

Platte River

Recovery Implementation Program:

IMPLEMENTATION OF THE WHOOPING CRANE

MONITORING PROTOCOL

Fall 2024 REPORT

Prepared for:
PRRIP Technical Advisory and Governance Committees
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Table of Abbreviations

Abbreviation	Definition
AHR	Associated Habitat Reach
AMP	Adaptive Management Plan
AWB	Aransas-Wood Buffalo
cfs	Cubic feet per second
CI	Confidence interval
CSRT	Chapman secondary return transect
EBQ	Extension Big Question
EDO	Executive Director's Office
ESRT	Elm Creek secondary return transect
FA	Fall
Fig.	Figure
ft	Feet or foot
GC	Governance Committee
GIS	Geographic Information System
GPS	Global positioning system
ID	Identification number or code
ISAC	Independent Scientific Advisory Committee
km	Kilometer
m	Meters
mph	Miles per hour
MUCW	Maximum width unobstructed by dense vegetation
MUOCW	Maximum unobstructed channel width
NE	Nebraska
NF	Nearest forest
Opp	Opportunistic
PRRIP or Program	Platte River Recovery Implementation Program
PWRTE	Primary wetland return transect east
PWRTW	Primary wetland return transect west
QA/QC	Quality assurance/quality control
SE	Standard error
SP	Spring
Sys	Systematic
TAC	Technical Advisory Committee
TUCW	Total unvegetated channel width
UFCW	Unforested corridor width
UOCW	Unobstructed channel width
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey
UTM	Universal Traverse Mercator
WC	Whooping crane, <i>Grus americana</i>
WSRT	Wood River secondary return transect
0SE	East river transect
0SW	West river transect

Executive Summary

The Executive Director's Office (EDO) of the Platte River Recovery Implementation Program ("Program" or "PRRIP") monitored whooping cranes (*Grus americana*) during the fall 2024 migration using daily systematic aerial surveys along PRRIP's Associated Habitat Reach (AHR) on the central Platte River from Lexington to Chapman, Nebraska. During the scheduled 35-day monitoring period that lasted from October 15 to November 18, 2024, PRRIP's EDO completed 53 of 70 (75.7%) scheduled flight routes with each day's route surveying the length of the river channel and off-channel habitat within the AHR. The monitoring period was extended through December 3 due to the continued presence of six whooping crane groups on the AHR. The EDO completed 14 of 18 (77.8%) additionally scheduled flights with systematic aerial surveys ending on November 27. Alternative survey methods, specifically ground searches, were implemented from November 28 through December 3 to survey for the final remaining group. Surveyors documented 65 individual whooping cranes consisting of 59 adults and six juveniles in 19 unique groups using both systematic aerial surveys and opportunistic ground observations. Systematic aerial surveys alone detected 63 individuals consisting of 58 adults and five juveniles. Overall, the EDO observed 67 group locations that consisted of repeated observations of 11 of the 19 unique groups. Of these 67 locations, nine were observations of the same group at a different location on the same day. Surveyors observed the first whooping crane group on October 26 and the final group on November 30, 2024.

The 65 individual whooping cranes represented 0.117 of the Aransas-Wood Buffalo (AWB) migratory population based on the U.S. Fish and Wildlife Service's 2024–2025 estimate of 557 whooping cranes (95% CI = 478.7, 645.1) on wintering grounds along the Texas coast of the Gulf of Mexico. With 28 of the 65 whooping cranes having multiple day stopovers on the AHR, PRRIP's EDO estimated 241 total crane use days for fall 2024. Stopover length (days present in the AHR) of the 19 unique whooping crane groups during fall 2024 ranged between one and 18 days (mean = 3.3; median = 1; standard error [SE] = 1.0). When considering whooping cranes observed only between October 19 and November 22, which represented the 5th and 95th percentiles of initial dates of fall whooping crane group observations in Nebraska from the U.S. Fish and Wildlife Service public sightings database during 2015–2024, PRRIP's EDO enumerated 65 whooping cranes and 205 adjusted crane use days. Stopover length of the 19 groups between October 19 and November 22 ranged from one to nine days (mean = 2.5; median = 1; SE = 0.7).

Flow in the Platte River as measured at four gaging stations along the AHR between Overton and Grand Island, Nebraska ranged from 89.9 cubic feet per second (cfs) to 2,270 cfs during the October 15 to December 3 monitoring period. Instantaneous discharge at the gaging station closest to each of 32 whooping crane group locations in the river channel ranged from 178 cfs to 1,750 cfs (mean = 748; median = 623; SE = 75.1). Whooping cranes stopping within the AHR generally experienced a range of low to moderate discharge (i.e., <1,000 cfs) at the nearest gage. About half (46.9%) of the 32 whooping crane groups observed in the river channel were closest to the Grand Island, Nebraska gage. Unobstructed channel widths at the 32 whooping crane riverine use sites ranged from 238 ft to 1,609 ft (mean = 799; median = 730; SE = 63.5). Distance to the nearest forest at the 32 riverine use sites ranged from 119 ft to 1,588 ft (mean = 521; median = 460; SE = 46.4).

We calculated 5th and 95th percentiles of dates of initial fall whooping crane group observations in Nebraska in 10-year periods between 1992 and 2024 and retrospectively calculated the adjusted proportion of the AWB population stopping on the AHR and adjusted number of crane use days from PRRIP fall surveys dating back to 2001. Fall surveys in 2001-2003, 2005-2007, 2013-2014, and 2018-2020 did not encompass the 5th-95th percentile dates for the corresponding periods. Therefore, it is likely the proportion of population and number of crane use days reported underestimate whooping crane stopover metrics during fall of those years. Without surveys spanning the full range of dates between the 5th and 95th percentile dates, metrics from 2001-2003, 2005-2007, 2013-2014, and 2018-2020 could not be adjusted. Use of 5th and 95th percentiles of dates to calculate whooping crane metrics resulted in adjustments being made to metrics in the fall of 2009, 2012, 2015, 2017, 2019, 2021, 2023, and 2024. Adjustments were minor in four of the eight years. However, large adjustments were made to the number of crane use days in fall 2015, fall 2017, and fall 2023 which decreased by 20, 52, and 184 days, respectively. In 2024, decreases in the whooping crane metrics resulted from six whooping crane groups staying beyond the 95th percentile date. For 2024, the proportion of population was not adjusted, but the number of crane use days decreased from 241 to 205 days due to adjustments made to account for whooping cranes observed only during the 5th through 95th percentiles of dates from 2015-2024.

Fall whooping crane stopover metrics on the AHR of the central Platte River as determined through PRRIP's surveys have demonstrated considerable annual variability. The unadjusted proportion of the AWB population using the AHR along the central Platte River during the fall migration has ranged from 0.005 to 0.162 between 2001 and 2024 (mean = 0.044; median = 0.036; SE = 0.008). The unadjusted number of crane use days during the fall migration has varied between 2 and 584 days (mean = 97.1; median = 38.0; SE = 31.5). When including adjusted metrics for years when that was possible from 2001 through 2024, the adjusted fall proportion of the population that stopped on the AHR ranged from 0.005 to 0.162 (mean = 0.044; median = 0.036; SE = 0.008) and the adjusted number of crane use days during fall varied between 2 and 519 days (mean = 84.3; median = 35.5; SE = 26.3). Over the past six years, we have observed four of the highest proportions of the population stopping on the AHR and three of the highest numbers of crane use days observed during fall since 2002. High use in fall 2019, 2021, 2023, and 2024 has been interspersed with lows well below fall historical averages in both stopover metrics in fall 2020 and 2022. Interannual variability makes it difficult to quantify long term trends in stopover metrics. The Program is currently investigating a range of factors that may help explain stopover decisions and annual variability in use of the AHR. The information collected from PRRIP's long-term systematic monitoring of whooping cranes along the central Platte River is being used to assess success of the Program's management objective of contributing to the survival of whooping cranes during migration and evaluate the biological response of whooping cranes to the Program's water and land management.

Introduction

The Platte River Recovery Implementation Program (“Program” or “PRRIP”) is responsible for implementing certain aspects of the recovery plan for endangered whooping cranes (*Grus americana*). In 2007, the Program began its 13-year First Increment and implementation of an Adaptive Management Plan (AMP) to learn more about the physical processes of the central Platte River in Nebraska and the response of whooping cranes from the migratory Aransas-Wood Buffalo (AWB) population to Program management of land and water along the river. In 2020, the Program began a 13-year Extension of the First Increment to continue the work and gather additional information to inform decisions for management of whooping crane habitat along the Program’s 90-mile Associated Habitat Reach (AHR) from Lexington to Chapman, Nebraska. The Program’s original AMP was updated in 2022 as an Extension Science Plan ([PRRIP 2022](#)) to provide guidance for Program science priorities during the Extension.

The Program’s management objective for whooping cranes is to contribute to their survival during migration ([PRRIP 2021a](#)). Quantifiable metrics to help evaluate the success of this objective include the: (1) availability and area of suitable roosting and foraging habitat; (2) number of days whooping cranes were observed along the AHR (i.e., crane use days); and (3) proportion of the AWB population that stops along the AHR during spring and fall migration. Additionally, several critical scientific and technical uncertainties about physical processes and the response of whooping cranes to management actions are the focus of applying rigorous adaptive management in the First Increment Extension through implementation of the Program’s Extension Science Plan. These uncertainties are stated as broad hypotheses in the Extension Science Plan ([PRRIP 2022](#)) and, as a means of better linking science learning to Program decision-making, those uncertainties comprise a set of “Extension Big Questions” (EBQs) to link specific hypotheses and metrics to management objectives and overall Program goals (see [PRRIP 2017](#), [PRRIP 2020](#)). Three EBQs directly relate to measuring whooping crane response to Program management ([Appendix A](#)):

- *EBQ #4* – What factors influence whooping crane decisions to stop or fly over the AHR?
- *EBQ #5* – What factors influence whooping crane stopover length within the AHR?
- *EBQ #6* – Why is spring use of the AHR greater than fall use by whooping cranes?

To gather information to reduce remaining uncertainties about whooping cranes during the Extension, several finer-scale priority management hypotheses were developed by Program participants to focus on the influence of river discharge for whooping crane decision-making ([Appendix A](#)). Underlying physical process hypotheses were developed in support of the management hypotheses to explain how discharge interacts with channel morphology to provide suitable whooping crane roosting habitat ([Appendix A](#)). Broader scope alternatives were also posed for investigation as potential factors affecting whooping crane behavior ([Appendix A](#)). Implementation of the whooping crane monitoring protocol is intended to provide the systematically-collected whooping crane use and habitat (i.e., landscape level attributes at roost sites and diurnal use sites) data necessary to test these whooping crane hypotheses, evaluate learning related to the whooping crane EBQs, and ultimately assess progress toward meeting the whooping crane management objective ([PRRIP 2017](#), [PRRIP 2020](#)).

The Program’s whooping crane monitoring protocol includes two major components ([PRRIP 2024](#)):

- 1) Detect and confirm whooping crane stopovers through systematic aerial surveys of river channel and palustrine wetland habitat within the 90-mile AHR. Stopover data is used to comparatively evaluate changes in the frequency and distribution of stopovers within the study area over time.
- 2) Collect landscape-level habitat data at use locations. Habitat data is used for resource selection analyses and other analyses intended to inform Program habitat creation and maintenance activities.

In an effort to align survey dates with the period when most (90%) whooping cranes were sighted in Nebraska, the Program established spring and fall monitoring periods to encompass the 5th through 95th percentiles of initial sighting dates for all recorded sightings of whooping crane groups in Nebraska from the U.S. Fish and Wildlife Service's (USFWS) public sighting database for 1975–1999 ([PRRIP 2021c](#)). Since then, the 5th and 95th percentile window of observations has served as a guideline to adjust monitoring dates to accommodate for temporal shifts in whooping crane arrival in Nebraska. In 2023, the Program's Technical Advisory Committee recommended and the Governance Committee approved a change in the fall monitoring period from October 9 through November 15 to October 15 through November 18 beginning in 2024 ([PRRIP 2023b](#)).

In this report, we summarize PRRIP's fall 2024 whooping crane monitoring efforts and results and place them in the context of PRRIP's long-term monitoring. Specifically, we report on the number of individual whooping cranes observed, proportion of the AWB population observed stopping on the AHR, number of crane use days, and use locations and associated habitat and flow metrics. We provide maps of whooping crane locations and photographs of observations. We summarize systematic and opportunistic survey efforts and resulting observations. We report on the detectability of whooping crane decoys during aerial surveys. Finally, we provide an assessment of how the 5th and 95th percentiles of dates of whooping crane group observations in Nebraska from the USFWS public sighting database have changed over time and how these changes may affect interpretation of whooping crane stopover metrics.

Methods

Study area

The study area encompassed the Program's AHR along the central Platte River (Figs. 1, 2) that extends from the Highway 283 Platte River bridge near Lexington, Nebraska (40°44'08.15" N; 99°44'37.31" W) to the Platte River bridge near Chapman, Nebraska (40°59'07.06" N; 98°08'40.40" W). The monitoring area spanned a total of approximately 90 linear miles of river and included Platte River channels and adjacent palustrine wetlands and ponds within 3.5 miles of the river channel(s).

Systematic aerial surveys

The PRRIP EDO conducted fall whooping crane monitoring in accordance with the *Platte River Recovery Implementation Program – Whooping Crane Monitoring Protocol Migrational Habitat Use in the Central Platte River Valley* rev. September 2024 ([PRRIP 2024](#)) during October 15, 2024 through December 3, 2024. We used two Cessna 172 aircraft, each crewed by a pilot and two observers, to make aerial observations along predetermined systematic flight transects (Figs. 1, 2).

The pilot utilized a GPS unit to follow defined transects and track miles flown. We flew systematic aerial transects daily, weather and visibility permitting, at an air speed of approximately 100 mph and an altitude of approximately 750 ft unless conditions demanded higher altitudes. Two flights were initiated each morning with one departing from Grand Island, Nebraska (east route; shown in red on Figs. 1, 2) and one from Kearney, Nebraska (west route; shown in green on Figs. 1, 2). Planes were required to be at transect starting points one-half hour before sunrise. Flights were typically completed in less than two hours. In the event of adverse weather, crews were able to wait up to two hours after sunrise for conditions to improve before cancelling the flight. Pilots were also able to cancel flights the night before or morning of a flight if they judged weather to be unsuitable for flying.

Two types of transects were flown on each route to ensure coverage of both on-channel riverine and off-channel wetland habitat. On-channel river transects (shown in blue on Figs. 1, 2) were flown east to west with the plane located south of the southern-most river channel to reduce the effect of sun glare. Starting points along riverine transects were alternated daily between two flight routes to allow different sections of the study area to be observed as early as possible in the flight times. Off-channel transects (shown in red and green on Figs. 1, 2) were designed to survey existing off-channel habitat within 3.5 mi of the river and serve as functional routes for planes to return to starting airports.

Route 1. The first pilot flew the transect covering the west half of the AHR from the Minden, Nebraska bridge west to the Lexington, Nebraska bridge (OSW; Fig. 1). The first pilot then flew the primary wetland return transect (PWRTW) from west to east (Fig. 1). The second pilot simultaneously flew the transect covering the east half of the AHR from the Chapman, Nebraska bridge west to the Minden bridge (OSE), followed by the primary wetland return transect (PWRTW) from west to east (Fig. 1). The second pilot flew a secondary transect (CSRT) to return to the airport (Fig. 1).

Route 2. The first pilot flew the transect covering the west half of the AHR beginning at the midpoint of the OSW river channel transect at the Odessa, Nebraska bridge west to the Lexington bridge (Fig. 2). The first pilot then flew the primary wetland return transect (PWRTW) east to the Minden bridge, followed by the OSW river channel transect back to the Odessa bridge (Fig. 2). The first pilot flew a secondary return transect (ESRT) from Hwy 183 at Elm Creek, Nebraska east to return to the Kearney airport (Fig. 2). The second pilot simultaneously flew the transect covering the east half of the AHR from the midpoint of the OSE river channel transect at the Wood River, Nebraska bridge west to the Minden bridge (Fig. 2). The second pilot then flew the primary wetland return transect (PWRTW) east to the Chapman bridge, followed by the remainder of the east half of the OSE transect back to the Wood River bridge (Fig. 2). The second pilot flew a secondary return transect east (WSRT) to return to the Grand Island airport (Fig. 2).

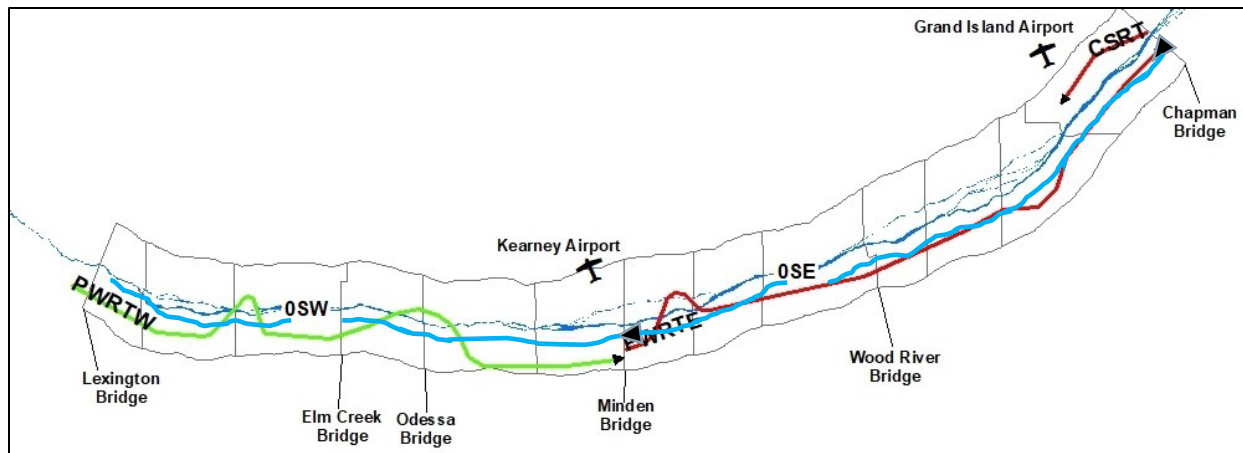


Figure 1. East and west flight transects for Route 1 of whooping crane aerial surveys between Lexington, Nebraska and Chapman, Nebraska. Black and grey triangles indicate starting points of flights. River channel transects (0SW; 0SE) are shown in blue. The west primary wetland return transect (PWRTW) is shown as a green line. The east primary wetland return (PW RTE) and secondary return transects (CRST) are shown in red.

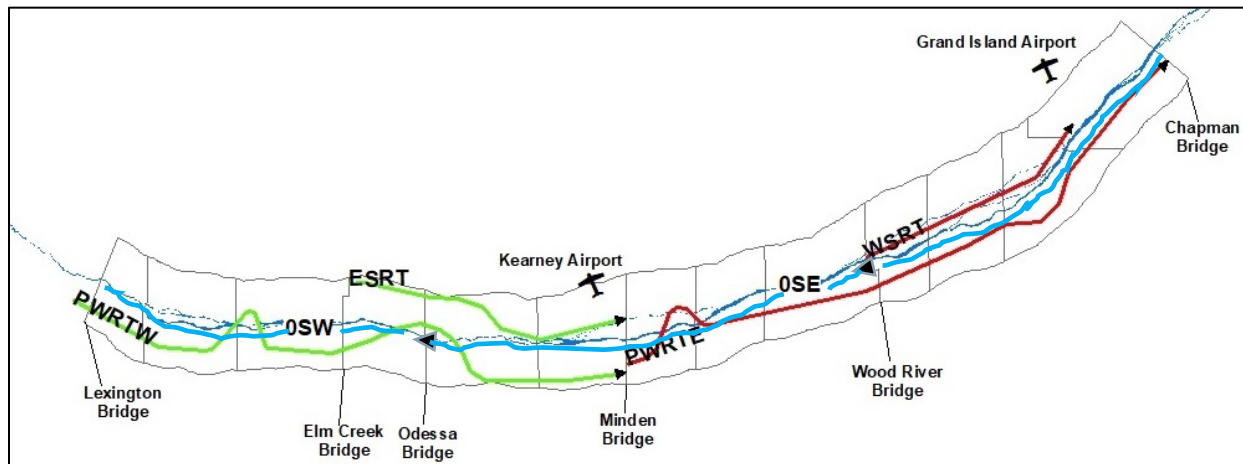


Figure 2. East and west flight transects for Route 2 of whooping crane aerial surveys between Lexington, Nebraska and Chapman, Nebraska. Black and grey triangles indicate starting points of flights. River channel transects (0SW; 0SE) are shown in blue. The west primary wetland return transect (PWRTW) and secondary return transect (ESRT) are shown as green lines. The east primary wetland return (PW RTE) and secondary return transects (WRST) are shown as red lines.

Observations and data collection

In addition to survey crews in airplanes, the EDO simultaneously deployed two ground crews on west and east survey routes to verify locations and identities of possible whooping cranes observed by aerial surveyors. Aerial survey crews relayed their position to ground survey crews via mobile phone at the beginning of each transect and at turn around points. Aerial surveyors used binoculars for sighting and a Canon Rebel T6s 760D camera for photo documentation of possible whooping cranes. If an aerial surveyor spotted potential whooping crane(s), then he or she took aerial photographs of the birds and the surrounding area to later confirm the identity and location. If additional observations for species identification were needed, then aerial surveyors contacted the nearest ground observer who positioned herself or himself to make a positive identification of the

whooping crane(s) without disturbance. Aerial and ground survey crews also confirmed and recorded opportunistic whooping crane sightings that occurred in addition to those observed during aerial systematic surveys. On days when flights were cancelled or after receiving a report of a potential whooping crane group requiring confirmation, ground personnel surveyed the area until the whooping crane(s) were located and confirmed, or sufficient search time had been allotted to confirm the whooping cranes had left or were not present in the area. Ground searches concluded when the whooping crane group was located, a bird species other than whooping cranes were located and identified at the general location where potential whooping cranes were reported, or a reasonable amount of search effort had been put forth with no whooping crane observed or other species identified. We notified USFWS Whooping Crane Migration Tracking Coordinator of survey results and opportunistic sightings daily following the completion of both morning flights and any ground search efforts. We coordinated with USFWS to determine whether whooping crane groups had been observed on previous mornings or whether they were new to the AHR.

Throughout the fall monitoring period, EDO staff placed a total of 20 whooping crane decoy sets consisting of 39 decoys (one to three decoys per set) in 20 unique locations along the aerial transects to evaluate the ability of aerial surveyors to detect whooping cranes. We placed 10 decoy sets at randomly selected locations within the river channel and 10 decoy sets at randomly selected locations along off-channel conservation lands within 500 ft of the channel.

Aerial and ground surveyors documented their observations of whooping crane groups with photographs and recorded the number of whooping cranes observed, age category of individuals as adults or juveniles, location, land cover type, time, and date of observation. Surveyors defined a whooping crane group as one or more whooping cranes observed at one location. EDO staff gave each whooping crane group a unique identification (ID) code (e.g., 2024FA01) combining the year, season (FA for fall), and PRRIP group number at sighting. If the same confirmed group was observed at more than a single location within the same day, the initial sighting received an A location identifier (e.g., 2024FA01A) with all subsequent locations receiving a B, C, etc. If the same confirmed group was observed the following day, then surveyors gave the group a new group ID (e.g., 2024FA02). We used aerial flight logs and ground search data sheets to document time and mileage devoted to searching for and identifying whooping cranes. During ground search surveys, mileage was calculated based on the driving distance from the location of the last reported sighting or known location to the conclusion of the search effort.

We recorded locations of each whooping crane group in Universal Transverse Mercator (UTM) coordinates within UTM Zone 14N using satellite imagery in ArcGIS Pro 3.4.0 (ESRI 2024) in conjunction with observation photographs and location descriptions provided by surveyors. We assigned use sites a number based on the date and time of sighting if the whooping crane group was observed in riverine, lacustrine, or palustrine land cover types. Whooping crane groups sighted outside of these land cover types were not assigned a use site number, but surveyors recorded the location's land cover classification. If the group was sighted while in flight, then surveyors recorded the location's land cover as "AIR." After entering data into the PRRIP species database, we conducted Quality Assurance/Quality Control (QA/QC) checks to ensure accuracy.

We used whooping crane group locations to evaluate river flow and habitat metrics at or near the use location. Four U.S. Geological Survey (USGS) flow gages were located on the Platte River

throughout the AHR from west to east during fall 2024 monitoring: Overton ([USGS 2024a](#)); Cottonwood Ranch ([USGS 2024b](#)); Kearney ([USGS 2024c](#)); and Grand Island ([USGS 2024d](#)). We used data from the gage closest to the whooping crane group location to the nearest 15 min of the group observation to assign a discharge in cubic feet per second (cfs) to each riverine location. The width of the Platte River channel unobstructed by dense vegetation (i.e., unobstructed channel width) and the distance to the nearest riparian forest (i.e., distance to nearest forest) have both been found to be important predictors of whooping crane use of the Platte River ([Baasch et al. 2019](#)). We used November 2024 aerial imagery of the Platte River channel and surrounding habitat at an aspect ratio of 1:1,750 in ArcGIS Pro 3.4.0 (ESRI 2024) and the photographs taken when the observation was made to estimate the unobstructed channel width and distance to nearest forest for each of the whooping crane group locations located in the Platte River channel.

Calculation of whooping crane stopover metrics and 5th and 95th percentiles of dates of observations

Proportion of population stopping on the AHR. We determined the total number of unique individual whooping cranes observed by PRRIP’s EDO during both systematic and opportunistic monitoring efforts throughout the AHR between October 15, 2024 and December 3, 2024. Unique individuals and groups were typically identifiable by their arrival date, location, and group composition (but see [PRRIP 2021b](#) for unique considerations during fall 2021). We divided the total number of unique individual whooping cranes observed through combined systematic and opportunistic monitoring efforts by the estimated size of the AWB population from winter 2024–2025 surveys ([USFWS 2025](#)) to estimate the proportion of the AWB population that stopped on the AHR during the fall 2024 migration.

Number of crane use days. We calculated the number of crane use days for each whooping crane group observed by multiplying the number of individual cranes in each group by the number of days the group was present, and adding one day per whooping crane observed if the initial observation was made before noon. We added one day per whooping crane observed because we assumed birds observed before noon were present and roosting on or near the river the evening prior to the morning of the observation. Similarly, an additional day per crane was added to USFWS public sightings only for observations made before noon. PRRIP crane use days includes observations made within the designated systematic survey period and any extensions of that survey period due to continued observed crane presence on the AHR per the Program’s monitoring protocol. PRRIP crane use days includes days when crane groups are not observed by PRRIP if dates of no observations are between consecutive PRRIP observations of that group. This assumes the group did not leave and return and that it is the same group. USFWS data are not used to calculate PRRIP crane use days, such that groups not observed by PRRIP and dates that groups were observed by USFWS prior to or after PRRIP observations are not included in the calculation of PRRIP crane use days. We calculated the total number of crane use days for fall 2024 by summing the number of crane use days across all whooping crane groups observed.

