

# Platte River Recovery Implementation Program

## Piping Plover and Interior Least Tern Monitoring and Research on the Central Platte River, Nebraska, in 2025 FINAL REPORT



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Technical Advisory Committee  
Governance Committee

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**PREFACE**

This report summarizes the Platte River Recovery Implementation Program's (Program or PRRIP) monitoring and research efforts for piping plovers and interior least terns during 2025. We prepared this report to inform Program partners, licensing agencies, and the public of our activities and to provide a summary of results to fulfill the requirements of the Program's state (Nebraska Master Permit #1421) and federal (TE183430-3.3) monitoring permits.

Annual monitoring reports produced by West Incorporated (2001-2007) and Program EDO staff (2008-2025) include previous data and analyses and are available on the Program's online Public Library (<https://platteriverprogram.org/program-library>). PRRIP's published data are also available for use by other programs to provide information on plover and tern productivity on the central Platte River that may be helpful for broader scale interpretation of species productivity and management decisions.

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Abbreviation	Definition
ac	Acres
AHR	Associated Habitat Reach
AMP	Adaptive Management Plan
BPE	Breeding Pair Estimate
cfs	Cubic feet per second
CI	Confidence interval
CNPPID	Central Nebraska Public Power and Irrigation District
CPNRD	Central Platte Natural Resources District
Cooperative Agreement	Cooperative Agreement for Platte River Research and Other Efforts Relating to Endangered Species Habitats
DSR	Daily survival rate
EA	Environmental Account
EDO	Executive Director's Office
ESA	Endangered Species Act
ft	Feet or foot
GC	Governance Committee
Hwy	Highway
ISAC	Independent Scientific Advisory Committee
J-2	Johnson Hydropower Return
LCL	Lower confidence limit
MCA	Moving complex approach
mi	Mile or miles
NAI	Non-Access Islands (Kearney Broadfoot South)
NPPD	Nebraska Public Power District
OCSW	Off-channel sand and water
PRRIP or Program	Platte River Recovery Implementation Program
sec	Second
spp.	Species
TAC	Technical Advisory Committee
UCL	Upper confidence limit
UNK	Unknown
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey

## EXECUTIVE SUMMARY

Improving productivity of piping plovers (*Charadrius melodus*; hereafter piping plovers or plovers) and interior least terns (*Sternula antillarum*; hereafter least terns or terns) on the central Platte River is a primary management objective of the Platte River Recovery Implementation Program (“Program” or “PRRIP”). Long-term monitoring of plovers and terns by the Program has been key to understanding the status of both species along the central Platte River. During 2025, the Executive Director’s Office (EDO) and Program partners surveyed the river and 18 adjacent off-channel sand and water (OCSW) sites for plovers and terns along PRRIP’s Associated Habitat Reach (AHR) on the central Platte River between Lexington and Chapman, Nebraska. Biologists conducted surveys once per month on the river and twice per month on the OCSW sites to count the number of adults and nests. Once at least one nest was found, biologists monitored the site twice per week to determine nest fate and, if the nest was successful, count number of chicks, monitor chick fates, and quantify number of fledglings. In addition to these monitoring efforts, the EDO implemented additional remote camera monitoring, predator track surveys, and predator management actions at six Program-managed OCSW sites for the fifth consecutive year to better understand the role of predation on plover productivity and the efficacy of predator deterrents on nest and chick predation. Below, we summarize results from our 2025 plover and tern monitoring, and predator management and monitoring efforts.

### Plover Monitoring

Plovers nested at 11 of 18 OCSW sites that provided a total of 253.63 ac of potential nesting habitat during 2025. A significant, positive relationship has been observed between the estimated number of plover breeding pairs and area of potential nesting habitat at OCSW sites since 2001. An estimated peak of 41 plover breeding pairs (BPE) was observed at our monitored sites across the AHR during 2025. Thirty-seven of 73 plover nests were successful, resulting in the second lowest apparent nest success (0.51) observed during the contemporary 2010-2025 monitoring period. Plover nests produced 111 chicks (<15 days old) and 60 fledglings ( $\geq 28$  days old). The fledge ratio (1.46 28D chicks/BPE) was the highest observed since 2014.

A high amount of variability was observed in plover reproductive effort and success among sites. Blue Hole, Leaman, Dyer, and Follmer were the most productive OCSW nesting sites for plovers in 2025 with fledge ratios  $> 1.00$  28D chicks/BPE. Cottonwood Ranch, Newark West, and Trust Wildrose East all had fledge ratios of 1.00 28D chicks/BPE. The other four OCSW sites at which plover nesting was observed had between two and seven successful nests. Fledge ratios at these four sites ranged between 0.00 28D chicks/BPE and 0.88 28D chicks/BPE (site-specific peak date used to estimate BPE).

Nest fates were successfully assigned to 59 of the 73 plover nests observed during 2025. Nineteen nests failed due to predation (0.26 of total nests), two failed due to abandonment (0.03), and one failed due to weather (0.01). Seven nests failed due to unknown causes (0.10) and seven nests had an unknown outcome (0.10). Of the 37 nests that were successful, 25 fledged (0.34 of total nests) and two failed due to predation (0.03). Nine broods failed due to unknown causes (0.12) and one brood had an unknown outcome (0.01). Since initiating remote camera monitoring in 2020, the

proportion of nests and broods that failed due to unknown causes has decreased from a maximum of 0.50 in 2019. This year, the proportion of nests and broods that failed due to unknown causes was 0.22.

The overall daily survival rate (DSR) of plover nests across all monitored OCSW sites was 0.980 (LCL: 0.965, UCL: 0.990) during 2025. Newark West had the lowest nest DSR (0.940) of the 11 OCSW sites with plover nesting. Because Newark West has experienced nest loss to predation above the USFWS allowable incidental take in two of the last five years, work is being done off-season at the nesting site to extend the water and fence barriers to make entry onto the nesting site by terrestrial predators more difficult.

Results from our 2025 plover monitoring efforts indicate continued increases in plover use and nest productivity metrics on monitored sites across the central Platte River from recent lows observed during 2018 and 2019. The second highest number of nests (73 nests) were observed this year, likely due to renesting after losses to predation, resulting in low apparent nest success (0.51). However, 60 fledglings, the second highest number of fledglings, were produced this year resulting in the highest fledge ratio since 2014 (1.46 28D fledglings/BPE).

### **Tern Monitoring**

Terns nested at 12 of 18 OCSW sites during 2025, and there has been a positive relationship between the estimated number of tern breeding pairs and area of potential nesting habitat at OCSW sites since 2001. An estimated peak of 167 tern breeding pairs was observed at our monitored sites, the highest number of estimated breeding pairs on our sites to date. Of 236 tern nests, 125 were successful for an apparent nest success of 0.53. Tern nests produced 255 chicks (<15 days old) and 167 fledglings ( $\geq 21$  days old). A fledge ratio of 1.00 21D chicks/BPE was observed.

A high amount of variability was observed in tern reproductive effort and success among sites. Blue Hole, Hooker Brothers Southeast, Dyer, Newark East, and Cottonwood Ranch were the most productive OCSW nesting sites for terns in 2025 with fledge ratios  $\geq 1.00$  21D chicks/BPE. The other seven OCSW sites at which tern nesting was observed had between one and 34 successful nests. Fledge ratios at these seven sites ranged between 0.00 21D chicks/BPE and 0.91 21D chicks/BPE (site-specific peak date used to estimate BPE).

Nest fates were successfully assigned to 158 of the 236 tern nests observed during 2025. Twenty-six nests failed due to predation (0.11 of total nests), six failed due to abandonment (0.03), and one failed due to weather (0.00). Fifty-four nests failed due to unknown causes (0.23) and 24 nests had an unknown outcome (0.10). Of the 125 nests that were successful, 93 fledged (0.39) and two failed due to predation (0.01). Thirty broods failed due to unknown causes (0.13). This year, the proportion of nests and broods that failed due to unknown causes was 0.36, slightly higher than the average proportion from 2017-2019 (0.35). Removal of nest-level cameras on three sites mid-season and documenting 19 tern nests where the adults sat past the hatch date and the eggs in the nest bowl did not hatch (non-viable eggs) contributed to the higher proportion of nests that failed due to unknown causes in 2025.

The overall DSR of tern nests across all monitored OCSW sites was 0.976 (LCL: 0.963, UCL: 0.984) during 2025. Newark West had the lowest nest DSR (0.935) of the 12 OCSW sites with tern nesting, and it was significantly lower than Dyer (reference site).

Results from our 2025 tern monitoring efforts indicate continued increases in tern use on monitored sites across the central Platte River. The BPE and total number of nests were the highest observed. Similar to plovers, terns had a low apparent nest success this year, likely due to renesting. However, the highest number of successful nests were observed (125 successful nests), producing the highest number of fledglings (167 fledglings).

### **Predator Management and Monitoring**

The Program employed basic predator management efforts at six OCSW sites for the predator monitoring study: Dyer, Cottonwood Ranch, Kearney Broadfoot South, Newark West, Newark East, and Leaman. Basic management included trapping and removal of predators; removal of trees within a  $\geq 492$  ft radius of the nesting area; installation of avian spikes on all potential non-removable perches; maintaining a  $\geq 100$  ft water moat surrounding nesting peninsulas; and installation of electrified predator exclusion fences across the entrances to each peninsula. Additional predator management efforts in the form of predator exclusion fencing with electrified wires surrounding nesting peninsulas and predator deterrent lights were employed by the Program at three of the six OCSW sites in the predator monitoring study (Kearney Broadfoot South, Newark West, and Leaman).

EDO biologists conducted a total of 110 shoreline track surveys across the six OCSW sites during 2025 and recorded 276 total unique track registers. Unique track registers per survey ranged from 1.79 at Newark West to 3.11 at Dyer and Kearney Broadfoot South. At sites with basic predator management (Dyer, Cottonwood Ranch, and Newark East), unique track registers per survey ranged from 2.00 to 3.11 and at sites with additional predator management (Kearney Broadfoot South, Newark West, and Leaman), unique track registers per survey ranged from 1.79 to 3.11.

Biologists deployed 29 shoreline cameras for a total of 3,564 camera days across the six sites and recorded 1,057 unique predator registers. Unique registers per camera day ranged from 0.158 at Cottonwood Ranch to 0.596 at Leaman. At sites with basic predator management, unique registers per camera day ranged from 0.158 to 0.308 and at sites with additional predator management, unique registers per camera day ranged from 0.251 to 0.596. Biologists deployed 25 site-level cameras for a total of 3,098 camera days across the six sites and recorded 158 unique predator registers. Unique registers per camera day ranged from 0.014 at Kearney Broadfoot South to 0.083 at Newark East. At sites with basic predator management, unique registers per camera day ranged from 0.043 to 0.083 and at sites with additional predator management, unique registers per camera day ranged from 0.014 to 0.074.

Biologists deployed 39 nest-level cameras to monitor 99 nests (38 plover; 61 tern) for a total of 1,107 camera days across the six sites. Eighty-three unique registers of predator species (e.g., within view of camera but did not predate the nest) and 26 unique predation events were documented on camera monitored nests across all six sites. Two of the 26 unique predation events were documented on nests with nest-level cameras that were assumed predated due to evidence at the nest and the timing of the nest losses, although the cameras on these nests malfunctioned.

Twenty-four of the 26 unique predation events were documented on nest-level cameras. Unique predation events per camera day ranged from 0.004 at Leaman to 0.086 at Dyer. At sites with basic predator management, unique predation events per camera day ranged from 0.005 to 0.086 and at sites with additional predator management, unique predation events per camera day ranged from 0.004 to 0.048. Out of all nests being monitored with cameras, 43 plover and tern nests were predated. Plover nests were predated by great horned owl (*Bubo virginianus*), red-tailed hawk (*Buteo jamaicensis*), striped skunk (*Mephitis mephitis*), and an unknown species. Tern nests were predated by American badger (*Taxidea taxus*), great horned owl, red-tailed hawk, and striped skunk.

Biologists placed nest cameras at 99 of 182 (54%) plover and tern nests at the six OCSW sites in 2025. Thirty-five of the 99 nests with cameras (35%) and 40 of the 83 nests without cameras (48%) were successful. All nests at Cottonwood Ranch had a camera present, so it was excluded from comparison of DSR by camera presence. For both plover and tern nests on the other five sites combined, we found nests with a camera (DSR: 0.956; LCL: 0.936; UCL: 0.972) had a significantly lower DSR than nests without a camera (DSR: 0.972; LCL: 0.959; UCL: 0.982; Figure 43). Biologists deployed cameras at 38 of 52 plover nests at the six OCSW sites and there was no significant difference in daily survival rate at nests with a camera (DSR: 0.963; LCL: 0.949; UCL: 1) and nests without a camera (DSR: 0.978; LCL: 0.962; UCL: 1). Biologists deployed cameras at 61 of 130 tern nests at the six OCSW sites and the daily survival rate was significantly lower for nests with a camera (DSR: 0.948; LCL: 0.929; UCL: 0.967) than nests without a camera (DSR: 0.971; LCL: 0.960; UCL: 0.983). By site, DSRs for nests with and without cameras in 2025 were lower than each site's median DSR during 2010-2016, prior to the use of nesting site cameras.

A combination of predator monitoring techniques was used to help reduce uncertainty of plover and tern nest fates, better understand predator communities at nesting sites, and evaluate the effectiveness of additional predator management efforts during 2025. Predation was the main cause of nest failure this year for both plovers and terns, but predator communities varied by site, which we are better able to understand because of the additional predator monitoring efforts. Mid-season this year, remote cameras at individual nests were removed on sites where we observed behavior of great horned owls interacting with nest-level cameras prior to predated the nest. The sites where nest-level cameras were removed included Newark East (removed 10 June), Dyer (removed June 11), and Newark West (removed 21 July). Nest-level cameras on sites where predators were not observed interacting with cameras (Cottonwood Ranch, Kearney Broadfoot South, and Leaman) remained. Site and shoreline cameras not associated with nests remained on all six sites to help document predator presence. The information from these efforts was used at each site to adjust trapping techniques specific to each site's predators and reinforce probable predator entry points.

In this report, we summarize results from the Program's management and monitoring efforts for plovers and terns during 2025 on the central Platte River and at OCSW nesting sites adjacent to the river. We also detail findings from our predator management, monitoring, and research efforts at six OCSW sites during 2025. Overall, the Program is using long-term plover and tern monitoring data and research on predator impacts on nest and brood success to evaluate progress toward management objectives and support adaptive management decision-making related to plovers and terns.

## INTRODUCTION

The northern Great Plains population of piping plover (*Charadrius melodus*; hereafter piping plover or plover) was listed as threatened on 10 January 1986 (50 Federal Register 50726) by the United States Fish and Wildlife Service (USFWS) under the Endangered Species Act (ESA). The northern Great Plains piping plover remains listed as threatened due to concerns over the species' viability given impacts of predation and habitat loss on survival and productivity ([USFWS 2020](#)). The interior least tern (*Sternula antillarum*; hereafter least tern or tern) was listed as endangered under the ESA on 27 June 1985 (50 Federal Register 21784). The USFWS removed the tern from ESA protective status on 12 February 2021 (86 Federal Register 2564); however, the tern remains protected under the Migratory Bird Treaty Act and the Nebraska Non-Game and Endangered Species Conservation Act (Nebraska Rev. Statute §37-801-811).

The Platte River provides key habitat for plovers and terns with both species nesting on manufactured sand and gravel pits adjacent to the active river channel and on unvegetated sandbars in the river channel ([Sidle and Kirsch 1993](#), [Kirsch 1996](#), [Farnsworth et al. 2017](#), [Farrell et al. 2018](#), [Jorgensen et al. 2021](#)). The Platte River Recovery Implementation Program (PRRIP or Program) is responsible for implementing certain aspects of plover and tern recovery plans along the central Platte River ([PRRIP 2021b](#)) and manages land and water to attain specific management objectives. The management objective for plovers and terns as defined in the Program's First Increment Adaptive Management Plan (AMP; [PRRIP 2021b](#)) is to improve their productivity along the central Platte River through: (1) increasing the number of fledged chicks; and (2) reducing adult mortality. Increasing the number of fledged chicks may be done through increasing the number of breeding pairs and/or increasing fledge ratios, the latter of which is related to nest loss and chick mortality due to predation, weather, and flooding. Reducing adult mortality may primarily be accomplished by reducing predation, although severe weather may affect adult survival. The Program uses the number of nesting pairs and number of chicks fledged per nest or breeding pair (i.e., fledge ratio) as indicators for monitoring the status of plovers and terns. Though not required for ESA compliance, in 2021 the Program's Governance Committee (GC) directed EDO staff to continue monitoring terns following the same protocol as it did prior to federal delisting ([PRRIP 2021a](#)).

The Program's monitoring efforts for plovers and terns ([PRRIP 2025b](#)) include: (1) observing use and nest productivity on riverine in-channel sandbars and created or rehabilitated off-channel sand and water (OCSW) nesting sites along the central Platte River between Lexington and Chapman, Nebraska; (2) identifying and documenting factors that influence nest site selection and nest and brood success; and (3) monitoring potential predators to gather information on the predator community present on and around nesting sites. The Program's First Increment Extension Science Plan, written in 2022, identified two Extension Big Questions related specifically to plover productivity and the role of predation ([PRRIP 2022a](#)). The first, "how much of an effect does predation have on plover productivity," is being addressed using data on nest and brood predation to quantify the impact of predation by identifying predator species, and by determining whether losses are incurred during incubation or brood rearing ([PRRIP 2022a](#)). The second, "how effective is Program management at mitigating losses of plover productivity due to predation," is being

addressed through data collection on the efficacy of trapping, fencing, and/or predator deterrent lighting at reducing nest and brood failure due to predation ([PRRIP 2022a](#)).

In this report, we summarize results from the Program's management and monitoring efforts for plovers and terns during 2025 on the central Platte River and at OCSW nesting sites adjacent to the river. We also detail findings from our predator management, monitoring, and research efforts at six OCSW sites during 2025. The monitoring conducted during 2025 was a collaborative effort between Program EDO staff and the Nebraska Public Power District (NPPD). Overall, long-term plover and tern monitoring data and research on predator impacts on plovers are being used to evaluate progress toward management objectives and to support adaptive management decision-making related to plovers and terns.

## **STUDY AREA**

Our study area encompassed the Program's Associated Habitat Reach (AHR) segment of the central Platte River between Lexington and Chapman, Nebraska (~90 river mi, Figure 1), and OCSW sites within 3.5 mi of the river in this reach (Figure 2). River or on-channel habitat includes naturally formed or constructed midstream sandbars used for nesting and the open river channel used for foraging. The number of low-elevation sandbars present within the PRRIP AHR of the central Platte River has been variable and dependent on seasonal and daily fluctuations in river flow. The size and distribution of non-vegetated, high-elevation sandbars characteristic of plover and tern nesting sites within the region has been dependent upon construction and vegetation management efforts.

OCSW habitat includes spoil piles of sparsely- or non-vegetated sand at sand and gravel mines and constructed nesting sites. Migratory plovers typically arrive in early May and nest on OCSW habitat or constructed on-channel islands. Adults forage on low elevation river sandbars or along the waterline of OCSW habitat, though they are more reliant on OCSW shorelines while nesting ([Sherfy et al. 2012](#)). Chicks forage along OCSW waterlines until fledging when they are often observed foraging on the river channel. Migratory terns typically arrive later in May and nest on OCSW habitat or constructed on-channel islands. Terns forage at both the sand and water site and on the river channel, though they rely more on the river channel for foraging ([Sherfy et al. 2012](#)). Fledged terns at OCSW habitat along the AHR are observed beginning to learn to forage in the water surrounding the nesting area and then are later often observed on the river channel.

## **2025 RIVER CONDITIONS**

Mean daily river discharge at the Kearney gage (USGS gage 06770200, [USGS 2025b](#)) between 1 May and 1 September 2025 showed the typical late spring to early summer peak as the median daily river discharge between 2001 and 2024, but magnitudes were different (Figure 3). Differences included lower flows in early to mid-May and August, and higher flows in early June of 2025 when compared to 2001-2024 (Figure 3). The Environmental Account (EA) flow release to suppress germination of in-channel woody vegetation was started by the Program in late May with EA flows reaching the Kearney gage on 27 May (Figure 3). Contribution to total discharge made by the EA release helped sustain water levels over 1,500 cfs throughout most of June and are visible as light blue shaded areas in Figure 3. The EA flow release was halted on 21 June with

the last of EA water reaching the Kearney gage on 26 June (Figure 3). The pictures below provide examples of river conditions on 15 May, 15 June, and 15 July that demonstrate river flow before, during, and after the June flow release in relation to sandbar habitat and vegetation growth from west to east across the AHR.

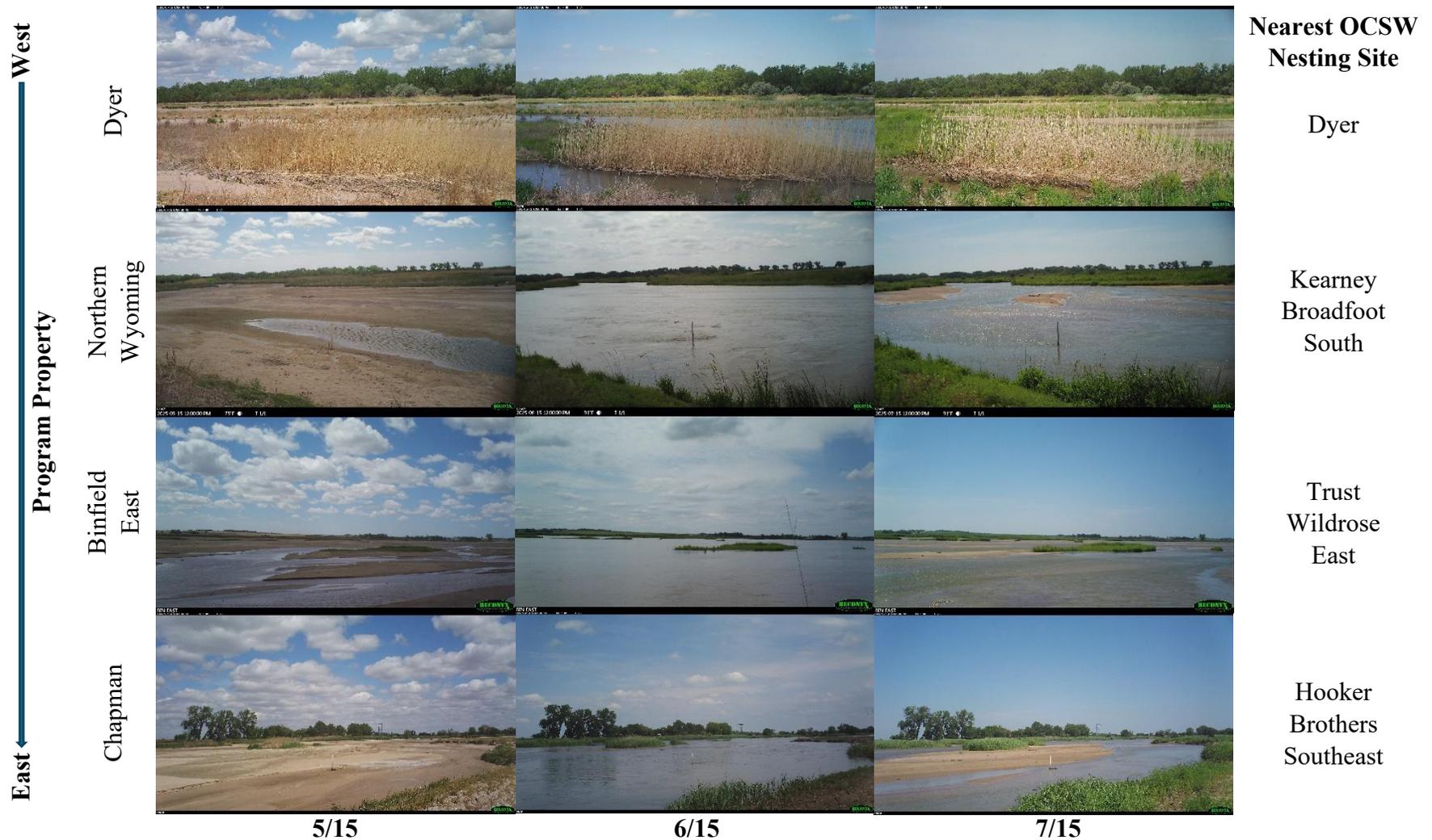
A lack of precipitation during the winter and early spring months resulted in central Platte River stream flows that were consistently below the 2001-2024 median and reached nearly dry river conditions by mid-May. Precipitation events coinciding with the start of the EA release for germination suppression in late May and early June produced a flow peak during the first week of June, and additional precipitation as the last of the EA water was passing through the system led to a second peak at the end of the month. The peak discharge at the Kearney gage was 2,980 cfs on 5 June due to contributions made by the EA release (Figure 3). The lowest flow recorded at the Kearney gage during the nesting season (1 May to 1 August) was 36.5 cfs on 18 May (Figure 3).

