Whooping Crane Recovery Activities

2022 BREEDING SEASON TO 2023 SPRING MIGRATION

By Kevin McAbee, Whooping Crane Recovery Coordinator, US Fish & Wildlife Service and John Conkin, Wildlife Biologist, Canadian Wildlife Service

January 2024

Executive Summary

Whooping cranes (*Grus americana*) are one of the rarest and most intensively monitored bird species in North America. The Aransas-Wood Buffalo population (AWBP), which breeds in northern Canada and winters in coastal Texas, is the only remaining wild, self-sustaining population of whooping cranes. During the summer 2022 breeding season, surveys of the AWBP detected 96 nests and 61 chicks. During the 2022-23 wintering period, the population size was an estimated 536 birds. The population has remained stable over the last two years, while the long-term growth rate in the whooping crane population has averaged 4.34%.

In addition to the AWBP, reintroduction efforts of many government agencies and non-governmental organizations have established populations of whooping cranes in Wisconsin and Louisiana, while a discontinued reintroduction program in Florida still harbors birds on the landscape. These reintroduction efforts are supported by captive breeding centers where whooping cranes are reared for reintroduction. Whooping cranes in captivity, including on display, breeding pairs, and non-breeding individuals, are managed as a captive population under the American Zoological Association (AZA) Saving Animals From Extinction (SAFE) guidelines. During the winter of 2022-2023, there were 163 cranes in reintroduced populations (Table 1) and 134 cranes held in captivity (Table 2), representing a slight increase from 162 and 130 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. The captive breeding capacity of the SAFE is currently less than is desired to support the SAFE and reintroduced populations. Efforts are ongoing by partners to increase the capacity of chick production to support all of these populations.

Aransas-Wood Buffalo Population

The Aransas-Wood Buffalo population (AWBP) of whooping cranes is the only remaining wild, self-sustaining whooping crane population. The AWBP breeds during the summer in and around Wood Buffalo National Park (WBNP) in the Canadian jurisdictions of Alberta and the Northwest Territories and migrates >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 536 during the 2022-2023 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.

2022 Breeding Season[1]

During the 2022 nesting period, water levels in the whooping crane nesting area were extremely high, with many ponds filled beyond capacity and standing water extending into adjacent upland habitats. Extreme water levels are thought to have resulted from above-average precipitation in the month of May while subsurface ice persisted in many locations. During fieldwork in July and August, observers noted that water had receded from May-levels but remained relatively high in most breeding-area ponds.

Aerial surveys to estimate abundance of breeding pairs with and without nests were conducted from May 23-27, 2022. Surveys detected 96 nests and 15 pairs without nests. Twenty-six nests were outside the area designated as critical habitat (CH) under Canada's Species at Risk Act, and 13 of those were outside WBNP. Of the 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.

Aerial surveys to estimate abundance of juveniles were conducted July 26-30, 2022. Observers detected 61 juveniles in 50 family groups and 21-22 pairs without juveniles. Of the 50 family groups, 39 were pairs with one juvenile and 11 were pairs with two juveniles. Using information collected during the breeding pair and juvenile surveys, we determined that annual productivity was 0.64 juveniles per nest which is well above the 20-year average of 0.49.

2022-2023 Migration and Wintering

Whooping cranes first arrived on the Texas coastal wintering grounds in and around Aransas National Wildlife Refuge (NWR) the week of 21 October, 2022. The last confirmed public sighting of a migrating whooping crane was 18 November 2022, demonstrating that most individuals were in coastal Texas by the end of November. The first confirmed sighting of whooping crane during spring migration was 2 March 2023, indicating that the peak wintering period was likely 4 months long.

The 2022 annual precipitation total of 26 inches (recorded at Rockport Airport[2]) was below the thirty-year annual average of 35 inches and was the fifth lowest of 22 annual data points since 1993[3]. Conditions were particularly dry during March through July where only 2.2 inches of precipitation were recorded. Precipitation in August, September, and November was substantial, accounting for 71% of the annual rainfall. San Antonio Bay salinities ranged from 2 to 32.6 parts-per-thousand (ppt) but were generally near the mean salinity of 24 ppt during the 2022-2023 wintering season[4].

Staff at Aransas NWR were able to use prescribed fire to improve whooping crane foraging opportunities and overall prairie upland condition during the 2022-2023 winter season. The refuge conducted winter prescribed burns on approximately 9,000 acres to benefit whooping crane secondary feeding habitat. Approximately 300 acres were treated for invasive Chinese tallow (*Triadica sebifera*) in refuge swales to benefit habitat historically used by whooping cranes.

[1] For the full update, see the attached report prepared by Canadian Wildlife Service.
[2] National Weather Service station KRKP.
[3] Seven years of data are not available for this data station, including 2004 and 2013-2018.
[4] Texas A&M Corpus Christi Division of Nearshore Research Station 127: GBRA Station #1

2022-2023 Winter Abundance[5]

During winter 2022–2023, the United States Fish and Wildlife Service (USFWS) conducted abundance surveys in late-January using a Quest Kodiak aircraft. The primary survey areas (approximately 170,500 acres; Figure 1) were surveyed during January 23–28, 2023. The South San Jose Island, San Jose Island, Lamar-Tatton, Blackjack, and Heron Flats survey areas were surveyed four times, and the Welder Flats, Matagorda Island Central, Holiday Beach, and West Marsh survey areas were surveyed three times. The secondary survey areas (approximately 85,250 acres; Figure 1) were not surveyed.

The USFWS estimated that 536 whooping cranes inhabited the primary survey area in the Aransas-Wood Buffalo population for the winter of 2022–2023 (95% CI = 443.5–644.1; CV = 0.146). The population has remained stable over the last two years, while the long-term growth rate in the whooping crane population has averaged 4.34% (n = 82; 95% CI = 1.76–6.83%). This population estimate included at least 88 juveniles (95% CI =67.1–124.0; CV = 0.199) and 203 adult pairs (95% CI = 170.0–242.6; CV = 0.144). Recruitment of juveniles into the winter flock was estimated at 19.9 chicks (95% CI = 14.4–27.4; CV = 0.163) per 100 adults. Discrepancy between juvenile abundance estimates on the breeding-grounds (61) and wintering-grounds (88) is likely caused by differences in survey methodology and detectability of young during the two survey periods.

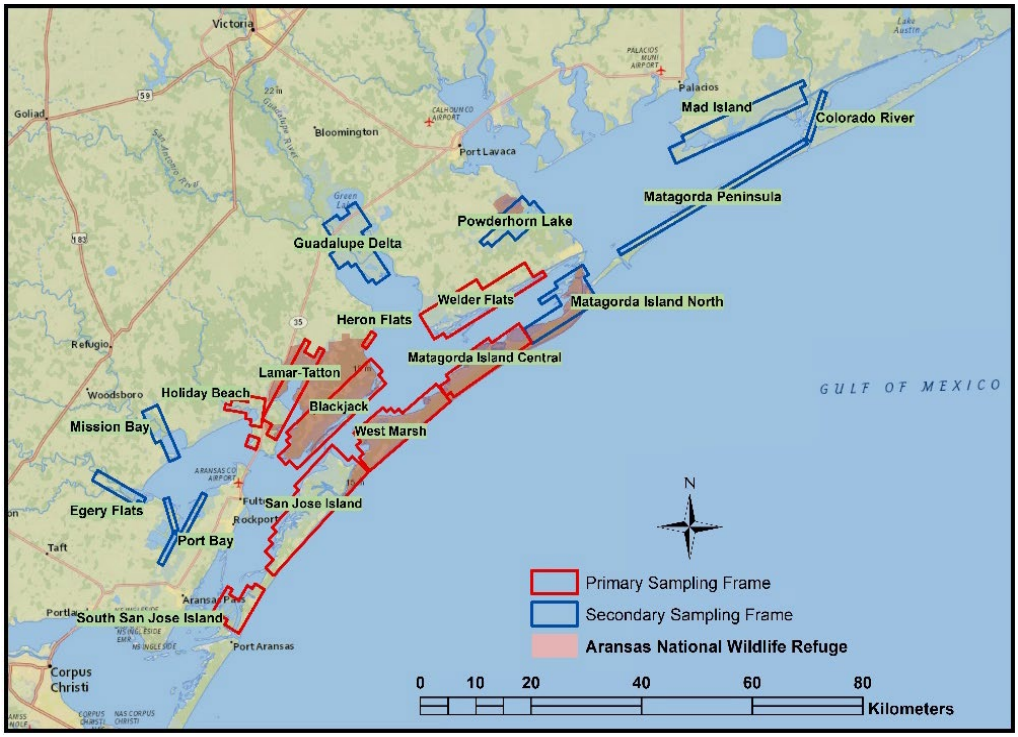


Figure 1. The sampling area used to monitor whooping crane abundance on their wintering grounds along the Texas coast of the Gulf of Mexico, USA.

[5] For the full 2022-23 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

Mortalities of Note

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 and charged. All four defendants pleaded guilty in 2023 and were each ordered to pay $17,000 in restitution to the International Crane Foundation and pay a $750 fine. The defendants were also each ordered to forfeit their shotguns and will also lose their hunting privileges in all 50 states for the next five years.

AWBP Whooping Crane Tracking Partnership

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 (Phase 1), was carried out by the Whooping Crane Tracking Partnership (WCTP), a cooperative effort between five core partners: Canadian Wildlife Service (CWS), US Geological Survey (USGS), USFWS, the Crane Trust, and Platte River Recovery Implementation Program, with additional support from Parks Canada Agency (PCA), International Crane Foundation (ICF), and 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 at the 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 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 and color leg bands. During 2017-2018, 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. From 2017 through 2022, WCTP partners marked 46 juvenile whooping cranes during the breeding season in WBNP and 53 adults and five juveniles on the Texas Gulf Coast during winter.

Reintroduced Populations

Florida Non-Migratory Population

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. A few pairs have continued to produce offspring.

As there are no plans for future reintroductions into this flock, a collaborative effort began in 2017 to translocate wild-hatched chicks and single cranes to Louisiana to aid in recovery efforts there. A partnership, consisting of FWC, Louisiana Department of Wildlife and Fisheries, White Oak Conservation, and the USFWS translocated the first two cranes in January 2019, another in November 2021, and two more in October 2022. Translocated Florida cranes include:

- A 1998 captive-reared female;
- A 2015 wild-hatched female (daughter of the 1998 captive-reared female);
- A 2019 wild-hatched female; and
- Two 2016 wild-hatched males (twins of the 1998 captive-reared female).

Thus far, translocation of individuals from the Florida flock has been successful in terms of the individuals surviving and remaining in Louisiana. All three females have paired and nested, though they have not yet produced offspring. The males have remained mainly alone since their release, but in areas with other whooping cranes.

At the end of the reporting period, the Florida non-migratory population was made up of five cranes:

- A pair in Osceola County containing a 2000 captive-reared male and 1999 captive-reared female;
- A 2000 captive-reared male in Polk County;
- A 2003 captive-reared male in Sumter County; and
- A 2006 wild-hatched female in Alachua County (daughter of the 1999 Osceola female).

There are plans underway to move the 2006 wild-hatched female to Louisiana. Following this translocation, the remaining four captive-reared cranes will continue to live out their lives in Florida.

Louisiana non-migratory flock[6]

The maximum size of the Louisiana non-migratory population (LNMP) as measured on June 30, 2023 was 83 fledged individuals (41 males, 35 females, 7 unknown) with 81 birds located in Louisiana and two of unknown or long term missing status. Additionally, there were two wild-hatched, pre-fledged chicks on the landscape, not yet counted in the population totals. Based on location data generated via remote transmitters, cranes were documented in 22 parishes throughout Louisiana. Two LMNP cranes were documented in Texas during the report period; one was captured and returned to Louisiana and the second returned on his own. Both birds are now paired and it is expected that use of Texas locations will be reduced in the future.

[6] For the full 2022-23 report, see attached prepared by Louisiana Department of Wildlife and Fisheries

Ten captive reared juvenile whooping cranes were received in early November 2022 from the Freeport-McMoRan Audubon Species Survival Center in New Orleans; six had been hatched and reared there while the remaining four were raised at the International Crane Foundation and sent to join the Audubon cohort in mid-October. They were transported to the White Lake Wetlands Conservation Area in Vermilion Parish where they were banded and placed in the top-netted section of the release pen until their release four days later. One crane disappeared by the end of the month and is presumed dead, however the other nine remained alive, splitting into several groups and leaving the marsh. Additionally, five wild-hatched chicks from 2022 remained alive through the report period.

During the 2023 breeding season, 19 pairs initiated 31 nests in seven different parishes in Louisiana, producing 15 wild-hatched chicks; eight pairs hatched one chick, two pairs hatched two, and one pair hatched three from two nesting efforts. Twelve chicks hatched to their biological parents and three hatched from fertile eggs that were swapped into nests. Three chicks had fledged by the end of the report period and two others remained alive, aged 52 and 34 days (both later fledged after the end of the report period). Three pairs with surviving chicks have successfully fledged chicks together in the past, one pair has one experienced female and one inexperienced male and the last pair has some chick rearing experience, but had lost previous chicks prior to fledge. Finally, in a first record for the species, one pair of cranes successfully fledged a chick from their first nest and then renested, sitting full term on a fertile egg that unfortunately died during incubation.

Now in its 13th year, the Louisiana whooping crane reintroduction continues to see positive progress, including good chick survival/fledging, but still has challenges to overcome, most notably the large number of fertile eggs that die during incubation. To that end, we have entered into a partnership with the USGS Alaska Science Center to more thoroughly investigate potential causes of the embryo mortality that is observed every year.

Eastern Migratory Population[7]

The maximum size of the Eastern Migratory as measured on January 3, 2023 was 75 whooping cranes. The majority spent the summer in Wisconsin, with the exception of two birds that spent the summer in Michigan. ICF recorded a total of 31 nests by 24 different pairs breeding in Wisconsin, not including hybrid sandhill-whooping crane nests. ICF collected 16 eggs from nine first nests for forced renesting, to encourage pairs to renest after black flies were no longer on the landscape. Additionally, they recovered two eggs from abandoned nests, and collected four additional eggs from four renests with two-egg clutches (took one egg from two two-egg clutches). In total, 22 eggs were brought into captivity for rearing and release. Fourteen chicks hatched from eight first nests and four re-nests. Two wild-hatched chicks fledged and survived to migration.

