Report on Whooping Crane Recovery Activities

2021 breeding season-2022 spring migration

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Executive Summary

Whooping cranes are one of the most rare, highly endangered and intensively monitored bird species in North America. The Aransas-Wood Buffalo population (AWBP), which breeds in northern Canada and winters in Texas, is the only remaining wild, self-sustaining population of whooping cranes. In summer 2021, surveys of the AWBP detected 102 nests and 50 chicks. During winter 2021-22, the peak winter population size on the primary wintering grounds grew to an estimated 543 birds (95% CI= 426.5–781.8; CV = 0.182). Other populations of reintroduced 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 2021 there were approximately 155 cranes in active reintroduced populations (Table 1) and 130 cranes held in captivity (Table 2), representing a slight increase from 152 and decrease from 139 cranes in the previous year, respectively. Reintroduced populations continued to see low levels of wild recruitment and population size is maintained via captive chick introduction.

Aransas-Wood Buffalo Population (AWBP)

Overview

The Aransas-Wood Buffalo population (AWBP) of whooping cranes is the only remaining wild, self-sustaining, 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 were reduced to a mere 16 individuals in 1941 and rebounded to about 543 during the 2021-2022 winter, representing a > 4% long term 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.

AWBP breeding grounds update

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

During the 2021 breeding season, water levels in the whooping crane nesting area appeared higher than recent years and seemed to provide ample habitat for nesting cranes. Precipitation during the breeding season (May to August) was 94% of the 60-year average. During juvenile surveys in August, observers noted that high water levels persisted in most breeding-area ponds. Wildfire affected 69 ha or 0.002% of WBNP (well below the 25-year average of 1.7%). Fires were not detected inside the area designated as

Critical Habitat (CH) under Canada's Species at Risk Act, or in close proximity to known whooping crane nests.

Aerial surveys to estimate abundance of breeding pairs with and without nests were conducted from May 21-25, 2021. Surveys detected 102 nests and 17-19 pairs without nests. The nest count represents the highest on record. Twenty-four nests were outside the area designated as CH and 11 of those were outside WBNP. Of the 11 nests outside WBNP, where CH has not yet been identified, all were north of the Nyarling River. Nests were not detected on Salt River First Nation reserve lands east of WBNP where up to two nesting pairs have been found in recent years.

Aerial surveys to estimate abundance of juveniles were conducted from August 5-8, 2021. Observers detected 50 juveniles in 50 family groups and 46 pairs without juveniles. Of the 50 family groups, 48 were pairs with one juvenile and two included a single adult with one juvenile. Using information collected during the breeding pair and juvenile surveys, we determined that annual productivity was 0.49 juveniles per nest, on par with the 20-year average of 0.48.

AWBP Whooping Crane Tracking Partnership update

In 2009, a multi-agency, collaborative research and monitoring project to capture and mark whooping cranes was initiated in order to quantify behavior, movement and habitat use of cranes during all aspects of their annual cycle. That project, which continued through 2016, was carried out by the Whooping Crane Tracking Partnership (WCTP, Phase 1), a cooperative effort between five core partners: CWS, US Geological Survey (USGS), US Fish and Wildlife Service (USFWS), the Crane Trust and Platte River Recovery Implementation Program, with additional support from Parks Canada Agency (PCA), the International Crane Foundation (ICF), and the Gulf Coast Bird Observatory. Specific objectives were 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 Phase 1 of the WCTP, captured birds were fitted with a GPS/PTT (Global Positioning System/Platform Transmitting Terminal) satellite transmitter mounted on a two-piece leg band. Transmitters were programmed to record each bird's spatial location four times daily, recording both daytime and nighttime locations throughout the annual cycle. From December 2009 to February 2014, 68 whooping cranes were captured and marked with satellite transmitters; 37 adults and two juveniles were marked on the Texas Gulf Coast wintering grounds and 31 juveniles were marked during the breeding season in WBNP. Transmitters are expected to function for three to five years but the number and frequency of GPS transmissions declines over time. By the end of 2018, phase 1 transmitters were offline. Additional information on this project is available here: Platte River Program Whooping Crane Library. Several scientific publications have resulted from Phase 1 of the WCTP, with additional publications currently under review. Please see the literature cited for a list of current publications.

Beginning in 2017, a renewed effort was made to capture whooping cranes and mark them with GPS tracking devices. This work is Phase 2 of the WCTP, which consists of four core partners: CWS, PCA, USFWS and USGS, with additional support from ICF, Calgary Zoo and the Joint Canada-Alberta Oil Sands Monitoring Program. Data collected through this project will build on existing baseline monitoring conducted via satellite telemetry since 2010 and will be used to investigate potential risk to

whooping cranes from industrial development (e.g., extraction of oil and gas, mining and wind power). During Phase 2, captured birds are fitted with GPS/GSM (GPS/Global System for Mobile Communication) transmitters with Global Positioning System capabilities and color leg bands. For most areas, GPS/GSM transmitters were programmed to collect up to 48 GPS locations daily at equal time intervals and to upload location data to the GSM system every 24 hours. This data acquisition schedule allows for highly detailed information on diurnal and nocturnal (roosting) habitat use during all stages of the annual cycle, and on migratory behavior in spring and fall. Beginning in 2019, more frequent GPS location collections (up to 1440 locations daily) are programmed for certain locales (e.g., the oil sands region of Northern Alberta and in proximity to wind farms in U.S.) to allow fine-scale tracking of movement and habitat use through these specific areas of interest. In 2017-2019, CWS and WCTP partners marked 29 juvenile whooping cranes during the breeding season in WBNP and from 2018-2021, USFWS and WCTP partners marked 46 adults on the Texas Gulf Coast. Most recently, USFWS and partners marked an additional seven adults and five juveniles in Texas during January to March, 2022.

AWBP wintering grounds update

2021-22 winter habitat conditions

The first marked whooping cranes arrived on the Texas coastal wintering grounds in and around Aransas National Wildlife Refuge the week of 29 October 2021. Fall arrivals have been about 2 weeks later than normal the last several years. The 2021 precipitation total (62.67 inches recorded at Aransas NWR RAWS January-December) was above the annual average of 38 inches for the Refuge (USFWS, 2010). This was driven by substantial rain accumulations in May (16.49 inches), June (7.13 inches), and July (15.94 inches), accounting for 63% of the total annual rainfall fall. Precipitation the first portion of 2022 was below average, with January–May 2022 rainfall totaling 5.84 inches. San Antonio Bay salinities ranged from 10-28 ppt but were generally near the mean salinity of 18 ppt during the 2021-2022 wintering season (http://lighthouse.tamucc.edu/pq/ ; GBRA Station #1).

Staff at Aransas NWR were able to use prescribed fire to improve whooping crane foraging opportunities and overall prairie upland condition during the 2021-2022 winter season. Given conditions were wetter than normal, only 2,174 acres were prescribed burned on the Aransas NWR complex. Prescribed burns occurred within Crane Unit 13, Upland Unit 8, and Upland Unit 9.

2022 winter abundance survey

For the full 2021-22 report, see attached prepared by U.S. Fish & Wildlife Service. There is also more information available here: https://ecos.fws.gov/ServCat/Collection/Profile/1206

Summary from full report:

The U.S. Fish and Wildlife Service estimated the abundance of whooping cranes in the Aransas-Wood Buffalo population for the winter of 2021–2022. Survey results indicated 543 whooping cranes (95% CI = 426.5–781.8; CV = 0.182) inhabited the primary survey area (Figure 1). This estimate included at least 31 juveniles (95% CI = 20.2–50.8; CV = 0.255) and 196 adult pairs (95% CI = 153.4–282.9; CV = 0.182). Recruitment of juveniles into the winter flock was 6.1 chicks (95% CI = 4.0–9.1; CV = 0.209) per 100 adults.

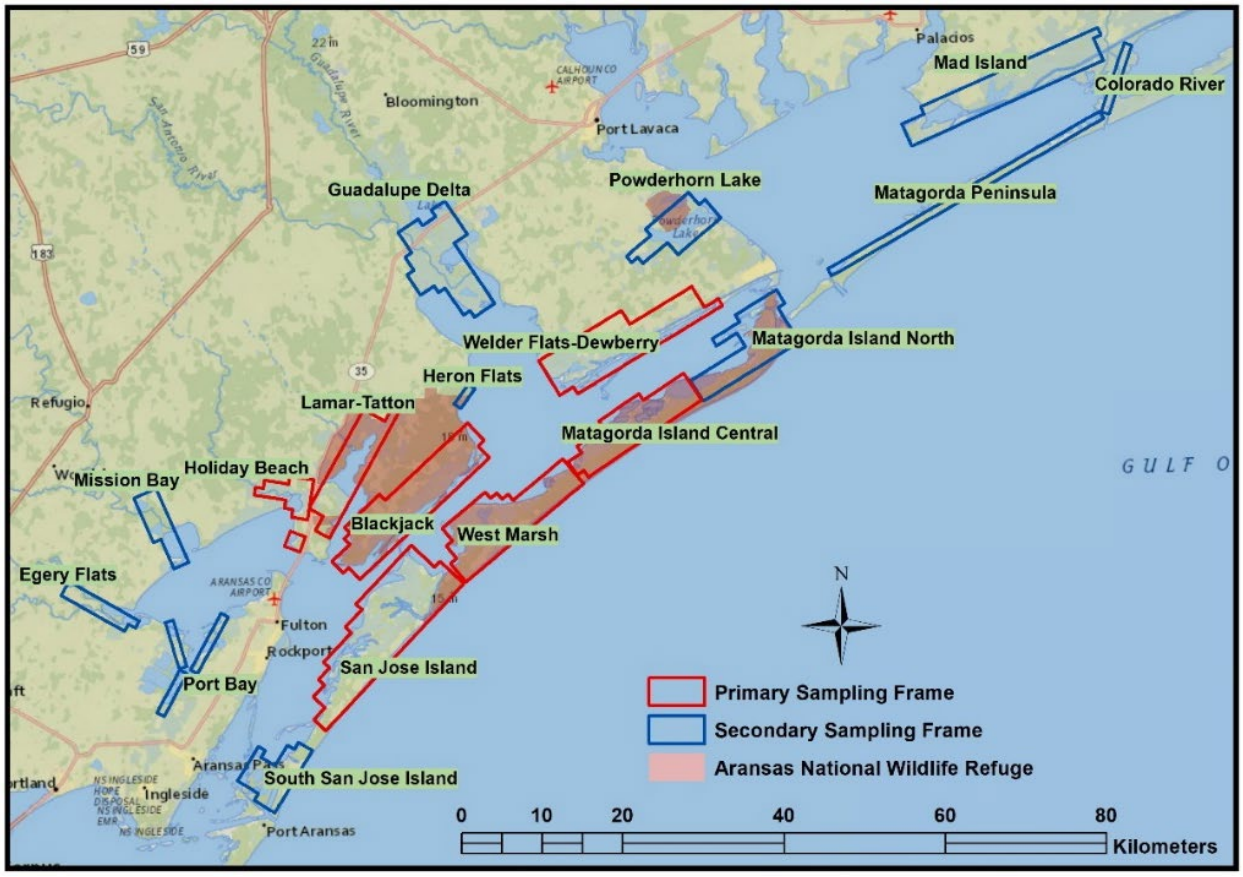

Figure 1. The sampling area used to monitor whooping crane abundance on their wintering grounds along the Texas coast of the Gulf of Mexico, USA.

During winter 2021–2022, the U.S. Fish and Wildlife Service conducted surveys in late-January through early-February using a Quest Kodiak aircraft. The primary survey areas (approximately 160,125 acres; Figure 1) were surveyed six-times during January 25–February 2, 2022. The secondary survey areas (approximately 110,950 acres; Figure 1) were surveyed twice during January 28–30, 2022.

The long-term growth rate in the whooping crane population has averaged 4.4% (n = 81; 95% CI = 1.81–6.92%). The population remained stable from winter 2017–2018 to winter 2019–2020, but it has grown over the last two years. The Canadian Wildlife Service reported 50 whooping crane chicks were fledged at WoodBuffalo National Park in summer 2021. We estimated at least 31 juveniles (95% CI = 20.2–50.8) on the wintering grounds. However, our juvenile abundance estimate is likely biased low since winter surveys are conducted in late-January after juvenile plumage color is less distinct from adults.

Mortalities:

In November 2021, four whooping crane mortalities were documented in western Oklahoma. Further investigation determined the cause of death as gunshot. Four subjects were identified. The case has been presented to the Western District of Oklahoma/United States Attorney's Office for prosecution.

In April 2022 an unmarked female whooping crane was found injured, missing the lower portion of one leg (below the tibiotarsus). The whooping crane was captured and died enroute to a wildlife rehabilitation center.

Reintroduced flocks

Florida non-migratory flock

Current status and future plans

Whooping cranes were released in Florida from 1993 to 2004, with the goal of establishing a non-migratory population. Unfortunately, low productivity and high mortality prevented establishment of a self-sustaining population. Florida Fish and Wildlife Conservation Commission (FWC) ended intensive monitoring of the remaining 18 non-migratory cranes in June 2012. Since then, monitoring efforts have been opportunistic and relied heavily on public observations, and a few pairs have continued to produce offspring.

Given there are no plans for future reintroductions into this flock, in 2017, biologists from Florida, Louisiana, and the USFWS decided to try and translocate some of the wild-hatched chicks and single cranes to Louisiana to help in recovery efforts. A partnership between FWC, Louisiana Department of Wildlife and Fisheries, White Oak Conservation, and the USFWS translocated the first cranes in January 2019 when a 1998 captive-reared female and her 2015 wild-hatched female chick were captured and moved to southwestern Louisiana. In November 2021, a 2019 wild-hatched female was captured and translocated to Louisiana after the only other whooping crane in the area was hit and killed by a vehicle.

The females translocated in 2019 have paired with Louisiana cranes and nested, although not successfully. The female translocated in 2021 has paired with a Louisiana crane but has not nested yet.

At the end of the reporting period, the Florida population was made up of seven cranes:

- A pair in Polk County made up of a 2000 captive-reared male and a 1993 captive-reared female.
- A pair in Osceola County containing a 2000 captive-reared male and 1999 captive-reared female.
- A 2006 wild-hatched female in Alachua County. This is the daughter of the 1999 Osceola female.
- Two 2016 twin wild-hatched males.

Louisiana non-migratory flock

For the full 2021-22 report, see attached prepared by Louisiana Department of Wildlife and Fisheries

Four juvenile, male whooping cranes were received on 10 November 2021 from the Freeport-McMoRan Audubon Species Survival Center (ASSC) in New Orleans, Louisiana. They were transported to the White Lake Wetlands Conservation Area (WLWCA) in Vermilion Parish where they were banded and immediately released into the open release pen. One died from predation just days after release, likely due to inappropriate habitat use, but the other three remained alive. Additionally, four wild-hatched chicks from 2021 remained alive through the report period.

The maximum size of the Louisiana non-migratory population at the end of the report period was 76 individuals (38 males, 29 females, 9 unknown) with 74 birds located in Louisiana and two in Texas. Based on location data generated via remote transmitters, we documented cranes in 19 parishes throughout Louisiana, with four of those parishes accounting for 75% of the data points within the state. With the death of one remaining, paired, breeding male in southeastern Texas, we expect that use of Texas locations will continue to decrease, and in fact, less than 1% of all points collected during the report period were located there. Additionally, female L4-17, who seasonally migrated from Oklahoma to northern Alabama for several years, died in November 2021, so use of areas outside of Texas and Lousiana will likely decrease as well.

During the 2022 breeding season, 17 pairs initiated 27 nests in seven different parishes in Louisiana and one county in southeast Texas. Fourteen pairs consisted of individuals who had previous experience nesting together, two pairs consisted of individuals who had previous experience with other cranes, and one pair consisted of individuals who were both nesting for the first time. Three pairs that had nested in 2021 did not nest in 2022. Nineteen nests from 10 pairs were located on private agricultural properties, nearly all of which were actively crawfished, while the remaining eight nests from seven pairs were located in marsh habitats; three pairs nested in the WLWCA marsh and four nested in marsh habitat on private property. One hatch year 2019 female was translocated from the failed Florida non-migratory population in October 2021. She paired, but did not nest in 2022. So far, translocation of individuals from the Florida flock has been successful with all three individuals pairing and setting up territories, but not yet producing offspring.

In 2022, 15 chicks hatched to 12 pairs (nine pairs hatched one chick; three pairs hatched two chicks). Twelve chicks hatched to their biological parents and three hatched from fertile eggs that were swapped into nests. Seven chicks (from six pairs) survived to fledging, with an eighth chick, from an additional pair, fledging shortly after the end of this report period. Five successful pairs had some prior parenting experience, with three of those pairs having successfully raised chicks to independence in the past. Two successful pairs had no prior parenting experience. The remaining seven chicks disappeared at 3-30 days of age. For the second year in a row and the third time since chicks were first produced in Louisiana, a single pair successfully fledged two chicks. The eight fledged chicks represent a record high for Louisiana as well as a record number of fledged chicks for any previous or current reintroduction project. Additionally, for the first time since 1939, chicks fledged from nests located in marsh habitats, including four from the WLWCA.

Now in its 12th year, the Louisiana whooping crane reintroduction continues to see positive progress, including a record number of fledged chicks, but still has challenges to overcome. We continue to explore potential causes of embryo mortality in order to better understand this issue.

Eastern migratory population

For the full 2021-2022 report, see attached prepared by International Crane Foundation

During 2021, there were about 75 whooping cranes in the Eastern Migratory Population. The majority spent the summer in Wisconsin, with the exception of two birds that spent the summer in Michigan. We recorded a total of 23 nests by 21 breeding pairs of cranes, from which 14 chicks hatched. Four of these chicks made it to fledging, three migrated south and wintered with their parents. Three captive-reared cranes were released, and two survived to migration There were four confirmed mortalities during 2021,

due to various causes. Members of the Field Team captured eight adult whooping cranes during 2021 for transmitter replacement, as well as two wild-hatched juveniles for initial transmitter deployment. All eight of the adults were fitted with GSM transmitters or VHF radios which will help us monitor nesting and chick-rearing seasons. Additionally, one adult whooping crane (16-12) was captured and removed from the Eastern Migratory Population due to his continued use of a military air base. He was placed back into captivity at the International Crane Foundation (ICF).

