen – ICF and Sarah Converse – USGS/PWRC; Communications and Outreach Chairs: Joan Garland – ICF and Heather Ray – OM.

Project decisions that cannot be made within a team or between teams are made by the Operations Team. The Operations Team Chair updates the Guidance Team on the project needs, operations and decisions. If the Operations Team is unable to come to agreement on a decision that involves multiple teams, they seek the support of the Guidance Team. In 2013, the Operations Team 2013 accomplishments include:

Monthly conference calls to discuss project operations held on the third Tuesday of each month except in February; summary notes of the call are posted to the WCEP Wiki; 2013 call dates: 1/13, 3/19, 4/22, 5/21, 6/18, 7/16, 8/20, 9/17, 10/31, 11/19 and 12/16.

Planned and facilitated the WCEP Annual Meeting on February 13th to report on 2012 accomplishments. The meeting was held as a webinar. The webinar format allowed for reduced travel costs and larger participation from partnership as participants were able to attend via the internet from their work locations around the country.

2013 WCEP Annual Report was drafted by Operational Teams; compiled by the Communications and Outreach Team; reviewed and edited by the Operations Team and Guidance Team; finalized and posted on the BringBacktheCranes.org website in February.

2013 work plans and budgets were finalized in January 2013. Drafting work plans for 2014 work plans were initiated in December 2013.

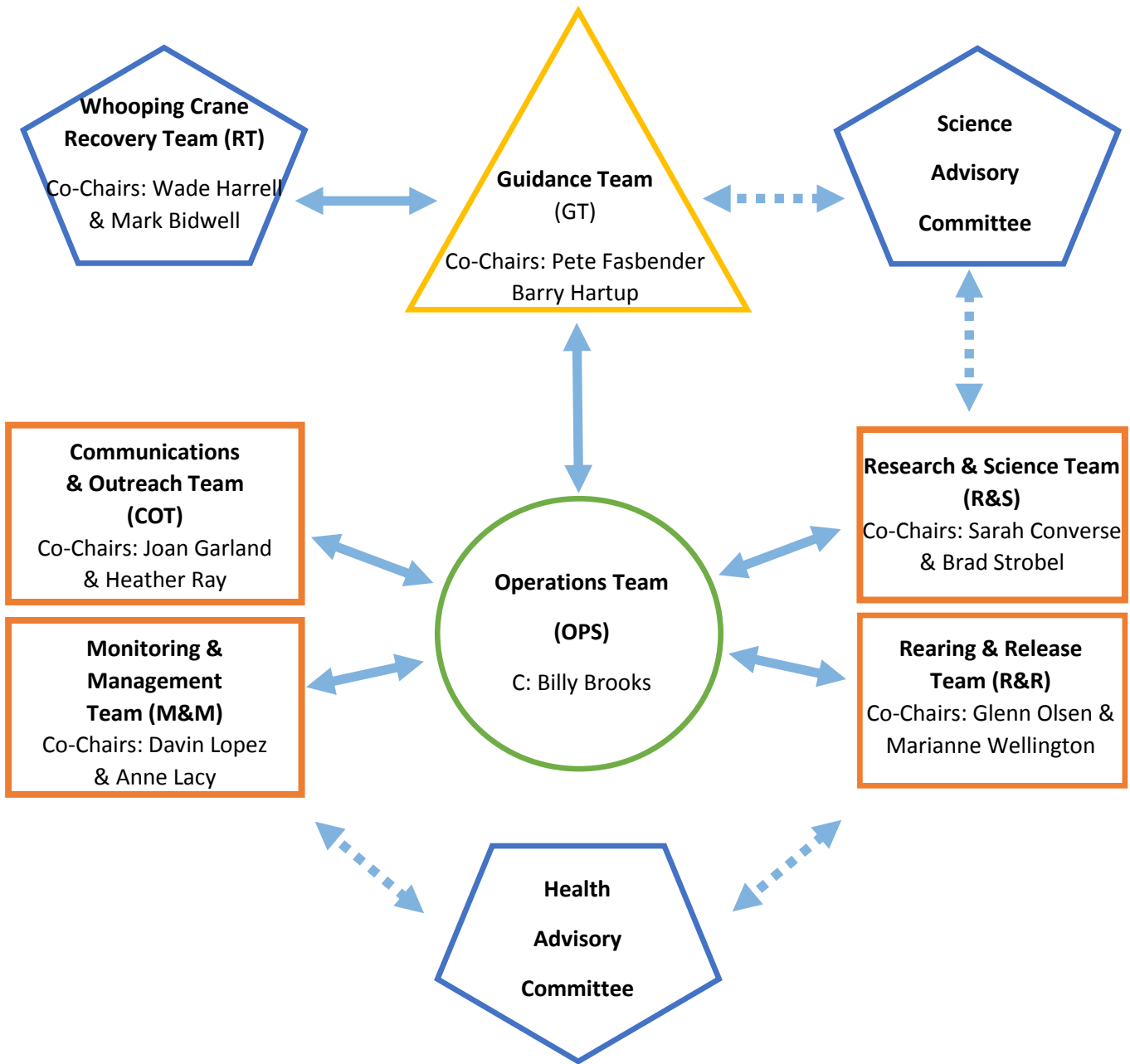
Operations Team provided a recommendation to the Guidance Team to include a Wisconsin DNR land manager on the Guidance Team in July 2013.

Operations Team concurred with Monitoring and Management Team Decision to use Teflon harness for experimental backpack transmitter attachment in August 2013.

In 2012, the WCEP Guidance Team chose to use a Structured Decision Making process to help revise the existing 5-year strategic plan. The Operations Team, along with the Guidance Team, formed the core of the participants and the initial workshop was held 20-24 August 2012. This resulted in the identification of 2 decision problems, the large-scale reintroduction strategy and management to address nesting failure. The resolution of the second decision problem was implemented beginning in the 2013 nesting season.

Additional work continued on the first decision problem in 2013 and culminated in a second meeting in Necedah, Wisconsin, 27-29 August 2013 to discuss results of modeling and negotiate tradeoffs amongst multiple objectives. The notes and final reports from the conference calls and workshops are being used by the Guidance Team to develop the future course of the project.

WCEP Organizational Structure



Note: Solid arrows represent decision-making and advisory pathways. Dashed arrows represent strictly advisory pathways.

REARING & RELEASE TEAM

Releases continued in the Wisconsin Rectangle in 2013. The number of chicks available for release was slightly increased this year due to eggs taken from Necedah. This year the R&R Team and WCEP decided to conduct the parent rearing experiment. The 5 eggs allocated to the parent rearing experiment were in addition to the 8 chicks in the ultralight program and the 9 chicks in the direct autumn release program. A summary of each release method is included below.