ICF released four captive-reared whooping cranes into the wild. Two died prior to migration, one died during migration, and one was released on the wintering grounds where she was later found dead. The two that died prior to migration were both one-year old birds raised at the Calgary Zoo, whose transfer to Wisconsin was delayed due to COVID-19 and HPAI. There were six confirmed mortalities during 2022, including four released birds, due to various causes.

[7] For the full 2022 report, see attached prepared by International Crane Foundation

Table 1. Estimated size of wild whooping crane populations in winter 2022-23.

Population	Date of Count	Male	Female	Unknown	Total	Breeding Pairs
Aransas-Wood Buffalo	January 2023	N/A	N/A	N/A	536	96
Eastern Migratory	January 2023	35	37	3	75	24
Louisiana Non-migratory	June 2023	41	35	7	83	19
Florida Non-migratory	June 2023	3	2	0	5	0
Total in wild populations					699	139

Table 2. Number of whooping cranes held at institutional members of American Zoological Association (AZA) Saving Animals From Extinction (SAFE) program on March 31, 2023. Institutions denoted with a star are designated as captive breeding centers.

Institution	Male	Female	Total
International Crane Foundation, Wisconsin*	17	19	36
Calgary Zoo, Alberta*	12	12	24
Audubon SSC (Species Survival Center)*	9	11	20
Smithsonian Conservation Biology Institute, Virginia*	5	5	10
Dallas Zoo, Texas*	5	4	9
White Oak Conservation Center, Florida*	4	4	8
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
Smithsonian National Zoo, Washington DC	1	1	2
Oklahoma City Zoo, Oklahoma	1	1	2
Northeastern Wisconsin Zoo	1	1	2
San Antonio Zoological Gardens and Aquarium, Texas*	1	1	2
Sylvan Heights Bird Park, North Carolina	1	1	2
Zoo New England, Massachusetts	1	1	2
Jacksonville Zoo, Florida	0	1	1
Total in captive population	**65**	**69**	**134**

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.

Literature Cited

Butler, M.J., C.R. Sanspree, A.A. Griffin, and J. Moon. 2023. Whooping Crane Survey Results: Winter 2022–2023. U.S. Fish and Wildlife Service. Austwell, Texas. 4pp.

Canadian Wildlife Service. 2023. Recovery and Ecology of Endangered Whooping Cranes: Monitoring of the Aransas-Wood Buffalo Population during the 2022 Breeding Season. 10pp.

Louisiana Department of Wildlife and Fisheries, Wildlife Division. 2023. 2022-23 Louisiana Whooping Crane Report. 18pp.

Thompson, H. 2023. EMP Field Team Annual Report 2022. 9pp.

Publications resulting from Phase I of WCTP:

Niemuth, N.D., A.J. Ryba, A.T. Pearse, S.M. Kvas, D.A. Brandt, B. Wangler, J.E. Austin, and M.J. Carlisle. 2018. Opportunistically collected data reveal habitat selection by migrating whooping cranes in the U.S. Northern Plains. The Condor: Ornithological Applications 120:343–356.

Pearse, A.T., D.A. Brandt, W.C. Harrell, K.L. Metzger, D.M. Baasch, and T.J. Hefley. 2015. Whooping crane stopover site use intensity within the Great Plains, U.S. Geological Survey Open-File Report 2015–1166.

Pearse, A.T., M.J. Harner, D.M. Baasch. G.D. Wright, A.J. Caven, and K.L. Metzger. 2017. Evaluation of nocturnal roost and diurnal sites used by whooping cranes in the Great Plains, United States. U.S. Geological Survey Open-File Report 2016–1209.

Pearse, A.T., M. Rabbe, L.M. Juliusson, M.T. Bidwell, L. Craig-Moore, D.A. Brandt, and W. Harrell. 2018. Delineating and identifying long-term changes in whooping crane (Grus americana) migration corridor. PLoS ONE 13:e0192737.

Pearse, A.T., D.A. Brandt, B.K. Hartup, and M.T. Bidwell. 2018. Mortality in Aransas-Wood Buffalo whooping cranes: timing, location, and causes. Pages 125–138 in J.B. French, Jr., S.J. Converse, and J.E. Austin, editors, Whooping Cranes: Biology and Conservation. Biodiversity of the World: Conservation from Genes to Landscapes. Academic Press, San Diego, CA.

Pearse, A.T., K.L. Metzger, D.A. Brandt, M.T. Bidwell, M.J. Harner, D.M. Baasch and W. Harrell. 2020. Heterogeneity in migration strategies of whooping cranes. Condor 122:1.

Recovery and Ecology of Endangered Whooping Cranes: Monitoring of the Aransas-Wood Buffalo Population during the 2022 Breeding Season

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

Summary

Annual, long-term monitoring of the Aransas-Wood Buffalo Population of whooping cranes (Grus americana), which numbers approximately 543, is a key element of Canada's efforts to recover the species under the Species at Risk Act. In 2022, Parks Canada staff from Wood Buffalo National Park (WBNP) led 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 96 nests; 15 pairs without nests were also observed. Twenty-six nests were outside the area designated as critical habitat and 13 of those were outside WBNP. Surveys in July detected 61 juveniles in 50 family groups. Annual productivity was 0.64 juveniles per nest, which is well above the 20-year average of 0.49. Results of monitoring in 2022 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 critical habitat.

In addition to long-term monitoring of the breeding population, Canadian Wildlife Service worked collaboratively with partners in 2022 to conduct scientific activities designed to improve our knowledge of the ecology of whooping cranes. In May and August, we performed fieldwork to identify factors that may limit nest success of Aransas-Wood Buffalo Population whooping cranes by deploying remote cameras with time-lapse surveillance, autonomous recording units and water level loggers at crane nest. The objective of the current phase of this work is to ensure that deployment and operation of cameras does not negatively affect nesting activities of cranes and that cameras capture adequate imagery to measure nest success or failure from predation or flooding events. We also renewed our efforts to monitor movement, behaviour and survival of whooping cranes throughout the annual cycle by capturing and banding 17 fledged juveniles in and near WBNP with coloured leg bands and GPS transmitters. Data collected through this project builds on existing baseline monitoring conducted via satellite telemetry since 2010 and is being used to investigate potential risk to cranes from industrial development.

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 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 543 individuals during winter 2021-22 (USFWS 2022), spends half of its annual cycle in Canada. During the summer breeding season, 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, cranes spend up to six weeks staging in central Saskatchewan before migrating to the Texas Gulf Coast where they spend winter in and near the Aransas National Wildlife Refuge. During spring migration, 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 documents as an activity required to achieve recovery goals. Data collected 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 18 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 (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 2021 to April 2022) was 85% of the 60-year average (Figure 1, Environment and Climate Change Canada 2022). Despite below-average annual precipitation prior to the breeding season, water levels in the whooping crane nesting area were extremely high during the nesting period, with many ponds filled beyond capacity and standing water extending into adjacent upland habitats. Extreme water levels are thought to have resulted from above-average precipitation in the month of May (176% of the 60-year average) while subsurface ice persists in many locations. Precipitation during the breeding season (May to August) was 62% of the 60-year average (Figure 1, Environment and Climate Change Canada 2022). During fieldwork in July and August, observers noted that water had receded from May-levels but remained relatively high in most breeding-area ponds.

Abundance of Breeding Pairs and Juveniles

In 2022, aerial surveys to estimate abundance of breeding pairs with and without nests were conducted May 23-27 using methods described in Johns (2010). Observers detected 96 nests and 15 pairs without nests (Table 1, Figure 2). Of the 96 nests, 26 were outside the area designated as containing CH and 13 of those were outside WBNP. Of the 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 (one pair without a nest was observed here). Breeding pair surveys were conducted by Lori Parker, Brandon Gregg and Teresa Little (PCA) using an EC-120 helicopter (Phoenix Heli-flight, Fort McMurray, AB).

Aerial surveys to estimate abundance of juveniles were conducted July 26-30, 2022. Observers detected 61 juveniles in 50 family groups and 21-22 pairs without juveniles (Table 1). Of the 50 family groups, 39 were pairs with one juvenile and 11 were pairs with two juveniles. Using information collected during the breeding pair and juvenile surveys, we determined that annual productivity was 0.64 juveniles per nest which is well above the 20-year average of 0.49 (Figure 3). Juvenile surveys were done by Lori Parker, Amber Erasmus and Kevin Hawkshaw (PCA), Earl Evans (Fort Smith Métis Council), Cochise Paulette (Smith's Landing First Nation) and Mike Forsberg using an EC-120 helicopter (Phoenix Heli-flight, Fort McMurray, AB).

Effects of Predation and Weather on Whooping Crane Nest Success

In 2019, we initiated a project designed to evaluate nest success of AWBP cranes and identify factors that may limit nest success using remote cameras with time-lapse surveillance, acoustic recorder units (ARUs) and water level gauges at nest sites. This project represents a multi-agency effort between CWS, PCA, USFWS and Calgary Zoo/Wilder Institute with specific objectives to (1) determine nest failure and success rates; (2) quantify causes of nest failure (e.g., predation, weather) and associations with reproductive behaviour (e.g., incubation); (3) evaluate the impacts of variation in nest survival on recruitment rates and population growth.

Activities under this project are conducted over three phases: a pre-pilot (2019), pilot (current phase, 2022), and full study (anticipatory start, 2023). During the pre-pilot in 2019, we deployed monitoring equipment at 11 inactive nest sites to evaluate logistic concerns and to determine if monitoring equipment attracts predators. Results from the pre-pilot phase indicated that deployment of cameras and other gear near whooping crane nests does not increase predator activity at nest sites, so we initiated pilot work in 2022 with monitoring equipment placed 6-13m from 10 active whooping crane nests. Objectives of the pilot phase are to ensure that deployment and operation of cameras does not negatively affect nesting activities of cranes (i.e., via heightened anxiety at the nest or nest abandonment) and that cameras capture adequate imagery to measure nest success or failure from predation or flooding events.

Capture and Banding of Fledged Juveniles

In 2009, a multi-agency, collaborative project to capture and mark whooping cranes was initiated to monitor movement, behaviour and survival 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, USGS, USFWS, the Crane Trust and Platte River Recovery Implementation Program, with additional support from 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 and unique colour leg bands. Transmitters were programmed to record each bird's spatial location four times daily, logging both daytime and nighttime locations throughout the annual cycle. From December 2009 to February 2014, 68 whooping cranes were captured and marked with 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.

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 core partners, ECCC, PCA, USFWS and USGS, with 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 under Phase 1 and will be used to investigate potential risk to whooping cranes from industrial development. During Phase 2, captured birds are fitted with GPS/GSM (GPS/Global System for Mobile Communication) transmitters with Global Positioning System capabilities and colour leg bands. During 2017 and 2018, 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 behaviour in spring and fall. Beginning in 2019, more frequent GPS location collections (up to 1440 locations daily) were 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 2018-2022, USFWS and WCTP partners marked 53 adults and five juveniles on the Texas Gulf Coast during winter.

In August 2022, CWS and WTCP partners again marked juveniles in and around WBNP. Family groups with young suitable for capture were located during juvenile fledging success surveys. During capture attempts, the helicopter circled to find a suitable landing spot to position the capture crew on the ground (typically 200-300 meters from the family group). The ground team consisted of Mark Bidwell and John Conkin (CWS), David Brant (USGS) and Dr. Sandra Black, DVM (Calgary Zoo); a Parks Canada observer (Lori Parker, Rhona Kindopp) remained in the helicopter to provide direction to the ground team via radio. From August 3-6, 17 cranes were captured and banded with a satellite transmitter; one additional captured crane was released without being marked with a transmitter as its weight was below the marking threshold identified in our Animal Use Protocol. For marked cranes, blood and feather samples were collected and basic biometric measurements (culmen, wing chord, tarsus and weight) were taken. Finally, Dr. Black performed a general assessment of the health of each bird before it was released. Capture activities were conducted using an AS350B2 helicopter operated by Phoenix Heli-flight.

Management Considerations

We confirmed nesting by 96 pairs in late spring, producing an average of 0.64 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 2022 nest count represents the fourth highest count on record and the highest five counts have all occurred during the last five years where fieldwork was conducted, highlighting the gradual but steady increase in the breeding population over time (Figure 3). Even so, the AWBP is many years away from achieving the Canadian down-listing goal of 250 productive pairs (Environment Canada 2007). Recovery of the species currently depends on growth of the AWBP, so monitoring should continue until recovery goals are reached (CWS & USFWS 2007). Twenty-six breeding pairs were detected outside the area designated as CH (Environment Canada 2007) under SARA, and 13 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 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. 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 13% 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

Financial and logistical support was provided by Environment and Climate Change Canada, Parks Canada, Calgary Zoo/Wilder Institute, United States Fish and Wildlife Service and United States Geological Survey. Activities were conducted under Environment and Climate Change Canada Scientific Permit SC-NR-2022-NT-001, Environment and Climate Change Canada Western & Northern Animal Care Committee Permit 22MB01, Northwest Territories Wildlife Research Permit WL501043, Northwest Territories Wildlife Care Committee Permit NWTWCC2022-003 and Parks Canada Agency Research and Collection Permit WB-2022-41918.

Literature cited

Boyce M.S., Lele S.R. & Johns B.W. 2005. Whooping crane recruitment enhanced by egg removal. Biological Conservation, 126:395-401.

COSEWIC. 2010. COSEWIC assessment and status report on the Whooping Crane *Grus americana* in Canada. Committee on the Status of Endangered Wildlife in Canada, Ottawa. https://wildlife-species.canada.ca/species-risk-registry/virtual_sara/files/cosewic/sr_Whooping%20Crane_0810_e.pdf

CWS (Canadian Wildlife Service) and USFWS (U.S. Fish and Wildlife Service). 2007. International recovery plan for the whooping crane. 162 pp. https://www.fws.gov/uploadedFiles/WHCR%20RP%20Final%207-21-2006.pdf

Environment Canada. 2007. Recovery Strategy for the Whooping Crane (*Grus americana*) in Canada. vii + 27 pp. Retrieved in Oct 2015 from: http://www.sararegistry.gc.ca/virtual_sara/files/plans/rs_whooping_crane_final_1007_e.pdf

Environment and Climate Change Canada. 2022. Historical Climate Data. Meteorological Service, Government of Canada. http://climate.weather.gc.ca/index_e.html#access

Johns, B. 2010. Aerial survey techniques for breeding whooping cranes. Proceedings of the North American Crane Workshop 11:83-88.

