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1 **Platte River Recovery Implementation Program: Implementation of the Whooping Crane**  
2 **Monitoring Protocol—Spring 2024 Report**  
3

4 **Prepared by:**

5 Ethan Ideus ([ideuse@headwaterscorp.com](mailto:ideuse@headwaterscorp.com)) and Malinda Henry  
6 Platte River Recovery Implementation Program  
7 Executive Director's Office  
8 4111 4<sup>th</sup> Avenue  
9 Suite 6  
10 Kearney, Nebraska 68845  
11

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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
CNPPID	Central Nebraska Public Power and Irrigation District
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") enumerated and monitored whooping cranes (*Grus americana*) during the spring 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 46-day monitoring period that lasted from March 5 to April 19, 2024, PRRIP's EDO completed 61 of 92 (66.3%) scheduled flight routes with each day's route surveying the length of the river channel and off-channel habitat within the AHR. Surveyors enumerated 187 individual whooping cranes consisting of 173 adults and 14 juveniles in 44 unique groups during systematic aerial surveys. Overall, the EDO observed 154 group locations that consisted of repeated observations of 22 of the 44 unique groups. Of these 154 locations, 14 were observations of the same group at a different location on the same day. Surveyors observed the first whooping crane group on March 5 and the final group on April 12, 2024.

The 187 individual whooping cranes represented 0.349 of the Aransas-Wood Buffalo (AWB) migratory population based on the U.S. Fish and Wildlife Service's 2022–2023 estimate of 536 whooping cranes (95% CI = 444, 644) on wintering grounds along the Texas coast of the Gulf of Mexico. With 107 of the 187 whooping cranes having multiple day stopovers on the AHR, PRRIP's EDO estimated 845 total crane use days for spring 2024. Stopover length (days present in the AHR) of the 44 unique whooping crane groups during spring 2024 ranged between one and 27 days (mean = 4.2; median = 1.5; standard error [SE] = 0.9). When considering whooping cranes observed only between March 9 and April 16, which represented the 5<sup>th</sup> and 95<sup>th</sup> percentiles of initial dates of spring whooping crane group observations in Nebraska from the U.S. Fish and Wildlife Service public sightings database during 2015–2024, PRRIP's EDO enumerated 184 whooping cranes and 823 adjusted crane use days. Stopover length of the 43 groups between March 9 and April 16 ranged from one to 23 days (mean = 4.0; median = 2.0; SE = 0.8). The spring of 2024 was truly unique, documenting use by 83 more whooping cranes (82% increase) over 359 more crane use days (77% increase) than the prior record set in spring 2018 when comparing metrics adjusted for the 5<sup>th</sup> and 95<sup>th</sup> percentile dates.

Flow in the Platte River as measured at four gaging stations along the AHR between Overton and Grand Island, Nebraska ranged from 250 cubic feet per second (cfs) to 2,650 cfs during the standard March 5 to April 19 monitoring period. Instantaneous discharge at the gaging station closest to each of 85 whooping crane group locations in the river channel ranged from 500 cfs to 2,230 cfs (mean = 1,739; median = 1,850; SE = 45). A spring Environmental Account release implemented by the USFWS in collaboration with Central Nebraska Public Power and Irrigation District (CNPPID) was designed to reduce periods of extremely low discharge between periods of hydrostepping during the spring 2024 migratory season. The release reduced variability in discharge during the time when most whooping cranes were present on the central Platte River. Whooping cranes with stopovers extending beyond this release experienced a range of low to high discharge at the nearest gage. Most (64.7%) of the 85 whooping crane groups observed in the river channel were closest to the Grand Island, Nebraska gage. Unobstructed channel widths at the 85 whooping crane riverine use sites ranged from 229 ft to 1,457 ft (mean = 777; median = 761; SE = 34). Distance to the nearest forest at the 85 riverine use sites ranged from 133 ft to 1,692 ft (mean = 655; median = 522; SE = 47).

1 We calculated 5<sup>th</sup> and 95<sup>th</sup> percentiles of dates of spring whooping crane group observations in  
2 Nebraska in 10-year periods between 1998 and 2024 and retrospectively calculated the adjusted  
3 proportion of the AWB population stopping on the AHR and adjusted number of crane use days  
4 from PRRIP spring surveys dating back to 2014. Spring surveys before 2014 did not include the  
5 5<sup>th</sup> percentile date of group observations. Therefore, it is likely the proportion of population and  
6 number of crane use days reported for 2007 through 2013 underestimate whooping crane stopover  
7 metrics during spring of those years. Without surveys spanning the full range of dates between the  
8 5<sup>th</sup> and 95<sup>th</sup> percentile dates, metrics from 2007–2013 could not be adjusted. Use of 5<sup>th</sup> and 95<sup>th</sup>  
9 percentiles of dates to calculate whooping crane metrics resulted in adjustments being made to  
10 metrics in the spring of 2018, 2021, 2022, 2023, and 2024. Adjustments were minor in three of the  
11 five years. However, in 2018, the number of individual whooping cranes observed, proportion of  
12 population that stopped on the AHR, and number of crane use days decreased from 118 to 101  
13 birds, 0.234 to 0.200, and 501 to 464 crane use days, respectively, when accounting for whooping  
14 cranes observed only during the 5<sup>th</sup> through 95<sup>th</sup> percentiles of dates from the 2009–2018 period.  
15 In 2024, decreases in the whooping crane metrics resulted from three whooping crane groups  
16 arriving before the 5<sup>th</sup> percentile date. For 2024, the numbers of individual whooping cranes  
17 observed decreased from 187 to 184, proportion of population that stopped on the AHR decreased  
18 from 0.349 to 0.343, and crane use days decreased from 845 to 823 days due to adjustments made  
19 to account for whooping cranes observed only during the 5<sup>th</sup> through 95<sup>th</sup> percentiles of dates from  
20 2015–2024.

21  
22 Spring whooping crane stopover metrics on the AHR of the central Platte River as determined  
23 through PRRIP's surveys have demonstrated considerable annual variability. When evaluating  
24 adjusted metrics from 2014 through 2024, the adjusted spring proportion of the population that  
25 stopped on the AHR ranged from 0.012 to 0.343 (mean = 0.101; SE = 0.030) and the adjusted  
26 number of crane use days during spring varied between 13 and 823 days (mean = 206; SE = 72).  
27 Over the past three years the number of whooping cranes, proportion of population stopping on  
28 the AHR, and number of crane use days as determined through PRRIP spring surveys have  
29 increased from recent lows in these metrics observed during 2019 through 2021. Spring 2024 saw  
30 the highest adjusted proportion of the population and adjusted crane use days documented during  
31 the spring within the AHR since 2007. Interannual variability makes it difficult to quantify long  
32 term trends in stopover metrics. We found no correlation between either the adjusted proportion  
33 of population stopping on the AHR and year, or the adjusted number of crane use days and year  
34 during 2014–2024 using a Spearman rank correlation. We also found no statistically significant  
35 relationship between either the adjusted proportion of population and year or the adjusted number  
36 of crane use days and year during 2014–2024 using a mixed effects model. The information  
37 collected from PRRIP's long-term systematic monitoring of whooping cranes along the central  
38 Platte River is being used to assess success of the Program's management objective of contributing  
39 to the survival of whooping cranes during migration and evaluate the biological response of  
40 whooping cranes to the Program's water and land management.

## 1 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 2017a](#), [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 2017a](#), [PRRIP 2020](#)).

The Program’s whooping crane monitoring protocol includes two major components ([PRRIP 2017b](#)):

- 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 5<sup>th</sup> through 95<sup>th</sup> 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 5<sup>th</sup> and 95<sup>th</sup> 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 spring monitoring period from March 6 through April 29 to March 5 through April 19 beginning in 2024 ([PRRIP 2023b](#)).

In this report, we summarize PRRIP’s spring 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 enumerated, proportion of the AWB population observed stopping on 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 5<sup>th</sup> and 95<sup>th</sup> 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

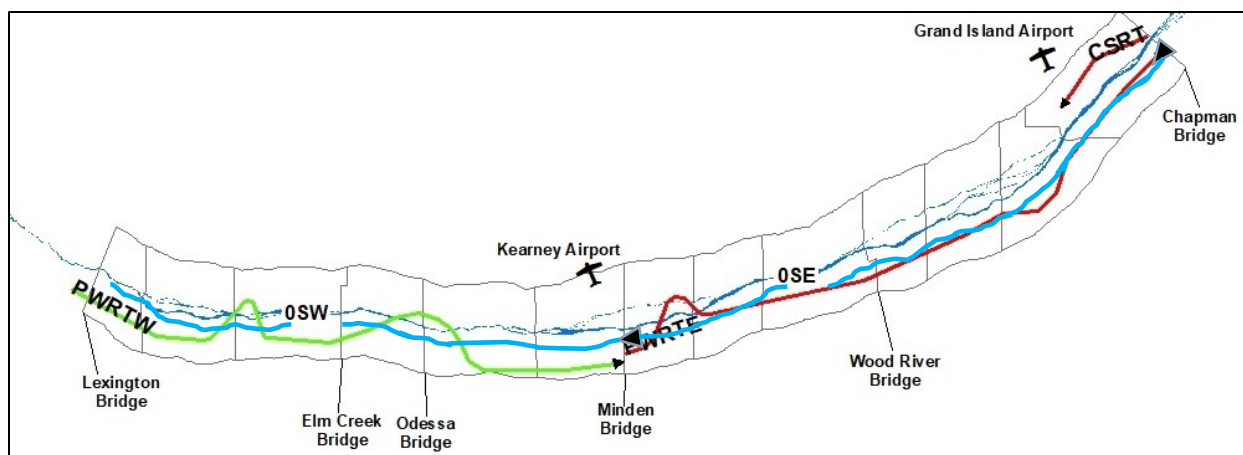
The PRRIP EDO conducted spring whooping crane monitoring in accordance with the *Platte River Recovery Implementation Program – Whooping Crane Monitoring Protocol Migrational Habitat Use in the Central Platte River Valley rev. July 2017* ([PRRIP 2017b](#)) during March 5, 2024 through April 19, 2024. 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).

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

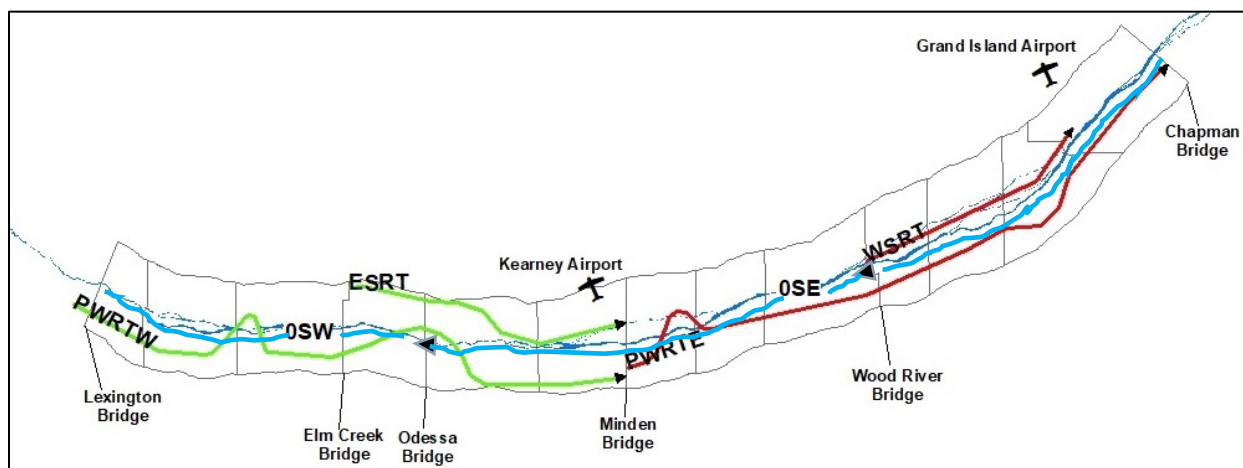
11  
12 Two types of transects were flown on each route to ensure coverage of both on-channel riverine  
13 and off-channel wetland habitat. On-channel river transects (shown in blue on Figs. 1, 2) were  
14 flown east to west with the plane located south of the southern-most river channel to reduce the  
15 effect of sun glare. Starting points along riverine transects were alternated daily between two flight  
16 routes to allow different sections of the study area to be observed as early as possible in the flight  
17 times. Off-channel transects (shown in red and green on Figs. 1, 2) were designed to survey  
18 existing off-channel habitat within 3.5 mi of the river and serve as functional routes for planes to  
19 return to starting airports.

20  
21 **Route 1.** The first pilot flew the transect covering the west half of the AHR from the Minden,  
22 Nebraska bridge west to the Lexington, Nebraska bridge (OSW; Fig. 1). The first pilot then flew  
23 the primary wetland return transect (PWRTW) from west to east (Fig. 1). The second pilot  
24 simultaneously flew the transect covering the east half of the AHR from the Chapman, Nebraska  
25 bridge west to the Minden bridge (OSE), followed by the primary wetland return transect (PWRTW)  
26 from west to east (Fig. 1). The second pilot flew a secondary transect (CSRT) to return to the  
27 airport (Fig. 1).

28  
29 **Route 2.** The first pilot flew the transect covering the west half of the AHR beginning at the  
30 midpoint of the OSW river channel transect at the Odessa, Nebraska bridge west to the Lexington  
31 bridge (Fig. 2). The first pilot then flew the primary wetland return transect (PWRTW) east to the  
32 Minden bridge, followed by the OSW river channel transect back to the Odessa bridge (Fig. 2).  
33 The first pilot flew a secondary return transect (ESRT) from Hwy 183 at Elm Creek, Nebraska east  
34 to return to the Kearney airport (Fig. 2). The second pilot simultaneously flew the transect  
35 covering the east half of the AHR from the midpoint of the OSE river channel transect at the Wood  
36 River, Nebraska bridge west to the Minden bridge (Fig. 2). The second pilot then flew the primary  
37 wetland return transect (PWRTW) east to the Chapman bridge, followed by the remainder of the  
38 east half of the OSE transect back to the Wood River bridge (Fig. 2). The second pilot flew a  
39 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 (PWRT) and secondary return transects (CSRT) 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 (PWRT) 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

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

14  
15 Throughout the spring monitoring period, EDO staff placed a total of 19 whooping crane decoy  
16 sets consisting of 36 decoys (one to three decoys per set) in 19 unique locations along the aerial  
17 transects to evaluate the ability of aerial surveyors to detect whooping cranes. We placed 11 decoy  
18 sets at randomly selected locations within the river channel and 8 decoy sets at randomly selected  
19 locations along off-channel conservation lands within 500 ft of the channel.

20  
21 Aerial and ground surveyors documented their observations of whooping crane groups with  
22 photographs and recorded the number of whooping cranes observed, age category of individuals  
23 as adults or juveniles, location, land cover type, time, and date of observation. Surveyors defined  
24 a whooping crane group as one or more whooping cranes observed at one location. EDO staff gave  
25 each whooping crane group a unique identification (ID) code (e.g., 2024SP01) combining the year,  
26 season (SP for spring), and PRRIP group number at sighting. If the same confirmed group was  
27 observed at more than a single location within the same day, the initial sighting received an A  
28 location identifier (e.g., 2024SP01A) with all subsequent locations receiving a B, C, etc... If the  
29 same confirmed group was observed the following day, then surveyors gave the group a new group  
30 ID (e.g., 2024SP02). We used aerial flight logs and ground search data sheets to document time  
31 and mileage devoted to searching for and identifying whooping cranes. During ground search  
32 surveys, mileage was calculated based on the driving distance from the location of the last reported  
33 sighting or known location to the conclusion of the search effort.

34  
35 We recorded locations of each whooping crane group in Universal Transverse Mercator (UTM)  
36 coordinates within UTM Zone 14N using satellite imagery in ArcGIS Pro 3.3.1 (ESRI 2024) in  
37 conjunction with observation photographs and location descriptions provided by surveyors. We  
38 assigned use sites a number based on the date and time of sighting if the whooping crane group  
39 was observed in riverine, lacustrine, or palustrine land cover types. Whooping crane groups  
40 sighted outside of these land cover types were not assigned a use site number, but surveyors  
41 recorded the location's land cover classification. If the group was sighted while in flight, then  
42 surveyors recorded the location's land cover as "AIR." After entering data into the PRRIP species  
43 database, we conducted Quality Assurance/Quality Control (QA/QC) checks to ensure accuracy.

44  
45 We used whooping crane group locations to evaluate river flow and habitat metrics at or near the  
46 use location. Four U.S. Geological Survey (USGS) flow gages were located on the Platte River



throughout the AHR from west to east during spring 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 2023 aerial imagery of the Platte River channel and surrounding habitat at an aspect ratio of 1:1,750 in ArcGIS Pro 3.3.1 (ESRI 2024) 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 5<sup>th</sup> and 95<sup>th</sup> 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 March 5, 2024 and April 19, 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 2022–2023 surveys ([USFWS 2023](#)) to estimate the proportion of the AWB population that stopped on the AHR during the fall 2023 migration. We used the population estimate from the winter 2022–2023 survey because no survey was implemented by USFWS during the winter of 2023–2024.

***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. Unique groups are typically individually identifiable by their arrival date, location, and group composition. 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 spring 2024 by summing the number of crane use days across all whooping crane groups observed.

***5<sup>th</sup> and 95<sup>th</sup> percentiles and adjusted whooping crane metrics.*** We used the USFWS whooping crane public sighting database for Nebraska (USFWS *unpublished data*) to determine the initial



1 date of spring whooping crane group observations during 1998–2024. We divided the data into  
2 18 10-year rolling periods with the first and last periods spanning 1998–2007 and 2015–2024,  
3 respectively. We used R version 4.3.1 ([R Core Team 2023](#)) to calculate the 5<sup>th</sup> and 95<sup>th</sup> percentiles  
4 of initial dates of group observations for each 10-year period.

5  
6 Spring surveys during 2007 through 2013 began later in the season and did not include the 5<sup>th</sup>  
7 percentile date for the corresponding period. Therefore, we could not adjust metrics to encompass  
8 the 5<sup>th</sup> and 95<sup>th</sup> percentile dates during those years. For PRRIP systematic surveys dating back to  
9 spring 2014, we calculated adjusted metrics as the total number of individual whooping cranes  
10 observed and total number of crane use days within the dates corresponding to the 5<sup>th</sup> and 95<sup>th</sup>  
11 percentiles of initial dates of group observations for each 10-year period. For example, for PRRIP  
12 surveys conducted during 2014, we used percentiles calculated from USFWS data from 2005–  
13 2014. For PRRIP surveys conducted during 2024, we used percentiles calculated from USFWS  
14 data from 2015–2024. We used a non-parametric Spearman’s rank correlation (Neter et al. 1996)  
15 to calculate the Spearman’s correlation coefficient ( $\rho$ ) and assess whether significant relationships  
16 at  $\alpha = 0.05$  existed between the adjusted proportion of population and year, and adjusted number  
17 of crane use days and year during 2014–2024. We also used package *nlme* in R ([Pinheiro and](#)  
18 [Bates 2000](#), [R Core Team 2023](#), [Pinheiro et al. 2023](#)) to fit mixed-effects models to examine  
19 whether a trend existed between the adjusted proportion of the population and year, and adjusted  
20 number of crane use days and year. In addition, we developed a mixed-effects model to assess  
21 whether a relationship existed between the estimated AWB population size and the number of  
22 whooping cranes observed during PRRIP spring surveys between the 5<sup>th</sup> and 95<sup>th</sup> percentiles of  
23 dates of spring whooping crane group observations in Nebraska during 2016–2024. We used  
24 2016–2024 as a range for this analysis because there was a change in survey dates and  
25 methodology for USFWS surveys on the winter range between winter 2014–2015 and winter  
26 2015–2016 ([USFWS 2023](#)). In each mixed-effects model, we included year as a random effect  
27 with an autoregressive correlation structure of order one to account for repeated measurements  
28 across years.

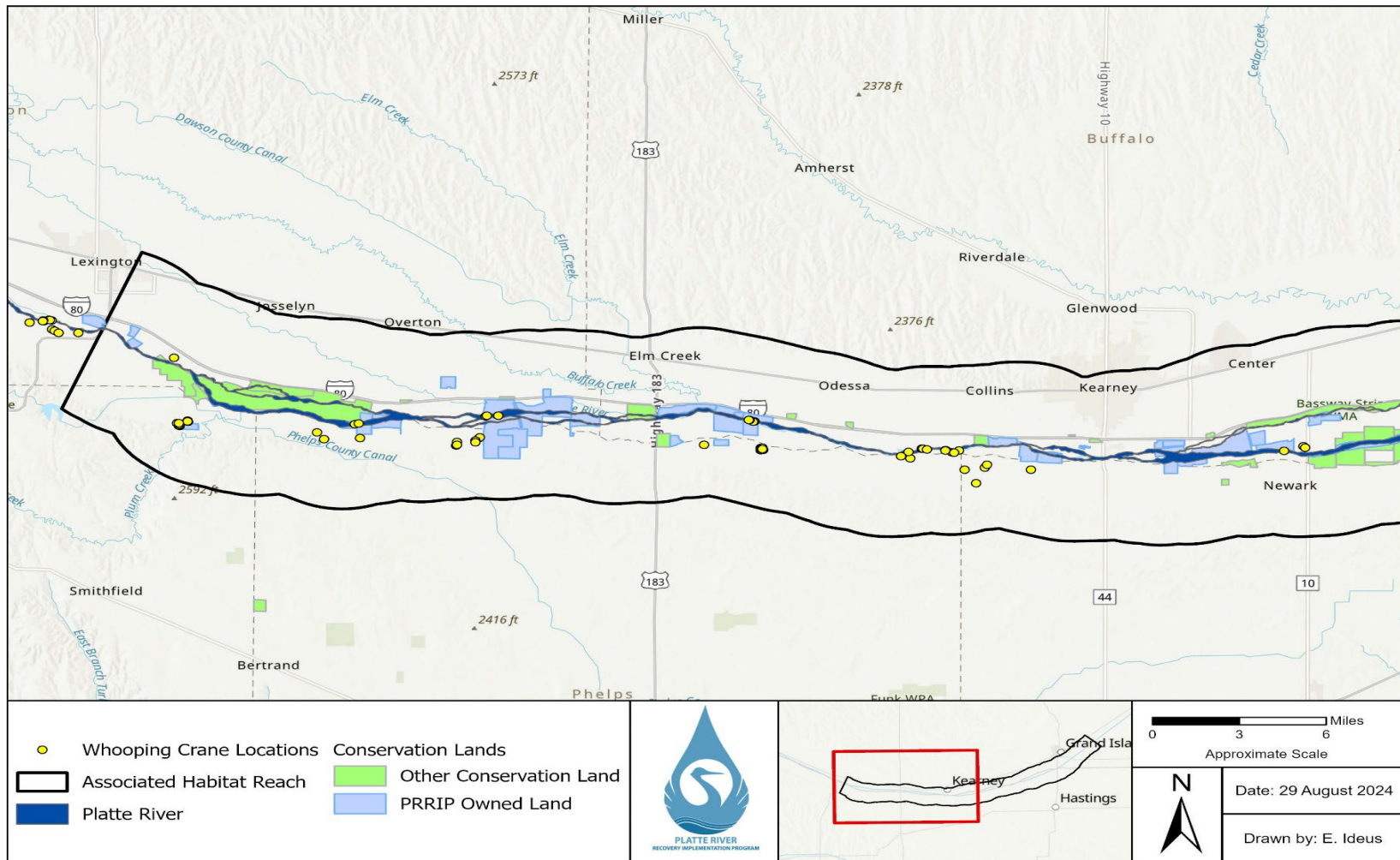
## 29 30 **Results**

### 31 32 **Whooping crane observations and monitoring effort**

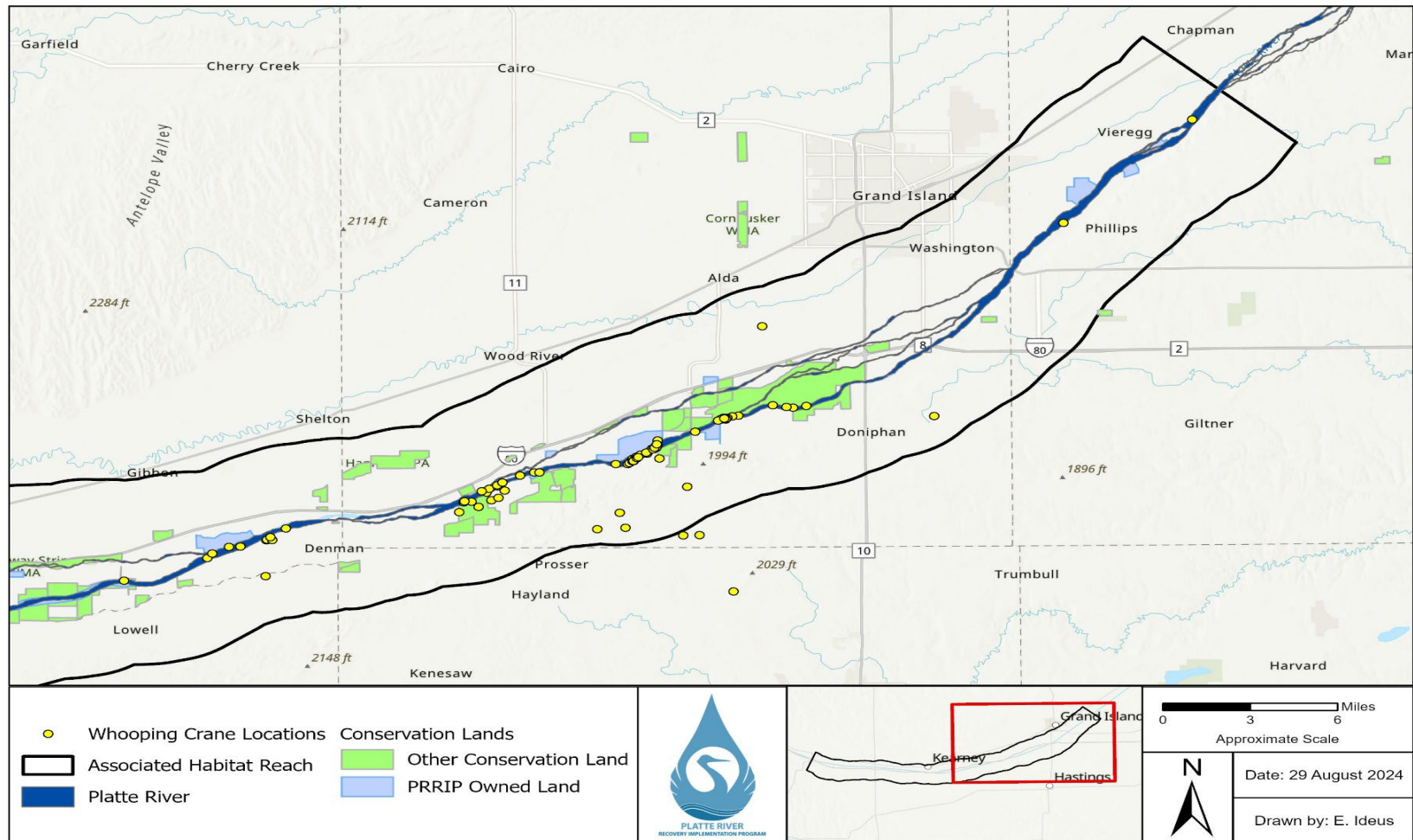
33  
34 Aerial and ground surveyors enumerated 187 individual whooping cranes consisting of 173 adults  
35 and 14 juveniles in 44 unique groups during spring 2024 monitoring (Figs. 3, 4; [Appendix B](#),  
36 [Appendix C](#)). The locations and distribution of historical spring observations of whooping crane  
37 groups by PRRIP during 2001–2024 are provided in an online interactive GIS database at:  
38 [https://hwc corp.maps.arcgis.com/apps/mapviewer/index.html?webmap=dd788353c4684bda90305](https://hwc corp.maps.arcgis.com/apps/mapviewer/index.html?webmap=dd788353c4684bda90305652cb7e12e7)  
39 [652cb7e12e7](https://hwc corp.maps.arcgis.com/apps/mapviewer/index.html?webmap=dd788353c4684bda90305652cb7e12e7).