## MANAGEMENT

The Program undertook management actions designed to increase or improve the amount of nesting and foraging habitat and increase productivity of plovers and terns at on and off-channel sites during fall 2024 and spring 2025. Management activities were site specific and included: disking, chemical application to kill or prevent emergence of vegetation (fall and/or spring herbicide application); and predator control (trapping, fencing, and/or predator deterrent lights).

### *OFF-CHANNEL MECHANICAL HABITAT CREATION AND MAINTENANCE (2007-2025)*

Approximately 48 ac of managed off-channel nesting habitat were present in the AHR at the beginning of the Program's First Increment in 2007 (Figure 4). The Program began acquiring and restoring off-channel sites in 2009, adding to the total off-channel habitat available for nesting beginning in 2010. Total monitored off-channel habitat in the AHR increased to ~250 ac by 2021 as the Program constructed and restored potential nesting habitat (Figure 4). Area of potential nesting off-channel habitat across the AHR has remained mostly unchanged since 2021 except for small differences in water levels, vegetation, and mining activity from year to year (Figure 4). Across nine Program owned or leased sites, bare sand habitat increased by a total of 4.26 ac between 2024 and 2025 (see site specific details below). The Follmer site experienced the largest gain in potential nesting habitat between 2024 and 2025 with an increase of 4.44 ac of bare sand due to a shift in mining activity. The largest loss in potential nesting habitat at Program sites between 2024 and 2025 occurred at the Newark East site where 2.83 ac of habitat was lost due to increased driving and mining activity on the far eastern side of the east peninsula. Across nine sites not owned or leased by the Program, bare sand habitat increased by a total of 3.33 ac between 2024 and 2025 (see site specific details below). The Ed Broadfoot and Sons site experienced the largest gain in potential nesting habitat between 2024 and 2025 with an increase of 2.40 ac of bare sand due to a shift in mining activities. Blue Hole lost the greatest amount of potential nesting habitat with a loss of 2.35 ac between 2024 and 2025 due to water level and vegetation changes.



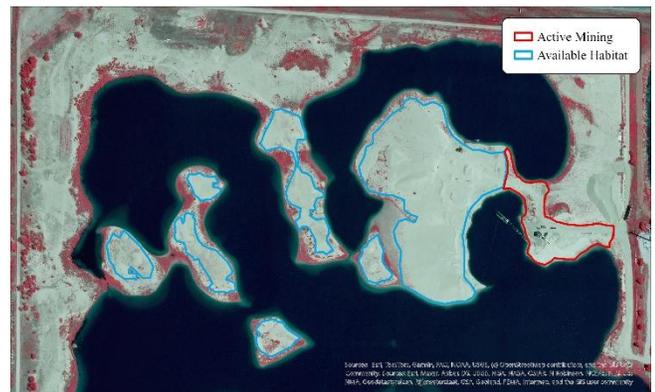
*Vegetation monitoring pictures demonstrating changes in on-channel habitat availability through time across the AHR from west (top) to east (bottom) before (left column), during (middle column), and after (right column) June flow release. The Program property and nearest OCSW nesting site corresponding with the location of each photo series are provided on the left and right y-axes, respectively.*

## *Off-Channel Sand and Water Sites*

The Program and its partners actively managed 13 of the 18 off-channel sand and water sites that were monitored during 2025 with the goal of increasing plover and tern productivity (Figure 2). Management efforts at each of the 18 sites are summarized below. Site numbers correspond to map locations on Figure 2. Provided in parentheses after each site name are letters denoting management efforts and history of each site. Program owned or leased sites are denoted with a “P”; managed sites are identified with an “M”; sites constructed specifically for plover and tern nesting are denoted by a “C”; and sand and gravel mines (formerly and currently active) that were rehabilitated into or designated as possible nesting habitat are identified with a “G”.

- 1. OSG Lexington (PMG)** — Program contractors applied a contact herbicide to kill existing vegetation along the waterline during fall 2024 and pre-emergent herbicide to the nesting area during spring 2025. Predator trapping occurred during the 2025 nesting season. A permanent 4-ft-high woven wire predator exclusion fence with offset electric wires and an electrified top wire at the entrance to the nesting peninsula was maintained in 2025. Additionally, a temporary 4-ft-high woven wire predator fence with offset electric wires was maintained across the east entrance to the nesting area separating the nesting site from ongoing sand and gravel mining occurring east of the habitat. A permanent 4-ft-high woven wire fence was installed in 2021 around the northern outer perimeter of the site as a predator deterrent and to limit human disturbance to the site, but this fence did not completely enclose the site. Potential nesting habitat decreased by 0.53 ac between 2024 and 2025 due to vegetation changes and increased washouts.
- 2. NPPD Lexington (MG)** — Program contractors applied a pre-emergent herbicide to the nesting area during spring 2025. Predator trapping occurred during the 2025 nesting season. Woven-wire predator exclusion fences with offset electric wires along the west side of the nesting areas were maintained during 2025. No sand and gravel mining occurred during 2025. Potential nesting habitat increased by 1.31 ac between 2024 and 2025 due to water level and vegetation changes.
- 3. Dyer (PMG)** — Program contractors applied a contact herbicide to kill existing vegetation along the waterline during fall 2024 and pre-emergent herbicide to the nesting area during spring 2025. Predator trapping occurred during the 2025 nesting season. Permanent 4-ft-high woven wire predator exclusion fences with offset electric wires and an electrified top wire across the south ends of each peninsula were maintained in 2025. No sand and gravel mining occurred during 2025. Potential nesting habitat decreased by 0.07 ac between 2024 and 2025 due to increased washouts and water level changes.
- 4. Cottonwood Ranch (PMC)** — Program contractors applied a contact herbicide to kill existing vegetation along the waterline during fall 2024 and pre-emergent herbicide to the nesting area during spring 2025. Predator trapping occurred during the 2025 nesting season. A permanent 4-ft-high woven wire predator exclusion fence with offset electric wires and an electrified top wire at the entrance to the nesting peninsula was maintained in 2025. Potential nesting habitat increased by 0.12 ac between 2024 and 2025 due to water level changes.

5. **T&F Lakeside (G)** — Not managed. Sand and gravel mining occurred during 2025. Potential nesting habitat increased by 1.96 ac between 2024 and 2025 due to vegetation changes.
6. **Blue Hole (MG)** — Program contractors applied a pre-emergent herbicide to the nesting area during spring 2025. Predator trapping occurred during the 2025 nesting season. There was no predator exclusion fence at the site. Sand and gravel mining did not occur during 2025; however, the area west of this OCSW site is a high traffic area for loading and unloading equipment. Potential nesting habitat decreased by 2.35 ac between 2024 and 2025 due to water level and vegetation changes.
7. **Johnson (MG)** — Program contractors applied a pre-emergent herbicide to the nesting area during spring 2025. No predator trapping occurred during 2025. NPPD maintained a non-electrified woven-wire predator exclusion fence along the west side of the nesting area. Sand and gravel mining did not occur during 2025. Potential nesting habitat increased by 0.28 ac between 2024 and 2025 due to water level and vegetation changes.
8. **Ed Broadfoot and Sons (G)** — Not managed. Sand and gravel mining occurred during 2025. Potential nesting habitat increased by 2.40 ac between 2024 and 2025 due to a shift in mining activities.
9. **Kearney Broadfoot South (PMG)** — Program contractors applied a contact herbicide to kill existing vegetation along the waterline during fall 2024 and pre-emergent herbicide to the nesting area during spring 2025. Predator trapping along the exterior shorelines of the site occurred during 2025. A permanent 4-ft-high woven wire predator exclusion fence with offset electric wires and an electrified top wire was maintained along the interior shoreline of the entire nesting peninsula and at the entrance to the nesting peninsula in 2025. Predator deterrent lights were installed on the site again for the 2025 nesting season as a part of our additional predator management study. Sand and gravel mining took place to the north and outside of the main peninsula where nesting occurred. Potential nesting habitat increased by 0.24 ac between 2024 and 2025 due to water level and vegetation changes.
10. **Non-Access Islands (NAI) Kearney Broadfoot South (PMG)** — Predator trapping occurred during 2025. Due to active mining, the area of this site varies from year to year. There were 8.59 ac of suboptimal habitat available on these islands for plover or tern nesting and foraging during 2025. This was an increase of 3.03 ac from 2024. Available habitat consists of the interior, unvegetated portions of islands to the west and the unvegetated sandy tailing that remains as the eastern peninsula is mined. The shorelines of most of these islands are partially or heavily vegetated, thus do not contribute to the acres counted as habitat for this site.



*Habitat availability (blue) and active mining (red) at Non-Access Islands Kearney Broadfoot South, June 2025.*

**11. Newark West (PMG)** — Program contractors applied a contact herbicide to kill existing vegetation along the waterline during fall 2024 and pre-emergent herbicide to the nesting area during spring 2025. A permanent 4-ft-high woven wire predator exclusion fence with offset electric wires and an electrified top wire at the entrance across the ends of each peninsula were maintained in 2025. In addition, the entire perimeter of the exterior of this site, outside of the surrounding water barrier, was enclosed with a permanent 4-ft-high woven wire fence with an offset electric wire. Predator trapping inside the perimeter fence, but outside the nesting peninsula, occurred during 2025. Predator deterrent lights were installed on the site again for the 2025 nesting season as a part of our additional predator management study. No sand and gravel mining occurred during 2025. Potential nesting habitat decreased by 0.07 ac between 2024 and 2025 due to water level changes.

**12. Newark East (PMG)** — Program contractors applied a contact herbicide to kill existing vegetation along the waterline during fall 2024 and pre-emergent herbicide to the nesting area during spring 2025. Predator trapping occurred during 2025. A permanent 4-ft-high woven wire predator exclusion fence with offset electric wires and an electrified top wire at the entrance across the west peninsula and a temporary 4-ft high woven wire predator fence with offset electric wires across the east peninsula were maintained in 2025. Increased driving and mining activity on the far eastern side of the east peninsula decreased potential nesting habitat by 2.83 ac between 2024 and 2025.

**13. Leaman (PMC)** — Program contractors applied a contact herbicide to kill existing vegetation along the waterline during fall 2024 and pre-emergent herbicide to the nesting area during spring 2025. Predator trapping occurred during 2025. A permanent 4-ft-high woven wire predator exclusion fence with offset electric wires and an electrified top wire at the entrance to the nesting peninsula was maintained in 2025. Additionally, there was a non-electrified 4-ft-high woven wire fence separating the northern boundary of the site from the property to the north, but this fence did not completely enclose the site. Predator deterrent lights were installed on the site again for the 2025 nesting season as a part of our additional predator management study. Potential nesting habitat decreased by 0.07 ac between 2024 and 2025 due to increased washouts.

**14. Follmer (PMG)** — Program contractors applied a contact herbicide to kill existing vegetation along the waterline during fall 2024 and pre-emergent herbicide to the nesting area during spring 2025. Predator trapping occurred during 2025. Because there was documented use by plovers and terns on this site for the first time in 2024, a temporary 4-ft-high woven wire predator exclusion fence with offset electric wires was installed at the entrance to the eastern nesting area prior to and maintained during the 2025 nesting season. Sand and gravel mining, including loading and unloading equipment



*Habitat availability (blue) and active mining (red) at Follmer, June 2025.*

and materials, occurred on the western nesting area in 2025. No predator exclusion fencing was installed to isolate the western nesting area due to the mining traffic. Potential nesting habitat increased by 4.44 ac between 2024 and 2025 due to a shift in mining activities.

**15. *Trust Wildrose East (MG)*** — Program contractors disked the nesting area in the fall of 2024 and applied a pre-emergent herbicide to the nesting area during spring 2025. No sand and gravel mining or predator trapping occurred during 2025. Potential nesting habitat increased by 0.05 ac between 2024 and 2025 due to water level changes.

**16. *DeWeese (G)*** — Not managed. Sand and gravel mining occurred during 2025. Potential nesting habitat increased by 0.08 ac due to a shift in mining activities.

**17. *Hooker Brothers Southeast (G)*** — Not managed. No sand and gravel mining occurred on the nesting area, but the area adjacent to this property was mined during 2025. Potential nesting habitat decreased by 1.27 ac between 2024 and 2025 due to increased vegetation.

**18. *Hooker Brothers East (G)*** — Not managed. Sand and gravel mining occurred during 2025. Potential nesting habitat increased by 0.87 ac due to a shift in mining activities.

#### *ON-CHANNEL MECHANICAL HABITAT CREATION AND MAINTENANCE (2007–2025)*

Constructed on-channel habitat availability was variable and somewhat limited during the First Increment of the Program and no additional on-channel habitat has been added during the First Increment Extension (Figure 5). Approximately 24 ac of constructed on-channel habitat were present in the AHR in 2007 as the result of efforts by other conservation organizations (Figure 5). That habitat was subsequently lost over the course of several years due to erosion during high flow events. On-channel habitat construction by other conservation organizations has been very limited since 2007. The Program began large-scale on-channel habitat construction efforts at the Elm Creek complex in fall 2012 and created on-channel habitat at the Cottonwood Ranch and Plum Creek complexes as part of sediment augmentation activities to add 55 ac of habitat during the 2013 nesting season (Figure 5). Much of that habitat was lost during a high flow event in fall 2013. On-channel island construction began at the Shoemaker Island complex following the fall 2013 event. A high flow event in June 2014 eroded a portion of the habitat constructed in fall 2013, but the Program was able to construct a total of 28 ac of on-channel habitat during fall 2014 at the Elm Creek and Shoemaker Island complexes to increase on-channel habitat availability for the 2015 nesting season (Figure 5). However, most of it was lost due to erosion during 2015 and 2016 high flow events. The Program did not construct on-channel habitat after 2014 and there has been limited suitable on-channel habitat available for plover and tern nesting during 2017-2025.

On-channel maintenance on Program managed properties was mainly in the form of herbicide application at targeted sites prior to the 2025 nesting season. The in-channel islands at the Cottonwood Ranch complex and the moving complex approach (MCA) island in the Chapman complex were sprayed with contact herbicide during fall 2024 and with pre-emergent herbicide during spring 2025. Program contractors also disked the MCA island in the Chapman complex during fall 2024 to increase foraging habitat along the river, but no nesting habitat that met Program requirements was created or maintained.

## **PLOVER AND TERN MONITORING**

### METHODS

#### *MONITORING PROTOCOL REVISIONS OVER TIME*

In 1997, the Department of the Interior and the States of Nebraska, Colorado, and Wyoming adopted the “Cooperative Agreement for Platte River Research and Other Efforts Relating to Endangered Species Habitats” (Cooperative Agreement). In 2001, the Cooperative Agreement coordinated a standardized protocol for monitoring reproductive success and reproductive habitat parameters of plovers and terns on the central Platte River from Lexington to Chapman, Nebraska. The standardized protocol was implemented by CNPPID, CPNRD, NPPD, and USFWS during 2001-2006 (<https://platteriverprogram.org/program-library>; [Target Species: piping plover, interior least tern](#); [Keywords: protocol implementation, \[Year of Study\]](#)). In 2007, the Program assumed this responsibility and Program staff, contracted personnel, and cooperators have since implemented the monitoring protocol. The protocol was revised prior to the 2010 nesting season ([PRRIP 2010](#)), prior to the 2017 nesting season ([PRRIP 2017](#)), and prior to the 2025 nesting season ([PRRIP 2025b](#)). Data for 2025 were collected following the 2025 monitoring protocol.

Changes in monitoring protocols that affect the comparability of results over time have been noted where appropriate in tables and figures. Most changes occurred in 2010 and included:

- The definition of fledging age changed from 15 days for both species to fledging ages of 28 days for plovers and 21 days for terns.
- River surveys increased from three monthly surveys between May and August in 2001-2009 to seven semi-monthly (1 and 15 May, June, and July; and 1 August) surveys in 2010-2024.
- Both inside and outside monitoring was implemented at all off-channel sites during 2012-2016.
- The Program began building and restoring OCSW sites to increase the amount of stable available habitat.
- The Program gained access to sites that had been previously restricted and, therefore, were not included in reproductive calculations prior to 2010.

Major changes since the 2017 protocol include:

- Band re-sighting was discontinued in 2021.
- River surveys decreased from seven semi-monthly (1 and 15 May, June, and July; and 1 August) surveys in 2010-2024 to four monthly surveys conducted May through August in 2025. Reduction in river survey frequency was due to lack of suitable on-channel nesting habitat and no documented on-channel nesting by either plovers or terns since 2016 on the central Platte River (with the exception of a single on-channel plover nest in 2023 that failed within a week).

These changes, along with a gradual refinement of fatig decisions to make them more consistent, have allowed us to improve our monitoring accuracy.

## *SEMI-MONTHLY OCSW SURVEYS AND MONTHLY RIVER SURVEYS*

During 2025, biologists conducted seven semi-monthly (1 and 15 May, June, and July; and 1 August) surveys of OCSW sites and four monthly (May, June, July, and August) surveys of the central Platte River spanning the AHR to count plover and tern adults, breeding pairs, nests, chicks, and fledglings.

### *Semi-Monthly OCSW Surveys*

EDO and NPPD biologists conducted semi-monthly surveys at 18 Program-owned or partnered OCSW sites along the AHR during 2025 (Figure 2). EDO surveys were usually conducted on the same date across multiple sites over the entire AHR. EDO biologists conducted semi-monthly surveys using spotting scopes and monitoring techniques from outside the nesting area on 28 April, 1 and 15 May; 2, 16, and 30 June; and 14 and 31 July 2025. NPPD biologists conducted surveys of the Blue Hole site on 5 and 15 May; 2, 16, and 30 June; 14 July; and 1 August, the NPPD Lexington site on 5 and 15 May; 2, 16, and 30 June; and 14 July, and the Johnson site on 5, 15, and 27 May; 11 and 30 June; and 10 July.

### *Monthly River Surveys*

Three EDO biologists (one driver; two surveyors) used an airboat to conduct monthly river surveys from May through August on the central Platte River spanning the AHR to count plover and tern adults, breeding pairs, nests, chicks, and fledglings. Active river channels >225 ft wide that could be safely navigated between the J-2 Return, located east of Lexington, and the Chapman bridge, located south of Chapman, Nebraska, were included in the survey. Surveys were conducted on 20-21 May; 18-19 June; 8-9 July; and 5-6 August during 2025.

EDO staff conducted point count surveys at accessible locations (e.g., bridges; boat ramps) when segments of the river were unnavigable due to low flow. During the May 2025 survey, the Alda bridge to Hwy 34 bridge sections were not entirely completed due to low water levels preventing access by airboat and severe weather conditions. The airboat was used as far as possible upstream and downstream and point counts were conducted at the Hwy 281, South Locust, and Hwy 34 bridges. All other sections of the river were completed with the airboat.

## *SEMI-WEEKLY NEST AND CHICK MONITORING*

In addition to semi-monthly surveys of all 18 OCSW sites and monthly river surveys, EDO and NPPD biologists monitored any OCSW or river site with adults, active nests, or broods on a semi-weekly basis throughout the nesting season. Upon location of an active nest, biologists monitored from outside the nesting area to observe nests and/or chicks twice per week until the nest or brood failed, or the chicks fledged. Biologists recorded numbers of adults, nests, chicks, and fledglings during each survey.

Each survey outside of the nesting area consisted of  $\geq 30$  minutes of observation using binoculars and/or spotting scopes at a distance that did not cause disturbance to nesting birds (usually >200 ft., but occasionally closer as terrain dictated). Observations were made from multiple vantage points to allow observation of as much of the site as possible. Nests and chicks were often located by first observing adult birds. The date, observation start and stop times, and the number of plover

and tern adults, nests, broods, chicks, and fledglings present were recorded during each semi-weekly site visit. When biologists observed chicks or fledglings, the date of hatching or fledging was estimated based on current and previous nest and chick observations. When the nest or brood failed, biologists attempted to determine the cause of failure and assign a nest/brood failure fate as abandoned, flooded, predated, weather, or unknown. Unknown causes of nest/brood failure were assigned when loss stage was known, but there was not enough evidence to assign a specific fate. When the timing of loss was such that it remained unclear whether a nest failed or was successful with the brood failing soon after hatch, both the nest and the brood were assigned an unknown outcome fate.

#### *METRICS AND BREEDING PAIR ESTIMATION*

For each semi-monthly OCSW site survey and each monthly river survey, the numbers of plover and tern adults, breeding pairs, nests, chicks, and fledglings observed were totaled. These numbers provided seven off-channel and four on-channel snapshots of plover and tern relative abundance during the 2025 nesting season without accounting for detection probability. Semi-weekly and semi-monthly survey data for OCSW sites with and without nests, respectively, were used to calculate the total number of plover and tern adults at all 18 OCSW sites based on the maximum number of adults observed at each site on any one survey. The total number of nests was calculated as the total unique nests observed across all sites. Brood count was calculated as the total number of successful nests ( $\geq 1$  chick hatched) across all sites. The total number of chicks ( $< 15$  days old and  $\geq 15$  days old) and fledglings ( $\geq 21$  days old for terns;  $\geq 28$  days old for plovers) was calculated based on the maximum number of chicks and fledglings that were associated with each unique nest and summed across all nests.

Plover and tern breeding pair estimates (BPE) for nesting observed on the river channel and at OCSW sites were calculated according to the methods described by Baasch et al. (2015). The Program's BPE was found to be the most appropriate estimator of breeding pairs based on our monitoring protocol and sampling effort (Baasch et al. 2015). Plover and tern BPE was calculated by adding the number of active or recently failed nests (within the species-defined re-nest interval) to the number of active or recently failed or fledged broods (within the species-defined re-nest or post fledge interval, respectively) observed on a given date. Plover breeding pair counts were determined by assuming: (1) plover nests did not hatch within 28 days of being initiated; (2) plovers did not re-nest within 5 days of losing a nest, brood, or fledging chicks; (3) plover chicks fledged at 28 days of age (defined fledging age for 2010-2025); (4) plover chicks that survived to 15 days of age (fledging age for 2007-2009) also fledged. Tern breeding pair estimates were determined by assuming: (1) tern nests did not hatch within 21 days of being initiated; (2) terns did not re-nest within five days of losing a nest or brood; (3) tern chicks fledged at 21 days of age (defined fledging age for 2010-2025); (4) tern chicks that survived to 15 days of age (fledging age for 2007-2009) also fledged; and (5) terns did not re-nest after fledging chicks.