Highlights related to monitoring and management of the EMP from 2021 include:

- During 2021, we recorded a total of 23 nests by 21 different pairs breeding in Wisconsin. This does not include one nest of a hybrid sandhill-whooping crane pair in Michigan, and two nests of a hybrid pair in Dodge County, Wisconsin. The numbers reported here are the total we observed but there may have been a few missed nests or chicks who only lived a few days. We recovered three eggs from abandoned nests, collected two eggs from two occupied nests, and conducted forced renesting for one additional nest with two eggs. In total we brought seven eggs into captivity for rearing and release. Additionally, we pulled a fertile egg from one nest and swapped it into a hybrid (sandhill-whooping crane) nest, however it did not hatch. Ten nests failed due to a variety of known and unknown causes (predation, abandonment. Additionally, two nests were incubated full term, but the pairs were confirmed later without chicks. Fourteen chicks hatched from eight first nests and two re-nests. Four wild-hatched chicks fledged and three survived to migration.
- Eight adults were captured for transmitter replacement, two wild-hatched chicks were captured for initial banding, and one adult was captured and placed back in captivity due to continued use of a military air base. In addition to having her transmitter replaced, Whooping Crane 6-17 was captured in Sauk County, Wisconsin, and translocated to White River Marsh SWA. She returned to Sauk County a few days later.
- There were four confirmed whooping crane mortalities during 2021.
- We released three captive-reared whooping cranes into the wild, and two survived to migration and headed south with other whooping cranes in the EMP.

Table 1. Estimated size of wild whooping crane populations in winter 2021-22.

Population	Male	Female	Unknown	Total	Breeding Pairs
Aransas-Wood Buffalo	N/A	N/A	N/A	543	102
Eastern Migratory	38	38	3	79	N/A
Louisiana Non-migratory	38	29	9	76	N/A
Florida Non-migratory	N/A	N/A	N/A	7	N/A
Total in wild populations				705	

Table 2. Number of whooping cranes held at institutional members of the Species Survival Program (SSP) in March 2022. Institutions denoted with a star are designated by the International Whooping Crane Recovery Team and the SSP as captive breeding centers.

Institution	Male	Female	Total
International Crane Foundation, Wisconsin*	16	17	33
Calgary Zoo, Alberta*	12	13	25
Audubon SSC (Species Survival Center)	10	6	16
White Oak Conservation Center, Florida*	5	4	9
Dallas Zoo, Texas*	5	4	9
Smithsonian Conservation Biology Institute, Virginia*	5	5	10
African Lion Safari, Ontario	2	2	4
Abilene Zoo, Texas	1	1	2
Audubon Zoo, Louisiana*	1	1	2
Homosassa Springs Wildlife State Park, Florida	1	1	2
Houston Zoo, Texas	1	1	2
Milwaukee County Zoo, Wisconsin	1	1	2
National Zoo	1	1	2
Oklahoma City Zoo, Oklahoma	1	1	2
Omaha Zoo, Nebraska	1	0	1
San Antonio Zoological Gardens and Aquarium, Texas*	1	1	2
Sylvan Heights Bird Park, North Carolina	1	1	2
Zoo New England, Massachusetts	0	1	1
Jacksonville Zoo, Florida	1	1	2
Northeastern Wisconsin Zoo	1	1	2
Total in captive population	67	63	130

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

Recovery and Ecology of Endangered Whooping Cranes:
Monitoring of the Aransas-Wood Buffalo Population during the 2021 Breeding Season

Mark Bidwell and John Conkin

Canadian Wildlife Service
Prairie Region, Environment and Climate Change Canada
Government of Canada

Summary

Annual, long-term monitoring of the Aransas-Wood Buffalo Population (AWBP) of whooping cranes (*Grus americana*, hereafter cranes), which numbers approximately 506, is a key element of Canada's efforts to recover the species under the *Species at Risk Act*. In 2021, Parks Canada staff from Wood Buffalo National Park (WBNP) conducted surveys for whooping cranes in breeding areas in southern Northwest Territories and northern Alberta, in and adjacent to WBNP, with support from the Canadian Wildlife Service. Breeding pair surveys in May detected 102 nests which represents the highest nest count on record. Twenty-four nests were outside the area designated as critical habitat (CH) and 11 of those were outside WBNP; 17-19 pairs without nests were also observed. Surveys in August detected 50 juveniles in 50 family groups, 13 of which were outside CH and seven were outside WBNP. Of the 50 family groups, 48 were pairs with one juvenile and two included a single adult with one juvenile. Annual productivity was 0.49 juveniles per nest, on par with the 20-year average of 0.48. Results of monitoring in 2021 highlight the continued increase in the breeding population (although still well below Canadian and international recovery goals) and the associated expansion of the breeding range outside WBNP and areas designated as CH.

Background and Rationale

The Government of Canada and its partners, via implementation of the Recovery Strategy for the Whooping Crane in Canada (hereafter RS; Environment Canada 2007) and the joint US-Canada International Recovery Plan (hereafter IRP; CWS and USFWS 2007), aims to protect, restore, and manage the whooping crane (*Grus americana*) to be self-sustaining in the wild by establishing 1,000 individuals in North America by 2035 (Environment Canada 2007). By reaching this goal and achieving other recovery criteria, the species may be considered for re-designation from Endangered to Threatened under the *Species at Risk Act* (SARA) in Canada, and under the *Endangered Species Act* in the United States. Coordination of activities designed to recover the species, including establishment and operation of a joint International Recovery Team, is governed by a memorandum of understanding between the Canadian Wildlife Service (CWS) of Environment and Climate Change Canada (ECCC), Parks Canada Agency (PCA), the US Fish and Wildlife Service (USFWS), and the US Geological Survey (USGS).

The only naturally occurring population of whooping cranes, the migratory Aransas-Wood Buffalo Population (AWBP), which numbered about 506 individuals during winter 2020-2021 (95% CI: 342.6 to 678.0; USFWS 2020), spends half of its annual cycle in Canada. During the summer breeding season (May to September), breeding adults and some non-breeding sub-adults reside in and adjacent to Wood Buffalo National Park (WBNP) in Alberta and the Northwest Territories. During fall (September and

October), adults, sub-adults, and juveniles spend up to 4-6 weeks staging in central Saskatchewan before migrating to the Texas Gulf Coast, where they spend winter (November to March) in and near the Aransas National Wildlife Refuge. During spring migration (March and April), cranes return to WBNP and adjacent areas via Saskatchewan, for initiation of breeding in May.

Annual monitoring of the AWBP by CWS and our partners is a key element of Canada's implementation of the RS and IRP, and is specified in those recovery documents as an activity required to achieve recovery goals. Data collected annually are used to (1) track progress towards recovery goals by estimating the abundance and productivity of breeding pairs annually; (2) identify and designate areas as critical habitat (CH) (i.e., areas vital to the survival or recovery of cranes) under SARA; and (3) predict future population dynamics and range expansion of the AWBP. Most breeding pairs nest inside WBNP, but the population has expanded its range outside the national park with up to 11 pairs nesting annually in the Northwest Territories, and up to two pairs on Salt River First Nation reserve lands.

Given the population's small size, we monitor almost all breeding individuals by conducting annual aerial surveys of the abundance of (1) breeding pairs and nests in late spring and (2) juveniles in mid-summer. Information obtained from both surveys is used to derive metrics required by the RS and IRP to track progress towards recovery (i.e., number of breeding pairs, annual productivity). Aerial surveys are conducted in the core breeding areas within WBNP, and in areas outside the national park. This monitoring work has been conducted annually since 1966 by CWS, and in close cooperation with PCA since 2011.

Habitat Conditions in Breeding Areas

Annual precipitation at Fort Smith, Northwest Territories preceding the breeding season (May 2020 to April 2021) was 126% of the 60-year average (Figure 1; Environment and Climate Change Canada 2021). During the 2021 breeding season, water levels in the whooping crane nesting area appeared higher than recent years and seemed to provide ample habitat for nesting cranes. Precipitation during the breeding season (May to August) was 94% of the 60-year average (Figure 1, Environment and Climate Change Canada 2021). During juvenile surveys in August, observers noted that high water levels persisted in most breeding-area ponds.

Wildfire affected only 69 ha or 0.002% of WBNP (well below the 25-year average of 1.7%). Fires were not detected inside the area designated as CH or in close proximity to known whooping crane nests.

Abundance of Breeding Pairs and Juveniles

In 2021, aerial surveys to estimate abundance of breeding pairs with and without nests were conducted from May 21-25 using methods described in Johns (2010). This year, we continued work to test new methods to detect whooping crane nests using analysis of high-resolution satellite imagery collected during the aerial survey period, in cooperation with Parks Canada and the Calgary Zoo. Using these methods, we detected 102 nests (Table 1, Figure 2), 98 of which were detected during the aerial survey and four via analysis of satellite imagery. We also detected 17-19 pairs without nests; this range reflects the possible number of unique pairs without nests because most cranes are not individually banded yet may move during the duration of the survey. Of the 102 nests, 24 were outside the area designated as containing CH and 11 of those were outside WBNP. Of the 11 nests outside WBNP, where CH has not yet been identified, all were north of the Nyarling River. Nests were not detected on Salt River First

Nation reserve lands (i.e., Lobstick Creek) east of WBNP where up to two nesting pairs have been found in recent years. In 2021, breeding pair surveys were conducted by Lori Parker (PCA), Sharon Irwin (PCA), and Brandon Gregg (PCA) over 28.2 hours using an EC-120 helicopter piloted by Felix Erner of Phoenix Heli-flight (Fort McMurray, AB).

Aerial surveys to estimate abundance of juveniles were conducted from August 5-8, 2021. Observers detected 50 juveniles in 50 family groups and 46 pairs without juveniles (Table 1). Of the 50 family groups, 48 were pairs with one juvenile and two included a single adult with one juvenile. Using information collected during the breeding pair and juvenile surveys, we determined that annual productivity was 0.49 juveniles per nest, on par with the 20-year average of 0.48 (Figure 3). Juvenile surveys were conducted by Lori Parker, Brandon Gregg, and Teresa Little (PCA) over 21 hours using an EC-120 helicopter piloted by Felix Erner of Phoenix Heli-flight.

Management Considerations

We confirmed nesting by 102 pairs in late spring, producing an average of 0.49 juveniles per nest by mid-summer. While the number of confirmed nests has increased steadily since surveys began in 1966, it also varies annually (Figure 3) possibly in response to environmental conditions during the breeding season. The ratio of juveniles to nests, which is an estimate of breeding success for the population, also varies annually (Figure 3) in response to environmental conditions but also in a periodic manner that tracks the 10-year boreal hare-lynx cycle (Boyce et al. 2005) likely because of periodicity in abundance of predators (e.g., wolves, lynx, red fox).

The 2021 nest count represents the highest count on record and the highest four counts have all occurred during the last four years where fieldwork was conducted, highlighting the gradual but steady increase in the breeding population over the last 60 years (Figure 3). Even so, the AWBP is many years away from achieving the Canadian down-listing goal of 250 pairs (COSEWIC 2010). Recovery of the species currently depends on growth of the AWBP, so monitoring should continue until recovery goals are reached (CWS & USFWS 2007).

Twenty-four breeding pairs were detected outside the area designated as CH (Environment Canada 2007) under SARA, and 11 of these were outside WBNP, representing the highest values for these metrics and emphasizing the continued expansion of the AWBP's breeding range outside WBNP and areas designated as CH. The first nest outside WBNP was detected in 1982 on reserve lands of the Salt River First Nation, east of WBNP, and in 1998 cranes were detected nesting north of WBNP, in the Northwest Territories. Up to 24% of nests and 36% of the nesting range occur outside CH annually, as defined in the current recovery strategy. Although cranes and their nests are protected under SARA and the *Migratory Birds Convention Act* wherever they occur, breeding habitat is not formally protected under federal legislation unless it is identified as CH. In particular, SARA prohibits destruction of CH in federal protected areas (e.g., WBNP) and includes measures that could protect CH in other areas. Moreover, up to 11% of nests occur outside WBNP annually, and these nests and associated habitat are not protected under the *Canada National Parks Act* or related regulations. Because the breeding range of whooping cranes has expanded outside the CH into areas that could be impacted by human development, ECCC supports efforts to update CH identification to ensure it more closely corresponds to current and probable future breeding ranges of the species.

Acknowledgements

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Table 1. The number and type of observations of whooping cranes that were detected during breeding pair and juvenile surveys in May and August 2021, respectively. *Note: Of the 50 pairs with juveniles observed in August, two adults without a mate were observed with one young.*

Observation type	May	Aug
Nests	102	n/a
Adults on or near nests	148	n/a
Pairs without nests	17-19	n/a
Pairs with juveniles	n/a	50
Juveniles	n/a	50
Pairs without juveniles	n/a	46
Lone cranes	37-38	10
Grouped cranes	3	0
Total cranes	222-227	250

Notes:

(i) Because cranes may move over the duration of the survey, ranges reflect the possible number of unique individuals or unique pairs. The main objectives of the surveys are to obtain estimates of (a) nests and (b) pairs with juveniles, which are reported with more precision.
(ii) Many lone cranes observed in May are likely mates of adults detected on nests.
(iii) Grouped cranes refer to three or more cranes at one location. In 2021, the maximum number of adults observed at one location was three.

Figure 1. The amount of the whooping crane nesting area burned by wildfire annually (left vertical axis, dashed red line represents 25-year mean), and the total precipitation recorded at Fort Smith, Northwest Territories before (October-April) and during (May-September) the breeding season (right vertical axis, dashed blue lines represent 60-year means), 1961 to 2021.

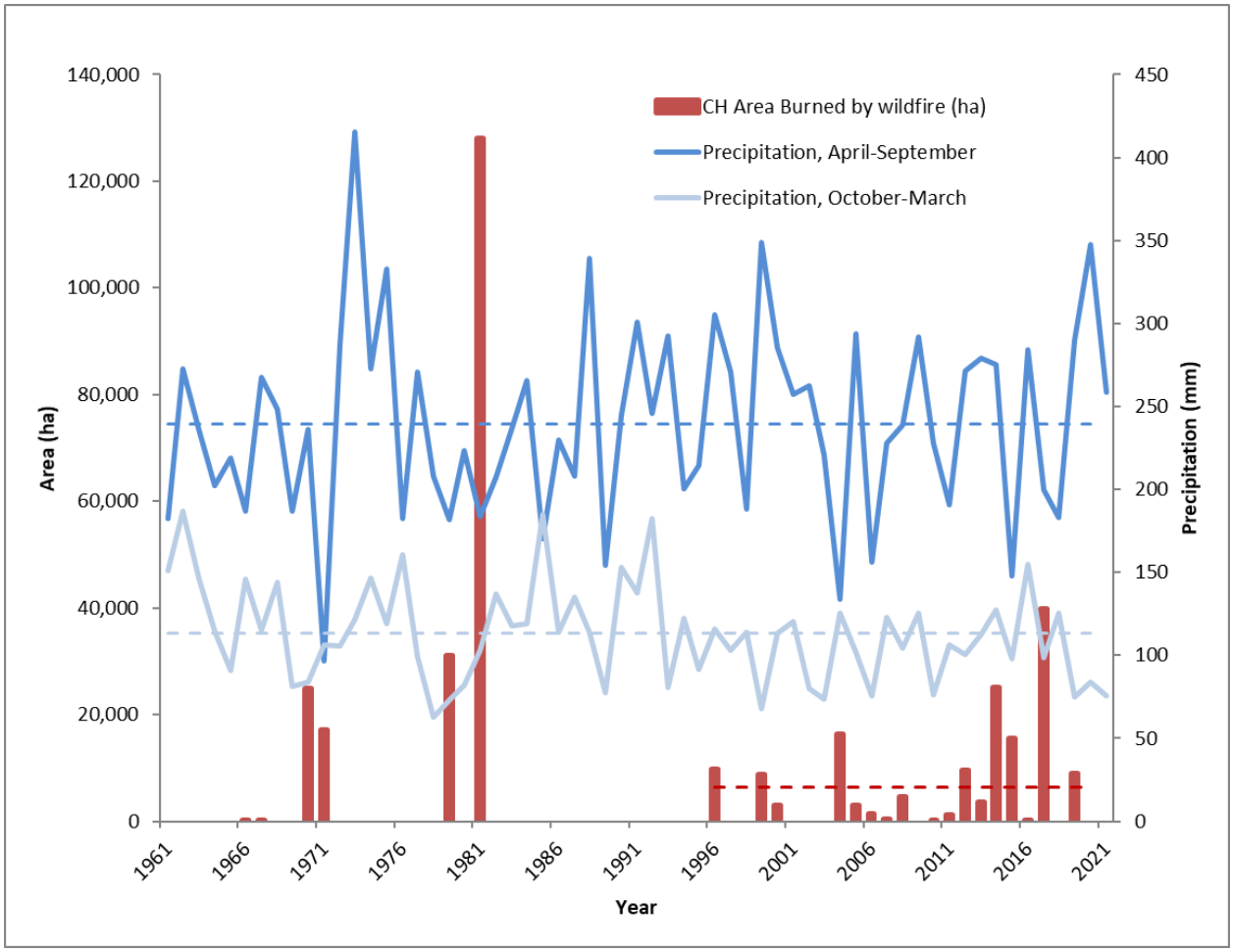


Figure 2. The density per 100 km^2 of whooping crane pairs, with and without nests, detected during the breeding pair survey in May 2021.