40  
41 PRRIP observed 44 original group locations ([Appendix B](#), [Appendix C](#)). Overall, PRRIP surveyors  
42 recorded 154 whooping crane group locations based on repeated observations of the same groups  
43 during the 46-day monitoring period ([Appendix B](#), [Appendix C](#)). Of these 154 locations, 14 were  
44 observations of the same group at a different location on the same day (i.e., “B” locations in

1 [Appendix B](#)). We observed changes in group size through time for eight groups (USFWS ID 24A-  
2 20, 24A-28, 24A-41, 24A-44, 24A-45, 24A-46, 24A-84, and 24A-85; [Appendix B](#)). It was more  
3 common for initial group sizes to become smaller over time as individuals left the group. Surveyors  
4 observed the first whooping crane group on March 5 and the final group on April 12, 2024. The  
5 mean and median initial dates of whooping crane group observations were March 27 and March  
6 28, respectively (standard error [SE] = 1.3 days,  $n = 44$ ). The mean and median dates of all 154  
7 group observations were March 27 and March 30, respectively (SE = 0.8 days).  
8



**Figure 3.** Locations of whooping crane groups observed during spring 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 spring observations of whooping crane groups by PRRIP during 2001–2024 are provided online at <https://hwcorp.maps.arcgis.com/apps/mapviewer/index.html?webmap=dd788353c4684bda90305652cb7e12e7>.



**Figure 4.** Locations of whooping crane groups observed during spring 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 spring observations of whooping crane groups by PRRIP during 2001-2024 are provided online at <https://hwcorp.maps.arcgis.com/apps/mapviewer/index.html?webmap=dd788353c4684bda90305652cb7e12e7>.

**Table 1.** Number of whooping crane groups observed during systematic aerial surveys and opportunistic aerial and ground surveys during spring 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 <sup>a</sup>	No. transects completed	No. transects incomplete	No. transects cancelled	Total no. transects scheduled	Duration of survey effort <sup>b</sup>	Miles flown or driven
Systematic aerial surveys (March 5 - April 19)	On Channel	0SE, 0SW <sup>c</sup>	83	62	1	29	92	32:54:00	
	Off Channel	PWRTE, PWRTW <sup>d</sup>	17	61	1	30	92	31:21:00	6822
	Off Channel	CSRT, ESRT, WSRT <sup>e</sup>	0	45	0	24	69	7:41:00	
Opportunistic surveys	Flight <sup>f</sup>	NA	13	NA	NA	NA	NA	NA	NA
	Ground <sup>g</sup>	NA	41	NA	NA	NA	NA	23:30:00	552
<b>Total</b>			154	168	2	83	253	95:26:00	7374

<sup>a</sup> see [Appendix B](#) for whooping crane group observation details. Includes B observations of same group on same day.

<sup>b</sup> duration of survey effort is denoted in hours:minutes

<sup>c</sup> primary transect (riverine): East – 0SE; West – 0SW (Figs. 1, 2)

<sup>d</sup> primary return transect: East – PWRTE; West – PWRTW (Figs. 1, 2)

<sup>e</sup> secondary return transect: East – WSRT; CSRT; West – ESRT (Figs. 1, 2)

<sup>f</sup> opportunistic flight: includes aerial observations made while in route to systematic transects or deviations from the systematic transects.

<sup>g</sup> 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 100 whooping crane group locations, including secondary locations of the same group on the same date, consisting of 146 individual whooping cranes (134 adults; 12 juveniles) in 37 unique groups (Table 1; Figs. 3, 4; [Appendix B](#), [Appendix C](#)). Most (83%) whooping crane groups observed during systematic aerial surveys were located along on-channel transects (Table 1). Pilots completed 61 of 92 (66.3%) regularly scheduled flights (Table 2). Thirty-one flights were either cancelled or not completed due to low visibility or poor weather (Table 2). Among all 253 scheduled systematic transects encompassing river channel and off-channel primary/secondary return transects, 168 (66.4%) were completed (Table 1). There were two 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, 83 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 41 whooping crane group locations during ground monitoring (Tables 1, 3; Figs. 3, 4; [Appendix B](#), [Appendix C](#)). Ground survey crews drove a total of 552 mi to search for potential whooping cranes (Table 3).

















**Table 2.** Number of systematic aerial surveys completed, cancelled or incomplete, and scheduled during spring 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	31	30	61
No. cancelled/incomplete	15	16	31
No. scheduled	46	46	92
<b>Percent completed</b>	<b>67.4%</b>	<b>65.2%</b>	<b>66.3%</b>

**Table 3.** Summary of ground search efforts for whooping cranes during spring 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
	24A-02	2024SP04	3/6	Known	1:00	15	Ground
	24A-03	2024SP03	3/6	No Info	2:01	2	Ground
	24A-02	2024SP06	3/7	Known	1:00	1	Ground
	24A-03	2024SP05	3/7	Plane	2:01	1	Both
	24A-03	2024SP13	3/11	Known	2:01	1	Ground
	24A-03	2024SP14	3/12	Known	2:01	1	Ground
N/A	N/A		3/12	Known	None	62	Ground
	24A-02	2024SP19	3/14	No Info	1:00	1	Ground
N/A	N/A		3/14	No Info	None	55	Ground
N/A	N/A		3/14	Known	None	30	Ground
	24A-13	2024SP26	3/16	No Info	5:00	1	Ground
	24A-16	2024SP34	3/20	Known	1:00	2	Ground
N/A	N/A		3/20	Plane	None	35	Both
	24A-02	2024SP40	3/22	Known	1:00	1	Ground
N/A	N/A		3/23	Plane	None	5	Both
	24A-20	2024SP57	3/28	No Info	2:00	1	Ground
	24A-20	2024SP58	3/28	No Info	5:00	1	Ground
	24A-41	2024SP47	3/28	Known	4:02	2	Ground
	24A-45	2024SP51	3/28	No Info	10:01	1	Ground
	24A-49	2024SP59	3/28	Known	13:01	20	Ground
	24A-20	2024SP68	3/29	No Info	3:00	1	Ground
	24A-32	2024SP62	3/29	Plane	2:00	1	Both
	24A-41	2024SP61	3/29	Plane	3:02	1	Both
	24A-32	2024SP77	3/30	Known	2:01	6	Ground
	24A-32	2024SP80	3/30	Known	2:00	1	Ground
	24A-39	2024SP78	3/30	Known	3:01	19	Ground
	24A-40	2024SP144	3/30	Known	3:00	1	Ground
	24A-44	2024SP73	3/30	Known	10:00	1	Ground
	24A-54	2024SP79	3/30	Known	8:00	23	Ground
	24A-44	2024SP85	3/31	No Info	6:00	1	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		4/1	Known	None	45	Ground
	24A-28	2024SP91	4/2	Known	14:01	3	Ground
	24A-32	2024SP94	4/2	Known	2:00	1	Ground
	24A-32	2024SP94	4/2	Known	2:00	1	Ground
	24A-41	2024SP92	4/2	Known	4:02	4	Ground
	24A-51	2024SP95	4/2	Known	1:00	1	Ground
	24A-79	2024SP93	4/2	Known	2:01	2	Ground
	24A-79	2024SP97	4/3	Plane	2:01	2	Both
N/A	N/A		4/5	Plane	None	5	Both
	24A-28	2024SP122	4/6	Known	4:00	5	Ground
	24A-57	2024SP124	4/6	Known	3:01	30	Ground
	24A-84	2024SP123	4/6	Known	6:00	45	Ground
	24A-28	2024SP126	4/7	Known	4:00	1	Ground
	24A-84	2024SP125	4/7	Known	6:00	1	Ground
N/A	N/A		4/7	No Info	None	65	Ground
N/A	N/A		4/7	Known	None	11	Ground
	24A-28	2024SP133	4/9	Known	4:00	1	Ground
	24A-57	2024SP134	4/9	Known	3:01	1	Ground
	24A-57	2024SP140	4/11	Known	3:01	1	Ground
N/A	N/A		4/11	Plane	None	6	Both
	24A-57	2024SP143	4/12	Known	3:01	1	Ground
N/A	N/A		4/15	Known	None	27	Ground
<b>TOTAL</b>					<b>157:21</b>	<b>552</b>	

## Whooping crane stopover metrics

**Proportion of population stopping on the AHR.** The USFWS estimated the AWB migratory whooping crane population to be 536 birds (95% confidence interval [CI] = 443.5, 644.1) based on winter 2022–2023 survey efforts within the primary survey area along the Texas coast of the Gulf of Mexico, USA wintering range (USFWS 2023; Appendix D). The USFWS did not conduct a winter 2023–2024 survey. Based on the 187 individual whooping cranes enumerated during PRRIP surveys, we estimated that 0.349 of the AWB whooping crane population was observed on the AHR along the central Platte River during the spring migration (Fig. 5a). The proportion of the AWB population using the AHR along the central Platte River during the spring migration has varied between 0.011 and 0.349 during 2007–2024 (mean = 0.086; median = 0.065; SE = 0.021; Fig. 5a).

**Number of crane use days.** The 44 unique whooping crane groups remained in the study area between one and 27 days (mean = 4.2; median = 1.5; SE = 0.9). Based on the lengths of stay of



the 44 groups and the number of whooping cranes enumerated in each group, we calculated a total of 845 crane use days for the spring 2024 monitoring period between March 5 and April 19, 2024 (Fig. 5a). Between 2007 and 2024, the number of crane use days during the spring migration has varied between 13 and 845 days (mean = 151.4; median = 73.0; SE = 48.6; Fig. 5a).

## **5<sup>th</sup> and 95<sup>th</sup> 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 March 7 to March 15 (mean = March 8; SE = 0.62 days) over the 18 10-year periods (Table 4). Ninety-fifth percentile dates ranged from April 16 to May 4 (mean = April 20; SE = 1.1 days; Table 4). The smallest range of days between the 5<sup>th</sup> and 95<sup>th</sup> percentile dates was 38 days between March 10 and April 17 during the 2013–2022, 2014–2023 periods and between March 9 and April 16 during the 2015–2024 period (Table 4). The largest range of days between the 5<sup>th</sup> and 95<sup>th</sup> percentile dates occurred during the 2000–2009 period, which spanned 55 days between March 10 and May 4 (Table 4).

Surveys during 2007 through 2013 did not include the 5<sup>th</sup> percentile date for the corresponding period (Table 4). Surveys during 2007 through 2011 began on March 21 or March 22. Surveys in 2012 and 2013 began on March 9 and March 11, respectively. Surveys in 2009 ended on April 28 prior to the 95<sup>th</sup> percentile date for the corresponding period (Table 4). Therefore, we could not assess the extent whooping crane metrics would have been adjusted during those years.

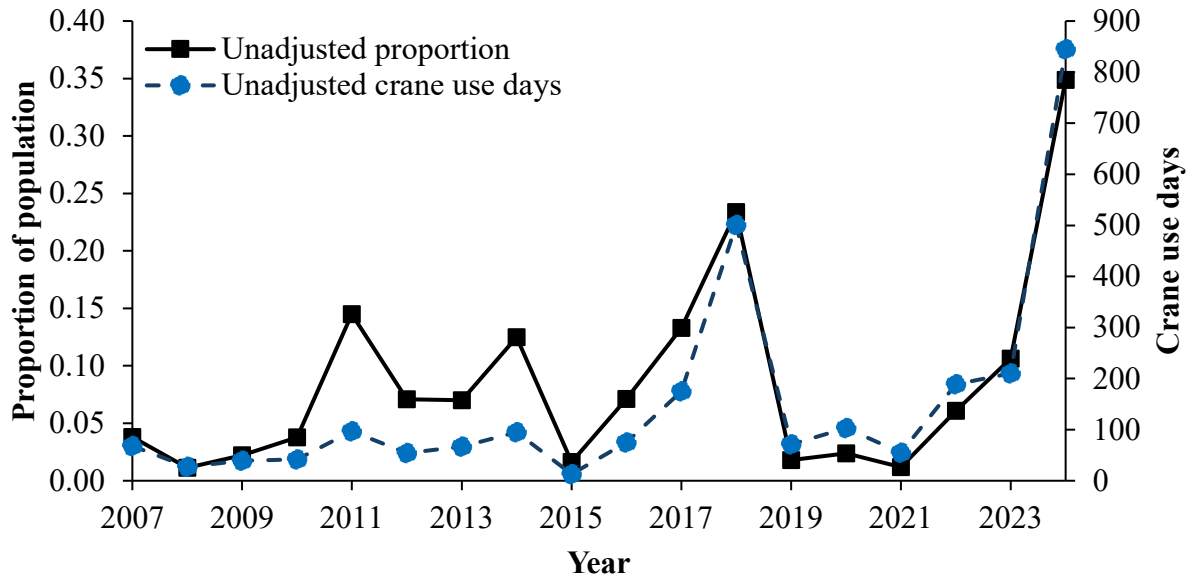
Use of 5<sup>th</sup> and 95<sup>th</sup> percentiles of dates to calculate whooping crane metrics resulted in adjustments being made to metrics in 2018, 2021, 2022, 2023, and 2024 (Figs. 5, 6). In 2018, the number of individual whooping cranes observed, proportion of population that stopped on the AHR, and number of crane use days decreased from 118 to 101 birds, 0.234 to 0.200, and 501 to 464 crane use days, respectively, when accounting for whooping cranes observed only during the 5<sup>th</sup> through 95<sup>th</sup> percentiles of dates from the 2009–2018 period (Figs. 4, 5). In 2021, 2022, and 2023, the number of individual whooping cranes observed and proportion of population that stopped on the AHR did not change between unadjusted and adjusted metrics (Figs. 4, 5a). However, the number of crane use days decreased from 55 to 54 in 2021, 189 to 185 in 2022, and 210 to 208 in 2023 when accounting for whooping cranes observed only during the 5<sup>th</sup> through 95<sup>th</sup> percentiles of dates from the 2012–2021, 2013–2022, and 2014–2023 periods (Figs. 4, 5b). For 2024, the numbers of individual whooping cranes observed decreased from 187 to 184, proportion of population that stopped on the AHR decreased from 0.349 to 0.343, and crane use days decreased from 845 to 823 days due to adjustments made to account for whooping cranes observed only during the 5<sup>th</sup> through 95<sup>th</sup> percentiles of dates from 2015–2024. In 2024, decreases in the whooping crane metrics resulted from three whooping crane groups arriving before the 5<sup>th</sup> percentile date.

We found no correlation between the adjusted proportion of population stopping on the AHR during spring and year during 2014–2024 using a Spearman's rank correlation ( $\rho = 0.091$ ;  $p = 0.80$ ). Likewise, we found no significant correlation between adjusted proportion of population stopping on the AHR during spring and year when evaluating a trend using mixed-effects models ( $\beta_{\text{year}} = 0.022$ ; SE = 0.035;  $p = 0.55$ ). There was a non-statistically significant relationship (at  $\alpha = 0.05$ ) between the adjusted number of crane use days and year during 2014–2024 using a

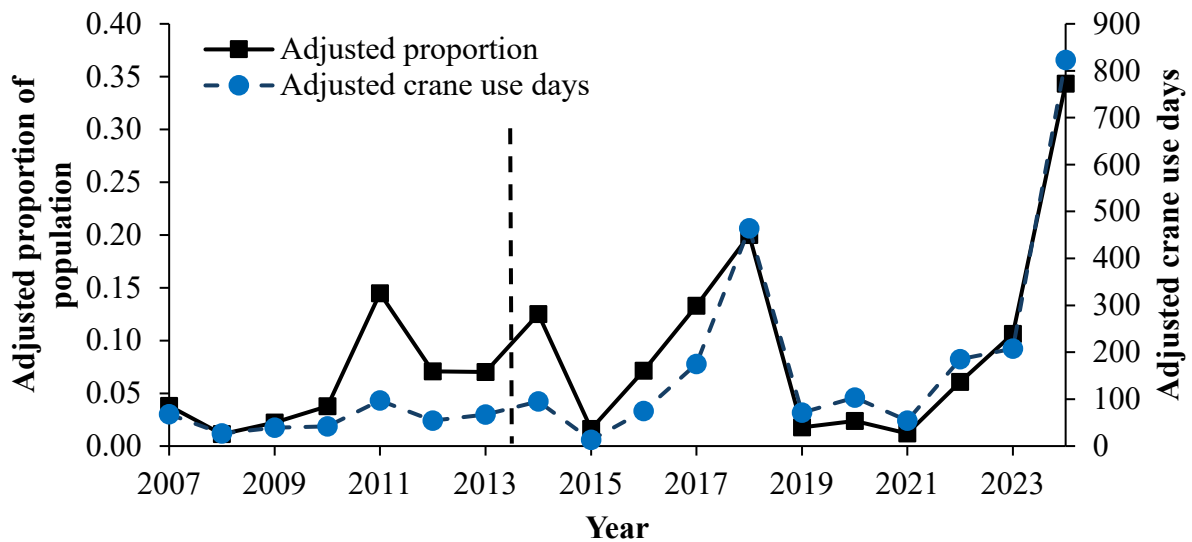
Spearman’s rank correlation ( $\rho = 0.545$ ;  $p = 0.09$ ). We also did not find a statistically significant relationship between the adjusted number of crane use days and year during 2014–2024 using mixed-effects models ( $\beta_{\text{year}} = 72.8$ ;  $\text{SE} = 82.0$ ;  $p = 0.40$ ). We found no relationship between the number of whooping cranes enumerated during PRRIP spring surveys between the 5<sup>th</sup> and 95<sup>th</sup> percentile dates and the estimated AWB population size during 2016–2024 ( $\beta_{\text{population}} = 1.11$ ;  $\text{SE} = 1.14$ ;  $p = 0.36$ ; Fig. D2, [Appendix D](#)).

**Table 4.** The 5th and 95th percentiles of initial dates of spring whooping crane group observations in Nebraska for 18 10-year periods ranging from 1998–2007 to 2015–2024. Percentiles were calculated using the USFWS whooping crane public sighting database for Nebraska during 1998–2024. For each period, the applicable survey year(s) for which the percentiles were used to adjust whooping crane metrics is provided. The start and end dates for PRRIP monitoring during each survey year are also provided.

Period	Applicable survey year(s)	5 <sup>th</sup> percentile	95 <sup>th</sup> percentile	Survey start date	Survey end date
1998–2007	2007	8-Mar	20-Apr	22-Mar	29-Apr
1999–2008	2008	10-Mar	22-Apr	21-Mar	29-Apr
2000–2009	2009	10-Mar	4-May	22-Mar	28-Apr
2001–2010	2010	15-Mar	29-Apr	21-Mar	29-Apr
2002–2011	2011	14-Mar	24-Apr	21-Mar	29-Apr
2003–2012	2012	7-Mar	24-Apr	9-Mar	29-Apr
2004–2013	2013	7-Mar	19-Apr	11-Mar	29-Apr
2005–2014	2014	7-Mar	19-Apr	6-Mar	29-Apr
2006–2015	2015	7-Mar	18-Apr	6-Mar	29-Apr
2007–2016	2016	7-Mar	18-Apr	6-Mar	29-Apr
2008–2017	2017	7-Mar	17-Apr	6-Mar	29-Apr
2009–2018	2018	7-Mar	18-Apr	6-Mar	29-Apr
2010–2019	2019	8-Mar	17-Apr	6-Mar	29-Apr
2011–2020	2020	7-Mar	17-Apr	6-Mar	29-Apr
2012–2021	2021	7-Mar	17-Apr	6-Mar	29-Apr
2013–2022	2022	10-Mar	17-Apr	6-Mar	29-Apr
2014–2023	2023	10-Mar	17-Apr	6-Mar	29-Apr
2015–2024	2024	9-Mar	16-Apr	5-Mar	19-Apr

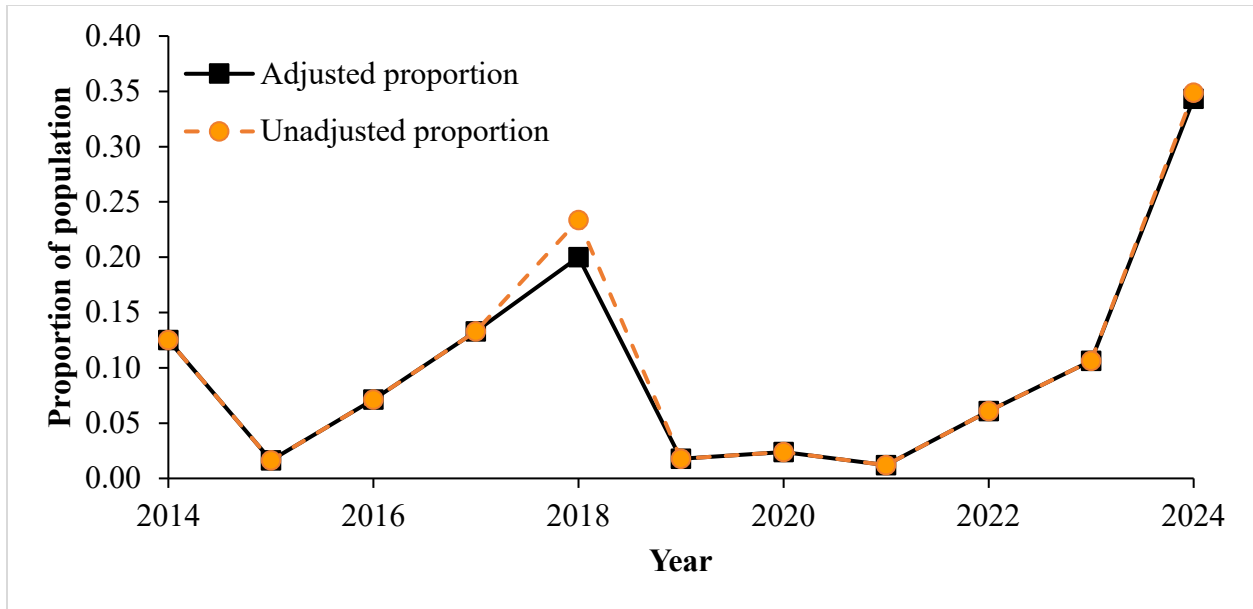


(a)

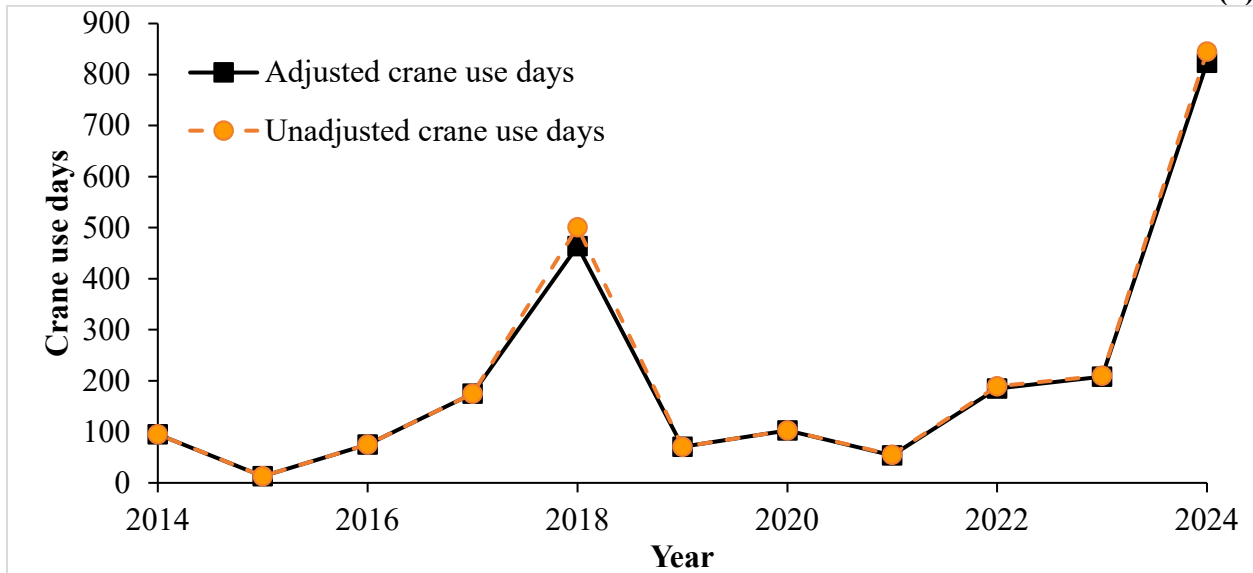


(b)

**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 2007 and 2024 during the spring migration. Panel (a) depicts the proportion of the population and number of crane use days for the entire spring 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 spring 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 spring of each year across the AHR between Lexington and Chapman, Nebraska. For the 2021 and 2024 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 vertical dashed line in (b) denotes surveys before 2014 did not include the 5th percentile date of group observations and adjusted metrics from 2007–2013 are not directly comparable to those from 2014–2024.