USFWS (United States Fish and Wildlife Service). 2022. Whooping Crane Survey Results: Winter 2021-2022. https://www.fws.gov/media/whooping-crane-update-winter-2021-2022

Table 1. The number and type of observations of whooping cranes that were detected during breeding pair and juvenile surveys in May and July 2022, respectively.

Observation type	May	Aug
Nests	96	n/a
Adults on or near nests	122	n/a
Pairs without nests	15	n/a
Pairs with juveniles	n/a	50
Juveniles	n/a	61
Pairs without juveniles	n/a	21-22
Lone cranes	47	4
Total cranes	199	207-209

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.

Figure 1. Total precipitation recorded at Fort Smith, Northwest Territories before (October-April) and during (May-September) the breeding season (dashed blue lines represent 60-year means), 1962 to 2022.

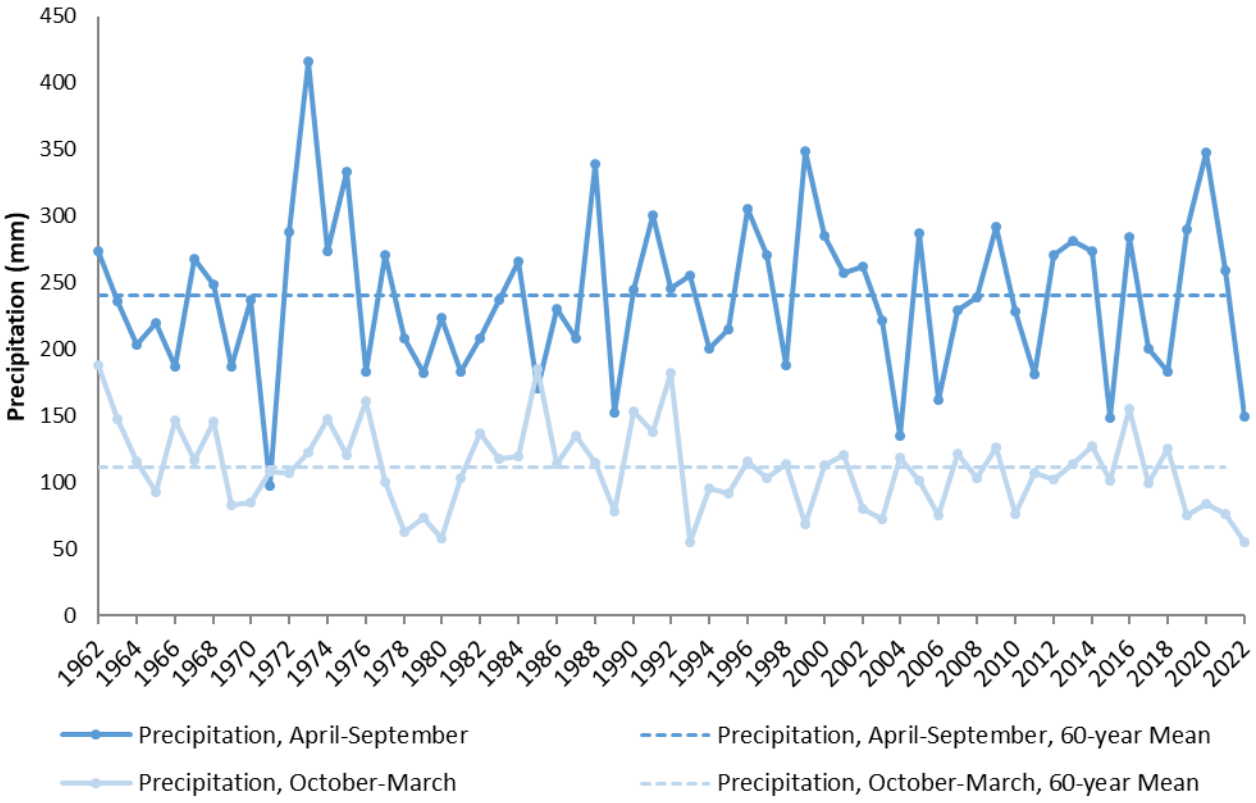


Figure 2. The density per 100 km^2 of whooping crane pairs, with and without nests, detected during the breeding pair survey in May 2022.

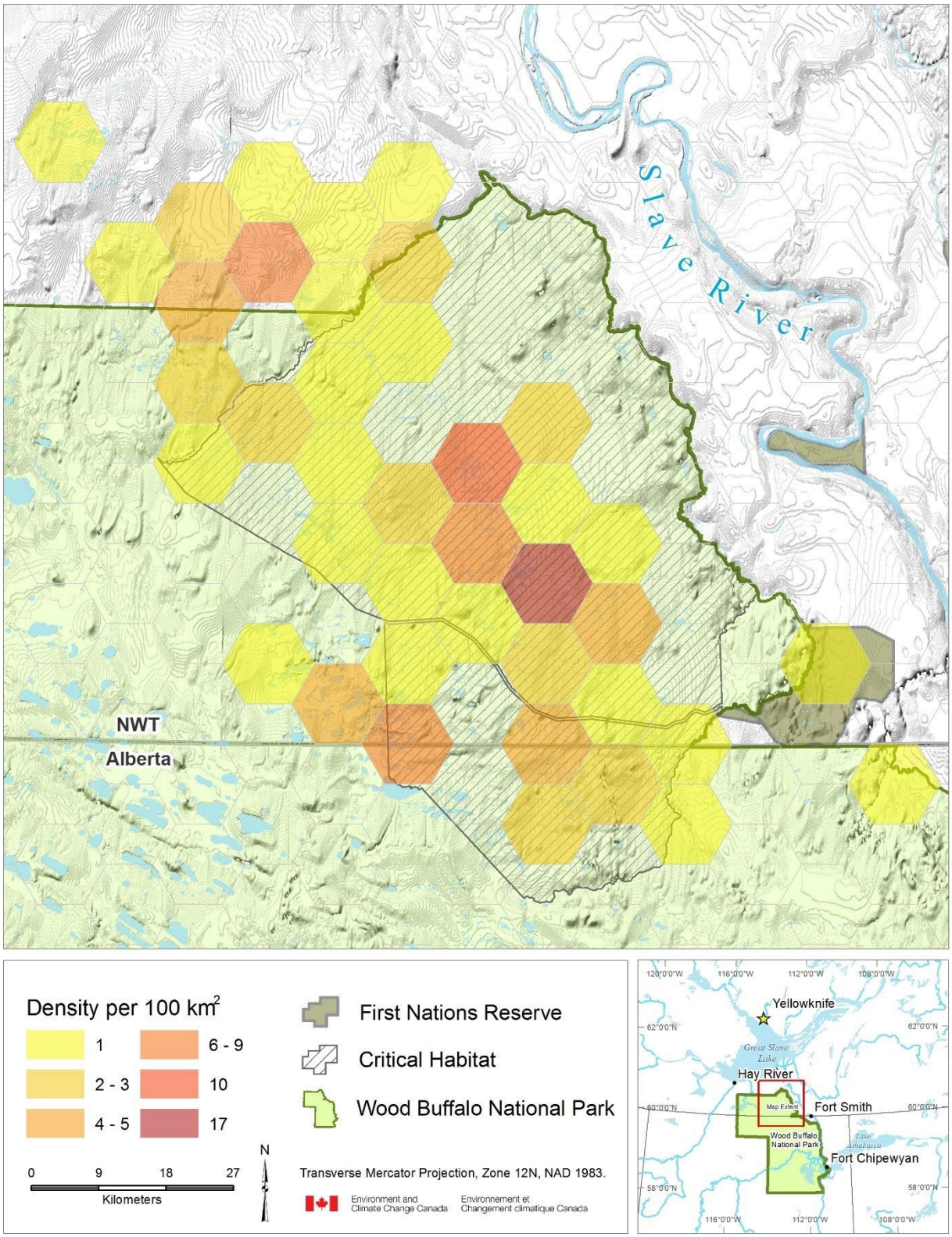
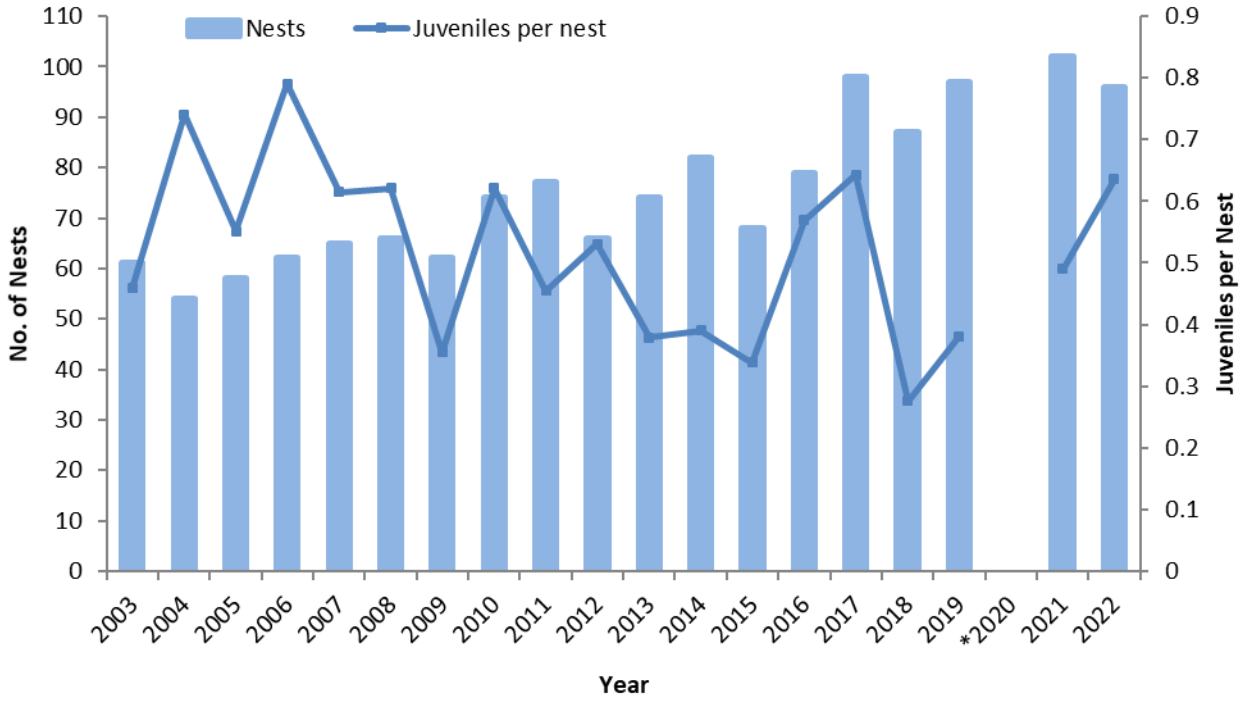


Figure 3. The number of whooping crane nests, and juveniles per nest, detected during aerial surveys from 2003-2022. The number of nests and juveniles are estimated during breeding pair (May) and juvenile (July-August) surveys, respectively; the number of juveniles per nest is calculated using information from both surveys. *Aerial surveys were not conducted during 2020 due to restrictions related to the COVID-19 pandemic.



Whooping Crane Survey Results: Winter 2022–2023
*536 Wild Whooping Cranes Estimated (*95% CI = 443.5–644.1)

The U.S. Fish and Wildlife Service estimated the abundance of whooping cranes in the Aransas-Wood Buffalo population for the winter of 2022–2023. Survey results indicated 536 whooping cranes (95% CI = 443.5–644.1; CV = 0.146) inhabited the primary survey area (Figure 1). This estimate included at least 88 juveniles (95% CI =67.1–124.0; CV = 0.199) and 203 adult pairs (95% CI = 170.0–242.6; CV = 0.144). Recruitment of juveniles into the winter flock was 19.9 chicks (95% CI = 14.4–27.4; CV = 0.163) per 100 adults.

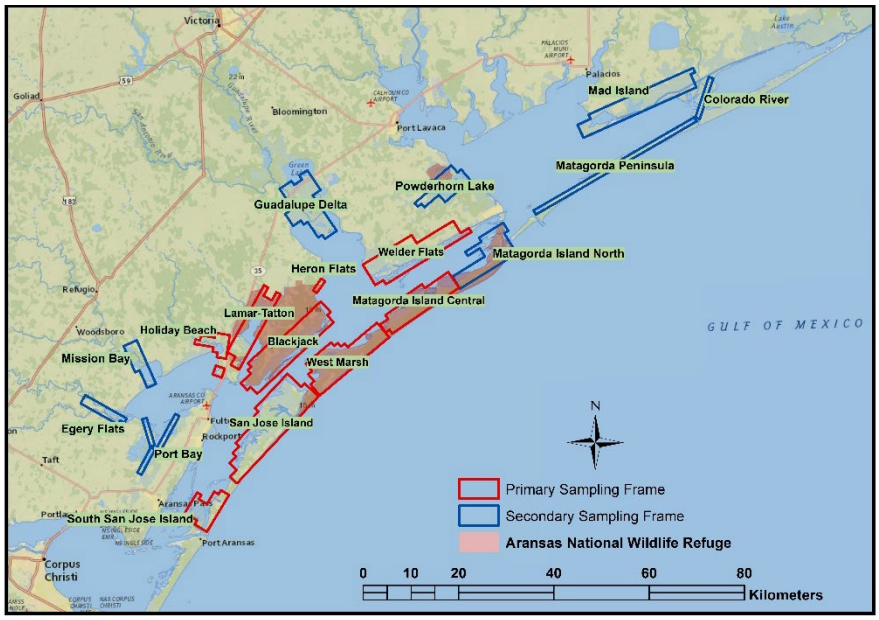


Figure 1. The sampling area used to monitor whooping crane abundance on their wintering grounds along the Texas coast of the Gulf of Mexico, USA.

During winter 2022–2023, the U.S. Fish and Wildlife Service conducted surveys in late-January using a Quest Kodiak aircraft. The primary survey areas (approximately 170,500 acres; Figure 1) were surveyed during January 23–28, 2023. The South San Jose Island, San Jose Island, Lamar-Tatton, Blackjack, and Heron Flats survey areas were surveyed 4 times, and the Welder Flats, Matagorda Island Central, Holiday Beach, and West Marsh survey areas were surveyed 3 times. The secondary survey areas (approximately 85,250 acres; Figure 1) were not surveyed this winter.