The Program reports peak BPE when numbers of plover and tern breeding pairs observed during a single observation period within the entire Program AHR first peaked. Thus, peak breeding pair estimates are associated with a specific date. On- and off-channel BPE were calculated based upon the number of nests observed on the river channel or on OCSW sites, respectively. Thus on- and

off-channel BPE represents the highest number of estimated breeding pairs across all on-channel river habitat during a single observation period, whereas off-channel BPE provides an estimate of the highest number of breeding pairs across all OCSW sites during a single observation period. Peaks in BPE for each OCSW site were also calculated, which represents the highest number of estimated breeding pairs at a single site during a single observation period regardless of the date when breeding pairs peaked over the entire AHR.

### *SURVIVAL RATES*

We estimated daily survival rates of plover and tern nests located on OCSW sites that were monitored during 2025 by Program staff and personnel from NPPD. Nest success is defined as any nest that hatched  $\geq 1$  chick. The incubation period for plovers and terns was considered to be 28 and 21 days, respectively, from when nests were determined to have been initiated. Daily survival rate estimation requires that each nest be assigned as either failed, active, or successful for each “observed” date of the incubation period. For the purpose of estimating daily survival rate, when the observed fate of a nest was unknown, a “failed” status was assigned to the nest if the nest was observed for less than 28 days for plovers or less than 21 days for terns. Otherwise, a “successful” status was assigned. The last “observed” date is the average date between the date the nest was last observed active and the date the nest received an unknown outcome fate. For example, if a plover nest was observed to be active 25 days after it was initiated and then was found to be empty (no eggs) four days later (29 days after it was initiated) with no sign of chicks of appropriate age in the area, the nest was fated at 27 days (midpoint of the two observation periods) and assigned a “failed” status for the purpose of estimating daily survival rate. If, however, a plover nest with an unknown fate was last observed to be active 26 days after it was initiated, but then four days later (30 days after it was initiated) an empty nest bowl was observed with no sign of chicks of appropriate age in the area, the fate of the nest on day 28 (midpoint of the two observation periods) was assigned a “successful” status. Our assumption was that, on average, survived and failed intervals were discarded in the same proportion they occurred in the data. For this reason, the number of successful and failed nests included those with unknown fates and may differ from those presented in other sections of the report when unknown fates are presented.

Daily survival rates of plover and tern broods monitored during 2025 were also separately estimated. As the exact date of hatching was occasionally unknown, the brooding period for plover and tern chicks was considered to be 28 and 21 days from the date nestlings were first observed, respectively. A successful brood was defined as any brood with  $\geq 1$  chick that was observed fledged or that survived 28 days (plovers) or 21 days (terns). Like nest survival methods, when the observed fate of a brood was unknown, the fate of the brood was assigned at the midpoint of when a brood was last observed active and first documented as an “unknown” status. A failed status was assigned to a brood if the date of fate determination was  $< 28$  or  $< 21$  days after plover or tern chicks were first observed, respectively, and a successful status was assigned to the brood otherwise. Similar to nests, the number of successful and failed broods included those with unknown fates and may differ from those presented in other sections of the report when unknown fates are present.

Mixed-effects nest fate logistic exposure models were used to estimate daily survival rates (DSRs) of plover nests and broods at OCSW sites ([Shaffer 2004](#)). Separate analyses were conducted to estimate DSRs of tern nests and broods at OCSW sites. Three models were developed for each of the four analyses. First, nest or brood survival was estimated as a constant (i.e., null model). Second, we evaluated whether nest or brood survival was different for nests at Program and non-Program managed sites (i.e., ownership model). Third, we evaluated whether nest or brood survival was different across sites (i.e., site model). Site was included as a random effect in each model to account for a potential lack of independence of nest fates at each site. The *glmer* function in package *lme4* ([Bates et al. 2015](#)) in Program R ([R Core Team 2025](#)) was used to fit models and estimate coefficients. When models did not converge due to insufficient data, we defaulted to a fixed effects model for estimates. For 2025, we defaulted to a fixed effects model for the DSR of plover broods at each site.

## RESULTS

### *PIPING PLOVERS*

#### *2025 Seasonal Summary*

During the 2025 plover nesting season, we observed: a high estimated number of breeding pairs (41 pairs); the second highest total number of nests (73 nests); and one of the highest total number of successful nests (37 nests; 2016 and 2023 each had 40 successful nests). The apparent nest success (0.51) was higher than the 2024 low (0.47), which remains the lowest apparent nest success in the contemporary 2010-2025 monitoring period. Sixty fledglings were observed in 2025, which is the second highest number of fledglings observed (2024 had 63 fledglings; Tables 1 and 2). The fledge ratio (1.46 28D chicks/BPE; Table 2) was the highest observed since 2014. The following were also observed during the 2025 nesting season.

- Plovers nested at 11 of 18 OCSW sites with a high amount of variability in reproductive effort and success (Table 3). There was a total of 253.63 ac of potential nesting habitat available at the 18 OCSW sites in 2025, which was an increase from 246.04 ac in 2024.
- The peak AHR breeding pair estimate for plovers was 41 pairs (Table 2). Plover nests produced 111 chicks (<15 days old) and 60 fledglings ( $\geq 28$  days old), resulting in a hatch ratio based on BPE of 2.71 <15D chicks/BPE and a fledge ratio of 1.46 28D chicks/BPE (Table 2).
- Plovers established 73 nests, resulting in a hatch ratio based on nests of 1.52 <15D chicks/nest and a fledge ratio of 0.82 28D chicks/nest (Table 2).
- Blue Hole, Leaman, Dyer, and Follmer were the most productive OCSW nesting sites for plovers in 2025 with fledge ratios  $> 1.00$  28D chicks/BPE. Cottonwood Ranch, Newark West, and Trust Wildrose East all had fledge ratios equal to 1.00 28D chick/BPE (site-specific peak date used to estimate BPE; Table 3).
- The other four OCSW sites at which plover nesting was observed had between two and seven successful nests (Table 3). Fledge ratios at these four sites ranged between 0.00 28D chicks/BPE and 0.88 28D chicks/BPE (site-specific peak date used to estimate BPE; Table 3).

- The proportion of nests and broods that failed due to unknown causes this year (0.22) was higher than the proportions from 2022-2024, but lower than the proportions from 2017-2019. Proportion of nest failures attributed to unknown causes peaked during the 2017-2019 period prior to the current experimental design for remote camera monitoring. Since then, information gathered by cameras has helped to reduce unknowns, but in 2025 the early removal of nest-level cameras at three sites in response to predator behavior limited the information available for failing nests at these sites ([see Predator Management and Monitoring section for more detail](#)).

#### *Semi-Monthly OCSW Surveys*

Plover breeding pairs, nests, chicks, and fledglings were observed on OCSW sites rather than on-channel river locations in 2025 (Tables 4, 5, 6, and 7), which was similar to previous years. Based on the twice monthly OCSW surveys, the number of plover nests peaked at 27 nests on the 15 May survey (Table 6). The number of plover adults, chicks, and fledglings observed peaked at 70 adults, 28 chicks, and 19 fledglings on the 1 July survey (Table 6). Since 2010, the number of adult plovers observed during twice monthly OCSW surveys generally was highest during the 1 June, 15 June, or 1 July surveys (Figure 6 and 7).

#### *Monthly River Surveys*

No plover nests or chicks were observed during monthly river surveys in 2025 (Table 7). The number of adult plovers observed (8 adults) peaked on the June survey, which was conducted on 18-19 June (Table 7). Plover fledglings observed (7 fledglings) peaked during the July survey, which was conducted 8-9 July. The number and timing of adult plovers observed during river surveys has varied greatly across years and surveys (Figures 8 and 9). We assumed adult plovers and the fledglings observed on the river were generally foraging from nearby OCSW sites due to the lack of nesting behavior witnessed on the river and the proximity of plover river locations to nearest OCSW sites. The June river survey conducted 18-19 June corresponded to a mean daily discharge of 1,710 cfs on 18 June and 1,510 cfs on 19 June at the Kearney gage (Figure 3). Most in-channel sandbars and potential nesting habitat were inundated during the periods of high flow during late May, June, and early July, and did not meet the Program's requirements towards in-channel nesting habitat ([PRRIP 2015](#)). Low or no suitable on-channel nesting habitat in the AHR during the First Increment and Extension of the Program (Figure 5) has resulted in most nesting occurring on managed off-channel sites (Table 4 vs. Table 5, Figure 10).

#### *Nest Monitoring, Brood Monitoring, and Survival Rates*

Plover nesting was observed at 11 of 18 OCSW sites during semi-monthly monitoring in 2025 (Table 3). Biologists then monitored nests and broods at the 11 OCSW sites on a semi-weekly basis and observed a total of 73 plover nests in 2025 (Table 2, Figure 11).

**Breeding Pairs** — Across OCSW sites, the number of estimated plover breeding pairs peaked at 41 pairs on 16 June. Biologists counted a maximum of 105 adults across all sites (Table 2). The mean plover BPE during the contemporary 2010-2025 monitoring period (35.8) has more than doubled the mean plover BPE during the historic 2001-2009 monitoring period (12.9), due in part to construction, rehabilitation, and maintenance of OCSW sites (Figure 12). Annual peak OCSW

plover BPE was positively correlated with the total area of potential nesting habitat available at OCSW sites during 2001-2025. For every acre increase in potential nesting habitat at OCSW sites, there was an increase of 0.15 (95% confidence interval [CI] = 0.11, 0.18) plover breeding pairs (Figure 13).

Nests — Biologists observed and monitored a total of 73 plover nests during 2025 (Table 2, Figure 14). The number of plover nests has followed a generally increasing trend over time as the total area of potential nesting habitat at OCSW sites increased (Figure 12). Of the 11 OCSW sites that had plover nesting, Dyer had the most at 15 nests, followed by Newark East (14 nests) and Kearney Broadfoot South (11 nests; Table 3, Figure 11). The first plover nests were observed on 3 May, and the last nest was first observed on 3 July. Thirty-seven of the 73 nests were successful, resulting in an apparent nest success of 0.51, which was higher than the 2024 low (0.47; Table 2, Figure 15).

The overall DSR of plover nests across all monitored OCSW sites was 0.980 (LCL: 0.965, UCL: 0.990) during 2025 (Tables 2 and 8). We found no significant difference in nest DSR between Program and non-Program sites (Table 9). This is due largely to the small number of nests and low variability in nest DSR at non-Program sites. The DSR of plover nests was 0.971 (LCL: 0.958, UCL: 0.984) at Program sites and 1 (LCL: 1, UCL: 1) at non-Program sites (Table 9). We found a significant difference in site-specific nest DSR, where Newark East had a higher DSR than Dyer (reference site). DSR ranged from 0.940 at Newark West to 1 at NPPD Lexington, Cottonwood Ranch, and Blue Hole at the 11 OCSW sites with plover nests (Table 8).

The overall incubation period (28-day) survival rate of plover nests on all monitored sites was 0.564 (LCL: 0.366, UCL: 0.748; Tables 2 and 8). Incubation period survival was 0.437 (LCL: 0.297, UCL: 0.639) at Program sites and 1 (LCL: 1, UCL: 1) at non-Program sites (Table 9). Incubation period survival ranged from 0.179 at Newark West to 1 at NPPD Lexington, Cottonwood Ranch, and Blue Hole (Table 8).

Broods — Biologists observed 111 chicks from the 37 broods from successful nests (Table 2). The hatch ratio of 1.52 <15D chicks/nest was the lowest observed in the contemporary 2010-2025 monitoring period (Table 2). The first nest observed to hatch occurred on 31 May, while the last nest observed to hatch occurred on 28 July. Of the 111 chicks, biologists observed 69 chicks that survived  $\geq 15$  days (Table 2). Brood counts generally increased from 2010-2016 and have remained relatively stable since then, averaging 33 broods from 2017-2025 (Figure 12).

Across the 11 OCSW sites with plover broods, overall DSR for broods was 0.992 (LCL: 0.980, UCL: 1; Tables 2 and 10). We found no significant difference in DSR for broods on Program (DSR: 0.992; LCL: 0.978, UCL: 0.999) compared to non-Program (DSR: 0.991; LCL: 0.954, UCL: 0.998) sites (Table 11). Likewise, we found no significant difference in DSR between the other 10 OCSW sites when compared to the Dyer reference site. Brood DSR ranged from 0.906 at NPPD Lexington to 1 at Dyer, Cottonwood Ranch, Blue Hole, Newark West, Follmer, and Trust Wildrose East (Table 10).

The overall brooding period (28-day) survival rate was 0.796 (LCL: 0.575, UCL: 0.994; Tables 2 and 10). Brooding period survival for plovers was 0.802 (LCL: 0.532, UCL: 0.979) at Program

sites and 0.777 (LCL: 0.271, UCL: 0.950) at non-Program sites (Table 11). Across monitored OCSW sites, brooding period survival ranged from 0.063 at NPPD Lexington to 1 at Dyer, Cottonwood Ranch, Blue Hole, Newark West, Follmer, and Trust Wildrose East (Table 10).

Fledges — Of the 111 chicks from the 37 nests, 60 chicks made it to the 28-day fledging age resulting in a fledge ratio of 0.82 28D chicks/nest or 1.46 28D chicks/BPE (Table 2). Biologists first observed a plover fledgling on 30 June and the last known plover chick to fledge did so on 25 August. The proportion of successful chicks was 0.54 (Figure 15). When using nests as a unit of measure, the fledge ratio of 0.82 28D chicks/nest was the lowest since 2021 (Table 2). When accounting for likely renesting using the Program’s breeding pair estimator, we estimated a fledge ratio of 1.46 28D chicks/BPE, which was the highest since 2014 (Table 2). The 3-year running average of plover fledge ratios has shown a steady increase since 2019 (Figure 16).

#### *Nest and Brood Fates*

Nest fates were successfully assigned to 59 of the 73 plover nests observed during 2025 (Figure 17). Nineteen nests failed due to predation (0.26 of total nests), two failed due to abandonment (0.03), and one failed due to weather (0.01; Figure 17). Seven nests failed due to unknown causes (0.10) and seven nests had an unknown outcome (0.10; Figure 17). Of the 37 nests that were successful, 25 fledged (0.34 of total nests) and two failed due to predation (0.03; Figure 17). Nine broods failed due to unknown causes (0.12) and one brood had an unknown outcome (0.01; Figure 17). Remote camera monitoring at the nest, site, and shoreline together with track surveys ([see Predator Management and Monitoring section for more detail](#)), has allowed us to gather more fatig evidence, improved our ability to fate nests, and reduced uncertainty regarding nest and brood fates on Program managed sites since 2020 (Figure 17).

#### *Incidental Take Summary and Mortality*

In its 2006 Biological Opinion ([USFWS 2006](#)) and 2018 Supplemental Biological Opinion ([USFWS 2018](#)) on the Program, the USFWS developed an incidental take statement addressing incidental take for plovers and terns associated with operation of existing and new water-related activities, and habitat alteration or monitoring conducted in the Platte River basin covered by the Program. Such take includes killing, harming, and harassing which could include the loss of habitat, individuals (adults, eggs, and/or chicks), and recruitment. In this incidental take statement, the USFWS described five types of losses reasonably foreseeable to occur as a result of the implementation of the Program and established allowable take under each category. Quantification of allowable take is also identified in the individual section 10(a)(1)(A) federal permits issued to researchers. The Service acknowledged “Acts of God” or “Acts of Nature” as beyond operational control of Program participants, with that type of take not included as incidental take.

Since the Program’s initiation in 2007, incidental take has been minimal (Table 12). The Program observed one habitat restoration and land management-related plover chick mortality during 2014 due to electrocution in a predator deterrent fence ([Cahis and Baasch 2015](#)). The Program observed one research-related plover chick mortality during 2011 due to flushing the chick into the water where it was consumed by a fish ([Baasch 2012](#)) and one research-related plover chick mortality

during 2013 due to a chick attempting to fly and landing into the water where it was consumed by a fish ([Baasch 2014](#)). In 2022, incidental take was observed at an inland lake as a single nest containing four plover eggs was inundated at Lake Minatare as the lake was filled in preparation for delivery of irrigation water ([PRRIP 2023](#)). Across the entire AHR encompassing both Program and non-Program sites, there was no documented research related mortality in 2025.

Between 2007 and 2016, a limited amount of nest and chick predation was observed and did not exceed the Service's threshold at any Program owned or managed off-channel sand and water nesting site in any year (Table 12; [USFWS 2018](#)). Increased effort to monitor predator activities began in 2017, which has resulted in more documented predation than during the First Increment. However, losses of plover nests and chicks to predation have not exceeded the Service's established threshold (i.e., the loss of 70% of nests or 80% of chicks to predation in three of five years for sites that average at least three plover nests; Table 12). The percentages provided in Table 12 for losses of nests due to predation are based on the total number of nests observed at each site during each year and percentages for losses of chicks are based on the total number of chicks observed at each site during each year.

In 2025, biologists documented five of six (83%) plover nests at Newark West fail due to predation. This is the second of five years that Newark West has been above the USFWS established threshold for nests. In 2022, 88% of plover nests and 100% of plover chicks were lost to predation at this site. Should nest loss to predation exceed 70% at Newark West in 2026, reinitiation will be limited to management of nesting habitat at the individual OCSW site at which the exceeding take occurred ([USFWS 2006](#), [USFWS 2018](#)).

### *Conclusions*

Results from our 2025 plover monitoring efforts indicate continued increases in plover productivity metrics on monitored sites across the central Platte River from lows observed during 2018 and 2019. During the 2025 season, the estimated number of breeding pairs was 41 pairs. Thirty-seven of 73 nests were successful, and those nests produced 60 fledglings. Although the apparent nest success (0.51) and the fledge ratio per nest (0.82 28D chicks/nest) were both low, the fledge ratio per breeding pair (1.46 28D chicks/BPE) was the highest it has been since 2014. Fledge ratios are one of the indicators used by the Program to measure reproductive success of plovers over time and a positive trend in fledge ratios has been observed over the past several years after a low of 0.62 28D chicks/BPE and 0.49 28D chicks/nest in 2018. It is likely that some renesting occurred for plovers this year because of the wave of nest initiations that occurred following documented predation events at multiple sites in 2025. The end product was a high number of nests (73 nests), low apparent nest success (0.51), but a high fledge ratio per breeding pair (1.46 28D chicks/BPE). Plovers responded to losses with increased reproductive effort to make 2025 a successful year for fledgling production across the AHR.

A significant, positive relationship between the estimated number of plover breeding pairs and area of potential nesting habitat at OCSW sites since 2001 has been observed (Figure 13). After the Program began constructing and managing more potential nesting habitat in 2010, the mean BPE (12.9 from 2001-2009; 35.8 from 2010-2025) has more than doubled, the mean number of nests observed (15.6 from 2001-2009; 50.6 from 2010-2025) has more than tripled, and the mean

number of broods observed (11.2 from 2001-2009; 32.9 from 2010-2025) has nearly tripled. Nesting habitat at OCSW sites plateaued at ~250 ac from 2021-2025, with the estimated number of breeding pairs fluctuating between 36 and 47 pairs. Plovers are territorial when establishing and defending nests, and this behavior requires sufficient spacing between nests ([Haffner et al. 2009](#)). Annual variability in breeding pairs at OCSW sites is likely related to a combination of the quantity of available habitat, density of plovers on each site as migratory birds arrive, site fidelity ([Ledee et al. 2010](#)), and previous nest success ([Friedrich et al. 2015](#); but see [Wiens and Cuthbert 1988](#)). Looking to the future, the Program will be rehabilitating an additional ~50 acres at OSG Lexington in preparation for the 2026 nesting season. Additional acres are also available for rehabilitation at Kearney Broadfoot South upon termination of mining efforts to provide additional habitat suitable for plover nesting in the near future.

The most productive plover OCSW nesting sites in 2025 were Blue Hole, Leaman, Dyer, and Follmer with fledge ratios >1.00 28D chicks/BPE (site-specific peak date used to estimate BPE; Table 3). Cottonwood Ranch, Newark West, and Trust Wildrose East all had fledge ratios equal to 1.00 28D chicks/BPE (Table 3). Seven OCSW sites had no plover nesting (Table 3). Blue Hole had the highest fledge ratio (3.00 28D chicks/BPE) and produced the highest number of fledglings (18 fledglings). Six fledglings from four nests were produced on Leaman for a fledge ratio of 2.00 28D chicks/BPE. Dyer had the highest number of nests (15 nests) and produced the second highest number of fledglings (10 fledglings). Prior to 2024, Follmer did not have plover or tern nesting, and last year's single plover nest did not produce any plover fledglings. However, this year, Follmer had five plover nests which produced six fledglings for a fledge ratio of 1.20 28D chicks/BPE.

The continued use of remote camera monitoring of shorelines, nesting sites, and nests on six Program-managed sites has allowed us to more accurately fate nests and, to a lesser extent, broods. Camera monitoring began in 2020 and, as a result, the proportion of nests and broods that failed due to unknown causes has decreased from a maximum of 0.50 in 2019 (Figure 17). In 2025, the proportion of nests and broods that failed due to unknown causes was 0.22 (Figure 17). Video and images from cameras and information from track surveys helped assign fates to 22 of the 36 plover nests that failed. Nineteen nests (0.26 of total nests) failed due to predation, two nests (0.03) failed due to abandonment, one nest (0.01) failed due to weather, and seven nests (0.10) failed due to unknown causes. A fate could not be assigned to seven plover nests (0.10) due to uncertainty about whether the nest failed before or after hatching (unknown outcome). Of the 37 successful plover nests, 11 broods failed with the failure of two of these broods attributed to predation and nine to unknown causes. A fate could not be assigned to one plover brood because the site was not visited enough times to give the brood a fate (unknown outcome). The cause of brood losses remains one of the information gaps of our monitoring. Cameras have been effective at documenting predation on recently hatched chicks at the nest, but once chicks begin spending time away from the nest, our cameras provide limited information on predation of broods. Overall, the data accumulated on plover nest and brood fates will be used to inform future management decisions to continue to improve adult survival and plover nest productivity along the AHR.

## *LEAST TERNS*

### *2025 Seasonal Summary*

Terns have positively responded to Program habitat creation, rehabilitation, and management along the AHR during 2001-2025 (Tables 13 and 14). During the 2025 tern nesting season, we observed: the highest peak estimated number of breeding pairs (167 pairs); the highest number of total nests (236 nests); the highest number of successful nests (125 nests); and the highest number of fledglings (167 fledglings; Tables 13 and 14). A fledge ratio of 1.00 21D chicks/BPE was observed in 2025 (Table 14). As with previous years, a high amount of variability in reproductive effort and success across OCSW nesting sites was observed (Table 15). The following were also observed during the 2025 nesting season.

- Terns nested at 12 of 18 OCSW sites (Table 15). There was a total of 253.63 ac of potential nesting habitat available at the 18 OCSW sites in 2025.
- The peak AHR breeding pair estimate for terns was 167 pairs (Table 14). Tern nests produced 255 chicks (<15 days old) and 167 fledglings ( $\geq 21$  days old), resulting in a hatch ratio of 1.53 <15D chicks/BPE and fledge ratio of 1.00 21D chicks/BPE based on BPE (Table 14).
- Terns established 236 nests, resulting in a hatch ratio of 1.08 <15D chicks/nest and a fledge ratio of 0.71 21D chicks/nest based on the number of nests (Table 14).
- Blue Hole, Hooker Brothers Southeast, Dyer, Newark East, and Cottonwood Ranch were the most productive OCSW nesting sites for terns in 2025 with fledge ratios  $\geq 1.00$  21D chicks/BPE (site-specific peak date used to estimate BPE; Table 15).
- The other seven OCSW sites at which tern nesting was observed had between one and 34 successful nests (Table 15). Fledge ratios at these seven sites ranged between 0.00 21D chicks/BPE and 0.91 21D chicks/BPE (site-specific peak date used to estimate BPE).
- The proportion of tern nests and broods that failed due to unknown causes was 0.36. This is slightly higher than the average proportion documented from 2017-2019 (0.35) prior to current implementation of shoreline, site-level, and nest-level camera monitoring. Plovers have been prioritized for remote camera monitoring, thus the amount of information to fate tern nests has been more limited.