(a)



(b)

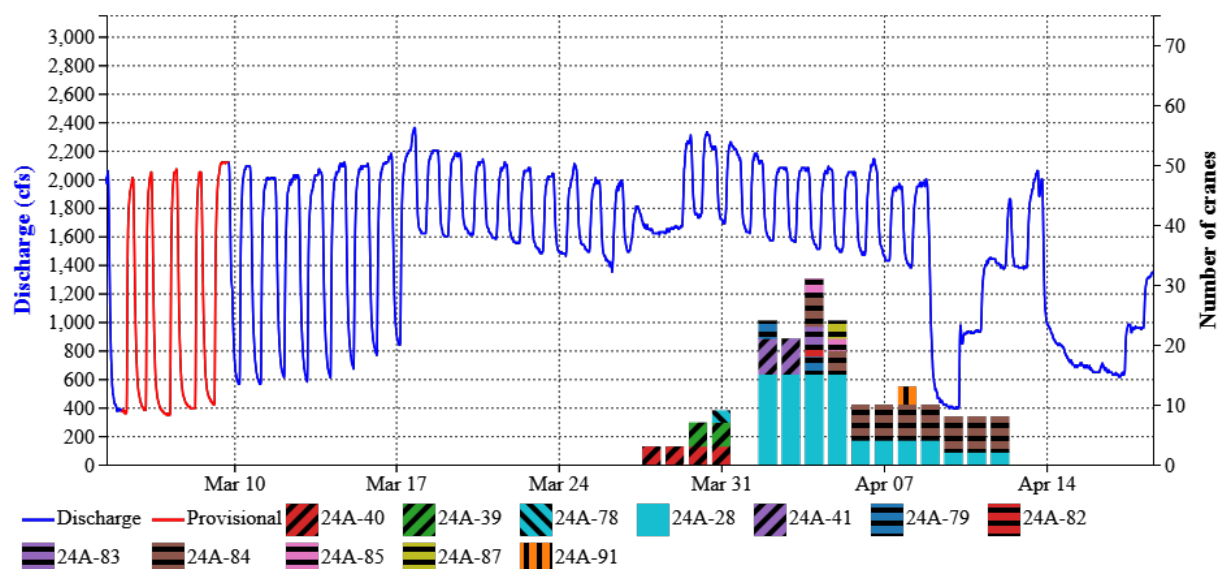
**Figure 6.** Annual variability between 2014 and 2024 during the spring migration in (a) the proportion of the Aransas-Wood Buffalo migratory whooping crane population that stopped on the Associated Habitat Reach (AHR) of the central Platte River, and (b) the associated number of crane use days. Each panel illustrates the whooping crane metric for the entire spring survey period (unadjusted; orange circles and dashed line) and only for dates constrained by the 5th and 95th percentiles of dates of spring whooping crane group observations in Nebraska (adjusted; black squares and solid line; see text for details). Whooping cranes were enumerated using PRRIP's systematic aerial surveys and opportunistic aerial and ground sightings during spring of each year across the AHR between Lexington and Chapman, Nebraska. Data from 2007–2013 are not shown because surveys during these years did not include the 5th percentile date for the corresponding period (Table 4) and adjusted metrics could not be calculated. For the 2021 and 2024 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

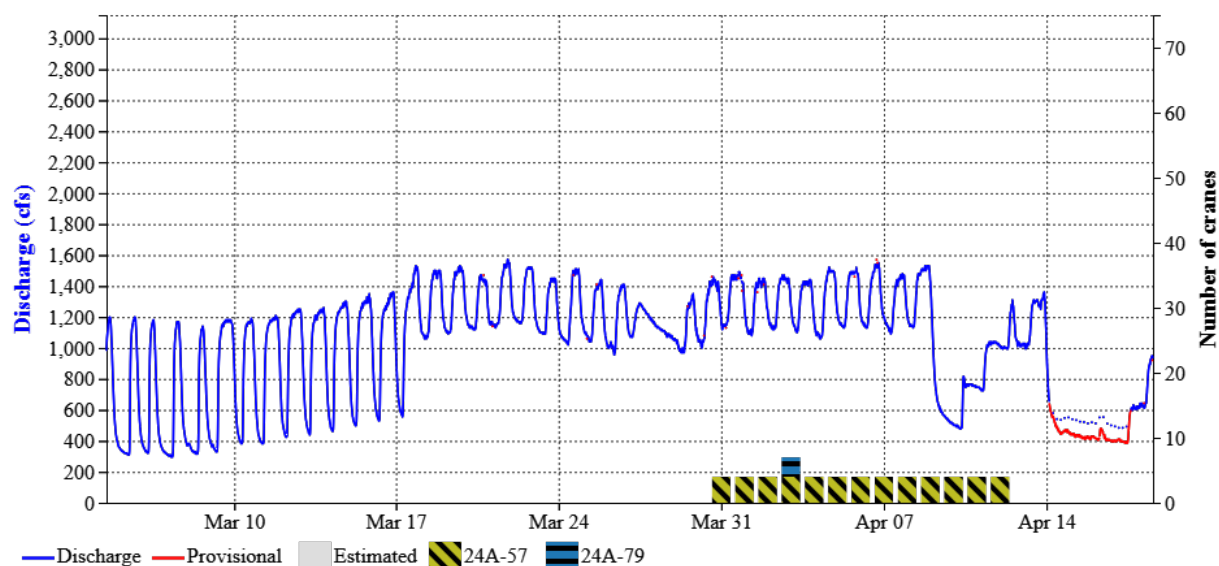
During the March 5 through April 19 spring 2024 whooping crane migration monitoring period, Platte River discharge in the AHR ranged from a low of 250 cfs at Kearney on April 18 ([USGS 2023c](#)) to a high of 2,650 cfs at Kearney on March 25 ([USGS 2023c](#); Figs. 7–10). Platte River discharge at the Overton gage ([USGS 2023a](#)) ranged from 348 cfs to 2,360 cfs (mean = 1513; SE = 8.4;  $n = 4,407$ ) with low and high flows recorded on March 7 and March 17–18, respectively (Fig. 7). Discharge at the Cottonwood Ranch gage ([USGS 2023b](#)) ranged from 296 cfs to 1,570 cfs (mean = 1,077; SE = 5.2;  $n = 4,069$ ) with low flow recorded on March 7 and high flow recorded on March 22 (Fig. 8). At the Kearney gage ([USGS 2023c](#)), discharge reached a low of 250 cfs on April 18 and a high of 2,650 cfs on March 25 (mean = 1,487; SE = 9.1;  $n = 4,380$ ; Fig. 9). The Grand Island gage ([USGS 2023d](#)) recorded a low discharge of 466 cfs on April 18–19 and peak discharge of 2,480 cfs on March 27 (mean = 1,580; SE = 7.7;  $n = 4,356$ ; Fig. 10). All gage discharge data was approved for publication except for the discharge data for the Cottonwood Range gage which was approved as estimated from March 14–17, 2024. as of the writing of this report.

Instantaneous discharge at the gaging station closest to the whooping crane group location ranged from 500 cfs to 2,230 cfs for all 85 riverine locations (mean = 1,739; median = 1,850; SE = 45; Table 5; Fig. 11), which included repeated observations of the same 31 unique riverine groups (USFWS groups 24A–20a and 24A20b/c are counted as two unique groups and 24A–32a and 24A–32b are considered as two separate groups). These discharge measurements were recorded to the nearest 15 min of the time the whooping crane group was observed. Most (64.7%) of the 85 whooping crane group locations in the river channel were closest to the Grand Island gage (Table 5; Fig. 10). Instantaneous discharge during the first riverine observation of each of the 31 unique groups ranged from 829 cfs to 2,210 cfs (mean = 1,782; median = 1,900; SE = 67; 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.

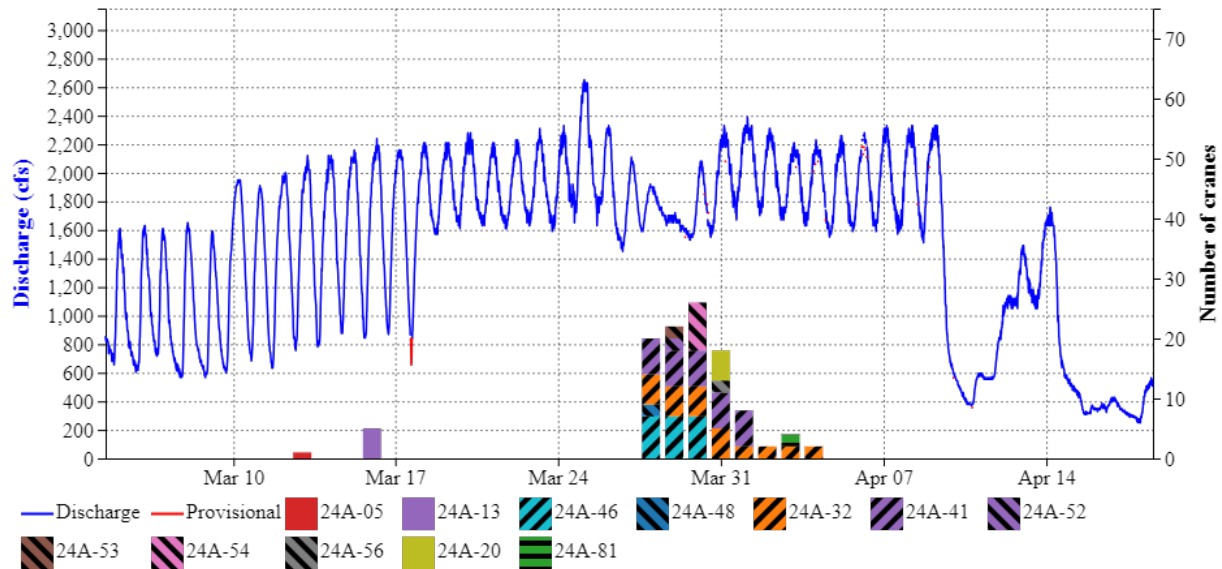
Unobstructed channel widths at the 85 whooping crane riverine use sites ranged from 229 ft to 1457 ft (mean = 777; median = 761; SE = 34; Table 6). Distance to the nearest forest at the 85 riverine use sites ranged from 133 ft to 1,692 ft (mean = 655; median = 522; SE = 47; Table 6).



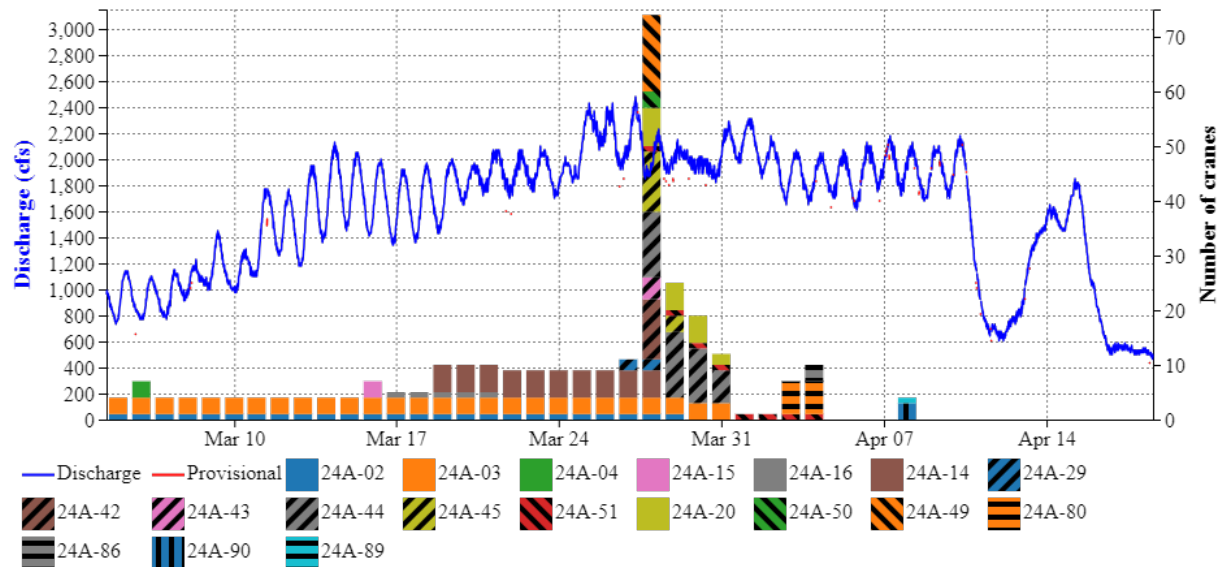
**Figure 7.** Platte River discharge in cubic feet per second (cfs; blue line [approved data]; red line [provisional data]) at the Overton, Nebraska gage during March 5 through April 19, 2024 (USGS 2023a) and the corresponding numbers of whooping cranes from each group (USFWS groups 24A-40, 39, 78, 28, 41, 79, 82, 83, 84, 85, 87, and 91 in color-coded bars) observed on the indicated dates either on- or off-channel at locations for which Overton was the nearest gaging station.



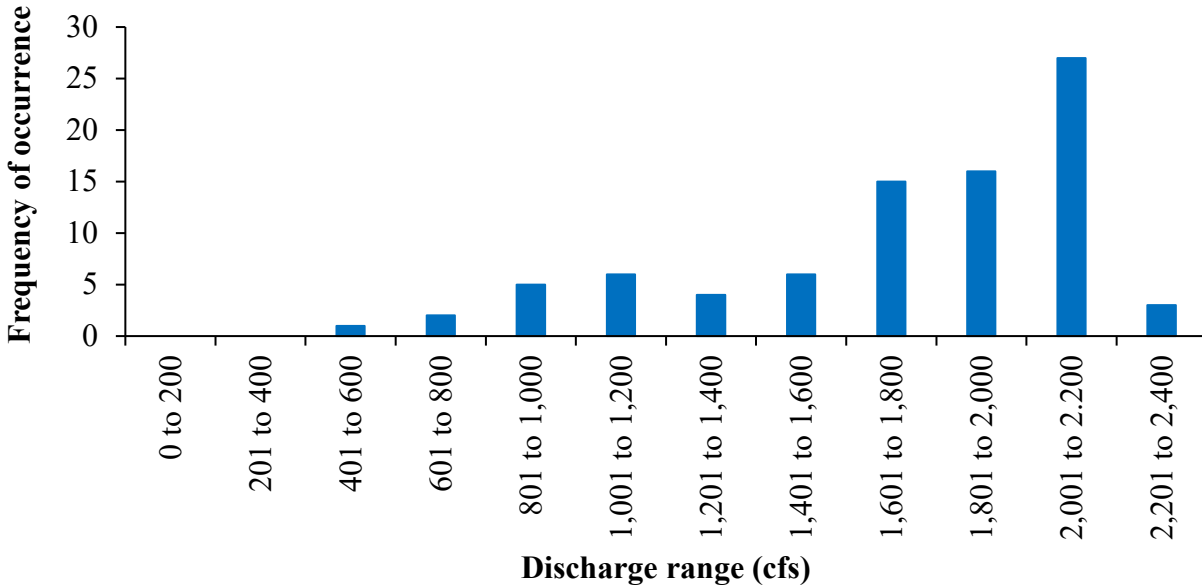
**Figure 8.** Platte River discharge in cubic feet per second (cfs; blue line [approved data]; red line [provisional data]; dotted line [estimated]) at the Cottonwood Ranch, Nebraska gage during March 5 through April 19, 2024 (USGS 2023b) and the corresponding numbers of whooping cranes from each group (USFWS groups 24A-57 and 79 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.



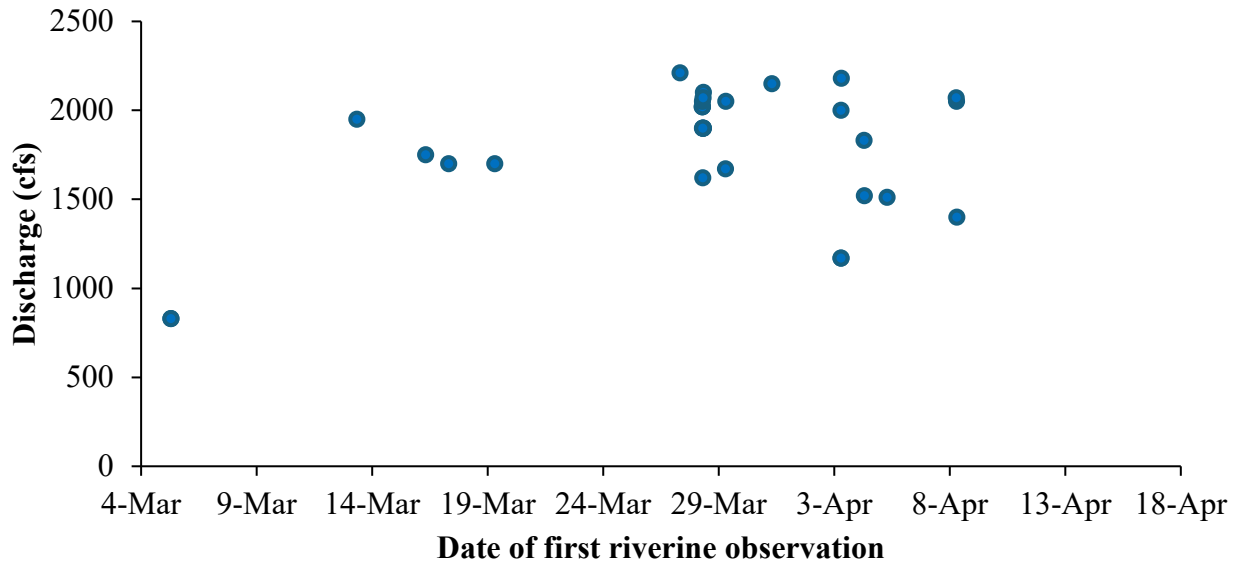
**Figure 9.** Platte River discharge in cubic feet per second (cfs; blue line [approved data]; red line [provisional data]) at the Kearney, Nebraska gage during March 5 through April 19, 2024 (USGS 2023c) and the corresponding numbers of whooping cranes from each group (USFWS groups 24A-05, 13, 46, 48, 32, 41, 52, 53, 54, 56, 20, and 81 in color-coded bars) observed on the indicated dates either on- or off-channel at locations for which Kearney was the nearest gaging station.



**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 March 5 through April 19, 2024 (USGS 2023d) and the corresponding numbers of whooping cranes from each group (USFWS groups 24A-02, 03, 04, 15, 16, 29, 42, 43, 44, 45, 51, 20, 50, 49, 80, 86, 90, and 89 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 85 total whooping crane group locations observed in the river channel during spring 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 31 unique whooping crane groups observed during spring 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 spring 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 <sup>a</sup>	Discharge (cfs)
	24A-02	2024SP02	1:00	2	3/5	Grand Island	829
	24A-02	2024SP07	1:00	4	3/9	Grand Island	1090
	24A-02	2024SP09	1:00	6	3/10	Grand Island	999
	24A-02	2024SP12	1:00	8	3/11	Grand Island	1270
	24A-02	2024SP15	1:00	10	3/13	Grand Island	1520
	24A-02	2024SP21	1:00	13	3/15	Grand Island	1800
	24A-02	2024SP23	1:00	15	3/16	Grand Island	1850
	24A-02	2024SP37	1:00	25	3/17	Grand Island	1700
	24A-02	2024SP29	1:00	19	3/18	Grand Island	1770
	24A-02	2024SP33	1:00	23	3/19	Grand Island	1720
	24A-02	2024SP36	1:00	24	3/20	Grand Island	1850
	24A-02	2024SP39	1:00	26	3/21	Grand Island	1970
	24A-02	2024SP40	1:00	27	3/22	Grand Island	1920
	24A-02	2024SP42	1:00	29	3/27	Grand Island	2150
	24A-02	2024SP65	1:00	49	3/29	Grand Island	2050
	24A-03	2024SP01	2:01	1	3/5	Grand Island	829
	24A-03	2024SP05	2:01	3	3/7	Grand Island	790
	24A-03	2024SP08	2:01	5	3/9	Grand Island	1130
	24A-03	2024SP10	2:01	7	3/10	Grand Island	999
	24A-03	2024SP13	2:01	9	3/11	Grand Island	1310
	24A-03	2024SP16	2:01	11	3/13	Grand Island	1540
	24A-03	2024SP22	2:01	14	3/15	Grand Island	1800
	24A-03	2024SP28	2:01	18	3/17	Grand Island	1700
	24A-03	2024SP30	2:01	20	3/18	Grand Island	1770
	24A-03	2024SP32	2:01	22	3/19	Grand Island	1720
	24A-03	2024SP41	2:01	28	3/27	Grand Island	2150
	24A-03	2024SP66	2:01	50	3/29	Grand Island	2050
	24A-03	2024SP82	2:01	57	3/31	Grand Island	2150
	24A-05	2024SP17	1:00	12	3/13	Kearney	1950
	24A-14	2024SP31	5:00	21	3/19	Grand Island	1700
	24A-14	2024SP54	5:00	41	3/28	Grand Island	2100
	24A-15	2024SP24	2:01	16	3/16	Grand Island	1750
	24A-16	2024SP27	1:00	17	3/17	Grand Island	1700

**Table 5—continued**







Unique group icon	USFWS group ID	PRRIP group ID	No. of cranes (adults:juveniles)	Use site no.	Date	Gaging Station <sup>a</sup>	Discharge (cfs)
	24A-16	2024SP38	1:00	25	3/21	Grand Island	1970
	24A-20	2024SP68	3:00	52	3/29	Grand Island	2050
	24A-20	2024SP83	2:00	58	3/31	Grand Island	2150
	24A-20	2024SP84	5:00	59	3/31	Kearney	2230
	24A-29	2024SP43	2:00	30	3/27	Grand Island	2210
	24A-29	2024SP56	2:00	43	3/28	Grand Island	2100
	24A-32	2024SP45	2:00	32	3/28	Kearney	1900
	24A-32	2024SP46	2:01	33	3/28	Kearney	1900
	24A-32	2024SP62	2:00	46	3/29	Kearney	1650
	24A-32	2024SP63	2:01	47	3/29	Kearney	1650
	24A-32	2024SP87	2:01	60	3/31	Kearney	2180
	24A-32	2024SP86	2:00	77	3/31	Kearney	2180
	24A-32	2024SP94	2:00	62	4/2	Kearney	2230
	24A-32	2024SP100	2:00	67	4/3	Kearney	2110
	24A-32	2024SP107	2:00	71	4/4	Kearney	2180
	24A-40	2024SP44	3:00	31	3/28	Overton	1620
	24A-41	2024SP61	4:02	45	3/29	Kearney	1670
	24A-41	2024SP98	4:02	66	4/3	Overton	1570
	24A-42	2024SP48	11:00	35	3/28	Grand Island	2020
	24A-43	2024SP49	4:00	36	3/28	Grand Island	2020
	24A-44	2024SP50	12:00	37	3/28	Grand Island	2020
	24A-44	2024SP73	10:00	53	3/30	Grand Island	1950
	24A-45	2024SP51	10:01	38	3/28	Grand Island	2050
	24A-45	2024SP67	3:00	51	3/29	Grand Island	2050
	24A-46	2024SP52	7:00	39	3/28	Kearney	1900
	24A-46	2024SP75	5:00	55	3/30	Kearney	2010
	24A-48	2024SP53	2:00	40	3/28	Kearney	1900
	24A-50	2024SP55	3:00	42	3/28	Grand Island	2100
	24A-51	2024SP60	1:00	44	3/28	Grand Island	2070
	24A-51	2024SP64	1:00	48	3/29	Grand Island	2130
	24A-51	2024SP81	1:00	56	3/31	Grand Island	2150
	24A-51	2024SP95	1:00	63	4/2	Grand Island	2130
	24A-51	2024SP103	1:00	70	4/3	Grand Island	2000
	24A-51	2024SP114	1:00	73	4/4	Grand Island	1830
	24A-57	2024SP96	3:01	64	4/3	Cottonwood	1170
	24A-57	2024SP117	3:01	76	4/5	Cottonwood	1170
	24A-57	2024SP134	3:01	83	4/9	Cottonwood	1200

**Table 5—continued**

































Unique group icon	USFWS group ID	PRRIP group ID	No. of cranes (adults:juveniles)	Use site no.	Date	Gaging station <sup>a</sup>	Discharge (cfs)
	24A-57	2024SP136	3:01	84	4/10	Cottonwood	500
	24A-79	2024SP97	2:01	65	4/3	Cottonwood	1170
	24A-79	2024SP108	2:01	72	4/4	Overton	1520
	24A-80	2024SP101	6:00	68	4/3	Grand Island	2000
	24A-80	2024SP116	6:00	75	4/4	Grand Island	1950
	24A-81	2024SP102	2:00	69	4/3	Kearney	2180
	24A-83	2024SP110	2:01	85	4/4	Overton	1520
	24A-84	2024SP129	6:00	86	4/8	Overton	1400
	24A-84	2024SP135	6:00	87	4/9	Overton	725
	24A-84	2024SP138	6:00	88	4/11	Overton	930
	24A-84	2024SP141	6:00	89	4/12	Overton	1380
	24A-86	2024SP115	3:00	74	4/4	Grand Island	1830
	24A-87	2024SP118	3:00	77	4/5	Overton	1510
	24A-89	2024SP132	1:00	81	4/8	Grand Island	2050
	24A-90	2024SP131	2:01	80	4/8	Grand Island	2070

<sup>a</sup> 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 spring 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 used 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 an aspect ratio of 1:1,750 using PRRIP aerial imagery from November 2023.