5th and 95th percentiles and adjusted whooping crane metrics. We used the USFWS whooping crane public sighting database for Nebraska (USFWS *unpublished data*) to determine the initial date of fall whooping crane group observations in Nebraska during 1992–2024. We divided the data into 24 10-year rolling periods with the first and last periods spanning 1992–2001 and 2015–

2024, respectively. We used R version 4.4.2 ([R Core Team 2024](#)) to calculate the 5th and 95th percentiles of initial dates of group observations for each 10-year period.

Fall surveys in 2001-2003, 2005-2007, 2013-2014, and 2018-2020 did not encompass the 5th – 95th percentile dates for the corresponding periods. Therefore, we could not adjust metrics to encompass the 5th and 95th percentile dates for those years. For each year of fall surveys that encompassed the 5th and 95th percentile dates, we calculated adjusted metrics as the total number of individual whooping cranes observed and total number of crane use days within the dates corresponding to the 5th and 95th percentiles of initial group observations for each 10-year period. For example, for PRRIP surveys conducted during 2004, we used percentile dates calculated from USFWS data from 1995–2004. For PRRIP surveys conducted during 2024, we used percentile dates calculated from USFWS data from 2015–2024.

Results

Whooping crane observations and monitoring effort

Aerial and ground surveyors observed 65 individual whooping cranes consisting of 59 adults and six juveniles in 19 unique groups during fall 2024 monitoring (Figs. 3, 4; [Appendix B](#), [Appendix C](#)). The locations and distribution of historical fall observations of whooping crane groups by PRRIP during 2001–2024 are provided in an online interactive GIS database at: <https://hwcorg.maps.arcgis.com/apps/mapviewer/index.html?webmap=97944a2aa0874d4b987f61f795953a4c>.

Overall, PRRIP surveyors recorded 67 whooping crane group locations consisting of 19 initial group locations and repeated observations of 11 of the 19 groups during the 50-day monitoring period ([Appendix B](#), [Appendix C](#)). Of these 67 locations, nine were observations of the same group at a different location on the same day (i.e., “B” locations in [Appendix B](#)). We observed changes in group size through time for one group (USFWS ID 24B-54; [Appendix B](#)). PRRIP surveyors observed the first whooping crane group on October 26 and the final group on November 30, 2024. The mean and median initial dates of whooping crane group observations were November 10 and November 13, respectively (standard error [SE] = 2.4 days, $n = 19$). The mean and median dates of all 67 group observations were November 14 and November 17, respectively (SE = 1.2 days).

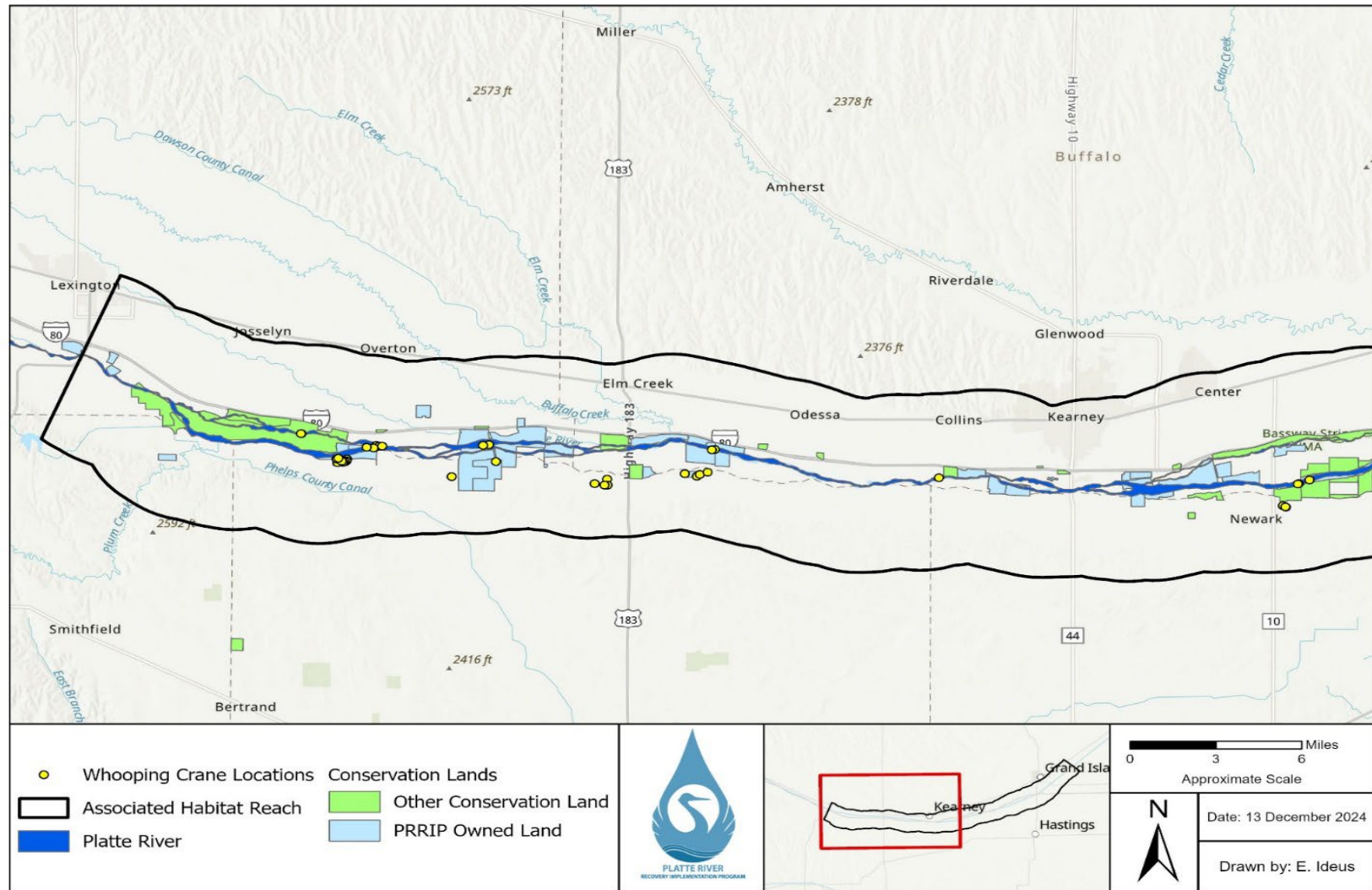


Figure 3. Locations of whooping crane groups observed during fall 2024 PRRIP systematic aerial surveys and ground surveys along the Associated Habitat Reach of the central Platte River between Lexington and Kearney, Nebraska. Enlarged and detailed location maps with group identification numbers are provided in Appendix C. Locations of historical fall observations of whooping crane groups by PRRIP during 2001-2024 are provided online at <https://hwc.org.maps.arcgis.com/apps/mapviewer/index.html?webmap=97944a2aa0874d4b987f61f795953a4c>.

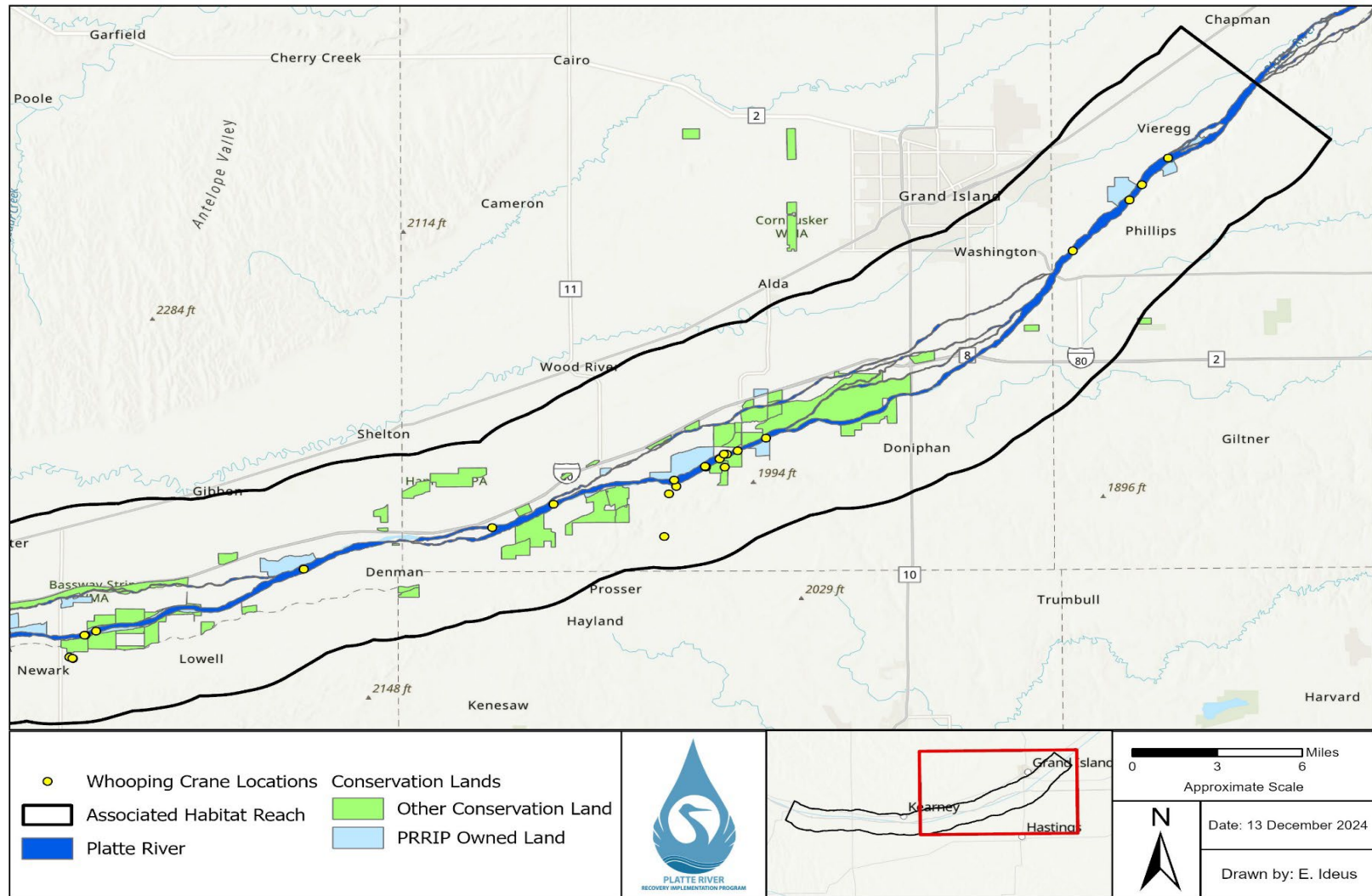


Figure 4. Locations of whooping crane groups observed during fall 2024 PRRIP systematic aerial surveys and ground surveys along the Associated Habitat Reach of the central Platte River between Kearney and Chapman, Nebraska. Enlarged and detailed location maps with group identification numbers are provided in Appendix C. Locations of historical fall observations of whooping crane groups by PRRIP during 2001-2024 are provided online at <https://hwcprp.maps.arcgis.com/apps/mapviewer/index.html?webmap=97944a2aa0874d4b987f61f795953a4c>.

Table 1. Number of whooping crane groups observed during systematic aerial surveys and opportunistic aerial and ground surveys during fall 2024 along the Associated Habitat Reach (AHR) of the central Platte River between Lexington and Chapman, Nebraska. Included for each type of survey effort are the: number of whooping crane groups observed; number of transects completed, incomplete, cancelled, and scheduled; duration of survey effort; and number of miles flown or driven during surveys.

Survey type		Flight transects	No. whooping crane groups observed ^a	No. transects completed	No. transects incomplete	No. transects cancelled	Total no. transects scheduled	Duration of survey effort ^b	Miles flown or driven
Systematic aerial surveys (October 15 - November 18)	On Channel	0SE, 0SW ^c	19	53	3	14	70	26:05	5838
	Off Channel	PWRTE, PWRTW ^d	4	53	1	16	70	24:27	
	Off Channel	CSRT, ESRT, WSRT ^e	0	41	0	11	52	7:21	
Additional systematic aerial surveys (November 19 - December 3)	On Channel	0SE, 0SW ^c	18	14	1	3	18	7:02	1613
	Off Channel	PWRTE, PWRTW ^d	2	14	1	3	18	6:27	
	Off Channel	CSRT, ESRT, WSRT ^e	0	11	0	3	14	1:59	
Opportunistic surveys	Flight ^f	NA	0	NA	NA	NA	NA	NA	NA
	Ground ^g	NA	24	NA	NA	NA	NA	22:34	465
Total			67	186	6	50	242	95:55	7916

^a see Appendix B for whooping crane group observation details. Includes B observations of same group on same day.

^b duration of survey effort is denoted in hours:minutes

^c primary transect (riverine): East – 0SE; West – 0SW (Figs. 1, 2)

^d primary return transect: East – PWRTE; West – PWRTW (Figs. 1, 2)

^e secondary return transect: East – WSRT; CSRT; West – ESRT (Figs. 1, 2)

^f opportunistic flight: includes aerial observations made while in route to systematic transects or deviations from the systematic transects.

^g opportunistic ground: includes efforts made by ground crew in motorized vehicle to search for known groups when flights were cancelled or to confirm or deny unconfirmed crane groups located outside of systematic flight transects. Does not include efforts to confirm possible crane groups at locations first observed by aerial observers during systematic flights.

Systematic aerial surveys. During systematic aerial monitoring, surveyors observed a total of 43 whooping crane group locations, including secondary locations of the same group on the same date, consisting of 63 individual whooping cranes (58 adults; 5 juveniles) in 19 unique groups (Table 1; Figs. 3, 4; [Appendix B](#), [Appendix C](#)). Most (86%) whooping crane groups observed during systematic aerial surveys were located along on-channel transects (Table 1). Pilots completed 53 of 70 (75.7%) regularly scheduled flights (Table 2). Seventeen flights were either cancelled or not completed due to low visibility or poor weather (Table 2). In addition, pilots completed 14 of 18 additionally scheduled flights after November 18 (Table 2). Among all 242 scheduled systematic transects encompassing river channel and off-channel primary/secondary return transects, 186 (76.9%) were completed (Table 1). There were six transects initiated but not completed when weather conditions deteriorated mid-survey (Table 1). Transects not initiated prior to ending the survey were recorded as cancelled along with all transects scheduled when the plane did not depart the airport. In total, 50 transects were cancelled (Table 1).

Opportunistic ground and aerial monitoring. We considered all ground monitoring observations that were not made to confirm previously observed whooping crane locations from systematic aerial surveys and all aerial observations made when not surveying defined transects to be opportunistic. Surveyors observed a total of 24 whooping crane group locations during opportunistic ground monitoring (Tables 1, 3; Figs. 3, 4; [Appendix B](#), [Appendix C](#)). Ground survey crews drove a total of 465 mi to search for potential whooping cranes (Tables 1, 3).

Table 2. Number of systematic aerial surveys completed, cancelled or incomplete, and scheduled during fall 2024 whooping crane monitoring for east and west flight routes along the Associated Habitat Reach of the central Platte River between Lexington and Chapman, Nebraska.

Flight route	East route	West route	Total
<i>Systematic surveys</i>			
No. completed	28	25	53
No. cancelled/incomplete	7	10	17
No. scheduled	35	35	70
<i>Percent systematic completed</i>	<i>80.0%</i>	<i>71.4%</i>	<i>75.7%</i>
<i>Additional systematic surveys flown^a</i>			
No. completed	7	7	14
No. cancelled/incomplete	2	2	4
No. scheduled	9	9	18
<i>Percent additional completed</i>	<i>77.8%</i>	<i>77.8%</i>	<i>77.8%</i>
Overall percent completed	79.5%	72.7%	76.1%

^a After November 27, only opportunistic ground searches were conducted to search for a single remaining known group

Table 3. Summary of ground search efforts for whooping cranes during fall 2024 monitoring along the Associated Habitat Reach of the central Platte River between Lexington and Chapman, Nebraska. The date of the search; information source that prompted the search (aerial sighting by plane [plane]; previous known location [known]; no information [no info]); miles driven during the search; and type of effort (aerial and ground surveyors working together [both]; ground observation only [ground]) are provided for each ground search effort entry. For confirmed whooping crane observations, the number of adults and juveniles enumerated are provided along with the corresponding USFWS and PRRIP group IDs. Color-coded unique group icons correspond to group symbols on Figures 7-10 and locations on maps in Appendix C.

























Unique group icon	USFWS group ID	PRRIP group ID	Date	Source	No. of confirmed whooping cranes (adults:juveniles)	Miles Driven	Type of effort
	24B-22	2024FA06	10/29/2024	Known	2:00	18	Ground
N/A	N/A	N/A	10/29/2024	Known	None	30	Ground
	24B-22	2024FA08	10/30/2024	Known	2:00	15	Ground
N/A	N/A	N/A	10/30/2024	Known	None	5	Ground
N/A	N/A	N/A	10/30/2024	Known	None	50	Ground
	24B-22	2024FA09	10/31/2024	Known	2:00	4	Ground
N/A	N/A	N/A	11/2/2024	Known	None	27	Ground
	24B-28	2024FA12	11/2/2024	Known	2:00	3	Ground
	24B-28	2024FA12	11/2/2024	Known	2:00	3	Ground
	24B-22	2024FA14	11/3/2024	Known	2:00	43	Ground
	24B-28	2024FA13	11/3/2024	Known	2:00	1	Ground
	24B-22	2024FA15	11/4/2024	Known	2:00	1	Ground
	24B-30	2024FA17	11/6/2024	Plane	2:01	1	Both
	24B-47	2024FA20	11/11/2024	Known	2:00	1	Ground
	24B-54	2024FA21	11/13/2024	No Info	6:01	2	Ground
	24B-54	2024FA25	11/16/2024	Known	5:00	1	Ground
	24B-85	2024FA29	11/17/2024	No Info	9:00	1	Ground
N/A	N/A	N/A	11/17/2024	Known	None	11	Ground
	24B-95	2024FA30	11/17/2024	No Info	2:01	1	Ground
	24B-95	2024FA31	11/18/2024	Known	2:01	4	Ground
	24B-54	2024FA32	11/18/2024	Known	2:00	4	Ground
	24B-95	2024FA35	11/20/2024	Known	2:01	4	Ground
	24B-54	2024FA36	11/20/2024	Known	2:00	4	Ground
	24B-95	2024FA46	11/23/2024	Known	2:01	1	Ground
	24B-54	2024FA47	11/23/2024	Known	2:00	1	Ground
N/A	N/A	N/A	11/26/2024	Plane	None	15	Both
	24B-54	2024FA53	11/27/2024	Known	2:00	3	Ground
	24B-54	2024FA56	11/28/2024	Known	2:00	10	Ground
	24B-54	2024FA57	11/29/2024	Known	2:00	15	Ground
	24B-54	2024FA58	11/30/2024	Known	2:00	10	Ground

Table 3 - continued

Unique group icon	USFWS group ID	PRRIP group ID	Date	Source	No. of confirmed whooping cranes (adults:juveniles)	Miles driven	Type of effort
N/A	N/A	N/A	12/1/2024	Known	None	34	Ground
N/A	N/A	N/A	12/2/2024	Known	None	60	Ground
N/A	N/A	N/A	12/3/2024	Known	None	40	Ground
N/A	N/A	N/A	12/3/2024	Known	None	42	Ground
TOTAL					62:6	465	

Whooping crane stopover metrics

Proportion of population stopping on the AHR. The USFWS estimated the AWB migratory whooping crane population to be 557 birds (95% confidence interval [CI] = 478.7, 645.1) based on winter 2024–2025 survey efforts within the primary survey area along the Texas coast of the Gulf of Mexico, USA wintering range (USFWS 2025; Appendix D).¹ Based on the 65 individual whooping cranes documented during PRRIP surveys, we estimated that 0.117 of the AWB whooping crane population was observed on the AHR along the central Platte River during the 2024 fall migration (Fig. 5a). The proportion of the AWB population using the AHR along the central Platte River during the fall migration has varied between 0.005 and 0.162 during 2001–2024 (mean = 0.044; median = 0.036; SE = 0.008; Fig. 5a).

Number of crane use days. The 19 unique whooping crane groups remained in the study area between one and 18 days (mean = 3.3; median = 1; SE = 1.0). Based on the lengths of stay of the 19 groups and the number of whooping cranes enumerated in each group, we calculated a total of 241 crane use days for the fall 2024 monitoring period between October 15 and December 3, 2024 (Fig. 5a). Between 2001 and 2024, the number of crane use days during the fall migration has varied between two and 584 days (mean = 97.1; median = 38; SE = 31.5; Fig. 5a).

5th and 95th percentile dates of whooping crane group observations and adjusted whooping crane stopover metrics

Fifth percentile dates of initial whooping crane group observations in Nebraska from the USFWS public sighting database ranged from October 13 to October 19 (mean = October 15; SE = 0.36 days) over the 24 10-year periods (Table 4). Ninety-fifth percentile dates ranged from November 5 to November 22 (mean = November 12; SE = 0.85 days; Table 4). The smallest range of days between the 5th and 95th percentile dates was 24 days between October 13 and November 5 during the 1990-2008 and 2001-2010 periods (Table 4). The largest range of days between the 5th and 95th percentile dates occurred during the 2015-2024 period, which spanned 35 days between October 19 and November 22 (Table 4).

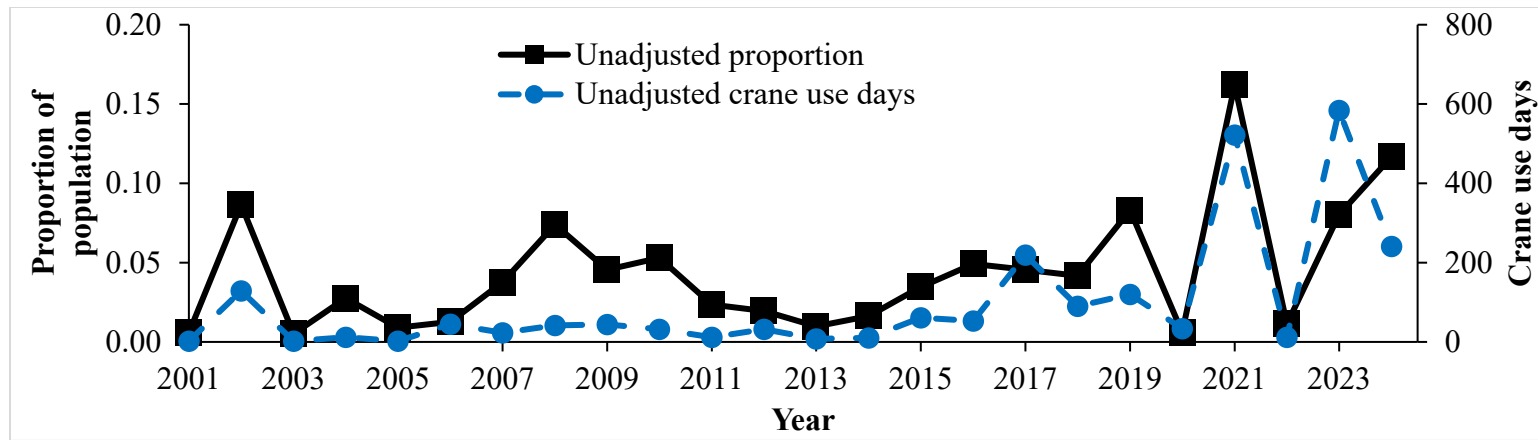
¹ Sixty-eight whooping cranes were documented outside the primary survey area during the winter 2024-2025 survey. The population estimate of 557 birds is based upon individuals observed within the primary sampling area alone.

All years of surveys except 2001 included the 5th percentile date for the corresponding period (Table 4). Surveys during 2001 began one day after the 5th percentile date. Surveys during 2001-2003, 2005-2007, 2013-2014, and 2018-2020 did not include the 95th percentile date for the corresponding period (Table 4). In 2001-2003, 2005-2007, 2018, and 2020, surveys ended one day before the 95th percentile date (Table 4). Surveys ended two days before the 95th percentile date in 2014 and 2019 (Table 4). In 2013, surveys ended three days before the 95th percentile date (Table 4). Therefore, we could not report metrics adjusted to reflect whooping crane use of the AHR during the standardized 5th and 95th percentile dates for those years.

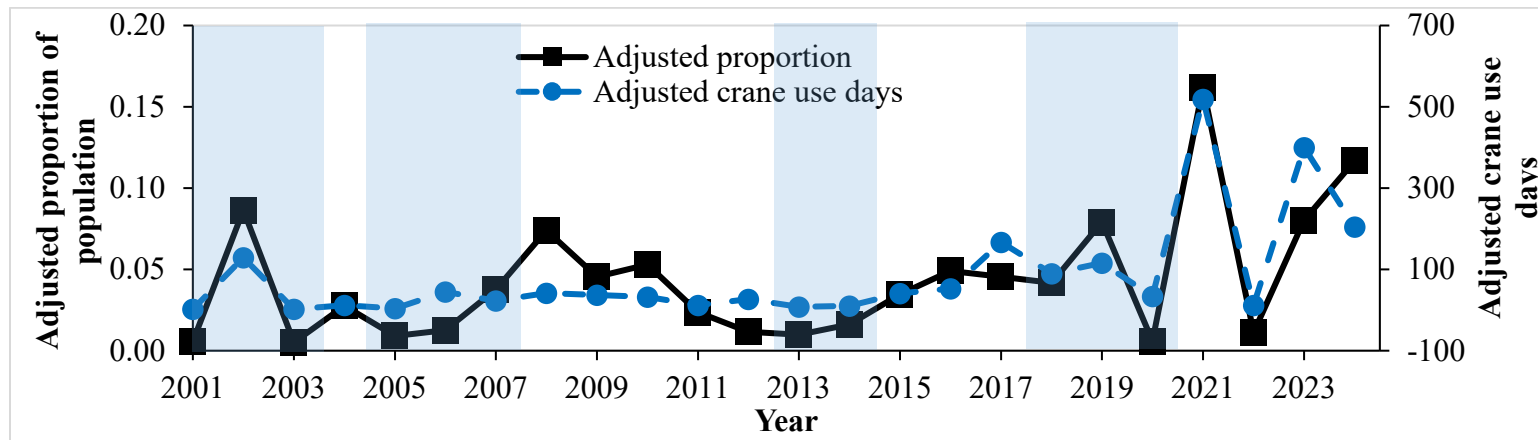
In years when the survey period encompassed the 5th and 95th percentile dates, those dates were used to adjust proportion of the population and crane use days to include only those observations made within the 5th and 95th percentile window. Adjustments were made for 2009, 2012, 2015, 2017, 2019, 2021, 2023, and 2024 (Figs. 5, 6). In 2012 and 2019, the number of individual whooping cranes observed decreased by two. This adjustment decreased the proportion of the population in these years to 0.012 in 2012 and 0.079 in 2019 (Figs. 5, 6). The number of crane use days decreased by seven days in 2009, five days in 2012, 20 days in 2015, 52 days in 2017, four days in 2019, three days in 2021, 184 days in 2023, and 36 days in 2024. The adjusted number of crane use days was 205 days in fall 2024. Except for 2012 and 2019, all decreases in the number of crane use days resulted from whooping crane groups arriving before and staying beyond the 95th percentile date.