Ultralight-led Migration

Early imprinting:

Between May 14 and May 19, 2013, eight Whooping crane chicks were hatched at Patuxent Wildlife Research Center. All eight were the result of eggs collected from abandoned nests at Necedah NWR. The birds were imprinted on the costumed handlers and conditioned to follow an aircraft provided by Operation Migration. (See Patuxent WRC for details of training) Due to this narrow age range, all the birds were socialized into one cohort. At a mean age of 48 days, the birds were transported in custom built containers by private aircraft provided Windway Capital courtesy of Terry Kohler.

Summer conditioning:

The birds arrived at the White River Marsh State Wildlife Area in Wisconsin on July 9, 2013 and were housed at the existing facilities including a dry pen with a visual barrier and the wet pen for night roosting. The birds spent a total of 85 days at White River (12 year mean 101.4 days). They had access to water roosting on 83 nights (12 year mean 90.5 days). The weather allowed us to train them with the aircraft on 52 days (12 year mean 58 days). The birds fledged on August 9, 2013 at an average age of 85 days.

Migration:

Although we targeted a much earlier departure date, the 2013 migration did not begin until October 2. Once the birds moved to the first stopover, we experienced another extended weather delay of eleven days. That caused a number of drop outs on the northern end of the migration. As a result of poor weather, this was the second longest migration taking 96 days compared to the 57 days it took to complete the migration in 2012.

Despite long weather delays and cold temperatures, all eight birds assigned to the aircraft led method and transported to Wisconsin in July, survived to reach the wintering grounds.

Wintering:

The decision to winter all the birds at St Marks NWR this year was made by the refuge managers and the WCEP Rearing and Release Team. The migration ended on January 5, 2014. All eight birds made the 45 minute flight from the last stopover in Leon County, FL and landed at the pen site. This enclosure covers an area of approximately 4 acres (1 hectare) including two ponds of brackish water and is not top netted.

The birds were kept in a smaller top netted pen built inside the release pen until they underwent a veterinary examination were fitted with permanent marking bands and radio tracking devices. That

procedure was completed on January 16 and the birds were released on January 21, 2014. We are very grateful for the assistance of Disney’s Animal Kingdom whose veterinary team provided the expertise to examine the birds. Our friends at Disney also assist with the winter monitoring.

Direct Autumn Release (method of releasing chicks near other cranes in the fall)

The Modified Direct Autumn Release Project began raising crane chicks at the International Crane Foundation (ICF), Baraboo, WI in 2011, transferring the birds to Necedah National Wildlife Refuge where they fledged, and moving them to Horicon National Wildlife Refuge where the chicks (ages 82-107 days) were allowed to fly freely and were released in October. After two years of promising results where the yearling birds returned closer in proximity to Horicon than Necedah NWR, the 2013 cohort was hatched and reared at ICF through fledging and then moved to a temporary pen on the Horicon. We met our goals of moving the group of chicks to Horicon within a similar age ranges as the chicks in 2011 & 2012.

Age of chicks when moved to Horicon NWR			
Year	Number of chicks	Age range of chicks in days	Average age
2011	8	82-107	96
2012	7	86-107	98
2013	9	82-102	96

The Horicon holding pen was in the same vicinity used in 2011 when 8 chicks were released. The chicks were banded in late September and released October 24th. Interactions between chicks, costumes and wildlife were similar to previous years though each year provides new challenges and nuances which will be addressed later. Because the previous years’ released birds left Horicon within a week after release (2011 birds left within a week & 2012 birds left the morning after release), the 2013 chicks were purposely released between cold fronts in hopes to keep the chicks near Horicon longer.

In order to follow the protocol of releasing the chicks near adult whooping cranes, a release site on the southeastern side of the Horicon NWR was selected. Radio signals of adult whooping cranes 16-11 and 18-11 indicated the adults were using the southern portion of the main pool, a fair distance from the sandhill roost where the 2011-12 chicks had been released. The release site was chosen where the chicks would be able to see and hear the adult whooping cranes and tens to hundreds of sandhills fly over. Although a different release site was selected, the method and timing of release was similar to previous years as was the chicks’ behavior. All chicks flew large circles post release, trying to get their bearings. A group of chicks made it back to an abandoned pen that night. Over the next several days the chicks remaining at the release site, left that area to either join the other chicks or return to the familiar area around the holding pen.

Within a few days all 9 chicks were back together and although they would split up, interact or follow sandhills briefly or overnight, they were often observed as a large group. The chicks roosted on the refuge and foraged in the fields similar to the wild sandhills and adult whooping cranes. The chicks were observed interacting with 16-11 and also with the captive parent reared chick, which flew to Horicon for the day before flying north again. Overall the chicks' behaviors were within normal limits: flying off roost and foraging in the corn fields, returning to the marsh and foraging or exploring various areas and for the most part roosting on the refuge until weather conditions no longer provided safe roosting areas. The chicks roosted in frozen cornfields as well as the frozen marsh. Even though several good migration opportunities occurred, the chicks' basic needs were met. They had plenty of food (field corn), water (a pond kept partially open behind a house near the Refuge), and a social group.

Migration:

No. 57-13 began migration from the Horicon NWR, Dodge County, WI, on 15-17 November. He was reported in Meigs County, Tennessee on the evening of 20 November and remains in the area.

Nos. 50, 51, and 54-13 began migration from the Horicon NWR, Dodge County, WI, on 11 December. They were detected in flight in Ogle County, Illinois, later that day and had arrived in Mason County, Illinois, by the night of 12 December. They were observed together at this location during an aerial survey on 13 December. Satellite readings from no. 54-13 indicated she was in the area through at January 9.

Mortality:

Four birds died prior to the group migrating on December 11.

The remains of Direct Autumn Release juvenile male no. 53-13 were discovered on the Horicon National Wildlife Refuge on 13 November. Death had occurred the previous night. Cause of death was predation.

The remains of the juvenile female no. 56-13 were discovered on private property near the Horicon National Wildlife Refuge, Dodge County, Wisconsin, on 29 November. Death likely occurred 28/29 November. Cause of death was trauma (impact or predatory).

The radio transmitter and metal federal leg band of Direct Autumn Release juvenile female no. 52-13 were recovered on the Horicon National Wildlife Refuge on 4 December. Death likely occurred on 30 November or 1 December. Cause of death pending; predation suspected.

The fully intact carcass of Direct Autumn Release juvenile male no. 55-13 was recovered on private property near the Horicon National Wildlife Refuge on 7 December. Death had occurred shortly before collection. Cause of death was acute fungal pneumonia, perhaps from foraging in contaminated silage.

More unfortunate news of the discovery of the deaths of 2 of the 3 birds that migrated to Illinois was reported mid-January. Male # 50-13 and female 51-13 were found near the Illinois River south of Peoria. No signals were heard for 54-13 in the vicinity and no PTT readings have been received.

Parent-Rearing (experimental research release)

In 2013 we were able to begin the parent-rearing research. We received 5 eggs for the parent-rearing research project at USGS Patuxent Wildlife Research Center, Laurel, Maryland. All 5 eggs hatched and we were able to rear 4 chicks (80%) for release (Figure 1). This rearing success rate is similar to the overall success rate over the last decade.