Unique group icon	USFWS group ID	PRRIP group ID	Use site no.	Zone 14N UTM <sub>x</sub>	Zone 14N UTM <sub>y</sub>	Unobstructed channel width (ft)	Nearest forest (ft)
	24A-02	2024SP02	2	540379	4511999	485	394
	24A-02	2024SP07	4	544606	4514503	1246	1456
	24A-02	2024SP09	6	544467	4514387	1123	1007
	24A-02	2024SP12	8	544477	4514432	1140	1023
	24A-02	2024SP15	10	548449	4515202	678	647
	24A-02	2024SP21	13	540954	4512600	971	1233
















**Table 6—continued**

Unique group icon	USFWS group ID	PRRIP group ID	Use site no.	Zone 14N UTM <sub>x</sub>	Zone 14N UTM <sub>y</sub>	Unobstructed channel width (ft)	Nearest forest (ft)
	24A-02	2024SP23	15	540801	4512415	1256	1414
	24A-02	2024SP29	19	539571	4511628	792	493
	24A-02	2024SP33	23	539391	4511324	659	296
	24A-02	2024SP36	24	539567	4511458	563	297
	24A-02	2024SP37	25	540820	4512452	1457	1395
	24A-02	2024SP39	26	539801	4511761	497	452
	24A-02	2024SP40	27	540595	4512248	1035	1214
	24A-02	2024SP42	29	539811	4511669	597	509
	24A-02	2024SP65	49	540319	4512064	444	691
	24A-03	2024SP01	1	540639	4512324	1195	1213
	24A-03	2024SP05	3	540810	4512472	1328	1332
	24A-03	2024SP08	5	539639	4511509	788	390
	24A-03	2024SP10	7	539647	4511471	786	266
	24A-03	2024SP13	9	539305	4511268	359	334
	24A-03	2024SP16	11	538655	4511271	1014	429
	24A-03	2024SP22	14	540885	4512500	1199	1388
	24A-03	2024SP28	18	539695	4511607	846	632
	24A-03	2024SP30	20	539711	4511638	876	644
	24A-03	2024SP32	22	540883	4512413	1425	1607
	24A-03	2024SP41	28	540014	4511909	761	412
	24A-03	2024SP66	50	540714	4512283	1281	1490
	24A-03	2024SP82	57	540799	4512393	1243	1459
	24A-05	2024SP17	12	511449	4503079	898	295
	24A-14	2024SP31	21	547330	4515388	382	710
	24A-14	2024SP54	41	549166	4515333	720	601
	24A-15	2024SP24	16	531491	4509249	440	334
	24A-16	2024SP27	17	548092	4515259	590	236
	24A-16	2024SP38	25	539618	4511472	627	273
	24A-20	2024SP68	52	530240	4508579	901	522
	24A-20	2024SP83	58	534425	4510678	688	558
	24A-20	2024SP84	59	517882	4505478	1109	680
	24A-29	2024SP43	30	545431	4514641	329	465

**Table 6—continued**

Unique group icon	USFWS group ID	PRRIP group ID	Use site no.	Zone 14N UTM <sub>x</sub>	Zone 14N UTM <sub>y</sub>	Unobstructed channel width (ft)	Nearest forest (ft)
	24A-29	2024SP56	43	543037	4513527	592	237
	24A-32	2024SP45	32	484707	4501284	781	424
	24A-32	2024SP46	33	482621	4501407	229	262
	24A-32	2024SP62	46	484313	4501158	759	283
	24A-32	2024SP63	47	482695	4501404	720	278
	24A-32	2024SP86	77	483948	4501309	666	282
	24A-32	2024SP87	60	482935	4501365	607	201
	24A-32	2024SP94	62	484430	4501139	584	133
	24A-32	2024SP100	67	483962	4501303	672	310
	24A-32	2024SP107	71	483950	4501294	669	263
	24A-40	2024SP44	31	458399	4503639	833	533
	24A-41	2024SP61	45	502763	4501260	476	405
	24A-41	2024SP98	66	451137	4503099	347	849
	24A-42	2024SP48	35	534126	4510674	848	442
	24A-43	2024SP49	36	533344	4510463	877	232
	24A-44	2024SP50	37	531652	4509524	386	679
	24A-44	2024SP73	53	530280	4508646	787	601
	24A-45	2024SP51	38	531221	4509361	393	355
	24A-45	2024SP67	51	532100	4509703	501	459
	24A-46	2024SP52	39	520415	4506748	687	426
	24A-46	2024SP75	55	517265	4505449	582	818
	24A-48	2024SP53	40	516071	4504674	381	445
	24A-50	2024SP55	42	544295	4514311	1007	613
	24A-51	2024SP60	44	545091	4514611	890	627
	24A-51	2024SP64	48	544820	4514495	1045	1299
	24A-51	2024SP81	56	544704	4514385	1245	1692
	24A-51	2024SP95	63	544723	4514484	1208	1616
	24A-51	2024SP103	70	544738	4514437	1216	1562
	24A-51	2024SP114	73	544649	4514458	1255	1588
	24A-57	2024SP96	64	473354	4503284	896	714
	24A-57	2024SP117	76	473265	4503267	931	766
	24A-57	2024SP134	83	473075	4503394	920	748

**Table 6—continued**

Unique group icon	USFWS group ID	PRRIP group ID	Use site no.	Zone 14N UTM <sub>x</sub>	Zone 14N UTM <sub>y</sub>	Unobstructed channel width (ft)	Nearest forest (ft)
	24A-57	2024SP136	84	473033	4503377	946	831
	24A-79	2024SP97	65	459111	4503684	404	573
	24A-79	2024SP108	72	458465	4503668	719	547
	24A-80	2024SP101	68	532082	4509781	771	438
	24A-80	2024SP116	75	532386	4509955	814	359
	24A-81	2024SP102	69	516331	4504992	1241	420
	24A-83	2024SP110	85	434135	4510252	458	189
	24A-84	2024SP129	86	433860	4510176	356	223
	24A-84	2024SP135	87	434180	4510240	551	149
	24A-84	2024SP138	88	433804	4510206	352	158
	24A-84	2024SP141	89	433801	4510153	340	150
	24A-86	2024SP115	74	540924	4512659	556	1020
	24A-87	2024SP118	77	451356	4503154	335	625
	24A-89	2024SP132	81	539887	4511750	236	617
	24A-90	2024SP131	80	570503	4535406	1241	483

1  
2











## 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 spring 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 and are reported to USFWS later in the day after systematic transects have been flown; (2) whooping crane groups leave the river prior to the plane surveying that portion of the transect; (3) observers do not see the group; (4) flights are cancelled due to poor visibility or weather; (5) 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 spring 2024, the USFWS public sighting database reported two whooping crane groups (24A-22 and 24A-27) that were not observed by PRRIP (Table 7). The USFWS reported group 24A-20 on March 27 with an initial observation of nine adults (Table 7) prior to the first PRRIP observation. PRRIP observed and considers USFWS group 24A-20 as two separate groups that were never observed together during PRRIP surveys. USFWS 24A-20a was observed by PRRIP as consisting of two adults throughout their stay. USFWS 24A-20b and c were observed by PRRIP as a unique group consisting of either five or three adults, depending on the day observed. Similarly, the USFWS reported group 24A-32 on March 27 as four adults and one juvenile. PRRIP observed a unique group of two adults (USFWS 24A-32a) and a unique group of two adults and one juvenile (USFWS 24A-32b). The USFWS received additional information from daily follows of whooping crane groups that identified more juveniles in USFWS 24A-28, 24A-44, 24A-45, and 24A-85 than observed by PRRIP aerial monitoring. Though a higher number of juveniles were reported by USFWS for these groups, the total number of individuals in each group agreed across survey methods.












Overall, the USFWS database consisted of 194 whooping crane (173 adults; 21 juveniles) observations (Table 7). In comparison, PRRIP surveyors observed 187 whooping cranes (173 adults; 14 juveniles; Table 7). The total number of crane use days from USFWS data was 213 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).

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

Unique group icon	PRRIP					USFWS				
	PRRIP group ID <sup>a</sup>	Dates present	Days present	Adults: juveniles	Crane use days <sup>c</sup>	USFWS group ID <sup>b</sup>	Dates present	Days present	Adults: juveniles	Crane use days <sup>d</sup>
	2024SP02,04,06,07,09, 12,15,19,21,23,29,33,36,37, 39, 40,42,65	3/5-3/29	25	1:00	26	24A-02	3/2- 3/29	28	1:00	28
	2024SP01,03,05,08,10,13, 14,16,22,25,28,30,32,41,66, 82	3/5-3/31	27	2:01	84	24A-03	3/4- 3/31	28	2:01	87
	2024SP18	3/6	1	2:01	6	24A-04	3/6	1	2:01	6
	2024SP17	3/13	1	1:00	2	24A-05	3/13	1	1:00	2
	2024SP26	3/16	1	5:00	10	24A-13	3/16	1	5:00	10
	2024SP31,35,54	3/19- 3/28	10	5:00	55	24A-14	3/17- 3/28	12	5:00	65
	2024SP24	3/16	1	2:01	6	24A-15	3/16	1	2:01	6
	2024SP27,34,38	3/17- 3/21	5	1:00	6	24A-16	3/16- 3/25	10	1:00	11
	2024SP57,83	3/28- 3/31	4	2:00	10	24A-20a				
	2024SP58	3/28	1	5:00	10	24A-20b				
	2024SP68	3/29- 3/30	2	3:00 <sup>e</sup>	6	24A-20c	3/27- 3/31	5	9:00 <sup>f</sup>	54
	2024SP84	3/31	1	5:00	7	24A-20b				
NA	NA	NA	NA	NA	NA	24A-22	3/27	1	2:01	3
NA	NA	NA	NA	NA	NA	24A-27	3/28	1	3:00	6


























**Table 7—continued**

Unique group icon	PRRIP group ID <sup>a</sup>	Dates present	Days present	Adults: juveniles	Crane use days <sup>c</sup>	USFWS group ID <sup>b</sup>	Dates present	Days present	Adults: juveniles	Crane use days <sup>d</sup>
	2024SP91,99,113,121	4/2-4/5	4	14:01	75	24A-28a,b,c	4/1-4/12	12	13:02 <sup>g</sup>	180
	2024SP122,126,130, 133	4/6-4/9	4	4:00	16					
	2024SP137,139,142	4/10-4/12	3	2:00	6					
	2024SP43,56	3/27-3/28	2	2:00	6	24A-29	3/27-3/28	2	2:00	6
	2024SP45,62,80,86,94, 100,107	3/28-4/4	8	2:00	18	24A-32a	3/27-4/4	9	4:01	45
	2024SP46,63,77,87	3/28-3/31	4	2:01	15	24A-32b				
	2024SP78,104	3/30-3/31	2	3:01	12	24A-39	3/28-4/3	7	3:01	28
	2024SP44,105,144	3/28-3/31	4	3:00	15	24A-40	3/28-3/31	4	3:00	15
	2024SP47,61,92,98	3/28-4/3	7	4:02	48	24A-41	3/28-4/3	7	4:02	48
	2024SP48	3/28	1	11:00	22	24A-42	3/28	1	11:00	22
	2024SP49	3/28	1	4:00	8	24A-43	3/28	1	4:00	8
	2024SP50	3/28-3/29	2	12:00	36	24A-44a,b,c	3/28-3/31	4	9:03 <sup>g</sup>	60
	2024SP73	3/30	1	10:00	10					
	2024SP85	3/31	1	6:00	6					
	2024SP51	3/28	1	10:01	22	24A-45a,b	3/28-3/29	2	9:02 <sup>g</sup>	33
	2024SP67	3/29	1	3:00	3					

1

2

Unique group icon	PRRIP group ID <sup>a</sup>	Dates present	Days present	Adults: juveniles	Crane use days <sup>c</sup>	USFWS group ID <sup>b</sup>	Dates present	Days present	Adults: juveniles	Crane use days <sup>d</sup>
	2024SP52	3/28	1	7:00	14	24A-46a,b,c	3/28-3/30	3	7:00	28
	2024SP71,75	3/29-3/30	2	5:00	10					
	2024SP72,76	3/29-3/30	2	2:00	4					
	2024SP53	3/28	1	2:00	4	24A-48	3/28	1	2:00	4
	2024SP59	3/28	1	13:01	28	24A-49	3/28	1	13:01	28
	2024SP55	3/28	1	3:00	6	24A-50	3/28	1	3:00	6
	2024SP60,64,81,95,103,114	3/28-4/4	8	1:00	9	24A-51	3/28-4/4	8	1:00	9
	2024SP69	3/29	1	2:00	4	24A-52	3/29	1	2:00	4
	2024SP70	3/29	1	2:00	4	24A-53	3/29	1	2:00	4
	2024SP79	3/30	1	8:00	16	24A-54	3/30	1	8:00	16
	2024SP88	3/31	1	2:00	4	24A-56	3/31	1	2:00	4
	2024SP90,96,117,124,127,134,136,140,143	3/31-4/12	13	3:01	56	24A-57	3/31-4/12	13	3:01	56
	2024SP89	3/31	1	2:00	4	24A-78	3/31	1	2:00	4
	2024SP93,97,108	4/2-4/4	3	2:01	12	24A-79	4/2-4/4	3	2:01	12
	2024SP101,116	4/3-4/4	2	6:00	18	24A-80	4/3-4/4	2	6:00	18
	2024SP102	4/3	1	2:00	4	24A-81	4/3	1	2:00	4
	2024SP109	4/4	1	2:00	4	24A-82	4/4	1	2:00	4
	2024SP110	4/4	1	2:01	6	24A-83	4/2-4/4	3	2:01	12
	2024SP111	4/4	1	5:00	10	24A-84a,b,c	4/2-4/12	11	5:00	60
	2024SP119	4/5	1	4:00	4					
	2024SP123,125,129,135,138,141	4/6-4/12	7	6:00	44					

<i>Table 7—continued</i>										
Unique group icon	PRRIP group ID <sup>a</sup>	Dates present	Days present	Adults: juveniles	Crane use days <sup>c</sup>	USFWS group ID <sup>b</sup>	Dates present	Days present	Adults: juveniles	Crane use days <sup>d</sup>
	2024SP112	4/4	1	3:00	6	24A-85a,b	4/2-4/12	11	2:01 <sup>g</sup>	36
	2024SP120	4/5	1	2:00	2					
	2024SP115	4/4	1	3:00	6	24A-86	4/4	1	3:00	6
	2024SP118	4/5	1	3:00	6	24A-87	4/5	1	3:00	6
	2024SP132	4/8	1	1:00	2	24A-89	4/8	1	1:00	2
	2024SP131	4/8	1	2:01	6	24A-90	4/8	1	2:01	6
	2024SP128	4/8	1	3:00	6	24A-91	4/8	1	3:00	6
<b>Total</b>		<b>140 groups</b>	<b>183</b>	<b>173:14</b>	<b>845</b>	<b>Total</b>	<b>44 groups</b>	<b>207</b>	<b>173:21</b>	<b>1058</b>

<sup>a</sup> PRRIP assigns a new whooping crane group ID each day a group is observed.

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

<sup>c</sup> 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.

<sup>d</sup> 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.

<sup>e</sup> The 3:0 individuals in 24A-20c are not included in total crane count because they were already counted as a part of the 5:00 for 24A-20b.

<sup>f</sup> USFWS observed two additional whooping cranes in this group on 3/27 prior to the first PRRIP observation.

<sup>g</sup> USFWS received information from daily follows of WC groups to identify juveniles.

## Detectability of whooping crane decoys

EDO staff placed whooping crane decoy sets at 19 unique locations between March 12 and April 17, 2024 (Table 8). Four decoy sets consisted of one whooping crane decoy; 13 sets contained two decoys; and two sets consisted of three decoys (Table 8). EDO staff placed two of the four decoy sets comprised of one decoy, eight of 13 sets consisting of two decoys, and one of two sets containing three decoys in the river channel (Table 8). The remaining eight sets of decoys were placed in off-channel, lowland grassland habitat (Table 8). Aerial surveyors spotted nine of 11 decoy sets placed in the river channel (82%) and none of the eight decoy sets placed at off-channel locations (0%; Table 8). Aerial surveyors detected two of the four sets consisting of one decoy; six of 13 sets consisting of two decoys; and one of two 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 spring 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 <sub>y</sub>	No. of decoys	Habitat type	Detected
3/12/2024	3/13/2024	452947	4503308	2	Grassland - Lowland	No
3/13/2024	3/15/2024	565025	4530235	2	Wetted Channel	Yes
3/19/2024	3/20/2024	496214	4501271	1	Grassland - Lowland	No
3/20/2024	3/21/2024	500257	4501173	2	Wetted Channel	No
3/20/2024	3/21/2024	517385	4505545	2	Grassland - Lowland	No
3/21/2024	3/23/2024	488789	4501182	2	Grassland - Lowland	No
3/27/2024	3/28/2024	459117	4503683	2	Wetted Channel	Yes
3/28/2024	3/29/2024	564833	4529936	2	Wetted Channel	No
4/4/2024	4/5/2024	499221	4501061	1	Wetted Channel	Yes
4/8/2024	4/9/2024	516638	4505190	1	Wetted Channel	Yes
4/8/2024	4/9/2024	502838	4501351	3	Grassland - Lowland	No
4/9/2024	4/10/2024	538278	4511539	2	Grassland - Lowland	No
4/9/2024	4/10/2024	501611	4501432	2	Grassland - Lowland	No
4/10/2024	4/11/2024	496337	4501145	3	Wetted Channel	Yes
4/11/2024	4/12/2024	540987	4512824	1	Grassland - Lowland	No
4/12/2024	4/13/2024	540707	4512535	2	Wetted Channel	Yes
4/15/2024	4/17/2024	538314	4511403	2	Wetted Channel	Yes
4/15/2024	4/17/2024	444094	4504426	2	Wetted Channel	Yes
4/17/2024	4/19/2024	539375	4511577	2	Wetted Channel	Yes

## Discussion

During spring 2024 PRRIP documented the highest proportion of the Aransas-Wood Buffalo population (0.349) and highest number of crane use days (845 days) along the Platte River (Fig. 5a) since 2007. When adjusting crane use days for the 5<sup>th</sup> and 95<sup>th</sup> percentile dates, the proportion of the population observed decreased to 0.343 and the number of crane use days decreased to 823 days but remained the highest recorded by PRRIP (Figs. 5, 6). We also recorded the largest number of cranes present in the AHR on a single day, with 93 birds present in 17 unique groups on March 28, 2024. PRRIP documented a record total of 187 whooping cranes over the monitoring season from March 5 through April 19, 2024. With 107 of the 187 whooping cranes having multiple day stopovers, ranging between one and 27 days (mean = 4.2; median = 1.5; SE = 0.9), PRRIP's EDO estimated 845 total crane use days for spring 2024.

Spring whooping crane stopover metrics for the central Platte River as determined through PRRIP's surveys have demonstrated considerable annual variability (Figs. 5, 6). Following a historical low in 2015, PRRIP observed an increasing level of whooping crane use of the central Platte River in the spring 2016, 2017, and 2018 migratory seasons. Whooping crane use of the AHR was again low in 2019 and 2020, reaching a record low in 2021. Numbers rose for spring 2022 and 2023 but remained within previously observed annual variability. The spring of 2024 was truly unique, documenting use by 83 more whooping cranes (82% increase) and over 359 more crane use days (77% increase) than the prior record set in spring 2018 when comparing metrics adjusted for the 5<sup>th</sup> and 95<sup>th</sup> percentile dates. High annual variability in whooping crane stopover metrics makes it more difficult to quantify whether significant long-term changes in these metrics have occurred. We found no relationship between the adjusted proportion of population stopping on the AHR during spring and year during 2014–2024 using either a Spearman's rank correlation or regression modeling approach. We also found no significant temporal trend in the adjusted number of spring crane use days during 2014–2024 when using either a Spearman's rank correlation or a regression modeling approach. Similarly, we found no significant relationship between the adjusted number of whooping cranes observed during PRRIP spring surveys and annual AWB population size during 2016–2024. The high amount of interannual variability in stopover metrics is likely due to the multiple factors affecting stopover decisions, locations, and durations (PRRIP 2022; Appendix A). 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.

Most whooping crane groups observed during PRRIP's spring 2024 surveys were distributed on the eastern half of the AHR, which was similar to that observed during spring 2023 and in previous years of monitoring (Figs. 3, 4; PRRIP 2023a). 26 of the 44 unique groups were observed in the eastern half of the AHR. When considering the 154 total group locations recorded by PRRIP, 87 group locations were observed east of Kearney compared to only 67 groups observed west of Kearney. Notably, three whooping crane groups were observed opportunistically outside of systematic flight transects west of Lexington, NE, outside of the AHR boundary (Appendix C, Fig.

C1). These observations were included in counts of whooping cranes observed as well as for calculations of crane use days. The DeBoer wetland in the western half of the AHR was also used by whooping cranes in spring 2024 (Appendix C, Fig. C2). The distribution and 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).

A spring Environmental Account release by the USFWS and in collaboration with CNPPID was successful at reducing the periods of low discharge between hydrostepping cycles typically seen during the spring migratory season. This reduced the variability in discharge that is typically experienced by whooping cranes stopping on the central Platte River in the spring. The release was timed such that it coincided with the period of peak whooping crane use of the central Platte River. Whooping cranes with stopovers extending beyond this release experienced a wider range of low to high discharge at the nearest gage (Figs. 7–10). Two whooping crane groups (24A-02 and 24A-03) remained within the AHR nearest the Grand Island gage for over three weeks (25 and 27 days, respectively). Both groups arrived when discharge was low (first riverine observation made at 829 cfs) and remained present as discharge at the Grand Island gage cycled daily to peak at 2,150 cfs during their stay on March 27 and March 31 (Fig. 10). Across the entire AHR, we observed an increase in the frequency of occurrence of group observations relative to discharge at the nearest gage (Fig. 11). Although these discharge measurements are not independent and lack spatially explicit information of river depth and flow at the whooping crane group location itself, they do provide an indication of river conditions during the stopover. Given the high variability in flow and depth in portions of the Platte River, especially in reaches with braided channels, whooping cranes may select stopover sites that combine shallow depths, more gentle flow, and habitat attributes preferred for predator protection within an area characterized by deeper, faster flow during periods of high discharge (Faanes et al. 1992, Baasch et al. 2019).

Finally, in this report we also assessed how the 5<sup>th</sup> and 95<sup>th</sup> percentiles of dates of spring whooping crane group observations from the USFWS public sighting database for Nebraska varied over time, whether PRRIP spring survey dates during 2007 through 2024 were within these percentiles, and adjustments to stopover metrics to correspond with observations recorded only during dates corresponding to the 5<sup>th</sup> through 95<sup>th</sup> percentiles. Surveys during 2007 through 2013 did not include the 5<sup>th</sup> percentile date for the corresponding period (Table 4). Therefore, we could not assess whooping crane metrics adjusted to the 5<sup>th</sup> through 95<sup>th</sup> percentile dates prior to 2014. Use of 5<sup>th</sup> and 95<sup>th</sup> percentiles of dates to calculate whooping crane metrics resulted in adjustments being made to metrics in 2018, 2021, 2022, 2023, and 2024 (Figs. 5, 6). In 2021, 2022, and 2023 the adjustments were minor. However, large adjustments were made for the high use years of 2018 and 2024. In 2018, adjustments were made to the number of individual whooping cranes observed (118 to 101 birds), proportion of population that stopped on the AHR (0.234 to 0.200), and number of crane use days (501 to 464 crane use days). For 2024, the numbers of individual whooping cranes observed decreased from 187 to 184, proportion of population that stopped on the AHR decreased from 0.349 to 0.343, and crane use days decreased from 845 to 823 days due to three whooping crane groups arriving before the 5<sup>th</sup> percentile date. The spring 2024 monitoring period of March 5 through April 19, 2024 encompassed both the 5<sup>th</sup> and 95<sup>th</sup> 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, or 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 spring 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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## 1 Appendix A. Whooping Crane Extension Big Questions and Hypotheses

<b>EBQ #4 What factors influence WC decision to stop or fly over the AHR?</b>
<b>Management Hypothesis: Probability of WC stopping within the AHR is a function of discharge.</b>
<b>Underlying Physical Processes Hypothesis</b> – 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).
<b>Alternative Hypotheses:</b> <ul style="list-style-type: none"> <li>• Time of day is the primary driver of WC stopovers with probability of use increasing with decreasing time until dark.</li> <li>• The probability of WC stopping over is a function of MUCW and unforested corridor width.</li> <li>• The probability of WC stopping over is a function of land cover or habitat suitability within a biologically relevant radius of flyover location.</li> <li>• 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.</li> <li>• Length of stay at previous stopover (inverse relationship) and distance traveled since last stopover (direct relationship) are important predictors of WC stopovers.</li> <li>• 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.</li> </ul>

2

<b>Extension Big Question #5: What factors influence WC stopover length within the AHR?</b>
<b>Management Hypothesis: Length of WC stopover within the AHR is a function of discharge.</b>
<b>Underlying Physical Processes Hypothesis</b> – 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).
<b>Alternative Hypotheses:</b> <ul style="list-style-type: none"> <li>• 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.</li> <li>• WC stopover length is inversely related to daily variability in flow.</li> <li>• WC stopover length is a function of MUCW and unforested corridor width.</li> <li>• WC stopover length is a function of land cover or habitat suitability within a biologically relevant radius of use location.</li> <li>• 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.</li> <li>• 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.</li> <li>• 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.</li> <li>• 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.</li> </ul>














3

<b>Extension Big Question #6: Why is Spring WC use of the AHR greater than Fall use?</b>
<b>Management Hypothesis: WC use of the AHR in the Spring is greater than during the Fall due to higher flows during the Spring.</b>
<b>Underlying Physical Processes Hypothesis</b> – 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).
<b>Alternative Hypotheses:</b> <ul style="list-style-type: none"> <li>• 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.</li> <li>• WC stay longer in the AHR during Spring migration because daily variability in flow is lower.</li> <li>• WC use of the AHR in the Spring is greater because proportional wetland landcover is greater.</li> <li>• 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</li> <li>• 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.</li> <li>• 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).</li> <li>• 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).</li> </ul>






## 1 Appendix B. Whooping Crane Group Observations

2 Tables of details of whooping crane group observations recorded during spring 2024 along the Associated Habitat Reach of the central  
 3 Platte River between Lexington and Chapman, Nebraska. One table is provided for each group based on the unique USFWS group  
 4 identification (ID) number. Provided for each group is the unique color-coded group icon that corresponds to icons provided in tables  
 5 and figures throughout the report; the USFWS group ID; USFWS subgroup; date(s) of observations of the group; number of adult and  
 6 juvenile whooping cranes in the group; the PRRIP group ID number; use site number; UTM x and y coordinates (zone 14N); and type  
 7 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  
 8 placed following the PRRIP group ID. Use site numbers are provided when the whooping crane group was observed in riverine,  
 9 lacustrine, or palustrine land cover types. When whooping crane groups were observed in a land cover type or environment that was  
 10 not riverine, lacustrine, or palustrine, then the appropriate land cover type is provided (i.e., Ag-agriculture; beans; corn). If the group  
 11 was sighted in flight, then “AIR” is provided for the use site number. Observation types are provided as systematic (Sys), opportunistic  
 12 (Opp), aerial (Flight), and Ground.

