Table 4. The 5th and 95th percentiles of initial dates of fall whooping crane group observations in Nebraska for 24 10-year periods ranging from 1992–2001 to 2015–2024. Percentiles were calculated using the USFWS whooping crane public sighting database for Nebraska during 1992–2024. The 10-year periods of public sightings in Nebraska used to determine the 5th and 95th percentile dates for each applicable survey year are provided. The start and end dates for PRRIP monitoring during each survey year are also provided.

Period	Applicable survey year(s)	5th percentile	95th percentile	Survey start date	Survey end date
1992–2001	2001	16-Oct	11-Nov	17-Oct	10-Nov
1993–2002	2002	13-Oct	11-Nov	9-Oct	10-Nov
1994–2003	2003	15-Oct	11-Nov	9-Oct	10-Nov
1995–2004	2004	14-Oct	11-Nov	9-Oct	16-Nov
1996–2005	2005	13-Oct	11-Nov	9-Oct	10-Nov
1997–2006	2006	13-Oct	11-Nov	9-Oct	10-Nov
1998–2007	2007	14-Oct	11-Nov	9-Oct	10-Nov
1999–2008	2008	13-Oct	5-Nov	9-Oct	10-Nov
2000–2009	2009	13-Oct	6-Nov	9-Oct	10-Nov
2001–2010	2010	13-Oct	5-Nov	9-Oct	10-Nov
2002–2011	2011	13-Oct	6-Nov	10-Oct	10-Nov
2003–2012	2012	14-Oct	10-Nov	9-Oct	16-Nov
2004–2013	2013	13-Oct	13-Nov	9-Oct	10-Nov
2005–2014	2014	15-Oct	14-Nov	9-Oct	12-Nov
2006–2015	2015	15-Oct	15-Nov	9-Oct	19-Nov
2007–2016	2016	15-Oct	16-Nov	9-Oct	20-Nov
2008–2017	2017	15-Oct	16-Nov	9-Oct	22-Nov
2009–2018	2018	16-Oct	16-Nov	9-Oct	15-Nov
2010–2019	2019	16-Oct	16-Nov	9-Oct	14-Nov
2011–2020	2020	16-Oct	16-Nov	9-Oct	15-Nov
2012–2021	2021	18-Oct	16-Nov	9-Oct	19-Nov
2013–2022	2022	17-Oct	16-Nov	9-Oct	18-Nov
2014–2023	2023	18-Oct	15-Nov	9-Oct	20-Jan
2015–2024	2024	19-Oct	22-Nov	15-Oct	3-Dec

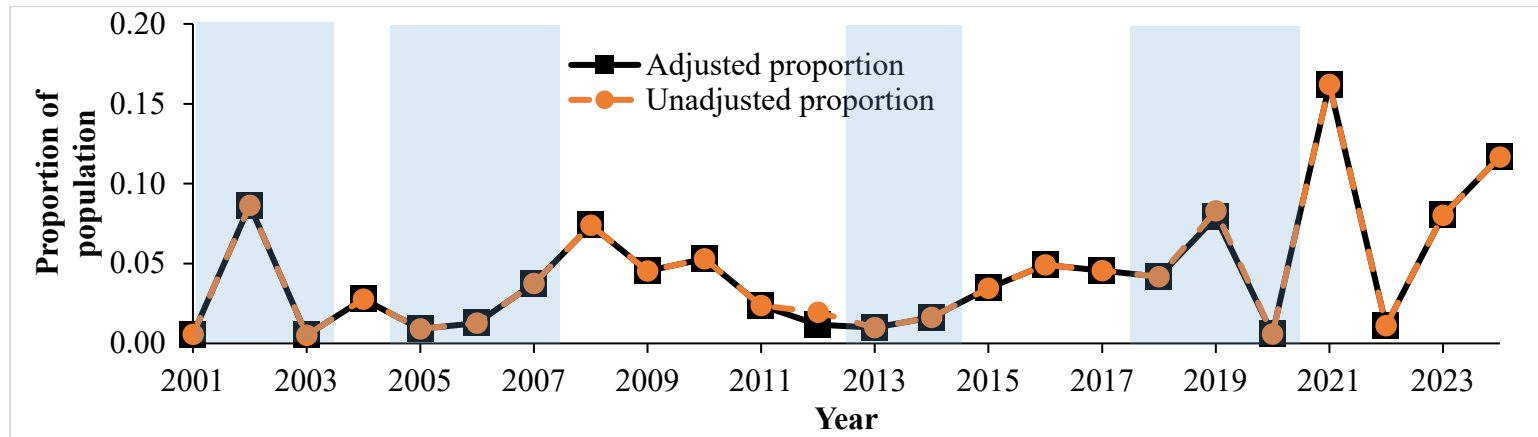


(a)

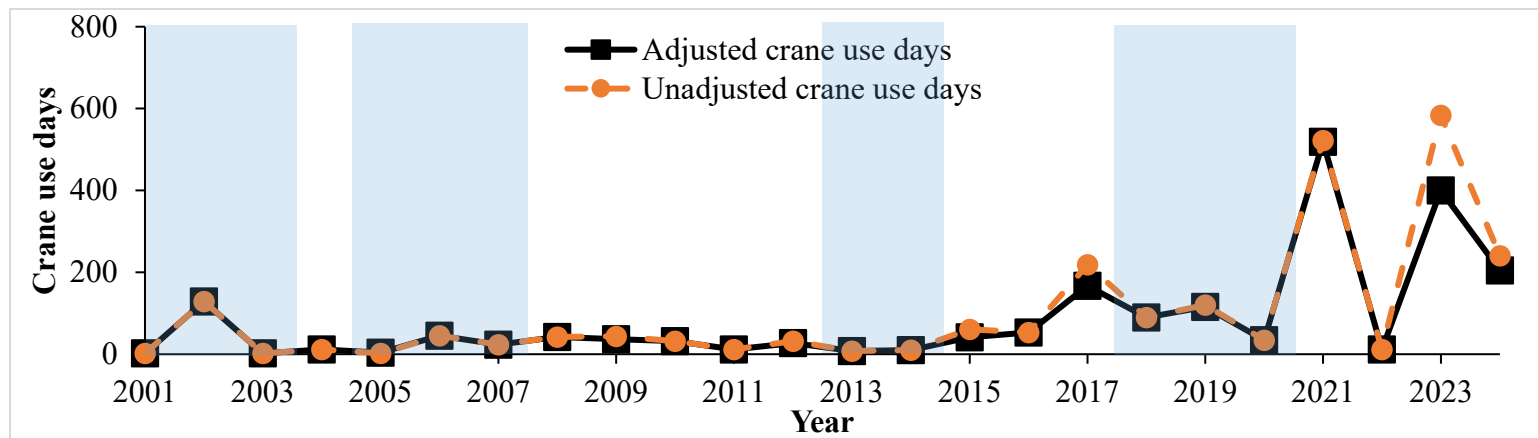


(b)

Figure 5. Annual variability in the proportion of the Aransas-Wood Buffalo (AWB) migratory whooping crane population that stopped on the Associated Habitat Reach (AHR) of the central Platte River and the associated number of crane use days between 2001 and 2024 during the fall migration. Panel (a) depicts the proportion of the population and number of crane use days for the entire fall survey period, whereas (b) illustrates the proportion of the population and number of crane use days calculated only for dates constrained by the 5th and 95th percentiles of dates of fall whooping crane group observations in Nebraska (see text for details). Whooping cranes were enumerated using PRRIP’s systematic aerial surveys and opportunistic aerial and ground sightings during fall of each year across the AHR between Lexington and Chapman, Nebraska. For the 2020 and 2023 proportion calculations, the estimated AWB population from winters 2019–2020 and winter 2022–2023, respectively, were used because no winter survey was completed during 2020–2021 or 2023–2024. The shaded sections in (b) denote that surveys in 2001–2003, 2005–2007, 2013–2014, and 2018–2020 did not encompass the 5th–95th percentile dates of group observations (Table 4) and metrics from these years could not be adjusted, thus are not directly comparable to those in the unshaded sections.



(a)



(b)

Figure 6. Annual variability between 2001 and 2024 during the fall migration in (a) the proportion of the Aransas-Wood Buffalo migratory whooping crane population that stopped on the Associated Habitat Reach (AHR) of the central Platte River, and (b) the associated number of crane use days. Each panel illustrates the whooping crane metric for the entire fall survey period (unadjusted; orange circles and dashed line) and only for dates constrained by the 5th and 95th percentiles of dates of fall whooping crane group observations in Nebraska (adjusted; black squares and solid line; see text for details). The shaded sections denote that surveys in 2001-2003, 2005-2007, 2013-2014, and 2018-2020 did not encompass the 5th–95th percentile dates of group observations (Table 4) and metrics from these years could not be adjusted, thus are not directly comparable to those in the unshaded sections. For the 2020 and 2023 proportion calculations, the estimated AWB population from winters 2019–2020 and winter 2022–2023, respectively, were used because no winter survey was completed during 2020–2021 or 2023–2024.

Whooping crane observations in relation to Platte River discharge and habitat metrics

During the October 15 through December 3 fall 2024 whooping crane migration monitoring period, Platte River discharge in the AHR ranged from a low of 89.9 cfs at Overton on October 17 ([USGS 2024a](#)) to a high of 2,270 cfs at Overton on November 28-29 (mean = 802; SE = 4.2; $n = 18,476$; [USGS 2024a](#)). Platte River discharge at the Overton gage ([USGS 2024a](#); Fig. 7) ranged from 89.9 cfs to 2,270 cfs with low and high flows recorded on October 17 and November 28-29, respectively (mean = 872; SE = 10.5; $n = 4,808$). Discharge at the Cottonwood Ranch gage ([USGS 2024b](#)) ranged from 140 cfs to 1,540 cfs (mean = 687; SE = 7.5; $n = 4,157$) with low flow recorded on October 15 and October 17 and high flow recorded on November 15 (Fig. 8). At the Kearney gage ([USGS 2024c](#)), discharge reached a low of 161 cfs on October 17-18 and a high of 2,070 cfs on November 29 (mean = 848; SE = 7.7; $n = 4,789$; Fig. 9). The Grand Island gage ([USGS 2024d](#)) recorded a low discharge of 139 cfs on October 19 and peak discharge of 1,810 cfs on October 29 (mean = 786; SE = 6.7; $n = 4,722$; Fig. 10). All gage discharge data were approved for publication except for the discharge data for the Cottonwood Ranch gage which was approved as estimated for October 29, November 1, and November 2-8, 2024.

Instantaneous discharge at the gaging station closest to the 32 observed whooping crane riverine locations ranged from 178 cfs to 1,750 cfs (mean = 748; median = 623; SE = 75.1; Table 5; Fig. 11), which included repeated observations of the same 16 unique riverine groups. These discharge measurements were recorded to the nearest 15 min of the time the whooping crane group was observed. Instantaneous discharge during the first riverine observation of each of the 16 unique groups ranged from 267 cfs to 1,750 cfs (mean = 889; median = 764; SE = 121; Table 5; Fig. 12). It is worth noting that these instantaneous discharges are indicative of river flow conditions when the group was first observed in the river channel by aerial or ground surveyors and not a measure of conditions when the group decided to stop.

Unobstructed channel widths at the 32 whooping crane riverine use sites ranged from 238 ft to 1,609 ft (mean = 799; median = 730; SE = 63.5; Table 6). Distance to the nearest forest at the 32 riverine use sites ranged from 119 ft to 1,588 ft (mean = 521; median = 460; SE = 46.4; Table 6).

2024/FA Overton

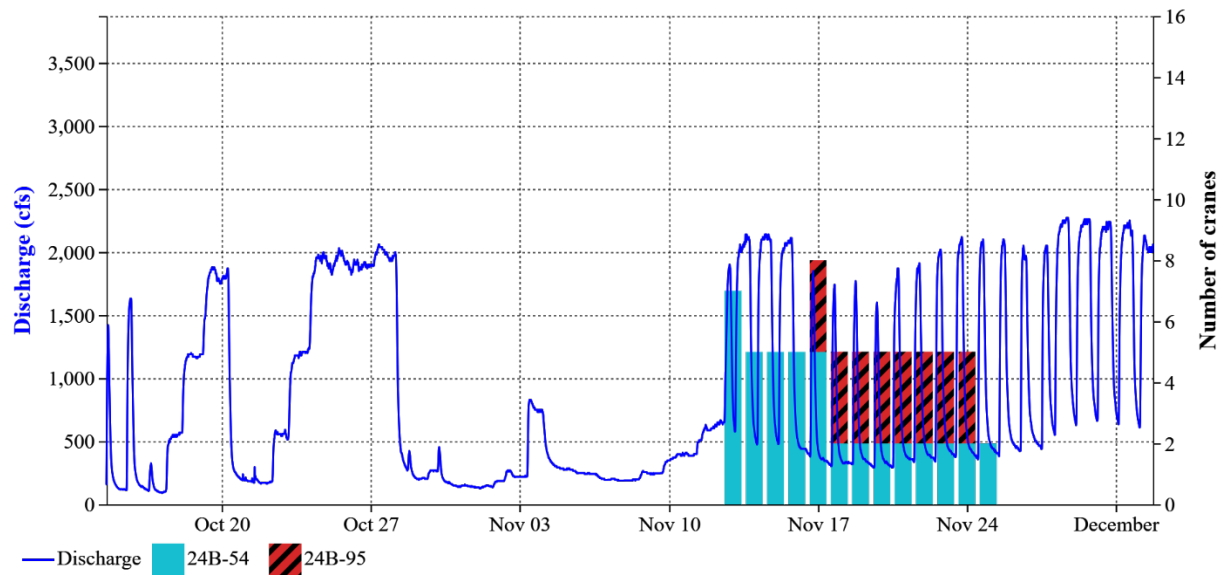


Figure 7. Platte River discharge in cubic feet per second (cfs) at the Overton, Nebraska gage during October 15 through December 3, 2024 ([USGS 2024a](#)) and the corresponding numbers of whooping cranes from each group (USFWS groups 24B-54 and 95 in color-coded bars) observed on the indicated dates either on- or off-channel at locations for which Overton was the nearest gaging station.

2024/FA Cottonwood

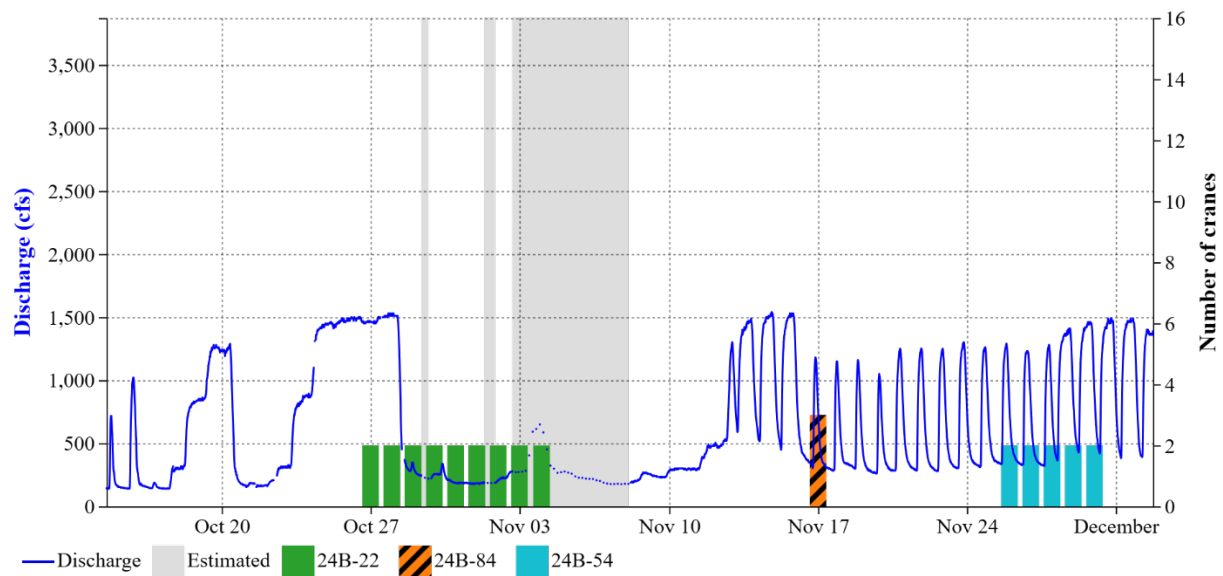


Figure 8. Platte River discharge in cubic feet per second (cfs) at the Cottonwood Ranch, Nebraska gage during October 15 through December 3, 2024 ([USGS 2024b](#)) and the corresponding numbers of whooping cranes from each group (USFWS groups 24B-22, 84, and 54 in color-coded bars) observed on the indicated dates either on- or off-channel at locations for which Cottonwood Ranch was the nearest gaging station.

2024/FA Kearney

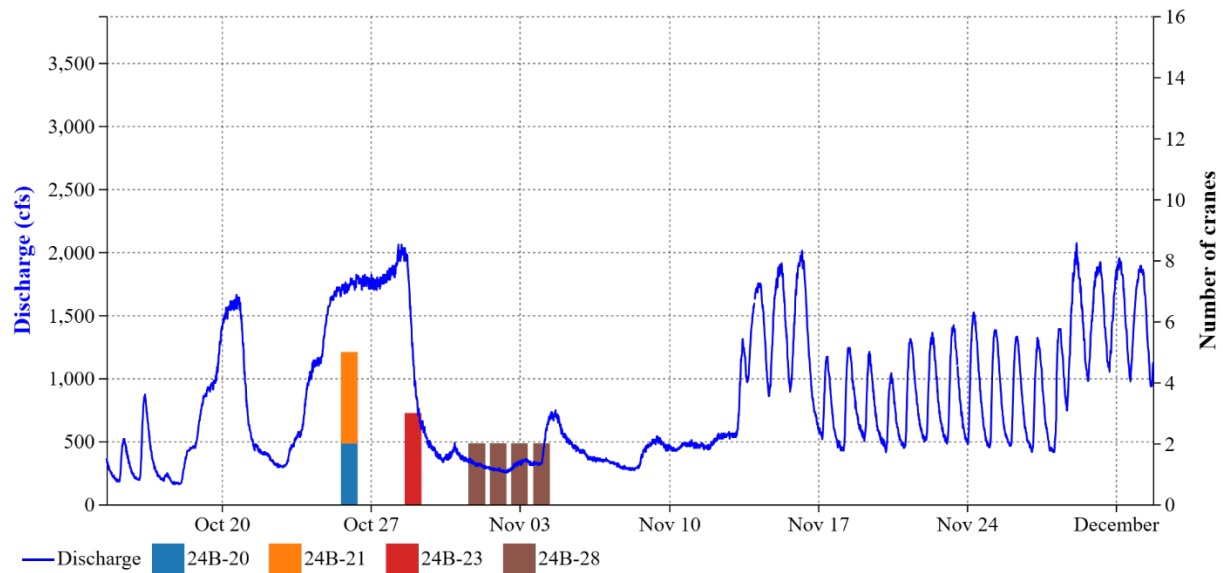


Figure 9. Platte River discharge in cubic feet per second (cfs) at the Kearney, Nebraska gage during October 15 through December 3, 2024 ([USGS 2024c](#)) and the corresponding numbers of whooping cranes from each group (USFWS groups 24B-20, 21, 23, and 28 in color-coded bars) observed on the indicated dates either on- or off-channel at locations for which Kearney was the nearest gaging station.

2024/FA Grand Island

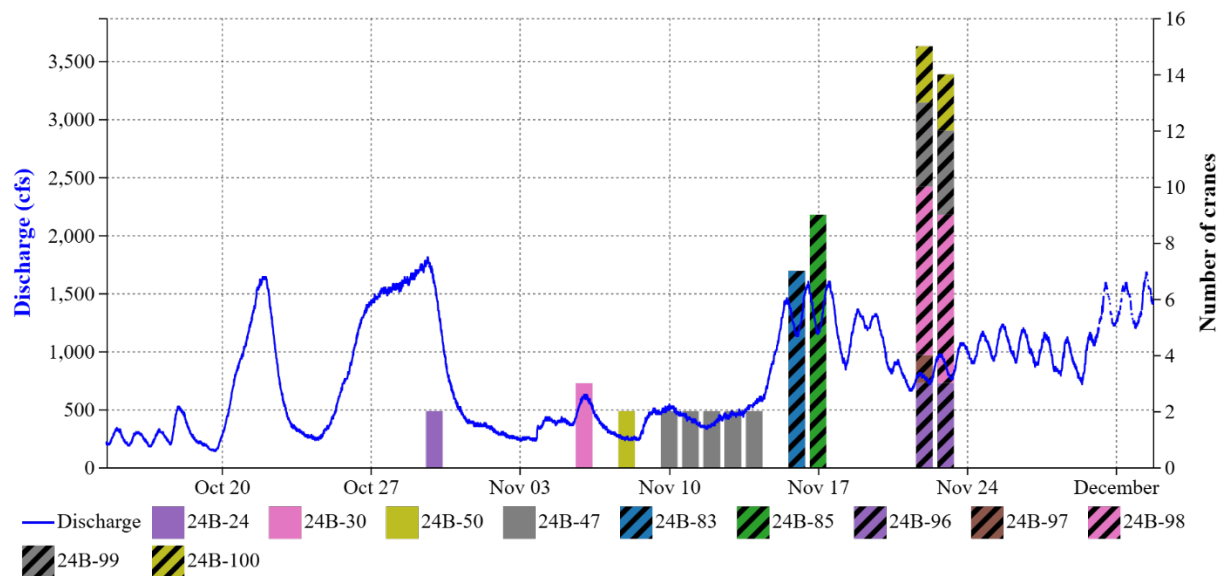


Figure 10. Platte River discharge in cubic feet per second (cfs; blue line [approved data]; red line [provisional data]) at the Grand Island, Nebraska gage during October 15 through December 3, 2024 ([USGS 2024d](#)) and the corresponding numbers of whooping cranes from each group (USFWS groups 24B-24, 30, 50, 47, 83, 85, 96, 97, 98, 99, and 100 in color-coded bars) observed on the indicated dates either on- or off-channel at locations for which Grand Island was the nearest gaging station.

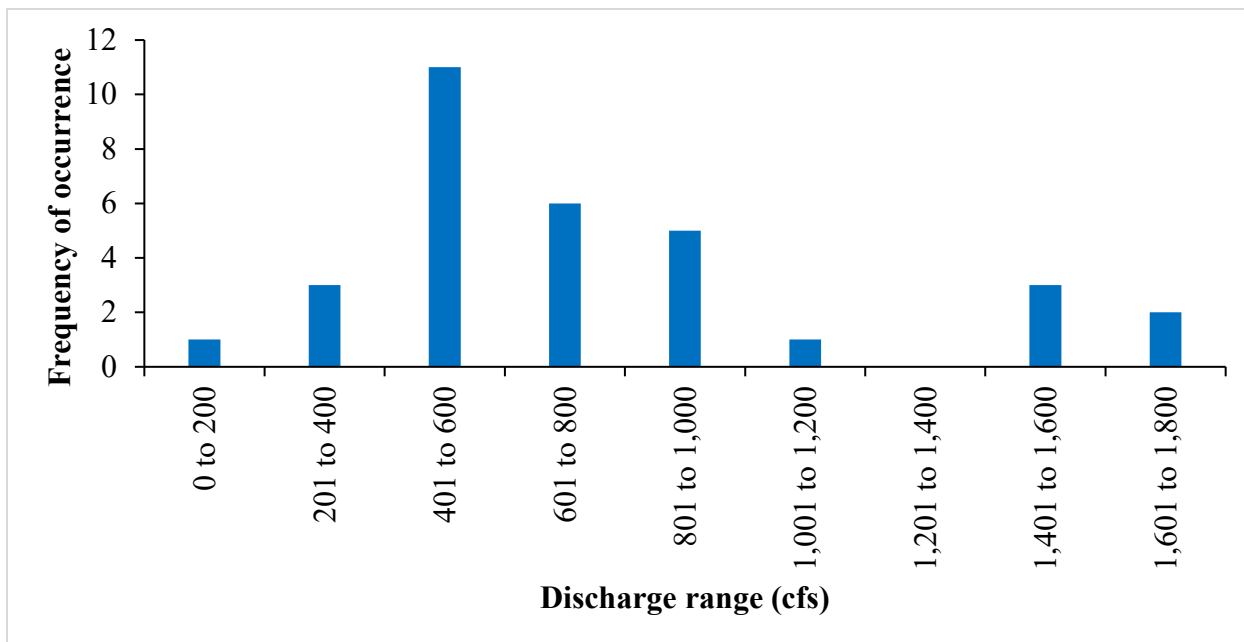


Figure 11. Distribution of Platte River discharge (cubic feet per second [cfs]) at the 32 total whooping crane group locations observed in the river channel during fall 2024 PRRIP monitoring. Discharge was determined from the gaging station nearest to the group location. Discharge data from the gaging station was used based on the time of group observation to the nearest 15 minutes.

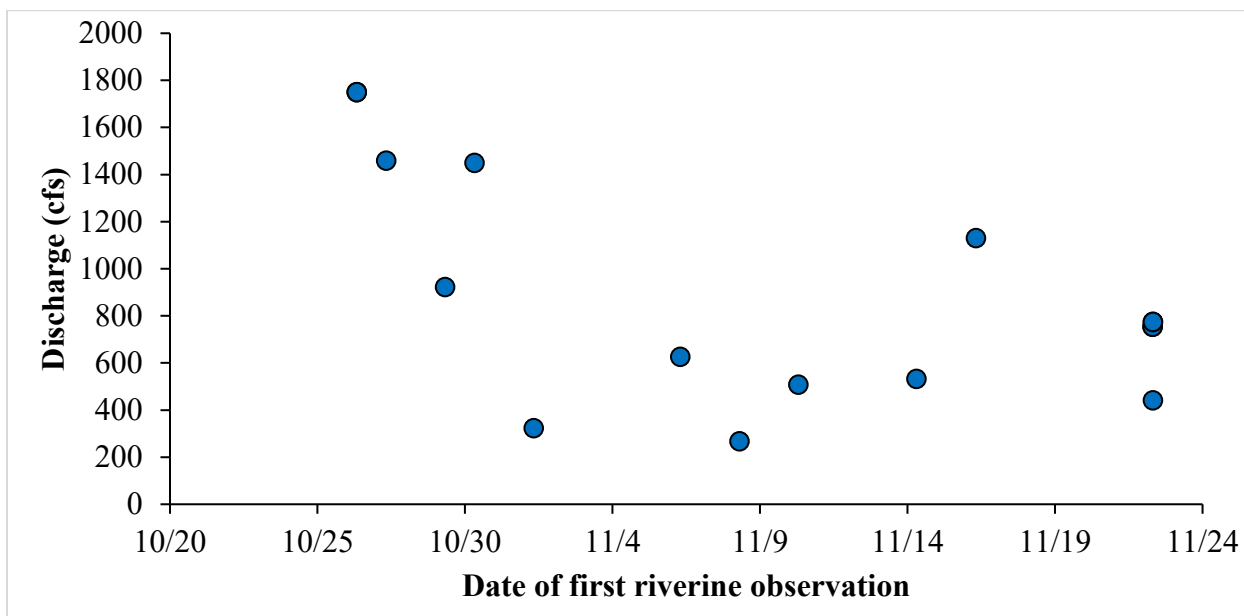


Figure 12. Platte River discharge (cubic feet per second [cfs]) by date during the first riverine observation of 16 unique whooping crane groups observed during fall 2024 PRRIP monitoring. Discharge was determined from the gaging station nearest to the group location. Discharge data from the gaging station was used based on the time of group observation to the nearest 15 minutes. Discharge is indicative of river flow conditions when the group was first observed in the river channel by aerial or ground surveyors and not a measure of conditions when the group decided to stop on the AHR.