The long-term growth rate in the whooping crane population has averaged 4.34% (*n* = 82; 95% CI = 1.76–6.83%). The population has remained stable over the last two years (Table 1; Figure 2). The Canadian Wildlife Service reported 61 whooping crane chicks were fledged at Wood-Buffalo National Park in summer 2022. We estimated at least 88 juveniles (95% CI = 67.1–124.0) on the wintering grounds. Typically, juvenile plumage color is less distinct in late-January than earlier in the winter, but this year observers noted it was more distinguishable than usual.

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.

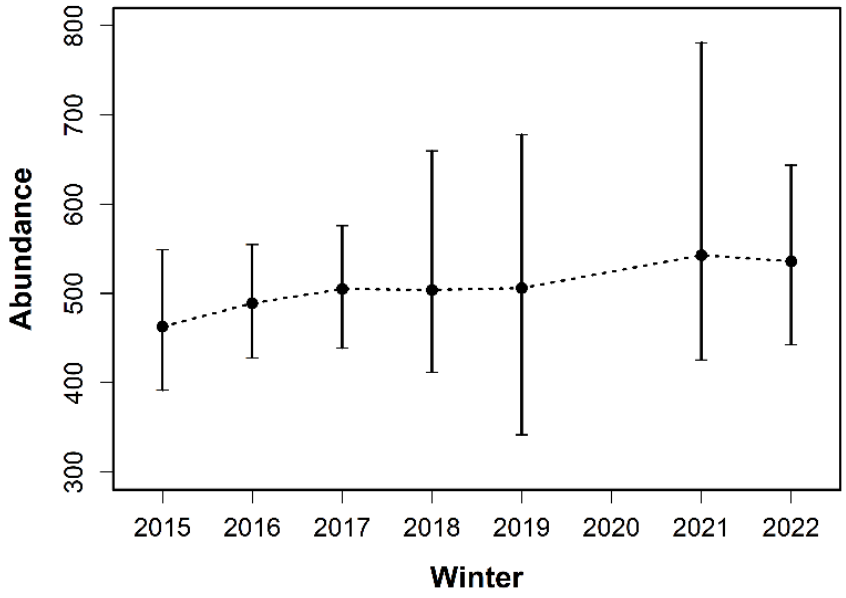


Figure 2. Time-series of whooping crane abundance estimates and 95% confidence intervals for the Aransas-Wood Buffalo population beginning in winter 2015–2016.

Table 1. Preliminary whooping crane abundance estimates for the Aransas-Wood Buffalo population on their wintering grounds, winter 2015–2016 through winter 2022–2023.

Survey year[a]	Survey month	Aircraft	Abundance[b]	CV	95% LCL	95% UCL	No. assumed beyond primary survey area[c]
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
winter 2022–2023	January	Kodiak	536	0.146	443	644	14

[a] Due to the COVID-19 pandemic, surveys were not conducted during winter 2020–2021.

[b] 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.

[c] 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.

The survey protocol contains guidelines for promoting secondary survey areas into the primary survey areas. During winter 2021–2022, we observed enough whooping crane groups in the Heron Flats and the South San Jose Island survey areas to promote them into the primary survey area. These two areas were included as part of the primary survey area in winter 2022–2023.

Table 2. Whooping cranes documented outside of the primary survey area during January 23–28, 2023.

General area[a]	Data source	Adults	Juveniles	Total	Notes
Wharton and Colorado counties, Texas	GPS tracking study iNaturalist International Crane Foundation	10	1	11	Several groups using agricultural areas throughout winter.
Lubbock County, Texas	International Crane Foundation eBird iNaturalist	1	0	1	Single adult overwintering with sandhill cranes in agricultural areas.
Powderhorn Lake (secondary survey area)	GPS tracking study	1	1	2	Family group was tracked during the period of the aerial survey.

[a] None of the secondary survey areas were flown during winter 2022–2023.

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.

***Matthew J. Butler**, U.S. Fish and Wildlife Service, National Wildlife Refuge System, Division of Biological Services, P.O. Box 1306, Albuquerque, NM 87103, USA.*

***Colt R. Sanspree**, U.S. Fish and Wildlife Service, Aransas National Wildlife Refuge, 1 Wildlife Circle, Austwell, TX 77950, USA.*

***Allison A. Griffin**, U.S. Fish and Wildlife Service, Aransas National Wildlife Refuge, 1 Wildlife Circle, Austwell, TX 77950, USA.*

***Jena A. Moon**, U.S. Fish and Wildlife Service, 1035 W Buccaneer Drive, Winnie, TX 77665, USA.*

2022-2023 Louisiana Whooping Crane Report

Louisiana Department of Wildlife and Fisheries

Wildlife Division

1 July 2022 through 30 June 2023

EXECUTIVE SUMMARY

The maximum size of the Louisiana non-migratory population at the end of the report period was 83 fledged individuals (41 males, 35 females, 7 unknown) with 81 birds located in Louisiana and two of unknown or long term missing status. Additionally, there were two wild-hatched, pre-fledged chicks on the landscape, not yet counted in the population totals. Based on location data generated via remote transmitters, we documented cranes in 22 parishes throughout Louisiana. Only two cranes were documented outside of Louisiana during the report period; one was captured and returned to Louisiana and the second returned on his own. Both birds are now paired and we expect that the use of Texas locations will be greatly reduced in the future.

In late October 2022, two adult male whooping cranes were received from the discontinued Florida non-migratory population. They join three Florida females that had been previously transferred in February 2019 and October 2021. Thus far, translocation of individuals from the Florida flock has been successful in terms of the individuals surviving and remaining in Louisiana. Aditionally, all three females have paired and nested, though they have not yet produced offspring. The males have remained mainly alone since their release, but in areas with other whooping cranes.

Ten captive reared juvenile whooping cranes were received in early November 2022 from the Freeport-McMoRan Audubon Species Survival Center in New Orleans; six had been hatched and reared there while the remaining four were raised at the International Crane Foundation and sent to join the Audubon cohort in mid-October. They were transported to the White Lake Wetlands Conservation Area (WLWCA) in Vermilion Parish where they were banded and placed in the top-netted section of the release pen until their release four days later. One crane disappeared by the end of the month and is presumed to be dead, however the other nine remained alive, splitting into several groups and leaving the marsh. Addtionally, five wild-hatched chicks from 2022 remained alive through the report period.

During the 2023 breeding season, 19 pairs initiated 31 nests in seven different parishes in Louisiana, producing 15 wild-hatched chicks; eight pairs hatched one chick, two pairs hatched two, and one pair hatched three from two nesting efforts. Twelve chicks hatched to their biological parents and three hatched from fertile eggs that were swapped into nests. Three chicks had fledged by the end of the report period and two others remained alive, aged 52 and 34 days (both later fledged after the end of the report period). Three pairs with surviving chicks have successfully fledged chicks together in the past, one pair has one experienced female and one inexperienced male and the last pair has some chick rearing experience, but had lost previous chicks prior to fledge. Finally, in a first record for the species, one pair of cranes successfully fledged a chick from their first nest and then renested, sitting full term on a fertile egg that unfortunately died during incubation.

Now in its 13th year, the Louisiana whooping crane reintroduction continues to see positive progress, including good chick survival/fledging, but still has challenges to overcome, most notably the large number of fertile eggs that die during incubation. To that end, we have entered into a partnership with the United States Geological Survey (USGS) Alaska Science Center to more thoroughly investigate potential causes of the embryo mortality that is observed every year.

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 along with 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 set mainly to collect a data point every hour or half an hour throughout the day, and transmit data three or four times per day. Based on the data collected, cranes were documented in 22 parishes in Louisiana and five counties in Texas during the reporting period. Due to the variation in data collection schedules and a number of cranes carrying nonfunctional transmitters, we did not summarize location points by parish. Distribution maps can be found in Figures 1 and 2.

Use of Distant Locations

Use of locations greater than 325 kilometers (approximately a one-day flight) from the release areas has continued to decrease, with only one crane documented moving beyond this distance during the report period. Male L1-18 began the reporting period in Limestone/Robertson counties, Texas, where he has spent significant amounts of time in previous years. He moved to Liberty Co, Texas, on 20 September and returned to Louisiana on 21 September, having spent 82 nights greater than 325km away. No other cranes have been documented using distant locations since, and it is unlikely that L1-18 will return to Texas now that he is paired.

TRANSLOCATION OF FLORIDA CRANES

Two 6.5-year-old wild-hatched sibling male whooping cranes (LFW28-16 and LFW29-16) were captured in Florida, temporarily held at White Oak Conservation in Yulee, Florida, and transported to the WLWCA, Vermilion Parish via plane on 31 October 2022. The two males were banded then immediately released on WLWCA leased agricultural property. LFW28-16 has remained mainly in Vermilion Parish, while his sibling moved more extensively, visiting six parishes. He spent mid-summer in Jefferson Davis Parish where he is suspected to have molted. Although they have both associated with a small number of resident Louisiana cranes neither one has forged any strong bonds with those cranes and have remained mainly alone since their release. Figure 3 shows all data points collected from both cranes for the eight months they have been in Louisiana.

Attempts to capture one additional wild-hatched crane in Florida will hopefully be made this coming winter. This would be the last crane targeted for translocation to Louisiana.

MOLTING

In 2023, molting was confirmed in 10 individuals: L3-14 and L13-14 (nine-year-old males), L13-16 (seven-year-old male), L15-17 and L21-17 (six-year-old males), L14-17 (six-year-old female), L3-21 (two-year-old male), and one member of the following pairs L3-11 or L1-13 and L5-14 or L12-16. We strongly suspect a number of other cranes also 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 LF1-98, LFW12-15, L8-16 and LW6-21.

CAPTURES

Fourteen captures of free-flying cranes were made on 20 days of attempts from 20 October 2022 – 20 June 2023. Eight captures were hand grabs and six were via a leg noose. Two captures were 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 1.

PAIRING AND REPRODUCTION

During the 10th year of nesting by the Louisiana flock, a total of 31 nests by 19 pairs were confirmed in seven parishes (Acadia, Allen, Avoyelles, Calcasieu, Cameron, Jefferson Davis, and Vermilion) in central and southwestern Louisiana in 2023 (Figure 4). Thirteen pairs consisted of individuals who had previous experience nesting together, one pair consisted of individuals who had previous experience with other cranes, four pairs had one experienced individual and one nesting for the first time, and one pair consisted of individuals who were both nesting for the first time. Two pairs that nested in 2021 and remain together did not nest in 2022 or 2023. An additional two pairs were observed with nest platforms but did not lay eggs.

Eighteen nests from 10 pairs were located on private agricultural properties, all but two (1 fallow, 1 rice) in actively crawfished fields, and the remaining thirteen nests from nine pairs were located in marsh habitats; six pairs nested in the White Lake Wetlands Conservation Area marsh and three nested in marsh habitat on private property. First nesting attempts were initiated in February (6-7), March (7-8), and April (5). Re-nesting attempts were initiated an estimated average of 20 days after the first nest attempt was completed, a chick disappeared (two instances) or a chick fledged (one instance) and occurred during March (1), April (5-6), May (1-2) and June (1). Three third nesting attempts were initiated in April (1) and May (2).

A minimum of 53 eggs were produced in 2023. Thirty-one eggs were confirmed fertile, of which 16 died prior to hatch (6 early dead, 4 mid-dead, 6 late dead) and 13 successfully hatched, 12 in the wild and one in captivity. One additional egg is presumed to have hatched based on evidence found at the nest, but with no additional evidence of a chick, it is not included in the chick totals. The last egg was found broken but confirmed fertile based on the presence of blood vessels visible in the membrane that remained. Seven other intact eggs were collected and were either non-viable or of unknown fertility due to young age, and the remaining 15 eggs disappeared or broke at the nest.

Of the 31 confirmed nests, six were incubated to full term or beyond with no hatch, 10 were abandoned or failed prior to full term, 10 successfully hatched 12 chicks, one outcome is unknown (but achieved full term incubation), and four had eggs swapped into them. All swapped eggs were received from captivity after having been collected from pairs in the eastern migratory population.

All three females who were translocated from the discontinued Florida reintroduction project nested in 2023. The older female (LF1-98) nested with her mate, L10-18, in Jefferson Davis Parish. Their single overdue egg was replaced with a dummy egg on 19 May and then a pipped egg was swapped into their nest on 23 May. LW10-23 hatched but disappeared at ~2 weeks old. Female LFW12-15 and mate L5-18 had one nest attempt in Cameron Parish, however their eggs were non-viable as they have been in their previous two years of nesting. Female LFW12-19 nested with mate L4-19 at the White Lake WCA, Vermilion Parish, but the pair abandoned their nest mid-way through incubation and their single egg had no evidence of development.

In a first record for the species, 12-year-old female, L7-11 and her mate, 6-year-old, L11-17, initiated a renest in June, after successfully fledging a chick. The family had been observed together with no signs of aggression several days before the renest began. Following the start of the renest, the fledged chick remained on the family territory, but separate from its parents, for 11 days before later being found with a different pair of cranes on a property nine miles to the northeast. L7-11/L11-17 incubated their renest past full term without an additional hatch and later examination of the single egg found that it was fertile but had died during the early-mid-incubation period.

Summary of breeding history from 2014-2023 is displayed in Table 2, and complete nesting histories can be found in Appendix A.

Chicks

In 2023, 15 chicks hatched to 11 pairs (eight pairs hatched one chick; two pairs hatched two; one pair hatched three from two different nesting attempts). Twelve hatched to their biological parents and three hatched from fertile eggs that were swapped into nests. Three chicks (from three pairs) survived to fledging and two additional chicks survived and fledged after the end of the report period. Earliest estimated fledge (one chick) occurred by/at 72 days old based on transmitter data from one of the parents.

The remaining ten chicks disappeared or died between 1-52 days of age; however, only one death was confirmed by discovery of remains.

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
L1-12/L10-19, July
L17-16/L9-18*, October
L10-17/L6-18, November
L9-17/L12-18*, Fall
L11-11/L1-19*, January
L1-18/LW7-21, January
LW6-21/LW14-21, January
L14-17/L3-21*, March
L4-19/FW12-19*, March
L9-19/L7-22, June

Dissolved
L9-16/L17-16, July, disappearance of female
L8-16/L6-18, September/October
L9-18/L1-19, October
L9-17/L23-17, Fall, disappearance of female
L11-11/L8-13, January, injury to male with removal into captivity
L9-19/FW12-19, March

In addition to the nineteen pairs who laid eggs in 2023, two other pairs were observed with nest platforms but did not lay eggs: L13-16/LW3-17 in Cameron Parish and L15-17/L17-17 in Vermilion Parish.