The parent-reared (PR) chicks hatched between 2 and 5 June 2013. Other than the one mortality from an accident on 8 July, no unusual problems were encountered. All chicks received vaccinations for West Nile virus and eastern encephalitis virus on 17 July and 14 August. A final comprehensive health examination was done on 5 September. At that time all 4 remaining chicks were tested for Salmonellosis and found negative. Routine complete blood counts and serum chemistries were within normal limits for that age group. No external or internal parasites were identified. All PR chicks were shipped to Necedah National Wildlife Refuge on 19 September on a flight donated by Windway Corporation.

During the PR chicks' stay at Patuxent, daily behavioral observations were made, using techniques formerly applied in our study of the differences between parent-reared sandhill crane chicks and costume raised whooping crane chicks. In 2013 we used the costume raised Louisiana whooping crane chicks as our comparison group, as the WCEP costume raised ultralight chicks were almost a month older than the PR whooping crane chicks. We intend to report these results at the next North American Crane Workshop in April 2014.

After arrival at Necedah NWR, the PR chicks were held one night together at site 3 (the former Direct Autumn Release pen, Figure 2), and then banded the next day. Each chick received colored leg bands with a conventional vhf radio transmitter on one leg and a PTT (satellite radio) on the other leg. In addition, each chick had distinct color banding of the transmitter leg bands and an aluminum Bird Banding Laboratory band above the foot. After banding, 3 of the chicks were transported to separate sites on the refuge where temporary pens had been created. At least one adult whooping crane pair was known to use the area surrounding all 4 temporary pen sites.

The pen sites were visited several times daily and checked for chick behavior and adult crane presence and behavior. In addition, all sites had remote cameras that recorded chicks and a limited field of view around the pen during daylight hours. Adult pairs of whooping cranes visited all chick pen sites on numerous occasions.

At 0600 hours on 23 September, we opened one wall of the temporary pen at site 1 and immediately the PR chick flew out and entered a low area about 50 m from the pen site. The adults that frequented this pen site came back within 10 minutes and appeared to be searching for the chick, locating the chick shortly afterwards. After that, the PR chick (24-13) was consistently seen with this pair of adult birds (2-04 and 8-09) at Necedah (Figure 3), at a staging area on the Wisconsin River near Baraboo, and finally on the wintering grounds for these adult whooping cranes in Hopkins County, Kentucky.

Over the next two days, 24-25 September, we released the other 3 PR whooping crane chicks. Chick 22-13 stayed at site 3 for several days, but despite being observed within 10 m of the resident adults, was never accepted by the adults, though no aggression was seen. Eventually the chick left the site 3 area and briefly associated with the site 1 birds for one morning. The chick was next seen several miles northeast of the refuge on a cranberry farm and associated marshes. There were sandhill cranes and a pair of whooping cranes there. Eventually the chick migrated east to the area used by the ultralight aircraft trained whooping cranes around Berlin, Wisconsin. The chick briefly visited the DAR area at Horicon NWR, and then migrated to the Kankakee River bottomlands in northern Indiana. This is a known staging area for sandhill cranes and at least some of the EMP whooping cranes. Here the chick was seen frequently in association with 4 adult whooping cranes (identities unknown). Eventually, during a cold spell with northerly winds, the chick migrated in one day from northern Indiana to Meigs County, Tennessee. Here the chick has been seen with a pair of EMP whooping cranes on the Hiwassee and Moon River state lands and the Armstrong Ferry Recreation Area.

Chick 21-13 was released from a site in the central part of the Necedah National Wildlife Refuge. In the pen the chick was visited numerous times by one, or two pairs of adults. After release the chick was seen in association with two different pairs of adult whooping cranes, but never for an extended period of time. No aggression by the adults was ever observed. Eventually, this chick moved several miles north, still on the refuge, but it was hit by a vehicle and killed on 2 October. Chick 20-13 was released from site 5 and associated with 9-05 and 35-09 and an unbanded pair of sandhill cranes that stayed near the adult whooping cranes. This chick was killed by a canid predator on the adults' territory in mid-October.

The PR research project met expectations this year. We introduced 4 PR whooping crane chicks as planned, observed chicks form temporary and longer-term social bonds with adult pairs of whooping cranes, and had 2 PR chicks successfully migrate to wintering areas.

The following individuals have substantially helped with this project in 2013

From Patuxent: Glenn Olsen and Sarah Converse, Co-investigators; John French, Branch Chief; Jane Chandler and Robert Doyle, lead caretakers for this project; Sharon Peregoy, biological technician Barbara Clauss, biological technician; Brian Clauss, biological technician; Charles Shafer, biological technician and chief helper with remote cameras; Carlyn Caldwell, veterinary technician; Anna Jiang, University of Maryland; Mary Ashley, 4th year veterinary student; Anne Harshbarger, Glenelg High School

From Necedah National Wildlife Refuge: Doug Staller, Refuge Manager; Brad Strobel, biologist; Richard Urbanek, biologist; The entire refuge staff helped with various details.

From International Crane Foundation: Eva Szyszkoski for help banding, and then monitoring cranes on migration; Anne Lacy and others for monitoring 24-13 and adults when they were in the Baraboo area Marianne Wellington and the DAR staff for watching 22-13 at Horicon.

MONITORING AND MANAGEMENT TEAM

This report documents the biology of the whooping cranes in the reintroduced eastern migratory population during the calendar year of 2013.

Winter 2012/2013

Maximum size of the eastern migratory population through the end of December 2012 was 114 birds (58 males and 56 females). Estimated distribution included 42 whooping cranes in Indiana, 16 in Florida, 16 in Alabama, 11 in Tennessee, eight in Illinois, three in Kentucky, three in Georgia, nine at unknown locations, two not recently reported, and four long term missing. The total in Florida included five recently-released ultralight-led juveniles. This total does not include a suspected, but unconfirmed, mortality.

Spring Migration 2013

Spring migration in 2013 was noticeably later than the previous year. Of known migration dates or ranges, the majority of birds initiated spring migration during the month of March. Nos. 27-06 and 26-09 were the first whooping cranes to be confirmed back at the Necedah NWR (by 17 March). Of documented cranes two years of age or older returning to central or southeastern Wisconsin, 12% did so by 25 March, an additional 65% arrived on or before 31 March (with 29 and 30 March being major migration completion days), and the remaining 23% by 8 April. Five juveniles were first documented in Wisconsin on 19 April-1 May. An additional juvenile was reported in Allegan County, Michigan, on 23 April.

Spring and Summer 2013

A majority of the 2012 juveniles did not exhibit extensive spring wandering movements and only one (no. 14-12) was documented traveling into another state (southern, Michigan and northern Indiana) where he remained until fall migration.