Table 5. Whooping crane groups observed in the Platte River channel within the Associated Habitat Reach between Lexington and Chapman, Nebraska, and the associated river discharge (cubic feet per second [cfs]) at the gaging station nearest to the group location during fall 2024 monitoring. Discharge data from the gaging station was used based on the time of group observation to the nearest 15 minutes. Color-coded unique group icons correspond to group symbols on Figures 7–10 and locations on maps in Appendix C.

































Unique group icon	USFWS group ID	PRRIP group ID	No. of cranes (adults:juveniles)	Use site no.	Date	Gaging station ^a	Discharge (cfs)
	24B-20	2024FA01	2:00	1	10/26	Kearney	1750
	24B-21	2024FA02	2:01	2	10/26	Kearney	1750
	24B-22	2024FA03	2:00	3	10/27	Cottonwood	1460
	24B-22	2024FA04	2:00	4	10/28	Cottonwood	1510
	24B-22	2024FA10	2:00	7	11/1	Cottonwood	178
	24B-23	2024FA05	3:00	5	10/29	Kearney	922
	24B-24	2024FA07	2:00	6	10/30	Grand Island	1450
	24B-28	2024FA11	2:00	8	11/1	Kearney	323
	24B-28	2024FA12	2:00	9	11/2	Kearney	270
	24B-30	2024FA17	2:01	10	11/6	Grand Island	626
	24B-47	2024FA19	2:00	12	11/10	Grand Island	508
	24B-47	2024FA20	2:00	13	11/11	Grand Island	415
	24B-47	2024FA22	2:00	14	11/14	Grand Island	552
	24B-50	2024FA18	2:00	11	11/8	Grand Island	267
	24B-54	2024FA23	5:00	15	11/14	Overton	533
	24B-54	2024FA24	5:00	16	11/15	Overton	536
	24B-54	2024FA25	5:00	17	11/16	Overton	495
	24B-54	2024FA28	5:00	19	11/17	Overton	403
	24B-54	2024FA40	2:00	21	11/22	Overton	442
	24B-54	2024FA47	2:00	27	11/23	Overton	487
	24B-54	2024FA52	2:00	30	11/26	Cottonwood	619
	24B-83	2024FA26	6:01	18	11/16	Grand Island	1130
	24B-95	2024FA39	2:01	20	11/22	Overton	442
	24B-95	2024FA46	2:01	26	11/23	Overton	487
	24B-96	2024FA41	2:01	22	11/22	Grand Island	754
	24B-96	2024FA48	2:01	28	11/23	Grand Island	834
	24B-98	2024FA43	6:00	23	11/22	Grand Island	754
	24B-98	2024FA49	6:00	29	11/23	Grand Island	834

Table 5 - Continued

Unique group icon	USFWS group ID	PRRIP group ID	No. of cranes (adults:juveniles)	Use site No.	Date	Gaging station ^a	Discharge (cfs)
	24B-99	2024FA44	3:00	24	11/22	Grand Island	774
	24B-99	2024FA54	3:00	31	11/23	Grand Island	834
	24B-100	2024FA45	2:00	25	11/22	Grand Island	774
	24B-100	2024FA55	2:00	32	11/23	Grand Island	834

^a Gaging Stations: Overton, Nebraska ([USGS 2024a](#)); Cottonwood Ranch, Nebraska ([USGS 2024b](#)); Kearney, Nebraska ([USGS 2024c](#)); Grand Island, Nebraska ([USGS 2024d](#)).

Table 6. Whooping crane groups observed during fall 2024 in the Platte River channel (i.e., riverine locations) within the Associated Habitat Reach between Lexington and Chapman, Nebraska, and the associated unobstructed channel width and distance to the nearest forest at the use location. Provided for each group are the USFWS and PRRIP group identification (ID) number; use site number; x and y UTM 14N coordinates. Color-coded unique group icons correspond to group symbols on Figures 7-10 and locations on maps in Appendix C. All habitat metrics were measured at a ratio of 1:1,750 using PRRIP aerial imagery from November 2024 and cross-checked with photographs taken when the observation was made .

































Unique group icon	USFWS group ID	PRRIP group ID	Use site no.	Zone 14N UTMx	Zone 14N UTM _y	Unobstructed channel width (ft)	Nearest forest (ft)
	24B-20	2024FA01	1	517918	4505546	906	819
	24B-21	2024FA02	2	505478	4501201	654	514
	24B-22	2024FA03	3	459663	4503714	472	262
	24B-22	2024FA04	4	472538	4503444	1000	861
	24B-22	2024FA10	7	460017	4503763	672	346
	24B-23	2024FA05	5	485306	4501603	417	119
	24B-24	2024FA07	6	528628	4508261	897	554
	24B-28	2024FA11	8	506124	4501465	966	1588
	24B-28	2024FA12	9	505512	4501205	636	546
	24B-30	2024FA17	10	541810	4513100	303	353
	24B-47	2024FA19	12	541974	4513094	1031	433
	24B-47	2024FA20	13	542575	4513319	674	376
	24B-47	2024FA22	14	544183	4514142	816	745
	24B-50	2024FA18	11	561620	4526472	945	438
	24B-54	2024FA23	15	454001	4503671	663	333
	24B-54	2024FA24	16	453140	4503614	342	411
	24B-54	2024FA25	17	453526	4503548	606	511
	24B-54	2024FA28	19	453825	4503681	474	246
	24B-54	2024FA40	21	453669	4503716	618	339

Table 6 - Continued

Unique group icon	USFWS group ID	PRRIP Group ID	Use site no.	Zone 14N UTMx	Zone 14N UTMy	Unobstructed channel width (ft)	Nearest forest (ft)
	24B-54	2024FA47	27	449461	4504490	261	549
	24B-54	2024FA52	30	472713	4503462	884	889
	24B-83	2024FA26	18	538974	4511399	893	344
	24B-95	2024FA39	20	453698	4503734	993	399
	24B-95	2024FA46	26	449451	4504487	238	586
	24B-96	2024FA41	22	567045	4532555	1609	720
	24B-96	2024FA48	28	564830	4529798	529	542
	24B-98	2024FA43	23	541562	4512785	732	529
	24B-98	2024FA49	29	540766	4512256	1440	447
	24B-99	2024FA44	24	540717	4512305	1390	582
	24B-99	2024FA54	31	540756	4512248	1404	415
	24B-100	2024FA45	25	532111	4509816	727	401
	24B-100	2024FA55	32	540775	4512260	1372	473

Comparison between PRRIP and USFWS data

We provide a comparison between whooping crane observations collected during PRRIP monitoring with those from the USFWS whooping crane public sighting database (USFWS *unpublished data*) for fall 2024 in Table 7. PRRIP coordinates with the USFWS to determine unique whooping crane groups throughout the monitoring period. Unique groups are typically individually identifiable by their arrival date, location, and group composition. However, discrepancies among datasets occur when: (1) whooping crane groups arrive before PRRIP systematic monitoring begins or after it has ended; (2) whooping crane groups arrive and are reported to USFWS later in the day after systematic transects have been flown; (3) whooping crane groups leave the river prior to the plane surveying that portion of the transect; (4) observers do not see the group; (5) flights are cancelled due to poor visibility or weather; (6) or the composition and/or location of a group changes over time resulting in observations that may differ based upon date and time the observation was made.

During fall 2024, the USFWS public sighting database reported two whooping crane groups (24B-109 and 24B-111) that were not observed by PRRIP (Table 7). Both group 24B-109 and group 24B-111 were reported to the USFWS after PRRIP had ended surveys for the 2024 fall monitoring season. PRRIP observed group 24B-54a on the morning of November 13 as a group of six adults and one juvenile. The USFWS received additional information on November 13 from a daily follow confirming an additional adult within this group, giving a total of seven adults and one juvenile.

Overall, the USFWS database consisted of 73 whooping crane (67 adults; six juveniles) observations (Table 7). In comparison, PRRIP surveyors observed 65 whooping cranes (59 adults; six juveniles; Table 7). The total number of crane use days from USFWS data was 117 use days greater than that from PRRIP data due to the two additional groups reported by USFWS, public sightings made over a wider range of dates, and calculation of crane use days using initial group sizes over the entire length of stay (Table 7).

Table 7. Comparison between whooping crane groups observed during PRRIP surveys with those from the USFWS public sighting database during fall 2024 monitoring along the central Platte River, Nebraska. Included for each unique group are a color-coded icon; group identification (ID) numbers assigned by PRRIP and USFWS; the date(s) the group was observed and number of days present; the number of adults and juveniles in the group; and number of crane use days. Color-coded unique group icons correspond to group symbols on Figures 7-10 and locations on maps in Appendix C.




















Unique group icon	PRRIP					USFWS				
	PRRIP group ID ^a	Dates present	Days present	Adults: juveniles	Crane use days ^c	USFWS group ID ^b	Dates present	Days present	Adults: juveniles	Crane use days ^d
	2024FA01	10/26	1	2:00	4	24B-20	10/26	1	2:00	4
	2024FA02	10/26	1	2:01	6	24B-21	10/26	1	2:01	6
	2024FA03,04,06,08,09,10,14,15	10/27-11/4	9	2:00	20	24B-22	10/27-11/4	9	2:00	20
	2024FA05	10/29	1	3:00	6	24B-23	10/29	1	3:00	6
	2024FA07	10/30	1	2:00	4	24B-24	10/30	1	2:00	4
	2024FA11,12,13,16	11/1-11/4	4	2:00	10	24B-28	11/1-11/4	4	2:00	10
	2024FA17	11/6	1	2:01	6	24B-30	11/6	1	2:01	6
	2024FA19,20,22	11/10-11/14	5	2:00	12	24B-47	11/10-11/14	5	2:00	12
	2024FA18	11/8	1	2:00	4	24B-50	11/8	1	2:00	4
	2024FA21	11/13	1	6:01	14	24B-54a	11/13-12/1	19	7:01 ^f	160
	2024FA23,24,25,28	11/14-11/17	4	5:00 ^e	20	24B-54b				
	2024FA32,34,36,38,40,47,51,52,53,56,57,58	11/18-11/30	13	2:00 ^e	26	24B-54c				
	2024FA26	11/16	1	6:01	14	24B-83	11/16	1	6:01	14
	2024FA27	11/17	1	3:00	6	24B-84	11/17	1	3:00	6
	2024FA29	11/17	1	9:00	18	24B-85	11/17	1	9:00	18

Table 7 - continued

Unique group icon	PRRIP group ID ^a	Dates present	Days present	Adults: juveniles	Crane use days ^c	USFWS group ID ^b	Dates present	Days present	Adults: juveniles	Crane Use days ^d
	2024FA30,31,33,35,37,39, 46,50	11/17-11/24	8	2:01	27	24B-95	11/17-11/24	8	2:01	27
	2024FA41,48	11/22-11/23	2	2:01	9	24B-96	11/22-11/23	2	2:01	9
	2024FA42	11/22	1	1:00	2	24B-97	11/22	1	1:00	2
	2024FA43,49	11/22-11/23	2	6:00	18	24B-98	11/22-11/23	2	6:00	18
	2024FA44,54	11/22-11/23	2	3:00	9	24B-99	11/22-11/23	2	3:00	9
	2024FA45,55	11/22-11/23	2	2:00	6	24B-100	11/22-11/23	2	2:00	6
NA	NA	NA	NA	NA	NA	24B-109 ^g	12/3-12/7	5	1:00	5
NA	NA	NA	NA	NA	NA	24B-111 ^g	12/11-12/12	2	6:00	12
Total		58 groups	62	59:6	241	Total	21 groups	70	67:6	358

^a PRRIP assigns a new whooping crane group ID each day a group is observed.

^b USFWS assigns a whooping crane group ID based on an initial sighting basis of identification and subsequent following of groups.

^c Crane use days based on PRRIP observations are calculated by multiplying the number of individual cranes in each group by the number of days the group was present, plus one day per crane. This is because each crane observed during early morning PRRIP aerial surveys is assumed to have been present the evening prior to the morning of the first observation.

^d Crane use days based on USFWS public sighting observations are calculated by multiplying the number of individual cranes in each group by the number of days the group was present, plus one day per crane only for observations made prior to 11:59 a.m.

^e Individuals following initial observation are not included in total crane count because they were already counted as part of the original observation of 6 adults and 1 juvenile.

^f USFWS received additional information confirming an additional adult from a daily follow of this WC group after PRRIP surveys had concluded for the day.

^g These observations occurred after PRRIP had ended surveys for the 2024 fall monitoring season.

Detectability of whooping crane decoys

EDO staff placed whooping crane decoy sets at 20 unique locations between October 21 and November 15, 2024 (Table 8). Six decoy sets consisted of one whooping crane decoy; nine sets consisted of two decoys; and five sets consisted of three decoys (Table 8). EDO staff placed four of the six decoy sets consisting of one decoy, three of nine sets consisting of two decoys, and three of five sets consisting of three decoys in the river channel (Table 8). The remaining ten sets of decoys were placed in off-channel, lowland grassland, or palustrine wetland habitat (Table 8). Aerial surveyors spotted eight of ten decoy sets placed in the river channel (80%) and five of the ten decoy sets placed at off-channel locations (50%; Table 8). Aerial surveyors detected three of the six sets consisting of one decoy; six of nine sets consisting of two decoys; and four of five sets consisting of three decoys (Table 8).

Table 8. Whooping crane decoy sets placed in river channel and off-channel habitats throughout the Associated Habitat Reach of the central Platte River between Lexington and Chapman, Nebraska during PRRIP’s fall 2024 systematic aerial surveys. Provided for each decoy set are the date the set was placed, date of the first flight after decoy placement, UTM x and y coordinates, number of decoys in the set, habitat type at the location of placement, and whether aerial surveyors detected the set.

Date placed	Date of flight	Zone 14N UTMx	Zone 14N UTM _y	No. of decoys	Habitat type	Detected
10/21/2024	10/22/2024	449430	4504387	2	Grassland - Lowland	Yes
10/21/2024	10/22/2024	505627	4500954	2	Grassland - Lowland	No
10/23/2024	10/24/2024	443511	4505483	2	Grassland - Lowland	No
10/23/2024	10/24/2024	506994	4501660	1	Grassland - Lowland	Yes
10/24/2024	10/25/2024	443118	4504862	1	Wetted Channel	Yes
10/24/2024	10/25/2024	507114	4501962	2	Grassland - Lowland	Yes
10/25/2024	10/26/2024	442749	4504944	1	Grassland - Lowland	No
10/25/2024	10/26/2024	509876	4502391	3	Wetted Channel	Yes
10/28/2024	10/29/2024	534250	4510618	1	Wetted Channel	No
10/28/2024	10/31/2024	444987	4505137	2	Wetted Channel	Yes
11/1/2024	11/5/2024	500684	4502119	3	Palustrine Wetland	No
11/4/2024	11/6/2024	564957	4530168	3	Wetted Channel	Yes
11/6/2024	11/7/2024	499193	4501138	2	Grassland - Lowland	Yes
11/7/2024	11/8/2024	547237	4515441	2	Grassland - Lowland	No
11/11/2024	11/12/2024	453147	4503518	2	Wetted Channel	Yes
11/12/2024	11/14/2024	530440	4508565	3	Grassland - Lowland	Yes
11/13/2024	11/14/2024	502284	4501251	1	Wetted Channel	Yes
11/13/2024	11/14/2024	550301	4515918	2	Wetted Channel	Yes
11/14/2024	11/15/2024	564252	4529488	3	Wetted Channel	Yes
11/15/2024	11/16/2024	496744	4501023	1	Wetted Channel	No

Discussion

During fall 2024, PRRIP documented the second highest proportion of the Aransas-Wood Buffalo population (0.117) and third highest number of crane use days (241 days) along the Platte River (Fig. 5a) since 2001. When adjusting for the 5th and 95th percentile dates, the number of crane use days decreased to 205 days but remained the third highest recorded by PRRIP (Figs. 5, 6). PRRIP documented a total of 50 whooping cranes over the scheduled monitoring season from October 15 through November 18, 2024. An additional 15 whooping cranes were observed during the season extension from November 19 through December 3, resulting in a total of 65 whooping cranes documented throughout the entire monitoring period. With 28 of the 65 whooping cranes having multiple day stopovers, ranging between one and 18 days (mean = 3.3; median = 1; SE = 1.0), PRRIP's EDO estimated 241 total crane use days for fall 2024.

Fall whooping crane stopover metrics for the central Platte River as determined through PRRIP's surveys have demonstrated considerable annual variability (Figs. 5, 6). Over the past six years, high use has alternated almost annually with low use, and with increased amplitude. High annual variability in whooping crane stopover metrics makes it more difficult to quantify whether significant long-term changes in these metrics have occurred. The high amount of interannual variability in stopover metrics is likely due to the multiple factors affecting stopover decisions, locations, and durations. Stopover decisions may be related to resource availability on wintering and breeding ranges, habitat and resource availability at stopover locations, duration of migratory bout, duration of last stopover, individual body condition, weather, and other environmental cues ([Anderson et al. 2019](#), [Pearse et al. 2020](#), [Schmaljohann et al. 2022](#)). Whooping cranes have demonstrated low fidelity to individual stopover sites across the migration corridor ([Pearse et al. 2020](#)). Individual cranes that use the AHR as a stopover site in one year may not necessarily use the AHR as a stopover site the following year. The Program is currently investigating factors hypothesized to play a role in stopover decisions along Nebraska sand bed rivers to help explain the variability observed ([PRRIP 2022](#); [Appendix A](#)).

Most whooping crane groups observed during PRRIP's fall 2024 surveys were distributed on the eastern half of the AHR, which was similar to that observed during fall 2023 and in previous years of monitoring (Figs. 3, 4; [PRRIP 2023a](#)). Fourteen of the 19 unique groups were observed in the eastern half of the AHR. However, when considering the 67 total group locations recorded by PRRIP, only 27 group locations were observed east of Minden compared to 40 group locations observed west of Minden. This can be attributed to longer stopovers as well as multiple observations of the same group at a different location on the same day (i.e., "B" locations in Appendix B) by three (24B-22, 54, and 95) of the five groups located on the western half of the AHR. Stopover lengths for these five groups ranged from one to 18 days (mean = 7.4; median = 8; SE = 3.14). Comparatively, stopover lengths for the 14 eastern groups ranged from one to five days (mean = 1.79; median = 1; SE = 0.334). The higher intensity of use of the eastern half of the AHR by whooping cranes is likely due to differences in river channel geomorphology, habitat characteristics in and surrounding the river, and position of the eastern AHR relative to the primary migratory flyway for whooping cranes ([Johnson 1994](#), [Murphy et al. 2004](#), [Farnsworth et al. 2018](#), [Pearse et al. 2018](#), [PRRIP 2022](#)).

Whooping cranes stopping within the AHR in fall of 2024 generally experienced a range of low to moderate discharge (i.e., <1,000 cfs) at the nearest gage (Figs. 7–11). Of the 32 riverine observations PRRIP documented, only six observations occurred during a period when discharge was $\geq 1,000$ cfs. Furthermore, the 16 initial riverine observations for each group occurred throughout a range of instantaneous discharge values spanning between 267 cfs and 1,750 cfs (mean = 889; median = 764; SE = 121). Discharge from the nearest gage while whooping crane groups are still on the river in the morning during aerial surveys does provide an indication of river conditions during the stopover but does not reflect the flow conditions whooping cranes are evaluating as they approach the Platte River, likely the evening prior to initial observation. The Program is currently using telemetry data to provide a temporally matched dataset to better reflect flow conditions when birds are deciding whether to stop or fly over the Platte River ([PRRIP 2022](#)).

Finally, in this report we used the USFWS public sighting database to assess how the 5th and 95th percentiles of dates for fall whooping crane arrivals in Nebraska varied over time (Table 4). We evaluated whether PRRIP fall survey dates during 2001 through 2024 encompassed these percentile dates as a way of standardizing the monitoring window across years. For those years when PRRIP fall surveys did encompass the 5th-95th percentile dates we made adjustments to stopover metrics to correspond with observations recorded only during dates corresponding to the 5th through 95th percentiles. Fall surveys in 2001-2003, 2005-2007, 2013-2014, and 2018-2020 did not encompass the 5th-95th percentile dates for the corresponding periods (Table 4). Therefore, we could not assess whooping crane metrics adjusted to the 5th through 95th percentile dates for these years. Use of 5th and 95th percentiles of dates to calculate whooping crane metrics resulted in adjustments being made to metrics in 2009, 2012, 2015, 2017, 2019, 2021, 2023, and 2024 (Figs. 5, 6). Adjustments were minor in 2009, 2012, 2019, and 2021. However, large adjustments were made to the number of crane use days in 2015, 2017, 2023, and 2024. In 2015, the number of crane use days decreased by 20 days (61 to 41 days), in 2017, the number of crane use days decreased by 52 days (219 to 167 days), and in 2023, the number of crane use days decreased by 184 days (584 to 400 days). Adjustments to the proportion of the population using the AHR were made for 2012 (from 0.019 to 0.012) and 2019 (from 0.083 to 0.079). For 2024, due to six whooping crane groups staying beyond the 95th percentile date of November 22, the number of crane use days decreased by 36 days (241 to 205 days). No adjustment was made for proportional use given all individual cranes were initially detected within the 5th-95th percentile dates. The fall 2024 monitoring period of October 15 through December 3, 2024 encompassed both the 5th and 95th percentile dates of initial whooping crane group observations in Nebraska.

Incidental Take

The USFWS in its 2006 Biological Opinion ([USFWS 2006](#)) and 2018 Supplemental Biological Opinion ([USFWS 2018](#)) on the Program developed an incidental take statement addressing incidental take for whooping cranes associated with monitoring and research as well as land management and habitat restoration conducted in the Platte River basin covered by the Program. Such take includes harm caused by harassment of individuals, and effects to fitness of adults resulting in loss of productivity. Six instances of take in the form of harassment of whooping cranes is exempted during the First Increment and 13-year Extension of the Program. The total amount of take that would remove an individual from the migrating population (i.e., lethal or crippling) exempted is one whooping crane during the First Increment and 13-year Extension of the Program.

The USFWS requires documentation of any human activity that occurred in the proximity of whooping cranes that could constitute “take” as defined by the Endangered Species Act (i.e., “...to harass, harm, pursue, hunt, shoot, wound, kill, capture, collect, or attempt to engage in any such conduct”). Because harassment interrupts essential feeding or sheltering behaviors, the definition includes disturbance of whooping cranes sufficient to result in cranes taking flight. Since the Program’s initiation in 2007, the Program has not observed take (lethal, crippling, harm, harassment, etc.) of any whooping cranes due to monitoring or research activities or due to habitat restoration and land management activities.

During the fall 2024 monitoring period, PRRIP documented no instances of take as defined above. Specifically:

- *Lethal or crippling take*

There were no observations of crippling or lethal take of whooping cranes this season resulting from the monitoring conducted by PRRIP.

- *Harassment*

PRRIP staff did not observe or engage in any activity that could be construed as harassment as defined by USFWS.

- *Public disturbance*

PRRIP staff did not observe any incident of public disturbance of whooping cranes.

Past Research Synthesis

In addition to implementation of the Program’s monitoring protocol, directed research has been conducted by the Program since 2007 to provide data to evaluate the Program’s management objectives and priority hypotheses. Design and implementation of research activities was guided by the Program’s EDO and Technical Advisory Committee (TAC), reviewed by the Program’s Independent Scientific Advisory Committee (ISAC), and ultimately approved by the Program’s Governance Committee (GC). Whooping crane monitoring and research conducted along the central Platte River were designed and implemented to provide information on an array of topics relevant to species management, including:

- Methods for monitoring whooping cranes and using detection data for drawing conclusions
- Whooping crane use of the central Platte River and the Great Plains migratory corridor
- Identification and characterization of riverine use sites
- Identification and characterization of diurnal use sites
- Whooping crane habitat selection analyses
- Management of river hydrology and morphology for whooping crane habitat
- Whooping crane use of off-channel palustrine wetlands

Links to these studies and other research relevant to the Program’s objectives for whooping cranes can be found in [Appendix E](#). Previous data and analyses are included in seasonal reports produced by the Platte River Cooperative Agreement (2001–2006) and the Program (2007–present), and are available in the Program’s online Public Library (<https://platteriverprogram.org/program-library>), located by selecting “whooping crane” as the target species and using “Monitoring Report” as the

Title Keyword Search terms. Long-term monitoring and research are used to evaluate progress toward the management objective and to support adaptive management decisions related to our target species (see [Appendix E](#) which provides a synthesis of past Program research). Data collected by the Program are available in published form or upon request for use by other programs to provide information on whooping crane use of the central Platte River that may be helpful for broader scale interpretation of migratory habitat use and factors to be considered when making management decisions.

Supplements

QA/QC of database was performed by PRRIP EDO staff.
Original datasheets – Retained at PRRIP EDO office.

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Appendix A. Whooping Crane Extension Big Questions and Hypotheses

EBQ #4 What factors influence WC decision to stop or fly over the AHR?
Management Hypothesis: Probability of WC stopping within the AHR is a function of discharge.
Underlying Physical Processes Hypothesis – The probability of a WC stopover is a function of the relationship between wetted width and the percent of the channel that is of suitable depth for roosting (< 1 ft deep).
Alternative Hypotheses: <ul style="list-style-type: none"> • Time of day is the primary driver of WC stopovers with probability of use increasing with decreasing time until dark. • The probability of WC stopping over is a function of MUCW and unforested corridor width. • The probability of WC stopping over is a function of land cover or habitat suitability within a biologically relevant radius of flyover location. • Weather (wind speed and direction, precipitation, temperature) encountered since the last stopover is an important predictor of WC stopovers with the probability of use of the AHR increasing as weather conditions become less favorable for flight. • Length of stay at previous stopover (inverse relationship) and distance traveled since last stopover (direct relationship) are important predictors of WC stopovers. • Point in migration (proportion of migration completed) is an important predictor of WC stopovers with the probability of use of the AHR demonstrating a quadratic relationship with proportion of migration completed.

Extension Big Question #5: What factors influence WC stopover length within the AHR?
Management Hypothesis: Length of WC stopover within the AHR is a function of discharge.
Underlying Physical Processes Hypothesis – WC stopover length is a function of the relationship between wetted width and the percent of the channel that is of suitable depth for roosting (< 1 ft deep).
Alternative Hypotheses: <ul style="list-style-type: none"> • Length of stay within the AHR has an inverse relationship with length of stay at the previous stopover and a direct relationship with distance traveled since last stopover. • WC stopover length is inversely related to daily variability in flow. • WC stopover length is a function of MUCW and unforested corridor width. • WC stopover length is a function of land cover or habitat suitability within a biologically relevant radius of use location. • Weather (wind speed and direction, precipitation, temperature) is an important predictor of WC stopover length with the length of stay within the AHR increasing as weather conditions become less favorable for flight. • The length of a WC stopover within the AHR is longer during the Fall migration. Stopover length within the AHR recapitulates the overall migratory pattern with longer Fall stopovers than Spring stopovers. • Point in migration (proportion of migration completed) is an important predictor of WC stopover length with stopover length demonstrating a quadratic relationship with proportion of migration completed. • WC group size, composition (adults, sub-adults, juveniles), and whether or not they are associated with sandhill cranes are important predictors of WC stopover length.