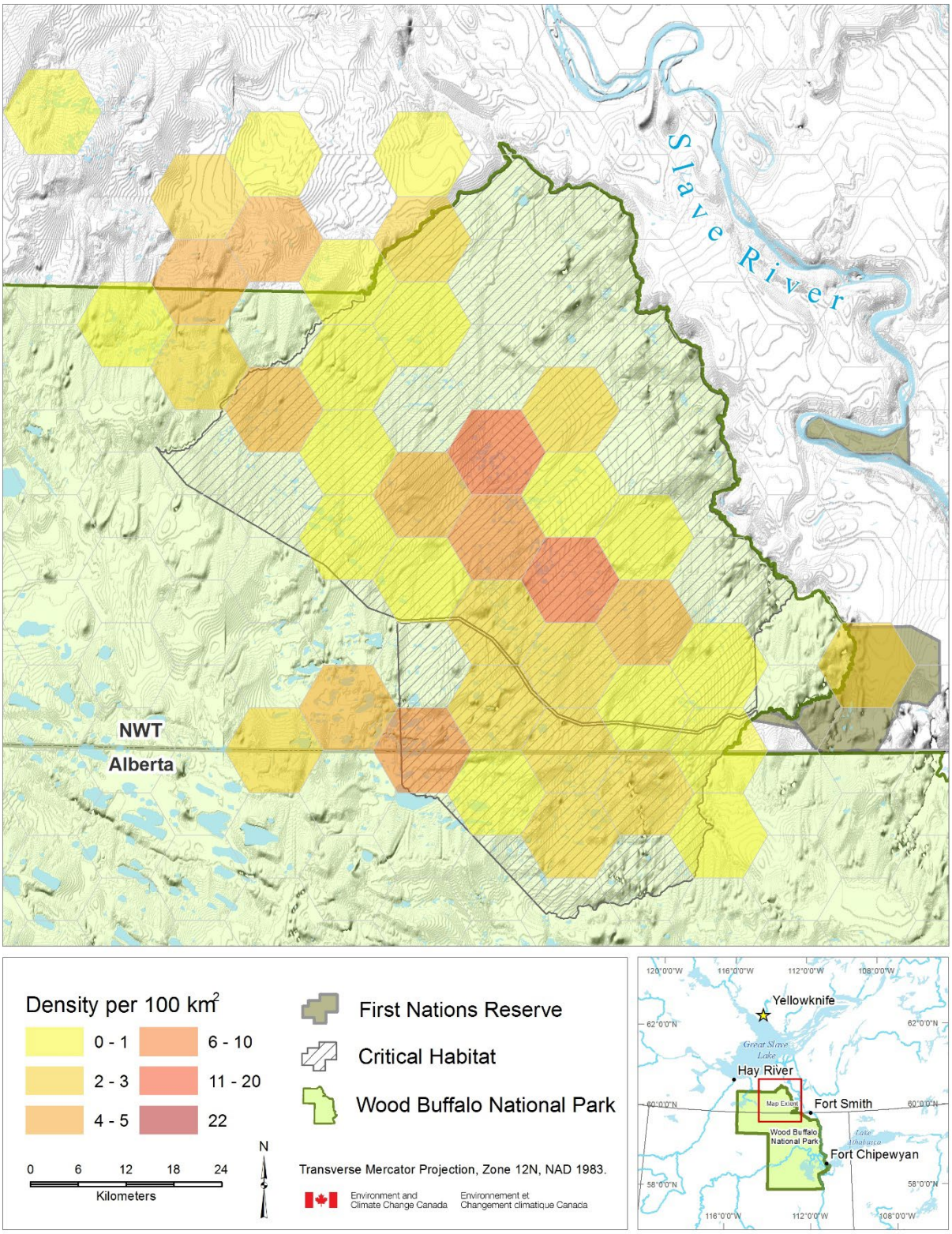
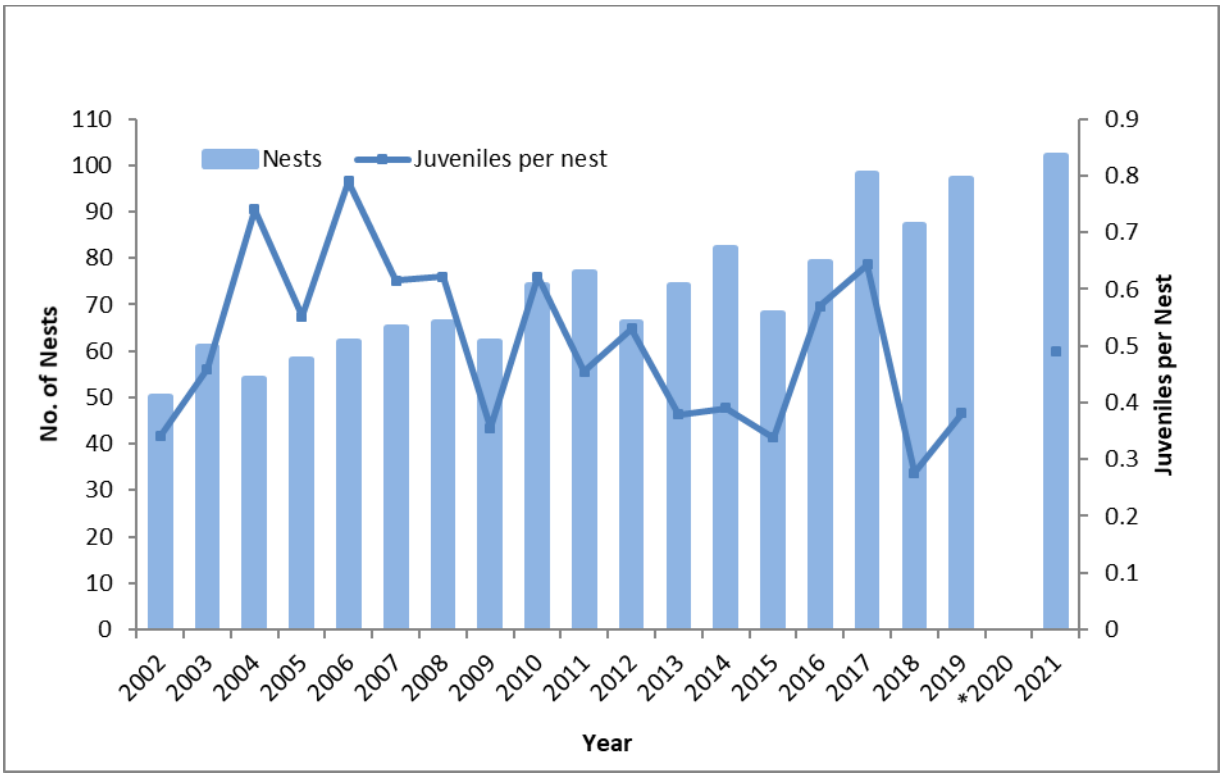


Figure 3. The number of whooping crane nests, and juveniles per nest, detected during aerial surveys from 2002-2021. The number of nests and juveniles are estimated during breeding pair (May) and juvenile (July-August) surveys, respectively; the number of juveniles per nest is calculated using information from both surveys. *Aerial surveys were not conducted during 2020 due to restrictions related to the COVID-19 pandemic.



Whooping Crane Survey Results: Winter 2021–2022

543 Wild Whooping Cranes Estimated (95% CI = 426.5–781.8)

The U.S. Fish and Wildlife Service estimated the abundance of whooping cranes in the Aransas-Wood Buffalo population for the winter of 2021–2022. Survey results indicated 543 whooping cranes (95% CI = 426.5–781.8; CV = 0.182) inhabited the primary survey area (Figure 1). This estimate included at least 31 juveniles (95% CI = 20.2–50.8; CV = 0.255) and 196 adult pairs (95% CI = 153.4–282.9; CV = 0.182). Recruitment of juveniles into the winter flock was 6.1 chicks (95% CI = 4.0–9.1; CV = 0.209) per 100 adults.

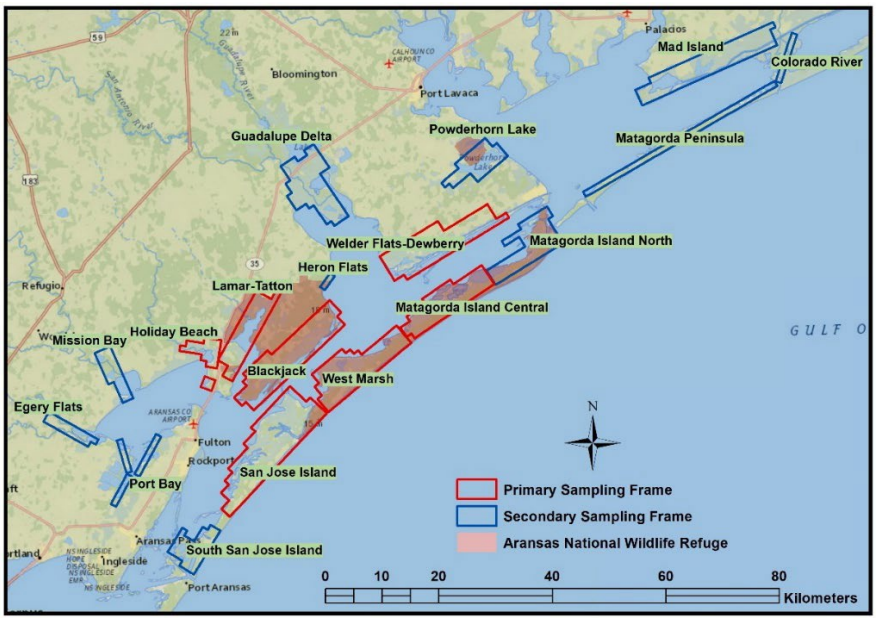


Figure 1. The sampling area used to monitor whooping crane abundance on their wintering grounds along the Texas coast of the Gulf of Mexico, USA.

During winter 2021–2022, the U.S. Fish and Wildlife Service conducted surveys in late-January through early-February using a Quest Kodiak aircraft. The primary survey areas (approximately 160,125 acres; Figure 1) were surveyed six-times during January 25–February 2, 2022. The secondary survey areas (approximately 110,950 acres; Figure 1) were surveyed twice during January 28–30, 2022.

The long-term growth rate in the whooping crane population has averaged 4.4% (n = 81; 95% CI = 1.81– 6.92%). The population remained stable from winter 2017–2018 to winter 2019–2020, but it has grown over the last two years (Table 1). The Canadian Wildlife Service reported 50 whooping crane chicks were fledged at Wood-Buffalo National Park in summer 2021. We estimated at least 31 juveniles (95% CI = 20.2–50.8) on the wintering grounds. However, our juvenile abundance estimate is likely biased low since winter surveys are conducted in late-January after juvenile plumage color is less distinct from adults.

During the survey period, some whooping cranes were observed outside of the primary survey areas. Table 2 provides our best understanding of whooping cranes outside the primary survey areas during the survey period. We cannot ascertain if all or some of these birds moved in and out of the primary survey

area during the survey period. Therefore, some unknown number of birds may be missed while others counted.

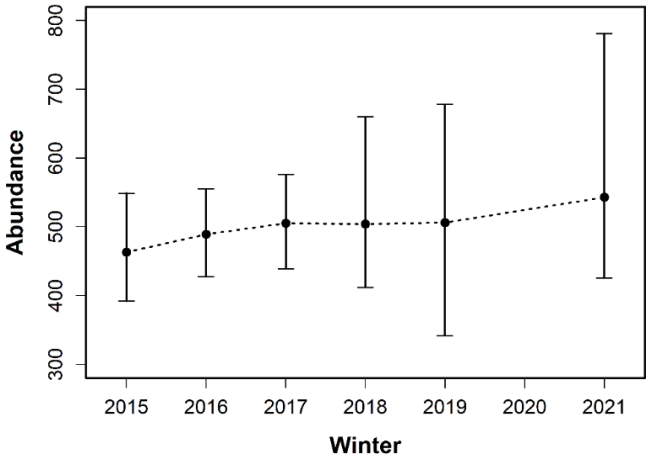


Figure 2. Time-series of whooping crane abundance estimates and 95% confidence intervals for the Aransas-Wood Buffalo population beginning in winter 2015–2016.

Table 1. Preliminary whooping crane abundance estimates for the Aransas-Wood Buffalo population on their wintering grounds, winter 2015–2016 through winter 2021–2022. *Note: Due to the COVID-19 pandemic, surveys were not conducted during winter 2020–2021. Estimated whooping crane abundance in the primary sampling area using aerial surveys and hierarchical distance sampling. CV = coefficient of variation, LCL = lower confidence limit, and UCL = upper confidence limit. Number assumed beyond primary survey area, provides our best understanding of the number of whooping cranes, at the time of the aerial surveys, that were outside of the primary survey areas. This information was based on data from Texas Whooper Watch, eBird reports, iNaturalist reports, the whooping crane GPS tracking study, and aerial surveys conducted in the secondary survey areas.*

Survey year	Survey month	Aircraft	Abundance	CV	95% LCL	95% UCL	Number assumed beyond primary survey area
winter 2015–2016	March	Kodiak	463	0.095	392	549	8
winter 2016–2017	March	Kodiak	489	0.116	428	555	6
winter 2017–2018	February	Kodiak	505	0.069	439	576	21
winter 2018–2019	February	Kodiak	504	0.122	412	660	12
winter 2019–2020	January	Kodiak	506	0.168	342	678	29
winter 2021–2022	January	Kodiak	543	0.182	426	781	38

The survey protocol contains guidelines for promoting secondary survey areas into the primary survey areas. During winter 2019–2020, we observed enough whooping crane groups in the Holiday Beach survey area to promote it into the primary survey area. The Holiday Beach survey area is now part of the primary survey area. The boundaries of the secondary survey areas were also modified so that survey effort in non-habitat areas was minimized (i.e., open water or brushy uplands). We added Heron Flats as a new secondary survey area this year, and we observed enough whooping crane groups to promote it into the primary survey area starting during winter 2022–2023. Also, we observed enough whooping crane groups to promote South San Jose Island into the primary survey area starting winter 2022–2023.

Table 2. Whooping cranes documented outside of the primary survey area during January 25– February 2, 2022.

General area	Data source	Adults	Chicks	Total	Notes
Aransas County (near Lamar, Texas and Goose Island State Park, and residential area)	eBird	4	0	4	22 reports of 2 to 6 birds between January 24–31, 2022. The median count is used.
Nueces County (near Leonabelle Turnbull Birding Center)	eBird	2	0	2	4 reports of a pair during January 29–31, 2022
Wharton and Colorado counties, Texas	GPS tracking study	4	1	5	Used flooded agricultural areas throughout winter
Matagorda Island North (secondary survey area)	GPS tracking study Aerial Survey	2	1	3	Family group detected during aerial survey on January 28, 2022, and a single crane on January 30, 2022
Powderhorn Lake (secondary survey area)	GPS tracking study Aerial Survey	4	1	5	Family group and a pair detected during aerial survey on January 30, 2022
Guadalupe Delta (secondary survey area)	Aerial Survey	4	2	6	Family group detected during aerial survey on January 28, 2022, and 2 family groups on January 30, 2022
Heron Flats (secondary survey area)	Aerial Survey	2	0	2	Pair detected during aerial survey on January 28, 2022
Mad Island (secondary survey area)	Aerial Survey	4	2	6	2 family groups detected during aerial surveys on January 28 & 30, 2022
Port Bay (secondary survey area)	Aerial Survey	1	0	1	A single detected during aerial survey on January 30, 2022
South San Jose (secondary survey area)	Aerial Survey	4	0	4	2 pairs detected during aerial survey on January 29, 2022, and a pair plus 2 singles on January 30, 2022

The data and results presented in this report are preliminary and subject to revision. This information is distributed solely for the purpose of providing the most recent information from aerial surveys. This information does not represent and should not be construed to represent any U.S. Fish and Wildlife Service determination or policy.

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2021-2022 Louisiana Whooping Crane Report

Louisiana Department of Wildlife and Fisheries

1 July 2021 through 30 June 2022

EXECUTIVE SUMMARY

Four juvenile, male Whooping Cranes were received on 10 November 2021 from the Freeport-McMoRan Audubon Species Survival Center (ASSC) in New Orleans, Louisiana. They were transported to the White Lake Wetlands Conservation Area (WLWCA) in Vermilion Parish where they were banded and immediately released into the open release pen. One died from predation just days after release, likely due to inappropriate habitat use, but the other three remained alive. Additionally, four wild-hatched chicks from 2021 remained alive through the report period.

The maximum size of the Louisiana non-migratory population at the end of the report period was 76 individuals (38 males, 29 females, 9 unknown) with 74 birds located in Louisiana and two in Texas. Based on location data generated via remote transmitters, we documented cranes in 19 parishes throughout Louisiana, with four of those parishes accounting for 75% of the data points within the state. With the death of one remaining, paired, breeding male in southeastern Texas, we expect that use of Texas locations will continue to decrease, and in fact, less than 1% of all points collected during the report period were located there. Additionally, female L4-17, who seasonally migrated from Oklahoma to northern Alabama for several years, died in November 2021, so use of areas outside of Texas and Lousiana will likely decrease as well.

During the 2022 breeding season, 17 pairs initiated 27 nests in seven different parishes in Louisiana and one county in southeast Texas. Fourteen pairs consisted of individuals who had previous experience nesting together, two pairs consisted of individuals who had previous experience with other cranes, and one pair consisted of individuals who were both nesting for the first time. Three pairs that had nested in 2021 did not nest in 2022. Nineteen nests from 10 pairs were located on private agricultural properties, nearly all of which were actively crawfished, while the remaining eight nests from seven pairs were located in marsh habitats; three pairs nested in the WLWCA marsh and four nested in marsh habitat on private property. One hatch year 2019 female was translocated from the failed Florida non-migratory population in October 2021. She paired, but did not nest in 2022. So far, translocation of individuals from the Florida flock has been successful with all three individuals pairing and setting up territories, but not yet producing offspring.

In 2022, 15 chicks hatched to 12 pairs (nine pairs hatched one chick; three pairs hatched two chicks). Twelve chicks hatched to their biological parents and three hatched from fertile eggs that were swapped into nests. Seven chicks (from six pairs) survived to fledging, with an eighth chick, from an additional pair, fledging shortly after the end of this report period. Five successful pairs had some prior parenting experience, with three of those pairs having successfully raised chicks to independence in the past. Two successful pairs had no prior parenting experience. The remaining seven chicks disappeared at 3-30 days of age. For the second year in a row and the third time since chicks were first produced in Louisiana, a single pair successfully fledged two chicks. The eight fledged chicks represent a record high for LA as well as a record number of fledged chicks for any previous or current reintroduction project. Additionally, this year, for the first time, chicks fledged from nests located in marsh habitats, including four from the WLWCA, the first since 1939.

Now in its 12th year, the Louisiana Whooping Crane reintroduction continues to see positive progress, including a record number of fledged chicks, but still has challenges to overcome. We continue to explore potential causes of embryo mortality in order to better understand this issue.

DISTRIBUTION

Whooping Cranes were monitored via remote tracking devices and in real time via very high frequency (VHF) transmitters in order to record movements, assess behaviors indicative of nesting and molting, and document the general health and survival of the population. Remote monitoring was accomplished using three types of GPS transmitters: two developed by Microwave Telemetry, Inc.: 22-g solar Argos/GPS platform transmitter terminals (PTT) and 25-g solar Global System for Mobile Communications (GSM)/GPS transmitters, and a new GPS/GSM design developed by Ornitela. The PTTs are programmed to collect data three times per day (06:00, 14:00, and 22:00 GMT) and transmit data every 48 hours. The Microwave GSM transmitters collect numerous location points throughout the day and transmit data approximately once per day, whenever cranes are within range of cell towers. The Ornitela transmitters can be programmed to collect and transmit data at different times, even after deployment. Programming for these transmitters varied but was mainly set to collect a data point every hour, and transmit data three to four times per day. In previous years, we reduced the overall number of GSM and Ornitela points analyzed by including only the points that matched those collected via PTT's as closely as possible in the dataset; however, as we continue to slowly phase out PTT use, beginning in January 2022, we included all points from all transmitters in the analysis.