13  
 14 **Table B.1.** Data for whooping crane group USFWS ID 24A-02.

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 UTMy	Observation type
	24A-02		3/5/2024	1:00	2024SP02	2	540379	4511999	Sys-Flight
	24A-02		3/6/2024	1:00	2024SP04	Corn	537624	4506702	Opp-Ground
	24A-02		3/7/2024	1:00	2024SP06	AIR	540956	4512919	Opp-Ground
	24A-02		3/9/2024	1:00	2024SP07	4	544606	4514503	Sys-Flight
	24A-02		3/10/2024	1:00	2024SP09	6	544467	4514387	Sys-Flight
	24A-02		3/11/2024	1:00	2024SP12	8	544477	4514432	Sys-Flight
	24A-02		3/13/2024	1:00	2024SP15	10	548449	4515202	Sys-Flight
	24A-02		3/14/2024	1:00	2024SP19	Corn	545149	4502340	Opp-Ground
	24A-02		3/15/2024	1:00	2024SP21	13	540954	4512600	Sys-Flight
	24A-02		3/16/2024	1:00	2024SP23	15	540801	4512415	Sys-Flight
	24A-02		3/17/2024	1:00	2024SP37	25	540820	4512452	Sys-Flight
	24A-02		3/18/2024	1:00	2024SP29	19	539571	4511628	Sys-Flight
	24A-02		3/19/2024	1:00	2024SP33	23	539391	4511324	Sys-Flight

**Table B.1—continued**



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 <sub>y</sub>	Observation type
	24A-02		3/20/2024	1:00	2024SP36	24	539567	4511458	Sys-Flight
	24A-02		3/21/2024	1:00	2024SP39	26	539801	4511761	Sys-Flight
	24A-02		3/22/2024	1:00	2024SP40	27	540595	4512248	Opp-Ground
	24A-02		3/27/2024	1:00	2024SP42	29	539811	4511669	Sys-Flight
	24A-02		3/29/2024	1:00	2024SP65	49	540319	4512064	Sys-Flight

**Table B.2.** Data for whooping crane group USFWS ID 24A-03.


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 <sub>y</sub>	Observation type
	24A-03		3/5/2024	2:01	2024SP01	1	540639	4512324	Sys-Flight
	24A-03		3/6/2024	2:01	2024SP03	Corn	543284	4506296	Opp-Ground
	24A-03		3/7/2024	2:01	2024SP05	3	540810	4512472	Sys-Flight
	24A-03		3/7/2024	2:01	2024SP05B	Beans	542378	4506258	Opp-Ground
	24A-03		3/9/2024	2:01	2024SP08	5	539639	4511509	Sys-Flight
	24A-03		3/10/2024	2:01	2024SP10	7	539647	4511471	Sys-Flight
	24A-03		3/11/2024	2:01	2024SP13	9	539305	4511268	Sys-Flight
	24A-03		3/11/2024	2:01	2024SP13B	Corn	538853	4507856	Opp-Ground
	24A-03		3/12/2024	2:01	2024SP14	Corn	539177	4506789	Opp-Ground
	24A-03		3/13/2024	2:01	2024SP16	11	538655	4511271	Sys-Flight
	24A-03		3/15/2024	2:01	2024SP22	14	540885	4512500	Sys-Flight
	24A-03		3/16/2024	2:01	2024SP25	Corn	542591	4509678	Sys-Flight
	24A-03		3/17/2024	2:01	2024SP28	18	539695	4511607	Sys-Flight
	24A-03		3/18/2024	2:01	2024SP30	20	539711	4511638	Sys-Flight
	24A-03		3/19/2024	2:01	2024SP32	22	540883	4512413	Sys-Flight
	24A-03		3/27/2024	2:01	2024SP41	28	540014	4511909	Sys-Flight




**Table B.2—continued**

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 <sub>y</sub>	Observation type
	24A-03		3/29/2024	2:01	2024SP66	50	540714	4512283	Sys-Flight
	24A-03		3/31/2024	2:01	2024SP82	57	540799	4512393	Sys-Flight


**Table B.3.** Data for whooping crane group USFWS ID 24A-04.

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 <sub>y</sub>	Observation type
	24A-04		3/6/2024	2:01	2024SP18	AIR	563385	4528158	Sys-Flight




**Table B.4.** Data for whooping crane group USFWS ID 24A-05.

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 <sub>y</sub>	Observation type
	24A-05		3/13/2024	1:00	2024SP17	12	511449	4503079	Sys-Flight


**Table B.5.** Data for whooping crane group USFWS ID 24A-13.

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 <sub>y</sub>	Observation type
	24A-13		3/16/2024	5:00	2024SP26	Corn	488702	4499963	Opp-Ground




**Table B.6.** Data for whooping crane group USFWS ID 24A-14.

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 <sub>y</sub>	Observation type
	24A-14		3/19/2024	5:00	2024SP31	21	547330	4515388	Sys-Flight
	24A-14		3/20/2024	5:00	2024SP35	Corn	556251	4514628	Sys-Flight
	24A-14		3/28/2024	5:00	2024SP54	41	549166	4515333	Sys-Flight



**Table B.7.** Data for whooping crane group USFWS ID 24A-15.

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 <sub>y</sub>	Observation type
	24A-15		3/16/2024	2:01	2024SP24	16	531491	4509249	Sys-Flight





**Table B.8.** Data for whooping crane group USFWS ID 24A-16.

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 <sub>y</sub>	Observation type
	24A-16		3/17/2024	1:00	2024SP27	17	548092	4515259	Sys-Flight
	24A-16		3/20/2024	1:00	2024SP34	Corn	541060	4511657	Opp-Ground
	24A-16		3/21/2024	1:00	2024SP38	25	539618	4511472	Sys-Flight












**Table B.9.** Data for whooping crane group USFWS ID 24A-20. PRRIP never observed 24A-20a together with 24A-20b,c. They were observed as two separate groups and are treated as such.

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 <sub>y</sub>	Observation type
	24A-20	a	3/28/2024	2:00	2024SP57	Corn	532153	4508899	Opp-Ground
	24A-20	a	3/31/2024	2:00	2024SP83	58	534425	4510678	Sys-Flight



**Table B.10.** Data for whooping crane group USFWS ID 24A-20. PRRIP considers 24A-20b and 24A-20c as the same group. PRRIP never observed 24A-20b,c together with 24A-20a. They were observed as two separate groups and are treated as such.

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 <sub>y</sub>	Observation type
	24A-20	b	3/28/2024	5:00	2024SP58	Corn	532498	4509397	Opp-Ground
	24A-20	c	3/29/2024	3:00	2024SP68	52	530240	4508579	Sys-Flight
	24A-20	c	3/29/2024	3:00	2024SP68B	Corn	530677	4508620	Opp-Ground
	24A-20	b	3/31/2024	5:00	2024SP84	59	517882	4505478	Sys-Flight










**Table B.11.** Data for whooping crane group USFWS ID 24A-28.

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 <sub>y</sub>	Observation type
	24A-28	a	4/2/2024	14:01	2024SP91	61	441830	4503295	Opp-Ground
	24A-28	a	4/3/2024	14:01	2024SP99	Corn	441392	4502980	Sys-Flight
	24A-28	a	4/4/2024	14:01	2024SP113	Corn	441339	4503042	Sys-Flight
	24A-28	a	4/5/2024	14:01	2024SP121	78	441841	4503335	Sys-Flight
	24A-28	b	4/6/2024	4:00	2024SP122	79	441874	4503267	Opp-Ground
	24A-28	b	4/7/2024	4:00	2024SP126	Corn	441351	4503001	Opp-Ground
	24A-28	b	4/8/2024	4:00	2024SP130	Corn	441261	4503170	Sys-Flight
	24A-28	b	4/9/2024	4:00	2024SP133	82	441828	4503280	Opp-Ground
	24A-28	c	4/10/2024	2:00	2024SP137	Corn	441365	4503090	Sys-Flight
	24A-28	c	4/11/2024	2:00	2024SP139	Corn	441386	4503067	Sys-Flight
	24A-28	c	4/12/2024	2:00	2024SP142	Corn	441357	4503160	Sys-Flight






1 **Table B.12.** Data for whooping crane group USFWS ID 24A-29.

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 <sub>y</sub>	Observation type
	24A-29		3/27/2024	2:00	2024SP43	30	545431	4514641	Opp-Flight
	24A-29		3/28/2024	2:00	2024SP56	43	543037	4513527	Sys-Flight



2  
3 **Table B.13.** Data for whooping crane group USFWS ID 24A-32. PRRIP never observed 24A-32a together with 24A-32b. They were  
4 observed as two separate groups and are treated as such.

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 <sub>y</sub>	Observation type
	24A-32	a	3/28/2024	2:00	2024SP45	32	484707	4501284	Sys-Flight
	24A-32	a	3/29/2024	2:00	2024SP62	46	484313	4501158	Sys-Flight
	24A-32	a	3/29/2024	2:00	2024SP62B	Corn	486153	4500124	Opp-Ground
	24A-32	a	3/30/2024	2:00	2024SP80	Corn	486255	4500319	Opp-Ground
	24A-32	a	3/31/2024	2:00	2024SP86	77	483948	4501309	Sys-Flight
	24A-32	a	4/2/2024	2:00	2024SP94	62	484430	4501139	Opp-Ground
	24A-32	a	4/2/2024	2:00	2024SP94B	Corn	485664	4499048	Opp-Ground
	24A-32	a	4/3/2024	2:00	2024SP100	67	483962	4501303	Sys-Flight
	24A-32	a	4/4/2024	2:00	2024SP107	71	483950	4501294	Sys-Flight




**Table B.14.** Data for whooping crane group USFWS ID 24A-32. PRRIP never observed 24A-32b together with 24A-32a. They were observed as two separate groups and are treated as such.

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 <sub>y</sub>	Observation type
	24A-32	b	3/28/2024	2:01	2024SP46	33	482621	4501407	Sys-Flight
	24A-32	b	3/29/2024	2:01	2024SP63	47	482695	4501404	Sys-Flight
	24A-32	b	3/30/2024	2:01	2024SP77	Corn	481991	4500751	Opp-Ground
	24A-32	b	3/31/2024	2:01	2024SP87	60	482935	4501365	Sys-Flight
	24A-32	b	3/31/2024	2:01	2024SP87B	Corn	481481	4500903	Sys-Flight







**Table B.15.** Data for whooping crane group USFWS ID 24A-39.

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 <sub>y</sub>	Observation type
	24A-39		3/30/2024	3:01	2024SP78	Ag	458018	4502141	Opp-Ground
	24A-39		3/31/2024	3:01	2024SP104	Ag	458067	4502196	Sys-Flight


**Table B.16.** Data for whooping crane group USFWS ID 24A-40.

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 <sub>y</sub>	Observation type
	24A-40		3/28/2024	3:00	2024SP44	31	458399	4503639	Sys-Flight
	24A-40		3/30/2024	3:00	2024SP144	Ag	458018	4502141	Opp-Ground
	24A-40		3/31/2024	3:00	2024SP105	Ag	457839	4501859	Sys-Flight


1 **Table B.17.** Data for whooping crane group USFWS ID 24A-41.

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 <sub>y</sub>	Observation type
	24A-41		3/28/2024	4:02	2024SP47	Corn	503842	4501582	Opp-Ground
	24A-41		3/29/2024	4:02	2024SP61	45	502763	4501260	Sys-Flight
	24A-41		3/29/2024	3:02	2024SP61B	Corn	503947	4501478	Opp-Ground
	24A-41		4/2/2024	4:02	2024SP92	Alfalfa	449022	4502543	Opp-Ground
	24A-41		4/3/2024	4:02	2024SP98	66	451137	4503099	Sys-Flight
	24A-41		4/3/2024	4:02	2024SP98B	Corn	451422	4502141	Sys-Flight





2  
3 **Table B.18.** Data for whooping crane group USFWS ID 24A-42.

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 <sub>y</sub>	Observation type
	24A-42		3/28/2024	11:00	2024SP48	35	534126	4510674	Sys-Flight




4  
5 **Table B.19.** Data for whooping crane group USFWS ID 24A-43.

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 <sub>y</sub>	Observation type
	24A-43		3/28/2024	4:00	2024SP49	36	533344	4510463	Sys-Flight






**Table B.20.** Data for whooping crane group USFWS ID 24A-44.

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 <sub>y</sub>	Observation type
	24A-44	a	3/28/2024	12:00	2024SP50	37	531652	4509524	Sys-Flight
	24A-44	b	3/30/2024	10:00	2024SP73	53	530280	4508646	Sys-Flight
	24A-44	b	3/30/2024	10:00	2024SP73B	Corn	529990	4507906	Opp-Ground
	24A-44	c	3/31/2024	6:00	2024SP85	Corn	531065	4508255	Opp-Ground

**Table B.21.** Data for whooping crane group USFWS ID 24A-45.


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 <sub>y</sub>	Observation type
	24A-45	a	3/28/2024	10:01	2024SP51	38	531221	4509361	Sys-Flight
	24A-45	a	3/28/2024	10:01	2024SP51B	Corn	531756	4508717	Opp-Ground
	24A-45	b	3/29/2024	3:00	2024SP67	51	532100	4509703	Sys-Flight

**Table B.22.** Data for whooping crane group USFWS ID 24A-46.


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 <sub>y</sub>	Observation type
	24A-46	a	3/28/2024	7:00	2024SP52	39	520415	4506748	Sys-Flight
	24A-46	b	3/29/2024	5:00	2024SP71	Corn	519658	4505938	Sys-Flight
	24A-46	b	3/30/2024	5:00	2024SP75	55	517265	4505449	Sys-Flight
	24A-46	c	3/29/2024	2:00	2024SP72	Corn	519551	4506147	Sys-Flight
	24A-46	c	3/30/2024	2:00	2024SP76	AIR	519278	4503410	Opp-Flight




**Table B.23.** Data for whooping crane group USFWS ID 24A-48.

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 <sub>y</sub>	Observation type
	24A-48		3/28/2024	2:00	2024SP53	40	516071	4504674	Sys-Flight







**Table B.24.** Data for whooping crane group USFWS ID 24A-49.

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 <sub>y</sub>	Observation type
	24A-49		3/28/2024	13:01	2024SP59	Corn	546743	4520916	Opp-Ground


**Table B.25.** Data for whooping crane group USFWS ID 24A-50.

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 <sub>y</sub>	Observation type
	24A-50		3/28/2024	3:00	2024SP55	42	544295	4514311	Sys-Flight


**Table B.26.** Data for whooping crane group USFWS ID 24A-51.

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 <sub>y</sub>	Observation type
	24A-51		3/28/2024	1:00	2024SP60	44	545091	4514611	Sys-Flight
	24A-51		3/29/2024	1:00	2024SP64	48	544820	4514495	Sys-Flight
	24A-51		3/31/2024	1:00	2024SP81	56	544704	4514385	Sys-Flight
	24A-51		4/2/2024	1:00	2024SP95	63	544723	4514484	Opp-Ground
	24A-51		4/3/2024	1:00	2024SP103	70	544738	4514437	Sys-Flight
	24A-51		4/4/2024	1:00	2024SP114	73	544649	4514458	Sys-Flight


**Table B.27.** Data for whooping crane group USFWS ID 24A-52.

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 <sub>y</sub>	Observation type
	24A-52		3/29/2024	2:00	2024SP69	Corn	519322	4505907	Sys-Flight


**Table B.28.** Data for whooping crane group USFWS ID 24A-53.

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 <sub>y</sub>	Observation type
	24A-53		3/29/2024	2:00	2024SP70	Corn	519359	4505965	Sys-Flight












**Table B.29.** Data for whooping crane group USFWS ID 24A-54.

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 <sub>y</sub>	Observation type
	24A-54		3/30/2024	8:00	2024SP79	Corn	485011	4499975	Opp-Ground


**Table B.30.** Data for whooping crane group USFWS ID 24A-56.

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 <sub>y</sub>	Observation type
	24A-56		3/31/2024	2:00	2024SP88	AIR	481891	4501201	Sys-Flight






1 **Table B.31.** Data for whooping crane group USFWS ID 24A-57.

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 <sub>y</sub>	Observation type
	24A-57		3/31/2024	3:01	2024SP90	Corn	470527	4501676	Sys-Flight
	24A-57		4/3/2024	3:01	2024SP96	64	473354	4503284	Sys-Flight
	24A-57		4/5/2024	3:01	2024SP117	76	473265	4503267	Sys-Flight
	24A-57		4/6/2024	3:01	2024SP124	Corn	473693	4501459	Opp-Ground
	24A-57		4/8/2024	3:01	2024SP127	Corn	473774	4501490	Opp-Flight
	24A-57		4/9/2024	3:01	2024SP134	83	473075	4503394	Sys-Flight
	24A-57		4/9/2024	3:01	2024SP134B	Corn	473821	4501335	Opp-Ground
	24A-57		4/10/2024	3:01	2024SP136	84	473033	4503377	Sys-Flight
	24A-57		4/10/2024	3:01	2024SP136B	Corn	473682	4501305	Sys-Flight
	24A-57		4/11/2024	3:01	2024SP140	Corn	473717	4501380	Opp-Ground
	24A-57		4/12/2024	3:01	2024SP143	Corn	473778	4501398	Opp-Ground



2  
3 **Table B.32.** Data for whooping crane group USFWS ID 24A-78.

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 <sub>y</sub>	Observation type
	24A-78		3/31/2024	2:00	2024SP89	Ag	457837	4501963	Sys-Flight


1 **Table B.33.** Data for whooping crane group USFWS ID 24A-79.

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 <sub>y</sub>	Observation type
	24A-79		4/2/2024	2:01	2024SP93	Grassland	456812	4501864	Opp-Ground
	24A-79		4/3/2024	2:01	2024SP97	65	459111	4503684	Sys-Flight
	24A-79		4/3/2024	2:01	2024SP97B	Corn	456766	4501641	Opp-Ground
	24A-79		4/4/2024	2:01	2024SP108	72	458465	4503668	Sys-Flight
	24A-79		4/4/2024	2:01	2024SP108B	Corn	456820	4501675	Sys-Flight


2  
3 **Table B.34.** Data for whooping crane group USFWS ID 24A-80.

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 <sub>y</sub>	Observation type
	24A-80		4/3/2024	6:00	2024SP101	68	532082	4509781	Sys-Flight
	24A-80		4/4/2024	6:00	2024SP116	75	532386	4509955	Sys-Flight


4  
5 **Table B.35.** Data for whooping crane group USFWS ID 24A-81.

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 <sub>y</sub>	Observation type
	24A-81		4/3/2024	2:00	2024SP102	69	516331	4504992	Sys-Flight









6  
7 **Table B.36.** Data for whooping crane group USFWS ID 24A-82.

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 <sub>y</sub>	Observation type
	24A-82		4/4/2024	2:00	2024SP109	Corn	449412	4502079	Opp-Flight



1 **Table B.37.** Data for whooping crane group USFWS ID 24A-83.

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 <sub>y</sub>	Observation type
	24A-83		4/4/2024	2:01	2024SP110	85	434135	4510252	Opp-Flight


2  
3 **Table B.38.** Data for whooping crane group USFWS ID 24A-84.

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 <sub>y</sub>	Observation type
	24A-84	a	4/4/2024	5:00	2024SP111	Corn	434297	4509613	Opp-Flight
	24A-84	b	4/5/2024	4:00	2024SP119	AIR	434267	4510224	Opp-Flight
	24A-84	c	4/6/2024	6:00	2024SP123	Corn	434661	4509371	Opp-Ground
	24A-84	c	4/7/2024	6:00	2024SP125	Corn	435769	4509354	Opp-Ground
	24A-84	c	4/8/2024	6:00	2024SP129	86	433860	4510176	Opp-Flight
	24A-84	c	4/9/2024	6:00	2024SP135	87	434180	4510240	Opp-Flight
	24A-84	c	4/11/2024	6:00	2024SP138	88	433804	4510206	Opp-Flight
	24A-84	c	4/12/2024	6:00	2024SP141	89	433801	4510153	Opp-Flight


4  
5 **Table B.39.** Data for whooping crane group USFWS ID 24A-85.

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 <sub>y</sub>	Observation type
	24A-85	a	4/4/2024	3:00	2024SP112	Corn	433065	4510071	Opp-Flight
	24A-85	b	4/5/2024	2:00	2024SP120	Corn	434440	4509500	Opp-Flight


**Table B.40.** Data for whooping crane group USFWS ID 24A-86.

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 <sub>y</sub>	Observation type
	24A-86		4/4/2024	3:00	2024SP115	74	540924	4512659	Sys-Flight


**Table B.41.** Data for whooping crane group USFWS ID 24A-87.

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 <sub>y</sub>	Observation type
	24A-87		4/5/2024	3:00	2024SP118	77	451356	4503154	Sys-Flight


**Table B.42.** Data for whooping crane group USFWS ID 24A-89.

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 <sub>y</sub>	Observation type
	24A-89		4/8/2024	1:00	2024SP132	81	539887	4511750	Sys-Flight

**Table B.43.** Data for whooping crane group USFWS ID 24A-90.

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 <sub>y</sub>	Observation type
	24A-90		4/8/2024	2:01	2024SP131	80	570503	4535406	Sys-Flight

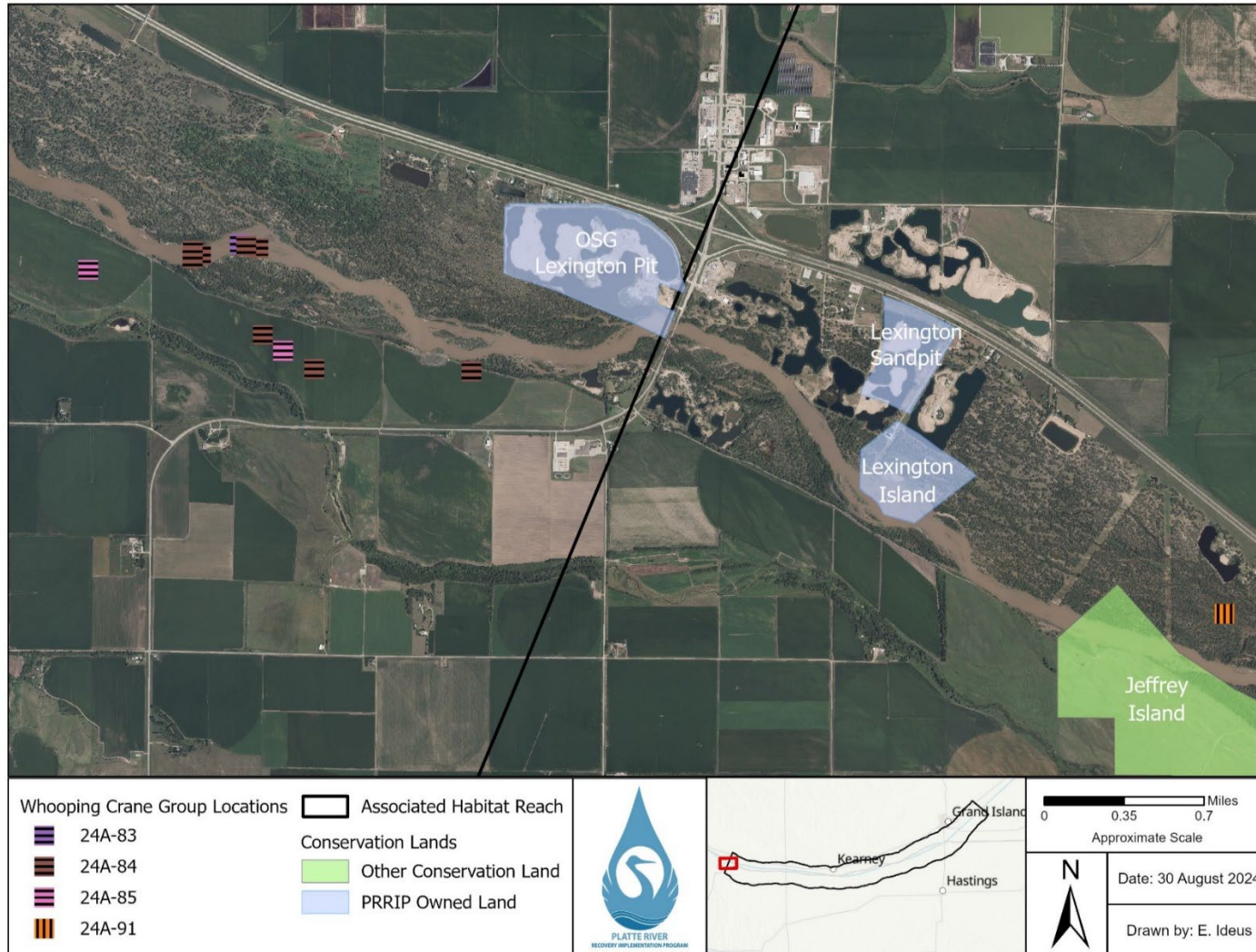
**Table B.44.** Data for whooping crane group USFWS ID 24A-91.