### *Semi-Monthly OCSW Surveys*

Biologists observed tern breeding pairs, nests, and chicks on OCSW sites rather than on-channel river locations in 2025 (Tables 16, 17, 18, and 19). Based on the twice monthly OCSW surveys, the number of tern adults, chicks, and fledglings observed peaked at 247 adults on the 15 June survey, 62 chicks on the 1 July survey, and 30 fledglings on the 15 July surveys (Table 18). The number of tern nests observed peaked at 128 nests on the 15 June survey (Table 18). Since 2010, the number of adult terns observed during twice monthly OCSW surveys generally has been highest during the 15 June or 1 July surveys (Figures 18 and 19).

### *Monthly River Surveys*

EDO staff observed no on-channel tern nesting during 2025 (Tables 17 and 19). The last tern nest at an on-channel island site was documented by the Program in 2016 (Table 17). EDO staff

counted a maximum of 67 adults and 27 fledglings on the August river survey conducted 5-6 August. It was assumed these birds came to forage along the river from nearby OCSW sites because no nests or chicks were observed on-channel prior to that survey (Table 19). These dates of peak tern river use corresponded to a period of low Platte River discharge with a documented mean daily discharge of 241 cfs on 5 August and 149 cfs on 6 August at the Kearney gage (Figure 3). Periods of peak tern foraging use of the river vary annually but generally occur prior to nesting in late May or early June and again after chicks fledge in late July or early August (Figures 20 and 21). Migratory terns arrive to the central Platte River later than plovers with low tern foraging use of the river documented during early May river surveys since 2010 (Figure 21). Low or no suitable on-channel nesting habitat in the AHR during the First Increment and Extension of the Program (Figure 5) has resulted in most nesting occurring on managed off-channel sites (Table 16 vs. Table 17, Figure 22).

#### *Nest Monitoring, Brood Monitoring, and Survival Rates*

Tern nesting was observed at 12 of 18 OCSW sites during semi-monthly monitoring in 2025 (Table 15). Biologists then monitored nests and broods at the 12 OCSW sites on a semi-weekly basis and observed a total of 236 tern nests in 2025 (Table 14, Figure 23).

Breeding Pairs — The estimated number of tern breeding pairs peaked at 167 pairs on 28 June, and biologists counted a maximum of 335 adults across all sites (Table 14). The BPE of 167 pairs is the highest tern BPE observed by the Program (Table 14, Figure 24). The numbers of tern breeding pairs, nests, and broods observed in 2024 and 2025 showed a large increase compared to the relative stability in these metrics since the last peak in 2015 (Figure 24). The mean BPE (154.0 from 2024-2025; 86.0 from 2016-2023), mean number of nests observed (228.5 from 2024-2025; 117.5 from 2016-2023), and mean number of broods observed (110.0 from 2024-2025; 74.1 from 2016-2023) have increased by almost 150% or more.

As with plovers, a significant, positive relationship between annual tern BPE at OCSW sites and the total area of potential OCSW nesting habitat available during 2001-2025 has been observed (Figure 25). However, the amount of variability explained by the data was higher for plovers ( $R^2 = 0.79$ ) than for terns ( $R^2 = 0.66$ ), and the relationship between BPE and acres had a greater slope for terns. For every acre increase in potential nesting habitat at OCSW sites, there was an increase of 0.39 (95% CI = 0.27, 0.52) tern breeding pairs (Figure 25).

Nests — Biologists observed and monitored a total of 236 tern nests during 2025, the highest observed to date (Table 14, Figure 26). The OCSW sites with the most tern nests were Follmer (49 nests), and Newark East (41 nests; Table 15). The remaining ten sites with nests had between one and 28 tern nests (Table 15). Biologists observed the first tern nest on 17 May and the last nest was first observed on 28 July. One hundred twenty-five of the 236 nests were successful, the highest number of successful nests observed, for an apparent nest success of 0.53, which was below the mean from 2010-2024 (Tables 13 and 14, Figure 27).

The overall DSR of tern nests across all monitored OCSW sites was 0.976 (LCL: 0.963, UCL: 0.984) during 2025 (Tables 14 and 20). We found a significant difference in nest DSR between Program and non-Program sites, with lower nest DSR on Program sites (Table 21). The DSR of

tern nests was 0.970 (LCL: 0.958, UCL: 0.979) at Program sites and 0.992 (LCL: 0.982, UCL: 0.998) at non-Program sites (Table 21). We found a significant difference in site-specific nest DSR, where Blue Hole had a higher nest DSR and Newark West had a lower nest DSR than Dyer (reference site). DSR ranged from 0.935 at Newark West to 1 at NPPD Lexington and Trust Wildrose East (Table 20).

The overall incubation period (21-day) survival rate of tern nests on all monitored sites was 0.602 (LCL: 0.454, UCL: 0.713; Tables 14 and 20). Incubation period survival was 0.528 (LCL: 0.408, UCL: 0.637) at Program sites and 0.838 (LCL: 0.688, UCL: 0.955) at non-Program sites (Table 21). Incubation period survival ranged from 0.246 at Newark West to 1 at NPPD Lexington and Trust Wildrose East (Table 20).

**Broods** — Biologists counted 255 chicks from the 125 broods from successful nests (Table 14). The hatch ratio for terns was 1.53 <15D chicks/BPE and 1.08 <15D chicks/nest (Table 14). The first nest observed to hatch occurred on 11 June, and the last nest observed to hatch occurred on 9 August. Of the 255 chicks, biologists observed 155 chicks that survived  $\geq 15$  days (Table 14).

Across the 12 OCSW sites with tern broods, overall DSR for broods was 0.984 (LCL: 0.966, UCL: 0.993; Tables 14 and 22). We found no significant difference in DSR for broods on Program (DSR: 0.984; LCL: 0.961, UCL: 0.994) compared to non-Program (DSR: 0.984; LCL: 0.927, UCL: 0.998) sites (Table 23). We found a significant difference in site-specific brood DSR, where Kearney Broadfoot South, NPPD Lexington, and Trust Wildrose East had a lower brood DSR than Dyer (reference site). Brood DSR ranged from 0.630 at NPPD Lexington to 1 at Hooker Brothers Southeast (Table 22).

The overall brooding period (21-day) survival rate was 0.717 (LCL: 0.480, UCL: 0.867; Tables 14 and 22). Brooding period survival for terns was 0.720 (LCL: 0.432, UCL: 0.890) at Program sites and 0.708 (LCL: 0.204, UCL: 0.962) at non-Program sites (Table 23). Across monitored OCSW sites, brooding period survival for terns ranged from 0.000 at NPPD Lexington to 1 at Hooker Brothers Southeast (Table 22).

**Fledges** — Of the 255 chicks from the 125 nests, 167 chicks made it to the 21-day fledging age resulting in a fledge ratio of 1.00 21D chicks/BPE or 0.71 21D chicks/nest (Table 14). Biologists first observed a tern fledgling on 3 July and the last known tern chick to fledge did so on 21 August. The proportion of successful chicks was 0.65, which was slightly higher than the 0.64 observed in 2024, and within the range of recent annual variability in the metric (Figure 27). When using nests as a unit of measure, the fledge ratio was 0.71 21D chicks/nest (Table 14). Based on BPE, the fledge ratio was 1.00 21D chicks/BPE, which was higher than last year (0.84 21D chicks/BPE), but lower than the fledge ratios in 2020-2023 (Table 14, Figure 28).

#### *Nest and Brood Fates*

Nest fates were successfully assigned to 158 of the 236 tern nests observed during 2025 (Figure 29). Twenty-six nests failed due to predation (0.11 of total nests), six failed due to abandonment (0.03), and one failed due to weather (0.00; Figure 29). Fifty-four nests failed due to unknown causes (0.23). We noted this year in 19 of the 54 nests that failed due to unknown causes, tern

adults sat past the hatch date and the eggs in the nest bowl did not hatch (non-viable eggs). Twenty-four nests had an unknown outcome (0.10; Figure 29). Of the 125 nests that were successful, 93 fledged (0.39), and two failed due to predation (0.01; Figure 29). Thirty broods failed due to unknown causes (0.13; Figure 29).

### *Incidental Take Summary and Mortality*

Incidental take of terns was minimal during the Program's First Increment and did not exceed the Service's threshold under any category of allowable take in any year ([USBR 2018](#)). With the removal of the tern from the federal list of threatened and endangered species on 12 February 2021, the Program's GC, including the USFWS, agreed that the provisions of the Incidental Take Statement specific to terns in the 2006 Biological Opinion ([USFWS 2006](#)) and 2018 Supplemental Biological Opinion ([USFWS 2018](#)) no longer apply ([PRRIP 2021a](#)). Across the entire AHR, spanning both Program and non-Program sites, there was no documented research related mortality during 2025.

### *Conclusions*

Our 2025 monitoring efforts documented terns nesting in high numbers on OCSW sites along the central Platte River. This year, we observed the highest: estimated number of tern breeding pairs (167 pairs), number of total nests (236 nests), number of successful nests (125 nests), and number of fledglings (167 fledglings). Apparent nest success (0.53) and the fledge ratio by nest (0.71 21D chicks/nest) were low again this year, but not as low as the 2024 apparent nest success (0.43) or fledge ratio by nest (0.53 21D chicks/nest). The fledge ratio by breeding pair (1.00 21D chicks/BPE) was also higher than last year's (0.84 21D chicks/BPE). Though renesting has been shown to be less common for terns than for plovers on the AHR ([Roche et al. 2016](#)), it is likely that some renesting was occurring for terns this year because of the wave of nest initiations that occurred following documented nest failures at multiple sites in 2025. The end product was a high number of nests (236 nests), low apparent nest success (0.53), but the highest number of successful tern nests (125 nests) documented. Like plovers, terns responded to losses with increased reproductive effort to make 2025 a successful year for fledgling production across the AHR.

As with plovers, there was a significant positive relationship between the estimated number of tern breeding pairs at OCSW sites and the area of potential nesting habitat at OCSW sites (Figure 25). Although the amount of variability explained by the data was higher for plovers ( $R^2 = 0.79$ ) than for terns ( $R^2 = 0.66$ ), the slope of the relationship between breeding pairs and OCSW habitat area was greater for terns than plovers. For every acre OCSW habitat increased, an increase of 0.39 tern breeding pairs was observed (95% CI: 0.27-0.52). This may be due to differences in nesting behavior as terns nest colonially whereas plovers are territorial. The Program has observed two peaks in tern use of OCSW habitat, one in 2015 and another in 2024 and 2025. Numbers of tern breeding pairs, nests, and broods increased and eventually peaked in 2015 after the Program began constructing and managing more potential nesting habitat (Figure 24). From 2016-2023, relative stability and a lack of immediate response by terns to increased habitat availability in terms of nest counts, breeding pairs, and brood counts were observed (Figure 24). The large increase in nests, breeding pairs, and brood counts observed in 2024 and 2025 follows a period of OCSW habitat

restoration that has added approximately 110 acres since 2016 to provide a total of approximately 250 OCSW acres.

We continue to observe high variability in tern use and productivity across OCSW sites. The most productive tern OCSW nesting sites in 2025 were Blue Hole, Hooker Brothers Southeast, Dyer, Newark East, and Cottonwood Ranch (site-specific peak date used to estimate BPE; Table 15). No tern nesting was observed on six OCSW sites (Table 15). Blue Hole produced the second highest number of fledglings (36 fledglings) and had the highest fledge ratio (1.64 21D chicks/BPE). Hooker Brothers Southeast had a fledge ratio of 1.25 21D chicks/BPE and produced 5 fledglings from 5 nests, and Dyer had a fledge ratio of 1.17 21D chicks/BPE and produced 14 fledglings from 18 nests. Newark East produced a high number of fledglings (34 fledglings) from the second highest number of nests (41 nests), and Cottonwood Ranch produced ten fledglings from ten nests. Follmer had the highest number of nests (49 nests) and produced the highest number of fledglings (42 fledglings). This was only the second year nesting was observed on Follmer. In 2024, Follmer had 12 nests produce 13 fledglings.

The proportion of tern nests and broods that failed due to unknown causes this season was 0.36 (Figure 29). This is slightly higher than the average proportion documented from 2017-2019 (0.35) prior to current implementation of shoreline, site-level, and nest-level camera monitoring. Plovers were prioritized for receiving nest-level cameras, thus the information available to fate tern nests was more limited ([see Predator Management and Monitoring section for more detail](#)). In addition, removing nest-level cameras on three sites mid-season and documenting 19 tern nests where the adults sat past the hatch date and the eggs in the nest bowl did not hatch (non-viable eggs) contributed to the higher proportion of nests that failed due to unknown causes in 2025.

## **PREDATOR MANAGEMENT AND MONITORING**

The Program and its partners implemented several long-term management strategies to reduce the risk of predation at 13 managed OCSW sites during their construction and/or rehabilitation. Off-channel nesting sites have been managed to create or maintain peninsulas surrounded by water to provide a  $\geq 100$  ft water deterrent to terrestrial predators where possible. Permanent and temporary electrified woven wire fences were installed across the land entrance to each nesting area. Non-electrified fence-panel wings were positioned on the ends of the electrified fence and extended between three and seven ft in the water or farther as water levels dropped to deter terrestrial predators from swimming from the mainland to the nesting peninsula. To reduce the potential for avian predation, all trees within a  $\geq 492$  ft radius of the nesting site were removed ([Baasch et al. 2017](#)) and avian spikes were placed on all potential perches that could not be removed. Finally, predators were trapped and removed from around the periphery of the site on an annual basis from March through early September.

The Program again used additional predator monitoring in 2025 to reduce the number of nest and brood losses attributed to unknown causes and increase our understanding of the impacts of predation on plovers and terns. This was the fifth year of our predator monitoring study after a 2020 pilot study, which was implemented due to low plover fledge ratios observed during 2018 and 2019, a decrease in the proportion of successful plover chicks over time, and concerns about

predation impacts on plovers. Predator monitoring efforts at six OCSW sites (three with basic predator management and three with additional predator management) included track surveys along the shoreline and remote camera monitoring at the shoreline, on the nesting site, and at individual nests. Mid-season this year, remote cameras at individual nests were removed on sites where we observed behavior of great horned owls interacting with nest-level cameras prior to predated the nest. The sites where nest-level cameras were removed included Newark East (removed 10 June), Dyer (removed June 11), and Newark West (removed 21 July). Nest-level cameras on sites where predators were not observed interacting with cameras (Cottonwood Ranch, Kearney Broadfoot South, and Leaman) remained. Site and shoreline cameras not associated with nests remained on all six sites to help document predator presence.

For the 2025 season, the basic design and implementation remained the same as in 2021-2024 ([PRRIP 2022b](#), [PRRIP 2023](#), [PRRIP 2024](#), [PRRIP 2025a](#)). Basic predator management was used at the Dyer, Cottonwood Ranch, and Newark East sites. Additional predator management efforts were deployed at the Kearney Broadfoot South, Newark West, and Leaman sites and included additional predator exclusion fences surrounding entire nesting peninsulas and predator deterrent lights (see details below). The Program will continue implementing additional predator management strategies in 2026 to provide a multi-year data set that will be analyzed and used to inform future management decisions; however, the use of cameras will be limited.

## PREDATOR MANAGEMENT

### *METHODS*

#### *Trapping*

Wayne Homan TSE LLC conducted trapping and lethal removal at ten Program-owned and NPPD off-channel nesting sites in 2025 (Table 24). Homan deployed traps from mid-March through early September at each site. Traps deployed included live cage traps, dog proof leg-hold traps, leg-hold/foot-hold traps (jaw traps), and body-hold snares/conibear traps (Table 24). Firearms were used when deemed necessary. Homan recorded the date on which each trap was deployed, trap type, trap identification number, and OCSW site. Daily trapping logs were kept to record the date and time of trap checks, trap type, number of traps checked, number of empty closed traps, number of traps closed with caught animal, and number of traps set to be checked the next day. When an animal was captured, Homan identified the species, the trap in which it was captured, time and date, and then lethally removed the animal from the site (excluding carp spp., domestic dog, river otter, and spiny softshell turtle, which were released).

Trapping effort was calculated at each site as the number of trap days, which was the total number of days each trap was open summed over all traps at each site. Because there were occasions when visits to traps were not conducted daily and because traps may have closed between visits, we determined the number of trap days when the trap closed between visits as one-half of the number of days since the trap was last checked. Firearm usage was not included in trapping effort. The total number of animals captured in traps at the site divided by the total number of trap days was used to calculate the number of captures per unit effort (i.e., trap days). Animals removed through

use of a firearm were counted toward total number of captures but were not included in the calculation of captures per trap day.

### *Predator Exclosure Fencing*

In addition to our predator exclusion fences that were deployed across nesting peninsula entrances, in 2021, additional predator exclusion fencing that surrounded nesting areas on two OCSW sites (Kearney Broadfoot South and Newark West) were installed and maintained. On the interior shoreline of the nesting area at Kearney Broadfoot South, an interior 4-ft woven wire predator fence with two electrified wires was installed (Figure 30). The fence had 4-in x 4-in openings to allow plovers and terns to easily move through but prevent medium- and large-sized mammalian predators from accessing the site. One wire was mounted 3-in above the fence and along the tops of the fence posts to prevent avian predator perching and minimize mammals from climbing over the fence. The second wire was mounted at approximately the same height as the top of the woven wire fence but offset to the outside to prevent mammals from climbing over. An exterior 4-ft high woven wire predator exclusion fence was deployed at Newark West that surrounded the outside of the water moat along the property line (Figure 31). One electrified wire was mounted offset to the outside of the fence and approximately 3-ft above the ground. Because the fence was located outside the nesting and foraging areas, a fence that had 2-in x 4-in openings was used.

### *Predator Deterrent Lighting*

Predator deterrent lights were deployed at three Program monitored and managed sites. At Kearney Broadfoot South, 4 motion-activated lights (Luposwiten Solar Motion Sensor Lights, Luposwiten Direct, Shenzhen, Guangdong), four random pattern lights (Foxlights Solar Night Predator Deterrent, Foxlights International PTY LTD, Bexley North, Australia), and 28 blinking walking lights (RISOON Solar Strobe Lights, RISOON; Figure 30) were deployed. The blinking walking lights were mounted to the interior predator exclusion fence and set each to flash at alternate times to give the illusion of movement along the fence. Motion-activated and random pattern lights were deployed in pairs of two across the site at a density of approximately one set per four ac. These lights were installed on top of a 7-ft high post with avian spikes placed on top of the lights to prevent them from being used as predator perches. At Newark West, four motion-activated and four random pattern lights were distributed across the two nesting peninsulas (Figure 31), and at Leaman, three sets of motion-activated and random pattern lights were distributed across the site (Figure 32).

## PREDATOR MONITORING

The Program monitored predator presence and predation events at six OCSW nesting sites during 2025: Dyer, Cottonwood Ranch, Kearney Broadfoot South, Newark West, Newark East, and Leaman. Predator presence was documented using a combination of trapping outside of the nesting peninsulas, track surveys along peninsula shorelines, remote cameras set along peninsula shorelines and within nesting sites, and remote cameras placed to monitor individual nests. Predation events were documented using remote cameras.

## *METHODS*

### *Trapping*

Daily trapping logs were used to provide information on potential predator presence along external shorelines and along the outside of nesting peninsulas. We identified the species present at the site and the number of captures per species per trap day as an indicator of relative abundance.

### *Track Surveys*

EDO biologists and technicians conducted track surveys along peninsula shorelines at the six nesting sites once per week from May through early September to document avian and terrestrial predator presence and any predators that entered the nesting peninsula. Track survey effort at each site was summarized by totaling the number of surveys completed during the nesting season. One or two observers began track surveys at the nesting peninsula entrance and walked the entirety of the shoreline while searching for evidence of predator species presence. Presence included tracks along the shoreline, digs (i.e., disturbed sand under a fence due to animal digging), fence turn backs (i.e., the animal walked to the fence and retreated), and scat. If observers found more than one sign of presence for any one species, then they recorded only one unique species register due to uncertainty as to the number of individuals of that species that were present. Observers attempted to identify the species responsible for animal digs when possible; otherwise, they attributed them to an unknown species. If other species' tracks were found during the same survey, observers did not count the animal dig as a unique register because it was likely caused by one of the identified species. Observers cleared tracks in the sand after each survey to prevent double counting upon the next weekly survey.

### *Remote Trail and Video Cameras*

EDO biologists attached shoreline trail cameras (Bushnell; Overland Park, KS) to 3-ft tall metal posts placed every 1,200 linear ft along the shorelines of the six nesting sites. Biologists attached avian spikes to the top of each post to prevent avian predator perching. When the 1,200 linear feet spacing did not provide camera coverage of shorelines, then the distance between shoreline cameras was shortened to improve coverage. Shoreline camera monitoring effort was quantified at each site as the number of days each shoreline camera was deployed (camera days) totaled over all cameras at each site. Trail cameras were programmed to take motion-triggered photos followed by a 30-sec video. Animals registered on cameras were identified to the species level, but we did not attempt to identify individuals. Because multiple cameras at a single site could have photographed the same individual several times, our final dataset was limited to include only unique potential predator registers captured by shoreline cameras. A unique register was defined as a photo/video of a single species separated by at least 24-hours from a previous register of the same species. Multiple photos of the same species taken by shoreline cameras at the same site within a 24-hour period were considered to be a single unique register. A photo/video of multiple individuals of the same species was considered to be a single unique register. The number of unique potential predator registers over the entire nesting season by site was added to calculate the total number of unique potential predator registers for each site. The number of unique shoreline registers for each site was divided by the total number of shoreline camera days to obtain a measure of registers per unit effort.

Site-level trail cameras were attached to 4-ft tall PVC pipes at each of the six nesting sites at a density of one camera every four ac near the edges of the peninsula facing inland to document

potential predator presence on the nesting site. Avian spikes were placed on the top of each PVC pipe to prevent avian predator perching. Site-level cameras were programmed to take motion-triggered photos followed by a 30-sec video. Monitoring effort, number of camera days, and unique registers were calculated and defined the same as for shoreline cameras. The number of unique site-level registers for each site was divided by the total number of site-level camera days to obtain a measure of registers per unit effort.

Nest-level trail cameras and cellular video cameras (Arlo; Carlsbad, CA) were placed at active plover and tern nests (i.e., adults were tending the nest until the nest was successful or failed) at the same six nesting sites to document potential predator presence and predation events occurring at the nest. Nest-level cameras were placed at a density of approximately one camera every two ac and were only placed at established nests (i.e., the nest contained  $\geq 1$  egg in the nest bowl). The number of cameras allocated per site was established before the nesting season with five to ten cameras deployed per site concurrently. Cameras were preferentially placed at plover nests before tern nests and not every nest was monitored by a camera to allow investigation of potential camera effects on nest survival and success. The camera was removed once the nest was no longer active (i.e., successful or failed) and the camera was used at another nest if needed.