Using the reduced number of GSM and Ornitela points, remote tracking devices transmitted just over 12,960 data points from 1 July - 31 December 2021. Alternately, when using all data points across all transmitters types, 121,996 data points were transmitted from 1 January – 30 June 2022.

Of all points described above, 75.2% were located in four parishes in Louisiana and 8.2% were located in three counties in Texas (Table 1a, 1b; Fig. 1, 2). Another 16.5% were distributed across 15 additional parishes in Louisiana, and 0.07% were distributed across five additional counties in Texas. The remaining 0.24% were from one individual, female L4-17, located in other states.

Use of Distant Locations

Eight individuals from the Louisiana population were documented (via remote transmitter data or visual observations) or presumed (based on known associations) to have used areas over 325 kilometers from release areas in Vermilion and Cameron parishes (Table 2). Migrating cranes can typically fly an average of 400 kilometers during a single migration day, so a distance of 325 kilometers represents approximately a one-day flight. Four of these individuals hatched in 2018, one in 2017, and three in 2021. Female L4-17, who had spent most of her time outside this zone since her release in November 2017 died in Lonoke County, Arkansas in November 2021.

MOLTING

In 2022, molting was confirmed in four or five individuals: L7-11 (eleven-year-old female) and/or L11-17 (five-year-old male), L6-16, L19-16, and L24-16, all six-year-old males. We suspect a number of other cranes also may have molted during the report period based on extended periods of limited movement during the spring and summer when molting takes place, feather condition in past years, and previous suspected or confirmed molts along with behavior of their mates. These include L1-18, L1-19, L8-19 and LFW12-19.

CAPTURES

Twenty-three captures of free-flying cranes were made on 45 days of attempts from 10 September 2021 – 26 April 2022. Eleven captures were hand grabs and 12 were via a leg noose. One capture was due to an injury, one was a translocation and the rest were for the purpose of banding or transmitter replacement. More information can found in Table 3.

PAIRING AND REPRODUCTION

During the 9th year of nesting by the Louisiana flock, a total of 27 nests by 17 pairs were confirmed in seven parishes (Acadia, Allen, Avoyelles, Calcasieu, Cameron, Jefferson Davis, and Vermilion) in central and southwestern Louisiana and one county (Jefferson) in southeast Texas in 2022 (Fig. 3). Fourteen pairs consisted of individuals who had previous experience nesting together, two pairs consisted of individuals who had previous experience with other cranes, and one pair consisted of individuals who were both nesting for the first time. Three pairs that nested in 2021 did not nest in 2022.

Nineteen nests from 10 pairs were located on private agricultural properties, nearly all of which were actively crawfished, while the remaining eight nests from seven pairs were located in marsh habitats; three pairs nested in the WLWCA marsh and four nested in marsh habitat on private property. First nesting attempts were initiated in February (9-10), March (6-7), and April (1). Re-nesting attempts were initiated an estimated average of 19 days after the first nest attempt was completed and occurred during April (4) and May (4). One third nesting attempt was initiated in May and a single fourth attempt in June.

A minimum of 50 eggs were produced in 2022. Thirty-one eggs were confirmed fertile, of which 16 died prior to hatch (6 early dead, 3 mid-dead, 7 late dead) and 15 successfully hatched, 14 in the wild and one in captivity. Seven other intact eggs were collected and were either non-viable or of unknown fertility and the remaining 12 eggs disappeared or broke at the nest.

Of the 27 confirmed nests, six were incubated to full term or beyond with no hatch, five were abandoned or failed prior to full term, nine successfully hatched 12 chicks, three had eggs pulled prior to full term, and three had eggs swapped into them (one received an egg from a pair in the eastern migratory population; two received an egg from a different Louisiana nest).

Both females who were translocated from the failed Florida reintroduction project in 2019 nested again in 2022, their second year of nesting in Louisiana. The older female (LF1-98) nested twice with her mate, L10-18, in Jefferson Davis Parish. Their first nest ended, when during a visit to check the nest just prior to full term, one egg was found to have broken on the nest, and the second was found to be non-viable, with a large crack in the shell, and was therefore removed. Eggs were pulled from their re-nest, and a viable egg from pair L6-16/16-17's re-nest was placed into it. The egg hatched but the chick only lived a few days before disappearing. Female LFW12-15 and mate L5-18 also nested twice in 2022, however none of the three intact eggs that were collected had any evidence of development.

Summary of breeding history by pair from 2014-2022 is displayed in Table 4, and complete nesting histories can be found in Appendix A.

Chicks

In 2022, 15 chicks hatched to 12 pairs (nine pairs hatched one chick; three pairs hatched two). Twelve hatched to their biological parents and three hatched from fertile eggs that were swapped into nests. Seven chicks (from six pairs) survived to fledging, with an eighth chick fledging shortly after the end of this report period. Fledging age for two chicks (including the eighth chick who fledged after the end of the report period) was confirmed via the transmitter data from one of the parents, and occurred by 71 and 77 days old. The age at which the other six chicks fledged was not able to be precisely confirmed.

The remaining seven chicks disappeared or died between 3-30 days of age; however, only one death was confirmed by discovery of remains found on the nest platform.

Pair Information

Pair, as used in this section, refers to consistent association between a male and a female that were observed copulating, nest building, or were together mainly exclusive of other individuals for at least 30 days. Pairs that both formed and nested during the report period are indicated by an asterisk (*).

Formed	Dissolved
L9-16/L17-16*, July/August	L8-15/L17-16, July/August, disappearance of female
L25-16/L6-19, September	L6-13/L10-17, August/September
L15-17/L17-17, October	L25-16/L13-17, September, injury to male
10/15-17, November/December	L2-15/17-17, October
L15-17/L17-17, January	L16-16/L26-16, January, death of female
L26-16/L10-17*, January	L10-17/L15-17, January
L2-15/L11-15, February	L15-17/L17-17, January
L8-16/L6-18, February	L26-16/L10-17, April, disappearance of male
L9-19/FW12-19, February	L24-16/L14-17, June, death of male
L9-18/L1-19, April	

In addition to the seventeen pairs who laid eggs in 2022, three other pairs were observed with nest platforms but did not lay eggs: L13-16/LW3-17 in Cameron Parish, L15-17/L17-17 in Vermilion Parish, and L9-18/L1-19 in Jefferson Davis Parish.

Current Population Structure

The population contained a maximum of 76 individuals as of 30 June 2022.

Confirmed breeding pairs (i.e., have produced eggs): 18
LF1-98/L10-18, L2-11/L13-11, L3-11/L1-13, L7-11/L11-17, L11-11/L8-13, L2-12/L3-14, L3-13/L8-14, L5-14/L12-16, L13-14/L6-15, L9-16/L17-16, L10-15/L19-16, LFW12-15/L5-18, L6-16/L16-17, L23-16/L3-17, L9-17/L23-17, L12-17/LW1-18, L21-17/LW3-18, L7-18/L3-19

Pairs that built nest platforms in 2022: 3
L13-16/LW3-17, L15-17/L17-17, L9-18/L1-19

Pairs without confirmed breeding activity or newly formed pairs: 4
L2-15/L11-15, L8-16/L6-18, L25-16/L6-19, L9-19/LFW12-19

Currently unpaired adult males: 8
L6-13, L1-18, L13-18, L4-19, L8-19, L10-19, L11-19, LW2-20

Currently unpaired adult females: 4
L1-12, L10-17, L14-17, L12-18

Missing and/or suspected dead: none

Yearlings (HY2021): 7
L2-21, L3-21, L4-21, LW5-21, LW6-21, LW7-21, LW14-21

Fledged wild-hatched juveniles: 7
LW1-22, LW2-22, LW4-22, LW5-22, LW9-22, LW10-22, LW11-22

Unfledged wild-hatched juveniles (not included in population total above): 1
LW13-22

Camera Deployments

For the 7th consecutive year, trail cameras were deployed near a subset of nests to help supplement nest-monitoring efforts. Cameras were deployed at six different nests (3 first attempts, 3 second attempts) at ~1-16 days into the incubation period (avg. = 9.2 days). Programming differed among them; however, a majority were programmed to be off for several hours in the middle of the night in order to extend the battery life.

Use of Data-logging Eggs

Due to previous experience with pulled eggs dying in captivity or dying prior to hatch after replacement into their original nest, once again we did not pull any eggs from two egg nests this year. Only one data-logging egg was deployed in 2022 and it was unknowingly added to a nest before the female laid her second egg.

Toxicology and Heavy Metal Screening

As part of the routine health screening done on birds captured for banding or transmitter replacement, heavy metal testing of blood and feathers samples is ongoing. Since we began screening for lead in 2017, 50 individuals have been tested with no concerning levels detected thus far. Those same individuals have also been screened for mercury, and results from 10 samples were noted to be at the "high-normal" end of the range; however, the database for crane results is noted to be small. None of these individuals exhibited any signs of illness, and other test results were generally normal and indicative of a healthy bird. Feathers from an additional 16 cranes (44 total) were tested for arsenic during the report period, with all results within normal limits so far. We plan to continue this testing to increase the number of cranes in our database and to compare samples from the same individuals to document changes over time.

SURVIVAL

As of 30 June 2022, 153 juvenile Whooping Cranes have been released in Louisiana since 2011. Additionally, 19 wild-hatched chicks have fledged (1 each in 2016, 2017, and 2020, 5 in 2018, 4 in 2021 and 7 in 2022), and 3 adult females were relocated to Louisiana from the discontinued Florida reintroduction. In total, 175 whooping cranes have been reintroduced or have fledged in the wild during the 11.5 years of the project, and as of the end of this report period, a maximum of 76 (43.0%) individuals survive. This total does not include one wild-hatched juvenile who fledged shortly after the reporting period ended.

Mortality and Morbidity

The following six mortalities were recorded during the report period:

L2-19: female, White Lake WCA, Vermilion Parish, Louisiana, 17 July, predation
L4-17: female, Lonoke County, Arkansas, ~7 November, unknown cause
L1-21: male, White Lake WCA, Vermilion Parish, Louisiana, 14 November, predation
L16-16: female, Cameron Parish, Louisiana, 9 January, suspected predation
L2-18: female, Jefferson Davis Parish, Louisiana, 30 January, powerline collision
L24-16: male, Jefferson County, Texas, 26 June, predation of molting bird

Two cranes disappeared during the report period and are presumed dead:
L8-15: Female L8-15 was last observed 21 July at the White Lake WCA, Vermilion Parish, Louisiana. Her mate was observed with a new female on 17 August.

L26-16: Male L26-16 was last observed 15 April in Cameron Parish, Louisiana. He and his unfledged chick apparently disappeared at the same time. His mate, female L10-17, was located alone during a flight on 20 April.

One additional crane was removed from the population due to injury:
L13-17: Male L13-17 was captured on 27 September at the White Lake WCA, Vermilion Parish, and transported to the Freeport-McMoRan Audubon Species Survival Center in New Orleans for evaluation and treatment of a left wing injury. He was found to have a septic left elbow joint and died while receiving treatment under anesthesia on 5 October.

Through the end of the reporting period, there have been 99 mortalities since the start of the reintroduction; 78 confirmed by recovery of remains and 21 others inferred based on supporting evidence or long-term missing status. Of mortalities where remains were recovered, the primary contributing factor of death could not be determined in 21 cases (26.9%) due to severely degraded or minimal remains recovered. The primary known or suspected cause of mortality in the remaining cases (n = 57) was trauma (33.3%), followed by predation (29.8%) and gunshot (26.3%). Thirteen trauma mortalities (16.7% of mortalities where remains were recovered) are attributed to collisions with power lines or fences.

EDUCATION, OUTREACH, AND MEDIA

Outreach

Although the COVID-19 pandemic was ongoing throughout this reporting period, this was a very different year compared to last year. While some presentations still took place online, many in-person events returned. LDWF staff participated in seven events including the department's online "Conservation Conversations" and the 25th annual Port Aransas Whooping Crane Festival and conservatively reached 3,480 individuals.

Additionally, after a pandemic induced hiatus, our traveling library display was back in action throughout the year, traveling to 11 different locations in several parishes across the state where signatures indicated 739 individuals were reached.

The LDWF Whooping Crane Facebook and Instagram pages continued to grow in popularity, and have proven to be effective tools for reaching and keeping those who are interested, up to date on the progress of the project. Moreover, the nature of sharing social media posts leads to new individuals discovering our pages. At the end of the reporting period, the Facebook page had 11,316 followers and the Instagram page had 604.

Our partnership with the International Crane Foundation (ICF), who employees a full time Whooping Crane Outreach Coordinator located in Louisiana, continued this year and ICF plans to expand their efforts moving forward. ICF staff participated in 19 events, separate from those attended by LDWF staff, and reached an additional 2,109 individuals.

Building on prior social science projects focused in other areas where Whooping Cranes are located, and meant to better understand the knowledge, attitudes, and behaviors toward Whooping Cranes, ICF, in coordination with LDWF, initiated a similar project here in Louisiana. ICF partnered with the LSU AgCenter and a team of social scientists (Drs. Michael Kaller, Ashley Long, and Lucien Laborde) to survey individuals with hunting licenses and other stakeholders to better understand the issue of illegal shootings, evaluate the results of LDWF's prior outreach, and inform ICF's ongoing and future outreach. Along with understanding existing attitudes toward Whooping Cranes in Louisiana, ICF will utilize social science findings to increase public awareness of, pride in, and vigilance for Whooping Cranes with an overall goal to reduce shootings. We look forward to our continued collaboration with ICF on this project and working with them to better focus and direct our outreach efforts in order to be as efficient and effective as possible in our efforts to inform the public about the project and help protect Louisiana's Whooping Cranes.

Table 1a. Distribution of location data points collected via remote tracking devices for the Louisiana non-migratory Whooping Crane population, 1 July 2021 – 31 December 2021. GSM and Ornitela points have been reduced to match PTT collection times. Numbers of individuals contributing to location data totals are given in parentheses. *Note: The Other Parishes column includes points collected in Allen, Avoyelles, Beauregard, Calcasieu, Cameron, Evangeline, Rapides & St. Landry Parishes, Louisiana. The Other Counties column inclues points collected in Jefferson, Robertson & Tyler Counties, Texas. The Number of points outside Louisiana and Texas comumn include points collected in Creek, Lincoln, Okfuskee & Wagoner Counties, Oklahoma;and Lonoke & Sebastian Counties, Arkansas. N/A indicated that no data were available.*

Cohort (by hatch year)	No. of Location Data Points	No. of points in Louisiana by Parish				No. of points in Texas by County			No. of points outside Louisiana & Texas
		Acadia	Jefferson Davis	Vermilion	Other Parishes	Chambers	Limestone	Other Counties	
HY1998 (1)	552	253	290	N/A	9	N/A	N/A	N/A	N/A
HY2011 (2)	1095	N/A	542	N/A	553	N/A	N/A	N/A	N/A
HY2012 (0)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
HY2013 (1)	8	N/A	N/A	8	N/A	N/A	N/A	N/A	N/A
HY2014 (2)	921	N/A	N/A	639	282	N/A	N/A	N/A	N/A
HY2015 (1)	552	N/A	N/A	549	3	N/A	N/A	N/A	N/A
HY2016 (7)	3018	868	548	570	487	544	N/A	1	N/A
HY2017 (6)	1795	N/A	22	728	640	N/A	N/A	80	325
HY2018 (7)	1415	36	411	555	161	N/A	245	7	N/A
HY2019 (8)	2529	N/A	235	2164	130	N/A	N/A	N/A	N/A
HY2020 (1)	493	N/A	493	N/A	N/A	N/A	N/A	N/A	N/A
HY2021 (5)	588	181	N/A	278	129	N/A	N/A	N/A	N/A
Totals	12966 (41)	1338 (5)	2541 (11)	5491 (23)	2394 (17)	544 (1)	245 (1)	88 (3)	325 (1)

Table 1b. Distribution of all location data points collected via remote tracking devices for the Louisiana non-migratory Whooping Crane population, 1 January 2022 – 30 June 2022. Numbers of individuals contributing to location data totals are given in parentheses. *Note: The Other Parishes column includes points collected in Avoyelles, Beauregard, Calcasieu, Caldwell, Cameron, Evangeline, Grant, Iberia, La Salle, Lafayette, Morehouse, Rapides, Richland, St. Landry & Vernon Parishes, Louisiana. The Other Counties column inclues points collected in Chambers, Hardin, Liberty, Orange & Robertson Counties, Texas. N.A indicates no data were available.*

Cohort (by hatch year)	No. of Location Data Points	No. of points in Louisiana by Parish					No. of points in Texas by County		
		Acadia	Allen	Jefferson Davis	Vermilion	Other Parishes	Limestone	Jefferson	Other Counties
HY1998 (1)	5627	N/A	N/A	5627	N/A	N/A	N/A	N/A	N/A
HY2011 (3)	5577	N/A	4133	273	N/A	1171	N/A	N/A	N/A
HY2012 (0)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
HY2013 (2)	7440	N/A	7439	N/A	1	N/A	N/A	N/A	N/A
HY2014 (2)	5323	N/A	N/A	N/A	5309	14	N/A	N/A	N/A
HY2015 (1)	2443	N/A	N/A	N/A	2441	2	N/A	N/A	N/A
HY2016 (8)	36089	6936	N/A	11401	10504	7176	N/A	N/A	72
HY2017 (5)	15054	N/A	N/A	141	4197	1038	N/A	9678	N/A
HY2018 (4)	8464	N/A	N/A	7908	360	39	151	N/A	6
HY2019 (7)	13217	16	N/A	435	7498	5240	N/A	23	5
HY2020 (1)	1977	2	3	1719	56	197	N/A	N/A	N/A
HY2021 (4)	20785	7826	38	5	6915	6001	N/A	N/A	N/A
Totals	121996 (38)	14780 (5)	11613 (5)	27509 (13)	37281 (25)	20878 (23)	151 (1)	9701 (3)	83 (3)

Table 2. Time spent over 325 kilometers from release locations by cranes in the Louisiana non-migratory population, July 2021 – 30 June 2022. * denotes females. *Note: For individuals or groups using multiple locations and spending over 5 consecutive nights out-of-state, area with most roost points are indicated in **bold** (Okfuskee County, Arkansas for L4-17 and Limestone County, Texas for L2-18 and 12-18). Time out of state is estimated based on visual tracking data or movement of known associates for 12-18, L6-18, W7-21, and W14-21 because they are either fitted with VHF only, have a nonfunctional remote transmitter or are unbanded.*

Crane ID(s)	Date departed buffer zone	Locations visited (roost locations only; as indicated by GPS)a	Date returned to w/in 325km	Consecutive nights spent >325km
L4-17*	NA; began outside zone	Creek, Lincoln, **Okfuskee**, Wagoner, Counties, Oklahoma; Lonoke County, Arkansas	NA; died ~7 Nov	129
L2-18* & 12-18b*	NA; began outside zone	**Limestone** & Robertson Counties, Texas	23-Sep	84
L6-18b	by 12 July	Limestone County, Texas	~23 Sept	73
L1-18	29-Apr	Limestone County, Texas	NA; ended outside zone	62
LW6-21, W7-21b, W14-21b	26-May	NA	26-May	0

Table 3. Summary of captures of free-flying Whooping Cranes in the Louisiana non-migratory population, 1 July 2021 - 30 June 2022.