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 <sub>y</sub>	Observation type
	24A-91		4/8/2024	3:00	2024SP128	AIR	441082	4507643	Sys-Flight

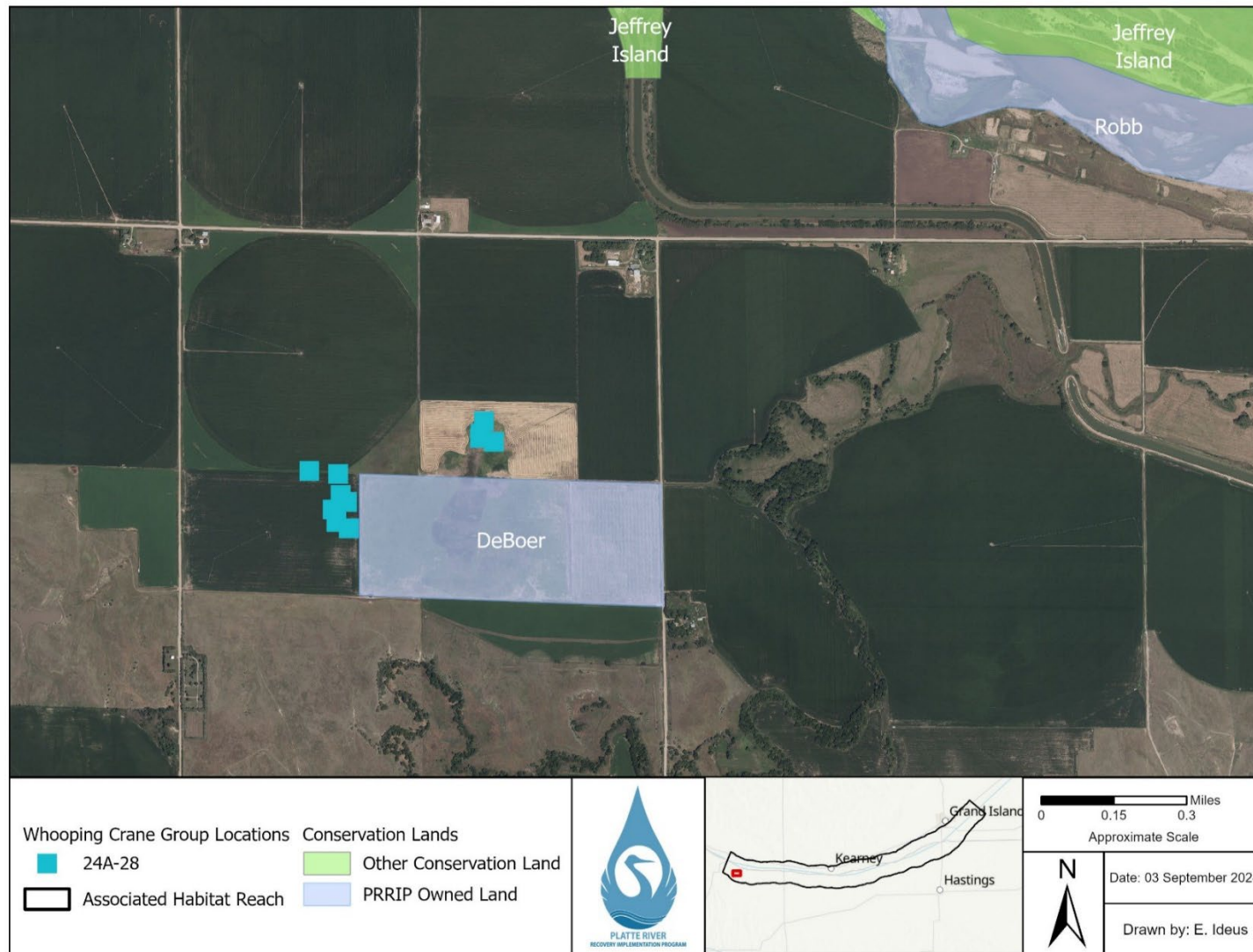
## Appendix C. Enlarged Maps of Whooping Crane Use Locations and Photographs of Groups

Maps of whooping crane group use locations observed during spring 2024 are presented from west to east beginning with Fig. C1 and ending with Fig. C13. The distribution of historical spring observations of whooping crane groups by PRRIP during 2001–2024 are provided online at <https://hwcorp.maps.arcgis.com/apps/mapviewer/index.html?webmap=dd788353c4684bda90305652cb7e12e7>. Photographs of the first systematically collected observation from each unique group are provided in Fig. C14 through Fig. C52.



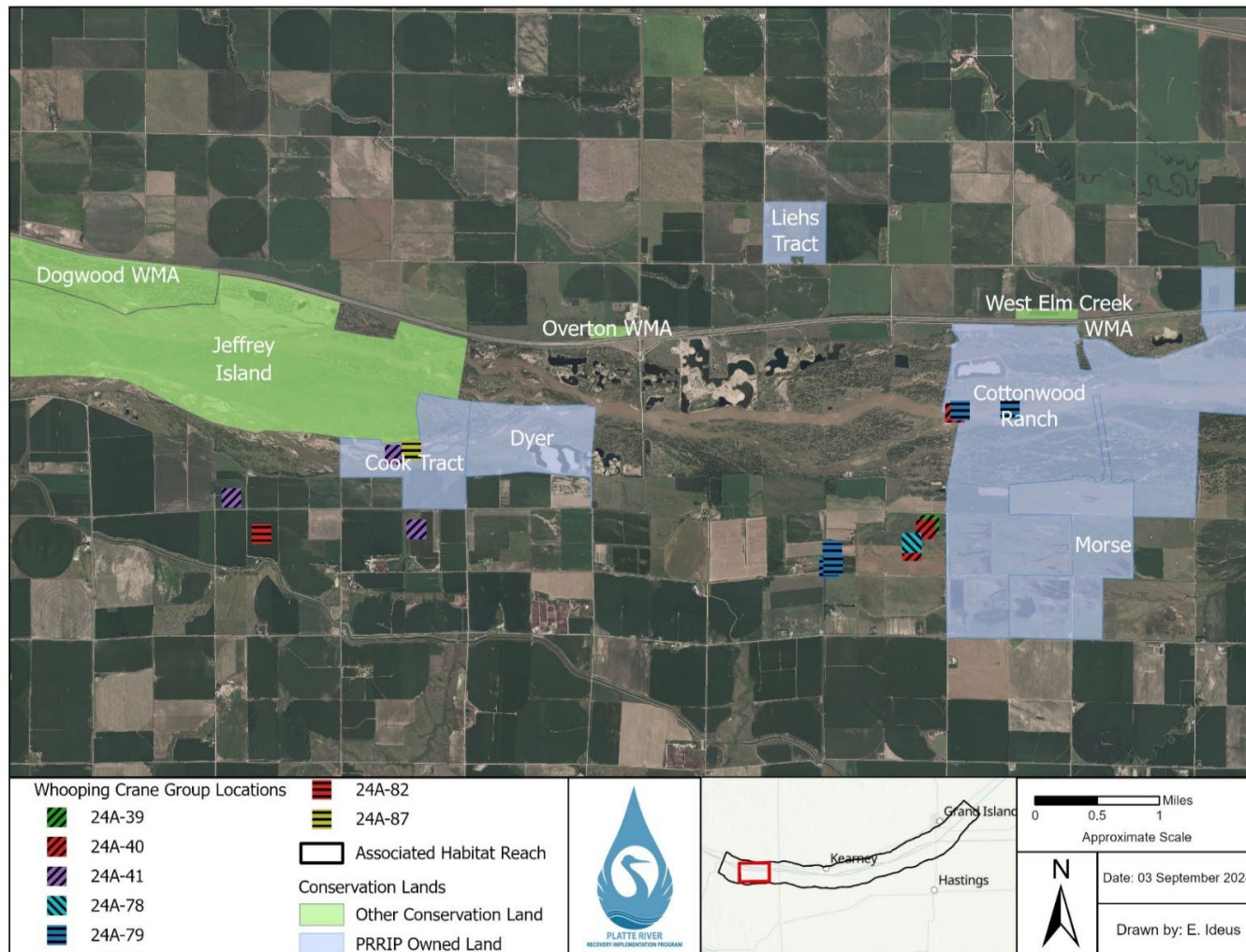


**Figure C1.** Whooping crane groups USFWS ID 24A-83 (PRRIP ID 2024SP110; sighted 4/4); USFWS ID 24A-84 (See Appendix B Table B.38 for PRRIP IDs; sighted 4/4-4/12); USFWS ID 24A-85 (PRRIP IDs 2024SP112, 2024SP120; sighted 4/4-4/5); USFWS ID 24A-91 (PRRIP ID 2024SP128; sighted 4/8) observed south of Lexington, Nebraska along the Associated Habitat Reach of the central Platte River during spring 2024. PRRIP aerial imagery from July 2023 is displayed for reference.

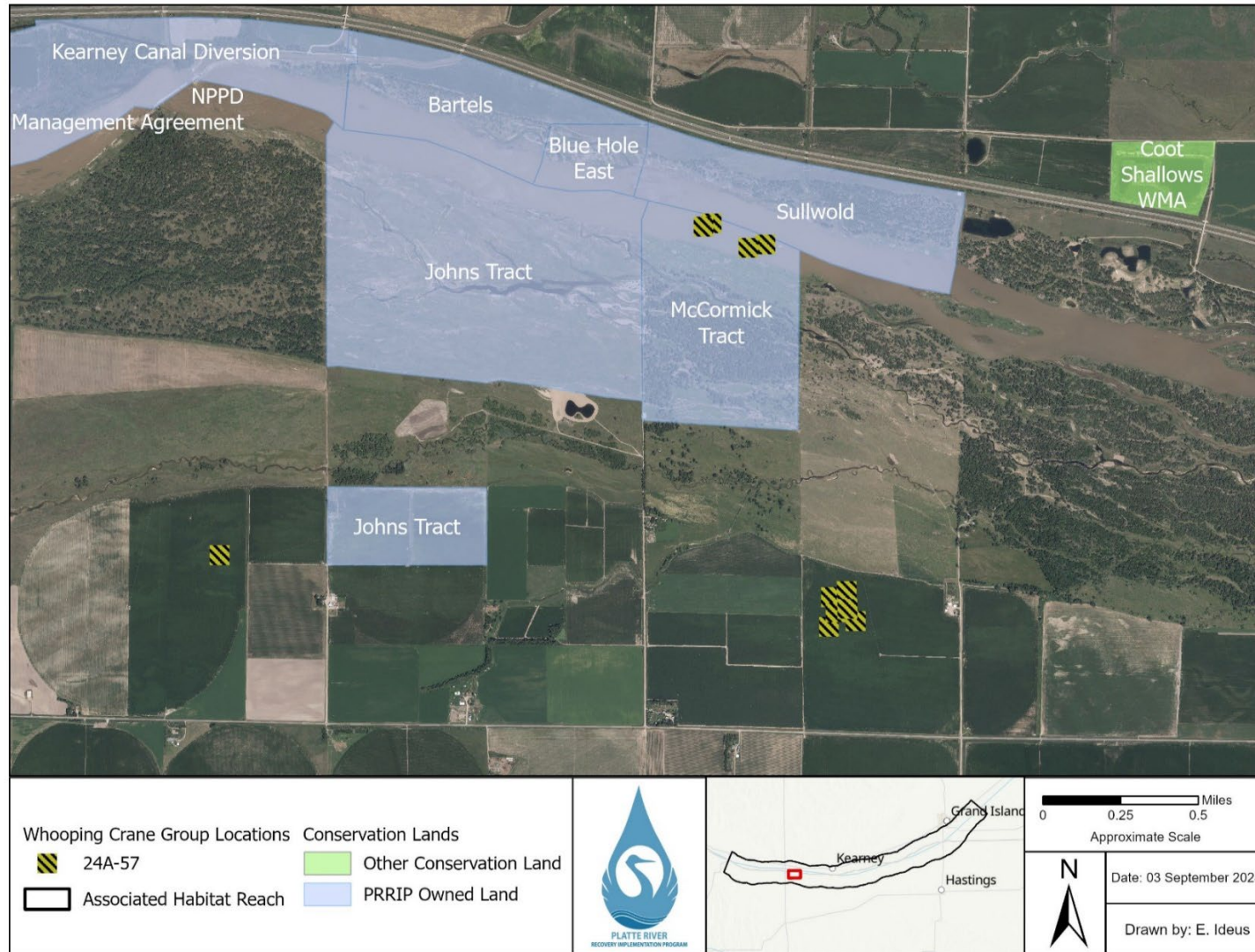


**Figure C2.** Whooping crane group USFWS ID 24A-28 (See Appendix B Table B.11 for PRRIP IDs; sighted 4/2-4/12) observed southeast of Lexington, Nebraska along the Associated Habitat Reach of the central Platte River during spring 2024. PRRIP aerial imagery from July 2023 is displayed for reference.



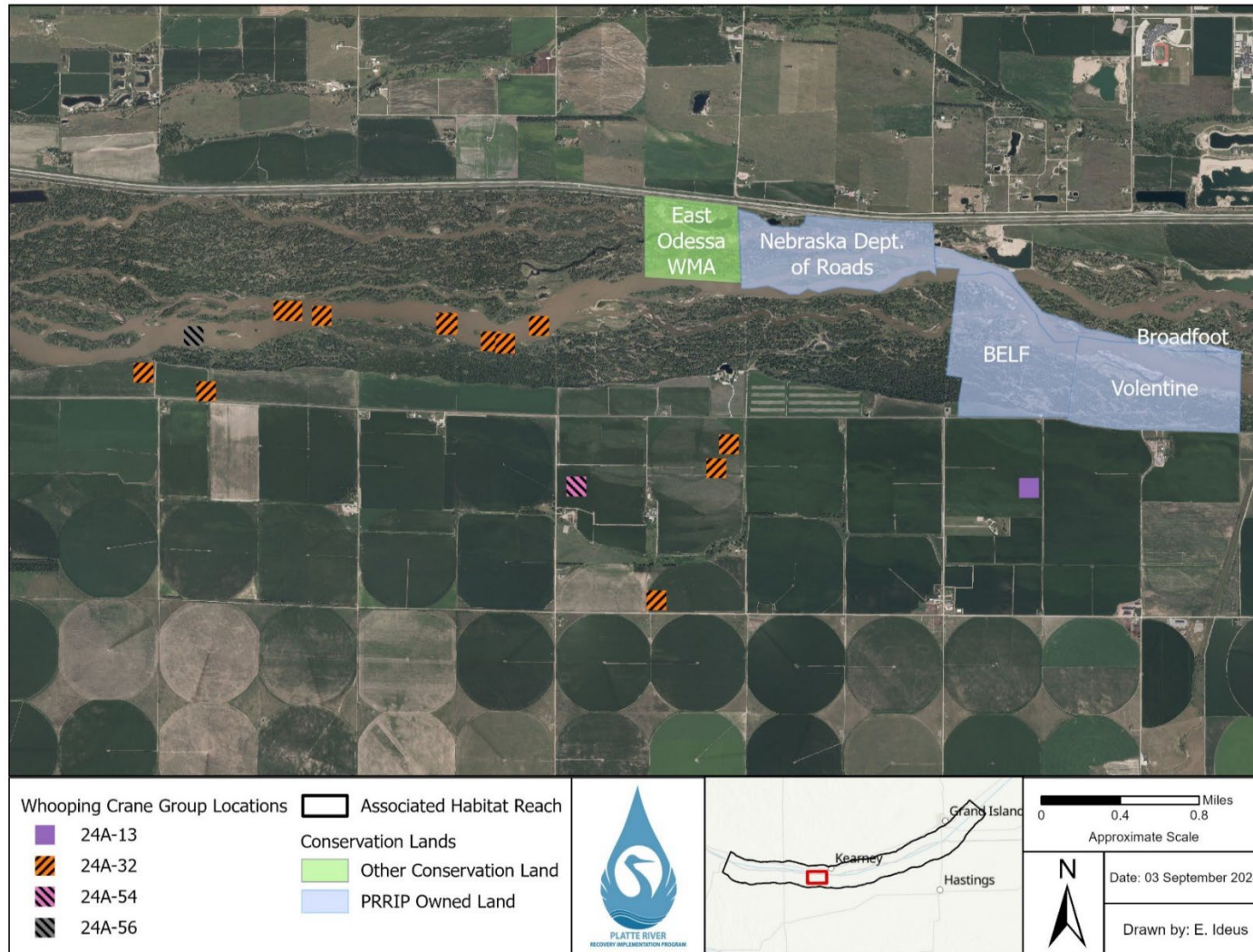


**Figure C3.** Whooping crane groups USFWS ID 24A-39 (PRRIP IDs 2024SP78, 2024SP104; sighted 3/30-3/31); USFWS ID 24A-40 (PRRIP IDs 2024SP44, 2024SP144, 2024SP105; sighted 3/28-3/31); USFWS ID 24A-41 (See Appendix B Table B.17 for PRRIP IDs; sighted 3/28-4/3); USFWS ID 24A-78 (PRRIP ID 2024SP89; sighted 3/31); USFWS ID 24A-79 (See Appendix B Table B.33 for PRRIP IDs; sighted 4/2-4/4); USFWS ID 24A-82 (PRRIP ID 2024SP109; sighted 4/4); USFWS ID 24A-87 (PRRIP ID 2024SP118; sighted 4/5) observed south of Overton, Nebraska along the Associated Habitat Reach of the central Platte River during spring 2024. PRRIP aerial imagery from July 2023 is displayed for reference.

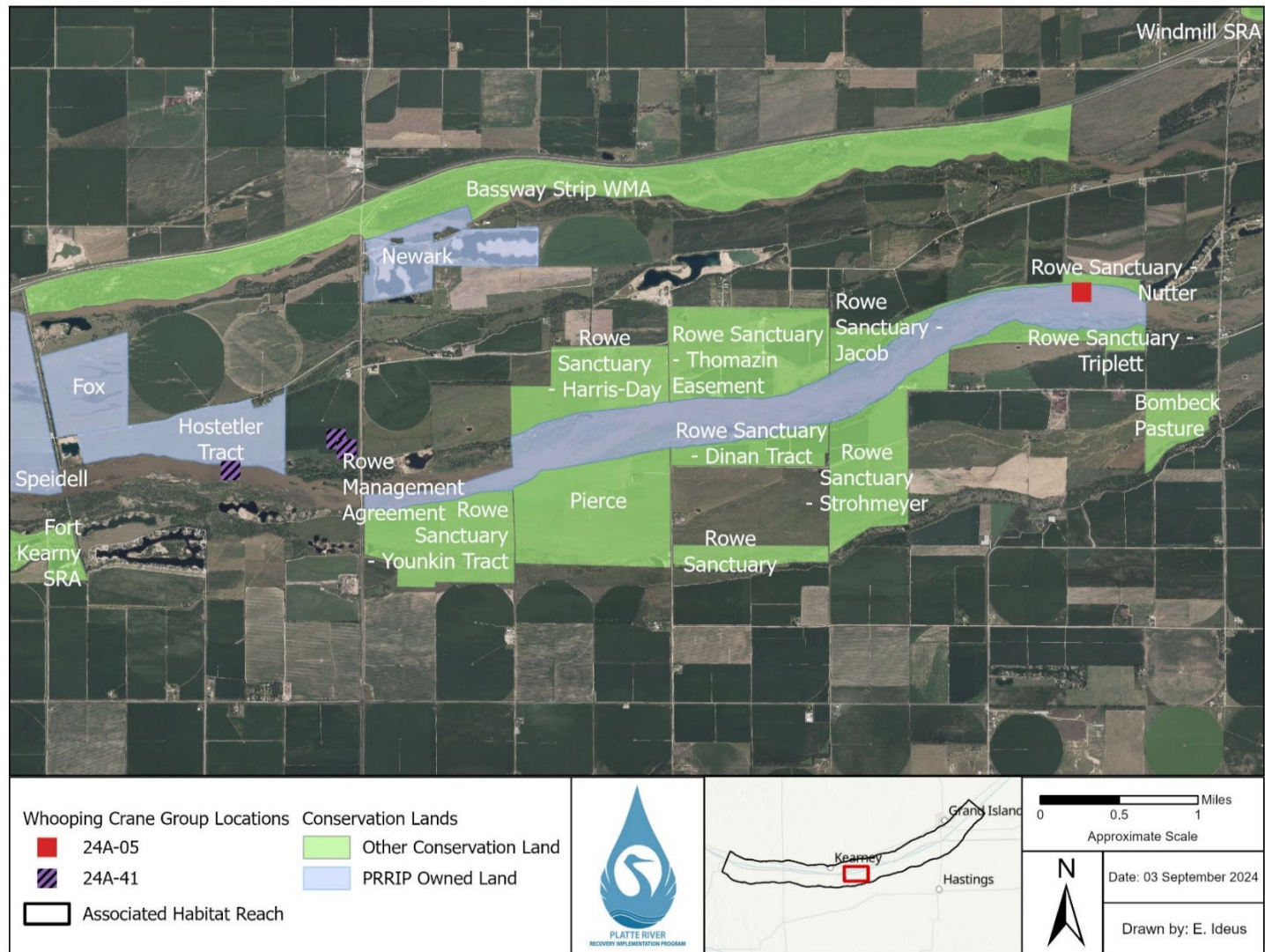


**Figure C4.** Whooping crane group USFWS ID 24A-57 (See Appendix B Table B.31 for PRRIP IDs; sighted 3/31-4/12) observed southeast of Elm Creek, Nebraska along the Associated Habitat Reach of the central Platte River during spring 2024. PRRIP aerial imagery from July 2023 is displayed for reference.



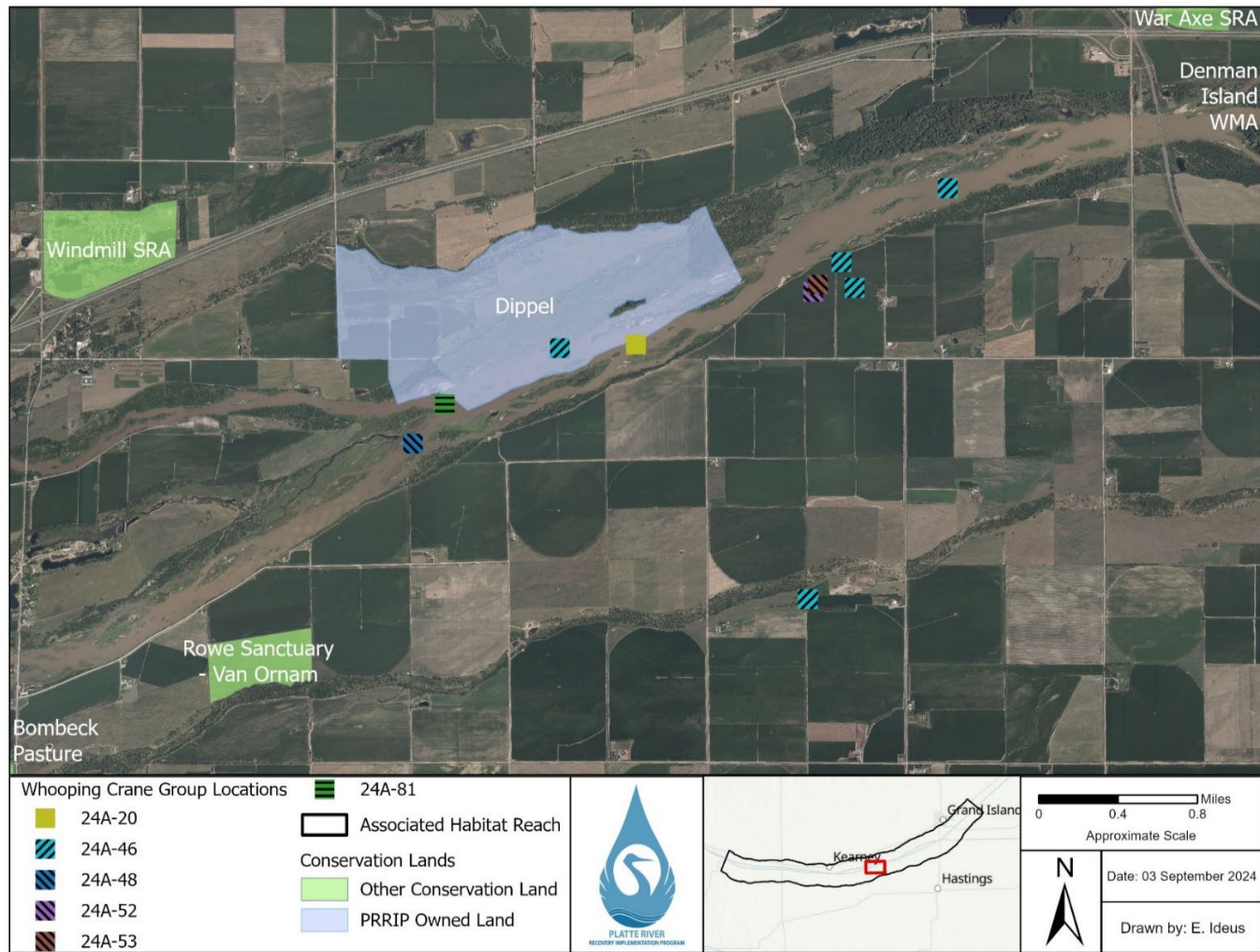


**Figure C5.** Whooping crane groups USFWS ID 24A-13 (PRRIP ID 2024SP26; sighted 3/16); USFWS ID 24A-32a (See Appendix B Table B.13 for PRRIP IDs; sighted 3/28-4/4); USFWS ID 24A-32b (See Appendix B Table B.14 for PRRIP IDs; sighted 3/28-3/31); USFWS ID 24A-54 (PRRIP ID 2024SP79; sighted 3/30); USFWS ID 24A-56 (PRRIP ID 2024SP88; sighted 3/31) observed southwest of Kearney, Nebraska along the Associated Habitat Reach of the central Platte River during spring 2024. PRRIP aerial imagery from July 2023 is displayed for reference.