Current Population Structure
The population contained a maximum of 83 individuals as of 30 June 2023.

Confirmed breeding pairs (i.e., have produced eggs): 21
LF1-98/L10-18, L2-11/L13-11, L3-11/L1-13, L7-11/L11-17, L11-11/L1-19, L2-12/L3-14, L3-13/L8-14, L5-14/L12-16, L13-14/L6-15, L2-15/L11-15, L10-15/L19-16, FW12-15/L5-18, L6-16/L16-17, L17-16/L9-18, L23-16/L3-17, L9-17/L12-18, L12-17/LW1-18, L14-17/L3-21, L21-17/LW3-18, L7-18/L3-19, L4-19/FW12-19

Pairs that built nest platforms in 2023: 2
L13-16/LW3-17, L15-17/L17-17

Pairs without confirmed breeding activity or newly formed pairs: 5
L1-12/L10-19, L25-16/L6-19, L10-17/L6-18, L1-18/LW7-21, LW6-21/LW14-21

Unpaired adult males: 8
L6-13, FW28-16, FW29-16, L8-19, L9-19, L10-19, LW2-20, LW5-21

Unpaired adult females: 1
L8-16

Long-term missing and/or suspected dead: 2
L13-18, L2-21

Yearlings (HY2022): 13
L1-22, L2-22, L3-22, L4-22, L7-22, L8-22, L9-22, L10-22, LW4-22, LW5-22, LW9-22, LW11-22, LW13-22

Fledged wild-hatched juveniles: 3
LW1-23, LW3-23, LW4-23

Unfledged wild-hatched juveniles not yet counted in population (fledging occurred after the reporting period): 2
LW9-23, LW14-23

Camera Deployments
Trail cameras were deployed near a subset of nests to help supplement nest/chick monitoring efforts. Cameras were deployed at 12 different nests (6 first attempts, 3 second attempts, 3 third attempts) at ~5-38 days into the incubation period (avg. ≈ 13.9 days). The camera deployed at 38 days of incubation was placed when a pipped egg was swapped into a nest, whose own overdue egg had failed to hatch, and was mainly for the purpose of monitoring the chick. Programming differed among them; however most were programmed to take a photo every 1, 3 or 5 minutes for most of the day and night.

Heavy Metal Screening and Egg Swabbing
Heavy metal testing of blood and feathers samples is ongoing. Since we began screening for lead in 2017, 52 individuals have been tested with no concerning levels detected thus far. The same 52 individuals have also been screened for mercury, and results from 13 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. Five of the individuals noted to have a "high-normal" result have been tested twice with two having a higher level at the later testing date and three having a lower level result at the later testing date. Feathers from 49 cranes have been tested for arsenic, 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.

In early 2023, we initiated a research project in collaboration with the USGS Alaska Science Center to further investigate, and hopefully better understand, the possible causes of the significant amount of embryo mortality we continue to observe. Previous toxicology (herbicide and pesticide) testing of egg samples yielded no concerning results, so this study will focus on potential bacterial factors with the first samples collected during the 2023 breeding season. During the early stages of incubation, samples were collected from eggshells using sterile swabs at nests where cameras were also deployed. Eggs that were past full term or abandoned and otherwise intact, were also swabbed at collection. Upon examination of any intact, unhatched egg, samples of the contents were collected. Finally, if the egg contained a large enough dead embryo, liver samples were also collected. Four eggs swabbed during early incubation ultimately hatched, 13 had dead embryos and 12 were later confirmed non-viable or were unknown. Ten eggs were swabbed twice; once early in incubation and once after collection.

SURVIVAL

As of 30 June 2023, 163 juvenile whooping cranes have been released in Louisiana since 2011. Additionally, 23 wild-hatched chicks have fledged (1 each in 2016, 2017, and 2020; 5 in 2018; 4 in 2021; 8 in 2022; 3 in 2023) and three adult females and two adult males were relocated to Louisiana from the discontinued Florida reintroduction. In total, 191 whooping cranes have been reintroduced or have fledged in the wild during the 12.5 years of the project, and as of the end of this report period, a maximum of 83 (43.5%) individuals survive.

Mortality and Morbidity
The following confirmed or presumed mortalities were recorded during the report period:

LW10-22; Juvenile wild-fledged female, Jefferson Davis Parish, 1 February, powerline collision

Six cranes disappeared, are presumed dead and have been removed from the population totals:

L11-19: Male L11-19 was last observed 10 March 2022 at the White Lake WCA, Vermilion Parish. He carried only a nonfunctional remote transmitter.
L23-17: Female L23-17 was last observed 5 May 2022 at the White Lake WCA, Vermilion Parish. She had a nonfunctional remote transmitter. Her mate was observed with a new female on 2 December.
L9-16: Female L9-16 was last observed 19 July 2022 at the White Lake WCA, Vermilion Parish. Her remote transmitter failed to send new data after roost that night and her mate and chick were observed off the property without her on 22 August.
LW2-22: Wild-fledged juvenile LW2-22 was last observed with parents and sibling on 26 July 2022 in Vermilion Parish and had disappeared by 23 August.
LW1-22: Wild-fledged juvenile LW1-22 (sibling to LW1-22) was last observed with parents on 29 August 2022 and had disappeared by 18 October.

L6-22: Juvenile male, last observed 27 November and last remote transmitter data received 28 November (PM), White Lake WCA, Vermilion Parish. By 30 November, his VHF signal was weak and he was not seen at that location during a flight one week later. COD is unknown as only VHF transmitter, separated from bands, was recovered.

Two additional cranes were captured and removed from the population due to injury:

L8-13: Male L8-13 was found with a broken left wing and infections in his left hock and right foot on 10 January in Jefferson Davis Parish. He was captured and transported to the Audubon Species Survival Center for treatment where his wing was amputated and despite initially recovering, he later died.
L5-22: Female L5-22 was found suffering from multiple fractures to her left leg along with a dislocated hip (among other internal injuries) on 20 June in Acadia Parish. She was captured and transported to the Audubon Species Survival Center in New Orleans where she was euthanized. Based on transmitter data and field evidence, she had hit a powerline on the morning of 19 June.

Through the end of the reporting period, there have been 108 mortalities since the start of the reintroduction; 81 confirmed by recovery of remains and 27 others inferred based on supporting evidence or long-term missing status. Pre-fledged wild-hatched chicks are not included in these totals. Of mortalities where remains were recovered, the primary contributing factor of death could not be determined in 21 cases (25.9%) due to severely degraded or minimal remains recovered. The primary known or suspected cause of mortality in the remaining cases (n = 60) was trauma (27.2%), followed by predation (20.9%) and gunshot (18.5%). Fifteen trauma mortalities (18.5% of mortalities where remains were recovered) are attributed to collisions with power lines or fences.

EDUCATION, OUTREACH, AND MEDIA

Outreach

LDWF's traveling library display continued to make its way around the state and was housed at eight different locations in four parishes, reaching 1,262 individuals (self-reported via a signature at the display) during the reporting period. Additionally, LDWF staff reached close to another 1,000 individuals through a variety of presentations at children's summer and 4-H camps, National Hunting and Fishing Day, the Port Aransas Whooping Crane Festival, as well as several presentations for various interested organizations. Additionally Country Roads Magazine, based in Baton Rouge, published an article about the Louisiana whooping crane project during the report period.

Social media continues to be a popular and effective format for sharing information and updates on the project with those who are interested as well as the general public who may come across these sites. The LDWF Whooping Crane Facebook page continues to grow in popularity, gaining over 14,000 new "likes" during the reporting period, for a new total of over 25,000, mainly due to a short video that went viral in late March. The video showed female, L14-17, being released from her transport box at the WLWCA after having been caught in Texas and returned to Louisiana. The number of individuals who follow the Instagram page also increased significantly this year, almost doubling to 805 followers.

Our partners with the International Crane Foundation (ICF) continued their outreach work in Louisiana, reaching almost 3,000 individuals through 37 different presentations and events. In spring 2023, ICF initiated a library program intended to reach elementary school age children in rural communities across southern Louisiana. The program discusses whooping cranes and their habits through stories, crafts, and interactive videos and had reached over 200 kids at 10 different library branches and bookmobile stops in five parishes by the end of the report period.

Table 1. Summary of captures of free-flying whooping cranes in the Louisiana non-migratory population, 1 July 2022 - 30 June 2023.

ID	Sex	Date	Method	Reason	Parish/County	
L10-18	M	10/20/2022	leg noose	transmitter replacement	Jefferson Davis	
LW10-22	F	10/26/2022	leg noose	initial banding	Jefferson Davis	with parents
LW4-22	M	11/17/2022	leg noose	initial banding	Avoyelles	with parents
L13-14	M	12/15/2022	leg noose	transmitter replacement	Vermilion	
L8-13	M	1/10/2023	hand grab	injury	Jefferson Davis	non-releasable
L4-19	M	1/23/2023	leg noose	transmitter replacement	Vermilion	
L8-16	F	1/26/2023	leg noose	transmitter replacement	Vermilion	
L1-13	M	2/12/2023	hand grab	transmitter replacement	Allen	
L12-16	M	2/12/2023	hand grab	transmitter replacement	Jefferson Davis	
L14-17	F	3/14/2023	hand grab	translocation	Jefferson, TX	released in LA
L17-16	M	3/29/2023	hand grab	transmitter replacement	Vermilion	
L21-17	M	5/2/2023	hand grab	transmitter replacement	Acadia	at overdue nest
L12-17	F	5/25/2023	hand grab	transmitter replacement	Jefferson Davis	at active nest
L5-22	F	6/20/2023	hand grab	injury	Acadia	euthanized

Table 2. Breeding history of egg laying pairs in the Louisiana non-migratory population of whooping cranes through 30 June 2023. Only confirmed nests are included in totals and only specific details for pairs active during the report period are shown.

Male	Female	Formed	Number of nest attempts/year										Chicks[j]		Egg information[h]				Dissolved
			2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	Hatch	Fledge[f]	Infertile/ nonviable	Fertile		Unk[a]	
																Dead	Hatch		
Former pairs		≥ Dec 2023	2	3	5	11	6	4	4	11	3		17, 2[b]	4	31	17	17	14	< July 2022
L2-11	L13-11	Apr 2015		1	2	4	1	2	1	2	1	2	3[b]		8	9	2	9	
L1-13	L3-11	May 2015		1	2	3	2	3	2	3	2	3	5[b], 1	4	6	20[e]	3	10	
L12-16	L5-14	Jan 2018					2	4	7[g]	5[g]	4	3	2	1	6	12	2	16	
L13-14	L6-15	Jan 2018					1	1	0	1	1	1	5	2			5	5	
L19-16	L10-15	Feb 2018					1	4	2	1	2	2	2[b], 7	2	6	6	7	1	
L3-13	L8-14	July 2018						2	1	2	1	2	3	1	4	1	1	4	
L6-16	L16-17	Dec 2018						1	1	2	2	1	3	1	1	5	4	2	
L3-14	L2-12	Jan 2019						1	0	1	0	0	0		2	1			
L11-17	L7-11	Jan 2019						2	3	2	1	2	4	4	7	3	4	5	
L8-13	L11-11	Feb 2019						3	1	3	1		3	2	3	5	3	4	Jan 2023[c]
L10-18	F1-98	Feb 2020								1	2	1	2[b]			3	1	2	
L5-18	FW12-15	Aug 2020								1	2	1	0		6			2	
L23-16	L3-17	Oct 2020								1	1	2	3	1	1	1	3	1[i]	
L23-17	L9-17	Oct 2020								2	0		0		1			1	Summer 2022[d]
LW1-18	L12-17	Dec 2020								1	2	3	1, 1[b]			5	1	4	
L3-19	L7-18	Mar 2021								2	0	0	0		2				
L21-17	LW3-18	Jan 2020									1	1	0		2			1	
L17-16	L9-16	July/Aug 2021									1		1	1			1		July/Aug 2022[d]
L2-15	L11-15	Feb 2022										2	0		1			2	
L17-16	L9-18	Oct 2022										1	1				1	1	
L9-17	L12-18	Fall 2022										1	0			1		1	
L1-19	L11-11	Jan 2023										1	1	1			1	1	
L4-19	FW12-19	Mar 2023										1	0		1				
L3-21	L14-17	Mar 2023										1	0			1	1		
Totals			**2**	**5**	**9**	**18**	**13**	**27**	**22**	**41**	**27**	**31**	**52, 15[b]**	**24**	**88**	**90**	**57**	**86**	

[a] Includes eggs that disappeared, were broken, or fertility could not be determined upon examination.
[b] Hatched from fertile egg(s) swapped into the nest while the pair's own eggs were removed.
[c] Death or injury of one member of the pair.
[d] Disappearance of one or both members of the pair.
[e] One fertile/viable egg pulled at day 8-10 died while hatching at captive center.
[f] Fledging date may be after the end of the report period.
[g] Number of nests are determined by number of new platforms containing an egg even if timing indicates eggs are from the same clutch.
[h] Eggs laid by Louisiana cranes, including those pulled from nests prior to full term and their outcome in captivity.
[i] Blood vessels present in egg remains but outcome of egg (hatch/no hatch) unknown.
[j] Only includes chicks that were hatched in the wild, regardless of egg source.