Trail cameras were placed  $\sim 5$  ft from plover nests and  $\sim 7$  ft from tern nests to minimize disturbance to nesting adults. Trail cameras were attached to 2-ft tall metal posts with avian spikes placed on top to prevent avian predator perching. Cellular video cameras were placed closer to the nest (i.e.,  $\sim 3$  ft) with the purpose of documenting detailed nesting information (i.e., adult nesting behavior, hatching, predation, and weather events) that trail cameras sometimes miss. Each nesting site was designated one cellular video camera. Nest-level cameras were programmed to take motion-triggered photos followed by a 30-sec video. Nest-level camera monitoring effort and number of nest-level camera days were calculated using the same methods described above for shoreline and site-level cameras. Photos/videos from each nest-level camera was categorized as a predator register (i.e., potential predator documented without predating the nest) or predation event (i.e., predator documented predating the nest). For predation events, the date, time, type of predation (ate egg[s], chick[s], or adult[s]), and predator behavior/activity were recorded. If more than one predation event by the same predator species was documented within 24-hr at the nesting site (at  $\geq 1$  nest[s]), we considered it as one unique predation event. However, all information from the predation event was included when totaling numbers of plover and tern nests, eggs, and chicks predated during 2025. The number of unique nest-level registers was added to the number of unique nest-level predation events and divided by the total number of nest-level camera days for each site to obtain a measure of nest-level registers per unit effort. The number of unique nest-level predation events was separately divided for each site by the total number of nest-level camera days to obtain a measure of predation events per unit effort.

Mixed-effects nest fate logistic exposure models were used to calculate DSR of nests at the six OCSW sites to determine whether the presence of nest cameras affected nest survival rates. Using data from the six sites, we conducted an analysis using all plover and tern nests combined and developed three models. First, we evaluated whether survival was different for nests with and without cameras (i.e., camera model). Second, we evaluated whether survival was different for nests with and without cameras and across sites (i.e., camera + site model). Third, we evaluated whether survival was different for nests with and without cameras, across sites, and within sites (i.e., camera + site + camera\*site model). Two additional analyses using data only from plover nests and from tern nests were conducted to separately fit the camera model. Site was included as

a random effect in each model to account for a potential lack of independence of nest fates at each site. Package *lme4* (Bates et al. 2015) in Program R (R Core Team 2025) was used to fit models and estimate coefficients. When models did not converge due to insufficient data, we defaulted to a fixed effects model for estimates. In 2025, we defaulted to a fixed effects model for the comparison of nests with and without cameras within each site. We also made an overall and site-by-site comparison between DSR of nests with and without cameras in 2025 to the combined average DSR of all plover and tern nests calculated using data from 2010-2016 prior to any camera usage at sites.

## RESULTS

### Trapping

There has been a high amount of variability among years and across OCSW sites based on trapping of potential predators during 2012-2025 (Figure 33). This variability is due to differences in trapping effort across years and sites and may be related to changes in predator communities over time. During 2025, Homan deployed 331 traps across ten sites with the number of traps per site ranging between 10 and 50 (Table 24). The first traps were set on 14 March and all traps were removed by 3 September 2025. Total number of trap days per site ranged from 1,050.5 days at Blue Hole to 6,235 days at Dyer and totaled 39,601.5 days across all ten sites (Table 25).

Traps captured and removed 558 animals encompassing 12 species. Homan used a firearm to remove four bullsnakes (*Pituophis catenifer*), five coyotes (*Canis latrans*), one raccoon (*Procyon lotor*), one Virginia opossum (*Didelphis virginiana*), and one woodchuck (*Marmota monax*; Table 26). Across the ten sites, total captures per trap day ranged between 0.009 captures per trap day at Newark West and 0.038 captures per trap day at NPPD Lexington (Table 25). When comparing the six OCSW nesting sites where the Program used cameras to monitor predator presence and predation events, total captures per trap day ranged from 0.010 to 0.017 at sites with basic predator management (Dyer, Cottonwood Ranch, and Newark East) and from 0.009 to 0.017 at sites with additional predator management (Kearney Broadfoot South, Newark West, and Leaman; Figure 34).

Raccoons were the most frequently captured species with a total of 413 raccoons captured across all ten sites (Tables 26 and 27; Figure 35). Other species captured in traps included American badger (*Taxidea taxus*), carp spp. (Family Cyprinidae), coyote, domestic dog (*Canis familiaris*), feral cat (*Felis catus*), river otter (*Lontra canadensis*), spiny softshell turtle (*Apalone spinifera*), striped skunk (*Mephitis mephitis*), Virginia opossum, and woodchuck (Tables 26 and 27).

### Shoreline Track Surveys

A total of 110 shoreline track surveys were conducted across the six OCSW sites during 2025 and recorded 276 total unique track registers during 2025 (Table 28). Unique track registers per survey ranged from 1.79 at Newark West to 3.11 at Dyer and Kearney Broadfoot South (Table 28). At sites with basic predator management, unique track registers per survey ranged from 2.00 to 3.11 and at sites with additional predator management, unique track registers per survey ranged from 1.79 to 3.11 (Table 28).

Tracks from avian species were most frequently observed at all sites (Figure 36). Among avian species, Canada goose (*Branta canadensis*) was most frequently observed on all six sites followed by great blue heron (*Ardea herodias*; Figure 37a). The frequency of occurrence and composition of the mammalian predator community as observed by track surveys varied greatly by site (Figure 37b). While white-tailed deer (*Odocoileus virginianus*) was observed most frequently at Cottonwood Ranch, Newark East, and Leaman; American mink (*Neogale vison*) was most frequently observed at Kearney Broadfoot South and Newark West; and river otter was most frequently observed at Dyer (Figure 37b). Among amphibian/reptilian species, turtle spp. (Order Testudinata) was most frequently observed at all sites (Figure 37c).

#### *Shoreline Camera Monitoring*

EDO biologists deployed 29 shoreline cameras for a total of 3,564 camera days across the six sites and recorded 1,057 unique predator registers during 2025 (Table 29). Number of shoreline cameras deployed per site ranged from three cameras totaling 327 camera days at Leaman to seven cameras totaling 876 camera days at Kearney Broadfoot South (Table 29). Unique registers per camera day ranged from 0.158 at Cottonwood Ranch to 0.596 at Leaman (Table 29). At sites with basic predator management, unique registers per camera day ranged from 0.158 to 0.308 and at sites with additional predator management, unique registers per camera day ranged from 0.251 to 0.596 (Table 29).

Avian species were documented most frequently on shoreline cameras at all six sites (Figure 38a). The site where avians were most frequently observed was Leaman (Figure 38a). Mammalians were observed on shoreline cameras most frequently at Kearney Broadfoot South (Figure 38b). Amphibian/reptilian species were observed on shoreline cameras most frequently at Cottonwood Ranch (Figure 38c).

Eleven different avian species were documented on shoreline cameras and Canada goose and great blue heron were the most frequently observed on all six sites (Figure 39a). Ten different mammalian species (in addition to one unknown mammalian species) were documented on shoreline cameras with the frequency of observation varying among the six sites (Figure 39b). Turtle spp. were the only amphibian/reptilian species documented on shorelines cameras and were observed on all sites except for Newark West (Figure 39c).

#### *Site-Level Camera Monitoring*

EDO biologists deployed 25 site-level cameras for a total of 3,098 camera days across the six sites and recorded 158 unique predator registers during 2025 (Table 30). Number of site-level cameras deployed per site ranged from three cameras totaling 327 camera days at Leaman to five cameras totaling 640 camera days at Kearney Broadfoot South and Newark East (Table 30). Unique registers per camera day ranged from 0.014 at Kearney Broadfoot South to 0.083 at Newark East (Table 30). At sites with basic predator management, unique registers per camera day ranged from 0.043 to 0.083 and at sites with additional predator management, unique registers per camera day ranged from 0.014 to 0.074 (Table 30).

Avian species were documented most frequently on site-level cameras at all sites (Figure 38a). The site where avians were most frequently observed was Newark East (Figure 38a). Mammalians were also observed most frequently at Newark East (Figure 38b). No amphibian/reptilian species were observed on site-level cameras (Figure 38c).

Seven avian species (in addition to one unknown avian species) were documented on site-level cameras and Canada goose was most frequently observed on all six sites (Figure 40a). Two different mammalian species were observed: coyote on Newark East and white-tailed deer on Cottonwood Ranch (Figure 40b).

### *Nest-Level Camera Monitoring*

EDO biologists deployed 39 nest-level cameras to monitor 99 nests for a total of 1,107 camera days across the six sites during 2025 (Table 31). The 99 nests were comprised of 38 plover and 61 tern nests. Mid-season, biologists observed great horned owls at three sites interacting with the cameras prior to preying on nests. As a cautionary measure, nest-level cameras were removed on 10 June from Newark East, 11 June from Dyer, and on 21 July from Newark West for the remainder of the season. Eighty-three unique registers of potential predator species (e.g., within view of camera but did not predate the nest; Table 32) and 26 unique predation events were documented on camera monitored nests across the six sites (Table 32). Avian species were observed on nest-level cameras at all six OCSW sites (Figure 38 and 41). Mammalian species were observed on nest-level cameras at Cottonwood Ranch, Kearney Broadfoot South, and Newark West (Figure 38 and 41). Amphibian/reptilian species were observed on nest-level cameras at Cottonwood Ranch, Kearney Broadfoot South, Newark West, and Leaman (Figure 38 and 41). Avian species observed on nest-level cameras included bald eagle (*Haliaeetus leucocephalus*), Canada goose, European starling (*Sturnus vulgaris*), great blue heron, great horned owl (*Bubo virginianus*), red-tailed hawk (*Buteo jamaicensis*), and red-winged blackbird (*Agelaius phoeniceus*; Figure 41a). Mammalian species observed on nest-level cameras included American badger, eastern mole (*Scalopus aquaticus*), striped skunk, and white-tailed deer (Figure 41b). The only amphibian/reptilian species observed on nest-level cameras was Woodhouse's toad (*Anaxyrus woodhousii*; Figure 41c).

Twenty-six unique predation events occurred on camera monitored nests across all six sites. Two of the 26 unique predation events were documented on nests with nest-level cameras that were assumed predated due to evidence at the nest and the timing of the nest losses, although the cameras on these nests malfunctioned. Twenty-four of the 26 unique predation events were documented on nest-level cameras (Table 32). Unique predation events per camera day ranged from 0.004 at Leaman to 0.086 at Dyer (Table 31). At sites with basic predator management, unique predation events per camera day ranged from 0.005 to 0.086 and at sites with additional predator management, unique predation events per camera day ranged from 0.004 to 0.048 (Table 31). Out of all nests being monitored with cameras, 43 plover and tern nests were predated (Table 32).

Use of nest-level cameras allowed us to accurately determine the fate of plover nests at the six OCSW sites (Table 33). Nest-level cameras were placed at 38 of 52 plover nests observed at these sites. Fourteen nests with cameras and six nests without cameras were successful, though two of the nests with cameras experienced predation following successful hatch of chicks. Nineteen nests with cameras failed due to predation, one nest with a camera failed due to abandonment, one nest without a camera failed due to weather, one nest with a camera and five nests without cameras failed due to unknown causes, and three nests with cameras and two nests without cameras had an unknown outcome (Table 33). Across the six sites during the plover incubation period, 43 of 146 eggs hatched (Table 34). Seventy-four eggs failed due to predation, four eggs failed due to abandonment, ten eggs failed due to unknown causes, and 15 eggs had an unknown outcome

(Table 34). During the brood-rearing period, 37 chicks left the nest and six chicks were documented as lost to predation (Table 34).

Nest-level cameras were placed at 61 of 130 tern nests observed at the six OCSW sites (Table 33). Twenty-one nests with cameras and 34 nests without cameras were successful, though two of the nests with cameras experienced predation following successful hatch of chicks. Twenty nests with cameras and five nests without cameras failed due to predation, three nests with cameras and three nests without cameras failed due to abandonment, one nest with a camera failed due to weather, 15 nests with cameras and 19 nests without cameras failed due to unknown causes, and one nest with a camera and eight nests without cameras had an unknown outcome (Table 33). Across the six sites during the tern incubation period, 48 of 148 eggs hatched. Fifty-six eggs failed due to predation, four failed due to abandonment, two failed due to weather, 35 failed due to unknown causes, and three had an unknown outcome (Table 34). During the brood-rearing period, 41 chicks left the nest, five chicks failed due to predation, and two failed in the nest bowl due to unknown causes (Table 34). All monitoring sources (i.e., outside/inside observers; nest, site, and shoreline camera data; and track surveys) were used to determine both plover and tern nest fates. However, individual plover/tern egg and chick fates were determined primarily using camera data with limited data available from outside monitoring.

Plover nests were predated by great horned owl, red-tailed hawk, striped skunk, and an unknown species (Table 35, Figure 42). Predation occurred at both the egg and chick stages for plovers. Among the 21 plover nests monitored by cameras that were predated, the predation event occurred at an average on day 17.76 of incubation, which represents 63.4% of the 28-day incubation period for plovers (Table 35, Figure 42). Tern nests were predated by American badger, great horned owl, red-tailed hawk, and striped skunk (Table 35, Figure 42). Predation occurred at both the egg and chick stages for terns. Among the 22 tern nests monitored by cameras that were predated, the predation event occurred at an average on day 13.50 of incubation, which represents 64.3% of the 21-day incubation period for terns (Table 35, Figure 42).

#### *Effect of Nest-level Cameras on Daily Survival Rates*

EDO biologists placed nest cameras at 99 of 182 (54%) plover and tern nests at the six OCSW sites in 2025 (Table 33). Thirty-five of the 99 nests with cameras (35%) and 40 of 83 nests without cameras (48%) were successful (Table 33). All nests at Cottonwood Ranch had a camera present, so it was excluded from comparison of DSR by camera presence. For both plover and tern nests on the other five sites combined, we found nests with a camera (DSR: 0.956; LCL: 0.936; UCL: 0.972) had a significantly lower DSR than nests without a camera (DSR: 0.972; LCL: 0.959; UCL: 0.982; Figure 43).

We also found significant differences in DSR both within and among the five sites that had nests with and without a camera (Table 36, Figure 44). DSR was significantly lower for nests with a camera compared to nests without a camera at Dyer ( $p < 0.001$ ; \*\*\*), Newark East ( $p = 0.029$ ; \*), and Leaman ( $p < 0.001$ ; \*\*\*). DSR was significantly higher for nests with a camera compared to nests without a camera at Kearney Broadfoot South ( $p < 0.001$ ; \*\*\*) and Newark West ( $p = 0.003$ ; \*\*).

Biologists deployed cameras at 38 of 52 plover nests at the six OCSW sites (Table 33). There was no significant difference in DSR at nests with (DSR: 0.963; LCL: 0.949; UCL: 1) and without (DSR: 0.978; LCL: 0.962; UCL: 1) a camera for plovers during 2025 (Figure 45). Biologists

deployed cameras at 61 of 130 tern nests at the six sites (Table 33). DSR for nests with a camera (DSR: 0.948; LCL: 0.929; UCL: 0.967) was significantly lower than nests without a camera (DSR: 0.971; LCL: 0.960; UCL: 0.983) for terns during 2025 (Figure 45).

By site, DSRs for nests with and without cameras in 2025 were lower than each site's median DSR during 2010-2016, prior to the use of nesting site cameras (Figure 46). The DSR of nests with a camera at Cottonwood Ranch in 2025 was closest to the historical median (below the median but above the lower quartile; Figure 46). The DSRs of nests without a camera at Dyer and nests with a camera at Kearney Broadfoot South in 2025 were above the historical minimum but below the lower quartile (Figure 46). All remaining DSRs for nests with and without a camera in 2025 were below the historical minimum (Figure 46).

## DISCUSSION

EDO biologists observed high use and reproductive investment in both plovers and terns during the 2025 monitoring period. The estimated number of breeding pairs (41 plover pairs and 167 tern pairs) and the total number of nests observed (73 plover nests and 236 tern nests) were among the highest observed in the 2010-2025 contemporary monitoring period. Although higher than last year's lows, both plovers and terns experienced low apparent nest success during the 2025 season (0.51 for plovers and 0.53 for terns). It is likely that some renesting was occurring for both species this year because of the wave of nest initiations that occurred following documented nest failures at multiple sites in 2025. Thirty-seven plover nests hatched, producing 60 fledglings for a fledge ratio of 1.46 28D chicks/BPE. For terns, 125 nests hatched, producing 167 fledglings for a fledge ratio of 1.00 21D chicks/BPE.

Great horned owls predated 19 camera monitored nests during the 2025 monitoring season. After observing behavior where great horned owls repeatedly interacted with nest-level cameras at Dyer, Newark West, and Newark East, nest-level cameras were removed from these sites for the remainder of the season to eliminate this potential source of attraction to the nest. To test if great horned owls were attracted to the cameras themselves, three cameras were placed on Newark East outside of the nesting area after nest-level cameras were removed from the site (two cameras facing each other in one area and an individual camera in another area). A week after the cameras were placed, a great horned owl was documented interacting with the two cameras facing each other. No great horned owls were documented on those three cameras for the remainder of the season. Without the use of nest-level cameras on three of the sites with predator monitoring, the proportion of plover and tern nests and broods with a failed-unknown or unknown outcome was higher in 2025 (0.43) when compared to the earlier years of the predator monitoring study from 2021-2024 (0.25). However, it was lower when compared to the years just prior to the predator monitoring study from 2017-2019 (0.51). With the documented behavior of great horned owls interacting with nest-level cameras, the potential effects of camera presence described in [Appendix B](#), and the higher proportion of failed-unknown and unknown outcomes, EDO biologists are working with the Program's Technical Advisory Committee (TAC) to revise the predator monitoring study for 2026. Revisions include limiting the number of cameras associated with nests while still providing data on predator presence to inform trapping and other management actions to reduce predation.

Removing nest-level cameras from half of the sites contributed to the higher proportion of failed-unknown and unknown outcomes, but we also observed failure of 19 tern nests (17% of total 111 unsuccessful nests) due to unknown causes, with adults sitting past the hatch date on eggs that did not hatch. Prolonged incubation of non-viable eggs is widely documented in birds ([Hemmings et al. 2012](#); [Assersohn et al. 2021](#)). Hatching failure is the result of either infertility or embryo mortality ([Hemmings et al. 2012](#)). These can be caused by low genetic diversity, pollution, rising temperatures, environmental stress due to climate change, extreme weather events such as drought, and human disturbance ([Assersohn et al. 2021](#)). Nests documented as failed-unknown due to the adult sitting past the hatch date occurred throughout the nesting season (initiated end of May to mid-July; failed end of June to beginning of August) on four different sites throughout the AHR (Dyer [1 nest], Kearney Broadfoot South [2 nests], Newark East [8 nests], and Leaman [8 nests]). Therefore, failures could have been caused by any or a combination of the factors Assersohn et al. (2021) discusses. We are not aware of any published estimates of the frequency of this behavior in interior least terns. Existing California least tern (*Sternula antillarum browni*) monitoring reports categorize a subset of nests as “failed after full incubation”; with 27% of unsuccessful California least tern nests reported by Housel et al. (2017), but only 2% sitting 48-59 days past hatch date according to Patton (2019).

Before nest-level cameras were removed on Newark West near the end of the nesting season, biologists documented five of six plover nests and 16 of 28 tern nests on both peninsulas fail due to predation, all by striped skunk. This is the second of five years that Newark West has been above the USFWS established threshold, which is the loss of 70% or more of nests to predation in three of five years ([USFWS 2006](#), [USFWS 2018](#)). To reduce access by terrestrial predators on this site, Newark West will be renovated prior to the 2026 monitoring season. The narrow water boundary between the two peninsulas will be excavated and the areas near the southeast peninsula entrance will be deepened to widen the water barrier (Figure 31). The peninsula entrance fence on the northwest peninsula will be replaced with a longer fence extending past narrow bank to peninsula areas, and horizontal paneling and crushed concrete will be added to the base. Biologists will document the effectiveness of these renovations with a modified predator monitoring study next year.

Although the full study design for the predator monitoring study will not be implemented for the 2026 monitoring season, the five years of data collected under the same study design from the 2021-2025 monitoring seasons are being used to help answer Extension Science Plan Big Questions, “how much of an effect does predation have on plover productivity” and “how effective is Program management at mitigating losses of plover productivity due to predation”. Using a Before-After-Control-Impact (BACI) design, we are evaluating management effectiveness for improving fledge ratios, quantifying the role of predation on and impact of other factors affecting daily nest and brood survival, and assessing predator communities and responses to management. To determine the effect predation has on productivity, a mixed-effects regression is being applied to analyze predator abundance over time, incorporating site-level variance to explore spatio-temporal variation in predation. Preliminary results indicate that predator presence, predation, and effectiveness of additional management are highly variable among years and sites and appear to be influenced by additional factors remaining to be investigated. In the meantime, PRRIP is using

information provided by cameras to better understand the dynamics of the system, quantify potential nest loss we can expect moving forward, and better understand how plovers and terns respond to predation pressure over time and space.

## **PAST RESEARCH SYNTHESIS**

Plover and tern monitoring and research conducted on the central Platte River since 2001 have been designed and implemented to provide information on an array of topics relevant to species management, including monitoring methods and protocol implementation; habitat use; reproductive success and survival; behavior; population demographics and dispersal; and predator monitoring and management. Reports produced by West Incorporated during 2001-2007 prior to Program implementation provided a general overview of plover and tern habitat use, nesting, and productivity (<https://platteriverprogram.org/program-library; Target Species: piping plover or interior least tern; Keywords: least tern, piping plover, technical reports, protocol implementation>). Upon Program implementation (2008-present), the surveillance monitoring protocol changed, and the resulting reports produced by EDO staff and partners contained more detailed information on implementation of the Program's surveillance monitoring protocol, conservation monitoring, and directed research. This directed research was used to address priority hypotheses developed in the Program's Adaptive Management Plan and evaluate progress toward the Program's First Increment and First Increment Extension management objectives. Design and implementation of research activities were guided by the EDO and the TAC, reviewed by the Program's Independent Scientific Advisory Committee (ISAC), and ultimately approved by the Program's GC. Links to these studies and other research relevant to the Program's objectives and our understanding of plover and tern ecology are provided in the [Appendix Table A1](#).

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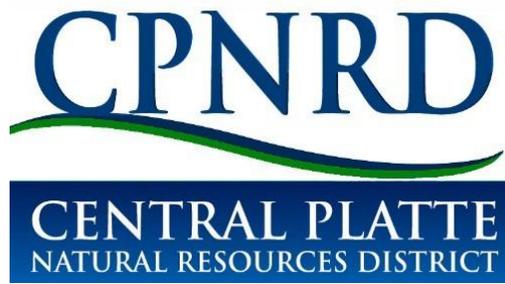
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## **TABLES**

**Table 1.** Summary of piping plover reproductive effort and success at off-channel sand and water (OCSW) and river island sites along the central Platte River in Nebraska, 2001-2009. Data collected during 2001-2009 used different monitoring protocols than 2010-2025. Changes adopted in 2010 included an increase of fledge age from 15 days to 28 days and an increase in monitoring effort.

<b>Reproductive Parameter</b>	<b>Piping Plover</b>								
	<b>2001</b>	<b>2002</b>	<b>2003</b>	<b>2004</b>	<b>2005</b>	<b>2006</b>	<b>2007</b>	<b>2008</b>	<b>2009</b>
Max Adult Count	25	40	34	51	48	47	66	45	47
Peak Breeding Pair Estimate (BPE)	10	13	14	11	14	13	16	13	12
Total Nests Observed	10	15	15	13	20	15	20	18	14
Successful Nests ( $\geq 1$ egg hatched)	8	13	13	9	15	11	15	8	9
Apparent Nest Success	0.80	0.87	0.87	0.69	0.75	0.73	0.75	0.44	0.64
Daily Nest Survival Rate	0.98	0.99	0.99	0.98	0.98	0.98	0.99	0.98	0.99
Incubation-period Survival Rate	0.53	0.75	0.85	0.63	0.64	0.65	0.71	0.58	0.67
Broods Observed	8	13	13	9	15	11	15	8	9
Chicks Observed (<15D)	28	28	43	34	46	37	45	26	30
Hatch Ratio (<15D Chicks/Nest)	2.80	1.87	2.87	2.62	2.30	2.47	2.25	1.44	2.14
Hatch Ratio (<15D Chicks/BPE)	2.80	2.15	3.07	3.09	3.29	2.85	2.81	2.00	2.50
Chicks ( $\geq 15D$ )	23	28	22	23	28	29	27	10	12
Fledglings (28D)	--- <sup>A</sup>	---	---	---	---	---	---	---	---
Historic Fledge Ratio ( $\geq 15D$ Chicks/Nest)	2.30	1.87	1.47	1.77	1.40	1.93	1.35	0.56	0.86
Fledge Ratio (28D Chicks/Nest)	---	---	---	---	---	---	---	---	---
Historic Fledge Ratio ( $\geq 15D$ Chicks/BPE)	2.30	2.15	1.57	2.09	2.00	2.23	1.69	0.77	1.00
Fledge Ratio (28D Chicks/BPE)	---	---	---	---	---	---	---	---	---
Daily Brood Survival Rate	---	---	---	---	---	---	---	0.94	0.98
Brooding-period Survival Rate	---	---	---	---	---	---	---	0.42	0.79

<sup>A</sup> “---” years for which indicated data were not collected.