ID	Sex	Date	Method	Reason	Parish/County
L13-17	M	9/28/2021	hand grab	injury	Vermilion
LW5-21	M	11/1/2021	leg noose	initial banding	Acadia
L6-19	M	11/1/2021	leg noose	transmitter replacement	Vermilion
LW6-21	M	11/19/2021	leg noose	initial banding	St. Landry
L8-13	M	11/23/2021	hand grab	transmitter replacement	Jefferson Davis
L12-16	M	11/23/2021	leg noose	transmitter replacement	Jefferson Davis
L9-16	F	11/24/2021	leg noose	transmitter replacement	Vermilion
L4-19	M	11/24/2021	leg noose	transmitter replacement	Vermilion
L23-16	M	12/1/2021	leg noose	transmitter replacement	Vermilion
L7-18	F	12/2/2021	leg noose	transmitter replacement	Vermilion
L15-17	M	1/6/2022	leg noose	transmitter replacement	Vermilion
L3-11	F	1/7/2022	leg noose	transmitter replacement	Allen
L13-11	F	1/11/2022	hand grab	transmitter replacement	Allen
L7-11	F	1/13/2022	hand grab	transmitter replacement	Avoyelles
L14-17	F	1/26/2022	leg noose	transmitter replacement	Jefferson, TX
L8-16	F	1/26/2022	hand grab	translocation	Chambers, TX
L10-15	F	2/8/2022	leg noose	transmitter replacement	Acadia
L10-18	M	2/9/2022	hand grab	transmitter replacement	Jefferson Davis
F1-98	F	2/9/2022	hand grab	transmitter replacement	Jefferson Davis
L1-13	M	2/11/2022	hand grab	transmitter replacement	Allen
L24-16	M	2/28/2022	hand grab	transmitter replacement	Jefferson, TX
L13-16	M	3/4/2022	hand grab	transmitter replacement	Cameron
L3-21	M	4/25/2022	hand grab	transmitter replacement	Vermilion

Table 4. Breeding history of egg laying pairs in the Louisiana non-migratory population of Whooping Cranes through 30 June 2022. Only confirmed nests are included in totals. *Note: The Unknownegg status column includes eggs that disappeared, were broken, or fertility could not be determined upon examination. In the Chicks Hatched column the letter b following a number indicates the chicks hatched from a swapped egg, placed into the nest while the pair's own eggs were removed. In the Pair dissolved column, the letter c indicates death or injury of one member of the pair, the letter d indicates the disappearance of one or both members of the pair. In the Fertile Egg Dead column, the letter e indicates that one fertile/viable egg pulled at day 8-10 died while hatching at a captive center. The Chicks Fledged column numbers include fledges that occurred after the end of the report period. In columns nest attempts columns the letter g indicates the number of nests were determined by number of new platforms containing an egg even if timing indicates eggs are from the same clutch. fledging date may be after the end of the report period*

Male	Female	Pair formed	Nest attempts in 2014	Nest attempts in 2015	Nest attempts in 2016	Nest attempts in 2017	Nest attempts in 2018	Nest attempts in 2019	Nest attempts in 2020	Nest attempts in 2021	Nest attempts in 2022	Chicks hatched	Chicks fledged	Infertile egg/ nonviable	Fertile egg/ dead	Fertile egg/ hatch	Unk. egg status	Pair dissolved
L8-11	L7-11	Dec 2013	2	2	2	3	3	N/A	N/A	N/A	N/A	1b	N/A	22	N/A	N/A	2	July 2018c
L10-11	L11-11	Dec 2013	N/A	N/A	2	2	1	N/A	N/A	N/A	N/A	1b	1	1	3	N/A	2	Mar 2018c
L1-11	L6-11	Jan 2015	N/A	1		1		N/A	N/A	N/A	N/A	0	N/A	N/A	2	N/A	1	July/Aug 2017d
L2-11	L13-11	April 2015	N/A	1	2	4	1	2	1	2	1	2b	N/A	7	7	2	8	N/A
L1-13	L3-11	May 2015	N/A	1	2	3	2	3	2	3	2	4b, 1	3	5	17e	3	8	N/A
L3-13	L11-12	Nov 2015	N/A	N/A	N/A	2	N/A	N/A	N/A	N/A	N/A	0	N/A	1	1	N/A	1	Dec 2017c
L8-13	L6-12	Jan 2016	N/A	N/A	1	2	1	N/A	N/A	N/A	N/A	4	3	1	1	4	1	Feb 2019c
L14-12	L2-12	Mar 2016	N/A	N/A	N/A	1	N/A	N/A	N/A	N/A	N/A	1	N/A	N/A	N/A	1	N/A	May 2017c
L12-16	L5-14	Jan 2018	N/A	N/A	N/A	N/A	2	4	7g	5g	4	2	1	6	9	2	14	N/A
L13-14	L6-15	Jan 2018	N/A	N/A	N/A	N/A	1	1	N/A	1	1	4	2	N/A	N/A	4	4	N/A
L2-15	L7-14	Jan 2018	N/A	N/A	N/A	N/A	1	1	N/A	N/A	N/A	1	N/A	1	1	1	1	Mar 2021c
L19-16	L10-15	Feb 2018	N/A	N/A	N/A	N/A	1	4	2	1	2	2b, 4	2	6	6	5	N/A	N/A
L3-13	L8-14	July 2018	N/A	N/A	N/A	N/A	N/A	2	1	2	1	1	1	4	1	1	3	N/A
L6-16	L16-17	Dec 2018	N/A	N/A	N/A	N/A	N/A	1	1	2	2	1	N/A	1	5	2	2	N/A
L3-14	L2-12	Jan 2019	N/A	N/A	N/A	N/A	N/A	1	N/A	1	0	0	N/A	2	1	N/A	N/A	N/A
L12-14	L8-15	Jan 2019	N/A	N/A	N/A	N/A	N/A	2	N/A	N/A	N/A	0	N/A	1	2	N/A	N/A	June 2019d
L13-16	L14-16	Jan 2019	N/A	N/A	N/A	N/A	N/A	1	1	1		3	N/A	N/A	N/A	3	1	May 2021c
L11-17	L7-11	Jan 2019	N/A	N/A	N/A	N/A	N/A	2	3	2	1	3	3	6	2	3	5	N/A
L8-13	L11-11	Feb 2019	N/A	N/A	N/A	N/A	N/A	3	1	3	1	3	2	3	5	3	4	N/A
L23-16	L11-15	Sept 2019	N/A	N/A	N/A	N/A	N/A	N/A	1	N/A	N/A	0	N/A	N/A	1	N/A	N/A	Oct-20
L22-17	L8-16	Mar 2019	N/A	N/A	N/A	N/A	N/A	N/A	1	2	N/A	2	N/A	N/A	N/A	2	1	June 2021c

L26-16	L16-16	Mar 2020	N/A	N/A	N/A	N/A	N/A	N/A	1	1	N/A	1	N/A	1		1	1	Jan 2022c
L24-16	L14-17	Dec 2018	N/A	N/A	N/A	N/A	N/A	N/A	N/A	3	2	1	N/A	2	3	1	3	June 2022c
L10-18	F1-98	Feb 2020	N/A	N/A	N/A	N/A	N/A	N/A	N/A	1	2	1b	N/A	N/A	2	1	2	N/A
L15-17	L9-16	April 2020	N/A	N/A	N/A	N/A	N/A	N/A	N/A	2	N/A	0	N/A	N/A	3	N/A	N/A	N/A
L17-16	L8-15	May/Jun 2020	N/A	N/A	N/A	N/A	N/A	N/A	N/A	1	N/A	2	N/A	N/A	N/A	2	N/A	July/Aug 2021d
L5-18	FW12-15	Aug 2020	N/A	N/A	N/A	N/A	N/A	N/A	N/A	1	2	0	N/A	5	N/A	N/A	1	N/A
L6-13	L10-17	Sep/Oct 2020	N/A	N/A	N/A	N/A	N/A	N/A	N/A	1	N/A	0	N/A	1	N/A	N/A	N/A	N/A
L23-16	L3-17	Oct 2020	N/A	N/A	N/A	N/A	N/A	N/A	N/A	1	1	2	1	1	N/A	2	N/A	N/A
L23-17	L9-17	Oct 2020	N/A	N/A	N/A	N/A	N/A	N/A	N/A	2	0	0	N/A	1	N/A	N/A	1	N/A
LW1-18	L12-17	Dec 2020	N/A	N/A	N/A	N/A	N/A	N/A	N/A	1	2	1, 1b	N/A	N/A	2	1	2	N/A
L3-19	L7-18	Mar 2021	N/A	N/A	N/A	N/A	N/A	N/A	N/A	2	0	0	N/A	2	N/A	N/A	N/A	N/A
L21-17	LW3-18	Jan 2020	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	1	0	N/A	1	N/A	N/A	1	N/A
L17-16	L9-16	July/Aug 2021	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	1	1	1	N/A	N/A	1	N/A	N/A
L26-16	L10-17	Jan 2022	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	1	2	N/A	N/A	N/A	2	N/A	March 2022d
Totals	**N/A**	**N/A**	**2**	**5**	**9**	**18**	**13**	**27**	**22**	**41**	**27**	**40, 12b**	**20**	**81**	**74**	**47**	**69**	**N/A**

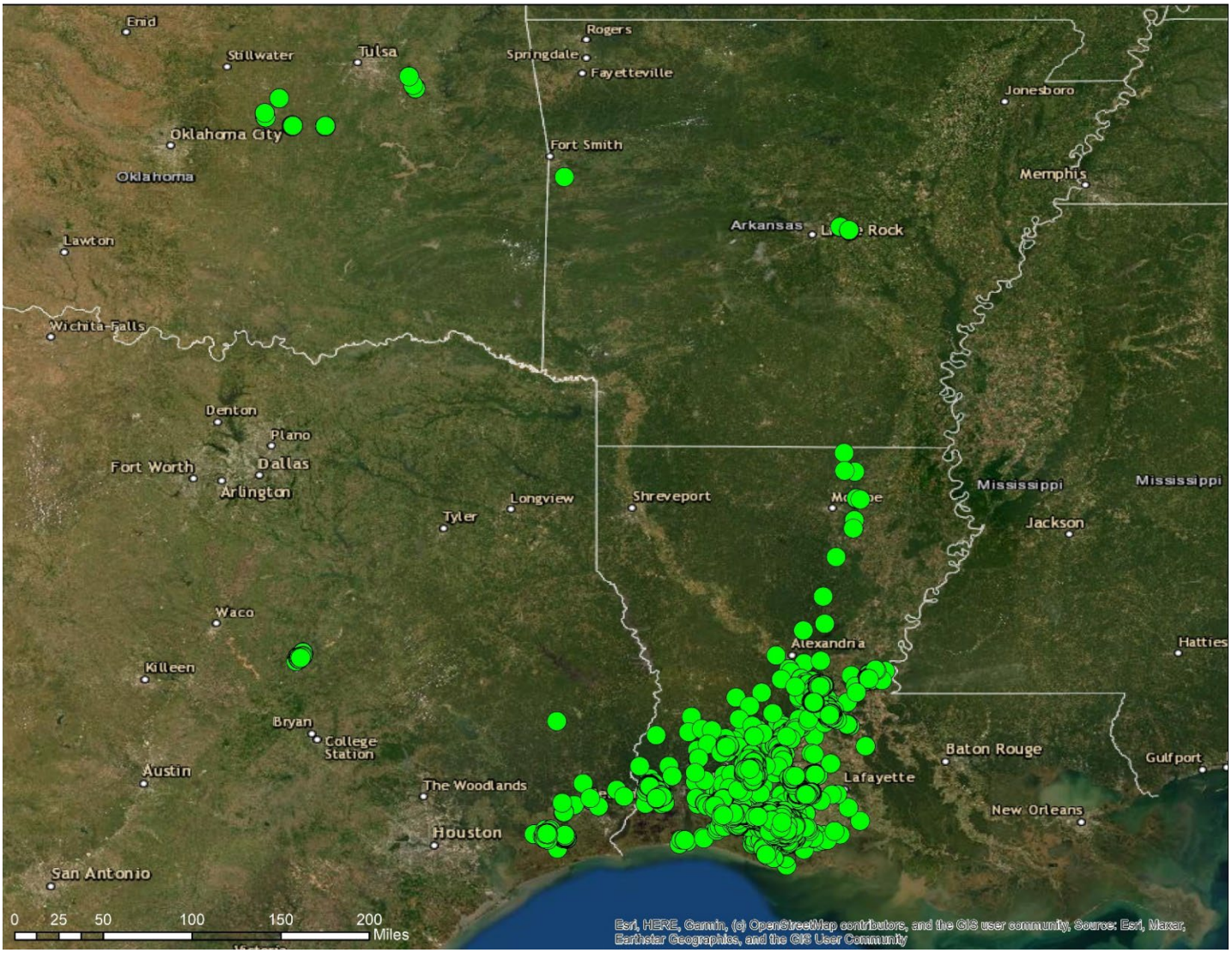

Figure 1. Location data collected from remote transmitters of reintroduced Whooping Cranes, 1 July 2021 – 30 June 2022.

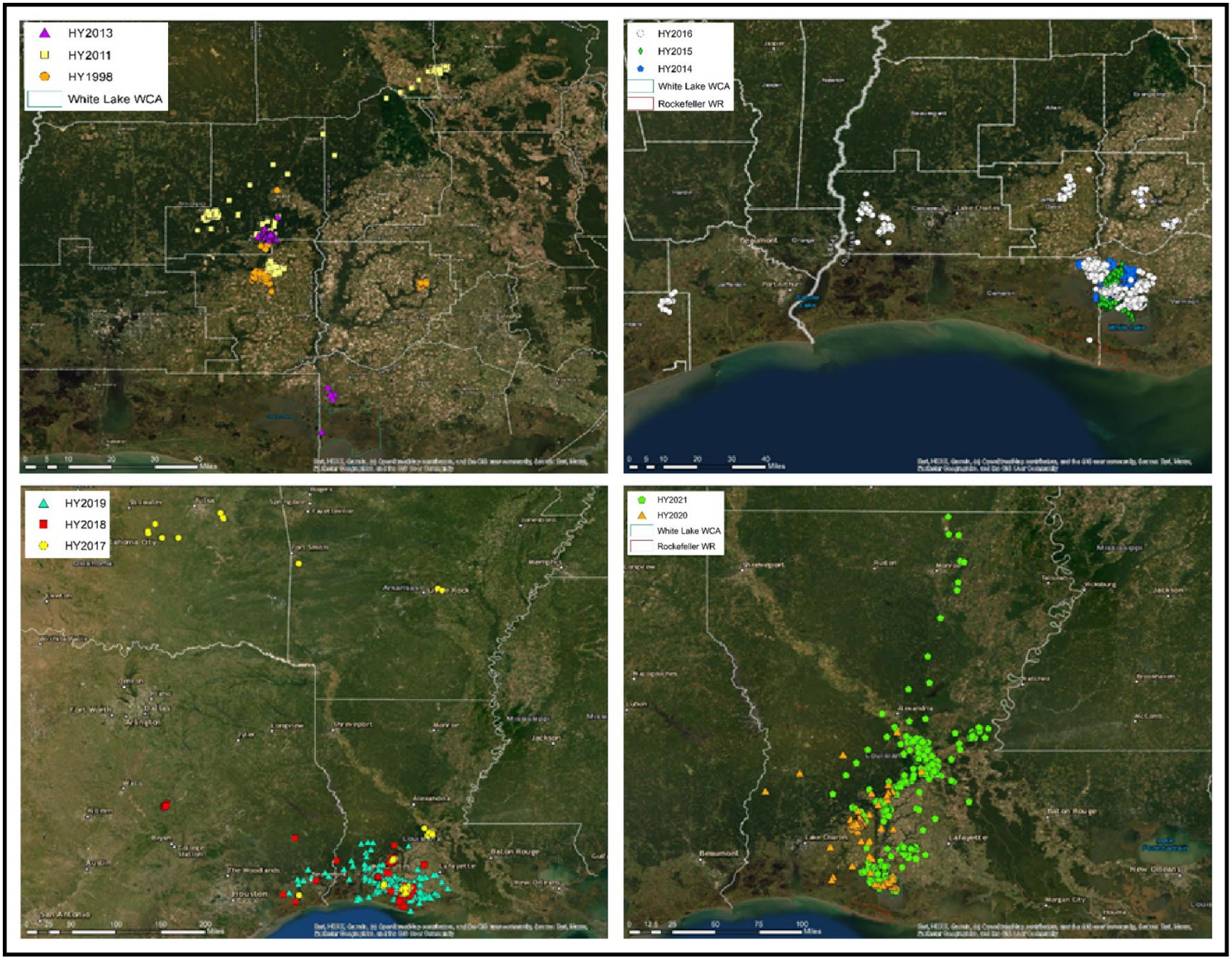

Figure 2. Location data of reintroduced Whooping Cranes in Louisiana by hatch year, 1 July 2021 – 30 June 2022.