Extension Big Question #6: Why is Spring WC use of the AHR greater than Fall use?
Management Hypothesis: WC use of the AHR in the Spring is greater than during the Fall due to higher flows during the Spring.
Underlying Physical Processes Hypothesis – WC use of the AHR is a function of the relationship between wetted width and the percent of the channel that is of suitable depth for roosting (<1 ft deep).
Alternative Hypotheses: <ul style="list-style-type: none"> • WC use of the AHR in the Spring is greater because WC do not stage in other areas prior to reaching the Platte, WC are further along in migration when they arrive, distance traveled since last stopover is longer, and stay length at previous stopovers is shorter when compared to Fall migration. • WC stay longer in the AHR during Spring migration because daily variability in flow is lower. • WC use of the AHR in the Spring is greater because proportional wetland landcover is greater. • WC use of the AHR in the Spring is greater due to more expansive unobstructed views (wider MUCW, reduced vegetation cover, lower vegetation heights, trees without leaves) that together increase perceived area of both on and off-channel suitable habitat during this period when compared with the Fall • WC use of the AHR in the Spring is greater because they encounter the AHR later in the day during this migratory season than they do during the Fall migratory season, increasing the probability of a stopover. • WC use of the AHR in the Spring is greater because weather (wind speed and direction, precipitation, temperature) conditions are less favorable for flight (heading into colder conditions, not away from them). • WC use of the AHR in the Spring is greater because group sizes are larger, more numerous and longer stopovers by juveniles and subadults (non-reproductive), and because of the presence of sandhill cranes (more abundant with longer stopovers within the AHR in the Spring).

Appendix B. Whooping Crane Group Observations

Tables of details of whooping crane group observations recorded during fall 2024 along the Associated Habitat Reach of the central Platte River between Lexington and Chapman, Nebraska. One table is provided for each group based on the unique USFWS group identification (ID) number. Provided for each group is the unique color-coded group icon that corresponds to icons provided in tables and figures throughout the report; the USFWS group ID; USFWS subgroup; date(s) of observations of the group; number of adult and juvenile whooping cranes in the group; the PRRIP group ID number; use site number; UTM x and y coordinates (zone 14N); and type of observation. When more than one observation of a whooping crane group was made in the same day, then letters (e.g., A, B, C) are placed following the PRRIP group ID. Use site numbers are provided when the whooping crane group was observed in riverine, lacustrine, or palustrine land cover types. When whooping crane groups were observed in a land cover type or environment that was not riverine, lacustrine, or palustrine, then the appropriate land cover type is provided (i.e., Ag-agriculture; beans; corn). If the group was sighted in flight, then “AIR” is provided for the use site number. Observation types are provided as systematic (Sys), opportunistic (Opp), aerial (Flight), and Ground.

Table B.1. Data for whooping crane group USFWS ID 24B-20.


Unique group icon	USFWS group ID	USFWS subgroup	Date	No. of whooping cranes (adults:juveniles)	PRRIP Group ID	Use site no.	Zone 14N UTMx	Zone 14N UTM _y	Observation type
	24B-20		10/26/2024	2:00	2024FA01	1	517918	4505546	Sys-Flight

Table B.2. Data for whooping crane group USFWS ID 24B-21.


Unique group icon	USFWS group ID	USFWS subgroup	Date	No. of whooping cranes (adults:juveniles)	PRRIP Group ID	Use site no.	Zone 14N UTMx	Zone 14N UTM _y	Observation type
	24B-21		10/26/2024	2:01	2024FA02	2	505478	4501201	Sys-Flight

Table B.3. Data for whooping crane group USFWS ID 24B-22.


Unique group icon	USFWS group ID	USFWS subgroup	Date	No. of whooping cranes (adults:juveniles)	PRRIP Group ID	Use site no.	Zone 14N UTMx	Zone 14N UTM _y	Observation type
	24B-22		10/27/2024	2:00	2024FA03	3	459663	4503714	Sys-Flight

Table B.3 - continued








Unique group icon	USFWS group ID	USFWS subgroup	Date	No. of whooping cranes (adults:juveniles)	PRRIP group ID	Use site no.	Zone 14N UTM _x	Zone 14N UTM _y	Observation type
	24B-22		10/28/2024	2:00	2024FA04	4	472538	4503444	Sys-Flight
	24B-22		10/29/2024	2:00	2024FA06	Corn	466510	4501119	Opp-Ground
	24B-22		10/30/2024	2:00	2024FA08	Corn	466672	4501128	Opp-Ground
	24B-22		10/31/2024	2:00	2024FA09	Corn	466656	4501510	Opp-Ground
	24B-22		11/1/2024	2:00	2024FA10	7	460017	4503763	Sys-Flight
	24B-22		11/3/2024	2:00	2024FA14	Ag	465958	4501208	Opp-Ground
	24B-22		11/4/2024	2:00	2024FA15	Corn	466585	4501123	Opp-Ground

Table B.4. Data for whooping crane group USFWS ID 24B-23.


Unique group icon	USFWS group ID	USFWS subgroup	Date	No. of whooping cranes (adults:juveniles)	PRRIP Group ID	Use site no.	Zone 14N UTM _x	Zone 14N UTM _y	Observation type
	24B-23		10/29/2024	3:00	2024FA05	5	485306	4501603	Sys-Flight

Table B.5. Data for whooping crane group USFWS ID 24B-24.


Unique group icon	USFWS group ID	USFWS subgroup	Date	No. of whooping cranes (adults:juveniles)	PRRIP Group ID	Use site no.	Zone 14N UTM _x	Zone 14N UTM _y	Observation type
	24B-24		10/30/2024	2:00	2024FA07	6	528628	4508261	Sys-Flight

Table B.6. Data for whooping crane group USFWS ID 24B-28.






Unique group icon	USFWS group ID	USFWS subgroup	Date	No. of whooping cranes (adults:juveniles)	PRRIP Group ID	Use site no.	Zone 14N UTM _x	Zone 14N UTM _y	Observation type
	24B-28		11/1/2024	2:00	2024FA11	8	506124	4501465	Sys-Flight
	24B-28		11/2/2024	2:00	2024FA12	9	505512	4501205	Opp-Ground
	24B-28		11/2/2024	2:00	2024FA12B	Corn	504806	4499664	Opp-Ground
	24B-28		11/3/2024	2:00	2024FA13	Corn	504624	4499761	Opp-Ground
	24B-28		11/4/2024	2:00	2024FA16	Corn	504783	4499691	Sys-Flight

Table B.7. Data for whooping crane group USFWS ID 24B-30.



Unique group icon	USFWS group ID	USFWS subgroup	Date	No. of whooping cranes (adults:juveniles)	PRRIP Group ID	Use site no.	Zone 14N UTM _x	Zone 14N UTM _y	Observation type
	24B-30		11/6/2024	2:01	2024FA17	10	541810	4513100	Sys-Flight
	24B-30		11/6/2024	2:01	2024FA17B	Corn	541842	4512252	Opp-Ground

Table B.8. Data for whooping crane group USFWS ID 24B-47.





Unique group icon	USFWS group ID	USFWS subgroup	Date	No. of whooping cranes (adults:juveniles)	PRRIP Group ID	Use site no.	Zone 14N UTM _x	Zone 14N UTM _y	Observation type
	24B-47		11/10/2024	2:00	2024FA19	12	541974	4513094	Sys-Flight
	24B-47		11/11/2024	2:00	2024FA20	13	542575	4513319	Opp-Ground
	24B-47		11/11/2024	2:00	2024FA20B	Corn	538669	4510494	Sys-Flight
	24B-47		11/14/2024	2:00	2024FA22	14	544183	4514142	Sys-Flight

Table B.9. Data for whooping crane group USFWS ID 24B-50.


Unique group icon	USFWS group ID	USFWS subgroup	Date	No. of whooping cranes (adults:juveniles)	PRRIP Group ID	Use site no.	Zone 14N UTM _x	Zone 14N UTM _y	Observation type
	24B-50		11/8/2024	2:00	2024FA18	11	561620	4526472	Sys-Flight

Table B.10. Data for whooping crane group USFWS ID 24B-54.




















Unique group icon	USFWS group ID	USFWS subgroup	Date	No. of whooping cranes (adults:juveniles)	PRRIP Group ID	Use site no.	Zone 14N UTM _x	Zone 14N UTM _y	Observation type
	24B-54	a	11/13/2024	6:01	2024FA21	Corn	452023	4502837	Opp-Ground
	24B-54	b	11/14/2024	5:00	2024FA23	15	454001	4503671	Sys-Flight
	24B-54	b	11/14/2024	5:00	2024FA23B	Corn	451536	4502875	Sys-Flight
	24B-54	b	11/15/2024	5:00	2024FA24	16	453140	4503614	Sys-Flight
	24B-54	b	11/16/2024	5:00	2024FA25	17	453526	4503548	Sys-Flight
	24B-54	b	11/16/2024	5:00	2024FA25B	Corn	451723	4502739	Opp-Ground
	24B-54	b	11/17/2024	5:00	2024FA28	19	453825	4503681	Sys-Flight
	24B-54	b	11/17/2024	5:00	2024FA28B	Corn	451743	4502699	Sys-Flight
	24B-54	c	11/18/2024	2:00	2024FA32	Corn	451439	4502825	Opp-Ground
	24B-54	c	11/19/2024	2:00	2024FA34	Corn	451503	4502595	Sys-Flight
	24B-54	c	11/20/2024	2:00	2024FA36	Corn	451997	4502722	Opp-Ground
	24B-54	c	11/21/2024	2:00	2024FA38	Corn	451668	4502770	Sys-Flight
	24B-54	c	11/22/2024	2:00	2024FA40	21	453669	4503716	Sys-Flight
	24B-54	c	11/23/2024	2:00	2024FA47	27	449461	4504490	Sys-Flight
	24B-54	c	11/23/2024	2:00	2024FA47B	Corn	451517	4502798	Opp-Ground
	24B-54	c	11/24/2024	2:00	2024FA51	Corn	451703	4502691	Sys-Flight
	24B-54	c	11/26/2024	2:00	2024FA52	30	472713	4503462	Sys-Flight
	24B-54	c	11/27/2024	2:00	2024FA53	Corn	471015	4501877	Opp-Ground
	24B-54	c	11/28/2024	2:00	2024FA56	Corn	471849	4501819	Opp-Ground

Table B.10 - continued



Unique group icon	USFWS group ID	USFWS subgroup	Date	No. of whooping cranes (adults:juveniles)	PRRIP group ID	Use site no.	Zone 14N UTM _x	Zone 14N UTM _y	Observation type
	24B-54	c	11/29/2024	2:00	2024FA57	Corn	472295	4501962	Opp-Ground
	24B-54	c	11/30/2024	2:00	2024FA58	Corn	471686	4501687	Opp-Ground

Table B.11. Data for whooping crane group USFWS ID 24B-83.


Unique group icon	USFWS group ID	USFWS subgroup	Date	No. of whooping cranes (adults:juveniles)	PRRIP Group ID	Use site no.	Zone 14N UTM _x	Zone 14N UTM _y	Observation type
	24B-83		11/16/2024	6:01	2024FA26	18	538974	4511399	Sys-Flight

Table B.12. Data for whooping crane group USFWS ID 24B-84.


Unique group icon	USFWS group ID	USFWS subgroup	Date	No. of whooping cranes (adults:juveniles)	PRRIP Group ID	Use site no.	Zone 14N UTM _x	Zone 14N UTM _y	Observation type
	24B-84		11/17/2024	3:00	2024FA27	AIR	460388	4502669	Sys-Flight

Table B.13. Data for whooping crane group USFWS ID 24B-85.



Unique group icon	USFWS group ID	USFWS subgroup	Date	No. of whooping cranes (adults:juveniles)	PRRIP Group ID	Use site no.	Zone 14N UTM _x	Zone 14N UTM _y	Observation type
	24B-85		11/17/2024	9:00	2024FA29	AIR	539091	4510977	Opp-Ground
	24B-85		11/17/2024	9:00	2024FA29B	AIR	538410	4507694	Sys-Flight

Table B.14. Data for whooping crane group USFWS ID 24B-95.










Unique group icon	USFWS group ID	USFWS subgroup	Date	No. of whooping cranes (adults:juveniles)	PRRIP Group ID	Use site no.	Zone 14N UTMx	Zone 14N UTM _y	Observation type
	24B-95		11/17/2024	2:01	2024FA30	Corn	457919	4501686	Opp-Ground
	24B-95		11/18/2024	2:01	2024FA31	Corn	451572	4502886	Opp-Ground
	24B-95		11/19/2024	2:01	2024FA33	Corn	451634	4502768	Sys-Flight
	24B-95		11/20/2024	2:01	2024FA35	Corn	451804	4502616	Opp-Ground
	24B-95		11/21/2024	2:01	2024FA37	Corn	451910	4502663	Sys-Flight
	24B-95		11/22/2024	2:01	2024FA39	20	453698	4503734	Sys-Flight
	24B-95		11/23/2024	2:01	2024FA46	26	449451	4504487	Sys-Flight
	24B-95		11/23/2024	2:01	2024FA46B	Corn	451598	4502831	Opp-Ground
	24B-95		11/24/2024	2:01	2024FA50	Corn	451878	4502703	Sys-Flight

Table B.15. Data for whooping crane group USFWS ID 24B-96.



Unique group icon	USFWS group ID	USFWS subgroup	Date	No. of whooping cranes (adults:juveniles)	PRRIP Group ID	Use site no.	Zone 14N UTMx	Zone 14N UTM _y	Observation type
	24B-96		11/22/2024	2:01	2024FA41	22	567045	4532555	Sys-Flight
	24B-96		11/23/2024	2:01	2024FA48	28	564830	4529798	Sys-Flight

Table B.16. Data for whooping crane group USFWS ID 24B-97.


Unique group icon	USFWS group ID	USFWS subgroup	Date	No. of whooping cranes (adults:juveniles)	PRRIP Group ID	Use site no.	Zone 14N UTMx	Zone 14N UTM _y	Observation type
	24B-97		11/22/2024	1:00	2024FA42	AIR	565554	4530793	Sys-Flight

Table B.17. Data for whooping crane group USFWS ID 24B-98.



Unique group icon	USFWS group ID	USFWS subgroup	Date	No. of whooping cranes (adults:juveniles)	PRRIP Group ID	Use site no.	Zone 14N UTM _x	Zone 14N UTM _y	Observation type
	24B-98		11/22/2024	6:00	2024FA43	23	541562	4512785	Sys-Flight
	24B-98		11/23/2024	6:00	2024FA49	29	540766	4512256	Sys-Flight

Table B.18. Data for whooping crane group USFWS ID 24B-99.





Unique group icon	USFWS group ID	USFWS subgroup	Date	No. of whooping cranes (adults:juveniles)	PRRIP Group ID	Use site no.	Zone 14N UTM _x	Zone 14N UTM _y	Observation type
	24B-99		11/22/2024	3:00	2024FA44	24	540717	4512305	Sys-Flight
	24B-99		11/23/2024	3:00	2024FA54	31	540756	4512248	Sys-Flight

Table B.19. Data for whooping crane group USFWS ID 24B-100.

Unique group icon	USFWS group ID	USFWS subgroup	Date	No. of whooping cranes (adults:juveniles)	PRRIP Group ID	Use site no.	Zone 14N UTM _x	Zone 14N UTM _y	Observation type
	24B-100		11/22/2024	2:00	2024FA45	25	532111	4509816	Sys-Flight
	24B-100		11/23/2024	2:00	2024FA55	32	540775	4512260	Sys-Flight

Appendix C. Enlarged Maps of Whooping Crane Use Locations and Photographs of Groups

Maps of whooping crane group use locations observed during fall 2024 are presented from west to east beginning with Fig. C1 and ending with Fig. C8. The distribution of historical fall observations of whooping crane groups by PRRIP during 2001–2024 are provided online at <https://hwcorp.maps.arcgis.com/apps/mapviewer/index.html?webmap=97944a2aa0874d4b987f61f795953a4c>. Photographs, when available, of the first systematically collected observation or opportunistic observation from each unique group are provided in Fig. C9 through Fig. C26.

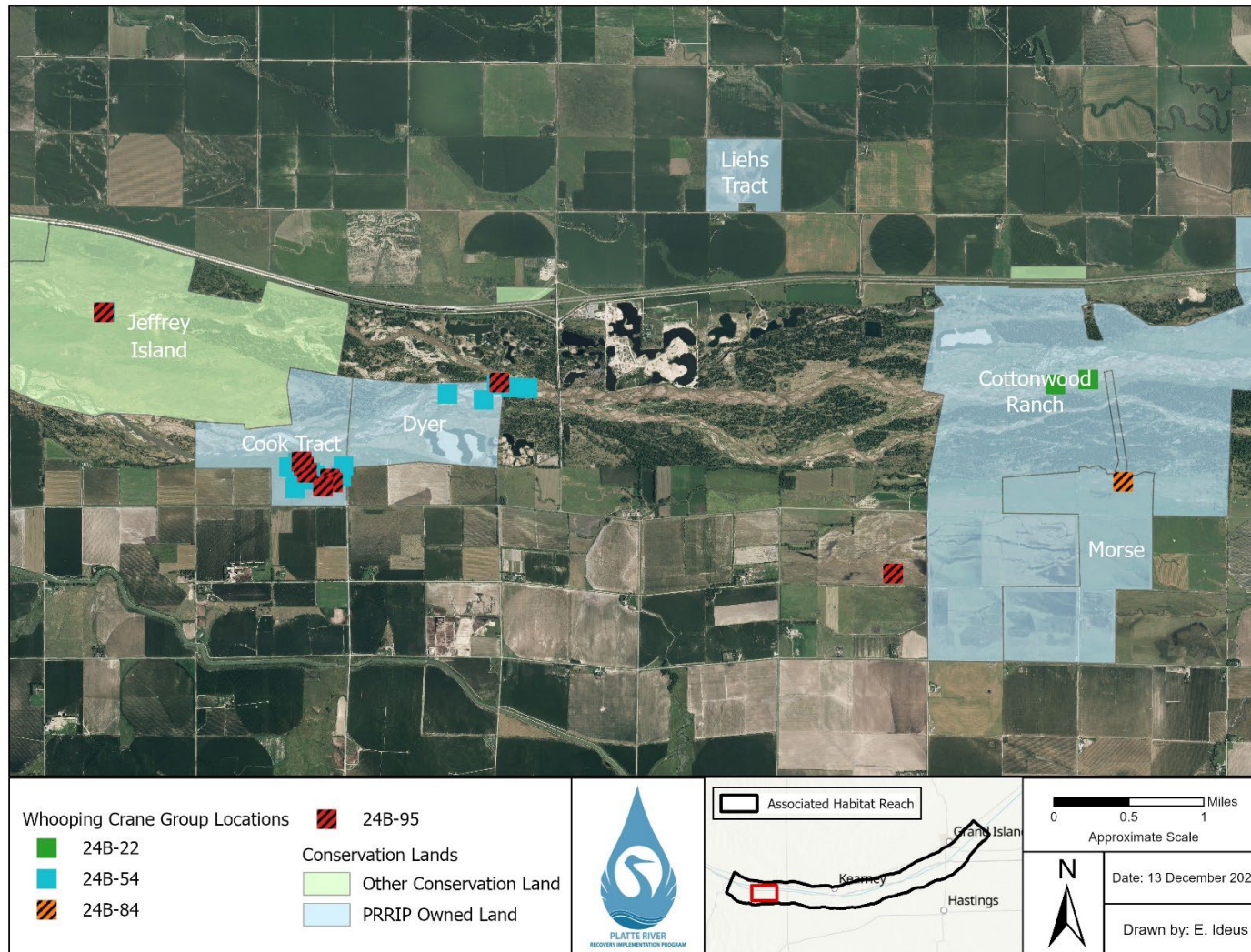


Figure C1. Whooping crane groups USFWS ID 24B-22 (See Appendix B Table B.3 for PRRIP IDs; sighted 10/27-11/4); USFWS ID 24B-54 (See Appendix B Table B.10 for PRRIP IDs; sighted 11/13-11/30); USFWS ID 24B-84 (PRRIP ID 2024FA27; sighted 11/17); USFWS ID 24B-95 (See Appendix B Table B.14 for PRRIP IDs; sighted 11/17-11/24) observed south of Overton, Nebraska along the Associated Habitat Reach of the central Platte River during fall 2024. PRRIP aerial imagery from July 2024 is displayed for reference as fall imagery is limited to the channel.

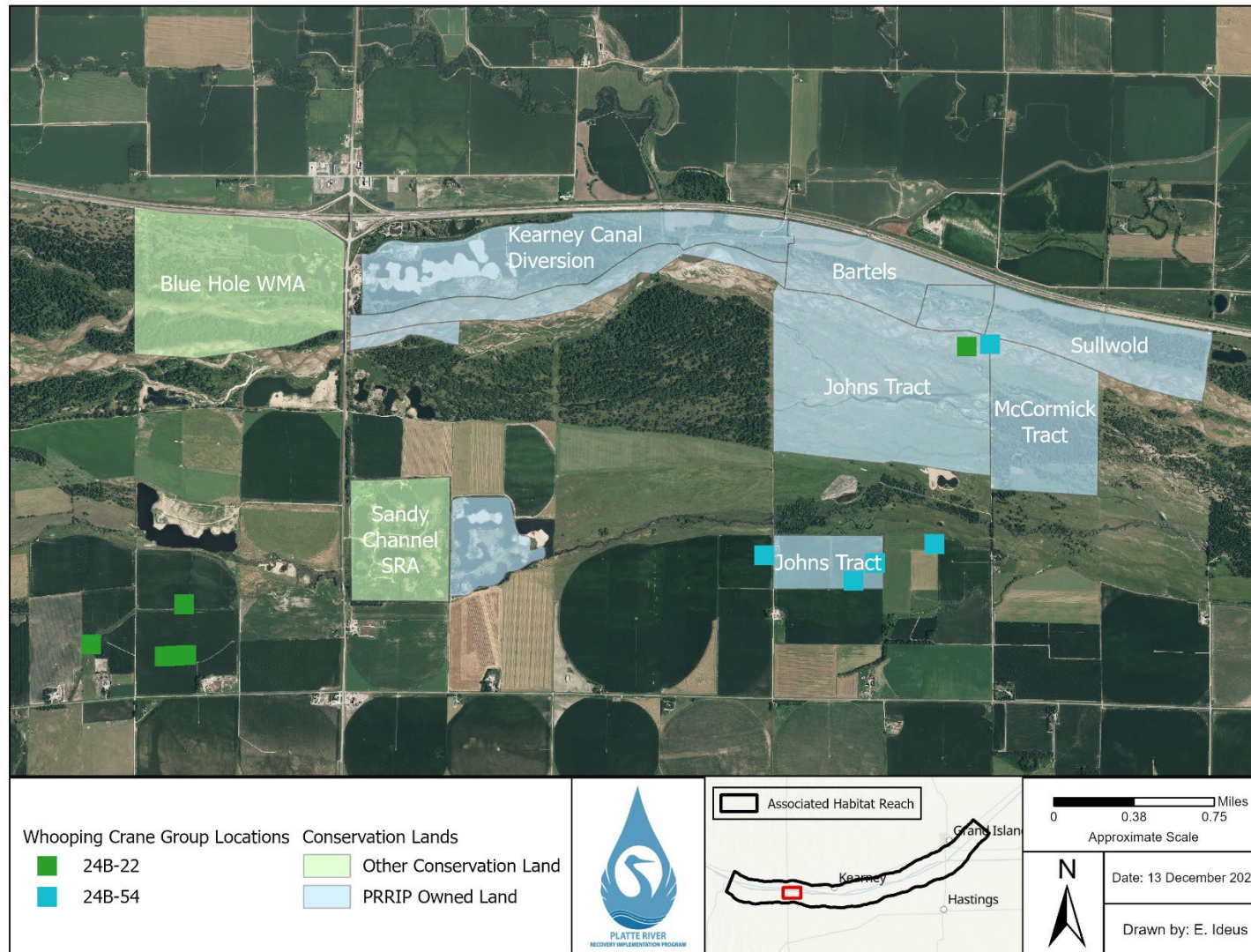


Figure C2. Whooping crane groups USFWS ID 24B-22 (See Appendix B Table B.3 for PRRIP IDs; sighted 10/27-11/4); USFWS ID 24B-54 (See Appendix B Table B.10 for PRRIP IDs; sighted 11/13-11/30) observed south of Elm Creek, Nebraska along the Associated Habitat Reach of the central Platte River during fall 2024. PRRIP aerial imagery from July 2024 is displayed for reference as fall imagery is limited to the channel.

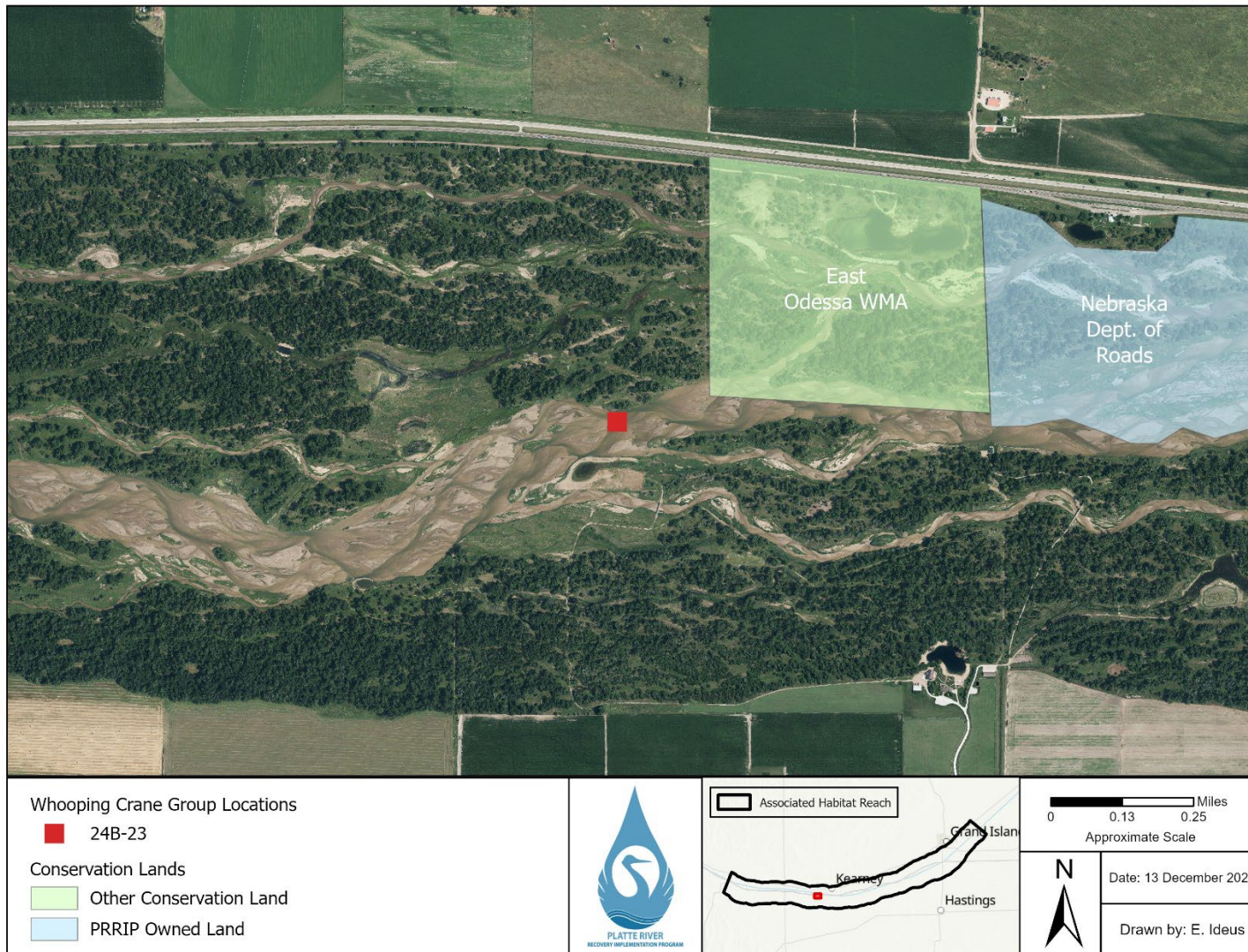


Figure C3. Whooping crane groups USFWS ID 24B-23 (PRRIP ID 2024FA05; sighted 10/29) observed southwest of Kearney, Nebraska along the Associated Habitat Reach of the central Platte River during fall 2024. PRRIP aerial imagery from July 2024 is displayed for reference as fall imagery is limited to the channel.