Maximum size of the eastern migratory population at the end of August was 101 birds (54 males, 46 females, and one unknown). This total includes one wild-hatched chick. Estimated distribution at the end of the report period or last record included 94 whooping cranes in Wisconsin, 2 in Michigan, 3 not recently reported, and 2 long term missing. Detailed information about the 2013 DAR and Ultralight led juveniles can be found in the Rearing and Release section of this report.

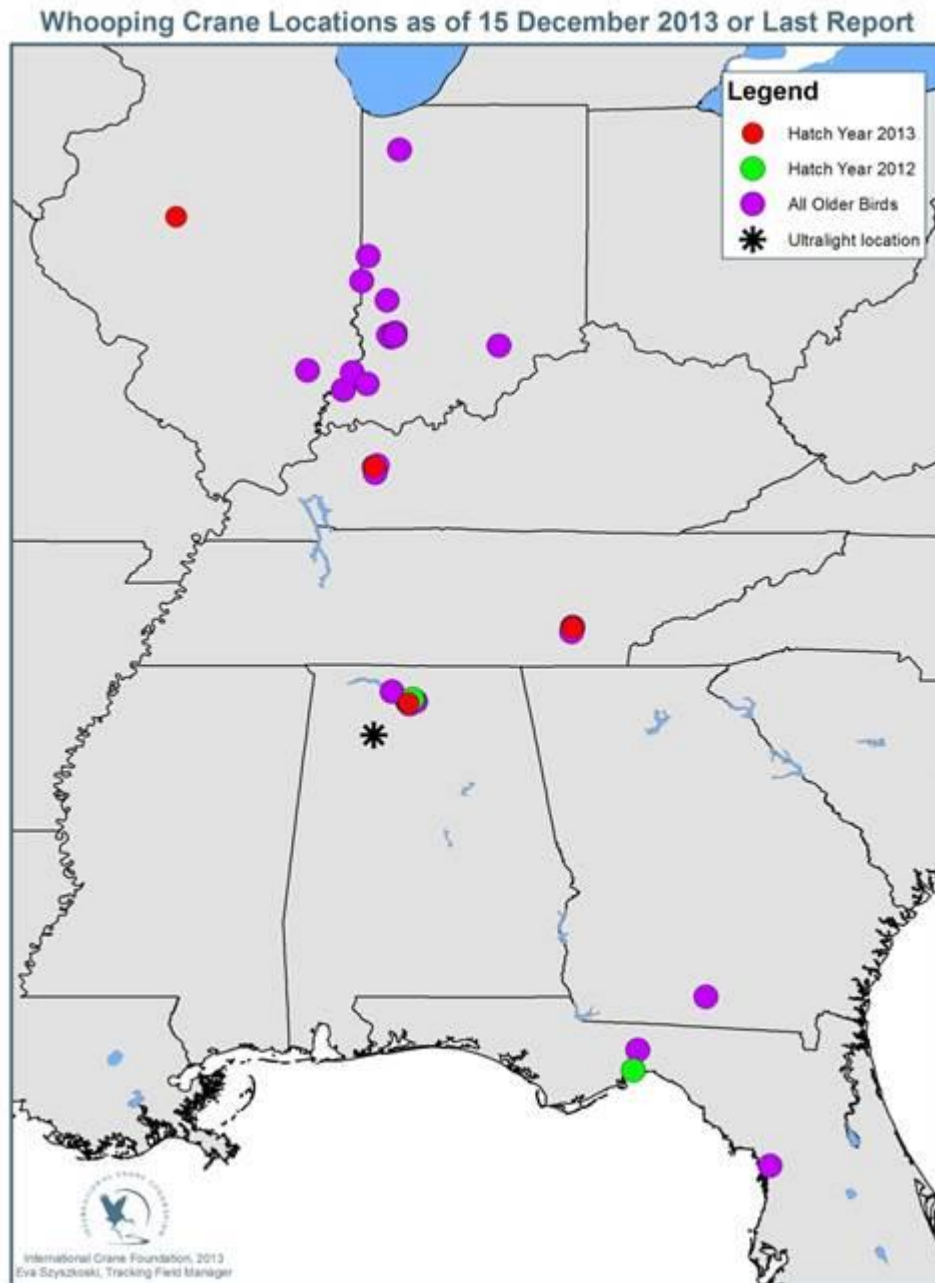
Most of the older cranes (Hatch Year 2001-11) summered on or near the Necedah National Wildlife Refuge, Horicon National Wildlife Refuge, or White River Marsh State Wildlife Area. Early autumn distribution was similar to summer distribution for most cranes in the population; however, some birds left their summering territories to use staging areas at remote locations in southern Wisconsin.

Autumn Migration 2013

The 2013 migration initiation date was quite varied, with only about half the birds having left Wisconsin by mid-November. The last birds (four 2013 DAR birds) in the population left Wisconsin on December 11 (three by flight, one by plane). The late departure was despite unseasonable cold temperatures in December and little open water for roosting. Additional information on this unusual pattern can be found in the Rearing and Release section of the report.

Winter 2013

Maximum size of the eastern migratory population through December 15 was 101 birds (56 males and 45 females). Estimated distribution at the end of the report period or last record included 5 whooping cranes in Illinois, 37 in Indiana, 9-11 in Tennessee, 7-9 in Kentucky, 24 in Alabama, 2 in Georgia, 6 in Florida, 3 at unknown locations, 3 not reported in eight or more months, 1 presumed dead, and 2 long term missing. This total does not include 8 cranes that were still being led south by ultralights at the end of 2013. Those eight were released in January 2014.



Survival

As of December 31, 2013, 220 whooping cranes have been released as juveniles since the reintroduction began in 2001 (8 more ultralight led cranes are due to be released in early 2014). This value excludes 17 HY2006 ultralight-led juveniles that died during confinement in a storm and one HY2007 ultralight-led juvenile that was removed from the project after being unable to fly after handling at the winter release site. An addition of six naturally produced juveniles (one in 2006, two in 2010, two in 2012, one in 2013) resulted in a grand total of 226 reintroduced individuals, of which 101 (44.6%) may currently survive.

In 2013 there were 20 confirmed mortalities, three suspected mortalities, and four long-term missing cranes that were removed from the population totals. Of these, seven (26%) were less than a year of age, six (22%) were one year olds, and the rest (52%) were two years old or older.

As of December 30, 2012, there have been 121 total recorded mortalities. Of those, 39% have had the cause of death determined, 38% have not, and 23% have never been recovered. The primary known cause of mortality was predation (47%), followed by impact trauma (19%), gunshot (19%), and disease (9%).

Reproduction

Twenty-three nests by 21 pairs were initiated in 2013, twenty-one first nests and two renests. All first nests were initiated between April 15 and April 29 except one late first nest initiated on May 30. Of the first nesting attempts, one nest hatched out two chicks and one incubated past term on nonviable eggs. Renesting attempts by two pairs were initiated in late May. Of the renests, one nest hatched out one chick.