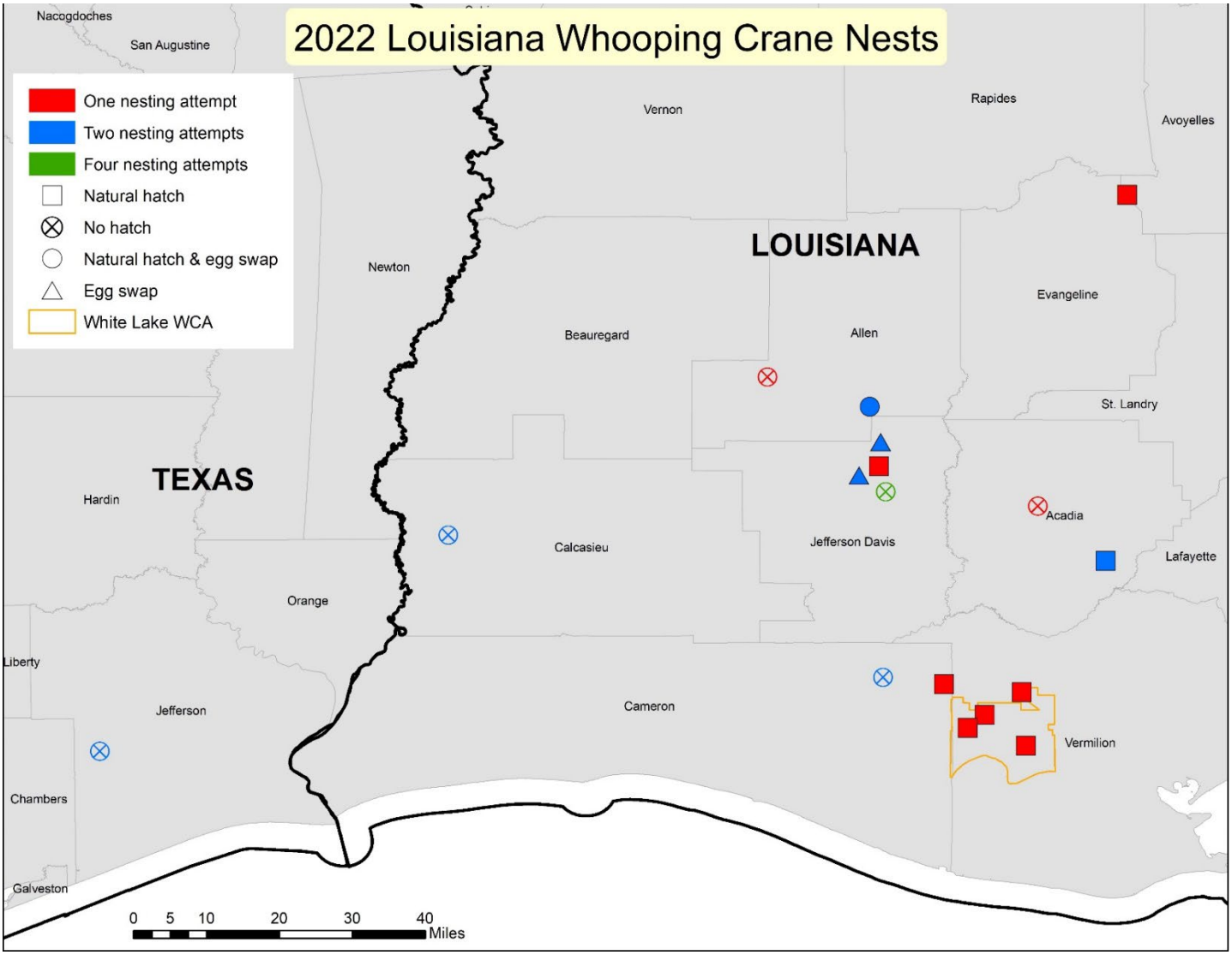

Figure 3. Approximate locations of Louisiana Whooping Crane nests in 2022

APPENDIX A:

Complete Nesting History of the Reintroduced Louisiana Whooping Crane Population

First nests of the season by Whooping Crane pairs in the reintroduced Louisiana non-migratory population, 2014-22.

Year	Male	Female	Parish	Initiation	No. eggs	Outcome of nest, fate of eggs	Days of incubation	Days to renest
2014	L8-11	L7-11	Avoyelles	24 Mar	2	Full term, collected 30 Apr, both infertile	37	18
2015	L8-11	L7-11	Avoyelles	28 Feb	2	Full term, collected 9 Apr, both infertile	40	18
2015	L1-11	L6-11	Vermilion	3/4 Apr	2	Flooded by/on 13 Apr, 1 intact (EDE) & fragments coll. 16 April	9-10	No renest
2015	L2-11	L13-11	Allen	6-14 May	1-2	Failed, shell fragment collected 12 June	27-37	No renest
2015	L1-13	L3-11	Allen	16-28 May	2	Abandoned by ~13 June PM, 1 coll. 17 June, (unk, likely infertile)	16-28	No renest
2016	L1-13	L3-11	Allen	12 Feb	2	Full term, collected 21 Mar, both fertile – 1 MDE, 1 LDE	39	17-21
2016	L8-11	L7-11	Avoyelles	28 Feb	2	Full term, collected 5 Apr, both infertile	38	18
2016	L8-13	L6-12	Jefferson-Davis	~12 Mar	2	Hatched 11 & 13 Apr	33	No renest
2016	L2-11	L13-11	Allen	8-14 Mar	1	Failed/collected 4 Apr (human disturbance), LDE	22-28	31-36
2016	L10-11	L11-11	Jefferson-Davis	1-4 Apr	1	Full term, no fragments/eggs found 3 May	30-33	15-16
2017	L8-11	L7-11	Avoyelles	11 Feb	2	Full term, collected 17 Mar, both infertile	34	19-20
2017	L8-13	L6-12	Jefferson-Davis	11-14 Feb	2	Full term, 1 broke 19 Mar, 2nd coll. 20 Mar, infertile	34-37	26-28
2017	L1-13	L3-11	Allen	17 Feb	1	Full term, collected 22 Mar, infertile	33	17-18
2017	L10-11	L11-11	Jefferson-Davis	18-21 Feb	1	Full term, collected 27 Mar, fertile - LDE	34-37	18-21
2017	L2-11	L13-11	Allen	4-15 Mar	1-2	Failed ~23 Mar, 1 infertile egg found in water 19 April	8-19	17-18
2017	L3-13	L11-12	Vermilion	15-17 Mar	1	Full term, collected 25 Apr, infertile	39-41	20
2017	L14-12	L2-12	Vermilion	~27 Mar	1	Hatched ~26 Apr	30	No renest
2017	L1-11	L6-11	Vermilion	16 Mar-4 Apr	1-2	Failed/abandoned by 18 April, 1 coll. 18 Apr, EDE	14-33	No renest
2018	L10-11	L11-11	Jefferson-Davis	10-12 Feb	2	Full term, DL egg 19 Feb-20 Mar, 1 coll. 19 Feb (MDE); 1 gone 16 Mar	36-38	No renest
2018	L12-16	L5-14	Jefferson-Davis	16-19 Feb	1-2	Full term; eggs disappeared by ~24 Mar	32-35	15
2018	L8-11	L7-11	Avoyelles	21-22 Feb	2	Full term; DL egg 28 Feb-28 Mar, 1 coll. 28 Feb; 1 coll. 28 Mar (2 infertile)	34-35	18
2018	L1-13	L3-11	Allen	25-27 Feb	2	DL egg 6 Mar-3 Apr, 1 coll. 6 Mar (EDE); 1 coll. 3 Apr (EDE)	35-37	18
2018	L2-11	L13-11	Allen	~15 Mar	2	Failed by 3 Apr; 1 found in water (MDE), 2nd broken on nest	~19	No renest
2018	L8-13	L6-12	Jefferson-Davis	~20-21 Mar	2	Hatched 18 & 20 Apr	~30-31	No renest

2018	L19-16	L10-15	Acadia	~15 Apr	2	Coll. 3 May (inf); gave hatched chick/shell & non-viable egg (L7/8-11's)	18	No renest
2018	L13-14	L6-15	Vermilion	~7 May	2	Abandoned 4 June, both broken 11 June (unk fertility)	28	No renest
2018	L2-15	L7-14	Vermilion	~8 May	2	Abandoned 25 May, collected 30 May (infertile, EDE)	~17	No renest
2019	L12-16	L5-14	Jefferson-Davis	13 Feb	2	Full term; DL egg 24 Feb-12 Mar, 1 viable removed & ret. to nest 12 Mar (LDE), 1 hatch 17 Mar	33	~16 (after chick)
2019	L1-13	L3-11	Allen	14 Feb	2	Full term; DL egg 24 Feb – 12 Mar, 1 viable removed & ret. on 12 Mar but LDE, 1 broke 15 Mar, abandoned by 17 Mar	29-30	16
2019	L19-16	L10-15	Acadia	18 Feb	2	Abandoned/coll. 25 Feb (human disturbance)	7	11
2019	L2-15	L7-14	Vermilion	18 Feb	2	Full term; 1 hatched 20-21 Mar, 2nd gone by 29 Mar	30-31	No renest
2019	L11-17	L7-11	Avoyelles	18 Feb	3	Full term; DL egg 25 Feb-20 Mar, two pulled, 1 viable ret. to nest 20 Mar but failed to hatch & disappeared 25-26 Mar	~35-36	18-20
2019	L3-13	L8-14	Vermilion	14-26 Feb	1	Full term; failed to hatch, 1 egg collected 1 Apr	~34	14-22
2019	L6-16	L16-17	Calcasieu	9/10 Mar	2	Full term; failed to hatch, shells found in water 16 Apr	Up to 37	No renest
2019	L8-13	L11-11	Jefferson-Davis	15 Mar	2	Full term, 1 hatch 16 Apr, 1 broke & chick died 18 Apr	34	19
2019	L3-14	L2-12	Vermilion	15-17 Mar	2	Abandoned 12 Apr, 2 eggs (1 viable later LDE) collected 15 Apr	26-28	No renest
2019	L2-11	L13-11	Allen	19 Mar	1	Abandoned/coll. 3 Apr (human disturbance), MDE	15	18
2019	L12-14	L8-15	Vermilion	22 Mar	2	Flooded/abandoned ~5 April, coll. 8 Apr, 1 EDE, 1 no dev	13-14	27
2019	L13-14	L6-15	Vermilion	24 Mar	2	Failed due to unk reasons (possibly deer?) 10 Apr, frags coll. 12 Apr	19	No renest
2019	L13-16	L14-16	Cameron	22-29 Mar	UNK	Failed due to unk reasons 12-22 April, no frag found	14-30	No renest
2020	L12-16	L5-14	Jefferson Davis	2 Feb	2	Full term; DL egg 7 Feb-6 Mar (3 egg nest); 1 broke 29 Feb, 1 broke 8 Mar	35	17
2020	L11-17	L7-11	Avoyelles	3 Feb	1	Full term; coll. 9 Mar (non-viable)	35	19
2020	L23-16	L11-15	Vermilion	8 Feb	1	Coll. 13 Mar (LDE, malpositioned)	~34	No renest
2020	L3-13	L8-14	Vermilion	15-29 Feb	1-2	Poss full term; membrane found on nest 2 Apr (possible hatch?)	UNK	UNK
2020	L1-13	L3-11	Allen	19-26 Feb	1	Full term; coll. 30 Mar (MDE)	33-40	17-19
2020	L6-16	L16-17	Calcasieu	22 Feb	1	DL egg 11 Mar-25 Mar; nest elevated 11 Mar; hatch 23 Apr (W1)	30	No renest
2020	L19-16	L10-15	Acadia	27 Feb	2	Full term; coll. 2 Apr (LDE, non-viable)	35	17
2020	L2-11	L13-11	Allen	27 Feb-3 Mar	2	Failed by 30 Mar; no eggs/frag. found 1 Apr	≤27-32	No renest
2020	L8-13	L11-11	Jefferson Davis	28 Feb	2	1 hatch 31 Mar (W2); 1 coll. 6 Apr (non-viable)	32	No renest
2020	L13-16	L14-16	Cameron	~18 Mar	1-2	Hatch ~19 Apr (W3, 1 found)	30	No renest
2020	L22-17	L8-16	Chambers, TX	31 Mar	1-2	Hatch ~30 Apr (TW4, 1 assumed)	30	No renest
2020	L26-16	L16-16	Cameron	27 Apr	1-2	Failed 18 May; fragments found 29 June	21	No renest
2021	L1-13	L3-11	Allen	2-7 Feb	1-2	Poss full term; rotten egg remains found 12 Mar	25-35	13-21

2021	L11-17	L7-11	Avoyelles	13 Feb	2	Abandoned due to hard freeze; coll. 19 Feb (unk fertility)	5-6	15-16
2021	L13-16	L14-16	Cameron	~11 Feb	2	Hatch 13 & 15 March (W1 & W2)	32	No renest
2021	L3-13	L8-14	Vermilion	13/14 Feb	UNK	Failed 13 March; no eggs/fragments found	27-28	18
2021	L12-16	L5-14	Jefferson Davis	23 Feb	2	Full term; 1 broke 25 Mar, 1 coll. 30 Mar (MDE)	35	13
2021	L8-13	L11-11	Jefferson Davis	24 Feb	2	Full term; DL egg added 4 Mar; 1 broke 23 Mar, 1 coll. 30 Mar (EDE)	34	12
2021	L17-16	L8-15	Vermilion	~25 Feb	2	Hatch 28 & 30 Mar (W3 & W4)	32	No renest
2021	L3-14	L2-12	Vermilion	28 Feb	1	Full term; coll. 9 Apr (non-viable)	40	No renest
2021	L6-16	L16-17	Calcasieu	2 Mar	1	Full term; added DL egg 12 Mar; coll. 5 Apr (non-viable)	34	30
2021	L19-16	L10-15	Acadia	3 Mar	2	1 hatch 4 Apr (W5); 1 coll. from water 9 Apr (LDE)	32	No renest
2021	L6-13	L10-17	Vermilion	27 Feb-6 Mar	1-2	Full term; rotten egg remains found 14 Apr	34-42	No renest
2021	L2-11	L13-11	Allen	9 Mar	2	Full term; 1 coll. 15 Apr (LDE); remains of second found	37	12
2021	L22-17	L8-16	Chambers, TX	9 Mar	1-2	1 hatch 8 Apr (TW8 – based on membrane found)	30	19
2021	L26-16	L16-16	Cameron	12 Mar	2	1 hatch 11 Apr (W9); 1 coll. 5 May (non-viable)	30	No renest
2021	L13-14	L6-15	Vermilion	~14 Mar	2	Hatch ~13 & 15 Apr (W10 & W11)	32	No renest
2021	L5-18	FW12-15	Cameron	11-17 Mar	2	Full term; coll. 26 Apr (both non-viable)	40-46	No renest
2021	LW1-18	L12-17	Jefferson Davis	20 Mar	1-2	1 hatch 21 Apr (W12)	32	No renest
2021	L15-17	L9-16	Vermilion	22 Mar	1	Abandoned 10 Apr (suspect weather related); coll. 15 Apr (MDE)	19	30
2021	L24-16	L14-17	Jefferson, TX	24-29 Mar	1-2	Failed 14 Apr (likely due to levee breach); fragments coll. 13 May	16-21	18-19
2021	L9-17	L23-17	Vermilion	20-31 Mar	1-2	Failed <20 Apr (unlikely full term); fragments coll. 28 Apr	19-30	≤27
2021	L3-19	L7-18	Vermilion	5 Apr	1	Full term; broke on nest (non-viable); fragments coll. 6 May	30	17
2021	L23-16	L3-17	Vermilion	28 Apr-2 May	1	Failed 26 May (suspect water level related); coll. 2 June (non-viable)	24-28	No renest
2021	L10-18	F1-98	Acadia	14 May	1	Flooded 17 May; coll. from water 20 May (unk fertility)	3	No renest
2022	L13-14	L6-15	Vermilion	~12 Feb	2	Hatch ~14 & 16 Mar (W1 & W2)	32	No renest
2022	L1-13	L3-11	Allen	12 Feb	2	1 hatch 16 Mar (W3); 1 coll. 24 Mar (LDE)	32	18 (after chick)
2022	L11-17	L7-11	Avoyelles	14 Feb	2	1 hatch ~18 Mar (W4); 1 coll. 21 Mar (non-viable)	32	No renest
2022	L23-16	L3-17	Vermilion	16 Feb	2	Hatch ~18 & 20 Mar (W5 & W6)	32	No renest
2022	L26-16	L10-17	Cameron	~17 Feb	2	Hatch ~19 & 21 Mar (W7 & W8)	32	No renest
2022	L3-13	L8-14	Vermilion	17 Feb	2	1 hatch ~21 Mar (W9); 1 disappeared	32	No renest
2022	L8-13	L11-11	Jefferson Davis	20 Feb	2	1 hatch 24 Mar (W10); 1 coll. 28 Mar (MDE)	32	No renest
2022	L6-16	L16-17	Calcasieu	21 Feb	2	Full term; coll. 28 Mar (EDE, malpositioned LDE)	35	24

2022	L17-16	L9-16	Vermilion	~28 Feb	1	1 hatch ~30 Mar (W11)	30	No renest
2022	L24-16	L14-17	Jefferson, TX	2 Mar	2	Full term; coll. 8 Apr (non-viable)	37	18
2022	L12-16	L5-14	Jefferson Davis	3 Mar	2	Full term; coll. 8 Apr (malpositioned LDE, fragments only)	36	14
2022	L19-16	L10-15	Acadia	7 Mar	1-2	1 hatch ~8 Apr (W12)	32	17 (after chick)
2022	L5-18	FW12-15	Cameron	22 Feb-10 Mar	2	Full term; coll. 19 Apr (non-viable)	40-56	17-27
2022	L10-18	F1-98	Jefferson Davis	15 Mar	2	DL egg 16 Mar-12 Apr; 1 cracked (EDE) & fragments coll. 12 Apr	28	21
2022	L2-11	L13-11	Allen	17 Mar	2	Full term; coll. 21 Apr (1 LDE, 1 fragments only)	34	No renest
2022	LW1-18	L12-17	Jefferson Davis	17-23 Mar	2	Full term; fragments only found at nest 25 Apr	32-38	15-17
2022	L21-17	LW3-18	Acadia	14-16 Apr	1-2	Failed (unk reason) on/by 13 May; 1 egg coll. 16 May (non-viable)	20-29	No renest

Subsequent nesting attempts by Whooping Crane pairs in the reintroduced Louisiana non-migratory population, 2014-22.