**Table 2.** Summary of piping plover reproductive effort and success at off-channel sand and water (OCSW) and river island sites along the central Platte River in Nebraska, 2010-2025. Data collected during 2010-2025 used different monitoring protocols than 2001-2009. Changes adopted in 2010 included an increase of fledge age from 15 days to 28 days and an increase in monitoring effort.

Reproductive Parameter	Piping Plover															
	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
Max Adult Count	96	71	73	94	108	99	108	77	74	88	71	67	74	82	101	105
Peak Breeding Pair Estimate (BPE)	20	28	30	27	30	40	43	40	37	45	31	36	37	41	47	41
Total Nests Observed	35	34	46	31	43	54	60	50	47	60	49	50	55	48	74	73
Successful Nests ( $\geq 1$ egg hatched)	21	27	32	23	34	34	40	30	35	31	28	30	30	40	35	37
Apparent Nest Success	0.60	0.79	0.70	0.74	0.79	0.63	0.67	0.60	0.74	0.52	0.57	0.60	0.55	0.83	0.47	0.51
Daily Nest Survival Rate	0.98	0.99	0.99	0.99	0.99	0.98	0.99	0.98	0.99	0.98	0.98	0.98	0.97	0.99	0.97	0.98
Incubation-period Survival Rate	0.54	0.77	0.69	0.74	0.77	0.64	0.69	0.61	0.68	0.51	0.51	0.54	0.48	0.80	0.46	0.56
Broods Observed	21	27	32	23	34	34	40	30	35	31	28	30	30	40	35	37
Chicks Observed (<15D)	76	88	99	80	116	119	120	92	95	94	98	99	100	143	120	111
Hatch Ratio (<15D Chicks/Nest)	2.17	2.59	2.15	2.58	2.70	2.20	2.00	1.84	2.02	1.57	2	1.98	1.82	2.98	1.62	1.52
Hatch Ratio (<15D Chicks/BPE)	3.80	3.14	3.30	2.96	3.87	2.98	2.79	2.3	2.57	2.09	3.16	2.75	2.70	3.49	2.55	2.71
Chicks ( $\geq 15D$ )	50	61	68	43	67	73	70	53	32	42	52	45	65	65	70	69
Fledglings (28D)	41	46	59	28	55	52	55	47	23	30	39	35	52	58	63	60
Historic Fledge Ratio ( $\geq 15D$ Chicks/Nest)	1.43	1.79	1.48	1.39	1.56	1.35	1.17	1.06	0.68	0.70	1.06	0.90	1.18	1.35	0.95	0.95
Fledge Ratio (28D Chicks/Nest)	1.17	1.35	1.28	0.90	1.28	0.96	0.92	0.94	0.49	0.50	0.80	0.70	0.95	1.21	0.85	0.82
Historic Fledge Ratio ( $\geq 15D$ Chicks/BPE)	2.50	2.18	2.27	1.59	2.23	1.83	1.63	1.33	0.86	0.93	1.68	1.25	1.76	1.59	1.49	1.68
Fledge Ratio (28D Chicks/BPE)	2.05	1.64	1.97	1.04	1.83	1.30	1.28	1.18	0.62	0.67	1.26	0.97	1.41	1.41	1.34	1.46
Daily Brood Survival Rate	0.99	0.99	0.99	0.98	0.99	0.99	0.98	0.98	0.96	0.97	0.98	0.98	0.99	0.99	0.99	0.99
Brooding-period Survival Rate	0.70	0.73	0.78	0.62	0.69	0.68	0.55	0.63	0.29	0.44	0.58	0.51	0.79	0.69	0.73	0.80

**Table 3.** Site-specific numbers of adults, nests, chicks, and fledglings observed while monitoring off-channel sand and water (OCSW) nesting sites adjacent to the central Platte River in Nebraska for piping plover reproduction during 2025. Numbers of estimated breeding pairs (BPE), apparent nest success, fledge ratios, and survey effort are provided for each site. Site numbers correspond with Figure 2.

Site Name and No.	Piping Plover													
	Management <sup>A</sup>	No. Surveys	Hours of Observation	Peak BPE (AHR peak date <sup>B</sup> )	Peak BPE (Site peak date <sup>C</sup> )	Adult Counts	No. Nests	No. Nests Hatched	No. Chicks 0–14 days	No. Chicks 15–28 days	No. Fledglings	Apparent Nest Success	Fledge Ratio (AHR peak date <sup>B</sup> )	Fledge Ratio (Site peak date <sup>C</sup> )
1. OSG Lexington	BFHPT	36	49	4	5	11	7	5	10	5	2	0.71	0.50	0.40
2. NPPD Lexington	FPT	25	28	2	2	4	2	2	7	0	0	1.00	0.00	0.00
3. Dyer	FHPT	35	46	6	7	14	15	4	12	11	10	0.27	1.67	1.43
4. Cottonwood Ranch	FHPT	34	36	2	2	4	2	2	6	4	2	1.00	1.00	1.00
5. T&F Lakeside	AN	11	6	---D	---D	0	0	0	0	0	0	---D	---D	---D
6. Blue Hole	PT	39	57	6	6	14	6	6	22	19	18	1.00	3.00	3.00
7. Johnson	FP	6	3	---D	---D	0	0	0	0	0	0	---D	---D	---D
8. Ed Broadfoot and Sons	AN	7	4	---D	---D	0	0	0	0	0	0	---D	---D	---D
9. Kearney Broadfoot South	BFHILPT	37	34	4	6	13	11	3	8	5	5	0.27	1.25	0.83
10. NAI Kearney Broadfoot South	AT	12	6	---D	---D	3	0	0	0	0	0	---D	---D	---D
11. Newark West	EFHLPT	38	27	2	3	7	6	1	3	3	3	0.17	1.50	1.00
12. Newark East	AFHPT	38	32	6	8	17	14	7	22	7	7	0.50	1.17	0.88
13. Leaman	FHLPT	32	19	3	3	8	4	3	10	6	6	0.75	2.00	2.00
14. Follmer	AFHPT	28	26	5	5	8	5	3	7	7	6	0.60	1.20	1.20
15. Trust Wildrose East	DP	28	14	1	1	2	1	1	4	2	1	1.00	1.00	1.00
16. DeWeese	AN	8	4	---D	---D	0	0	0	0	0	0	---D	---D	---D
17. Hooker Brothers Southeast	N	21	11	---D	---D	0	0	0	0	0	0	---D	---D	---D
18. Hooker Brothers East	AN	8	4	---D	---D	0	0	0	0	0	0	---D	---D	---D

<sup>A</sup> Management actions include: active sand/gravel mining within primary nesting area (A), active sand/gravel mining outside primary nesting peninsula (B), diking (D), exterior predator fencing (E), peninsula entry predator fencing (F), fall 2024 herbicide (H), interior predator fencing (I), predator deterrent lights (L), no management (N), spring 2025 pre-emergent herbicide (P), or predator trapping (T). See the Management Section of this report for a detailed description of management actions taken at each site.

<sup>B</sup> Peak estimated number of breeding pairs (BPE) at each site as calculated using the Program’s BPE calculator on 16 June, when numbers of piping plover breeding pairs observed within the entire Program Associated Habitat Reach first peaked.

<sup>C</sup> Peak BPE (site peak date) represents the highest number of estimated pairs at a site during the nesting season, regardless of AHR Peak Breeding Pair dates.

<sup>D</sup> “---” denotes cannot be calculated.

**Table 4.** Peak estimated number of breeding pairs (BPE), number of nests and successful nests, and productivity by year for piping plovers at off-channel sand and water (OCSW) sites adjacent to the central Platte River in Nebraska, 2001-2025.

Year	Piping Plover				
	Off-Channel Peak BPE <sup>A</sup>	No. Nests	No. Successful Nests	No. Fledglings <sup>B</sup>	Fledglings Per Peak BPE <sup>AB</sup>
2001	10	10	8	22	2.20
2002	13	15	13	28	2.15
2003	14	15	13	22	1.57
2004	11	13	9	23	2.09
2005	14	20	15	28	2.00
2006	13	15	11	29	2.23
2007	14	16	13	20	1.43
2008	10	13	10	7	0.70
2009	10	12	8	11	1.10
2010	18	22	17	31	1.72
2011	28	34	27	46	1.64
2012	29	45	31	55	1.90
2013	27	31	23	28	1.04
2014	29	41	33	55	1.90
2015	35	47	33	51	1.46
2016	42	58	39	54	1.29
2017	40	50	30	47	1.18
2018	37	47	35	23	0.62
2019	45	60	31	30	0.67
2020	31	49	28	39	1.26
2021	36	50	30	35	0.97
2022	37	55	30	52	1.41
2023	41	47	40	58	1.41
2024	47	74	35	63	1.34
2025	41	73	37	60	1.46
<b>Mean</b>	<b>26.88</b>	<b>36.48</b>	<b>23.96</b>	<b>36.68</b>	<b>1.47</b>

<sup>A</sup> BPE represents the peak recorded at off-channel sites. Peak BPE dates differ on-channel and off-channel and each may differ from the overall AHR peak BPE.

<sup>B</sup> The dotted black line represents a change in protocol between 2009 and 2010. Among other changes, in 2010 the Program began to use 28 days as the fledge age for piping plover chicks rather than the previous 15-day success interval.

**Table 5.** Peak estimated number of breeding pairs (BPE), number of nests and successful nests, and productivity by year for piping plovers at on-channel sites on the central Platte River in Nebraska, 2001-2025.

Year	Piping Plover				
	On-Channel Peak BPE <sup>A</sup>	No. Nests	No. Successful Nests	No. Fledglings <sup>B</sup>	Fledglings Per Peak BPE <sup>AB</sup>
2001	--- <sup>C</sup>	0	0	0	---
2002	---	0	0	0	---
2003	---	0	0	0	---
2004	---	0	0	0	---
2005	---	0	0	0	---
2006	---	0	0	0	---
2007	4	4	2	7	1.75
2008	3	5	1	3	1.00
2009	2	2	1	1	0.50
2010	5	13	4	10	2.00
2011	---	0	0	0	---
2012	1	1	1	4	4.00
2013	---	0	0	0	---
2014	2	2	1	4	2.00
2015	6	7	1	1	0.17
2016	1	2	1	1	1.00
2017	---	0	0	0	---
2018	---	0	0	0	---
2019	---	0	0	0	---
2020	---	0	0	0	---
2021	---	0	0	0	---
2022	---	0	0	0	---
2023	1	1	0	0	0.00
2024	---	0	0	0	---
2025	---	0	0	0	---
<b>Mean</b>	<b>2.78</b>	<b>1.48</b>	<b>0.48</b>	<b>1.24</b>	<b>1.38</b>

<sup>A</sup> BPE represents the peak recorded at on-channel sites. Peak BPE dates differ on-channel and off-channel and each may differ from the overall AHR peak BPE.

<sup>B</sup> The dotted black line represents a change in protocol between 2009 and 2010. Among other changes, in 2010 the Program began to use 28 days as the fledge age for piping plover chicks rather than the previous 15-day success interval.

<sup>C</sup> “---” denotes cannot be calculated.

**Table 6.** Number of piping plover adults, estimated number of piping plover breeding pairs (BPE), and numbers of piping plover nests, chicks, and fledglings documented from outside the nesting area (i.e., outside monitoring) during semi-monthly off-channel sand and water (OCSW) site surveys on sites adjacent to the central Platte River in Nebraska in 2025.

<b>Piping Plover</b>					
<b>Survey Date</b>	<b>No. Adults</b>	<b>BPE<sup>A</sup></b>	<b>No. Nests</b>	<b>No. Chicks</b>	<b>No. Fledglings</b>
1-May	38	0	1	0	0
15-May	66	32	27	0	0
1-Jun	55	38	15	8	0
15-Jun	65	40	22	26	0
1-Jul	70	39	21	28	19
15-Jul	30	26	5	18	6
1-Aug	11	11	0	20	6

<sup>A</sup> BPE represents the estimated number of breeding pairs present on OCSW sites on 1 and 15 May, 1 and 15 June, 1 and 15 July, and 1 August. BPE may be different from number of nests because it sums the number of active or recently failed nests (within the species-defined renest interval) plus the number of active or recently failed or fledged broods (within the species-defined renest or post fledge interval, respectively) on the 1<sup>st</sup> or 15<sup>th</sup> of the month. Number of nests reflect counts from semi-monthly surveys that occurred over several days that were close to, but not necessarily on, the indicated survey date.

**Table 7.** Number of piping plover adults, estimated number of piping plover breeding pairs (BPE), and numbers of piping plover nests, chicks, and fledglings observed during monthly airboat river surveys of the central Platte River in Nebraska in 2025.

<b>Piping Plover</b>					
<b>Survey Month</b>	<b>No. Adults</b>	<b>BPE<sup>A</sup></b>	<b>No. Nests</b>	<b>No. Chicks</b>	<b>No. Fledglings</b>
May <sup>B</sup>	3	--- <sup>C</sup>	0	0	0
June	8	---	0	0	0
July	5	---	0	0	7
August	3	---	0	0	3

<sup>A</sup> BPE represents the estimated number of breeding pairs present on river islands on 20 May, 18 June, 8 July, and 5 August. Breeding pair counts were obtained using the Program’s BPE calculator. BPE may be different from number of nests because it sums the number of active or recently failed nests (within the species-defined renest interval) plus the number of active or recently failed or fledged broods (within the species-defined renest or post fledge interval, respectively) on the first day of the river survey. Number of nests reflect counts from monthly river surveys that occurred over 20-21 May, 18-19 June, 8-9 July, and 5-6 August.

<sup>B</sup> The Alda bridge to Hwy 34 bridge sections were not entirely completed due to low water levels preventing access by airboat and severe weather. Point counts were conducted at the Hwy 281, South Locust, and Hwy 34 bridges.

<sup>C</sup> "---"denotes cannot be calculated.

**Table 8.** Daily and incubation-period survival rates and 95% lower (LCL) and upper confidence limits (LCL) for piping plover nests monitored on OCSW sites adjacent to the central Platte River in Nebraska in 2025. Incubation-period nest survival rate = daily nest survival rate<sup>28</sup>.

Site	Management <sup>A</sup>	No. Nests	No. Nests Failed	Exposure Days	Daily Nest Survival Rate	Daily Nest Survival Rate		Incubation Period Survival Rate	Incubation Period Survival Rate	
						LCL	UCL		LCL	UCL
OSG Lexington	BFHPT	7	2	112	0.982	0.961	1	0.595	0.326	1
NPPD Lexington	FPT	2	0	40	1	1	1	1	1	1
Dyer <sup>B</sup>	FHPT	15	11	229	0.951	0.918	0.974	0.245	0.090	0.472
Cottonwood Ranch	FHPT	2	0	34	1	1	1	1	1	1
Blue Hole	PT	6	0	122	1	1	1	1	1	1
Kearney Broadfoot South	BFHILPT	11	8	198	0.958	0.928	0.979	0.300	0.125	0.551
Newark West	EFHLPT	6	5	88	0.940	0.902	0.987	0.179	0.055	0.688
Newark East	AFHPT	14	5	358	0.986*	0.975	0.995	0.671	0.487	0.860
Leaman	FHLPT	4	1	81	0.988	0.944	1	0.706	0.197	1
Follmer	AFHPT	5	2	93	0.978	0.948	1	0.533	0.226	1
Trust Wildrose East	DP	1	0	28	1	1	1	1	1	1
<b>All Sites</b>		<b>73</b>	<b>34</b>	<b>1,383</b>	<b>0.980</b>	<b>0.965</b>	<b>0.990</b>	<b>0.564</b>	<b>0.366</b>	<b>0.748</b>

<sup>A</sup> Management actions include: active sand/gravel mining within primary nesting area (A), active sand/gravel mining outside primary nesting peninsula (B), disking (D), exterior predator fencing (E), peninsula entry predator fencing (F), fall 2024 herbicide (H), interior predator fencing (I), predator deterrent lights (L), spring 2025 pre-emergent herbicide (P), or predator trapping (T). See the Management Section of this report for a detailed description of management actions taken at each site.

<sup>B</sup> Reference site

\*Survival rates that were significantly different from the reference site are denoted (\*p<0.05, \*\*p<0.01, \*\*\*p<0.001).

**Table 9.** Daily and incubation-period survival rates and 95% lower (LCL) and upper confidence limits (LCL) for piping plover nests monitored on Program and non-Program OCSW sites adjacent to the central Platte River in Nebraska in 2025. Incubation-period nest survival rate = daily nest survival rate<sup>28</sup>.

Ownership	No. Nests	No. Nests Failed	Exposure Days	Daily Nest Survival Rate	Daily Nest Survival Rate		Incubation Period Survival Rate	Incubation Period Survival Rate	
					LCL	UCL		LCL	UCL
Program <sup>A</sup>	64	34	1193	0.971	0.958	0.984	0.437	0.297	0.639
Non-Program <sup>B</sup>	9	0	190	1	1	1	1	1	1
<b>All Sites</b>	<b>73</b>	<b>34</b>	<b>1,383</b>	<b>0.980</b>	<b>0.965</b>	<b>0.990</b>	<b>0.564</b>	<b>0.366</b>	<b>0.748</b>

<sup>A</sup> Program sites: OSG Lexington, Dyer, Cottonwood Ranch, Kearney Broadfoot South, Newark West, Newark East, Leaman, and Follmer.

<sup>B</sup> Non-Program sites: NPPD Lexington, Blue Hole, and Trust Wildrose East.

**Table 10.** Daily and brooding-period survival rates and 95% lower (LCL) and upper confidence limits (LCL) for observed piping plover broods ( $\geq 1$  chicks) monitored on OCSW sites adjacent to the central Platte River in Nebraska in 2025. Brooding-period survival rate = daily brood survival rate<sup>28</sup>.

Site	Management <sup>A</sup>	No. Broods	No. Broods Failed	Exposure Days	Daily Brood Survival Rate	Daily Brood Survival Rate		Brooding Period Survival Rate	Brooding Period Survival Rate	
						LCL	UCL		LCL	UCL
OSG Lexington	BFHPT	5	4	94	0.955	0.888	0.982	0.273	0.036	0.609
NPPD Lexington	FPT	2	2	24	0.906	0.705	0.975	0.063	0.000	0.493
Dyer <sup>B</sup>	FHPT	4	0	112	1	1	1	1	1	1
Cottonwood Ranch	FHPT	2	0	56	1	1	1	1	1	1
Blue Hole	PT	6	0	161	1	1	1	1	1	1
Kearney Broadfoot South	BFHILPT	3	1	62	0.983	0.894	0.998	0.627	0.043	0.936
Newark West	EFHLPT	1	0	28	1	1	1	1	1	1
Newark East	AFHPT	7	4	93	0.978	0.918	0.994	0.538	0.090	0.856
Leaman	FHLPT	3	1	71	0.986	0.907	0.998	0.668	0.064	0.945
Follmer	AFHPT	3	0	83	1	1	1	1	1	1
Trust Wildrose East	DP	1	0	28	1	1	1	1	1	1
<b>All Sites</b>		<b>37</b>	<b>12</b>	<b>812</b>	<b>0.992</b>	<b>0.980</b>	<b>1</b>	<b>0.796</b>	<b>0.575</b>	<b>0.994</b>

<sup>A</sup> Management actions include: active sand/gravel mining within primary nesting area (A), active sand/gravel mining outside primary nesting peninsula (B), disking (D), exterior predator fencing (E), peninsula entry predator fencing (F), fall 2024 herbicide (H), interior predator fencing (I), predator deterrent lights (L), spring 2025 pre-emergent herbicide (P), or predator trapping (T). See the Management Section of this report for a detailed description of management actions taken at each site.

<sup>B</sup> Reference site

**Table 11.** Daily and brooding-period survival rates and 95% lower (LCL) and upper confidence limits (LCL) for piping plover broods ( $\geq 1$  chicks) monitored on Program and non-Program OCSW sites adjacent to the central Platte River in Nebraska in 2025. Brooding-period survival rate = daily brood survival rate<sup>28</sup>.

Ownership	No. Broods	No. Broods Failed	Exposure Days	Daily Brood Survival Rate	Daily Brood Survival Rate		Brooding Period Survival Rate	Brooding Period Survival Rate		
					LCL	UCL		LCL	UCL	
Program <sup>A</sup>	28	10	599	0.992	0.978	0.999	0.802	0.532	0.979	
Non-Program <sup>B</sup>	9	2	213	0.991	0.954	0.998	0.777	0.271	0.950	
<b>All Sites</b>		<b>37</b>	<b>12</b>	<b>812</b>	<b>0.992</b>	<b>0.980</b>	<b>1</b>	<b>0.796</b>	<b>0.575</b>	<b>0.994</b>

<sup>A</sup> Program sites: OSG Lexington, Dyer, Cottonwood Ranch, Kearney Broadfoot South, Newark West, Newark East, Leaman, and Follmer.

<sup>B</sup> Non-Program sites: NPPD Lexington, Blue Hole, and Trust Wildrose East.

**Table 12.** Piping plover incidental take at Program and non-Program sites during 2007-2025 under five take categories as specified by [USFWS 2006](#) and [USFWS 2018](#). Each cell in the table is shaded as white (no data available); green (below established limit for allowable take for a given year); or red (exceeded established limit for allowable take for a given year). Green shaded cells without values had no documented take.

Allowable Take <sup>A</sup>	First Increment Year													Extension Year						
	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	
<b>Inundating Flow</b>																				
<b>Inland Lakes</b>														1 <sup>B</sup>						
<b>Habitat Restoration and Land Management</b>	1 <sup>C</sup>																			
<b>Research and Monitoring</b>	1 <sup>D</sup>					1 <sup>E</sup>														
<b>Percent of Nests and Chicks Observed at Site Lost Due to Predation<sup>F</sup></b>																				
<b>Off-channel Sand and Water (OCSW) Nesting Sites</b>	<b>Nests</b>	OSG Lexington																		
		NPPD Lexington				17%			20%							20%	29%		50%	
		Dyer													21%		36%	11%	33%	53%
		Cottonwood Ranch							50%									33%	33%	
		Blue Hole	17%		20%					13%		38%	8%	25%	14%	43%	20%	14%		
		Johnson				33%							100%							
		Ed Broadfoot and Sons																		
		Kearney Broadfoot South								31%					11%	31%			85%	45%
		NAI Kearney Broadfoot South																		
		Newark West								17%						25%	88%		57%	83%
		Newark East													17%		14%	9%		7%
		Leaman													50%	100%				
		Trust Wildrose East									25%		50%							
		Follmer																		
		Hooker Brothers Southeast																		

Table 12 continued		First Increment Year													Extension Year						
		2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	
Off-channel Sand and Water (OSCW) Nesting Sites	Chicks	OSG Lexington																			
		NPPD Lexington														20%					
		Dyer							33%									14%			
		Cottonwood Ranch																			
		Blue Hole											61%								
		Johnson																			
		Ed Broadfoot and Sons																			
		Kearney Broadfoot South								6%							16%			50%	
		NAI Kearney Broadfoot South																			
		Newark West															27%	100%			
		Newark East																		7%	27%
		Leaman																			
		Trust Wildrose East																			
		Follmer																			
Hooker Brothers Southeast																					

<sup>A</sup> For Allowable Take information, see [USFWS 2006](#), [USFWS 2018](#), and [USBR 2018](#).