Transmitter Testing

Due to continued budget constraints and the high cost of obtaining data from Doppler and GPS PTT units, combined with the continued emergence of cellular technology for wildlife tracking, the Monitoring and Management Team decided to test cellular technology on the Eastern Migratory Population of whooping cranes. To do so we, along with Operation Migration staff, deployed three experimental, backpack-mounted, cellular transmitters designed by the University of Nebraska-Lincoln on three captive ultralight birds. While the backpack mount and cellular technology seemed to work fine, a flaw in the design of the strap attachment to the transmitters and the transmitter casing design caused undo drag on the birds while they were in flight training next to ultralight aircraft, as observed by the pilots. Due to this issue, the transmitters were removed shortly after deployment. In 2014, we will continue to explore redesigning and redeploying these transmitters as well as the possible use of commercially made leg-mounted cellular tracking devices.

RESEARCH & SCIENCE TEAM

Efforts by the Research and Science Team this year have focused on advancing our understanding of reproductive success from a number of different perspectives. We report here on: 1) the conclusion of the field component of our reproductive success experiment; 2) new tests with captive sandhill cranes regarding any potential effect of leg-mounted radio transmitters on the incubation environment; 3) the development of new techniques designed to improve research in the future; 4) the potential for environmentally induced changes to the genetics of the EMP (termed epigenetics); 5) how our research has been used in WCEP and in the broader science community; and, finally, 6) how we wish to test the knowledge we have gained so far through a forced re-nesting experiment.

Reproductive Success Experiment

This project began in 2009 when we measured hatching success in the absence of any management effort. In 2010, we completed a test application of *Bti* in a portion of the Yellow River and determined that a larger scale treatment would be possible. We also measured the distribution of avian feeding black fly species (*Simulium* spp.) throughout a broader area of Wisconsin and found that the Necedah area appears to be a somewhat unique area of concentration for avian-feeding black flies. In 2011 and 2012 we completed *Bti* treatments on a landscape scale and measured a significant decrease in *S. annulus* and *S. johannseni* along with an increase in hatching success for whooping cranes. Importantly, with improved hatching success we were able to examine chick mortality and found that, though 9 chicks hatched only 2 chicks fledged. Reproductive success, as measured by the number of chicks fledged to fall migration per territory, remained too low to produce a sustainable population in the long term. In 2013 we replicated our protocol from 2009 and did no *Bti* treatment so that we could rule out annual variation as an explanation for changes in hatch success among years. Black fly abundance returned on the landscape and nest success declined, especially in response to *S. annulus* abundance. Currently we are analyzing these data further and hope to submit a paper for publication by the end of the year.

Do Leg-mounted Transmitters Effect Copulation or Incubation Environment of Sandhill Cranes?

To test this question USGS Patuxent Wildlife Research Center staff used 8 pair of known self-fertile sandhill cranes that were also good at incubation. Leg-mounted transmitters were placed on 4 pairs of sandhill cranes while only color bands were placed on the other 4 pairs as controls. All 8 pairs laid, each pair laying 2 clutches of 2 eggs each. Each pair was allowed to incubate the last 2 egg clutch, though one egg in each clutch of 7 of the pairs was a replaced by a data-logger egg to examine incubation environment. The 4 pairs with leg-mounted transmitters laid 11 fertile eggs and 5 infertile eggs. The control sandhill cranes laid 9 fertile eggs, 7 infertile. This was the first year of a 2-year study. The leg band transmitters were removed from the cranes during the fall health examinations, refurbished, and placed on the former control cranes on 17 January, 2014.

Testing Backpack Harnesses and Cell Tracking Devices

In 2013, ICF collaborated with the University of Nebraska – Lincoln to test several facets of experimental cell transmitters and backpack harness attachment mechanisms. Specific tests included: 1) A cell transmitter was deployed on a captive bird at ICF to test accelerometer data (3 planes of movement). Data was collected, but issues with camera prevented developing correlations between behaviors and device readings. 2) Testing quick attachment methods for backpack harnesses on captive birds to minimize handling times and bird stress. Handling times fell within allowable protocols. 3) Deployment of backpack harnessed cell trackers on Sandhill Cranes to test both harness effects and cell devices. All birds survived well and acted normally. Cell devices

failed at higher than acceptable rates. 4) Deployed 4 cell transmitters on UL birds in Sept. Observations in flight revealed that the design of experimental transmitter produced unacceptable drag during flight. All transmitters were removed after several days. 5) ICF summarized deployments of all recent backpack-mounted devices deployed on cranes (and other large-bodied birds) to examine known outcomes. The Monitoring and Management Team then produced a recommendation for WCEP regarding the use of backpack harnesses for WCEP cranes. These tests suggest that further testing is needed. Future plans include ensuring that design of transmitter does not inhibit flight; further testing of backpack attachment on Sandhill Cranes; another transmitter deployed on a captive bird to record movement data and possibly additional testing with UL birds for longer periods.

Epigenetics

Mark Berres (UW-Madison) is examining the potential influence of diet and/or environmental contamination on epigenetic patterns in Whooping Cranes. The first examination is to compare how genomes of western and eastern populations of Whooping Cranes compare. They should be similar because the eastern population was produced from captive birds that came from the western population. Real differences in the genome between the populations, beyond that expected through mutation, could be due to environmental effects. One means for epigenetic affects is through the diet's potential impact on methylation patterns. Environmental pollutants might also change genetics as well.

Preliminary testing came from blood samples taken from 4 western and 3 eastern whooping cranes (known breeders) to compare differences (if any) and one sandhill crane as a reference. Sequence data have been completed. Analysis is due to be completed by the end of January. If results seem interesting with the small, initial sample size, more exhaustive sampling can be done. Management implications relate to diet fed captive cranes and potential influence of pollutants on breeding wild birds.

Science Impact of the Eastern Migratory Population Reintroduction Effort

The science output from the Eastern Migratory Population reintroduction effort has been growing substantially in recent years. To date, a total of 26 peer-reviewed articles have appeared, focused on topic areas including health, demography, behavior, and management. In addition, 12 published abstracts and 2 student theses have been produced. The scientific impact of EMP-focused publications is also growing. The most widely cited paper (Runge et al. 2011) has been cited 57 times (scholar.google.com, accessed 23 January, 2014). The second most-cited paper (Hartup et al. 2005) has 13 citations. The journal impact factors for selected outlets have generally been less than 2, but 3 papers published between 2011 and 2014 have been in journals with impact factors >3 (Biological Conservation, 3.79, Runge et al. 2011; Ecological Applications, 3.82, Servanty et al. 2014; Science, 31.2, Mueller et al. 2013). Journal impact factors are a widely used tool to assess the visibility of publication outlets. Increasing the visibility of publication outlets and the diversity of topics will benefit the overall science impact of the reintroduction. Taking advantage of opportunities for collaboration outside the partnership may be especially beneficial, as additional expertise can be tapped.