Second Nest Attempts (renests)

Year	Male	Female	Parish	Initiation	No. eggs	Outcome of nest, Fate of eggs	Days of incubation	Days to next nest
2014	L8-11	L7-11	Avoyelles	19 May	2	Full term, collected 26 June, both infertile	38	No 3rd nest
2015	L8-11	L7-11	Avoyelles	28 Apr	2	Full term, collected 4 June, both infertile	37	No 3rd nest
2016	L1-13	L3-11	Allen	8-11 Apr	2	Full term, 1 gone ~12 May, 2nd gone 15 May; 1 LDE coll. from water, 16 May	33-37	No 3rd nest
2016	L8-11	L7-11	Avoyelles	24 Apr	2	Full term, failed/abandoned 26-28 May; 1 coll. From water 1 June, infertile	32-34	No 3rd nest
2016	L2-11	L13-11	Allen	6-11 May	2	Poss. full term, failed/abandoned 3-6 June; 1 infertile coll. from water 6 June	23-31	No 3rd nest
2016	L10-11	L11-11	Jefferson-Davis	18/19 May	1	Full term, collected 21 June, infertile	34-35	No 3rd nest
2017	L8-11	L7-11	Avoyelles	5/6 Apr	2	Egg swap 12 Apr; pulled 2 infertile, gave pipped egg	6-7	15-16
2017	L1-13	L3-11	Allen	8/9 Apr	2	Failed/abandoned 3/4 May likely due to flooding rains, eggs disappeared	24-26	15-17
2017	L2-11	L13-11	Allen	~9 Apr	2	Failed 16/17 Apr, 1 intact infertile egg & 1 broken coll. from water 19 Apr	~7-8	12-16
2017	L10-11	L11-11	Jefferson-Davis	14-17 Apr	1	Swap 5 May, pulled egg (F but died – malpositioned), gave pipped egg	18-21	No 3rd nest
2017	L8-13	L6-12	Jefferson-Davis	15-17 Apr	1	Full term, collected 19 May, 1 LDE (malpositioned)	32-34	No 3rd nest
2017	L3-13	L11-12	Vermilion	~15 May	2	Full term, collected 23 June, 1 fertile mid-late DE & egg shell in water	39	No 3rd nest
2018	L12-16	L5-14	Jefferson-Davis	8 Apr	2	Full term; DL egg 12 Apr-3 May, coll. 1 & put back 3 May (LDE), 1 hatch 9 May	33	No 3rd nest
2018	L8-11	L7-11	Avoyelles	15 Apr	2	Failed 25-26 April, nest very small; both infertile	10-11	8-9

2018	L1-13	L3-11	Allen	21 Apr	2	Egg swap/hatch 1 May, 2 coll. – 1 EDE, 1 F LDE -died while hatching at ASSC	10	No 3rd nest
2019	L19-16	L10-15	Acadia	8 March	1	Full term, collected 12 Apr (no dev)	35	14
2019	L1-13	L3-11	Allen	2 April	2	Gave peeping egg 17 Apr, LDE, replaced with plaster egg 22 Apr. Failed due to snake predation 23 Apr. DL egg 10-17 April.	21	~15
2019	L11-17	L7-11	Avoyelles	15 April	2	Full term, disappeared on/by 16 May	30	No 3rd nest
2019	L3-13	L8-14	Vermilion	15-23 April	2	Full term, coll. 24 May (no dev)	31-39	No 3rd nest
2019	L2-11	L13-11	Allen	21 April	2	Egg swap 6 May, LW4-19 hatched 7 May, pulled eggs both hatched in captivity	16	No 3rd nest
2019	L12-16	L5-14	Jefferson Davis	23 April	1	Flooded 25 April, 1 egg found	2	1
2019	L12-14	L8-15	Vermilion	~2 May	1	Abandoned by 21 May, poss. due to flooding 19 May	17-19	No 3rd nest
2019	L8-13	L11-11	Jefferson Davis	7 May	2	Flooded 10 May, abandoned by 11 May, frags coll. 31 May	3-4	12-13
2020	L12-16	L5-14	Jefferson Davis	25 Mar	1	Abandoned 27 Mar; coll. 30 Mar (nonviable)	2	6
2020	L11-17	L7-11	Avoyelles	28 Mar	2	Abandoned 25 Apr (1 egg gone); 1 coll. 28 Apr (LDE)	28	32
2020	L1-13	L3-11	Allen	16-18 Apr	2	Full term; coll. 22 May (1 LDE, 1 MDE)	34-36	No 3rd nest
2020	L19-16	L10-15	Acadia	19 Apr	2	Hatched 19 & 21 May (W5 & W6-20)	32	No 3rd nest
2021	L11-17	L7-11	Avoyelles	6 Mar	2	Hatch 5 & 7 April (W6 & W7)	32	No 3rd nest
2021	L1-13	L3-11	Allen	22-26 Mar	2	Full term; 1 broke 25 Apr; 1 coll. 29 Apr (LDE)	34-38	16-22
2021	L3-13	L8-14	Vermilion	31 Mar	2	Full term; coll. 5 May (1 LDE, 1 non-viable)	35	No 3rd nest
2021	L8-13	L11-11	Jefferson Davis	11 April	2	Full term; 1 broke 14 May; 1 coll. 17 May (LDE)	36	15
2021	L12-16	L5-14	Jefferson Davis	12 April	2	Full term; coll. 17 May (1 LDE, 1 non-viable)	35	17
2021	L2-11	L13-11	Allen	27 Apr	2	Coll. 26 May for egg swap (1 LDE, 1 EDE); swapped egg hatch 26 May (W13)	29	No 3rd nest
2021	L22-17	L8-16	Chambers, TX	1 May	UNK	Failed on/by 10 May for unk reasons; no eggs/fragments found	9	No 3rd nest
2021	L6-16	L16-17	Calcasieu	5 May	2	Full term; eggs into water on 29 Mar & 6 June; coll. 8 June (1 MDE, 1 LDE)	32	No 3rd nest
2021	L15-17	L9-16	Vermilion	10 May	2	Abandoned 28 May (poss. water issues); coll. 2 June (1 MDE, 1 LDE)	18	No 3rd nest
2021	L24-16	L14-17	Jefferson, TX	2/3 May	2	Abandoned 18 May; coll. 19 May (1 EDE, 1 MDE)	15-16	17
2021	L9-17	L23-17	Vermilion	29 Apr-6 May	1	Abandoned by 24 May (likely due to rain/flooding); coll. 25 May (non-viable)	17-24	No 3rd nest
2021	L3-19	L7-18	Vermilion	~22 May	1-2	Failed 13 May (likely due to non-viable egg); fragments coll. 16 June	~22	No 3rd nest
2022	L1-13	L3-11	Allen	9 Apr	2	Egg swap 4 May (1 hatch ASSC, 1 EDE); swapped egg (EMP) hatch 5 May (W13)	25	No 3rd nest
2022	L6-16	L16-17	Calcasieu	21 Apr	2	Pulled 20 May due to forecast water issues; both placed into F1-98/10-18 nest (1 hatch 23 May, 1 LDE)	29	No 3rd nest

2022	L24-16	L14-17	Jefferson, TX	26 Apr	2	Failed 18 May; 1 coll. from water 20 May (MDE) & 1 fragments only	22	No 3rd nest
2022	L12-16	L5-14	Jefferson Davis	22 Apr	2	Flooded 1/2 May; coll. from water 4 May (1 EDE, 1 unk)	10-11	11-12
2022	L19-16	L10-15	Acadia	21 May	1	Pulled 6 June at landowner request (MDE)	16	No 3rd nest
2022	L5-18	FW12-15	Cameron	6-16 May	2	Abandoned ≤12 June (no water); 1 intact (nonviable), 1 broken coll. 14 June	16-37	No 3rd nest
2022	L10-18	F1-98	Jefferson Davis	3 May	2	Egg swap 20 May; swapped egg (L16-17's) hatch 23 May (W14); 1 LDE, 1 swapped into 12-17/W1-18 renest 3 June	20	No 3rd nest
2022	LW1-18	L12-17	Jefferson Davis	9-11 May	2	Egg swap 3 June (1 EDE, 1 MDE); swapped egg (F1-98's) hatch 4 June (W15)	23-25	No 3rd nest

Third nest attempts

Year	Male	Female	Parish	Initiation	No. eggs	Outcome of nest, Fate of eggs	Days of incubation	Days to next nest
2017	L2-11	L13-11	Allen	29 Apr-2 May	2	Failed 3-5 May, collected 9 May, 1 infertile & shell fragment	2-6	12-14
2017	L8-11	L7-11	Avoyelles	15 May	2	Full term, egg swap 20 June, abandoned 21 June, 2 pulled eggs infertile	37	No 4th nest
2017	L1-13	L3-11	Allen	19/20 May	2	Full term, floated 15 June - 1 infertile removed, 1 coll. 26 June (infertile)	37-38	No 4th nest
2018	L8-11	L7-11	Avoyelles	4 May	2	Abandoned AM 11 May; egg swap unsuccessful; 1 inf, 1 unk (put in 10-15 nest)	7	No 4th nest
2019	L12-16	L5-14	Jefferson Davis	~26 April	1	Failed, likely clutch mate of single renest egg, coll. 31 May (broken)	1	~14
2019	L19-16	L10-15	Acadia	26 April	2	Egg swap 3 May, failed by 4 May possibly due to storms, 1 EDE, 1 hatch ASSC	7-8	11
2019	L1-13	L3-11	Allen	8 May	2	Egg/chick (W6) swap 22 May, 1 unk, 1 hatch at WO	14	No 4th nest
2019	L8-13	L11-11	Jefferson Davis	23 May	1-2	Failed unk reasons 28 May, frag coll. 31 May	5	No 4th nest
2020	L12-16	L5-14	Jefferson Davis	2 Apr	1	Abandoned 3 Apr; coll. 6 Apr (nonviable)	1	15
2020	L11-17	L7-11	Avoyelles	27 May	2	Abandoned 5 June; 2 coll. from water 9 June (nonviable)	9	No 4th nest
2021	L1-13	L3-11	Allen	15-21 May	2	Coll. 26 May for egg swap; transfer to ASSC 27 May (2 MDE); swapped egg hatched 28 May (W14)	7-13	No 4th nest
2021	L8-13	L11-11	Jefferson Davis	1 June	2	Coll. 11 June for egg swap; transfer to ASSC 16 June (2 MDE); swapped egg died at hatch on 14 June	13	No 4th nest
2021	L12-16	L5-14	Jefferson Davis	3 June	2	Failed; coll. from water 8 June (unk fertility); laid 2nd egg of clutch on new plat	~3	~3
2021	L24-16	L14-17	Jefferson, TX	4 June	2	1 hatch 3 July (W15); 2nd disappeared	30	No 4th nest
2022	L12-16	L5-14	Jefferson Davis	13 May	1-2	Flooded 22 May; 1 egg coll. from water 24 May (EDE)	9	13
2022	L12-16	L5-14	Jefferson Davis	4 June	2	4th nest; abandoned 11 June; coll. 13 June (1 unk, 1 fragments only)	7	

Fourth - Seventh nest attempts

Year	Male	Female	Parish	Initiation	No. eggs	Outcome of nest, Fate of eggs	Days of incubation	Days to next nest
2017	L2-11	L13-11	Allen	17 May	2	4th nest; full term, collected 20 June, both infertile	34	
2019	L12-16	L5-14	Jefferson Davis	9/10 May	1-2	4th nest; Failed 28-30 May, fragments coll. 31 May	18-20	
2019	L19-16	L10-15	Acadia	15 May	2	4th nest; Chick swap 20 May, both LDE in captivity	5	
2020	L12-16	L5-14	Jefferson Davis	~18 Apr	1	4th nest; abandoned ~20 Apr; coll. 19 May (nonviable)	2	UNK
2020	L12-16	L5-14	Jefferson Davis	UNK	1	5th nest; coll. 12 May (nonviable)	UNK	UNK
2020	L12-16	L5-14	Jefferson Davis	2 May	2	6th nest; abandoned 9 May; 1 coll. 12 May (EDE), 1 broken on nest	7	16
2020	L12-16	L5-14	Jefferson Davis	25 May	UNK	7th nest; failed 3 June; no eggs/fragments found on 8 June	9	
2021	L12-16	L5-14	Jefferson Davis	~5 June	1	Nest 3.5; new platform but second egg from 3rd nest attempt; abandoned ~8 June; coll. 8 June (unk fertility)	~2	5
2021	L12-16	L5-14	Jefferson Davis	13 June	1	5th nest: Abandoned 17 June; coll. 21 June (unk fertility)	4	
2022	L12-16	L5-14	Jefferson Davis	4 June	2	4th nest; abandoned 11 June; coll. 13 June (1 unk, 1 fragments only)	7	

EMP FIELD TEAM ANNUAL REPORT 2021

Prepared by Hillary Thompson and Annika Poitras, International Crane Foundation

During 2021, there were about 75 Whooping Cranes in the Eastern Migratory Population. The majority spent the summer in Wisconsin, with the exception of 2 birds that spent the summer in Michigan (Figure. 1). We recorded a total of 23 nests by 21 breeding pairs of cranes, from which 14 chicks hatched. Four of these chicks made it to fledging, and 3 migrated south, and wintered with their parents. Three captive-reared cranes were released, and 2 survived to migration. There were 4 confirmed mortalities during 2021, due to various causes. Members of the Field Team captured 8 adult Whooping Cranes during 2021 for transmitter replacement, as well as 2 wild-hatched juveniles for initial transmitter deployment. All 8 of the adults were fitted with GSM transmitters or VHF radios to help us monitor during nesting and chick-rearing seasons. Additionally, 1 adult Whooping Crane (16-12) was captured and removed from the Eastern Migratory Population due to his continued use of a military air base. He was placed back into captivity at the International Crane Foundation (ICF).

Highlights related to monitoring and management of the EMP from 2021 include:

- During 2021, we recorded a total of 23 nests by 21 different pairs breeding in Wisconsin. This does not include 1 nest of a hybrid Sandhill-Whooping Crane pair in Michigan, and 2 nests of a hybrid pair in Dodge County, Wisconsin. The numbers reported here are the total we observed but there may have been a few missed nests or chicks who only lived a few days. We recovered 3 eggs from abandoned nests, collected 2 eggs from 2 occupied nests, and conducted forced renesting for one additional nest with 2 eggs. In total we brought 7 eggs into captivity for rearing and release. Additionally, we pulled a fertile egg from one nest and swapped it into a hybrid (Whooping Crane – Sandhill Crane) nest, however it did not hatch. Ten nests failed due to a variety of known and unknown causes (predation, abandonment, Table 2). Additionally, 2 nests were incubated full term, but the pairs were confirmed later without chicks. 14 chicks hatched from 8 first nests and 2 re-nests (Table 2). Four wild-hatched chicks fledged and 3 survived to migration (Table 3).

- Eight adults were captured for transmitter replacement, 2 wild-hatched chicks were captured for initial banding, and 1 adult was captured and placed back in captivity due to continued use of a military air base. In addition to having her transmitter replaced, Whooping Crane 6-17 was captured in Sauk County, Wisconsin, and translocated to White River Marsh SWA. She returned to Sauk County a few days later.

- We released 3 captive-reared Whooping cranes into the wild, and 2 survived to migration and headed south with other Whooping Cranes in the EMP.

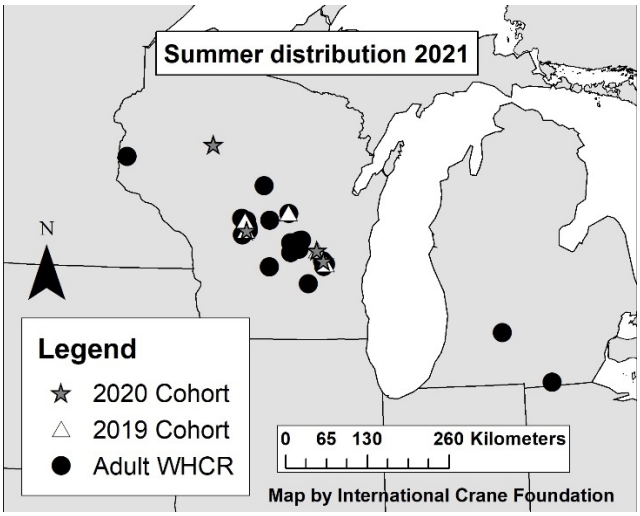

Figure 1. Summer distribution of the Eastern Migratory Population of Whooping Cranes during 2021. Seventy-three cranes spent the summer in Wisconsin and 2 were in Michigan.

Winter 2020-21

The estimated population size as of 1 January 2021 was 80 (39 F, 38 M, 3 U). The final wintering locations of Whooping Cranes in the EMP during winter 2020-21 were as follows (Figure 2): 36 in Indiana, 10 in Illinois, 11 in Kentucky, 1 in Tennessee, 14 in Alabama, 2 in Georgia, and 1 in Florida. There were 5 in unknown locations, including 1 pair who consistently winter in an unknown spot, 2 birds who became long-term missing in early 2021, and 72-17 who was confirmed dead in spring 2021 but likely died during fall 2020.

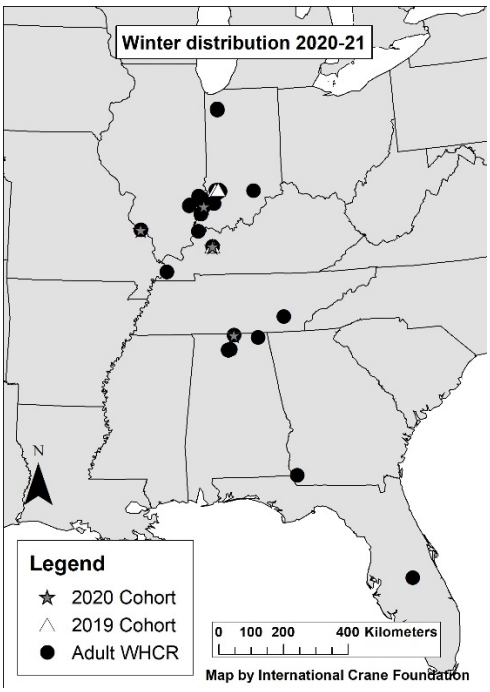

Figure 2. Distribution of the Eastern Migratory Population of Whooping Cranes during winter 2020-2021.