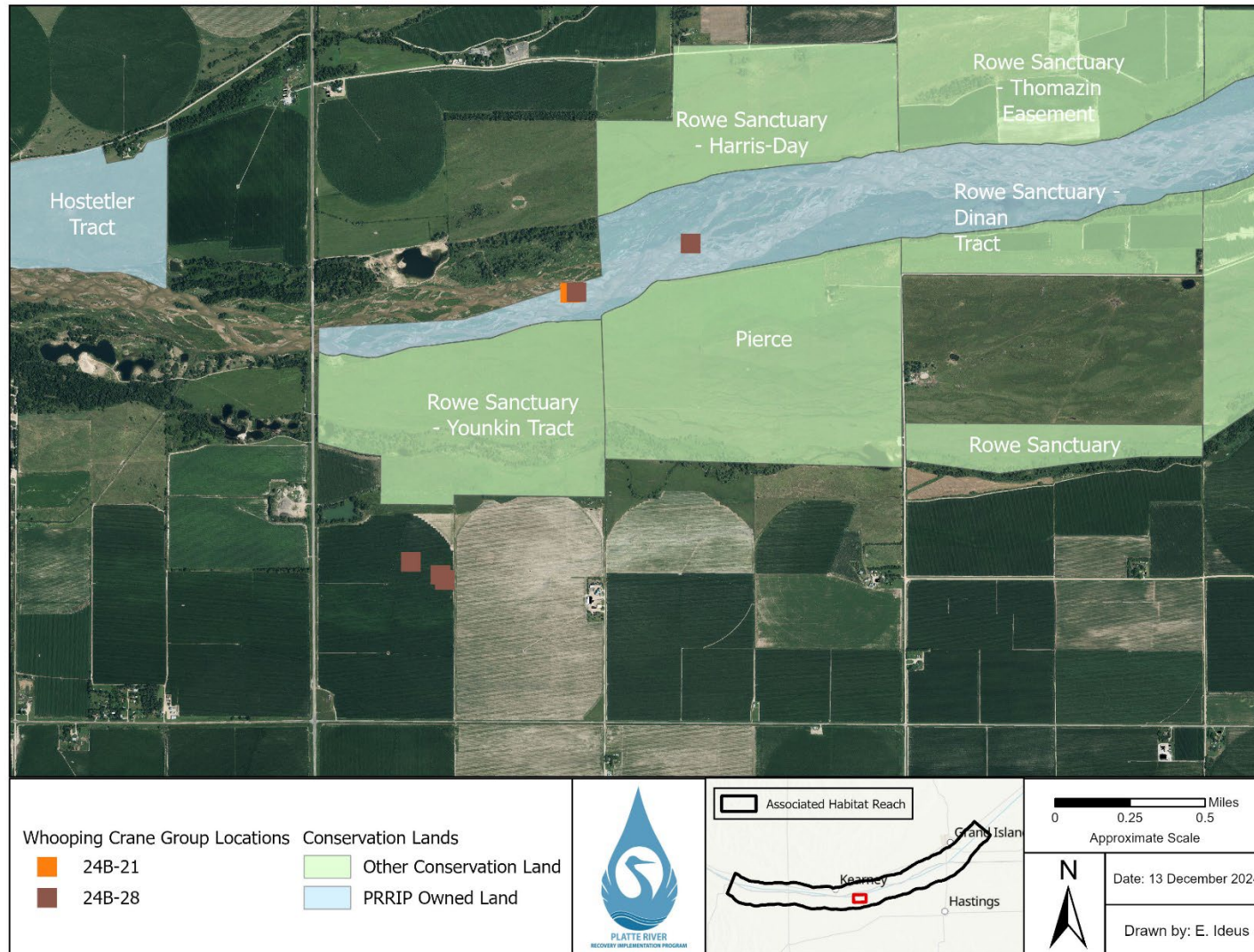


Figure C4. Whooping crane groups USFWS ID 24B-21 (PRRIP ID 2024FA02; sighted 10/26); USFWS ID 24B-28 (See Appendix B Table B.6 for PRRIP IDs; sighted 11/1-11/4) observed southeast of Kearney, Nebraska along the Associated Habitat Reach of the central Platte River during fall 2024. PRRIP aerial imagery from July 2024 is displayed for reference as fall imagery is limited to the channel.

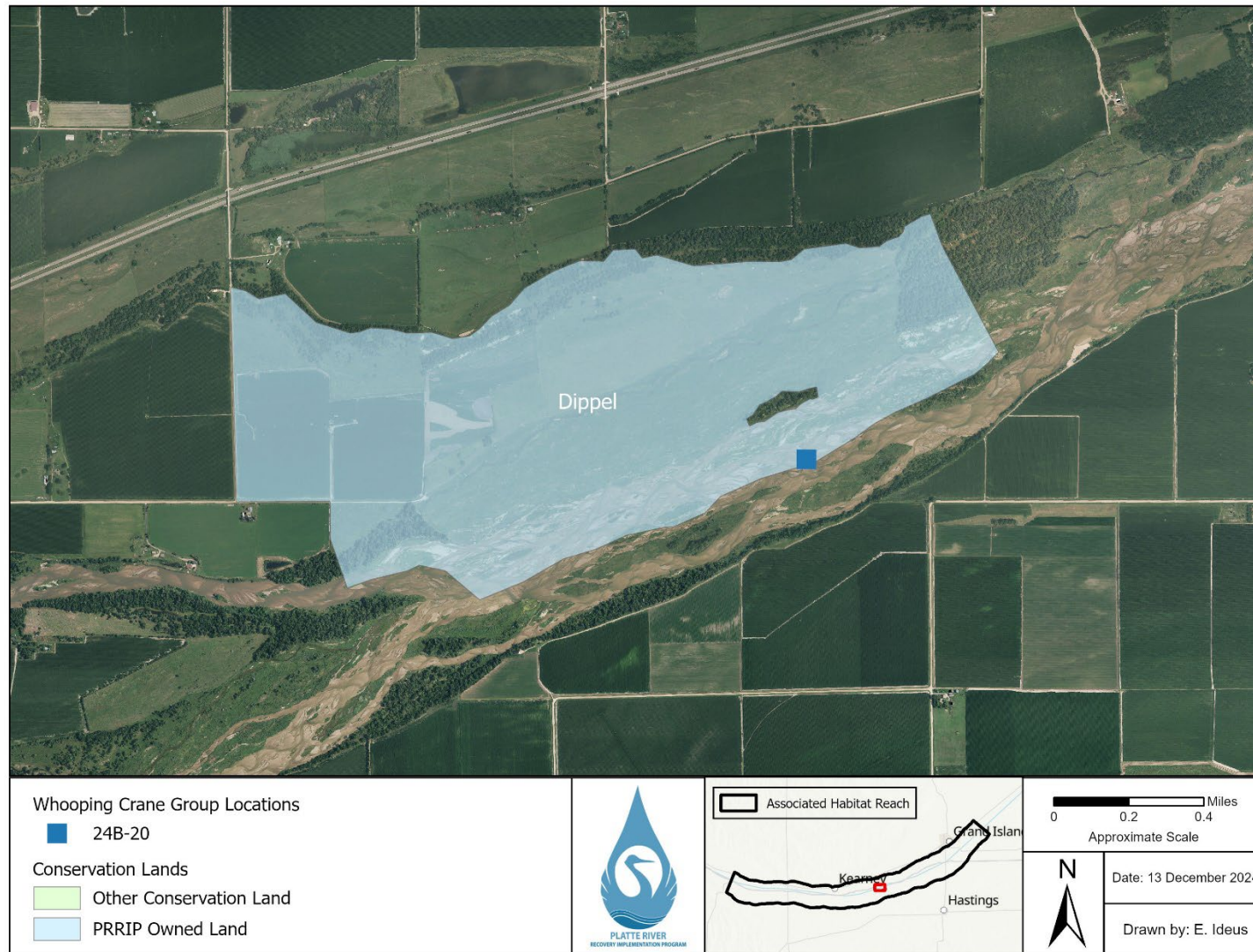


Figure C5. Whooping crane groups USFWS ID 24B-20 (PRRIP ID 2024FA01; sighted 10/26) observed southeast of Gibbon, Nebraska along the Associated Habitat Reach of the central Platte River during fall 2024. PRRIP aerial imagery from July 2024 is displayed for reference as fall imagery is limited to the channel.

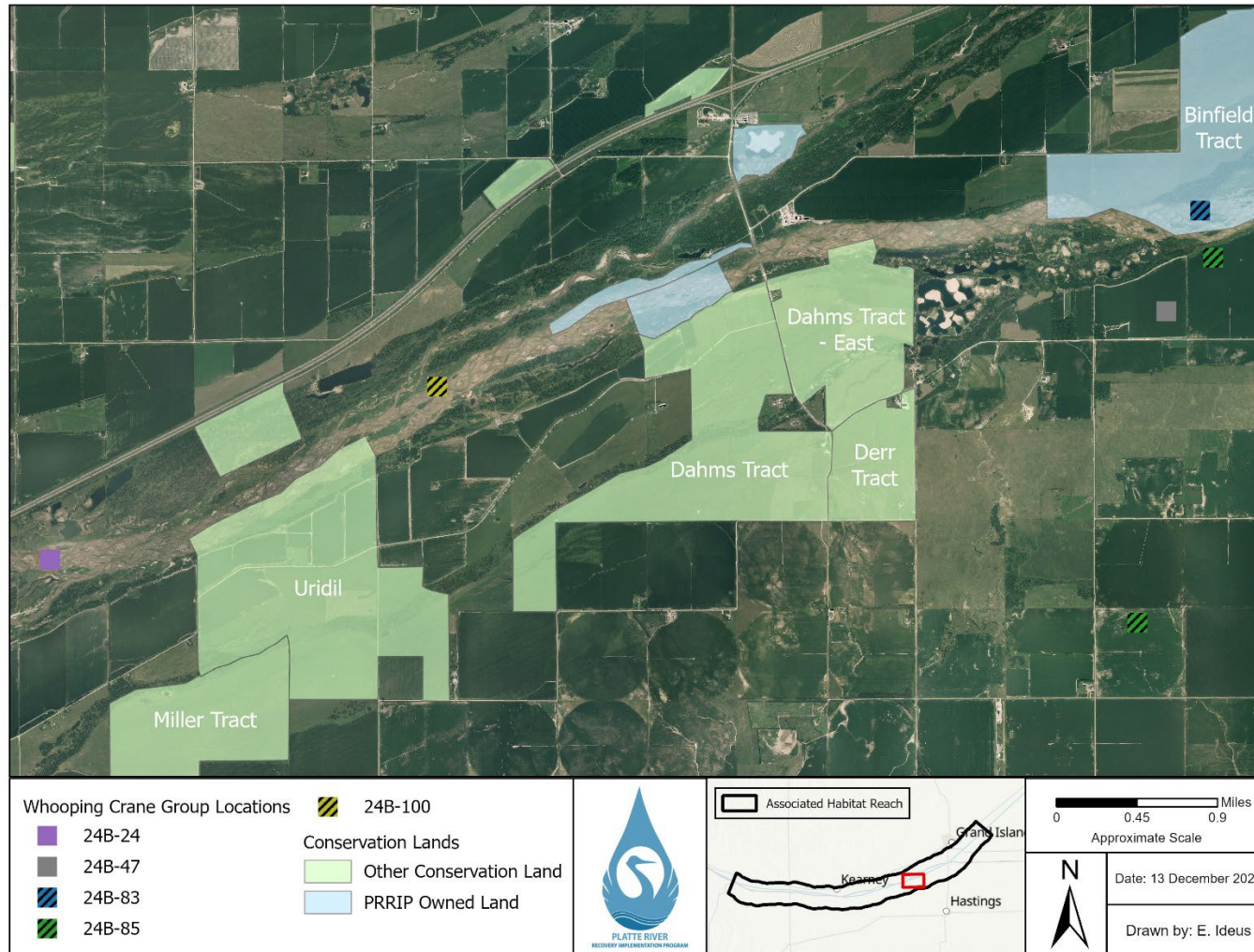


Figure C6. Whooping crane groups USFWS ID 24B-24 (PRRIP ID 2024FA07; sighted 10/30); USFWS ID 24B-47 (See Appendix B Table B.8 for PRRIP IDs; sighted 11/10-11/14); USFWS ID 24B-83 (PRRIP ID 2024FA26; sighted 11/16); USFWS ID 24B-85 (PRRIP ID 2024FA29; sighted 11/17); USFWS ID 24B-100 (PRRIP IDs 2024FA45, 2024FA55; sighted 11/22-11/23) observed south of Wood River, Nebraska along the Associated Habitat Reach of the central Platte River during fall 2024. PRRIP aerial imagery from July 2024 is displayed for reference as fall imagery is limited to the channel.

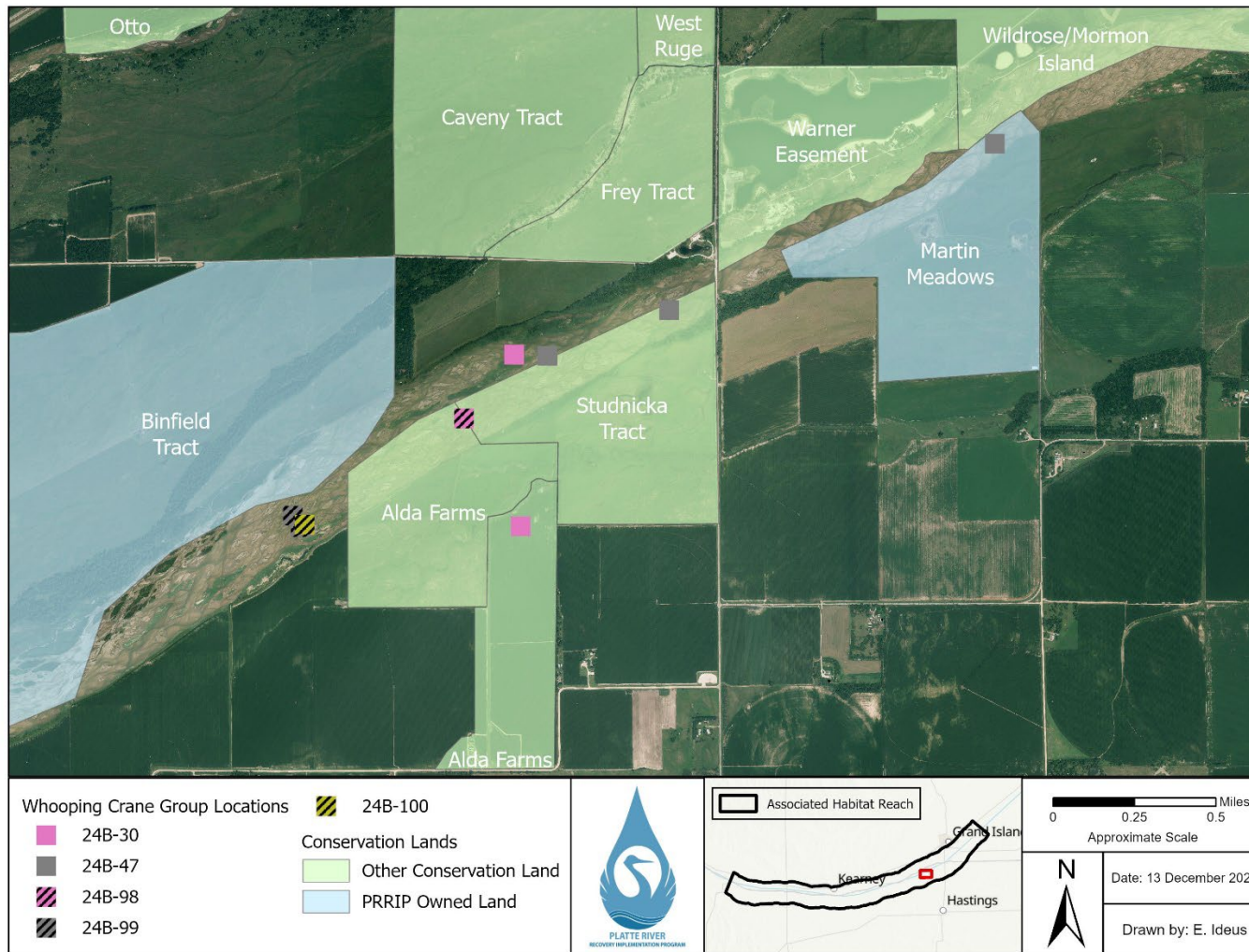


Figure C7. Whooping crane groups USFWS ID 24B-30 (PRRIP ID 2024FA17; sighted 11/6); USFWS ID 24B-47 (See Appendix B Table B.8 for PRRIP IDs; sighted 11/10-11/14); USFWS ID 24B-98 (PRRIP IDs 2024FA43, 2024FA49; sighted 11/22-11/23); USFWS ID 24B-99 (PRRIP IDs 2024FA44, 2024FA54; sighted 11/22-11/23); USFWS ID 24B-100 (PRRIP IDs 2024FA45, 2024FA55; sighted 11/22-11/23) observed south of Alda, Nebraska along the Associated Habitat Reach of the central Platte River during fall 2024. PRRIP aerial imagery from July 2024 is displayed for reference as fall imagery is limited to the channel.

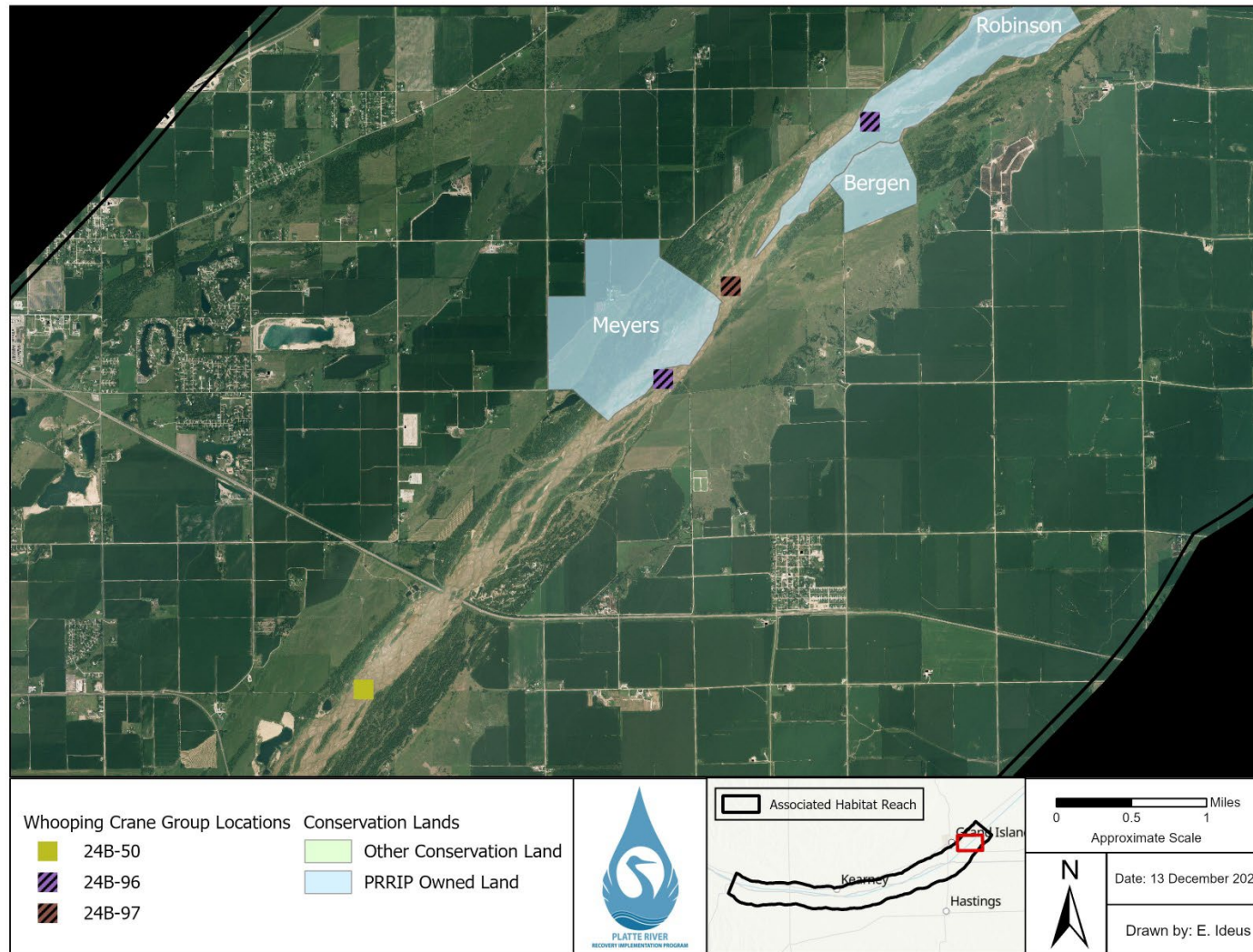


Figure C8. Whooping crane groups USFWS ID 24B-50 (PRRIP ID 2024FA18; sighted 11/8); USFWS ID 24B-96 (PRRIP IDs 2024FA41, 2024FA48; sighted 11/22-11/23); USFWS ID 24B-97 (PRRIP ID 2024FA42; sighted 11/22) observed east of Grand Island, Nebraska along the Associated Habitat Reach of the central Platte River during fall 2024. PRRIP aerial imagery from July 2024 is displayed for reference as fall imagery is limited to the channel.



Figure C9. Photograph of whooping crane group PRRIP ID 2024FA01 (USFWS ID 24B-20) on 10/26/2024. The whooping crane group was observed during systematic aerial surveys.



Figure C10. Photograph of whooping crane group PRRIP ID 2024FA02 (USFWS ID 24B-21) on 10/26/2024. The whooping crane group was observed during systematic aerial surveys.



Figure C11. Photograph of whooping crane group PRRIP ID 2024FA03 (USFWS ID 24B-22) on 10/27/2024. The whooping crane group was observed during systematic aerial surveys.



Figure C12. Photograph of whooping crane group PRRIP ID 2024FA05 (USFWS ID 24B-23) on 10/29/2024. The whooping crane group was observed during systematic aerial surveys.



Figure C13. Photograph of whooping crane group PRRIP ID 2024FA07 (USFWS ID 24B-24) on 10/30/2024. The whooping crane group was observed during systematic aerial surveys.



Figure C14. Photograph of whooping crane group PRRIP ID 2024FA11 (USFWS ID 24B-28) on 11/01/2024. The whooping crane group was observed during systematic aerial surveys.



Figure C15. Photograph of whooping crane group PRRIP ID 2024FA17 (USFWS ID 24B-30) on 11/06/2024. The whooping crane group was observed during systematic aerial surveys.



Figure C16. Photograph of whooping crane group PRRIP ID 2024FA19 (USFWS ID 24B-47) on 11/10/2024. The whooping crane group was observed during systematic aerial surveys.



Figure C17. Photograph of whooping crane group PRRIP ID 2024FA18 (USFWS ID 24B-50) on 11/08/2024. The whooping crane group was observed during systematic aerial surveys.



Figure C18. Photograph of whooping crane group PRRIP ID 2024FA23 (USFWS ID 24B-54) on 11/14/2024. The whooping crane group was observed during systematic aerial surveys.



Figure C19. Photograph of whooping crane group PRRIP ID 2024FA26 (USFWS ID 24B-83) on 11/16/2024. The whooping crane group was observed during systematic aerial surveys.



Figure C20. Photograph of whooping crane group PRRIP ID 2024FA29 (USFWS ID 24B-85) on 11/17/2024. The whooping crane group was observed during systematic aerial surveys.



Figure C21. Photograph of whooping crane group PRRIP ID 2024FA33 (USFWS ID 24B-95) on 11/19/2024. The whooping crane group was observed during systematic aerial surveys.



Figure C22. Photograph of whooping crane group PRRIP ID 2024FA41 (USFWS ID 24B-96) on 11/22/2024. The whooping crane group was observed during systematic aerial surveys.



Figure C23. Photograph of whooping crane group PRRIP ID 2024FA42 (USFWS ID 24B-97) on 11/22/2024. The whooping crane group was observed during systematic aerial surveys.



Figure C24. Photograph of whooping crane group PRRIP ID 2024FA43 (USFWS ID 24B-98) on 11/22/2024. The whooping crane group was observed during systematic aerial surveys.



Figure C25. Photograph of whooping crane group PRRIP ID 2024FA44 (USFWS ID 24B-99) on 11/22/2024. The whooping crane group was observed during systematic aerial surveys.



Figure C26. Photograph of whooping crane group PRRIP ID 2024FA45 (USFWS ID 24B-100) on 11/22/2024. The whooping crane group was observed during systematic aerial surveys.