<sup>B</sup> One plover nest containing four plover eggs was inundated at Lake Minatare on 6/5/2022 ([PRRIP 2023](#)).

<sup>C</sup> The Program observed one habitat restoration and land management plover chick mortality during 2014 due to electrocution in a predator deterrent fence ([Cahis and Baasch 2015](#)).

<sup>D</sup> The Program observed one research-related plover chick mortality during 2011 due to flushing the chick into the water where it was consumed by a fish ([Baasch 2012](#)).

<sup>E</sup> The Program observed one research-related plover chick mortality during 2013 due to a chick attempting to fly and landing into the water where it was consumed by a fish ([Baasch 2014](#)).

<sup>F</sup> As of 12/31/2016, a limited amount of predation was observed and did not exceed the Service's threshold at any Program owned or managed off-channel sand and water nesting site in any year ([USBR 2018](#)). Increased effort to monitor predator activities began in 2017, which has resulted in more documented predation than during the First Increment, but losses to predation have not exceeded the Service's established threshold (i.e., the loss of 70% of nests or 80% of chicks to predation in three of five years for sites that average at least three plover nests).

**Table 13.** Summary of least tern reproductive effort and success at off-channel sand and water (OCSW) and river island sites along the central Platte River in Nebraska, 2001-2009. Data collected during 2001-2009 used different monitoring protocols than 2010-2025. Changes adopted in 2010 included an increase of fledge age from 15 days to 21 days and an increase in monitoring effort.

Reproductive Parameter	Least Tern								
	2001	2002	2003	2004	2005	2006	2007	2008	2009
Max Adult Count	45	117	105	133	184	122	133	145	114
Peak Breeding Pair Estimate (BPE)	22	33	38	39	45	33	38	36	42
Total Nests Observed	27	39	49	48	56	49	49	55	54
Successful Nests ( $\geq 1$ egg hatched)	20	27	31	33	38	19	22	29	29
Apparent Nest Success	0.74	0.69	0.63	0.69	0.68	0.39	0.45	0.53	0.54
Daily Nest Survival Rate	0.98	0.98	0.98	0.98	0.98	0.96	0.97	0.98	0.99 <sup>A</sup>
Incubation-period Survival Rate	0.70	0.70	0.62	0.70	0.70	0.46	0.55	0.61	0.73 <sup>A</sup>
Broods Observed	20	27	31	33	38	19	22	29	29
Chicks Observed (<15D)	46	65	62	72	73	38	49	59	68
Hatch Ratio (<15D Chicks/Nest)	1.70	1.67	1.27	1.50	1.30	0.78	1.00	1.07	1.26
Hatch Ratio (<15D Chicks/BPE)	2.09	1.97	1.63	1.85	1.62	1.15	1.29	1.64	1.62
Chicks ( $\geq 15D$ )	44	59	57	60	62	25	40	44	46
Fledglings (21D)	--- <sup>B</sup>	---	---	---	---	---	---	---	---
Historic Fledge Ratio ( $\geq 15D$ Chicks/Nest)	1.63	1.51	1.16	1.25	1.11	0.51	0.82	0.80	0.85
Fledge Ratio (21D Chicks/Nest)	---	---	---	---	---	---	---	---	---
Historic Fledge Ratio ( $\geq 15D$ Chicks/BPE)	2.00	1.79	1.50	1.54	1.38	0.76	1.05	1.22	1.10
Fledge Ratio (21D Chicks/BPE)	---	---	---	---	---	---	---	---	---
Daily Brood Survival Rate	---	---	---	---	---	---	---	0.98	0.98 <sup>C</sup>
Brooding-period Survival Rate	---	---	---	---	---	---	---	0.75	0.79 <sup>C</sup>

<sup>A</sup> Does not include reproductive information from Mormon Island.

<sup>B</sup> “---” denotes years for which indicated data were not collected.

<sup>C</sup> Does not include reproductive information from Dinan Island.

**Table 14.** Summary of least tern reproductive effort and success at off-channel sand and water (OCSW) and river island sites along the central Platte River in Nebraska, 2010-2025. Data collected during 2010-2025 used different monitoring protocols than 2001-2009. Changes adopted in 2010 included an increase of fledge age from 15 days to 21 days and an increase in monitoring effort.

Reproductive Parameter	Least Tern															
	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
Max Adult Count	170	150	137	197	260	262	200	159	174	169	158	166	188	157	334	335
Peak Breeding Pair Estimate (BPE)	53	62	66	65	94	141	88	78	88	93	83	83	85	90	141	167
Total Nests Observed	76	90	88	96	146	187	122	118	112	132	105	99	128	124	221	236
Successful Nests ( $\geq 1$ egg hatched)	48	52	63	51	82	116	77	63	79	67	74	64	86	83	95	125
Apparent Nest Success	0.63	0.58	0.72	0.53	0.56	0.62	0.63	0.53	0.71	0.51	0.70	0.65	0.67	0.67	0.43	0.53
Daily Nest Survival Rate	0.98	0.97	0.99	0.97	0.97	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.96	0.98
Incubation-period Survival Rate	0.64	0.58	0.76	0.56	0.52	0.63	0.71	0.61	0.65	0.61	0.72	0.65	0.64	0.66	0.45	0.60
Broods Observed	48	52	63	51	82	116	77	63	79	67	74	64	86	83	95	125
Chicks Observed (<15D)	122	125	144	118	180	258	170	129	168	137	160	158	196	207	184	255
Hatch Ratio (<15D Chicks/Nest)	1.61	1.39	1.64	1.23	1.23	1.38	1.39	1.09	1.50	1.04	1.52	1.60	1.53	1.67	0.83	1.08
Hatch Ratio (<15D Chicks/BPE)	2.30	2.02	2.18	1.82	1.91	1.83	1.93	1.65	1.91	1.47	1.93	1.90	2.31	2.30	1.30	1.53
Chicks ( $\geq 15D$ )	76	101	95	70	104	158	91	78	113	74	97	100	141	126	127	155
Fledglings (21D)	75	96	84	64	91	146	80	76	117	71	107	102	143	124	118	167
Historic Fledge Ratio ( $\geq 15D$ Chicks/Nest)	1.00	1.12	1.08	0.73	0.71	0.84	0.75	0.66	1.01	0.56	0.92	1.01	1.10	1.02	0.57	0.66
Fledge Ratio (21D Chicks/Nest)	0.99	1.07	0.95	0.67	0.62	0.78	0.66	0.64	1.04	0.54	1.02	1.03	1.12	1.00	0.53	0.71
Historic Fledge Ratio ( $\geq 15D$ Chicks/BPE)	1.43	1.63	1.44	1.08	1.11	1.12	1.03	1.00	1.28	0.80	1.17	1.20	1.66	1.40	0.90	0.93
Fledge Ratio (21D Chicks/BPE)	1.42	1.55	1.27	0.98	0.97	1.04	0.91	0.97	1.33	0.76	1.29	1.23	1.68	1.38	0.84	1.00
Daily Brood Survival Rate	0.98	0.99	0.99	0.97	0.98	0.98	0.98	0.97	0.98	0.97	0.98	0.99	0.99	0.99	0.99	0.98
Brooding-period Survival Rate	0.72	0.89	0.81	0.59	0.69	0.68	0.61	0.56	0.69	0.57	0.70	0.77	0.84	0.85	0.82	0.72

**Table 15.** Site-specific numbers of adults, nests, chicks, and fledglings observed while monitoring off-channel sand and water (OCSW) nesting sites adjacent to the central Platte River in Nebraska for least tern reproduction during 2025. Numbers of estimated breeding pairs (BPE), apparent nest success, fledge ratios, and survey effort are provided for each site. Site numbers correspond with Figure 2.

Site Name and No.	Management <sup>A</sup>	Least Tern												
		No. Surveys	Hours of Observation	Peak BPE (AHR peak date <sup>B</sup> )	Peak BPE (Site peak date <sup>C</sup> )	Adult Counts	No. Nests	No. Nests Hatched	No. Chicks 0–14 days	No. Chicks 15–28 days	No. Fledglings	Apparent Nest Success	Fledge Ratio (AHR peak date <sup>B</sup> )	Fledge Ratio (Site peak date <sup>C</sup> )
1. OSG Lexington	BFHPT	36	49	18	19	36	25	11	24	13	14	0.44	0.78	0.74
2. NPPD Lexington	FPT	25	28	1	1	10	1	1	3	0	0	1.00	0.00	0.00
3. Dyer	FHPT	35	46	7	12	30	18	9	15	12	14	0.50	2.00	1.17
4. Cottonwood Ranch	FHPT	34	36	6	10	23	10	9	20	14	10	0.90	1.67	1.00
5. T&F Lakeside	AN	11	6	--- <sup>D</sup>	---	3	0	0	0	0	0	---	---	---
6. Blue Hole	PT	39	57	19	22	36	24	20	45	31	36	0.83	1.89	1.64
7. Johnson	FP	6	3	---	---	0	0	0	0	0	0	---	---	---
8. Ed Broadfoot and Sons	AN	7	4	---	---	0	0	0	0	0	0	---	---	---
9. Kearney Broadfoot South	BFHILPT	37	34	9	9	16	13	7	17	5	5	0.54	0.56	0.56
10. NAI Kearney Broadfoot South	AT	12	6	---	---	1	0	0	0	0	0	---	---	---
11. Newark West	EFHLPT	38	27	13	18	22	28	5	10	6	6	0.18	0.46	0.33
12. Newark East	AFHPT	38	32	31	31	45	41	20	40	34	34	0.49	1.10	1.10
13. Leaman	FHLPT	32	19	11	13	31	20	5	9	1	1	0.25	0.09	0.08
14. Follmer	AFHPT	28	26	46	46	70	49	34	67	39	42	0.69	0.91	0.91
15. Trust Wildrose East	DP	28	14	2	2	4	2	2	4	0	0	1.00	0.00	0.00
16. DeWeese	AN	8	4	---	---	0	0	0	0	0	0	---	---	---
17. Hooker Brothers Southeast	N	21	11	4	4	8	5	2	1	0	5	0.40	1.25	1.25
18. Hooker Brothers East	AN	8	4	---	---	0	0	0	0	0	0	---	---	---

<sup>A</sup> Management actions include: active sand/gravel mining within primary nesting area (A), active sand/gravel mining outside primary nesting peninsula (B), disking (D), exterior predator fencing (E), peninsula entry predator fencing (F), fall 2024 herbicide (H), interior predator fencing (I), predator deterrent lights (L), no management (N), spring 2025 pre-emergent herbicide (P), or predator trapping (T). See the Management Section of this report for a detailed description of management actions taken at each site.

<sup>B</sup> Peak estimated number of breeding pairs (BPE) at each site as calculated using the Program’s BPE calculator on 28 June, when numbers of least tern breeding pairs observed within the entire Program Associated Habitat Reach first peaked.

<sup>C</sup> Peak BPE (site peak date) represents the highest number of estimated pairs at a site during the nesting season, regardless of AHR Peak Breeding Pair dates.

<sup>D</sup> “---” denotes cannot be calculated.

**Table 16.** Peak estimated number of breeding pairs (BPE), number of nests and successful nests, and productivity by year for least terns at off-channel sand and water (OCSW) sites adjacent to the central Platte River in Nebraska, 2001-2025.

Year	Least Tern				
	Off-Channel Peak BPE <sup>A</sup>	No. Nests	No. Successful Nests	No. Fledglings <sup>B</sup>	Fledglings Per Peak BPE <sup>AB</sup>
2001	22	27	20	44	2.00
2002	33	39	27	59	1.79
2003	38	49	31	57	1.50
2004	39	48	33	60	1.54
2005	45	56	38	62	1.38
2006	33	49	19	25	0.76
2007	30	36	20	38	1.27
2008	26	35	21	35	1.35
2009	38	46	24	42	1.11
-----					
2010	53	76	48	75	1.42
2011	62	90	52	96	1.55
2012	66	88	63	84	1.27
2013	65	96	51	64	0.98
2014	94	144	82	91	0.97
2015	133	173	113	146	1.10
2016	86	120	74	80	0.93
2017	78	118	63	76	0.97
2018	88	112	79	117	1.33
2019	93	132	67	71	0.76
2020	83	105	74	107	1.29
2021	83	99	64	102	1.23
2022	85	128	86	143	1.68
2023	90	124	83	124	1.38
2024	141	221	95	118	0.84
2025	167	236	125	167	1.00
<b>Mean</b>	<b>70.84</b>	<b>97.88</b>	<b>58.08</b>	<b>83.32</b>	<b>1.26</b>

<sup>A</sup> BPE represents the peak recorded at off-channel sites. Peak BPE dates differ on-channel and off-channel and each may differ from the overall AHR peak BPE.

<sup>B</sup> The dotted black line represents a change in protocol between 2009 and 2010. Among other changes, in 2010 the Program began to use 21 days as the fledge age for least tern chicks rather than the previous 15-day success to fledge interval.

**Table 17.** Peak estimated number of breeding pairs (BPE), number of nests and successful nests, and productivity by year for least terns at on-channel sites on the central Platte River in Nebraska, 2001-2025.

Year	Least Tern				
	On-Channel Peak BPE <sup>A</sup>	No. Nests	No. Successful Nests	No. Fledglings <sup>B</sup>	Fledglings Per Peak BPE <sup>AB</sup>
2001	--- <sup>C</sup>	0	0	0	---
2002	---	0	0	0	---
2003	---	0	0	0	---
2004	---	0	0	0	---
2005	---	0	0	0	---
2006	---	0	0	0	---
2007	11	13	2	2	0.18
2008	10	20	8	9	0.90
2009	6	8	5	4	0.67
-----					
2010	---	0	0	0	---
2011	---	0	0	0	---
2012	---	0	0	0	---
2013	---	0	0	0	---
2014	2	2	0	0	0.00
2015	8	14	3	0	0.00
2016	2	2	0	0	0.00
2017	---	0	0	0	---
2018	---	0	0	0	---
2019	---	0	0	0	---
2020	---	0	0	0	---
2021	---	0	0	0	---
2022	---	0	0	0	---
2023	---	0	0	0	---
2024	---	0	0	0	---
2025	---	0	0	0	---
<b>Mean</b>	<b>6.50</b>	<b>2.36</b>	<b>0.72</b>	<b>0.60</b>	<b>0.29</b>

<sup>A</sup> BPE represents the peak recorded at on-channel sites. Peak BPE dates differ on-channel and off-channel and each may differ from the overall AHR peak BPE.

<sup>B</sup> The dotted black line represents a change in protocol between 2009 and 2010. Among other changes, in 2010 the Program began to use 21 days as the fledge age for least tern chicks rather than the previous 15-day success interval.

<sup>C</sup> “---” denotes cannot be calculated.

**Table 18.** Number of least tern adults, estimated number of least tern breeding pairs (BPE), and numbers of least tern nests, chicks, and fledglings documented from outside the nesting area (i.e., outside monitoring) during semi-monthly off-channel sand and water (OCSW) site surveys on sites adjacent to the central Platte River in Nebraska in 2025.

Survey Date	Least Tern				
	No. Adults	BPE <sup>A</sup>	No. Nests	No. Chicks	No. Fledglings
1-May	0	0	0	0	0
15-May	52	0	0	0	0
1-Jun	132	50	47	0	0
15-Jun	247	133	128	7	0
1-Jul	193	153	73	62	0
15-Jul	184	139	43	61	30
1-Aug	86	109	11	24	21

<sup>A</sup> BPE represents the estimated number of breeding pairs present on OCSW sites on 1 and 15 May, 1 and 15 June, 1 and 15 July, and 1 August. Breeding pair counts were obtained using the Program's BPE calculator. BPE may be different from number of nests because it sums the number of active or recently failed nests (within the species-defined renest interval) plus the number of active or recently failed or fledged broods (within the species-defined renest or post fledge interval, respectively) on the 1<sup>st</sup> or 15<sup>th</sup> of the month. Number of nests reflect counts from semi-monthly surveys that occurred over several days that were close to, but not necessarily on, the indicated survey date.

**Table 19.** Number of least tern adults, estimated number of least tern breeding pairs (BPE), and numbers of least tern nests, chicks, and fledglings observed during monthly airboat river surveys of the central Platte River in Nebraska in 2025.

Survey Month	Least Tern				
	No. Adults	BPE <sup>A</sup>	No. Nests	No. Chicks	No. Fledglings
May <sup>B</sup>	27	--- <sup>C</sup>	0	0	0
June	41	---	0	0	0
July	52	---	0	0	0
August	67	---	0	0	27

<sup>A</sup> BPE represents the estimated number of breeding pairs present on river islands on 20 May, 18 June, 8 July, and 5 August. Breeding pair counts were obtained using the Program's BPE calculator. BPE may be different from number of nests because it sums the number of active or recently failed nests (within the species-defined renest interval) plus the number of active or recently failed or fledged broods (within the species-defined renest or post fledge interval, respectively) on the first day of the river survey. Number of nests reflect counts from monthly river surveys that occurred over 20-21 May, 18-19 June, 8-9 July, and 5-6 August.

<sup>B</sup> The Alda bridge to Hwy 34 bridge sections were not entirely completed due to low water levels preventing access by airboat and severe weather. Point counts were conducted at the Hwy 281, South Locust, and Hwy 34 bridges.

<sup>C</sup> "---"denotes cannot be calculated.

**Table 20.** Daily and incubation-period survival rates and 95% lower (LCL) and upper confidence limits (LCL) for least tern nests monitored on OCSW sites adjacent to the central Platte River in Nebraska in 2025. Incubation-period nest survival rate = daily nest survival rate<sup>21</sup>.

Site	Management <sup>A</sup>	No. Nests	No. Nests Failed	Exposure Days	Daily Nest Survival Rate	Daily Nest Survival Rate		Incubation Period Survival Rate	Incubation Period Survival Rate	
						LCL	UCL		LCL	UCL
OSG Lexington	BFHPT	25	13	353	0.962	0.940	0.981	0.446	0.274	0.671
NPPD Lexington	FPT	1	0	21	1	1	1	1	1	1
Dyer <sup>B</sup>	FHPT	18	8	294	0.972	0.955	0.989	0.553	0.381	0.797
Cottonwood Ranch	FHPT	10	1	194	0.995	0.985	1	0.897	0.730	1
Blue Hole	PT	24	3	459	0.993*	0.987	1	0.871	0.756	1
Kearney Broadfoot South	BFHILPT	13	6	161	0.969	0.935	0.992	0.521	0.245	0.845
Newark West	EFHLPT	28	23	321	0.935*	0.910	0.959	0.246	0.138	0.411
Newark East	AFHPT	41	20	711	0.971	0.960	0.984	0.543	0.421	0.706
Leaman	FHLPT	20	14	350	0.959	0.940	0.980	0.418	0.273	0.651
Follmer	AFHPT	49	13	736	0.982	0.972	0.990	0.682	0.548	0.814
Trust Wildrose East	DP	2	0	37	1	1	1	1	1	1
Hooker Brothers Southeast	N	5	2	84	0.975	0.932	1	0.593	0.229	1
<b>All Sites</b>		<b>236</b>	<b>103</b>	<b>3,721</b>	<b>0.976</b>	<b>0.963</b>	<b>0.984</b>	<b>0.602</b>	<b>0.454</b>	<b>0.713</b>

<sup>A</sup> Management actions include: active sand/gravel mining within primary nesting area (A), active sand/gravel mining outside primary nesting peninsula (B), disking (D), exterior predator fencing (E), peninsula entry predator fencing (F), fall 2024 herbicide (H), interior predator fencing (I), predator deterrent lights (L), spring 2025 pre-emergent herbicide (P), or predator trapping (T). See the Management Section of this report for a detailed description of management actions taken at each site.

<sup>B</sup> Reference site

\*Survival rates that were significantly different from the reference site are denoted (\*p<0.05, \*\*p<0.01, \*\*\*p<0.001).

**Table 21.** Daily and incubation-period survival rates and 95% lower (LCL) and upper confidence limits (LCL) for least tern nests monitored on Program and non-Program OCSW sites adjacent to the central Platte River in Nebraska in 2025. Incubation-period nest survival rate = daily nest survival rate<sup>21</sup>.

Ownership	No. Nests	No. Nests Failed	Exposure Days	Daily Nest Survival Rate	Daily Nest Survival Rate		Incubation Period Survival Rate	Incubation Period Survival Rate	
					LCL	UCL		LCL	UCL
Program <sup>A</sup>	204	98	3,120	0.970*	0.958	0.979	0.528	0.408	0.637
Non-Program <sup>B</sup>	32	5	601	0.992	0.982	0.998	0.838	0.688	0.955
<b>All Sites</b>	<b>236</b>	<b>103</b>	<b>3,721</b>	<b>0.976</b>	<b>0.963</b>	<b>0.984</b>	<b>0.602</b>	<b>0.454</b>	<b>0.713</b>

<sup>A</sup> Program sites: OSG Lexington, Dyer, Cottonwood Ranch, Kearney Broadfoot South, Newark West, Newark East, Leaman, and Follmer.

<sup>B</sup> Non-Program sites: NPPD Lexington, Blue Hole, Trust Wildrose East, and Hooker Brothers Southeast.

\*Survival rates that were significantly different are denoted (\*p<0.05, \*\*p<0.01, \*\*\*p<0.001).

**Table 22.** Daily and brooding-period survival rates and 95% lower (LCL) and upper confidence limits (LCL) for observed least tern broods ( $\geq 1$  chicks) monitored on OCSW sites adjacent to the central Platte River in Nebraska in 2025. Brooding-period survival rate = daily brood survival rate<sup>21</sup>.

Site	Management <sup>A</sup>	No. Broods	No. Broods Failed	Exposure Days	Daily Brood Survival Rate	Daily Brood Survival Rate		Brooding Period Survival Rate	Brooding Period Survival Rate	
						LCL	UCL		LCL	UCL
OSG Lexington	BFHPT	11	3	200	0.985	0.968	1	0.723	0.510	1
NPPD Lexington	FPT	1	1	4	0.630**	0.000	1	0.000	0.000	0.998
Dyer <sup>B</sup>	FHPT	9	2	166	0.988	0.966	0.996	0.772	0.487	0.918
Cottonwood Ranch	FHPT	9	1	174	0.994	0.979	1	0.885	0.647	1
Blue Hole	PT	20	1	403	0.998	0.991	1	0.949	0.834	1
Kearney Broadfoot South	BFHILPT	7	5	63	0.934*	0.849	0.988	0.237	0.032	0.770
Newark West	EFHLPT	5	2	75	0.973	0.928	1	0.558	0.209	0.991
Newark East	AFHPT	20	1	403	0.998	0.992	1	0.949	0.839	1
Leaman	FHLPT	5	4	59	0.945	0.876	0.999	0.307	0.062	0.976
Follmer	AFHPT	34	10	559	0.982	0.971	0.991	0.678	0.544	0.827
Trust Wildrose East	DP	2	2	22	0.899*	0.705	0.999	0.108	0.001	0.985
Hooker Brothers Southeast	N	2	0	42	1	1	1	1	1	1
<b>All Sites</b>		<b>125</b>	<b>32</b>	<b>2,170</b>	<b>0.984</b>	<b>0.966</b>	<b>0.993</b>	<b>0.717</b>	<b>0.480</b>	<b>0.867</b>

<sup>A</sup> Management actions include: active sand/gravel mining within primary nesting area (A), active sand/gravel mining outside primary nesting peninsula (B), disking (D), exterior predator fencing (E), peninsula entry predator fencing (F), fall 2024 herbicide (H), interior predator fencing (I), predator deterrent lights (L), spring 2025 pre-emergent herbicide (P), or predator trapping (T). See the Management Section of this report for a detailed description of management actions taken at each site.