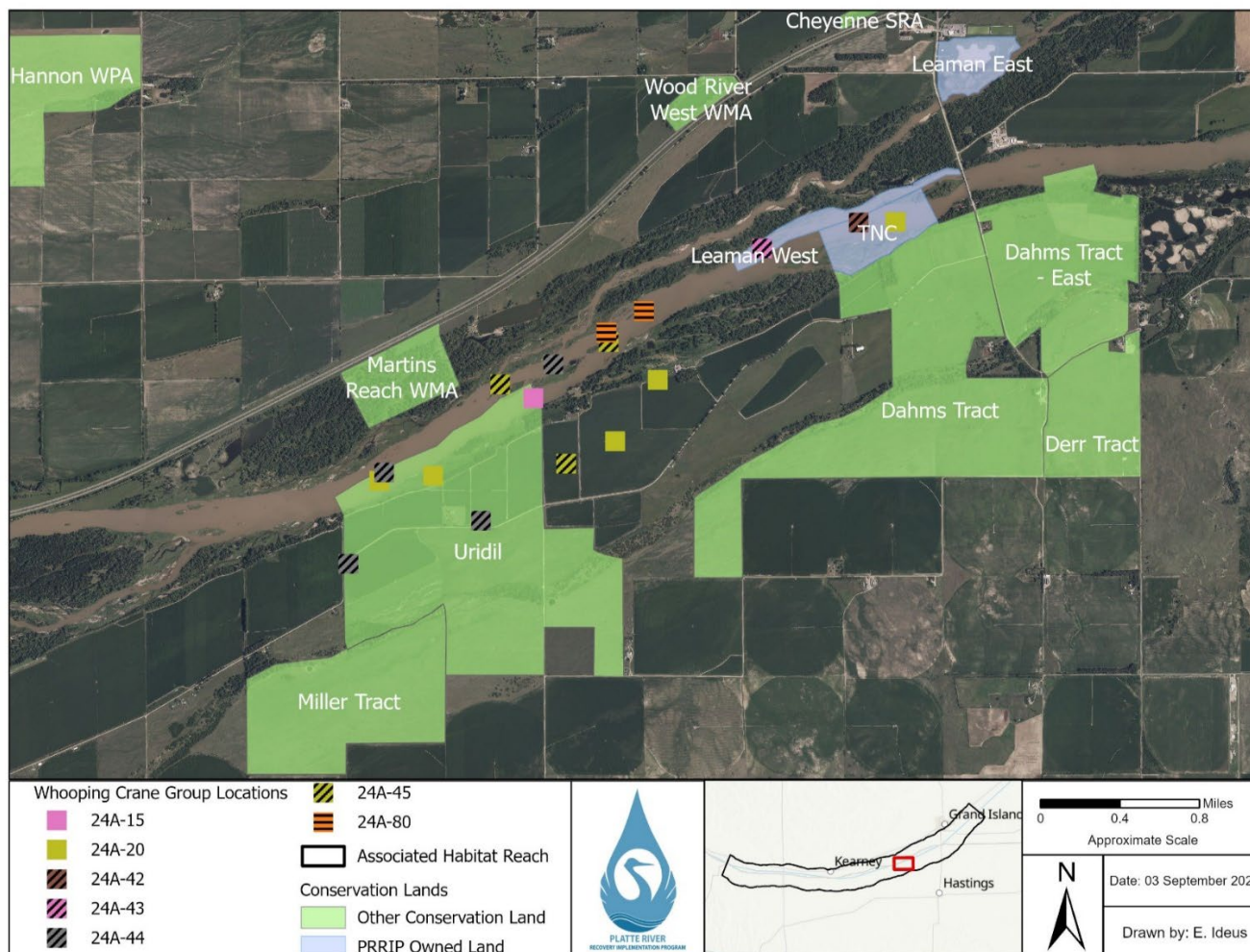
**Figure C6.** Whooping crane groups USFWS ID 24A-05 (PRRIP ID 2024SP17; sighted 3/13); USFWS ID 24A-41 (See Appendix B Table B.17 for PRRIP IDs; sighted 3/28-4/3) observed southeast of Kearney, Nebraska and south of Gibbon, Nebraska along the Associated Habitat Reach of the central Platte River during spring 2024. PRRIP aerial imagery from July 2023 is displayed for reference.



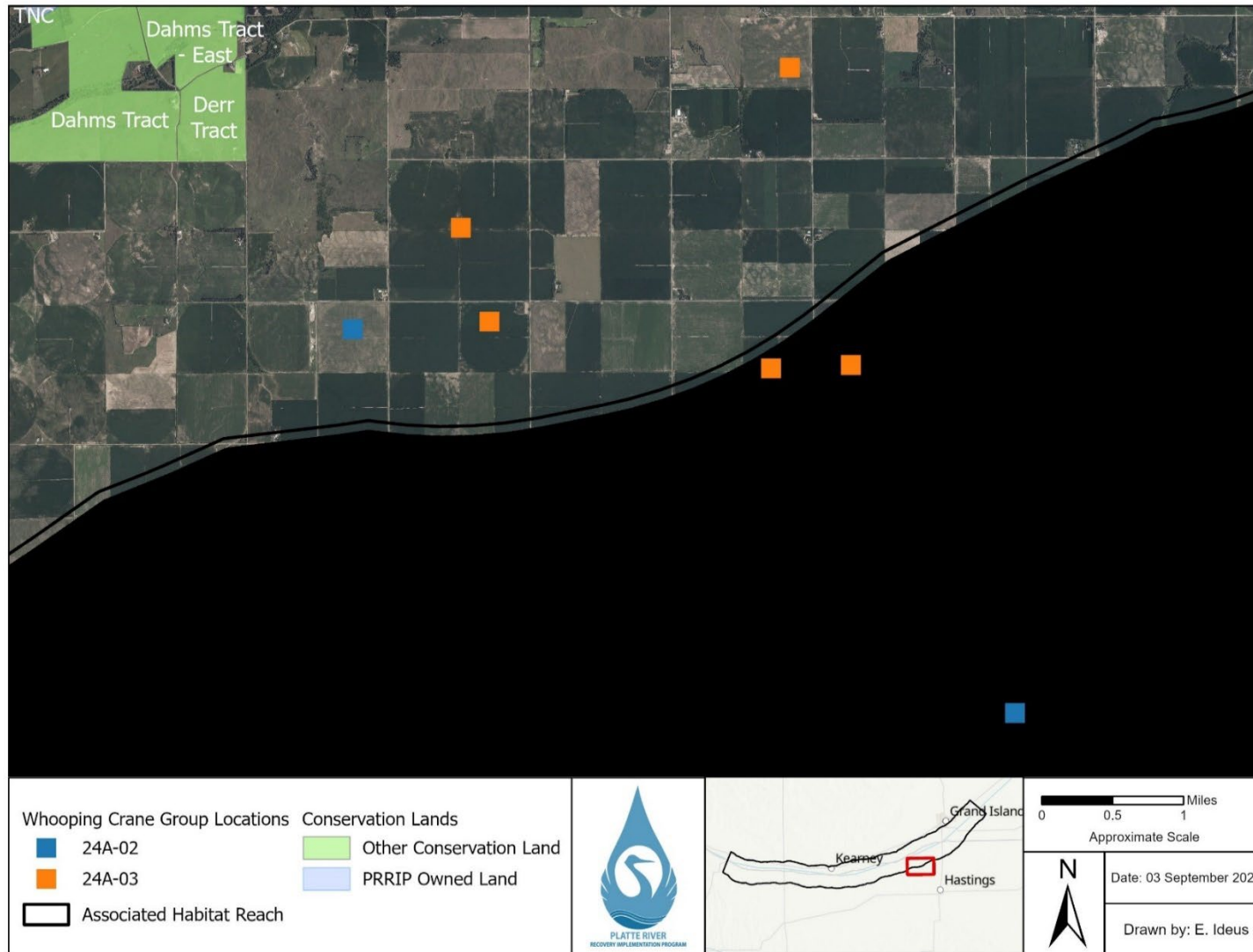


**Figure C7.** Whooping crane groups USFWS ID 24A-20b,c (See Appendix B Table B.10 for PRRIP IDs; sighted 3/28-3/31); USFWS ID 24A-46 (See Appendix B Table B.22 for PRRIP IDs; sighted 3/28-3/30); USFWS ID 24A-48 (PRRIP ID 2024SP53; sighted 3/28); USFWS ID 24A-52 (PRRIP ID 2024SP69; sighted 3/29); USFWS ID 24A-53 (PRRIP ID 2024SP70; sighted 3/29); USFWS ID 24A-81 (PRRIP ID 2024SP102; sighted 4/3) observed southeast of Gibbon, Nebraska along the Associated Habitat Reach of the central Platte River during spring 2024. PRRIP aerial imagery from July 2023 is displayed for reference.



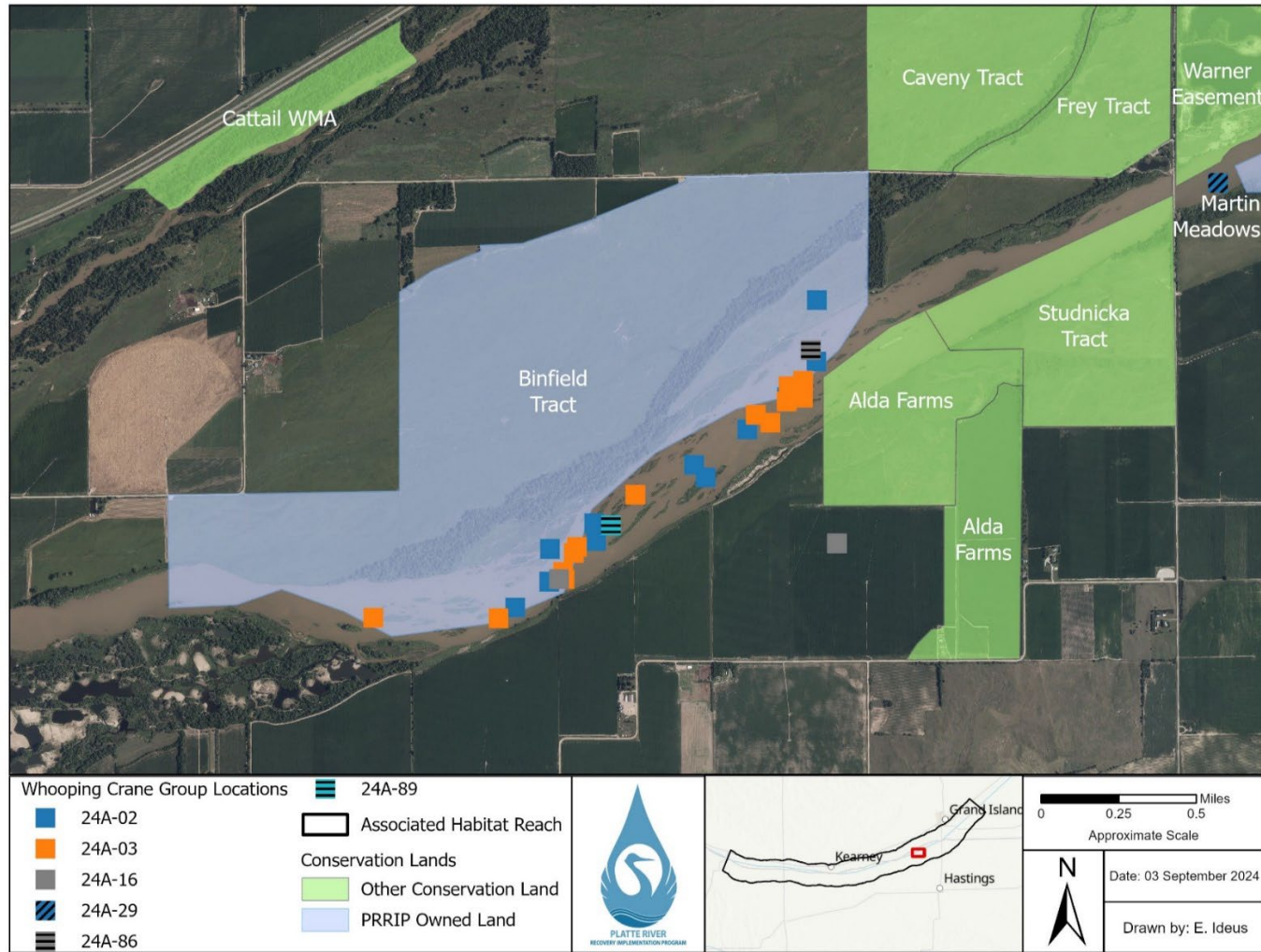


**Figure C8.** Whooping crane groups USFWS ID 24A-15 (PRRIP ID 2024SP24; sighted 3/16); USFWS ID 24A-20a (PRRIP IDs 2024SP57, 2024SP83; sighted 3/28 and 3/31); USFWS ID 24A-20b,c (See Appendix B Table B.10 for PRRIP IDs; sighted 3/28-3/31); USFWS ID 24A-42 (PRRIP ID 2024SP48; sighted 3/28); USFWS ID 24A-43 (PRRIP ID 2024SP49; sighted 3/28); USFWS ID 24A-44 (See Appendix B Table B.20 for PRRIP IDs; sighted 3/28-3/31); USFWS ID 24A-45 (PRRIP IDs 2024SP51, 2024SP67; sighted 3/28-3/29); USFWS ID 24A-80 (PRRIP IDs 2024SP101, 2024SP116; sighted 4/3-4/4) observed southwest of Wood River, Nebraska along the Associated Habitat Reach of the central Platte River during spring 2024. PRRIP aerial imagery from July 2023 is displayed for reference.

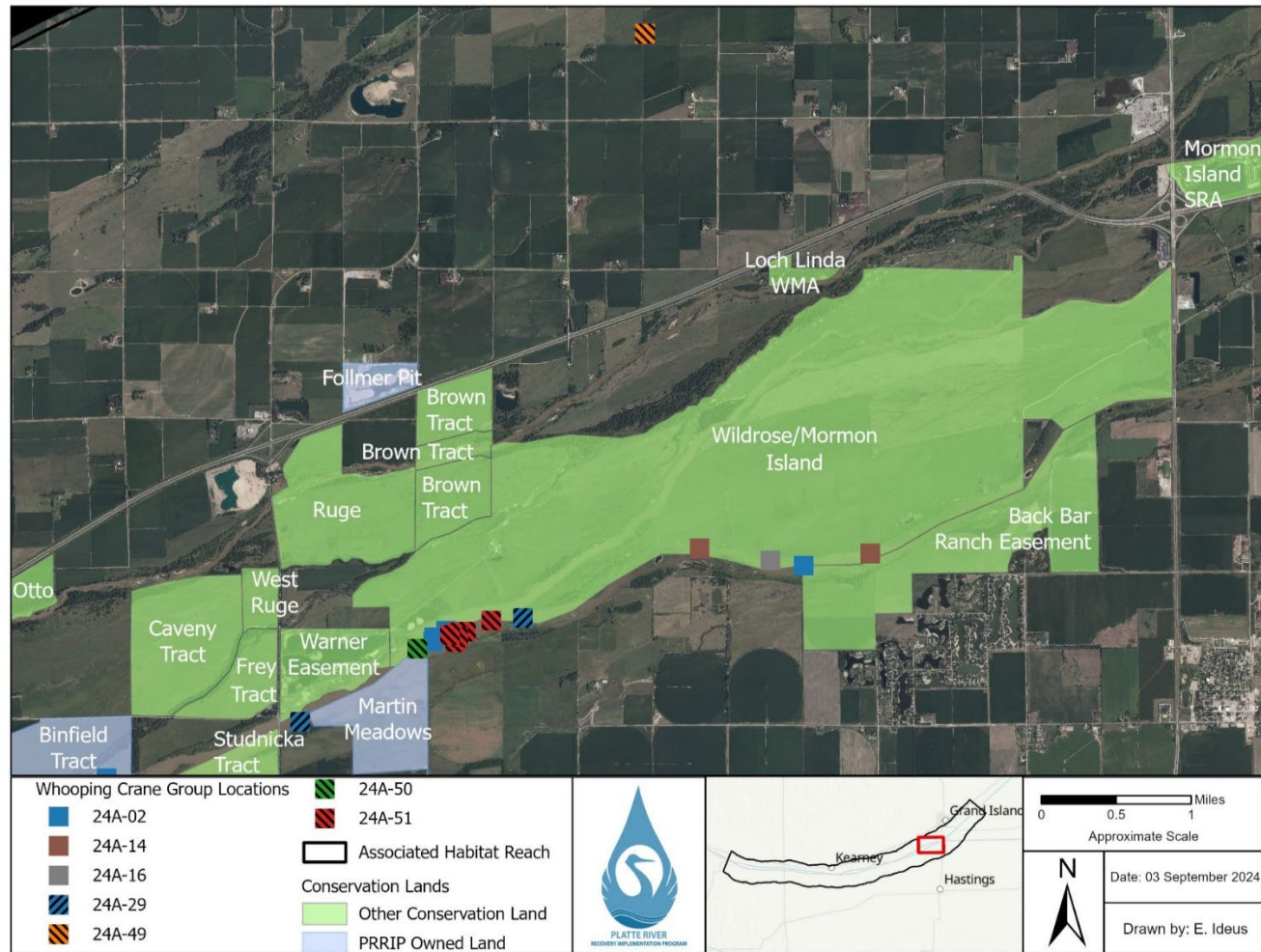


**Figure C9.** Whooping crane groups USFWS ID 24A-02 (See Appendix B Table B.1 for PRRIP IDs; sighted 3/5-3/29); USFWS ID 24A-03 (See Appendix B Table B.2 for PRRIP IDs; sighted 3/5-3/31) observed southwest of Alda, Nebraska along the Associated Habitat Reach of the central Platte River during spring 2024. PRRIP aerial imagery from July 2023 is displayed for reference.



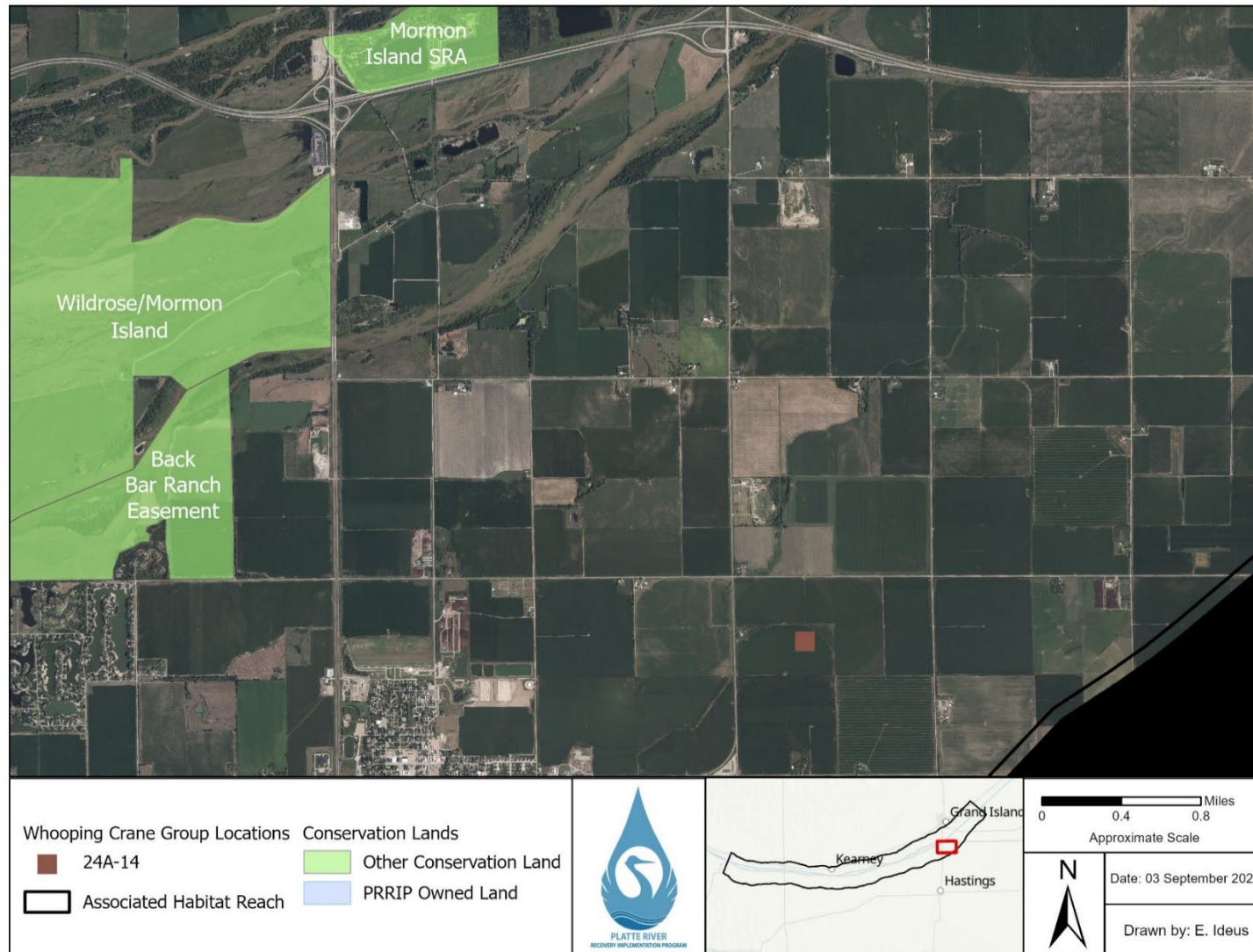


**Figure C10.** Whooping crane groups USFWS ID 24A-02 (See Appendix B Table B.1 for PRRIP IDs; sighted 3/5-3/29); USFWS ID 24A-03 (See Appendix B Table B.2 for PRRIP IDs; sighted 3/5-3/31); USFWS ID 24A-16 (PRRIP IDs 2024SP27, 2024SP34, 2024SP38; sighted 3/17-3/21); USFWS ID 24A-29 (PRRIP IDs 2024SP43, 2024SP56; sighted 3/27-3/28); USFWS ID 24A-86 (PRRIP ID 2024SP115; sighted 4/4); USFWS ID 24A-89 (PRRIP ID 2024SP132; sighted 4/8) observed southwest of Alda, Nebraska along the Associated Habitat Reach of the central Platte River during spring 2024. PRRIP aerial imagery from July 2023 is displayed for reference.

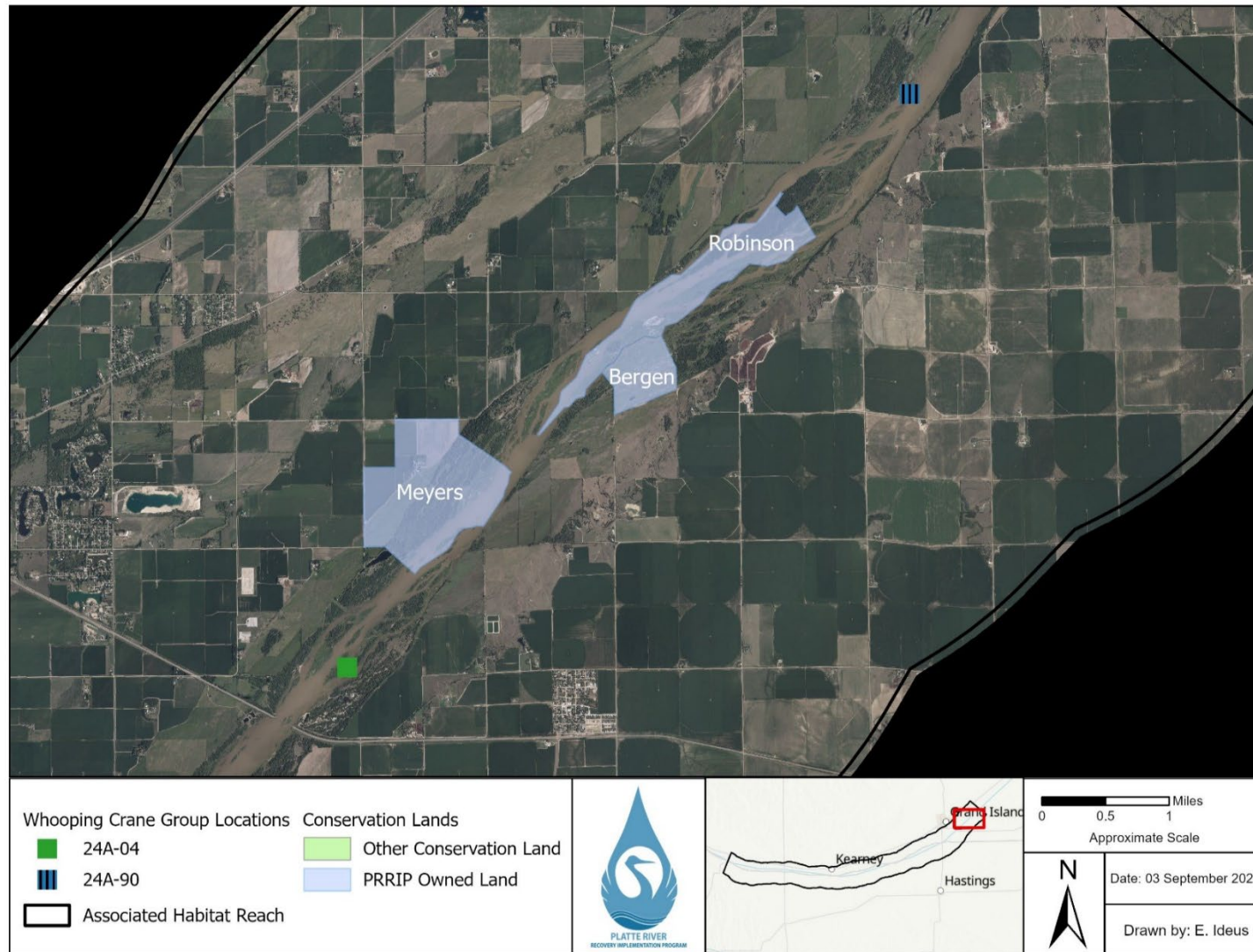


**Figure C11.** Whooping crane groups USFWS ID 24A-02 (See Appendix B Table B.1 for PRRIP IDs; sighted 3/5-3/29); USFWS ID 24A-14 (PRRIP IDs 2024SP31, 2024SP35, 2024SP54; sighted 3/19-3/20, 3/28); USFWS ID 24A-16 (PRRIP IDs 2024SP27, 2024SP34, 2024SP38; sighted 3/17-3/21); USFWS ID 24A-29 (PRRIP IDs 2024SP43, 2024SP56; sighted 3/27-3/28); USFWS ID 24A-49 (PRRIP ID 2024SP59, sighted 3/28); USFWS ID 24A-50 (PRRIP ID 2024SP55, sighted 3/28); USFWS ID 24A-51 (See Appendix B Table B.26 for PRRIP IDs; sighted 3/28-4/4) observed southeast of Alda, Nebraska along the Associated Habitat Reach of the central Platte River during Spring 2024. PRRIP aerial imagery from July 2023 is displayed for reference.





**Figure C12.** Whooping crane group USFWS ID 24A-14 (PRRIP IDs 2024SP31, 2024SP35, 2024SP54, sighted 3/19-3/20, 3/28) observed east of Doniphan, Nebraska along the Associated Habitat Reach of the central Platte River during Spring 2024. PRRIP aerial imagery from July 2023 is displayed for reference.



**Figure C13.** Whooping crane groups USFWS ID 24A-04 (PRRIP ID 2024SP18; sighted 3/6); USFWS ID 24A-90 (PRRIP ID 2024SP131; sighted 4/8) observed east of Grand Island, Nebraska along the Associated Habitat Reach of the central Platte River during spring 2024. PRRIP aerial imagery from July 2023 is displayed for reference.





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2 **Figure C14.** Photograph of whooping crane group PRRIP ID 2024SP02 (USFWS ID 24A-02) on 3/5/2024. The whooping crane group was observed  
3 during systematic aerial surveys.



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2 **Figure C15.** Photograph of whooping crane group PRRIP ID 2024SP01 (USFWS ID 24A-03) on 3/5/2024. The whooping crane group was observed  
3 during systematic aerial surveys.