Appendix D. Aransas-Wood Buffalo Population Estimates

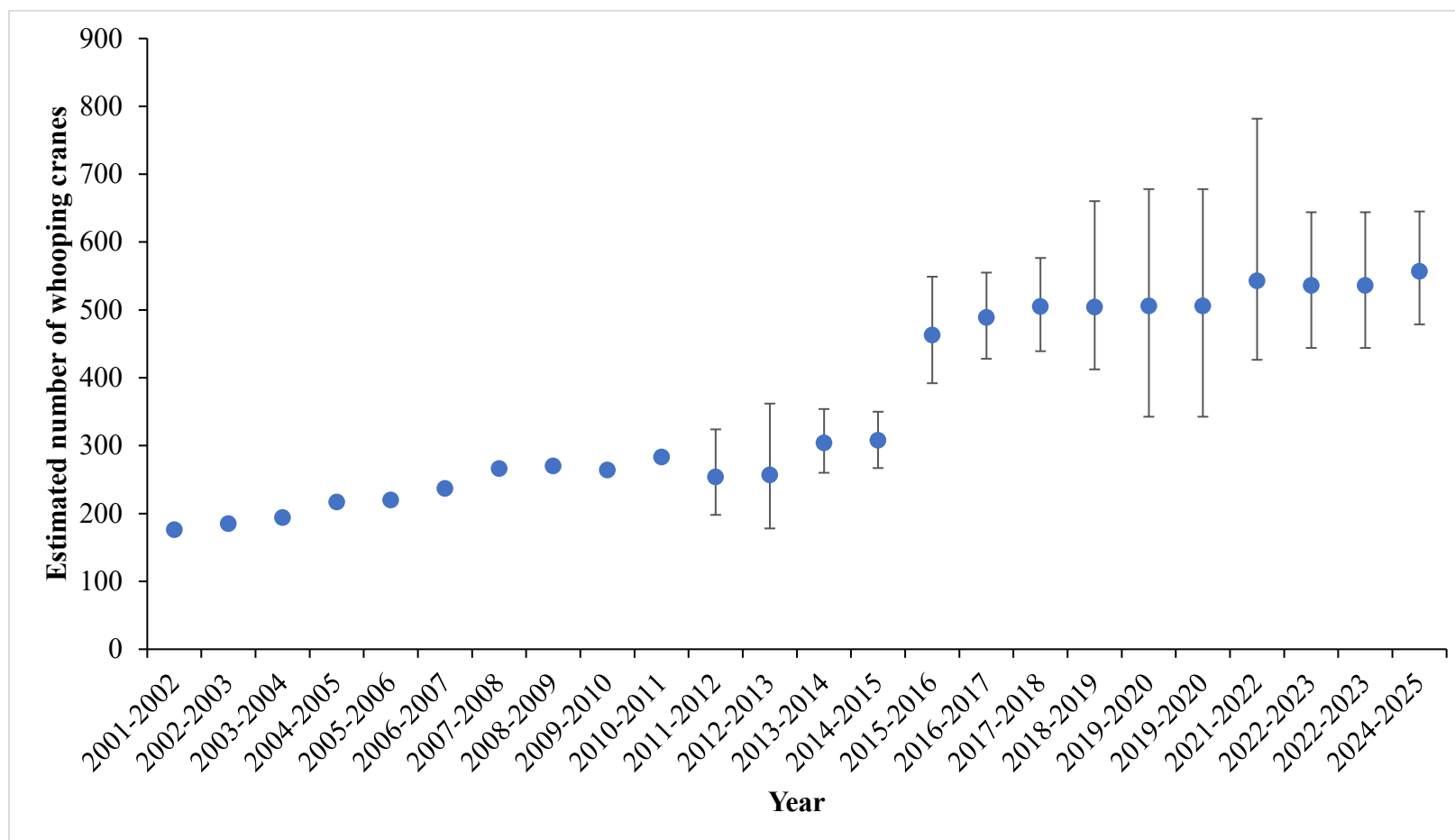


Figure D1. Estimated size of the migratory Aransas-Wood Buffalo whooping crane population based on surveys of the primary sampling area on the winter range on the Texas Gulf Coast of Mexico during 2007–2024 ([USFWS 2025](#)). A change in survey methodology occurred after 2014–2015, which resulted in an increase in the number of whooping cranes observed during 2015–2016. 95% confidence intervals are provided for 2011–2024. For the 2020–2021 and 2023–2024 estimates, the estimated AWB population from winter 2019–2020 (506 birds) and winter 2022–2023 (536 birds), respectively, was used because no winter surveys were completed during 2020–2021 or 2023–2024.

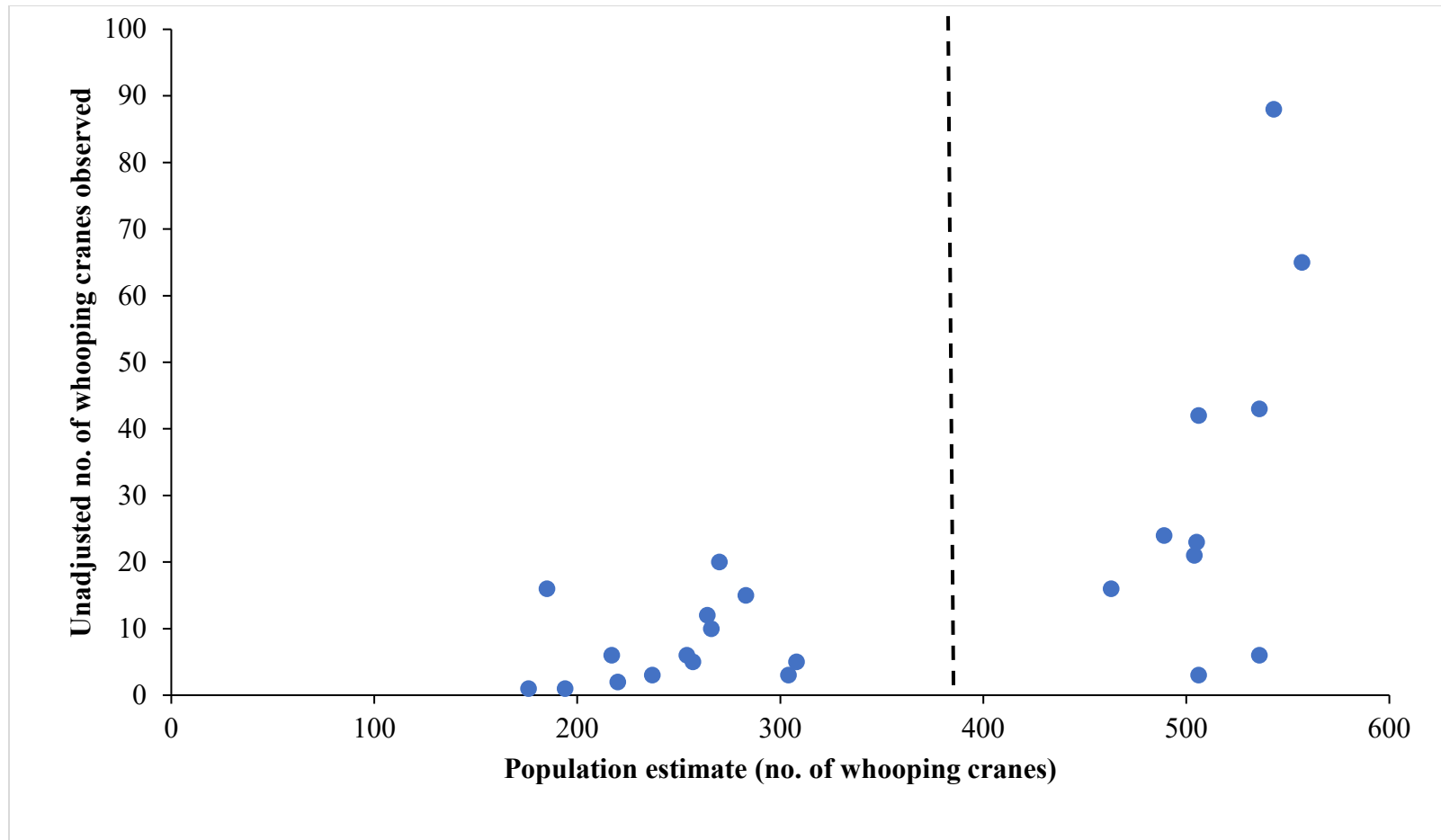


Figure D2. Relationship between the unadjusted number of individual whooping cranes observed during fall surveys from 2001-2024 on the Associated Habitat Reach of the central Platte River and the estimated size of the Aransas-Wood Buffalo population based on surveys of the primary sampling area on the winter range during 2001–2025. For the 2020-2021 and 2023-2024 estimates, the estimated AWB population from winter 2019–2020 (506 birds) and winter 2022-2023 (536 birds), respectively, was used because no winter surveys were completed during 2020–2021 or 2023-2024. Both long-term datasets have undergone changes in survey protocol over time. We used unadjusted numbers of whooping crane observations on the AHR because data from 2001-2003, 2005-2007, 2013-2014, and 2018-2020 could not be adjusted. There was also a change in survey dates and methodology for USFWS surveys on the winter range after winter 2014–2015 (indicated by dashed black line) which resulted in an increase in the number of whooping cranes observed in 2014-2015 ([USFWS 2025](#)).

Appendix E. Past Research Synthesis

Published	Study Topic	Document Title	Summary	Principal Findings	Citation
2024	Inland wintering habitat use	Space use and movements of inland wintering whooping cranes in the Aransas-Wood Buffalo population	Examined daily distance movements, auto-correlated kernel density estimates (AKDE), and daily movement patterns of inland wintering whooping cranes compared to coastal wintering whooping cranes.	Inland wintering birds' AKDE home ranges were 3.1 times larger than coastal wintering birds' home ranges. According to the top generalized linear mixed-effects model, birds that spent a portion of the winter inland had an increase of $92.0 \pm 4.2\%$ in daily movement throughout the winter, and, generally, daily movements were greater in the late fall and early spring. Several factors were found to influence daily movement patterns including temporal effects and age/family status.	Crouch CG, Caven AJ, Bradshaw MR, Fernald KM, Butler MJ, Kalisek MA. 2024. Space use and movements of inland wintering whooping cranes in the Aransas-Wood Buffalo population. <i>Avian Conservation and Ecology</i> 19(2):16. https://doi.org/10.5751/ACE-02746-190216
2024	Power line collisions	Power-line collisions in reintroduced whooping cranes (<i>Grus americana</i>)	Assessed biological, environmental, and structural circumstances associated with whooping crane collisions with power lines in all reintroduced populations.	Both migratory and nonmigratory reintroduced populations were at risk of power line collisions, with collisions being more likely during migration for the migratory populations. In nonmigratory populations, males were significantly more likely to be involved in fatal collisions with power lines than females, and there were more juvenile and sub-adult collisions with power lines than adults when examining all reintroduced populations. Generally, most collisions occurred in the spring and around or after sunset. In all populations, both transmission and distribution lines were equally potential threats for collisions.	Sime MJ, Thompson HL, Szyszkoski EK, Zimorski SE, Dellinger TA, Schmidt SM. 2024. Power-line collisions in reintroduced whooping cranes (<i>Grus americana</i>). <i>Southeastern Naturalist</i> 23(2): 194-211. https://doi.org/10.1656/058.023.0205
2024	Migratory behavior	Long-term migratory alterations to whooping crane arrival and departure on the wintering and staging grounds	Examined timing of abundance peak on wintering grounds in Texas and period of occurrence in a fall migratory staging area in central Saskatchewan.	The amount of time spent on fall staging grounds in central Saskatchewan has lengthened over time, whereas the peak abundance period on wintering grounds has shortened over time. Changes in migration phenology may impact the timing and length of stopover habitat use within the migratory corridor.	Butler MJ and Bidwell MT. 2024. Long-term migratory alterations to whooping crane arrival and departure on the wintering and staging grounds. <i>Endangered Species Research</i> 53:481-491. https://doi.org/10.3354/esr01315

Published	Study Topic	Document Title	Summary	Principal Findings	Citation
2024	Population dynamics	Investigation of the population dynamics of endangered whooping cranes in the breeding ground Wood Buffalo National Park: an agent-based modelling approach.	Examines the factors affecting whooping crane population dynamics, including how species biology, predation, and climate change affect reproductive success in Wood Buffalo National Park.	Agent-based modelling tool developed for assessing potential consequences of various scenarios and interventions on the Aransas Wood Buffalo whooping crane population. Rate of climate change was the most sensitive factor influencing whooping crane population dynamics through alteration of blue crab food resources and chick survival.	Kipirti MO. 2024. Investigation of the population dynamics of endangered whooping cranes in the breeding ground Wood Buffalo National Park: an agent-based modelling approach. MS thesis, University of Calgary, Calgary, Canada. https://prism.ucalgary.ca/server/api/core/bitstreams/a6ede97c-0988-42a6-b800-0f3cc813f7a8/content
2024	Habitat use	Management implications of habitat selection by whooping cranes (<i>Grus americana</i>) on the Texas coast.	Multiscale habitat analysis of whooping crane habitat selection along the Texas gulf coast and simulations of results of management actions on whooping crane habitat selection.	Land cover variables were most important for predicting whooping crane use at both the population and home range scale. Drought index also had a modest effect. At a use location scale, the most important variable was topography. Impact of prescribed fire to manage vegetation on whooping crane use varied by habitat type. Fire increased propensity of use in estuarine habitat when implemented at short 1-6 year intervals. Conversely, whooping cranes were less likely to use grasslands or palustrine wetlands immediately after a burn, but more likely to use them >6 years following a burn.	Lehnen SE, Sesnie SE, Butler MJ, Pearce AT, Metzger KL. 2024. Management implications of habitat selection by whooping cranes (<i>Grus americana</i>) on the Texas coast. Ecosphere 15:e4820. https://doi.org/10.1002/ecs2.4820
2024	Migratory behavior	Flexible migration and habitat use strategies of an endangered waterbird during hydrological drought.	Evaluated differences in migratory strategy and habitat use across the northern Great Plains, central Great Plains, and southern Great Plains in response to drought.	A reliable network of habitat was available across the Great Plains. Under drought conditions a shift was seen from use of natural wetlands to use of more permanent water sources such as impounded palustrine and lacustrine environments and riverine systems. The use of the central Platte River was similar over both drought and non-drought years.	Pearse AT, Caven AJ, Baasch DM, Bidwell MT, Conkin JA, Brandt DA. 2024. Flexible migration and habitat use strategies of an endangered waterbird during hydrological drought. Conservation Science and Practice 6(5), e13120. https://doi.org/10.1111/csp2.13120

Published	Study Topic	Document Title	Summary	Principal Findings	Citation
2023 / 2024	Group size	Record-sized flock of whooping cranes (<i>Grus americana</i>) observed staging in the central Platte River valley during autumn 2021	46 whooping cranes gathering as a single flock during autumn 2021	The paper summarizes how the large aggregation of 46 whooping cranes formed from five smaller groups. The authors speculated drought and hydrologic conditions before and during this event affected the formation of the large group	<p>Baasch DM, Caven AJ, Rabbe M, Medaries AH, Schaaf MR, Ostrom BL, Wiese JD, Malzahn JM, Smith TI. 2023. Erratum: Record-sized flock of whooping cranes (<i>Grus americana</i>) observed staging in the central Platte River valley during autumn 2021. <i>Waterbirds</i> 46(2-4):289. https://doi.org/10.1675/063.046.0418</p> <p>Baasch DM, Rabbe M, Medaries AH, Schaaf MR, Ostrom BL, Wiese JD, Malzahn JM, Smith TI. 2023. Record-sized flock of whooping cranes (<i>Grus americana</i>) observed staging in the central Platte River valley during autumn 2021. <i>Waterbirds</i> 45(4):484–491. https://doi.org/10.1675/063.045.0413</p>
2023	Migratory behavior	Differential shortstopping behaviour in whooping cranes: habitat or social learning?	Documented shortstopping behavior during migration (i.e., shifting wintering grounds closer to breeding grounds) in the eastern reintroduced whooping crane population, but did not find evidence of shortstopping in remnant population.	Authors did not find shortstopping behavior in the Aransas Wood Buffalo migratory whooping crane population, but did with the reintroduced Eastern Migratory Population. Because juveniles from the reintroduced population did not associate with older conspecifics in nearly half of observed wintering events, the authors suggested the social transmission of winter migration behaviors might be less effective in the reintroduced population. In contrast, juveniles from the Aransas Wood Buffalo population overwintered with their parents, suggesting social learning may play a role in migratory behavior and strategies.	<p>Mendgen P, Converse SJ, Pearse AT, Teitelbaum CS, Mueller T. 2023. Differential shortstopping behaviour in whooping cranes: habitat or social learning? <i>Global Ecology and Conservation</i> 41:e02365. https://doi.org/10.1016/j.gecco.2022.e02365</p>

Published	Study Topic	Document Title	Summary	Principal Findings	Citation
2023	Conservation and endangered species	Biological case against downlisting the whooping crane and for improving implementation under the Endangered Species Act.	In response to potential downlisting of WCs from endangered to threatened status by the USFWS, the authors examined the status of WCs in the context of population status and current threats. The authors concluded that proposed downlisting is unwarranted before WC recovery plan population criteria have been met.	The authors examined the current status of WCs in the context of Endangered Species Act (ESA) threat factors, USFWS's Species Assessment framework, and similar avian downlisting actions to determine if downlisting the WC from endangered to threatened is biologically warranted. The authors noted that WCs are the rarest of 15 crane species worldwide with 702 birds estimated in fall 2022. The authors noted five major threats to WCs including habitat loss, environmental conditions, physical harm, disease, and pollution. The authors documented 17 avian species that have been downlisted under the ESA and found only one was downlisted from endangered status with a population <3,000 birds. The authors concluded WCs are facing an intensification of threats across their ranges, the population is still small relative to other crane species and most avian species of conservation concern, and that downlisting before WC population criteria for recovery have been met would be inconsistent with previous population management actions for avian species under the ESA. The authors concluded that downlisting WCs is objectively unwarranted.	Caven AJ, Thompson HL, Baasch DM, Hartup BK, Hegg AM, Schmidt, SM, Louque I, Allen CR, Crouch CG, Davis CA, Jorgensen JG, Austin, JE, Ostrom, BL, Beilfuss RD, Archibald GW, Lacy AE. 2023. Biological case against downlisting the whooping crane and for improving implementation under the Endangered Species Act. Papers in Natural Resources 1655. https://digitalcommons.unl.edu/natr espapers/1655?utm_source=digitalcommons.unl.edu%2Fnatrespapers%2F1655&utm_medium=PDF&utm_campaign=PDFCoverPages

Published	Study Topic	Document Title	Summary	Principal Findings	Citation
2023	Diurnal behavior	Whooping crane diurnal behavior and natural history during migration in the central Great Plains: summary report—Spring 2019 – Fall 2022	Studied WC diurnal activity and behavior in south-central Nebraska during the spring 2019 through fall 2022 migration seasons. Documented behaviors in different land cover types, responses to disturbance, and species on which WCs were foraging.	Used scan sampling to study WC activity and responses to disturbance and predators during 2019–2022. Observed 69 WC groups comprised of 248 birds and collected 5,017 instantaneous cane samplings totaling 23,676 individual behaviors. WC were observed foraging on multiple species, including fish, frogs, turtles, and arthropods. WC exhibited more alert and defensive behaviors in cornfields than other land cover types. WC were documented loafing and preening more often in palustrine and lacustrine wetland land cover types. Observed 15 aircraft-WC interactions involving 90 WCs with 57 birds having no reaction, 30 birds exhibiting alert responses, and three birds flushing. Baasch suggested wetland habitats provide valuable habitat for WCs to forage and rest and provide security to perform important social interactions.	Baasch DM. 2023. Whooping crane diurnal behavior and natural history during migration in the central Great Plains: summary report—Spring 2019 – Fall 2022. Final Report, Platte River Whooping Crane Maintenance Trust, Inc. Wood River, NE. Baasch-2023-Whooping-Crane-Migration-Behavior-Progress-Report-Spring-2019-Fall-2022.pdf
2023	Wind energy and bird conservation	Forecasting suitable areas for wind turbine occurrence to proactively wildlife conservation	Identified conservation priority areas for WC, golden eagles, and lesser prairie-chickens across an eight-state region using a combination of a wind turbine suitability model with animal movement, relative abundance, and population density models.	Authors used GPS locations from WC tagged with satellite transmitters from 2009–2018 to estimate whooping crane space use along migration corridor. They used a biased random bridge estimator to estimate utilization distributions of WCs during spring and fall migration. Multiplied spring and fall utilization distributions with wind turbine suitability predictions to develop a joint probability of intensity of use and wind turbine suitability and considered areas with highest joint probabilities as high conservation priority areas. Fig. 8 in the paper provides spatially explicit maps of conservation priority areas in relation to wind turbine suitability.	Boggie MA, Butler MJ, Sesnie SE, Millsap BA, Stewart DR, Harris GM, Broska JC. 2023. Forecasting suitable areas for wind turbine occurrence to proactively wildlife conservation. Journal for Nature Conservation 74(2023) 126442. https://doi.org/10.1016/j.jnc.2023.126442

Published	Study Topic	Document Title	Summary	Principal Findings	Citation
2022	Habitat use	Whooping crane (<i>Grus americana</i>) use patterns in relation to an ecotone classification in the central Platte River Valley, Nebraska, USA	Evaluation of ecotone-based landcover at 400 m and 1000m spatial scales to predict WC use of the central Platte River.	Integrated both landcover classification and hydrological factors into a finer scale ecotone data layer. USFWS public sighting WC use locations were characterized utilizing this ecotone data layer with a 400 m and a 1000 m buffer around each locational data point. Generalized linear mixed-effects models were used to assess the effects of ecotone composition, flooding frequency, and wetland status on the probability of whooping crane use. Ecotones at the 1000 m scale explained nearly 40% of the variation in WC use. WC were present more frequently in wetland portions of both agriculture fields and grassland communities, and less likely to use upland portions of these landcover types. Use was positively associated with proximity to the main channel of the Platte River. The probability of WC use was predicted to decrease as the proportion of developed landcover increased and distance to nearest road decreased.	Baasch DM, Caven AJ, Jorgensen JG, Grosse R, Rabbe M, Varner DM, LaGrange T. 2022 Whooping Crane (<i>Grus americana</i>) use patterns in relation to an ecotone classification in the Central Platte River Valley, Nebraska, USA. https://ace-eco.org/vol17/iss2/art35/
2022	Power line collision mitigation	Mitigating avian collisions with power lines through illumination with ultraviolet light.	Tested effectiveness of two avian collision avoidance systems (ACASs) at reducing collisions of large-bodied avian species. Whooping cranes were not documented as part of this study.	ACAS illumination and environmental variables were important predictors of avian collisions with power lines. ACAS illumination reduced collisions at focal power line by 88%. Collisions were more likely at moderate wind speeds.	Baasch DM, Hegg AM, Dwyer JF, Caven AJ, Taddicken WE, Worley CA, Medaries AH, Wagner CG, Dunbar PG, Mittman ND. 2022 Mitigating avian collisions with power lines through illumination with ultraviolet light. Avian Conservation and Ecology 17(2):9. https://doi.org/10.5751/ACE-02217-170209

Published	Study Topic	Document Title	Summary	Principal Findings	Citation
2022	Wintering habitat use	Whooping and sandhill cranes visit upland ponds proportional to migration phenology on the Texas coast	Evaluated whooping and sandhill crane use of constructed freshwater ponds as alternative water sources during drought on wintering grounds.	Used camera traps to estimate visits/month of 7 constructed ponds over 3 winters with drought conditions. Used generalized linear mixed-effects models to evaluate the effect of pond type, pond salinity, distance to saltmarsh, bay salinity, tide levels, rainfall, time of year, and migration phenology on the probability of pond use each month. Examined daily activity patterns of crane use at ponds. The best fitting models (both at the pond and broader scale) suggested more whooping crane group visits occurred in January when most whooping cranes were on the wintering grounds. More whooping cranes visited ponds on the mainland than on Matagorda Island. Whooping cranes were not observed at ponds prior to sunrise and infrequently after sunset, thus upland ponds were visited by whooping cranes diurnally.	Butler MJ, Metzger KL, Sanspre CR, Cain JW, Harris GM. 2022. Whooping and sandhill cranes visit upland ponds proportional to migration phenology on the Texas coast. Wildlife Society Bulletin 46(3): e1290. https://doi.org/10.1002/wsb.1290
2022	Wintering habitat use	Space use and site fidelity of wintering whooping cranes on the Texas Gulf Coast	Evaluation of AWB whooping crane winter home ranges through time and in relation to age, sex, reproductive status, and drought.	Used telemetry data from 57 individual telemetered whooping cranes from 2009-2017 and autocorrelated kernel density estimation (AKDE) to explore variation in home range size in relation to age, sex, reproductive status, and drought. Examined overlap in and distance between home range centroids through time to examine site fidelity. Estimated 95% AKDE mean as 30.1 km ² . Home range estimates did not differ for groups with vs. without juveniles. Sub-adult male home ranges were similar in size to those of family groups. Home ranges of sub-adult females were approximately double that of family groups. Home ranges increased in size during drought on the wintering grounds. From one year to the next, home range site fidelity averaged 68% overlap, but as the number of years increased between home ranges of an individual adult whooping crane, they overlapped less. Fidelity to juvenile winter home range declined with age through the 4 th winter, but the limited data available beyond the 4 th winter suggested that older individuals may return to within 2 km of their juvenile home range.	Butler MJ, Stewart DR, Harris GM, Bidwell MT, Pearce AT. 2022. Space use and site fidelity of wintering whooping cranes on the Texas Gulf Coast. Journal of Wildlife Management 86(5): e22226. https://doi.org/10.1002/jwmg.22226

Published	Study Topic	Document Title	Summary	Principal Findings	Citation
2022	Stopover duration	Whooping crane stay length in relation to stopover site characteristics	Examined the relationship between habitat characteristics and stopover duration during whooping crane migration.	Quantified habitat characteristics at 605 use locations from 449 stopover sites obtained through telemetry from 58 individual whooping cranes. Performed random forest regression to estimate importance of landcover variables for predicting stopover stay length. Mean stopover duration was 3.1 days. Over half of the stopover sites assessed for habitat characteristics were used only a single day or less. Landscape level variables explained 43% of variation in stay length, whereas site level variables explained 9%. Stay length increased with latitude, proportion of land cover as open-water slough with emergent vegetation, proportion of landcover as alfalfa, and longitude. At the site level, wetted width combined over all wetland classes, landcover of nearest shoreline, distance to terrestrial bank from a wetland use location, and wetland class were better predictors of variability in stay length. Stay length increased with wetted width at riverine sites but decreased with wetted width at lacustrine and palustrine sites.	Caven AJ, Pearse AT, Brandt DA, Harner MJ, Wright GD, Baasch DM, Brinley Buckley EM, Metzger KL, Rabbe MR, Lacy AE. 2022. Whooping crane stay length in relation to stopover site characteristics. Proceedings of the North American Crane Workshop 15:6-33. https://digitalcommons.unl.edu/cgi/viewcontent.cgi?article=1387&context=nacwgproc
2022	Habitat use	Balancing future renewable energy infrastructure siting and associated habitat loss for migrating whooping cranes	Evaluation of functional migratory habitat across the Great Plains relative to renewable energy infrastructure, human development and disturbance, and drought.	Used locational data from 57 individual telemetered whooping cranes from 2010-2016 in the US Great Plains to assess habitat selection and avoidance of disturbance (including renewable energy infrastructure) during migration relative to drought conditions. Land use within 800 m were the best predictors of WC use. Zones of influence distances were determined for disturbance variables. Relationships between WC use and predictor variables were compared under drought and non-drought conditions. An optimization analysis was performed to select potential sites for new wind energy development that minimize habitat loss for whooping cranes while maximizing wind energy potential.	Ellis KS, Pearse AT, Brandt DA, Bidwell MT, Harrell W, Butler MJ, Post van der Burg M. Balancing future renewable energy infrastructure siting and associated habitat loss for migrating whooping cranes. Frontiers in Ecology and Evolution 10:931260. https://doi.org/10.3389/fevo.2022.931260