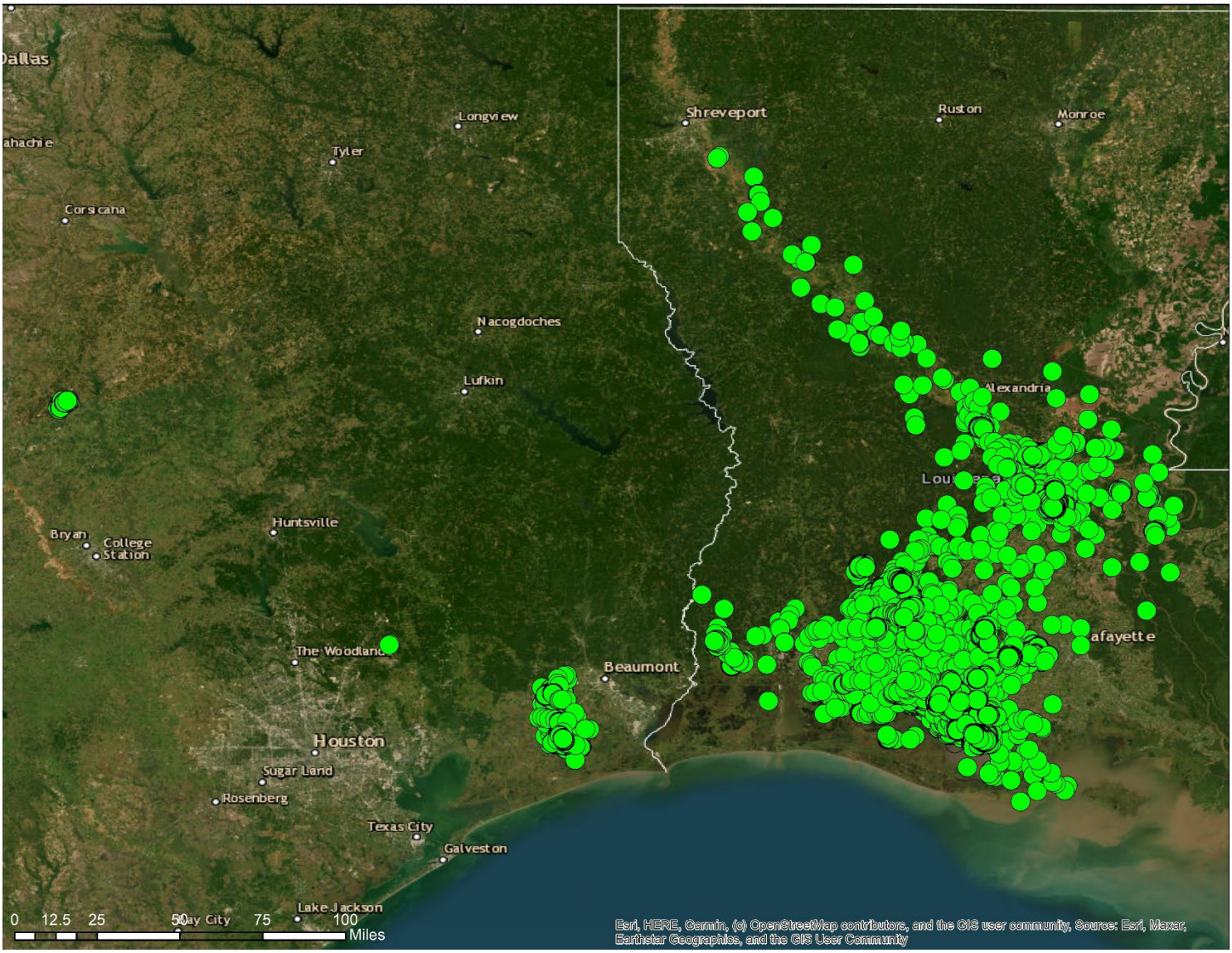


Figure 1. Location data collected from remote transmitters of reintroduced whooping cranes, 1 July 2022 – 30 June 2023.

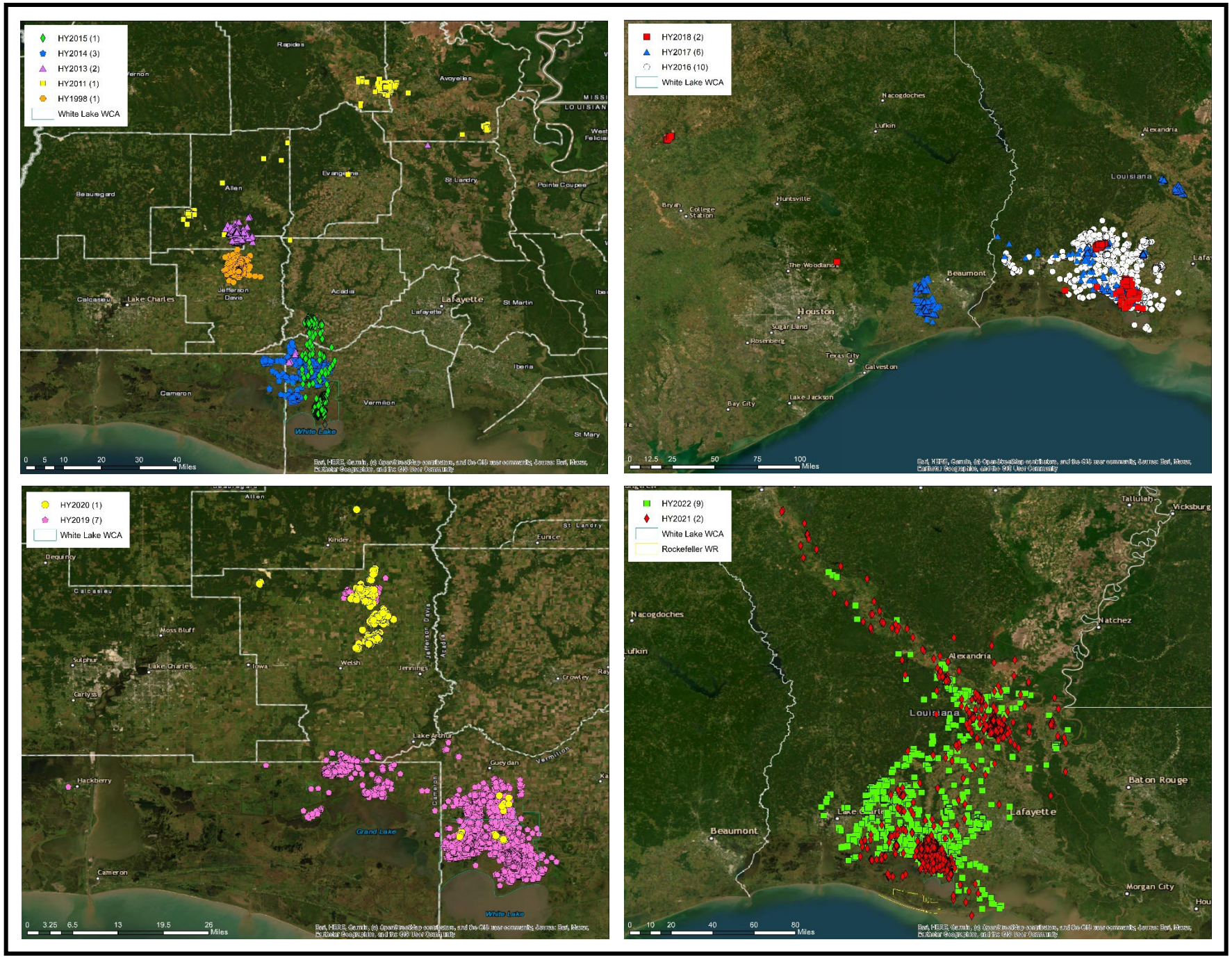


Figure 2. Location data of reintroduced whooping cranes in Louisiana by hatch year, 1 July 2022 – 30 June 2023. Number of cranes contributing to data points in parenthesis.

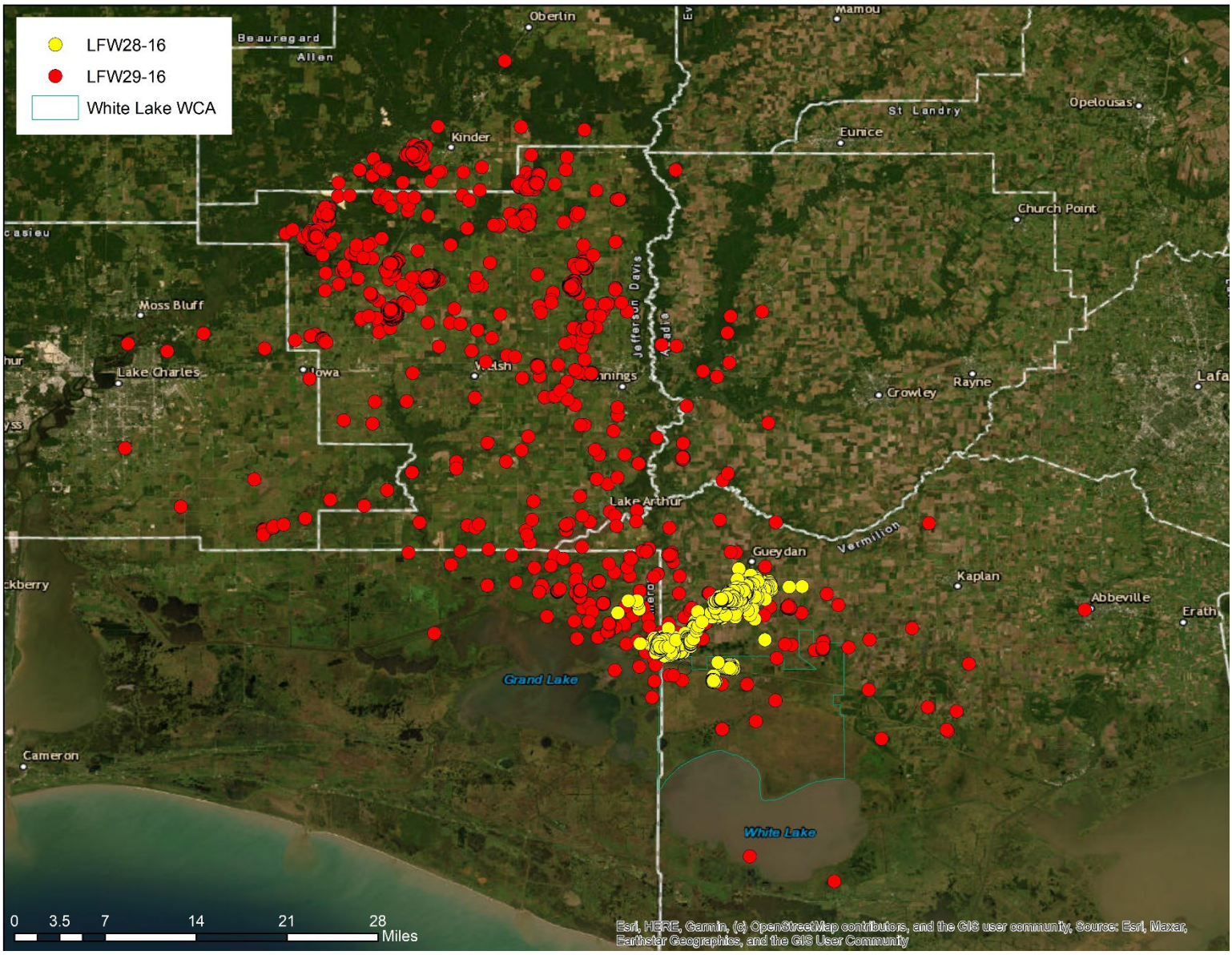


Figure 3. Location data of LFW28-16 and LFW29-16 from their release at the White Lake WCA, Vermilion Parish on 31 October 2022 - 30 June 2023.

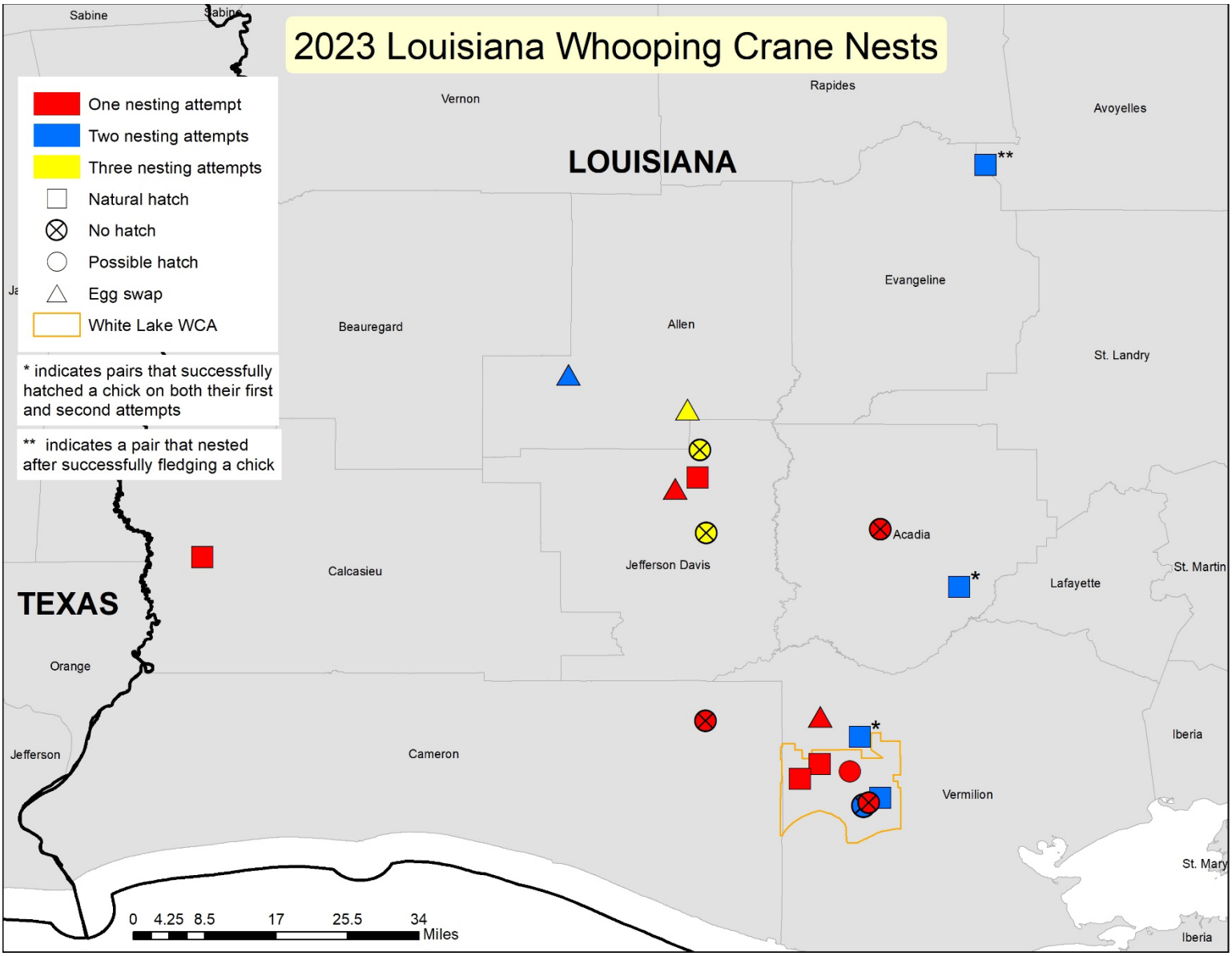


Figure 4. Approximate locations of Louisiana whooping crane nests in 2023.