A full report is available from Sarah Converse in Appendix 1.

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2014 Plans: Forced Re-nesting Experiment

In 2014 we will begin two unique research projects that focus on better understanding the breeding ecology of Whooping Cranes at NNWR. First we will examine the Effects of Forced Re-nesting on Reproduction of a Reintroduced Population of Whooping Crane (*Grus americana*). By forcing pairs to re-nest we hope to modify the timing of re-nesting efforts so that second nests fall outside the activity period of *S. annulus* and thereby increase hatch success. This experiment will also allow salvage eggs from initial nests that can be used to increase reintroduction efforts. Similar nest manipulations have been conducted with wild populations of Mississippi Sandhill Cranes and Florida Sandhill Cranes. Second nests have higher fledging rates (21% versus 0.1%) than initial nest attempts. Forced re-nesting rates have been ~75% in Mississippi Sandhill Cranes. The objectives of this experiment are to a) determine if egg salvage induced nest failure can increase the population’s re-nesting rate, b) modify the timing of re-nesting to avoid peak black fly population levels and c) compare the reproductive success of forced re-nests and first nests of whooping cranes.

Second, we seek to Compare the Breeding Ecology and Reproductive Success of Sandhill Cranes and Whooping Cranes. Since the reintroduction of whooping cranes, few data have been collected on Sandhill Cranes on NNWR. To understand the factors limiting the reproductive success of the EMP, it is logical to examine the reproductive ecology of the population of Sandhill Cranes nesting at NNWR.

If *Simuliidae* flies are the ultimate cause of low reproductive success in Whooping Cranes then reproductive success of Sandhill Cranes may be low as well. If reproductive success differs between Sandhill Cranes and Whooping Cranes then ecological, biological or behavioral differences may be important. The objectives of this study are to: a) collect data on the ecology of the population of Sandhill Cranes nesting on NNWR, b) compare the reproductive success of Sandhill and Whooping Cranes if differences exist, c) compare reproductive success to other known breeding populations in Wisconsin where black flies are not prevalent and d) evaluate factors of nest success that may be responsible.

Transition of Leadership

It has been almost four years since WCEP reorganized into the present team structure. These teams are now working well and the overall effectiveness of WCEP has been greatly enhanced. The next step in our evolution is to evoke productive transitions between leadership within WCEP. As part of that process Jeb Barzen has stepped down as chair of the Research and Science Team and Sarah Converse has assumed that role. Brad Strobel has accepted the co-chair position. It has been a rewarding challenge for the entire team to lead WCEP’s research efforts and we are hopeful that our focus on applied science will ultimately lead us to a sustainable population of Whooping Cranes in the EMP.

COMMUNICATIONS AND OUTREACH TEAM

The 13th year of whooping crane reintroductions by WCEP saw a continued effort by the Communications and Outreach Team to lead external communications for WCEP including outreach, education, and media relations.

The team is responsible for and directs all aspects of external communications and public contact on behalf of WCEP. Comprising communications and education specialists and other key partner staff representing WCEP founding members, the Communications and Outreach Team remains essential to building support for the project through education, media relations, and coordinated public outreach efforts.

WCEP Media Releases/Press Statements

The Communications and Outreach Team issued press releases and statements during project milestones, including:

- Spring migration update
- Arrival of ultralight cranes at White River Marsh
- Arrival of DAR cranes at Horicon NWR
- Study of nesting success
- Departure of the DAR and ultralight-led fall migrations
- State updates of ultralight-led migration
- Updates on cases involving illegal shootings of whooping cranes

Media Coverage

Spikes in media coverage occurred at several points in 2013: During the crane's spring migration, when the ultralight-led and DAR cranes departed on migration, the nesting study press release, and illegal shootings of whooping cranes.

Increasing Outreach Opportunities

WCEP focused on expanding outreach to out-of-state partners and audiences via:

- Putting updates and news releases on Facebook and Twitter
- Expanding the WCEP media contact list to include other states along the flyway

Education and Outreach Programs and Events

Education continues to be a key component of the Communications and Outreach Team's efforts. The whooping crane reintroduction project has offered a strong opportunity to inform and motivate students along the flyway about cranes and wetland conservation. The migration of these birds highlights the dependence of cranes and other wildlife on wetlands along the migration route, so the decisions and conservation outlook of future generations are critical to the survival of these cranes.

The Communications and Outreach Team delivered presentations throughout the year at partner organizations, schools, universities, conservation and birding clubs, professional conferences, birding festivals, civic organizations, and zoos. Outreach representatives distribute education materials, including brochures and curricula, which help interpret crane migration, behavior and ecology. In addition to presentations, the team also participated on other outreach activities such as radio and TV interviews and live chats.

Environmental education accomplishments in 2013 included the continued partnership with Journey North to extend educational outreach efforts into schools throughout North America. Journey North is an internet-based education project that links students across North America to track wildlife migration and seasonal change, including WCEP cranes' status and general locations during the fall and spring migrations. Journey North reaches nearly 1 million students at 54,000 sites, and their website receives over 250,000 visitors per month. Operation Migration funds the Journey North whooping crane participation each year.

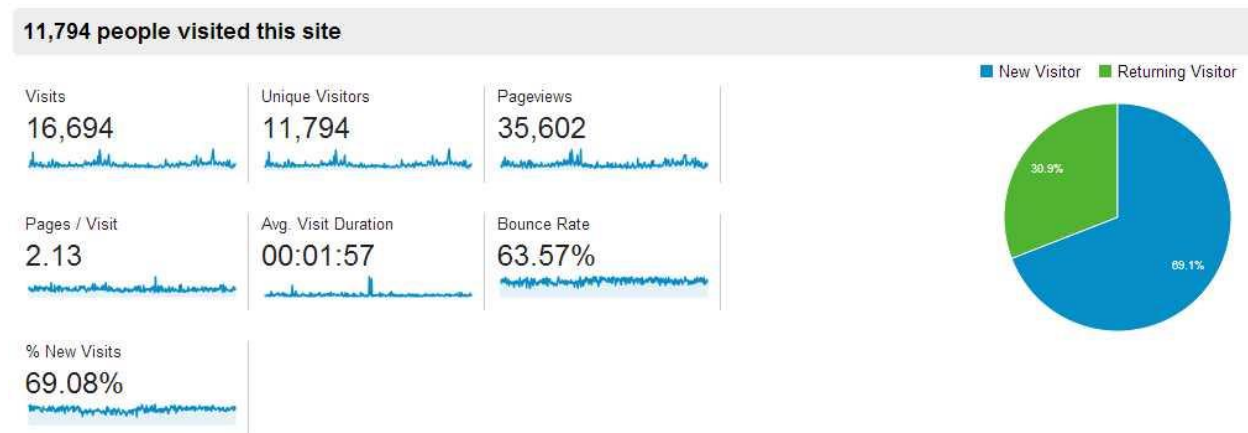
WCEP partners participated in a number of regional and national outreach festivals in 2013, reaching approx. 12,000 people. Events attended included the Port Aransas Whooping Crane Festival, Texas; Berlin Whooping Crane Festival, Wisconsin; Bald Eagle Days, Wisconsin; Wisconsin Wetlands Association Annual Conference; International Migratory Bird Day, Florida; Rivers and Wildlife Festival, Nebraska; and the St. Marks NWR Wildlife Heritage and Outdoors Festival, Florida.