1  
2 **Figure C16.** Photograph of whooping crane group PRRIP ID 2024SP18 (USFWS ID 24A-04) on 3/6/2024. The whooping crane group was observed  
3 during systematic aerial surveys.



1  
2 **Figure C17.** Photograph of whooping crane group PRRIP ID 2024SP17 (USFWS ID 24A-05) on 3/13/2024. The whooping crane group was  
3 observed during systematic aerial surveys.





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2 **Figure C18.** Photograph of whooping crane group PRRIP ID 2024SP26 (USFWS ID 24A-13) on 3/16/2024. The whooping crane group was  
3 observed during opportunistic ground surveys.





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2 **Figure C19.** Photograph of whooping crane group PRRIP ID 2024SP31 (USFWS ID 24A-14) on 3/19/2024. The whooping crane group was  
3 observed during systematic aerial surveys.



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2 **Figure C20.** Photograph of whooping crane group PRRIP ID 2024SP24 (USFWS ID 24A-15) on 3/16/2024. The whooping crane group was  
3 observed during systematic aerial surveys.





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2 **Figure C21.** Photograph of whooping crane group PRRIP ID 2024SP27 (USFWS ID 24A-16) on 3/17/2024. The whooping crane group was  
3 observed during systematic aerial surveys.



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2 **Figure C22.** Photograph of whooping crane group PRRIP ID 2024SP83 (USFWS ID 24A-20a) on 3/31/2024. The whooping crane group was  
3 observed during systematic aerial surveys.





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2 **Figure C23.** Photograph of whooping crane group PRRIP ID 2024SP68 (USFWS ID 24A-20b,c) on 3/29/2024. The whooping crane group was  
3 observed during systematic aerial surveys.





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2 **Figure C24.** Photograph of whooping crane group PRRIP ID 2024SP99 (USFWS ID 24A-28) on 4/3/2024. The whooping crane group was  
3 observed during systematic aerial surveys.



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2 **Figure C25.** Photograph of whooping crane group PRRIP ID 2024SP56 (USFWS ID 24A-29) on 3/28/2024. The whooping crane group was  
3 observed during systematic aerial surveys.





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2 **Figure C26.** Photograph of whooping crane group PRRIP ID 2024SP45 (USFWS ID 24A-32a) on 3/28/2024. The whooping crane group was  
3 observed during systematic aerial surveys.



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2 **Figure C27.** Photograph of whooping crane group PRRIP ID 2024SP46 (USFWS ID 24A-32b) on 3/28/2024. The whooping crane group was  
3 observed during systematic aerial surveys.





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2 **Figure C28.** Photograph of whooping crane group PRRIP ID 2024SP104 (USFWS ID 24A-39) on 3/31/2024. The whooping crane group was  
3 observed during systematic aerial surveys.



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2 **Figure C29.** Photograph of whooping crane group PRRIP ID 2024SP44 (USFWS ID 24A-40) on 3/28/2024. The whooping crane group was  
3 observed during systematic aerial surveys.





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2 **Figure C30.** Photograph of whooping crane group PRRIP ID 2024SP61 (USFWS ID 24A-41) on 3/29/2024. The whooping crane group was  
3 observed during systematic aerial surveys.



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2 **Figure C31.** Photograph of whooping crane group PRRIP ID 2024SP48 (USFWS ID 24A-42) on 3/28/2024. The whooping crane group was  
3 observed during systematic aerial surveys.





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2 **Figure C32.** Photograph of whooping crane group PRRIP ID 2024SP49 (USFWS ID 24A-43) on 3/28/2024. The whooping crane group was  
3 observed during systematic aerial surveys.



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2 **Figure C33.** Photograph of whooping crane group PRRIP ID 2024SP50 (USFWS ID 24A-44) on 3/28/2024. The whooping crane group was  
3 observed during systematic aerial surveys.





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2 **Figure C34.** Photograph of whooping crane group PRRIP ID 2024SP51 (USFWS ID 24A-45) on 3/28/2024. The whooping crane group was  
3 observed during systematic aerial surveys.



**Figure C35.** Photograph of whooping crane group PRRIP ID 2024SP52 (USFWS ID 24A-46) on 3/28/2024. The whooping crane group was observed during systematic aerial surveys.



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2 **Figure C36.** Photograph of whooping crane group PRRIP ID 2024SP53 (USFWS ID 24A-48) on 3/28/2024. The whooping crane group was  
3 observed during systematic aerial surveys.





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2 **Figure C37.** Photograph of whooping crane group PRRIP ID 2024SP55 (USFWS ID 24A-50) on 3/28/2024. The whooping crane group was  
3 observed during systematic aerial surveys.



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2 **Figure C38.** Photograph of whooping crane group PRRIP ID 2024SP60 (USFWS ID 24A-51) on 3/28/2024. The whooping crane group was  
3 observed during systematic aerial surveys.





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2 **Figure C39.** Photograph of whooping crane groups PRRIP ID 2024SP69 (USFWS ID 24A-52), PRRIP ID 2024SP70 (USFWS ID 24A-53), PRRIP  
3 ID 2024SP71 (USFWS ID 24A-46), and PRRIP ID 2024SP72 (USFWS ID 24A-46) on 3/29/2024. These whooping crane groups were observed  
4 during systematic aerial surveys.





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2 **Figure C40.** Photograph of whooping crane group PRRIP ID 2024SP79 (USFWS ID 24A-54) on 3/30/2024. The whooping crane group was  
3 observed during opportunistic ground surveys.





1  
2 **Figure C41.** Photograph of whooping crane group PRRIP ID 2024SP90 (USFWS ID 24A-57) on 3/31/2024. The whooping crane group was  
3 observed during systematic aerial surveys.



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2 **Figure C42.** Photograph of whooping crane group PRRIP ID 2024SP89 (USFWS ID 24A-78) on 3/31/2024. The whooping crane group was  
3 observed during systematic aerial surveys.





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2 **Figure C43.** Photograph of whooping crane group PRRIP ID 2024SP97 (USFWS ID 24A-79) on 4/3/2024. The whooping crane group was  
3 observed during systematic aerial surveys.



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2 **Figure C44.** Photograph of whooping crane group PRRIP ID 2024SP101 (USFWS ID 24A-80) on 4/3/2024. The whooping crane group was  
3 observed during systematic aerial surveys.





1  
2 **Figure C45.** Photograph of whooping crane group PRRIP ID 2024SP102 (USFWS ID 24A-81) on 4/3/2024. The whooping crane group was  
3 observed during systematic aerial surveys.



1  
2 **Figure C46.** Photograph of whooping crane group PRRIP ID 2024SP110 (USFWS ID 24A-83) on 4/4/2024. The whooping crane group was  
3 observed during opportunistic aerial surveys.





1  
2 **Figure C47.** Photograph of whooping crane group PRRIP ID 2024SP111 (USFWS ID 24A-84) on 4/4/2024. The whooping crane group was  
3 observed during opportunistic aerial surveys.





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2 **Figure C48.** Photograph of whooping crane group PRRIP ID 2024SP112 (USFWS ID 24A-85) on 4/4/2024. The whooping crane group was  
3 observed during systematic aerial surveys.





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2 **Figure C49.** Photograph of whooping crane group PRRIP ID 2024SP115 (USFWS ID 24A-86) on 4/4/2024. The whooping crane group was  
3 observed during systematic aerial surveys.



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2 **Figure C50.** Photograph of whooping crane group PRRIP ID 2024SP118 (USFWS ID 24A-87) on 4/5/2024. The whooping crane group was  
3 observed during systematic aerial surveys.





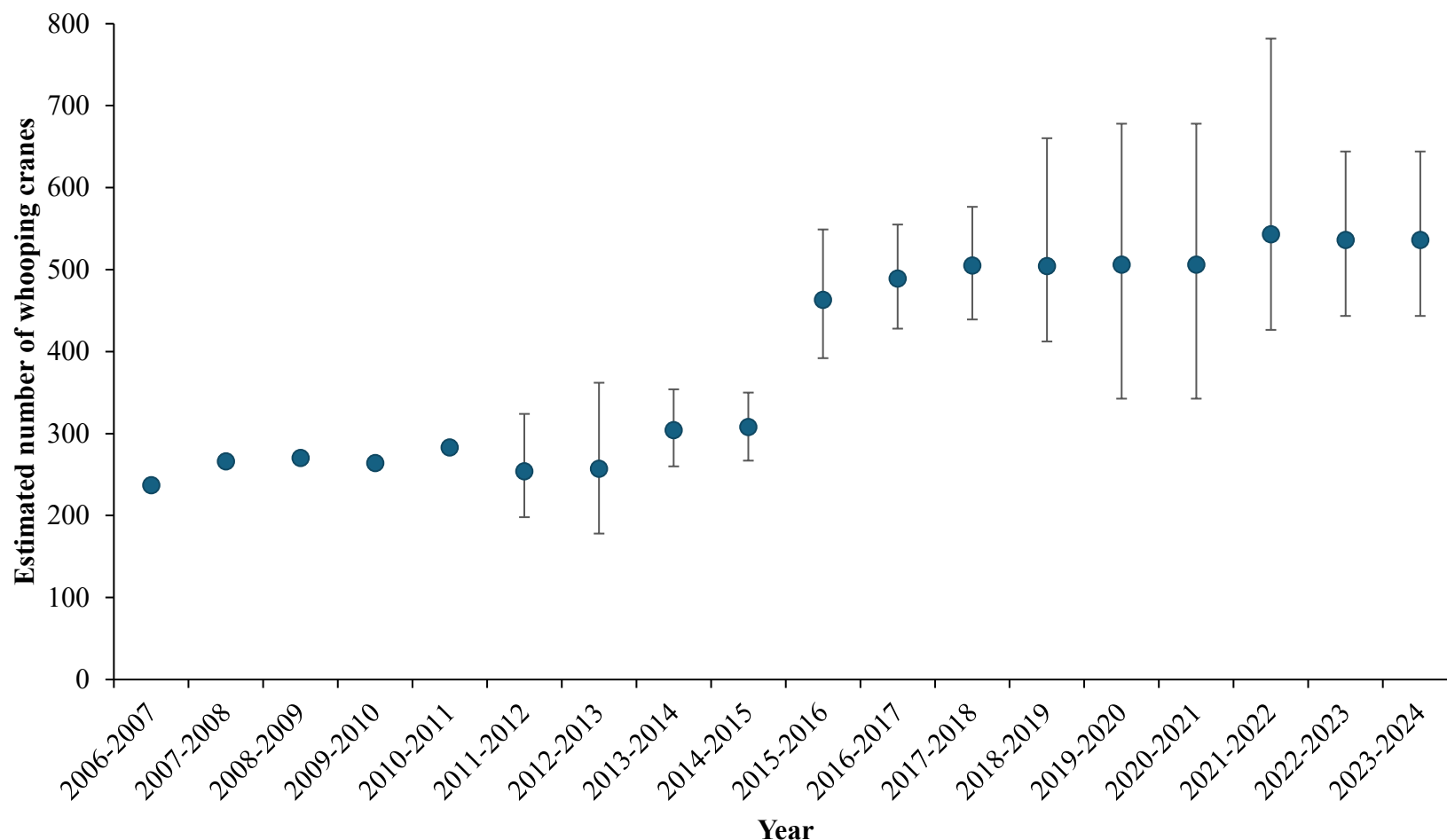
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2 **Figure C51.** Photograph of whooping crane group PRRIP ID 2024SP132 (USFWS ID 24A-89) on 4/8/2024. The whooping crane group was  
3 observed during systematic aerial surveys.



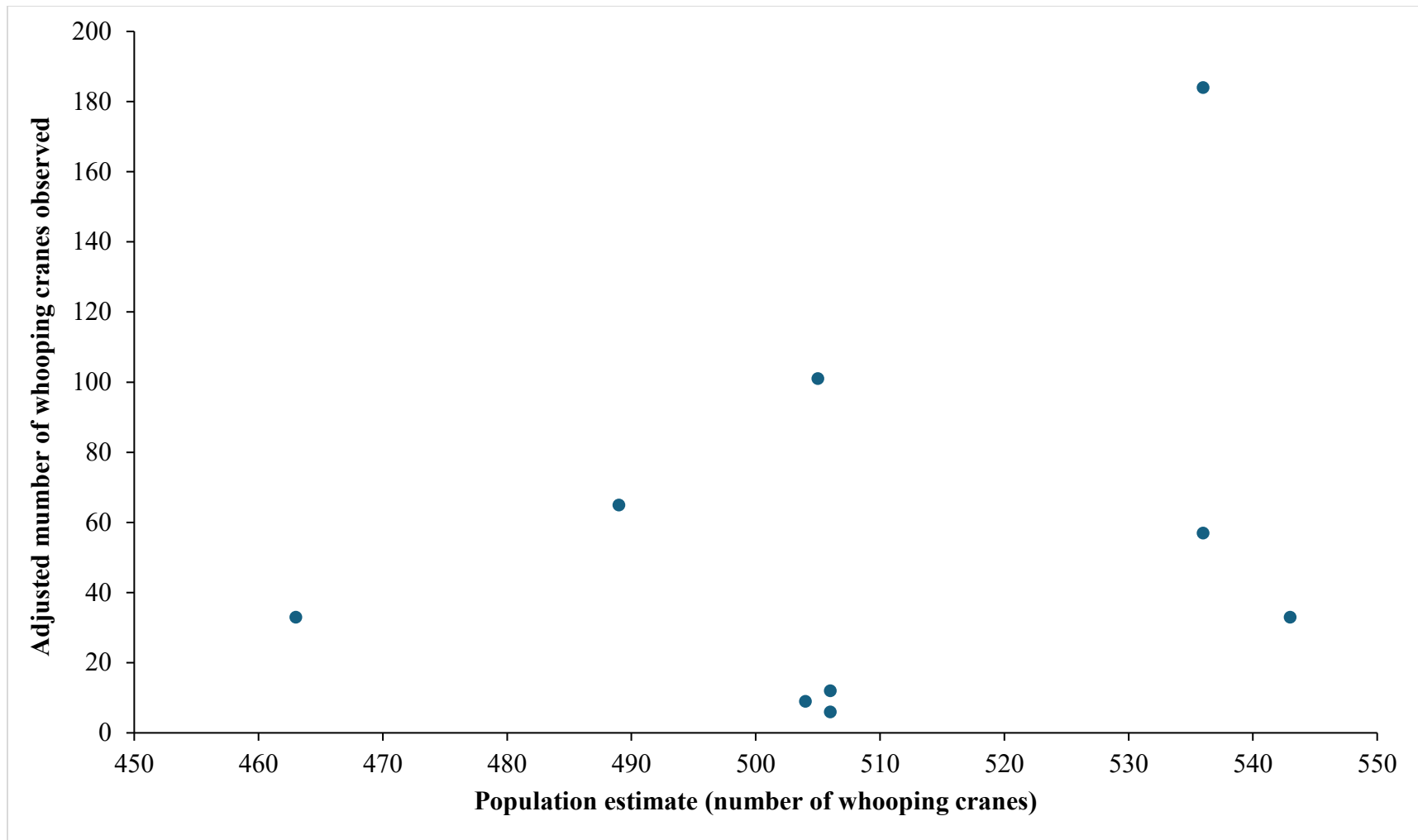
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2 **Figure C52.** Photograph of whooping crane group PRRIP ID 2024SP131 (USFWS ID 24A-90) on 4/8/2024. The whooping crane group was  
3 observed during systematic aerial surveys.



## Appendix D. Aransas-Wood Buffalo Population Estimates



**Figure D1.** Estimated size of the migratory Aransas-Wood Buffalo whooping crane population based on surveys on the winter range on the Texas Gulf Coast of Mexico during 2007–2023 (USFWS 2023). 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 number of individual whooping cranes enumerated during PRRIP spring surveys from 2016-2024 on the Associated Habitat Reach of the central Platte River between the 5th and 95th percentiles of dates of spring whooping crane group observations in Nebraska (see text for details) and the estimated size of the Aransas-Wood Buffalo population based on surveys on the winter range during 2016–2023. 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.

## Appendix E. Past Research Synthesis

Published	Study Topic	Document Title	Summary	Principal Findings	Citation
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. <a href="https://doi.org/10.3354/esr01315">https://doi.org/10.3354/esr01315</a>
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. <a href="https://prism.ucalgary.ca/server/api/core/bitstreams/a6ede97c-0988-42a6-b800-0f3cc813f7a8/content">https://prism.ucalgary.ca/server/api/core/bitstreams/a6ede97c-0988-42a6-b800-0f3cc813f7a8/content</a>
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, Pearse AT, Metzger KL. 2024. Management implications of habitat selection by whooping cranes ( <i>Grus americana</i> ) on the Texas coast. <i>Ecosphere</i> 15:e4820. <a href="https://doi.org/10.1002/ecs2.4820">https://doi.org/10.1002/ecs2.4820</a>



Published	Study Topic	Document Title	Summary	Principal Findings	Citation
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. <i>Conservation Science and Practice</i> 6(5), e13120. <a href="https://doi.org/10.1111/csp2.13120">https://doi.org/10.1111/csp2.13120</a>
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	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. <a href="https://doi.org/10.1675/063.046.0418">https://doi.org/10.1675/063.046.0418</a>  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. <a href="https://doi.org/10.1675/063.045.0413">https://doi.org/10.1675/063.045.0413</a>

Published	Study Topic	Document Title	Summary	Principal Findings	Citation
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.	Mendgen P, Converse SJ, Pearse AT, Teitelbaum CS, Mueller T. 2023. Differential shortstopping behaviour in whooping cranes: habitat or social learning? Global Ecology and Conservation 41:e02365. <a href="https://doi.org/10.1016/j.gecco.2022.e02365">https://doi.org/10.1016/j.gecco.2022.e02365</a>
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. <a href="https://digitalcommons.unl.edu/natrespapers/1655?utm_source=digitalcommons.unl.edu%2Fnatrespapers%2F1655&amp;utm_medium=PDF&amp;utm_campaign=PDFCoverPages">https://digitalcommons.unl.edu/natrespapers/1655?utm_source=digitalcommons.unl.edu%2Fnatrespapers%2F1655&amp;utm_medium=PDF&amp;utm_campaign=PDFCoverPages</a>

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. <a href="https://cranetrust.org/file_download/684f620c-2142-429a-a0e2-d70a04f376c9">https://cranetrust.org/file_download/684f620c-2142-429a-a0e2-d70a04f376c9</a>
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. <a href="https://doi.org/10.1016/j.jnc.2023.126442">https://doi.org/10.1016/j.jnc.2023.126442</a>



Published	Study Topic	Document Title	Summary	Principal Findings	Citation
2022	Habitat use	Whooping crane ( <i>Grus americana</i> ) use patterns in relation to an ecotop classification in the central Platte River Valley, Nebraska, USA	Evaluation of ecotop-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 ecotop data layer. USFWS public sighting WC use locations were characterized utilizing this ecotop 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 ecotop composition, flooding frequency, and wetland status on the probability of whooping crane use. Ecotopes 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 ecotop classification in the Central Platte River Valley, Nebraska, USA. <a href="https://ace-eco.org/vol17/iss2/art35/">https://ace-eco.org/vol17/iss2/art35/</a>
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. <a href="https://doi.org/10.5751/ACE-02217-170209">https://doi.org/10.5751/ACE-02217-170209</a>

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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. <a href="https://doi.org/10.1002/wsb.1290">https://doi.org/10.1002/wsb.1290</a>
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 <sup>2</sup> . 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 <sup>th</sup> winter, but the limited data available beyond the 4 <sup>th</sup> winter suggested that older individuals may return to within 2 km of their juvenile home range.	Butler MJ, Stewart DR, Harris GM, Bidwell MT, Pearse AT. 2022. Space use and site fidelity of wintering whooping cranes on the Texas Gulf Coast. Journal of Wildlife Management 86(5): e22226. <a href="https://doi.org/10.1002/jwmg.22226">https://doi.org/10.1002/jwmg.22226</a>

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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. <a href="https://digitalcommons.unl.edu/cgi/viewcontent.cgi?article=1387&amp;context=nacwgproc">https://digitalcommons.unl.edu/cgi/viewcontent.cgi?article=1387&amp;context=nacwgproc</a>
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. <a href="https://doi.org/10.3389/fevo.2022.931260">https://doi.org/10.3389/fevo.2022.931260</a>



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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. <a href="https://doi.org/10.1111/csp2.12696">https://doi.org/10.1111/csp2.12696</a>
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. <a href="https://doi.org/10.1002/ece3.8719">https://doi.org/10.1002/ece3.8719</a>
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. <a href="https://apps.dtic.mil/sti/pdfs/AD1176388.pdf">https://apps.dtic.mil/sti/pdfs/AD1176388.pdf</a>

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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. <a href="https://doi.org/10.1016/j.gecco.2022.e02365">https://doi.org/10.1016/j.gecco.2022.e02365</a>
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. <a href="https://cranetrust.org/who-we-are/what-we-do/conservation/research/publications.html">https://cranetrust.org/who-we-are/what-we-do/conservation/research/publications.html</a>
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. <a href="https://digitalcommons.unl.edu/natr espapers/1460/">https://digitalcommons.unl.edu/natr espapers/1460/</a>

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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. <a href="https://doi.org.10.1002/eap.2324">https://doi.org.10.1002/eap.2324</a>
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. <a href="https://platteriverprogram.org/system/files/2021-10/03-Palustrine%20Wetland%20Memo0.pdf">https://platteriverprogram.org/system/files/2021-10/03-Palustrine%20Wetland%20Memo0.pdf</a>
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 $\geq 10$ 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. <a href="https://doi.org/10.1016/j.heliyon.2020.e03549">https://doi.org/10.1016/j.heliyon.2020.e03549</a>



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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 <math>\geq 0.12</math> 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 <math>\geq 275</math> 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. <a href="https://doi.org/10.1101/2020.12.30.424870">https://doi.org/10.1101/2020.12.30.424870</a></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 <math>&gt;15</math> km from development, and <math>&lt; 2</math> 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. <a href="https://doi.org/10.1016/j.jnc.2020.125892">https://doi.org/10.1016/j.jnc.2020.125892</a></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. <a href="http://hdl.handle.net/11603/18389">http://hdl.handle.net/11603/18389</a></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. <a href="https://doi.org/10.5066/P9Y8KZJ9">https://doi.org/10.5066/P9Y8KZJ9</a>
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. <a href="https://academic.oup.com/condor/article/122/1/duz056/5700702">https://academic.oup.com/condor/article/122/1/duz056/5700702</a>
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. <a href="https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0209612">https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0209612</a>

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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. <a href="https://doi.org/10.5751/ACE-01317-140106">https://doi.org/10.5751/ACE-01317-140106</a>
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). <a href="https://scholarsarchive.byu.edu/mwnan/vol11/iss1/2/?utm_source=scholarsarchive.byu.edu%2Fmwnan%2Fvol11%2Fiss1%2F2F2&amp;utm_medium=PDF&amp;utm_campaign=PDFCoverPages">https://scholarsarchive.byu.edu/mwnan/vol11/iss1/2/?utm_source=scholarsarchive.byu.edu%2Fmwnan%2Fvol11%2Fiss1%2F2F2&amp;utm_medium=PDF&amp;utm_campaign=PDFCoverPages</a>



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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. <a href="https://doi.org/10.1016/j.heliyon.2018.e00851">https://doi.org/10.1016/j.heliyon.2018.e00851</a>
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. <a href="https://doi.org/10.1650/CONDOR-17-80.1">https://doi.org/10.1650/CONDOR-17-80.1</a>

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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. <a href="https://platteriverprogram.org/sites/default/files/PubsAndData/ProgramLibrary/Correlates%20of%20Whooping%20Crane%20Habitat%20Selection%20and%20Trends%20in%20Use%20in%20the%20Central%20Platte%20River.pdf">https://platteriverprogram.org/sites/default/files/PubsAndData/ProgramLibrary/Correlates%20of%20Whooping%20Crane%20Habitat%20Selection%20and%20Trends%20in%20Use%20in%20the%20Central%20Platte%20River.pdf</a>
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., <a href="https://pubs.usgs.gov/of/2016/1209/ofr20161209.pdf">https://pubs.usgs.gov/of/2016/1209/ofr20161209.pdf</a>

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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. <a href="https://platteriverprogram.org/sites/default/files/PubsAndData/ProgramLibrary/PRRIP%20Whooping%20Crane%20Habitat%20Synthesis%20Chapters.pdf">https://platteriverprogram.org/sites/default/files/PubsAndData/ProgramLibrary/PRRIP%20Whooping%20Crane%20Habitat%20Synthesis%20Chapters.pdf</a>
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., <a href="https://pubs.er.usgs.gov/publication/ofr20151166">https://pubs.er.usgs.gov/publication/ofr20151166</a>



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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. <a href="https://besjournals.onlinelibrary.wiley.com/doi/epdf/10.1111/2041-210X.12144">https://besjournals.onlinelibrary.wiley.com/doi/epdf/10.1111/2041-210X.12144</a>
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. <a href="https://www.sciencedirect.com/science/article/pii/S0006320713000980">https://www.sciencedirect.com/science/article/pii/S0006320713000980</a>

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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. <a href="https://onlinelibrary.wiley.com/doi/epdf/10.1002/ece3.887">https://onlinelibrary.wiley.com/doi/epdf/10.1002/ece3.887</a>
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. <a href="https://ecos.fws.gov/ServCat/Collection/Profile/1206">https://ecos.fws.gov/ServCat/Collection/Profile/1206</a>

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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. <a href="https://platteriverprogram.org/system/files/Internal%20Pubs%20WEST%20Inc.%202008%20WC%20Migrational%20Habitat%20Use%20%282001-2006%29.pdf">https://platteriverprogram.org/system/files/Internal%20Pubs%20WEST%20Inc.%202008%20WC%20Migrational%20Habitat%20Use%20%282001-2006%29.pdf</a>
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. <a href="https://platteriverprogram.org/program-library?field_document_category_ref_target_id=11&amp;field_document_focus_area_ref_target_id=17&amp;field_document_type_ref_target_id=All&amp;field_document_species_ref_target_id=24&amp;title=Monitoring+Report&amp;items_per_page=20">https://platteriverprogram.org/program-library?field_document_category_ref_target_id=11&amp;field_document_focus_area_ref_target_id=17&amp;field_document_type_ref_target_id=All&amp;field_document_species_ref_target_id=24&amp;title=Monitoring+Report&amp;items_per_page=20</a>

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