Figure 6. Traveling library display.

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
2023	L6-16	L16-17	Calcasieu	1 Feb	2	Hatch 4 & 5 March (W1 & W2)	32	No renest
2023	L11-17	L7-11	Avoyelles	1-3 Feb	2	1 hatch 4 March (W3); 1 coll. 8 March (non-viable)	30	25 (after fledge)
2023	L1-19	L11-11	Jefferson Davis	5 Feb	2	1 hatch 9 March (W4); 2nd not found	32	No renest
2023	L3-13	L8-14	Vermilion	~17 Feb	unk	1 hatch ~19 Mar (W5)	30	11-27 (after chick)
2023	L1-13	L3-11	Allen	17/18 Feb	2	Abandoned 13 Mar; 1 broke 9 Mar; 1 coll. 15 Mar (LDE)	~28	14
2023	L12-16	L5-14	Jefferson Davis	~25 Feb	1	Abandoned 4 March; coll. 6 March (nonviable-too young?)	~7?	32-35
2023	L19-16	L10-15	Acadia	3 March	unk	Hatch 2 & 4 April (W6 & W7)	32	16 (after chick)
2023	L5-18	FW12-15	Cameron	21 Feb-6 Mar	unk	Full term; coll. 17 Apr (1 non-viable, 1 rotten egg contents on nest)	42-55	No renest
2023	L23-16	L3-17	Vermilion	8-14 Mar	2	Full term; abandoned by 18 Apr; coll. 19 Apr (1 LDE, 1 frag only)	~30	12-15
2023	LW1-18	L12-17	Jefferson Davis	<15 Mar	2	Full term; 1 broke 13 Apr, 1 abandoned 14 Apr & coll. 19 Apr (EDE)	≥31	15-19
2023	L2-15	L11-15	Vermilion	22-24 Mar	2	Abandoned by 31 Mar (eggs predated)	2-8	19-24
2023	L2-11	L13-11	Allen	22 Mar	2	Abandoned 2 Apr; 1 intact coll. 4 Apr (non-viable), 1 broken on nest	11	24
2023	L21-17	LW3-18	Acadia	25-29 Mar	1	Full term; collected 2 May (non-viable)	34-38	No renest
2023	L13-14	L6-15	Vermilion	28-30 Mar	2	1 hatch ~30 Apr (W8); 2nd disappeared	32	No renest
2023	L4-19	FW12-19	Vermilion	3 Apr	1	Abandoned 18 Apr; coll. 19 Apr (non-viable)	15	No renest
2023	L3-21	L14-17	Vermilion	16 Apr	2	Egg swap 11 May, unk outcome (off nest next AM, no chick); 1 hatch at ASSC, 1 LDE	25	No renest
2023	L10-18	F1-98	Jefferson Davis	16 Apr	1	Dummy egg 19 May; egg swap 23 May, hatch 24 May (W11); pulled EDE	38	No renest
2023	L9-17	L12-18	Vermilion	19-28 Apr	2	1 poss. hatch based on membrane (no ID given); 1 LDE	~30	No renest
2023	L17-16	L9-18	Vermilion	26 Apr	2	1 hatch 26 May (W13)	30	No renest

Subsequent nesting attempts 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 next nest
Second nest attempts (renests)								
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
2023	L1-13	L3-11	Allen	27 Mar	2	Abandoned 6 Apr; 1 disappeared 4 Apr; 2nd coll. from water 8 Apr (non-viable)	9	13
2023	L12-16	L5-14	Jefferson Davis	5-8 Apr	2	Failed 19 Apr (nest fell apart); coll. from water 21 Apr (both EDE)	11-14	16
2023	L2-15	L11-15	Vermilion	≤19 Apr	1	Abandoned ~21 Apr; coll. 26 Apr (nonviable, too young?)	2+	No 3rd nest
2023	L3-13	L8-14	Vermilion	25-28 Apr	2	1 hatch ~27 May (W14); 2nd not coll.	30-32	No 3rd nest
2023	L23-16	L3-17	Vermilion	25-28 Apr	1	Hatch ~26 May (W12)	30	No 3rd nest
2023	L2-11	L13-11	Allen	26 Apr	2	Egg swap/hatch 12 May (W10); pulled eggs both MDE	16	No 3rd nest
2023	LW1-18	L12-17	Jefferson Davis	29 Apr-3 May	1-2	Failed by 11 May; 1 broken egg coll from water 12 May	≤11	3-15
2023	L19-16	L10-15	Acadia	17 May	2	1 hatch 18 June (W15); 2nd not found	32	No 3rd nest
2023	L11-17	L7-11	Avoyelles	9 June	1	Full term; coll. 13 July (MDE)	34	No 3rd nest
Third nest attempts								
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
2023	L1-13	L3-11	Allen	19 Apr	2	Egg swap/hatch 9 May (W9); 1 MDE, 1 LDE (died 16 May at ASSC)	20	No 4th nest
2023	L12-16	L5-14	Jefferson Davis	5 May	2	Full term; 1 broke 6 June, 1 coll. 9 June (LDE)	35	No 4th nest
2023	LW1-18	L12-17	Jefferson Davis	13-19 May	2	Abandoned 29 May; coll. 30 May (both EDE)	10-16	No 4th nest
Fourth - Seventh nest attempts								
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 2022

Prepared by Hillary Thompson, International Crane Foundation

During 2022, 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 (Fig. 1). There were 6 confirmed mortalities during 2022, including the 4 released birds, due to various causes.

Highlights related to monitoring and management of the EMP from 2022 include:

- We recorded a total of 31 nests by 24 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. We collected 16 eggs from 9 first nests for forced renesting, to encourage pairs to renest after black flies were no longer on the landscape. Additionally, we recovered 2 eggs from abandoned nests, and collected 4 additional eggs from 4 renests with 2 egg clutches (took 1 egg from two 2-egg clutches). In total we brought 22 eggs into captivity for rearing and release. 14 chicks hatched from 8 first nests and 4 re-nests (Table 2). Two wild-hatched chicks fledged and survived to migration (Table 3).

- Two adults were captured for transmitter replacement and one wild-hatched chick was captured for initial banding.

- We released 4 captive-reared Whooping cranes into the wild. Two died prior to migration, one died during migration, and one was released on the wintering grounds where she was later found dead. It was a tough year for released birds! The two that died prior to migration were both 1 year old birds raised at the Calgary Zoo, whose transfer to Wisconsin was delayed due to COVID-19 and HPAI.

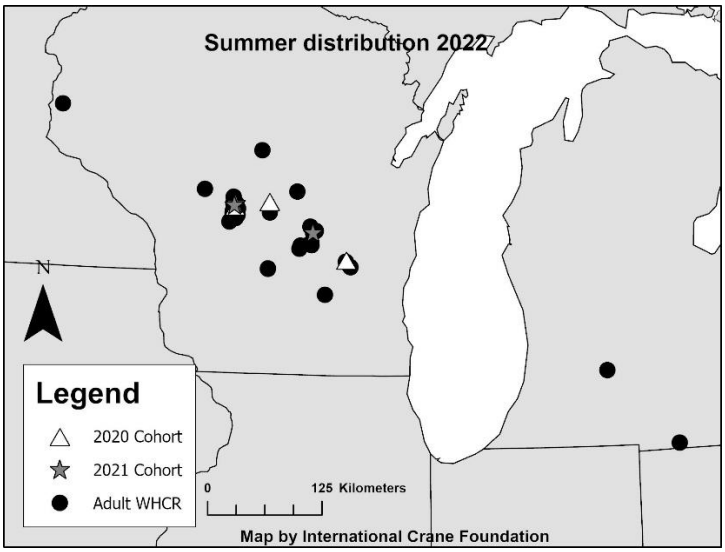


Figure 1. Summer distribution of the Eastern Migratory Population of Whooping Cranes during 2022. Seventy-one cranes spent the summer in Wisconsin and 2 were in Michigan.

Winter 2021-22

The estimated population size as of 1 January 2022 was 79 (38 F, 38 M, 3 U). The final wintering locations of Whooping Cranes in the EMP during winter 2021-22 were as follows (Fig. 2): 34 in Indiana, 11 in Illinois, 8 in Kentucky, 1 in Tennessee, 16 in Alabama, 3 in Georgia, and 1 in Florida. There were 5 in unknown locations, including 1 pair who consistently winter in an unknown spot, 1 bird who was confirmed dead in early 2022 but had likely died in fall 2021, and 2 birds who became long-term missing in 2022.

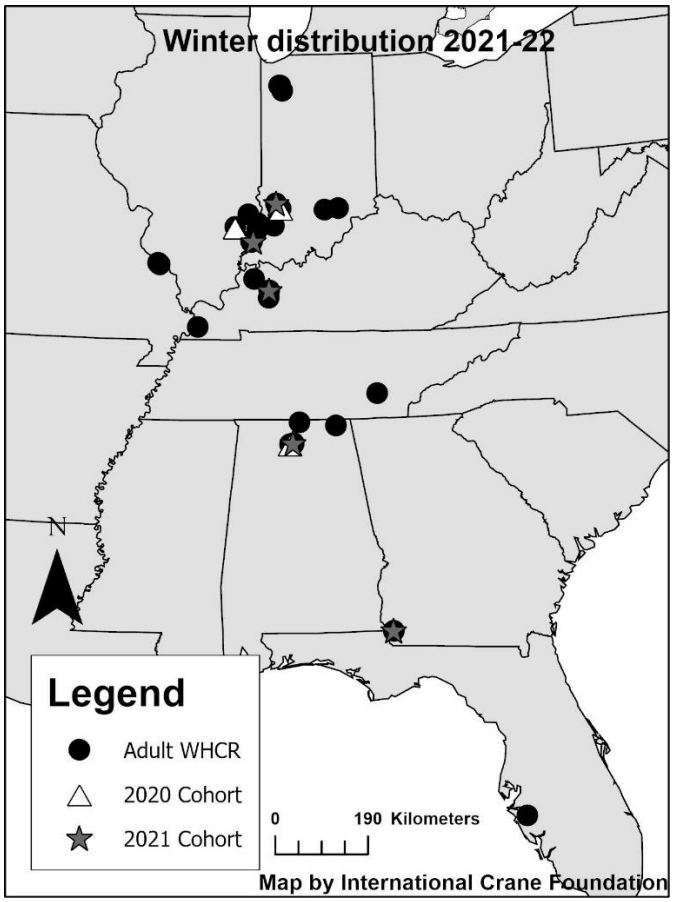


Figure 2. Distribution of the Eastern Migratory Population of Whooping Cranes during winter 2021-22.

Captures and Banding in 2022

- Captures for transmitter replacement:
  - W5-18 Juneau County, Wisconsin, 5 Apr
  - 42-09 Juneau County, Wisconsin, 23 Sept
- Captures of pre-fledged wild-hatched chick (transmitter and bands):
  - W4-22 Portage County, Wisconsin, 14 July
- Banding prior to release for captive-reared birds:
  - 81-21 and 82-21 Juneau County, Wisconsin, 30 Aug
  - 90-22 ICF, 12 Sept
  - 88-22 SCBI - banded by SCBI staff, 2 Nov

Winter distribution as of 3 January 2023

The maximum population size as of 3 January 2023 was 75 (37 Female, 35 Male, 3 Unknown). The distribution of these birds is as follows (Fig. 3): 25 in Indiana, 11-12 in Illinois, 5-8 in Kentucky, 2 in Tennessee, 15 in Alabama, 2 in Georgia, and 2 in Florida. There were 9 in unknown locations, 7 of which have not been seen south of the breeding grounds.

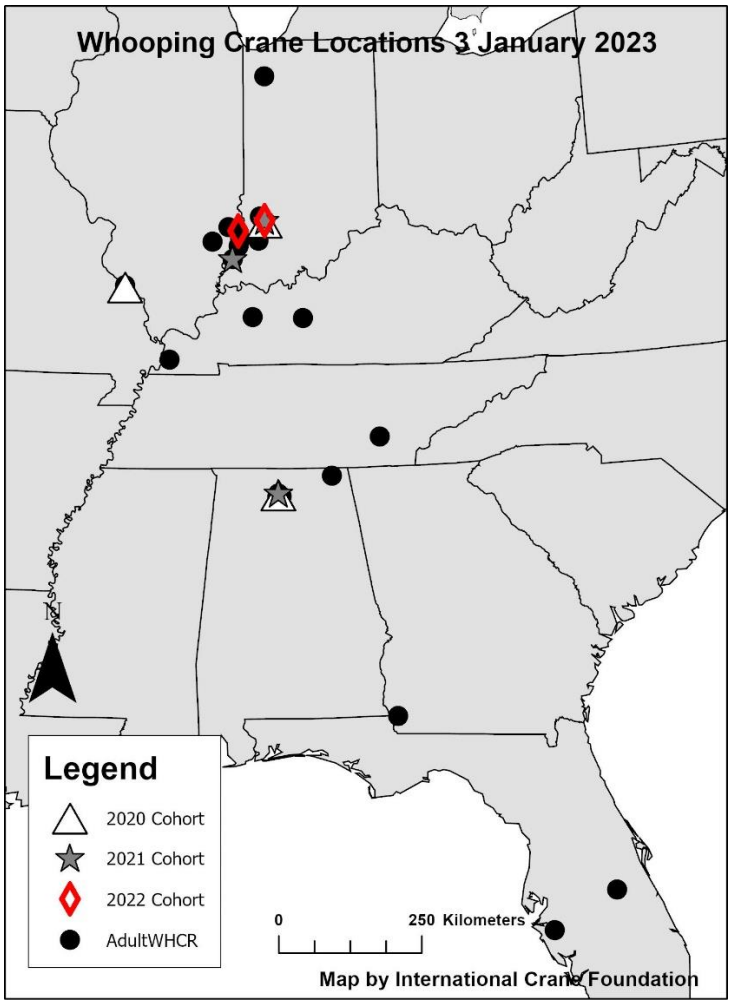


Figure 3. Distribution of wintering Whooping Cranes in the EMP as of 3 Jan 2023.