Captures and Banding in 2021

- Captures for transmitter replacement:
  - 4-17 Sauk County, Wisconsin, March 26th
  - 7-07 Juneau County, Wisconsin, April 30th
  - 18-03 Juneau County, Wisconsin, August 23rd
  - W1-06 Juneau County, Wisconsin, August 23rd
  - W10-15 Juneau County, Wisconsin, August 31st
  - 6-17 Sauk County, Wisconsin, October 26th.
    - Translocated to White River Marsh SWA in Green Lake County, but she returned to Sauk County shortly thereafter.
  - 12-05 Knox County, Indiana, December 13th
  - 15-11 Greene County, Indiana, December 14th

- Captures of pre-fledged wild-hatched chicks (transmitter and bands):
  - W11-21 Juneau County, Wisconsin, August 2nd
  - W14-21 Juneau County, Wisconsin, August 3rd

- Captured to be removed from the population due to use of a military air base:
  - 16-12 Juneau County, Wisconsin, April 14th

Winter distribution as of 1 January 2022

The maximum population size as of 1 January 2022 was 79 (38 Female, 38 Male, 3 Unknown). The distribution of these birds at this time is as follows (Figure 3): 34 in Indiana, 13 in Illinois, 6 in Kentucky, 1 in Tennessee, 14 in Alabama, 3 in Georgia, and 1 in Florida. There were 7 in unknown locations, 3 of which have not been seen south of Wisconsin.

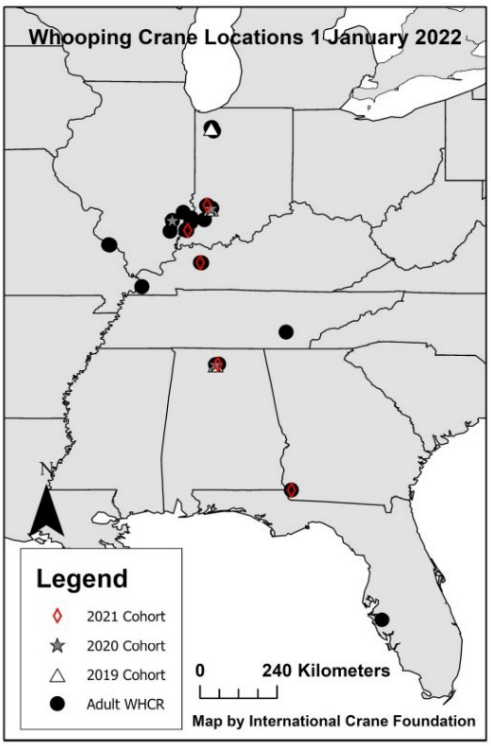

Figure 3. Distribution of wintering Whooping Cranes in the Eastern Migratory Population as of 1 Jan 2022.

Survival

- The total (both captive releases and wild-hatched chicks) coming into this population since 2001 is 327 (Figure 4), of which 79 (24%) may be alive as of 31 December 2021 (Figure 5). There have been 298 captive raised Whooping Cranes released since the beginning of the reintroduction in 2001. This number does not include the 17 HY2006 ultralight-led juveniles that died during confinement in a storm and one HY2007 ultralight-led juvenile that was removed from the project prior to release. There have been 32 wild-hatched chicks that survived to fledging, 28 of which have been recruited to the EMP (see Reproduction section below). One of the fledged wild-hatched chicks died prior to fall migration.

- There were 4 confirmed mortalities recorded in 2021 (not including pre-fledge wild-hatched chicks born in 2021, Table 1):
  - 72-17 - remains collected March 20th, cause unknown - possibly powerline collision
  - 11-15 - remains collected May 26th, suspected bobcat predation
  - W3-18 - remains collected July 19th, cause unknown
  - 83-21 – remains collected October 8th, cause unknown - possibly predation

- There were 3 cranes classified as long-term missing during 2021, that had not been seen in more than a year.
  - W7-17 – last seen 24 March, 2020 in Fayette County, Illinois
  - 23-10 – last seen 8 April, 2020 in Juneau County, Wisconsin

- W10-21 – has not been missing for more than one year, but is a hatch year bird whose parents showed up on the wintering grounds with no chick. Therefore, we assume W10-21 is dead, although there was never a carcass recovered.

Table 1. Causes of death for fledged, wild-hatched and captive-reared Whooping Cranes in the Eastern Migratory Population. We did not include confirmed mortalities for wild-hatched pre-fledged chicks. "Other" causes of mortality included euthanasia due to injuries, hemorrhages, capture myopathy, emaciation, and egg binding.

Cause of Death	**Number of cases cumulatively 2001-2020**	**Number of cases 2021**
Predation	38	1
Impact Trauma – confirmed or suspected power line collision	10	0
Impact Trauma – other (vehicle or aircraft collision, unknown source of trauma)	11	0
Gunshot	14	0
Disease (including lead poisoning)	8	0
Other	14	0
Unknown	73	3
Total confirmed mortalities	168	4

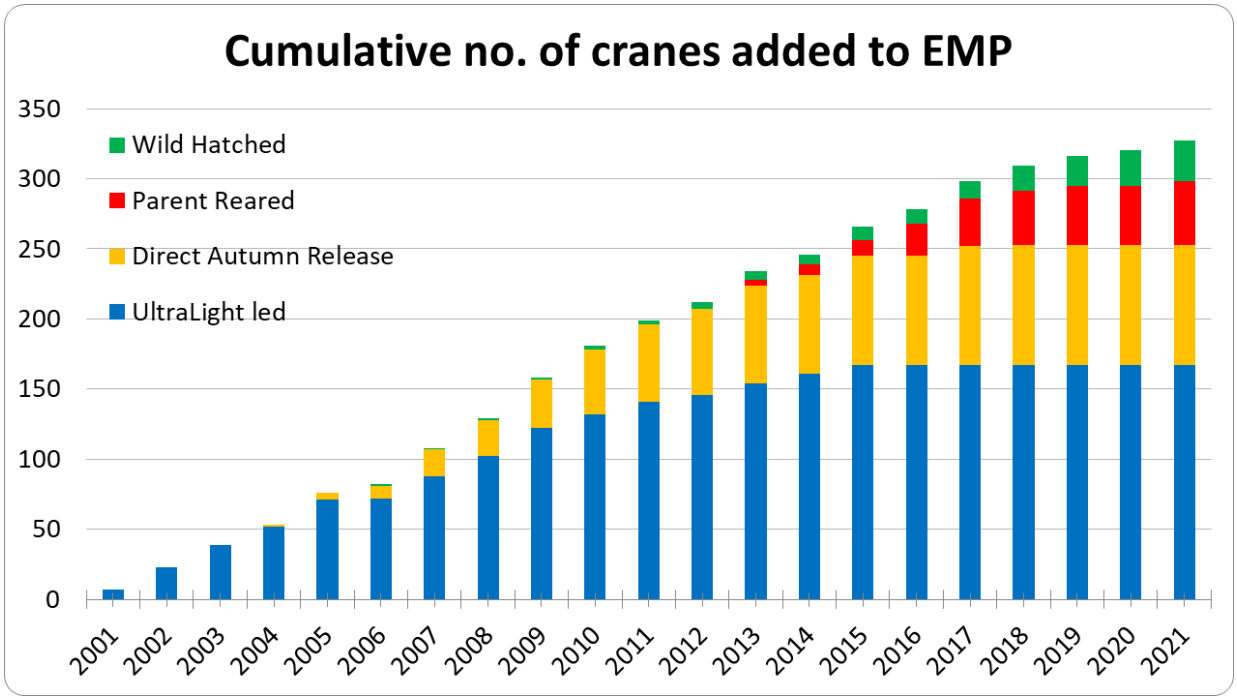

Figure 4. Cumulative number of cranes added to the Eastern Migratory Population by rearing method since 2001. As of 2021, there have been 167 UltraLight led, 86 Direct Autumn Release, 45 Parent Reared, and 29 Wild Hatched Whooping Cranes added to the EMP.

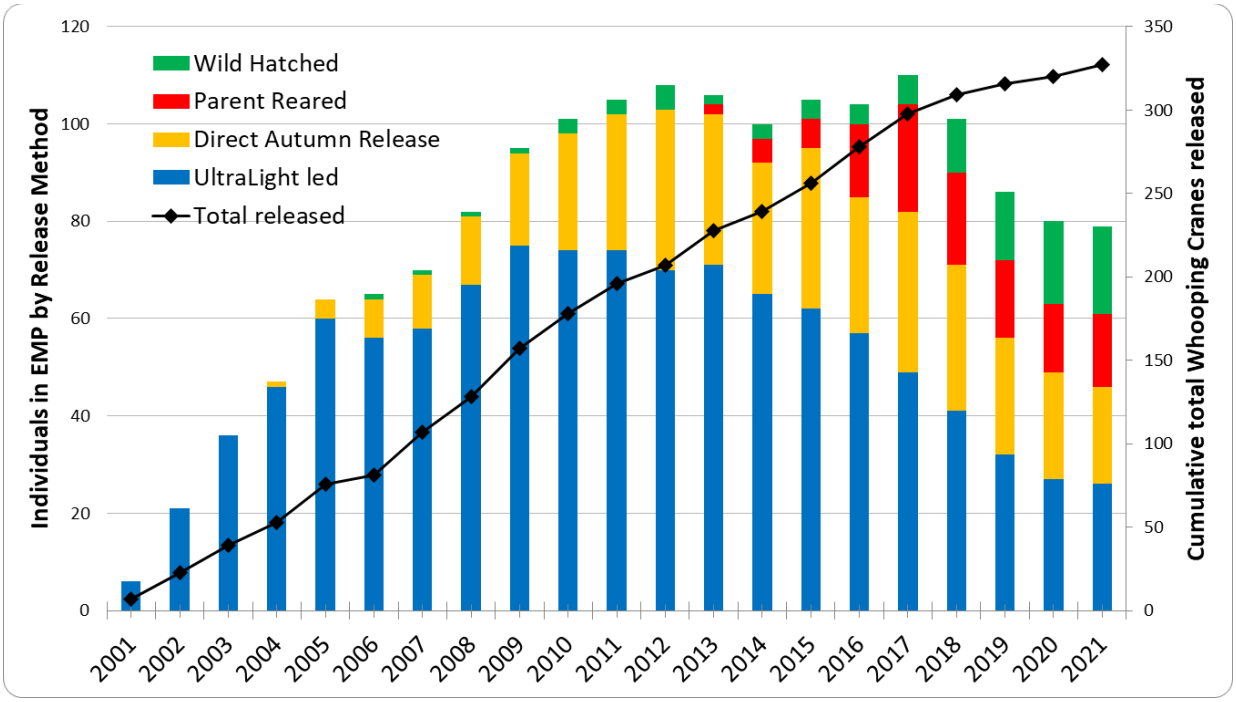

Figure 5. Population size of EMP by rearing method. As of 1 January 2022, there were 79 birds recorded in the EMP (left axis; 38 males, 38 females, 3 unknown). Black line indicates the total birds released (or wild-hatched and fledged) into the population cumulatively (right axis; same number as figure 4, above).

Reproduction

- This year we recorded a total of 23 nests by 21 different pairs breeding in Wisconsin. This does not include 3 hybrid Sandhill-Whooping Crane nests, by 2 pairs. The numbers reported here are the total we observed but there may have been a few missed nests or chicks who only lived a few days.

- We recovered 3 eggs from abandoned nests, collected 2 eggs from 1 occupied nest, and collected 2 additional eggs from 2 renests with 2 egg clutches (took 1 egg from two 2-egg clutches). In total we brought 7 eggs into captivity for rearing and release.

- 10 nests failed due to a variety of known and unknown causes (predation, abandonment, Table 2). Additionally, 2 nests were incubated full term, but the pairs were confirmed later without chicks.

- There was 1 hybrid Sandhill-Whooping Crane pair in Michigan and 1 in Dodge County, Wisconsin. In Michigan, Michigan DNR staff replaced the hybrid eggs with dummy eggs. The pair in Dodge County was given a fertile egg collected from another nest, but the female Sandhill Crane did not continue incubating after the disruption. This pair re-nested later in the season, and the eggs were collected (Table 2).

- 14 chicks hatched from 8 first nests and 2 re-nests (Table 2). Four wild-hatched chicks fledged and 3 survived to migration (Table 3).

- At the end of 2021, there have been a total of 377 nests (294 first nests, and 83 re-nests). 167 chicks hatched in the wild of which 32 fledged of 31 December 2021, 18 of those survive in the wild (Tables 3 and 4).

Table 2. Nesting summary for 2021. Asterisks indicate a re-nest.

Female	Male	Nest Outcome	Date Completed	County	Chicks	Notes
12-11	5-11	Failed - abandoned	4/7/2021	Juneau	Not Applicable	Nest failed around black fly emergence. Likely abandoned due to black flies.
36-09	18-03	Failed - unknown	4/7/2021	Juneau	Not Applicable	Likely abandoned due to black flies but did not find any remains of eggs.
2-17	16-04	Failed - abandoned	4/7/2021	Juneau	Not Applicable	One egg was broken with black flies in it. The second egg was collected and hatched in captivity.
24-17	4-17	Failed - abandoned	4/20/2021	Sauk	Not Applicable	Abandoned for unknown reasons. Eggs were salvaged and one egg was hatched in captivity.
10-15	4-13	Active nest management	4/21/2021	Marquette	Not Applicable	Eggs collected for captive rearing.
25-09	2-04	Failed - unknown	4/24/2021	Juneau	Not Applicable	None
W3-17	30-16	Hatched	4/26/2021	Green Lake	W1-21	Chick did not fledge.
15-11	29-08	Failed - unknown	4/28/2021	Juneau	Not Applicable	None
W3-10	7-07	Failed – abandoned	4/30/2021	Juneau	Not Applicable	None
59-13	5-11	Failed - predation	5/1/2021	Saint Croix	Not Applicable	One egg was collected and placed in the nest of 16-11 and SACR mate. The second egg was eaten by an unknown nocturnal predator.
3-14	4-12	Hatched	5/2/2021	Green Lake	W2-21, W3-21	W3-21 did not fledge. W2-21 fledged and migrated south with parents.
42-09	11-15	Hatched	5/4/2021	Adams	W4-21 W5-21	Neither chick fledged.
7-11	19-10	Failed - predation	5/4/2021	Juneau	Not Applicable	Egg eaten by a canid.
27-14	10-11	Hatched	5/7/2021	Green Lake	W6-21, W7-21	Neither chick fledged.

38-17	63-15	Hatched	5/11/2021	Dodge	W8-21 W9-21	Neither chick fledged.
13-03	9-05	Failed - predation	5/19/2021	Juneau	Not Applicable	One egg was collected and hatched in captivity. Nest camera showed the nest was destroyed and the other egg was likely predated.
12-03	12-05	Hatched	5/21/2021	Juneau	W10-21	Chick died sometime after fledging but before or during migration.
36-09	18-03	Hatched*	5/23/2021	Juneau	W11-21	Chick fledged and migrated south with parents.
24-08	13-02	Hatched	5/27/2021	Juneau	W12-21	Chick did not fledge.
69-16	W10-15	Hatched	5/31/2021	Juneau	W13-21	Chick did not fledge.
73-18	3-04	Full term	5/31/2021	Juneau	Not Applicable	None
25-09	2-04	Hatched*	6/2/2021	Juneau	W14-21	One egg collected and raised in captivity. The second egg hatched and W14-21 fledged and migrated south with parents.
8-17	28-17	Full term	6/7/2021	Green Lake	Not Applicable	None
SACR	14-12	Failed - management	4/1/2021	Lenawee Co, MI	Not Applicable	Hybrid eggs were removed and replaced with dummy eggs.
SACR	16-11	Failed - abandoned	4/26/2021	Dodge	Not Applicable	Hybrid eggs were replaced with fertile egg from 59-13 and 1-11 nest. SACR never returned to the nest after the disturbance.
SACR	16-11	Failed* - management	5/24/2021	Dodge	Not Applicable	Removed hybrid eggs from the nest.

Table 3. Nest initiation dates, number of nests, number of chicks hatched, and number of chicks fledged 2005-2021. This does not include hybrid nests or chicks nor does it include same-sex pairs. There was one same-sex female pair that nested in 2020, was given fertile eggs, and hatched a chick that did not fledge. This chick is included in the number of chicks hatched, but the nest is not included in nest totals.
Note: In 2016, one chick was old enough to have fledged when it died, but flights were never observed.

Year	First Nest Initiation	Number First Nests	Number Re-nests	Total Nests	Number Hatched	Number Fledged
2005	16-Apr	2	0	2	0	0
2006	5-6 Apr	5	1	6	2	1
2007	3-Apr	4	1	5	0	0
2008	7-Apr	11	0	11	0	0
2009	2-Apr	12	5	17	2	0
2010	<1 Apr	12	5	17	7	2
2011	3-4 Apr	20	2	22	4	0
2012	<26 Mar	22	7	29	9	2
2013	15-Apr	21	2	23	3	1
2014	7-Apr	25	3	28	13	1
2015	1-3 Apr	27	9	36	24	3
2016	29-31 Mar	25	16	41	24	3
2017	30-Mar	25	10	35	18	2
2018	8-Apr	17	6	23	10	6
2019	30-Mar	25	11	36	19	3
2020	25-Mar	20	3	23	18	4
2021	<31 Mar	21	2	23	14	4
Total		294	83	377	167	32

Table 4. Pairs that have successfully fledged chicks with years of fledging. *Note: In 2016, Male 12-02 died before chick fledged. Chick was old enough to have fledged when it died, but flights were never observed. Female 4-11 was found shot at her wintering area at the beginning of 2017. In 2018, Male 14-08 disappeared before chick fledged and 14-08 is believed to be dead. The chick (W9-18) was old enough to have fledged when it died, but flights were never observed.*

Sire	Dam	Year(s)	Year(s)	Year(s)
11-02	17-02	2006		
3-04	9-03	2010	2013	2015
12-02	19-04	2010	2012	2014
9-05	13-03	2012	2019	
10-09	17-07	2015		
2-04	25-09	2015	2021	
29-09	12-03	2016		
12-05	12-03	2019	2020	2021
1-04	8-05	2016		
12-02	4-11	2016		
14-08	24-08	2017	2018	
13-02	24-08	2020		
24-09	42-09	2017	2018	
11-15	42-09	2020		
5-11	12-11	2018	2019	
4-08	23-10	2018		
8-04	W3-10	2018		
1-04	16-07	2018		
63-15	38-17	2020		
18-03	36-09	2021		
4-12	3-14	2021		