Published	Study Topic	Document Title	Summary	Principal Findings	Citation
2022	Wintering habitat	Spatial and temporal predictions of whooping crane (<i>Grus americana</i>) habitat along the US Gulf Coast	Study mapping the historical spatial transformation of whooping crane habitat in and around Aransas National Wildlife Refuge.	Used exploratory spatial data analysis to document areas used by whooping cranes and how this space use has changed over time from 1990-2009. Developed a time series of ecological niche models to identify environmental factors (biotic and abiotic) correlated with crane habitat use and how importance has changed over time. Utilized multitemporal models to forecast areas along the US Gulf Coast that may provide additional wintering habitat for an expanding whooping crane population and where habitat may be lost due to rising sea levels predicted with climate change.	Golden KE, Hemingway BL, Frazier AE, Scholtz R, Harrell W, Davis CA, Fuhlendorf SD. 2022. Spatial and temporal predictions of whooping crane (<i>Grus americana</i>) habitat along the US Gulf Coast. Conservation Science and Practice 4(6): e12696. https://doi.org/10.1111/csp2.12696
2022	Agricultural land cover as habitat	Winners and losers of land use change: A systematic review of interactions between the world's crane species (<i>Gruidae</i>) and the agricultural sector	Meta-analysis of published literature on crane use of agricultural landcover and importance of agricultural crops in the diet of cranes to evaluate the bilateral effects of land use change.	Reviewed 135 articles describing 285 crane-agriculture interactions. Agricultural crops are an important dietary component for the majority of crane species with corn and wheat making the largest proportional contribution to the crane diet). Crane use of cropland as foraging habitat was identified in one-third of studies reviewed, but crop damage was identified in only ten percent of studies. Study identified two potential effects of increasing agricultural land cover: 1) habitat loss with negative effects on crane species dependent upon specific non-agricultural habitats and 2) superabundant food availability beneficial for opportunistic crane species able to utilize these resources.	Hemminger K, König H, Månsson J, Bellingrath-Kimura SD, Nilsson L. 2022. Winners and losers of land use change: A systematic review of interactions between the world's crane species (<i>Gruidae</i>) and the agricultural sector. Ecology and Evolution 12(3): e8719. https://doi.org/10.1002/ece3.8719
2022	Migratory habitat	The use of US Army Corp of Engineers reservoirs as stopover sites for the Aransas-Wood Buffalo population of whooping crane	Summary of AWB whooping crane use of USACE reservoirs as stopover sites.	Assessed AWB whooping crane stopover use of USACE reservoirs within the migratory corridor. Utilized WC stopover locations from USGS Telemetry Database from 2009-2018 together with USFWS Cooperative Whooping Crane Tracking Project database and USGS Biodiversity Information Serving Our Nation database to document significant stopover use of USACE reservoirs in both spring and fall migratory seasons. One reservoir was used as a wintering location in multiple years.	Jung JF, Fischer RA, McConnell C, Bates P. 2022. The use of US Army Corp of Engineers reservoirs as stopover sites for the Aransas-Wood Buffalo population of whooping crane. US Army Engineer Research and Development Center, Vicksburg, MS. https://apps.dtic.mil/sti/pdfs/AD1176388.pdf

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2022	Migratory habitat	Differential shortstopping behavior in whooping cranes: habitat or social learning?	Characterizes shortstopping winter habitat utilized by the Eastern migratory population (EMP) to estimate the amount of potential shortstopping wintering habitat available to the Aransas Wood Buffalo population (AWBP) within the Great Plains migratory corridor. Tests habitat availability and social learning as potential drivers leading to the difference in wintering behavior between the EMP and the AWBP populations.	Based upon habitat characteristics of shortstopping sites used by the EMP, an estimated 31.4% of the AWBP migratory corridor is suitable for wintering, reducing the likelihood that insufficient habitat suitability limits shortstopping during fall migration by the AWBP. Limited interactions among adults and juveniles of the EMP may reduce social learning of and adherence to established migratory behavior, leaving room for experience with and uptake of novel migratory behaviors such as shortstopping.	Mendgen, P, Converse SJ, Pearse AT, Teitelbaum CS, Mueller, T. 2022. Differential shortstopping behavior in whooping cranes: habitat or social learning? Global Ecology and Conservation 41: e02365. https://doi.org/10.1016/j.gecco.2022.e02365
2021	Behavior	Whooping crane diurnal behavior and natural history during migration in the central Great Plains: Interim report – Fall 2020.	Used long-range photography/videography, spotting scopes, and binoculars to document whooping crane activity, response to aircraft, and response to potential predators via scan sampling.	Observed 10 whooping crane groups, including 27 individuals. Documented foraging, preening, loafing, social, and defensive behaviors over both on and off-channel environments. Foraging/drinking was the most common behavior observed. Loafing and preening occurred most often in open-water wetland land classes. Alert or defensive behaviors were most often observed in cornfields.	Baasch DM, Caven AJ, Krohn B. 2021. Whooping crane diurnal behavior and natural history during migration in the central Great Plains: Interim report – Fall 2020. Crane Trust, Wood River, NE. https://www.researchgate.net/publication/363315982_Whooping_Crane_Diurnal_Behavior_and_Natural_History_during_Migration_in_the_Central_Great_Plains_Interim_Report_-_Fall_2020
2021	Diet and foraging behavior	Whooping crane (<i>Grus americana</i>) family consumes a diversity of aquatic vertebrates during fall migration stopover at the Platte River, Nebraska	Used long-range photography, videography, and behavioral scan sampling to document forage items consumed by whooping cranes.	During an 11-day stopover along the central Platte River during the fall of 2019 three adults- and one colt were observed. They consumed 16 individual vertebrates of at least 6 different species during the stopover. The research documented 7 channel catfish (<i>Ictalurus punctatus</i>), 5 ray-finned fish (Actinopterygii), 1 sunfish (Centrarchidae), 1 carp/minnow relative (Cypriniformes), 1 perch relative (Percidae), and 1 leopard frog relative (Lithobates sp.) consumed by whooping cranes.	Caven AJ, Koupal KD, Baasch DM, Brinley Buckley EM, Malzahn J, Forsberg ML, Lundgren M. 2021. Whooping crane (<i>Grus americana</i>) family consumes a diversity of aquatic vertebrates during fall migration stopover at the Platte River, Nebraska. Western North American Naturalist 81(4): 592-607. https://digitalcommons.unl.edu/natr espapers/1460/

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2021	Habitat selection	Migrating whooping cranes avoid wind-energy infrastructure when selecting stopover habitat	Used telemetry locations from 57 whooping cranes to detect potential avoidance of wind-energy infrastructure.	Examined how wind energy infrastructure may affect stopover locations. Used whooping crane ground locations and compared habitat characteristics within a buffer around each use and 19 available locations. Predictor variables included percentage wetland, percentage cropland, road density, distance from center of migratory corridor, and distance from energy tower. Zone of influence analysis demonstrated reduced probability of use of areas within 5 km of wind towers.	Pearse AT, Metzger KL, Brandt DA, Shaffer JA, Bidwell MT, Harrell W. 2021. Migrating whooping cranes avoid wind-energy infrastructure when selecting stopover habitat. Ecological Applications 31(5): e02324. https://doi.org.10.1002/eap.2324
2021	Habitat use	Disposition of non-complex palustrine wetlands	Used PRRIP whooping crane use locations from PRRIP monitoring and telemetry data from the whooping crane tracking partnership to assess use of the off-channel non-complex palustrine wetlands managed by the Program.	Whooping Cranes have not been documented to date using the non-complex palustrine wetlands managed by the Program.	PRRIP. 2021. Disposition of Non-Complex Palustrine Wetlands. https://platteriverprogram.org/system/files/2021-10/03-Palustrine%20Wetland%20Memo0.pdf
2020	Migratory group sizes	Trends in the occurrence of large whooping crane groups during migration in the Great Plains, USA	Used public sighting database to examine trends in migrating whooping crane group sizes over time and space.	Whooping crane group size and the amount of variation in group size has increased over time and in relation to an increasing whooping crane population with the strongest trend observed in the increasing number of groups with 7-9 and ≥ 10 individuals. Large groups tended to occur within the 50% migratory corridor, at staging areas closer to the ends of the migratory corridor, and disproportionately on conservation-managed habitat.	Caven AJ, Rabbe M, Malzahn J, Lacy AE. 2020. Trends in the occurrence of large whooping crane groups during migration in the Great Plains, USA. Heliyon 6(4): E03549. https://doi.org/10.1016/j.heliyon.2020.e03549

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2020	Migratory habitat	Identifying, protecting, and managing stopover habitats for wild whooping cranes on U.S. Army Corps of Engineers lakes	Evaluation of USACE lakes within the AWB population migratory corridor as potential whooping crane habitat for management.	<p>Thirty-four USACE lakes within the migratory corridor were evaluated using the following criteria: lake, pond, wetland ≥ 0.12 ha, with shallow area 12-25 cm deep for roosting, and gradual, sloping shorelines; little/no submerged/emergent vegetation in potential roost area; glide path clear of obstruction, no trees or tall, dense vegetation, open landscape with extensive horizontal visibility; and ≥ 275 m from human development/disturbance.</p> <p>Within the 34 lakes, 624 locations were identified as potential whooping crane stopover sites within North and South Dakota, Nebraska, Kansas, Oklahoma, and Texas with commitments to manage the identified habitat as resources allow.</p>	<p>McConnell, C. 2020. Identifying, protecting, and managing stopover habitats for wild whooping cranes on U.S. Army Corps of Engineers lakes. bioRxiv 12.30.424870. https://doi.org/10.1101/2020.12.30.424870</p>
2020	Wintering habitat	Identifying sustainable winter habitat for whooping cranes	Predicting future wintering habitat quality and quantity under scenarios of sea level rise and urban development. Calculation of potential carrying capacity over wintering habitat.	<p>Whooping cranes used salt marsh, areas >15 km from development, and < 2 km from estuarine water more frequently. Area of salt marsh changed over time with sea rise. One to three percent of suitable habitat was predicted to be lost to urbanization by 2100. Under the scenario of higher coastal urbanization over time, carrying capacity of wintering habitat for whooping cranes was predicted to initially increase with a 0.6 m rise in sea level, but decrease as sea level rose by 1-2 m through time.</p>	<p>Metzger KL, Lehnen SE, Sesnie SE, Butler MJ, Pearse AT, Harris G. 2020. Identifying sustainable winter habitat for whooping cranes. Journal for Nature Conservation 57. https://doi.org/10.1016/j.jnc.20.125892</p>
2020	Diet	A characterization of the diets of wild and reintroduced whooping cranes (<i>Grus americana</i>)	Inventoried proventriculus and ventriculus contents from dead birds to compare diet between Wisconsin-Florida (eastern migratory) population and the Aransas-Wood Buffalo population.	<p>Wisconsin-Florida and Aransas-Wood Buffalo populations had similar dietary compositions, including benthic invertebrates, beetles, crabs/crayfish, vegetation, seeds, mollusks and unidentified vertebrates.</p>	<p>Neri H. 2020. A characterization of the diets of wild and reintroduced whooping cranes (<i>Grus americana</i>). MS Thesis, Department of Environmental Biology, Hood College, Frederick, MD. http://hdl.handle.net/11603/18389</p>

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2020	Migration telemetry	Location data for whooping cranes of the Aransas-Wood Buffalo population, 2009-2018 (data set).	Telemetry tracking locational dataset for AWB migratory population of whooping cranes from 2009-2018.	Telemetry tracking locational dataset for AWB migratory population of whooping cranes from 2009-2018.	Pearse AT, Brandt DA, Baasch DM, Bidwell MT, Conkin JA, Harner MJ, Harrell W, Metzger KL. 2020. Location data for whooping cranes of the Aransas-Wood Buffalo population, 2009-2018 (data set). US Geological Survey. https://doi.org/10.5066/P9Y8KZJ9
2020	Migration strategy	Heterogeneity in migration strategies of whooping cranes	Used telemetry to assess variation in migration strategies among 58 whooping cranes and the variables associated with those differences.	Whooping cranes showed little consistency in stopover sites used among migration seasons. Timing of migration showed consistency among age classes and reproductive cycles. Time spent at stopover sites was positively associated with distances traveled and negatively associated with time spent at previous stopover sites.	Pearse AT, Metzger KL, Brandt DA, Bidwell MT, Harner MJ, Baasch DM, Harrell W. 2020. Heterogeneity in migration strategies of whooping cranes. The Condor 122(1): 1-15. https://academic.oup.com/condor/article/122/1/duz056/5700702
2019	Riverine habitat selection	Whooping crane use of riverine stopover sites	Analyzed habitat characteristics for riverine stopover sites in the Great Plains and on the Platte River using telemetry locations for the Great Plain analysis and both PRRIP systematic aerial monitoring and telemetry for the Platte River analysis.	This analysis found that whooping crane use on riverine sites was maximized at 200m for unobstructed channel width (656 ft. UOCW), 160m for nearest forest (524ft NF), and suggested managing for unforested corridor widths of 330m (1,082ft UFCW).	Baasch DM, Farrell PD, Howlin S, Pearse AT, Farnsworth JM, Smith CB. 2019. Whooping crane use of riverine stopover sites. PLoS ONE 14 (1): e0209612. https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0209612

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2019	Diurnal habitat selection	Diurnal habitat selection of migrating whooping crane in the Great Plains	This study used telemetry marked whooping cranes to assess diurnal use of landcover types throughout the U.S. migration corridor.	Diurnal habitat selection by whooping cranes was found to be influenced by land-cover type and distance to roads. Avoidance of roads varied based on land cover type. At 200 m from any road, all water-based land-cover types (river, open water, and semipermanent wetlands) were estimated to be at least three times as likely and lowland grassland was more than twice as likely to be selected as diurnal use sites than other non-water-based land-cover types (upland grass, corn, wheat, and other agriculture). Corn and semipermanent wetlands were more than 3 times as likely to be selected for at 1 km compared to 200 m from any road, whereas open water and riverine were similarly selected at 1km and 200 m from any road. Semi-permanent wetland was the only water-based land-cover type that was influence by avoidance of roads and was almost 3 times as likely selected at 1 km compared to 200m.	Baasch DM, Farrell PD, Pearse AT, Brandt DA, Caven AJ, Harner MJ, Wright GD, Metzger KL. 2019. Diurnal habitat selection of migrating Whooping Crane in the Great Plains. Avian Conservation and Ecology 14(1):6. https://doi.org/10.5751/ACE-01317-140106
2019	Diet and foraging	Adult whooping crane (<i>Grus americana</i>) consumption of juvenile catfish (<i>Ictalurus punctatus</i>) during the avian spring migration in the Central Platte River Valley, Nebraska, USA.	First observation of whooping crane consumption of fish in the Platte River.	22 March 2018 observation and photo documentation of an adult whooping crane consuming five juvenile channel catfish.	Caven AJ, Malzahn J, Koupal KD, Brinley Buckley EM, Wiese JD. 2019. Adult whooping crane (<i>Grus americana</i>) consumption of juvenile catfish (<i>Ictalurus punctatus</i>) during the avian spring migration in the Central Platte River Valley, Nebraska, USA. Monographs of the Western North American Naturalist 11(2). https://scholarsarchive.byu.edu/mwnan/vol11/iss1/2/?utm_source=scholarsarchive.byu.edu%2Fmwnan%2Fvol11%2Fiss1%2F2F2&utm_medium=PDF&utm_campaign=PDFCoverPages

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2018	Riverine habitat management	Investigating whooping crane habitat in relation to hydrology, channel morphology and a water-centric management strategy on the central Platte River, Nebraska	This study used annual aerial imagery to monitor effectiveness of sediment augmentation, mechanical/chemical vegetation clearing, channel consolidating, and short duration high flow releases to maintain suitable unobstructed channels for whooping cranes.	This study found 40-day mean peak discharge, wetted width of the channel, disking and herbicide application to be the best predictors of total unvegetated channel width (TUCW). Maximum unvegetated channel width (MUCW) was best explained by 40-day duration peak discharge and wetted width of the main channel. Disking and herbicide application were also included in the top model. Implementation of a short duration high flow release in a given year was predicted to increase TUCW by 0.0 – 6.7 m and MUOCW by 0.0 – 4.6 m depending on baseline river discharge at the time of the release.	Farnsworth JM, Baasch D, Farrell PD, Smith CB, Werbylo KL. 2018. Investigating whooping crane habitat in relation to hydrology, channel morphology and a water-centric management strategy on the central Platte River, Nebraska. Heliyon 4(10): E00851. https://doi.org/10.1016/j.heliyon.2018.e00851
2018	Diurnal habitat selection	Opportunistically collected data reveal habitat selection by migrating Whooping Cranes in the U.S. Northern Plains.	The study combined opportunistic whooping crane sightings from the USFWS public sightings database with landscape data to identify correlates of whooping crane occurrence along the migration corridor in North and South Dakota, USA.	The study found whooping cranes migrating through North and South Dakota select diverse wetland communities and upland (cropland) foraging opportunities. A 1.2 km buffer (radius around use and available locations) for quantification of habitat metrics was the spatial scale with best model support. Road density and distance to increased survey area were found to be important variables to incorporate into the model to account for detection bias in the public sightings database.	Niemuth ND, Ryba AJ, Pearse AT, Kvas SM, Brandt DA, Wangler B, Austin JE, Carlisle, MJ. 2018. Opportunistically collected data reveal habitat selection by migrating Whooping Cranes in the U.S. Northern Plains. The Condor 120(2):343-356. https://doi.org/10.1650/CONDOR-17-80.1

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2017	Riverine and diurnal use site selection	Correlates of whooping crane habitat selection and trends in use in the central Platte River	Using PRRIP systematic aerial monitoring data from 2001-2014, distance to nearest forest and unobstructed channel widths were important predictors of whooping crane use. However, distance to nearest obstruction was in the top five models. The proportion of population using the Platte River is increasing faster than the population during spring migration but not for fall. Neither spring nor fall migration has a significantly increasing trend.	Statistical modeling of habitat use indicated unobstructed channel width and nearest forest were the most important predictor variables for management purposes. Nearest obstruction was in all top five models but was not included in the management list as it cannot be managed for. Statistical modeling of diurnal habitat use indicated the full model for diurnal use containing all four covariates including nearest obstruction, nearest disturbance, proximity to roosting location, and land cover. Based upon PRRIP monitoring data from 2001-2014, statistical modeling indicated a significant increase in the proportion of the Aransas-Wood Buffalo population of whooping crane using the Platte River in spring through time. However, the statistical modeling for fall use indicated a decreasing trend through time but was not statistically different than zero. These same trends for proportion of population were seen as well for crane use days for spring and fall migration, but neither were statistically different from zero.	Howlin S, Nasman K. 2017. Correlates of whooping crane habitat selection and trends in use in the central Platte River, Nebraska. https://platteriverprogram.org/sites/default/files/PubsAndData/ProgramLibrary/Correlates%20of%20Whooping%20Crane%20Habitat%20Selection%20and%20Trends%20in%20Use%20in%20the%20Central%20Platte%20River.pdf
2017	Roost and diurnal use sites	Evaluation of nocturnal roost and diurnal sites used by whooping cranes in the Great Plains, United States	This document used telemetry marked whooping cranes to locate roost and diurnal use sites in the great plains. Characteristics of each site were measured to develop criteria to help identify habitat along the central Platte River for restoration, conservation, and management actions.	Whooping cranes were able to tolerate a wider range of habitat metrics in the larger portion of the migration corridor than defined by the Program's initial habitat criteria thresholds for the Platte River except for distance to nearest disturbance. Whooping cranes appeared to be more tolerant of disturbances on the Platte River than they were when analyzing the entire corridor.	Pearse AT, Harner MJ, Baasch DM, Wright GD, Caven AJ, Metzger KL. 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, 29 p., https://pubs.usgs.gov/of/2016/1209/ofr20161209.pdf

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2017	Habitat selection	PRRIP whooping crane habitat synthesis chapters	Used Program systematic monitoring along with telemetry datasets to identify riverine habitat for whooping cranes in the Great Plains and central Platte River.	Unable to establish a relationship between whooping crane use and river flow metrics or total channel width but identified unobstructed channel width and distance to nearest forest as good predictors of whooping crane use. Selection for unobstructed channel width was maximized around 650ft and unforested corridor width was maximized at 1,000 ft. Short-duration high-flow releases will not create or maintain favorable whooping crane riverine habitat in the central Platte River.	PRRIP. 2017. Whooping crane (<i>Grus americana</i>) habitat synthesis chapters. https://platteriverprogram.org/sites/default/files/PubsAndData/ProgramLibrary/PRRIP%20Whooping%20Crane%20Habitat%20Synthesis%20Chapters.pdf
2015	Use site intensity throughout the migration corridor	Whooping crane stopover site use intensity within the Great Plains	Used five years data from 58 telemetry marked whooping cranes to analyze use site intensity throughout the migration corridor to identify landscapes important to whooping cranes during migration.	Twenty percent of the grid cells contained one or more stopovers. Thirty percent received only fall stopovers and 47% exclusively spring use. Twenty-three percent had use during both migration seasons. Lands with some type of protection covered approximately 10 percent of the migration corridor used by whooping cranes and approximately 27% of the core corridor. Based on the derived centerline of the migration corridor, 75% of stopover sites occurred within 59 km, 85% within 82 km, and 95% within 144 km of the centerline. Results were similar to those obtained from public sightings data (with known observational bias based upon location) supporting the idea that public sightings data may have value in large scale evaluation.	Pearse AT, Brandt DA, Harrell WC, Metzger KL, Baasch DM, Hefley TJ. 2015. Whooping crane stopover site use intensity within the Great Plains: U.S. Geological Survey Open-File Report 2015–1166, 12 p., https://www.researchgate.net/publication/292143948_Whooping_crane_stopover_site_use_intensity_within_the_Great_Plains

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2014	Species distribution modeling	Correction of location errors for presence-only species distribution models	Analyzed sampling bias of whooping crane locations and the effects those errors had on species distribution models.	Whooping cranes avoid development within 100 and 250 m radius but are indifferent to development at 500 m. Species distribution models rely on accurate species locational data as well as accurate measurement of environmental covariates included in the model postulated to be important for species distribution. Errors in location data can lead to biased regression coefficients for species distribution modeling. Regression calibration can reduce this bias, but can increase variance surrounding parameter estimates, widening confidence intervals associated with variables predicting species distribution. Managers should consider whether there is enough location error (either random or systematic) to warrant correction in light of the increase in uncertainty around resulting parameter estimates. Recording accurate locations from the field will greatly increase the accuracy of models.	Hefley TJ, Baasch DM, Tyre AJ, Blankenship EE. 2014. Correction of location errors for presence-only species distribution models. <i>Methods in Ecology and Evolution</i> 5: 207-214. https://besjournals.onlinelibrary.wiley.com/doi/epdf/10.1111/2041-210X.12144
2013	Population dynamics and recovery planning.	Influence of whooping crane population dynamics on its recovery and management	Modeled 73-year time series of WC abundance to estimate the probability of downlisting. Source for USFWS best estimates of AWB population 1938-2011 obtained through winter surveys.	AWB population experiences periodic population declines but is unlikely to go extinct if future conditions remain similar to those experienced in the past. Provides information for evaluating recovery timelines, habitat conservation targets, management triggers, and monitoring frequency.	Butler MJ, Harris G, Strobel BN. 2013. Influence of whooping crane population dynamics on its recovery and management. <i>Biological Conservation</i> 162: 89-99. https://www.sciencedirect.com/science/article/pii/S0006320713000980

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2013	Species distribution modeling	Non-detection sampling bias in marked presence-only data	Used whooping crane data to develop a method that corrects for non-detection sampling bias when using presence-only locational data for species distribution modeling.	Developed a marked inhomogeneous Poisson point process species distribution model that accounted for non-detection and aggregation behavior. Correcting for non-detection sampling bias requires estimates of the probability of detection which must be obtained from auxiliary data, as presence-only data do not contain information about the detection mechanism. The number of detections required may be relatively small to result in adequate correction of non-detection sampling bias. Studies documenting the relationship between environmental features and species distribution of abundance must consider the grouping behavior of individuals.	Heffley TJ, Tyre AJ, Baasch DM, Blankenship EE. 2013. Non-detection sampling bias in marked presence-only data. Ecology and Evolution 3(16):5225-5236. https://onlinelibrary.wiley.com/doi/epdf/10.1002/ece3.887
2012-present	USFWS whooping crane survey results: winter 2012 - present	USFWS Whooping crane survey results: winter 2012 - present	Source for USFWS annual estimates of AWB population obtained through winter surveys 2012-present.	The USFWS estimated the abundance of whooping cranes in the AWB population for the winter of 2021–2022 as 543 whooping cranes (95% CI = 426.5–781.8; CV = 0.182) inhabiting the primary survey area. This estimate included at least 31 juveniles (95% CI = 20.2–50.8; CV = 0.255) and 196 adult pairs (95% CI = 153.4–282.9; CV = 0.182).	Butler MJ, Harrell W. Bradley SN, Sanspree CR, Moon JA 2012-2022. Whooping crane survey results: Winter 2012 – present. https://ecos.fws.gov/ServCat/Collection/Profile/1206

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2008	Summary of WC use of central Platte River from 2001-2006	Whooping crane migrational habitat use in the central Platte River during the Cooperative Agreement period, 2001-2006	Used data collected from systematic aerial surveys during the cooperative agreement to answer five objectives related to whooping crane use of the AHR.	During the cooperative agreement period, average predicted probability of detection for each survey ranged from 0.34 to 0.78. The average distance moved (straight line distance between two consecutive locations) across the 13 crane groups was 3.22 miles, ranging from 0.49 – 21.64 miles. There was no trend found in the index of WC use during this monitoring period. Feeding behaviors were the most common activity observed during crane group monitoring. The second most observed behavior was resting. WC selected channels with large unobstructed views with probability of use maximized when unobstructed width was 343 meters (1,125 ft). A flow dependent selection model indicated that wetted width at suitable depth increased the probability of WC use, maximizing probability of selection at a wetted width of 319 meters and proportion of channel at suitable depth or sand being 0.48.	Howlin S, Derby C, Strickland D. West, Inc. 2008. Whooping crane migrational habitat use in the central Platte River during the Cooperative Agreement period, 2001-2006. https://platteriverprogram.org/system/files/Internal%20Pubs%20WEST%20Inc.%202008%20WC%20Migrational%20Habitat%20Use%20%282001-2006%29.pdf
2001-present	Annual spring and fall whooping crane monitoring reports for the central Platte River	Platte River Recovery Implementation Program: implementation of the whooping crane monitoring protocol	Results from systematic aerial monitoring of the AHR on the central Platte River for spring and fall migration.	Results from systematic aerial monitoring of the AHR on the central Platte River for spring and fall migration.	Platte River Recovery Implementation Program (PRRIP). 2001-Present. https://platteriverprogram.org/program-library?field_document_category_ref_target_id=11&field_document_focus_area_ref_target_id=17&field_document_type_ref_target_id=All&field_document_species_ref_target_id=24&title=Monitoring+Report&items_per_page=20