Survival

- The total (both captive releases and wild-hatched chicks) coming into this population since 2001 is 333 (Fig. 4), of which 75 (23%) may be alive as of 31 December 2022 (Fig. 5). There have been 302 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 34 wild-hatched chicks that survived to fledging (see Reproduction section below).
- There were 6 confirmed mortalities recorded in 2022 (not including pre-fledge wild-hatched chicks born in 2022, Table 1, Fig. 6):
    - 69-16 - remains collected 8 Jan, due to broken leg but unknown how injury occurred
    - W14-20 - remains collected 7 Apr but mortality likely occurred fall 2021, cause unknown
    - 81-21 - remains collected 19 Sept, cause unknown – suspect predation
    - 82-21 – remains collected 11 Oct, due to injury
    - 90-22 – remains collected 1 Dec, cause unknown – suspect vehicle collision
    - 88-22 – remains collected 6 Dec, cause unknown – suspect bobcat predation
- There were 4 cranes classified as long-term missing during 2022.
    - 19-10 – last seen 13 July 2021 in Juneau County, WI
    - W19-19 – last seen 13 July 2021 in Juneau County, WI
    - 10-11 – last seen 24 Jan 2022 in Lawrence County, IL
    - 25-09 – last seen 24 May 2022 in Juneau County, WI

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 2001-2021**	**Number of cases 2022**
Predation	39	2
Impact Trauma – confirmed or suspected power line collision	10	0
Impact Trauma – other (vehicle or aircraft collision, unknown source of trauma)	11	1
Gunshot	14	0
Disease (including lead poisoning)	8	0
Other	14	1
Unknown	76	2
Total confirmed mortalities	172	6

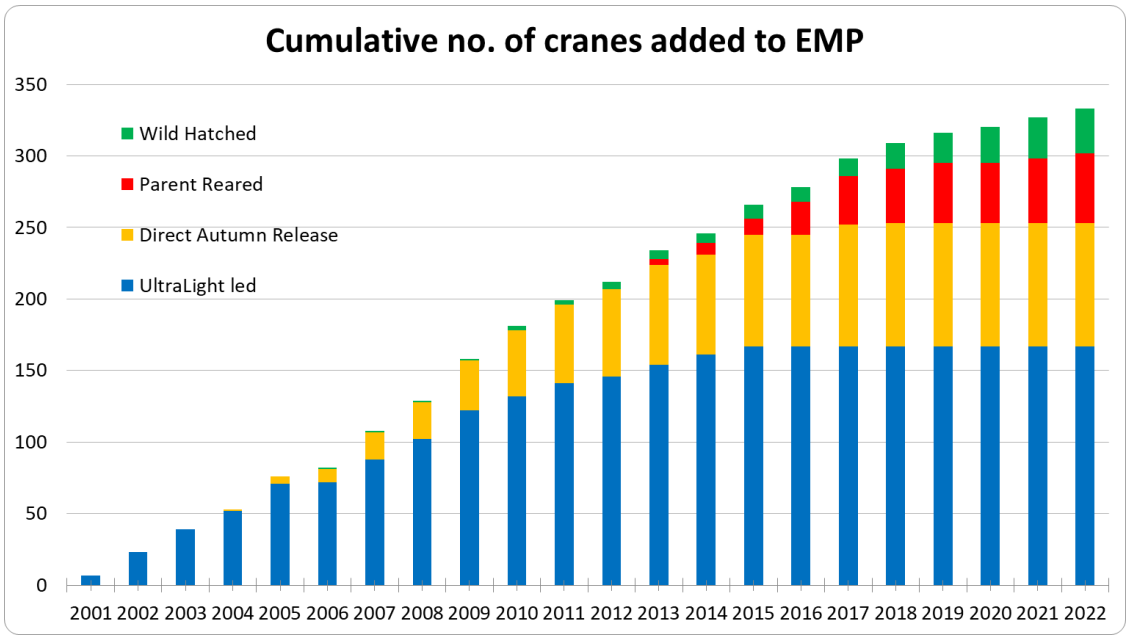


Figure 4. Cumulative number of cranes added to the Eastern Migratory Population by rearing method since 2001. As of 2022, there have been 167 UltraLight led, 86 Direct Autumn Release, 49 Parent Reared, and 31 Wild Hatched Whooping Cranes added to the EMP.

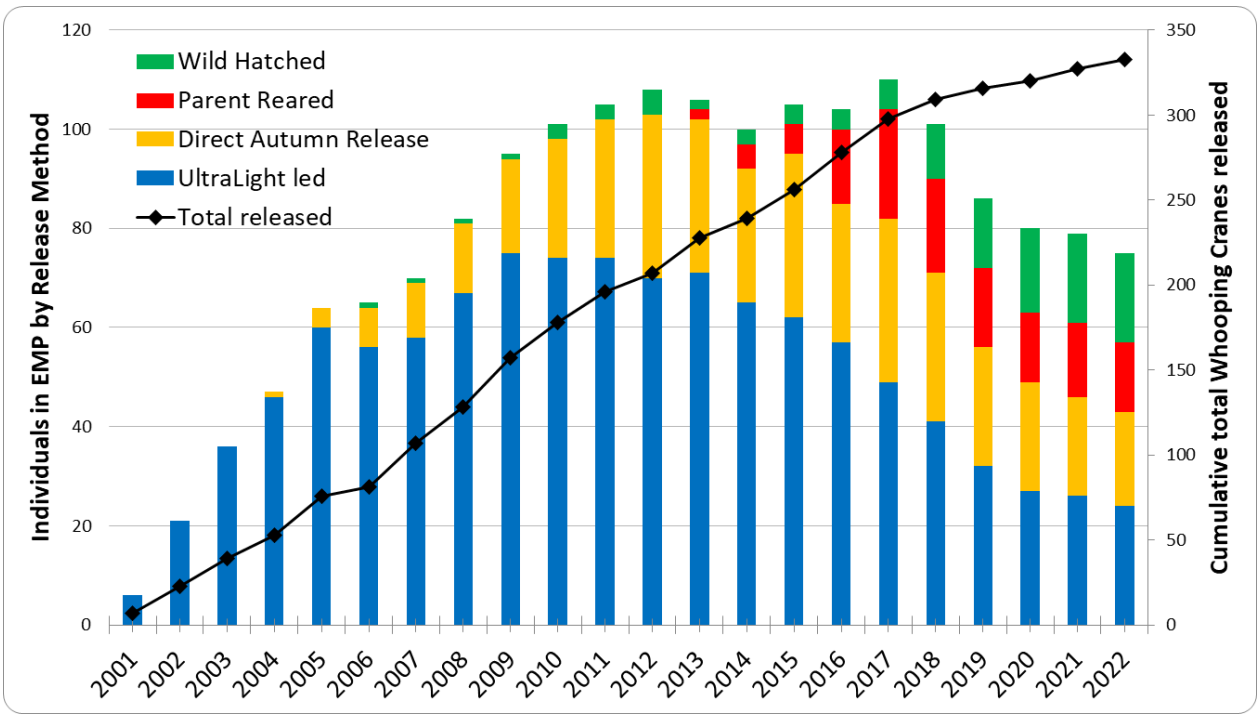


Figure 5. Population size of EMP by rearing method. As of 1 January 2023, there were 75 birds recorded in the EMP (left axis; 35 males, 37 females, 3 unknown). Black line indicates the total birds released (or wild-hatched and fledged) into the population cumulatively (right axis; same number as Fig. 4, above).

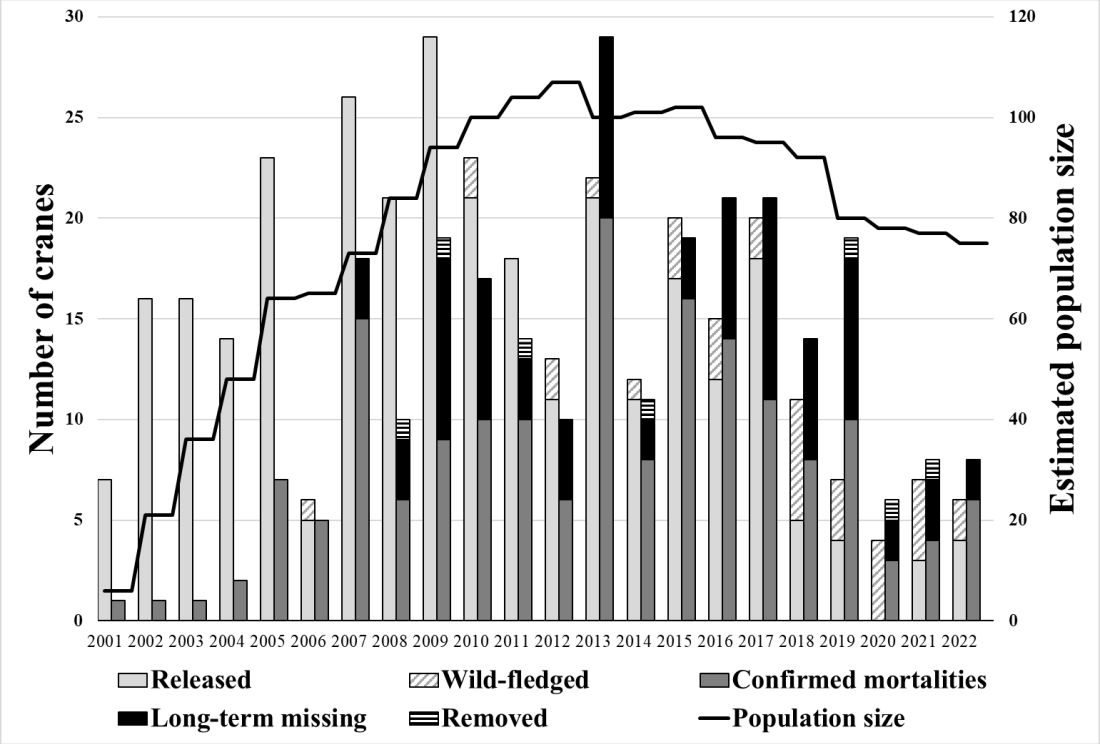


Figure 6. Estimated population size of the Eastern Migratory Population of Whooping Cranes from 2001-2022 (right axis). The number of cranes added into the population each year are shown in a stacked bar on the left (left axis). The number of cranes subtracted from the population each year are shown in a stacked bar on the right (left axis).

Reproduction

- This year we recorded a total of 31 nests by 24 different Whooping Crane pairs breeding in Wisconsin. The numbers reported here are the total we observed but there may have been a few missed nests or young chicks.
- We collected 16 eggs from 9 first nests for forced renesting, to encourage pairs to renest after black flies were gone. We recovered 2 eggs from abandoned nests and collected 4 eggs from 4 renests with 2 egg clutches. In total we brought 22 eggs into captivity for rearing and release.
- Eight nests failed due to a variety of known and unknown causes (predation, abandonment, Table 2). Additionally, 1 nest was incubated full term, and 1 nest had an unknown outcome, 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 hybrid nests in Dodge County were destroyed (Table 2).
- 14 chicks hatched from 8 first nests and 4 re-nests (Table 2). Two wild-hatched chicks fledged and survived to migration (Table 3).
- At the end of 2022, there have been a total of 408 nests (318 first nests, and 90 re-nests). 181 chicks hatched in the wild, of which 34 have fledged. As of 1 January 2023, 18 of those survive in the wild (Tables 3 and 4).

Table 2. Nesting summary for 2022. Asterisks indicate a re-nest.

Female	Male	Nest Outcome	Date Completed	County	Chicks	Notes
12-11	5-11	Hatched	5/2/22	Juneau	W1, W2	W1-22 fledged
3-14	4-12	Hatched	5/5/22	Green Lake	W3	
59-13	1-11	Failed – abandoned	4/17/22	St. Croix		Egg infertile
25-09	2-04	Failed – unknown	4/21/22	Juneau		
W3-17	30-16	Failed – predation	4/22/22	Green Lake		Unknown predator
24-08	13-02	Failed – abandoned	4/23/22	Juneau		Eggs scavenged
W1-06	W10-15	Active nest management	4/25/22	Juneau		
13-03	9-05	Active nest management	4/25/22	Juneau		
12-03	12-05	Active nest management	4/25/22	Juneau		
73-18	3-04	Active nest management	4/25/22	Juneau		
42-09	37-07	Active nest management	4/25/22	Juneau		
W10-18	W6-18	Active nest management	4/25/22	Juneau		
6-15	19-09	Failed – unknown	4/29/22	Juneau		
2-17	16-04	Failed – abandoned	5/4/22	Juneau		
15-11	29-08	Active nest management	5/4/22	Juneau		
W3-10	7-07	Active nest management	5/4/22	Juneau		
36-09	W5-18	Active nest management	5/4/22	Juneau		
8-17	28-17	Unknown	5/5/22	Marquette		
W1-19	1-17	Hatched	5/7/22	Portage	W4	W4-22 fledged
67-15	3-17	Hatched	5/14/22	Green Lake	W5, W6	
7-17	4-14	Hatched	5/16/22	Green Lake	W7	
24-17	4-17	Hatched	5/17/22	Sauk	W8	
38-17	63-15	Hatched	5/23/22	Dodge	W9	
10-15	4-13	Hatched	5/23/22	Green Lake	W10	
25-09	2-04	Failed* - unknown	5/23/22	Juneau		
59-13	1-11	Failed* - abandoned	6/6/22	St. Croix		Eggs were infertile – gave them a fertile egg from another pair
13-03	9-05	Hatched*	6/12/22	Juneau	W11	
24-08	13-02	Hatched*	6/12/22	Juneau	W12	
W1-06	W10-15	Hatched*	6/13/22	Juneau	W13	
15-11	29-08	Hatched*	6/17/22	Juneau	W14	
12-03	12-05	Full Term*	6/27/22	Juneau		
SACR	14-12	Failed - management	4/7/22	Lenawee Co, MI		Hybrid eggs were removed and replaced with dummy eggs.
SACR	16-11	Failed - management	5/2/22	Dodge		Removed hybrid eggs from the nest.
SACR	16-11	Failed* - management	6/13/22	Dodge		Removed hybrid eggs from the nest.

Table 3. Nest initiation dates, number of nests, number of chicks hatched, and number of chicks fledged 2005-2022. 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.

Year	First Nest Initiation	# First Nests	# Re-nests	Total Nests	# Hatched	# 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
2022	30 Mar - 2 Apr	24	7	31	14	2
Total		318	90	408	181	34

*One chick was old enough to have fledged when it died, but flights were never observed.

Table 4. Pairs that have successfully fledged chicks with years of fledging

Sire	Dam	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	2022
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		
1-17	W1-19	2022		

*12-02 died before chick fledged. Chick was old enough to have fledged when it died, but flights were never observed. 4-11 was found shot at her wintering area at the beginning of 2017.

** 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.