Other education and outreach activities included interpretive tours and education programs at partner facilities, the International Crane Foundation and Operation Migration crane cams, and ultralight flyover events. The Communications and Outreach Team also continues to maintain the whooping crane trunk and education manual for school and other group use (dnr.wi.gov/files/PDF/pubs/ER/ERO661.pdf).

WCEP Website

The WCEP website (www.bringbackthecranes.org) and related partner websites continue to be effective and efficient means of communicating up-to-date information to large numbers of stakeholders, news media, students, and the general public.

www.bringbackthecranes.org – Just under 12,000 unique visitors were captured during 2013. These visits resulted in more than 35,000 page views.



When combined with partner websites: <http://www.operationmigration.org> (121,223) and www.savingcranes.org (WCEP-related pages: 42,052) unique visitor traffic, a total of 175,069 were reached.

Where are they coming from?

Search engine traffic generated just under 7000 visits, while referring websites and social media avenues generated the balance.

Source	Visits	Visits	Contribution to total: Visits
	5,651 % of Total: 33.85% (16,694)	5,651 % of Total: 33.85% (16,694)	
1. operationmigration.org	1,740	30.79%	
2. facebook.com	619	10.95%	
3. fws.gov	550	9.73%	
4. in.gov	142	2.51%	
5. google.com	137	2.42%	
6. m.facebook.com	132	2.34%	
7. learner.org	128	2.27%	
8. t.co	125	2.21%	
9. myfwc.com	120	2.12%	
10. links.govdelivery.com	117	2.07%	

WCEP Social Media Sites

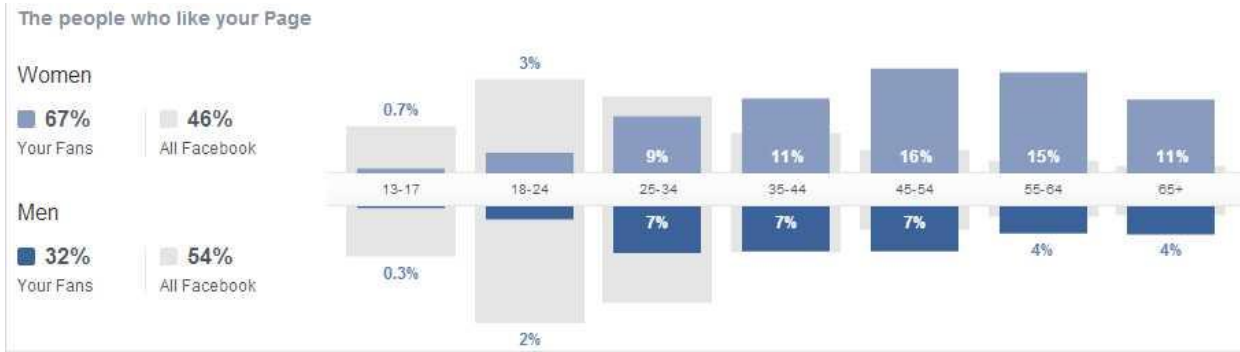
Social media sites provide WCEP with an additional tool to better reach new and existing audiences about the project and its partners.

The primary materials posted to the WCEP Facebook Page ([facebook.com/WhoopingCraneEasternPartnership](https://www.facebook.com/WhoopingCraneEasternPartnership)) were news releases and WCEP partner items of interest (often cross-posted between partner Facebook pages). Through increased usage and exposure, WCEP was able to increase the number of “likes” the page had received from 395 on 1/1/13 to 669 on 12/31/13, representing growth of 69% over the year.

“Likes” are a useful metric to determining the amount of potential overall exposure a page has, however, a Facebook user needn’t “like” the WCEP page to be able to interact. Case in point is that 4461 unique visitors shared 5385 stories about the WCEP Facebook page throughout the year.

Facebook defines this activity as: *The number of people sharing stories about your page. These stories include liking your Page, posting to your Page's timeline, liking, commenting on or sharing one of your Page posts, answering a question you posted, responding to one of your events, mentioning your Page, tagging your Page in a photo.*

Demographic breakdown of WCEP Facebook page ‘Likes’:



WCEP also uses Twitter (twitter.com/bringbackcranes). In an effort to continue to expand outreach, WCEP is actively following numerous Twitter feeds that are similar in scope and nature to WCEP’s. The Communications and Outreach Team primarily utilized Twitter to disseminate news releases (an ever-expanding use of Twitter) and to send out important updates and breaking news items.

In addition to Facebook and Twitter, the Communications and Outreach team has a dedicated WCEP Flickr site ([flickr.com/photos/wcep1](https://www.flickr.com/photos/wcep1)), which provides a central location to post and disseminate photos pertaining to the reintroduction project. Currently the Flickr site hosts 164 photos. The Monitoring and Management Team often receives many high-quality photos from the public that are available for WCEP and others to use as well as the countless photos taken by partners during various activities. The Flickr site allows the Communications and Outreach Team to direct the media and the public to the site, which provides the photos for download and contains crediting information as needed.

Illegal Shooting and Hunter Education Initiative

To help address the unfortunate issue of whooping crane shootings, the Communications and Outreach Team is coordinating a multi-state, multi-agency initiative to help mitigate future losses. A 14-member working group of partners from the three whooping crane populations was formed in 2013. The team is comprised of federal, state and non-profit agencies from Wisconsin, Minnesota, Indiana, Georgia, Tennessee, Nebraska, Louisiana, and Texas. The working group provides partners with an opportunity to share ideas, resources, and identify needed materials and programs to address accidental and intentional whooping crane shootings.

ICF developed two hunter education panels as part of this new initiative. The panels were installed on kiosks at the Patoka River National Wildlife Refuge in Indiana. The signs are available to other state and federal wildlife refuges along the eastern flyway and complement existing WCEP hunter education materials.

WCEP Wiki

To provide a transparent and effective information sharing structure for the partnership, the Communications and Outreach Team continues to develop and manage the WCEP intranet site (Wiki). The Wiki serves as a repository for WCEP information that is accessible to all WCEP members.

Appendix 1

Science Impact of the Eastern Migratory Population Reintroduction Effort

Sarah Converse

The science output from the Eastern Migratory Population reintroduction effort has been growing substantially in recent years. To date, a total of 26 peer-reviewed articles have appeared, focused on topic areas including health, demography, behavior, and management. In addition, 12 published abstracts and 2 student theses have been produced (Figure 1).

The scientific impact of EMP-focused publications is also growing. The most widely cited paper (Runge et al. 2011) has been cited 57 times (scholar.google.com, accessed 23 January, 2014). The second most-cited paper (Hartup et al. 2005) has 13 citations.

The journal impact factors for selected outlets have generally been less than 2 (Figure 2), but 3 papers published between 2011 and 2014 have been in journals with impact factors >3 (Biological Conservation, 3.79, Runge et al. 2011; Ecological Applications, 3.82, Servanty et al. 2014; Science, 31.2, Mueller et al. 2013). Journal impact factors are a widely used tool to assess the visibility of publication outlets.

Increasing the visibility of publication outlets and the diversity of topics will benefit the overall science impact of the reintroduction. Taking advantage of opportunities for collaboration outside the Partnership may be especially beneficial, as additional expertise can be tapped.

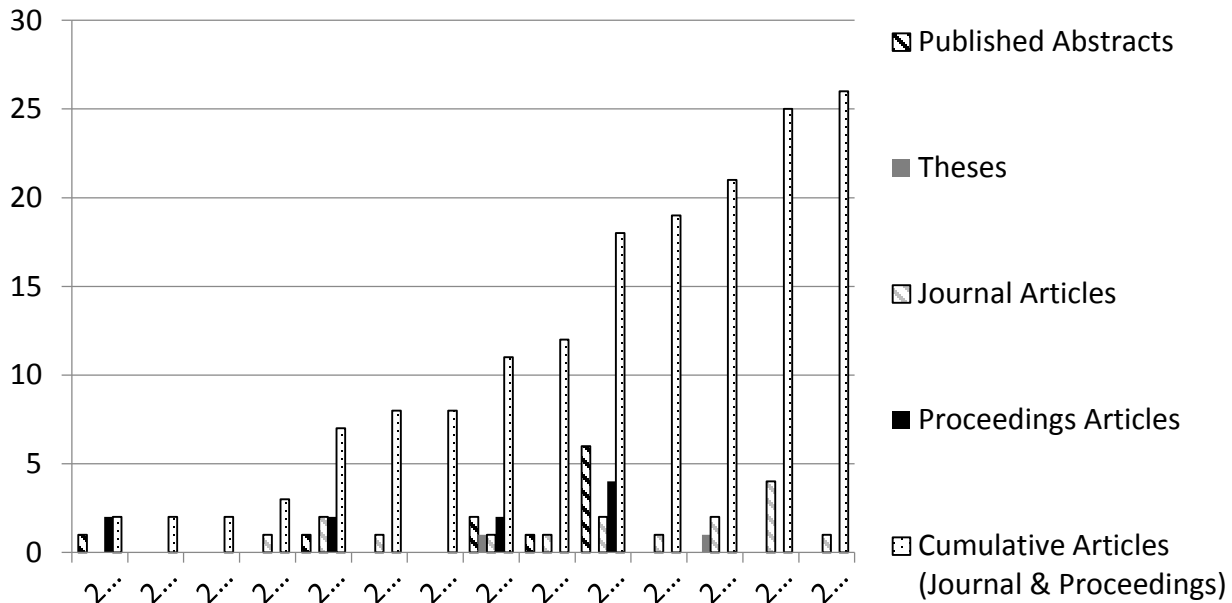


Figure 1. Scientific publications, 2001-present, resulting from the Eastern Migratory Population reintroduction effort. All journal and proceedings articles are in peer-reviewed journals, and abstracts are peer-referred.

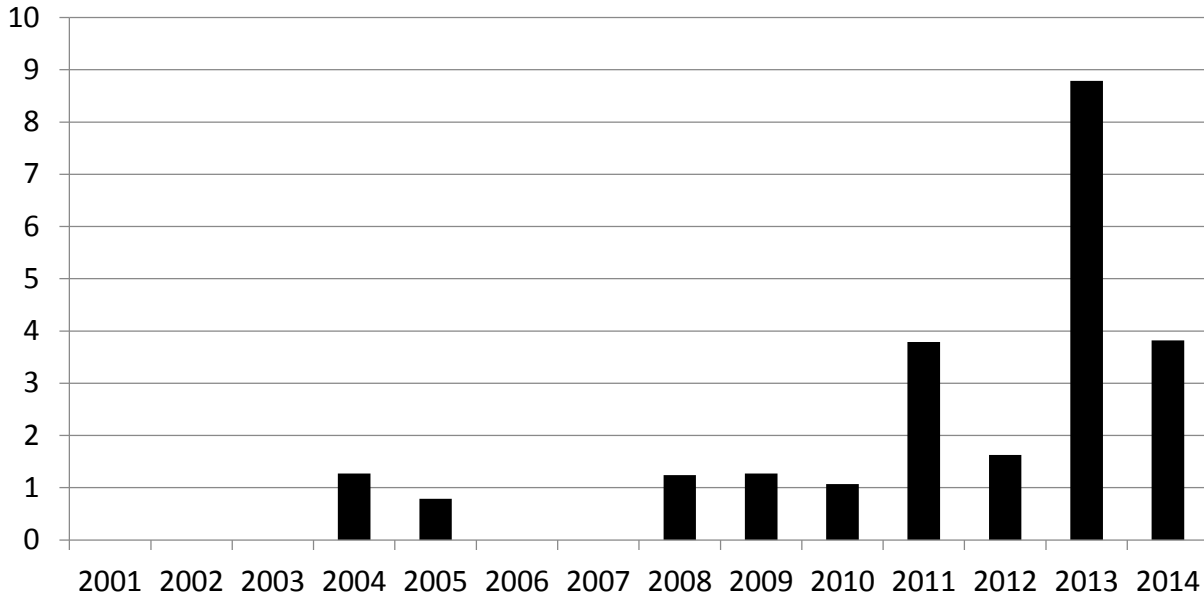


Figure 2. Average journal impact factor, by year of publication, for journal publications resulting from the Eastern Migratory Population reintroduction effort. Journal impact factors were obtained from ResearchGate (researchgate.net; accessed 23 January, 2014).

Literature Cited

Hartup, B. K., G. H. Olsen, and N. M. Czekala. 2005. Fecal corticoid monitoring in whooping cranes (*Grus americana*) undergoing reintroduction. *Zoo Biology* 24:15-28.

Mueller, T., R.B. O'Hara, S.J. Converse, R.P. Urbanek, and W.F. Fagan. 2013. Social learning of migratory performance. *Science* 341:999-1002.

Runge, M. C., S. J. Converse, and J. E. Lyons. 2011. Which uncertainty? Using expert elicitation and expected value of information to design an adaptive program. *Biological Conservation* 144:1214-1223.

Servanty, S., S. J. Converse, and L. L. Bailey. 2014. Demography of a reintroduced population: moving toward management models for an endangered species, the whooping crane. *Ecological Applications: In Press*