<sup>B</sup> Reference site

\*Survival rates that were significantly different from the reference site are denoted (\* $p < 0.05$ , \*\* $p < 0.01$ , \*\*\* $p < 0.001$ ).

**Table 23.** Daily and brooding-period survival rates and 95% lower (LCL) and upper confidence limits (LCL) for least tern broods ( $\geq 1$  chicks) monitored on Program and non-Program OCSW sites adjacent to the central Platte River in Nebraska in 2025. Brooding-period survival rate = daily brood survival rate<sup>21</sup>.

Ownership	No. Broods	No. Broods Failed	Exposure Days	Daily Brood Survival Rate	Daily Brood Survival Rate		Brooding Period Survival Rate	Brooding Period Survival Rate	
					LCL	UCL		LCL	UCL
Program <sup>A</sup>	100	28	1,699	0.984	0.961	0.994	0.720	0.432	0.890
Non-Program <sup>B</sup>	25	4	471	0.984	0.927	0.998	0.708	0.204	0.962
<b>All Sites</b>	<b>125</b>	<b>32</b>	<b>2,170</b>	<b>0.984</b>	<b>0.966</b>	<b>0.993</b>	<b>0.717</b>	<b>0.480</b>	<b>0.867</b>

<sup>A</sup> Program sites: OSG Lexington, Dyer, Cottonwood Ranch, Kearney Broadfoot South, Newark West, Newark East, Leaman, and Follmer.

<sup>B</sup> Non-Program sites: NPPD Lexington, Blue Hole, Trust Wildrose East, and Hooker Brothers Southeast.

**Table 24.** Number of traps by trap type deployed for predator trapping at ten Program and Nebraska Public Power District owned piping plover and least tern off-channel sand and water (OCSW) nesting sites adjacent to the central Platte River during mid-March through early September 2025.

Site	Management <sup>A</sup>	No. Cage Traps	No. Dog Proof Traps	Trap Type		Total No. Traps
				No. Leg Hold Traps	No. Snare/Conibear Traps	
OSG Lexington	BFHPT	8	13	11		32
NPPD Lexington	FPT	1	16	2		19
Dyer	FHPT	12	21	11		44
Cottonwood Ranch	FHPT	7	22	1	1	31
Blue Hole	PT	2		8		10
Kearney Broadfoot South <sup>B</sup>	BFHILPT	13	23			36
Newark West	EFHLPT	13	23	2	12	50
Newark East	AFHPT	11	17	18		46
Leaman	FHLPT	3	17			20
Follmer	AFHPT	5	33	5		43
<b>Total</b>		<b>75</b>	<b>185</b>	<b>58</b>	<b>13</b>	<b>331</b>

<sup>A</sup> Management actions include: active sand/gravel mining within primary nesting area (A), active sand/gravel mining outside primary nesting peninsula (B), exterior predator fencing (E), peninsula entry predator fencing (F), fall 2024 herbicide (H), interior predator fencing (I), predator deterrent lights (L), spring 2025 pre-emergent herbicide (P), or predator trapping (T).

<sup>B</sup> Predators trapped at Kearney Broadfoot South and NAI Kearney Broadfoot South are reported as a total for both sites and are labeled as Kearney Broadfoot South.

**Table 25.** Summary of predator trapping activities at ten Program and Nebraska Public Power District owned piping plover and least tern off-channel sand and water (OCSW) nesting sites adjacent to the central Platte River during mid-March through early September 2025. Provided for each site are the total number of trap days and corresponding total number of captures based on the total number of days each trap was deployed.

Site	Management <sup>A</sup>	No. Traps Deployed	Total No. Trap Days	Total No. Captures	Captures / Trap Day <sup>B</sup>
OSG Lexington	BFHPT	32	4,209.5	53	0.012
NPPD Lexington	FPT	19	1,717.0	67	0.038
Dyer	FHPT	44	6,235.0	77	0.012
Cottonwood Ranch	FHPT	31	4,669.0	80	0.017
Blue Hole	PT	10	1,050.5	21	0.020
Kearney Broadfoot South <sup>C</sup>	BFHILPT	36	5,034.0	86	0.017
Newark West	EFHLPT	50	5,362.0	49	0.009
Newark East	AFHPT	46	5,734.0	57	0.010
Leaman	FHLPT	20	2,819.0	32	0.011
Follmer	AFHPT	43	2,771.5	36	0.012
<b>Total</b>		<b>331</b>	<b>39,601.5</b>	<b>558</b>	

<sup>A</sup> Management actions include: active sand/gravel mining within primary nesting area (A), active sand/gravel mining outside primary nesting peninsula (B), exterior predator fencing (E), peninsula entry predator fencing (F), fall 2024 herbicide (H), interior predator fencing (I), predator deterrent lights (L), spring 2025 pre-emergent herbicide (P), or predator trapping (T).

<sup>B</sup> Removed one raccoon at OSG Lexington, two bullsnakes at NPPD Lexington, one coyote at Dyer, one bullsnake and one coyote at Kearney Broadfoot South, one Virginia opossum and one woodchuck at Newark West, one bullsnake and one coyote at Newark East, and two coyotes at Follmer with a firearm. These captures were included in total captures but not included in calculation of captures/trap day.

<sup>C</sup> Predators trapped at Kearney Broadfoot South and NAI Kearney Broadfoot South are reported as a total for both sites and are labeled as Kearney Broadfoot South.

**Table 26.** Summary of predator trapping activities at ten Program and Nebraska Public Power District owned piping plover and least tern off-channel sand and water (OCSW) nesting sites adjacent to the central Platte River during mid-March through early September 2025. Provided for each site are the numbers of each species captured, total number of captures at the site, total number of trap days, and number of captures per trap day. spp. = not identified to species.

Site	Management <sup>A</sup>	Species Captured											Trap Days	Captures/ Trap Day <sup>B</sup>			
		American Badger	Bullsnake	Carp spp.	Coyote	Domestic Dog	Feral Cat	Raccoon	River Otter	Spiny Softshell Turtle	Striped Skunk	Virginia Opossum			Woodchuck	No. Captures	
OSG Lexington	BFHPT				2		4	37	3			7		53	4,209.5	0.012	
NPPD Lexington	FPT		2		1	1	1	54				6	2	67	1,717.0	0.038	
Dyer	FHPT	5		1	9			55				1	5	1	77	6,235.0	0.012
Cottonwood Ranch	FHPT	3		2	1			63				6	5		80	4,669.0	0.017
Blue Hole	PT				7			13	1					21	1,050.5	0.020	
Kearney Broadfoot South <sup>C</sup>	BFHILPT		1		1			60	4	1	8	11		86	5,034.0	0.017	
Newark West	EFHLPT	2			2		1	32				3	4	5	49	5,362.0	0.009
Newark East	AFHPT	1	1		7			40				3	5		57	5,734.0	0.010
Leaman	FHLPT							30						32	2,819.0	0.011	
Follmer	AFHPT				5			29				1	1		36	2,771.5	0.012
<b>Total</b>		<b>11</b>	<b>4</b>	<b>3</b>	<b>35</b>	<b>1</b>	<b>6</b>	<b>413</b>	<b>8</b>	<b>1</b>	<b>30</b>	<b>40</b>	<b>6</b>	<b>558</b>	<b>39,601.5</b>		

<sup>A</sup> Management actions include: active sand/gravel mining within primary nesting area (A), active sand/gravel mining outside primary nesting peninsula (B), exterior predator fencing (E), peninsula entry predator fencing (F), fall 2024 herbicide (H), interior predator fencing (I), predator deterrent lights (L), spring 2025 pre-emergent herbicide (P), or predator trapping (T).

<sup>B</sup> Removed one raccoon at OSG Lexington, two bullsnakes at NPPD Lexington, one coyote at Dyer, one bullsnake and one coyote at Kearney Broadfoot South, one Virginia opossum and one woodchuck at Newark West, one bullsnake and one coyote at Newark East, and two coyotes at Follmer with a firearm. These captures were included in total captures but not included in calculation of captures/trap day.

<sup>C</sup> Predators trapped at Kearney Broadfoot South and NAI Kearney Broadfoot South are reported as a total for both sites and are labeled as Kearney Broadfoot South.

**Table 27.** Total number of predators captured by species and trap type at ten Program and Nebraska Public Power District owned piping plover and least tern off-channel sand and water (OCSW) nesting sites adjacent to the central Platte River during mid-March through early September 2025. spp. = not identified to species.

Species	No. Captures by Trap Type					Total No. Captures
	Cage	Dog Proof	Firearm <sup>A</sup>	Leg Hold	Snare/ Conibear	
American Badger	1	1		6	3	11
Bullsnake			4			4
Carp spp.	3					3
Coyote	2		5	27	1	35
Domestic Dog				1		1
Feral Cat	4	1		1		6
Raccoon	52	344	1	9	7	413
River Otter	7			1		8
Spiny Softshell Turtle	1					1
Striped Skunk	9	15		4	2	30
Virginia Opossum	18	18	1	3		40
Woodchuck	4		1		1	6
<b>Total</b>	<b>101</b>	<b>379</b>	<b>12</b>	<b>52</b>	<b>14</b>	<b>558</b>

<sup>A</sup> Removed one raccoon at OSG Lexington, two bullsnakes at NPPD Lexington, one coyote at Dyer, one bullsnake and one coyote at Kearney Broadfoot South, one Virginia opossum and one woodchuck at Newark West, one bullsnake and one coyote at Newark East, and two coyotes at Follmer with a firearm. These captures were included in total captures but not included in calculation of captures/trap day.

**Table 28.** Summary of weekly track surveys conducted at six off-channel sand and water (OSCW) piping plover and least tern nesting sites adjacent to the central Platte River during May through early September 2025.

<b>Nesting Site</b>	<b>Management<sup>A</sup></b>	<b>Total No. Track Surveys</b>	<b>Total Unique Track Registers</b>	<b>Unique Track Registers/Survey</b>
Dyer	FHPT	18	56	3.11
Cottonwood Ranch	FHPT	19	38	2.00
Kearney Broadfoot South	BFHILPT	19	59	3.11
Newark West	EFHLPT	19	34	1.79
Newark East	AFHPT	19	56	2.95
Leaman	FHLPT	16	33	2.06
<b>Total:</b>		<b>110</b>	<b>276</b>	

<sup>A</sup> Management actions include: active sand/gravel mining within primary nesting area (A), active sand/gravel mining outside primary nesting peninsula (B), exterior predator fencing (E), peninsula entry predator fencing (F), fall 2024 herbicide (H), interior predator fencing (I), predator deterrent lights (L), spring 2025 pre-emergent herbicide (P), or predator trapping (T).

**Table 29.** Summary of registers of potential predator species captured by shoreline cameras deployed at six off-channel sand and water (OCSW) piping plover and least tern nesting sites adjacent to the central Platte River during May through early September 2025.

Nesting Site	Management <sup>A</sup>	No. of Shoreline Cameras	Total No. Shoreline Camera Days <sup>B</sup>	Total No. Unique Predator Registers	Unique Registers/ Camera Day
Dyer	FHPT	6	717	184	0.257
Cottonwood Ranch	FHPT	4	512	81	0.158
Kearney Broadfoot South	BFHILPT	7	876	277	0.316
Newark West	EFHLPT	4	506	127	0.251
Newark East	AFHPT	5	626	193	0.308
Leaman	FHLPT	3	327	195	0.596
<b>Total:</b>		<b>29</b>	<b>3,564</b>	<b>1,057</b>	

<sup>A</sup> Management actions applied to each site: active sand/gravel mining within primary nesting area (A), active sand/gravel mining outside primary nesting peninsula (B), exterior predator fencing (E), peninsula entry predator fencing (F), fall 2024 herbicide (H), interior predator fencing (I), predator deterrent lights (L), spring 2025 pre-emergent herbicide (P), and predator trapping (T).

<sup>B</sup> Individual cameras were not functioning for a total of 3 days at Dyer, 20 days at Kearney Broadfoot South, 6 days at Newark West, and 14 days at Newark East. Total number of shoreline camera days excludes days when cameras malfunctioned.

**Table 30.** Summary of registers of potential predator species captured by site-level cameras deployed at six off-channel sand and water (OCSW) piping plover and least tern nesting sites adjacent to the central Platte River during May through early September 2025.

Nesting Site	Management <sup>A</sup>	No. of Site-level Cameras	Total No. Site-level Camera Days <sup>B</sup>	Total No. Unique Predator Registers	Unique Registers/ Camera Day
Dyer	FHPT	5	600	33	0.055
Cottonwood Ranch	FHPT	4	512	22	0.043
Kearney Broadfoot South	BFHILPT	5	640	9	0.014
Newark West	EFHLPT	3	379	28	0.074
Newark East	AFHPT	5	640	53	0.083
Leaman	FHLPT	3	327	13	0.040
<b>Total:</b>		<b>25</b>	<b>3,098</b>	<b>158</b>	

<sup>A</sup> Management actions applied to each site: active sand/gravel mining within primary nesting area (A), active sand/gravel mining outside primary nesting peninsula (B), exterior predator fencing (E), peninsula entry predator fencing (F), fall 2024 herbicide (H), interior predator fencing (I), predator deterrent lights (L), spring 2025 pre-emergent herbicide (P), and predator trapping (T).

<sup>B</sup> Individual cameras were not functioning for a total of 5 days at Newark West. Total number of shoreline camera days excludes days when cameras malfunctioned.

**Table 31.** Summary of nest-level camera monitoring effort and registers of predation events captured by cameras deployed at six off-channel sand and water (OCSW) piping plover and least tern nesting sites adjacent to the central Platte River during May through August 2025. Nest-level cameras were removed from Newark East on 10 June, Dyer on 11 June, and Newark West on 21 July due to great horned owls interacting with cameras.

Nesting Site	Management <sup>A</sup>	No. of Nest Cameras Allocated to Site	Max No. of Nest Cameras Used Concurrently	No. of Nests Monitored	Total No. Nest Camera Days	Total Unique Predation Events on Camera	Unique Predation Events/ Camera Day
Dyer	FHPT	10	5	13	81	7	0.086
Cottonwood Ranch	FHPT	8	6	12	222	1	0.005
Kearney Broadfoot South	BFHILPT	8	8	21	248	3	0.012
Newark West	EFHLPT	7	7	22	166	8	0.048
Newark East	AFHPT	8	8	14	129	4	0.031
Leaman	FHLPT	5	5	17	261	1	0.004
<b>Total</b>		<b>46</b>	<b>39</b>	<b>99</b>	<b>1,107</b>	<b>24</b>	

<sup>A</sup> Management actions include: active sand/gravel mining within primary nesting area (A), active sand/gravel mining outside primary nesting peninsula (B), exterior predator fencing (E), peninsula entry predator fencing (F), fall 2024 herbicide (H), interior predator fencing (I), predator deterrent lights (L), spring 2025 pre-emergent herbicide (P), or predator trapping (T).

**Table 32.** Summary of unique predator registers, predation events captured by nest-level cameras, and predation events documented but not captured on camera (due to camera malfunction) at six off-channel sand and water (OCSW) piping plover and least tern nesting sites adjacent to the central Platte River during May through August 2025. Nest-level cameras were removed from Newark East on 10 June, Dyer on 11 June, and Newark West on 21 July due to great horned owls interacting with cameras.

Site	Date	Nest ID	Target Species Nest	Predator Type	Predator Species	Unique Predator Register <sup>A</sup>	Unique Predation Event Captured on Camera <sup>B</sup>	Unique Predation Event Not Captured on Camera <sup>C</sup>	No. of Individual Predated Nests <sup>D</sup>	Unique Events <sup>E</sup>
Dyer	5/17/2025	O-DS-02-25	Plover	Avian	Great Horned Owl		1		1	1
Dyer	5/18/2025	O-DS-03-25	Plover	Avian	Great Horned Owl	1				1
Dyer	5/21/2025	O-DS-01-25	Plover	Avian	Great Horned Owl		1		1	1
Dyer	5/22/2025	O-DS-07-25	Tern	Avian	Canada Goose	1				1
Dyer	5/23/2025	O-DS-05-25, O-DS-06-25	Plover, Plover	Avian	Great Horned Owl		1		2	1
Dyer	5/24/2025	O-DS-07-25	Tern	Avian	Canada Goose	1				1
Dyer	5/27/2025	O-DS-07-25	Tern	Avian	Canada Goose	1				1
Dyer	5/28/2025	O-DS-03-25	Plover	Avian	Great Horned Owl		1		1	1
Dyer	5/29/2025	O-DS-04-26, O-DS-07-25	Plover, Tern	Avian	Great Horned Owl		1		2	1
Dyer	5/31/2025	O-DS-10-25	Plover	Avian	Canada Goose	1				1
Dyer	6/1/2025	O-DS-08-25	Tern	Avian	Great Horned Owl	1				1
Dyer	6/3/2025	O-DS-10-25	Plover	Avian	Great Horned Owl		1		1	1
Dyer	6/4/2025	O-DS-12-25	Plover	Avian	Great Horned Owl	1				1
Dyer	6/5/2025	O-DS-11-25	Plover	Avian	Great Horned Owl		1		1	1
Cottonwood Ranch	6/1/2025	O-CWR-01-25	Plover	Avian	Bald Eagle	1				1
Cottonwood Ranch	6/8/2025	O-CWR-01-25	Plover	Avian	Bald Eagle	1				1
Cottonwood Ranch	6/19/2025	O-CWR-05-25, O-CWR-06-25, O-CWR-07-25	Tern, Tern, Tern	Mammalian	White-tailed Deer	1				1
Cottonwood Ranch	7/20/2025	O-CWR-12-25	Tern	Mammalian	American Badger		1		1	1

Table 32 continued

Site	Date	Nest ID	Target Species Nest	Predator Type	Predator Species	Unique Predator Register <sup>A</sup>	Unique Predation Event Captured on Camera <sup>B</sup>	Unique Predation Event Not Captured on Camera <sup>C</sup>	No. of Individual Predated Nests <sup>D</sup>	Unique Events <sup>E</sup>
Cottonwood Ranch	7/27/2025	O-CWR-11-25	Tern	Amphibian/Reptilian	Woodhouse's Toad	1				1
Kearney Broadfoot South	5/11/2025	O-BFS-01-25	Plover	Avian	Canada Goose	1				1
Kearney Broadfoot South	5/14/2025	O-BFS-04-25	Plover	Avian	European Starling	1				1
Kearney Broadfoot South	5/16/2025	O-BFS-01-25	Plover	Avian	Canada Goose	1				1
Kearney Broadfoot South	5/17/2025	O-BFS-03-25	Plover	Avian	Canada Goose	1				1
Kearney Broadfoot South	5/21/2025	O-BFS-03-25	Plover	Unknown	Unknown Species			1	1	1
Kearney Broadfoot South	5/21/2025	O-BFS-04-25	Plover	Avian	Canada Goose	1				1
Kearney Broadfoot South	5/22/2025	O-BFS-04-25	Plover	Avian	Canada Goose	1				1
Kearney Broadfoot South	5/28/2025	O-BFS-01-25	Plover	Mammalian	Striped Skunk		1		1	1
Kearney Broadfoot South	5/30/2025	O-BFS-04-25, O-BFS-05-25	Plover, Plover	Mammalian	Striped Skunk			1	2	1
Kearney Broadfoot South	6/19/2025	O-BFS-08-25 <sup>F</sup>	Tern	Avian	Red-tailed Hawk		1		1	1
Kearney Broadfoot South	6/21/2025	O-BFS-11-25	Tern	Amphibian/Reptilian	Woodhouse's Toad	1				1
Kearney Broadfoot South	7/3/2025	O-BFS-13-25	Plover	Avian	Red-tailed Hawk		1		1	1
Kearney Broadfoot South	7/10/2025	O-BFS-17-25	Tern	Mammalian	Eastern Mole	1				1
Kearney Broadfoot South	7/12/2025	O-BFS-20-25	Tern	Avian	European Starling	1				1

Table 32 continued

Site	Date	Nest ID	Target Species Nest	Predator Type	Predator Species	Unique Predator Register <sup>A</sup>	Unique Predation Event Captured on Camera <sup>B</sup>	Unique Predation Event Not Captured on Camera <sup>C</sup>	No. of Individual Predated Nests <sup>D</sup>	Unique Events <sup>E</sup>
Kearney Broadfoot South	7/16/2025	O-BFS-20-25	Tern	Avian	Canada Goose	1				1
Kearney Broadfoot South	7/17/2025	O-BFS-20-25	Tern	Avian	Canada Goose	1				1
Kearney Broadfoot South	7/30/2025	O-BFS-23-25	Tern	Avian	Canada Goose	1				1
Newark West	5/10/2025	O-NW-01-25	Plover	Avian	Canada Goose	1				1
Newark West	5/11/2025	O-NW-01-25	Plover	Avian	Canada Goose	1				1
Newark West	5/14/2025	O-NW-02-25	Plover	Amphibian/ Reptilian	Woodhouse's Toad	1				1
Newark West	5/16/2025	O-NW-01-25	Plover	Avian	Canada Goose	1				1
Newark West	5/17/2025	O-NW-02-25	Plover	Avian	Canada Goose	1				1
Newark West	5/18/2025	O-NW-01-25	Plover	Avian	Canada Goose	1				1
Newark West	5/19/2025	O-NW-01-25	Plover	Avian	Canada Goose	1				1
Newark West	5/20/2025	O-NW-01-25	Plover	Avian	Canada Goose	1				1
Newark West	5/21/2025	O-NW-01-25	Plover	Avian	Canada Goose	1				1
Newark West	5/29/2025	O-NW-02-25, O-NW-03-25, O-NW-04-25	Plover, Plover, Tern	Mammalian	Striped Skunk		1		3	1
Newark West	5/30/2025	O-NW-01-25, O-NW-07-25, O-NW-08-25	Plover, Tern, Tern	Mammalian	Striped Skunk		1		3	1
Newark West	6/15/2025	O-NW-21-25	Plover	Mammalian	Striped Skunk		1		1	1
Newark West	6/17/2025	O-NW-10-25, O-NW-11-25, O-NW-14-25	Tern, Tern, Tern	Mammalian	Striped Skunk		1		3	1
Newark West	6/17/2025	O-NW-20-25	Plover	Avian	Great Horned Owl	1				1
Newark West	6/18/2025	O-NW-09-25, O-NW-12-25	Tern, Tern	Mammalian	Striped Skunk		1		2	1
Newark West	6/18/2025	O-NW-13-25, O-NW-16-25	Tern, Tern	Avian	Canada Goose	1				1

Table 32 continued

Site	Date	Nest ID	Target Species Nest	Predator Type	Predator Species	Unique Predator Register <sup>A</sup>	Unique Predation Event Captured on Camera <sup>B</sup>	Unique Predation Event Not Captured on Camera <sup>C</sup>	No. of Individual Predated Nests <sup>D</sup>	Unique Events <sup>E</sup>
Newark West	6/19/2025	O-NW-16-25	Tern	Avian	Canada Goose	1				1
Newark West	6/19/2025	O-NW-20-25	Plover	Mammalian	Striped Skunk		1		1	1
Newark West	6/20/2025	O-NW-16-25	Tern	Avian	Canada Goose	1				1
Newark West	6/20/2025	O-NW-22-25	Tern	Mammalian	Striped Skunk	1				1
Newark West	6/21/2025	O-NW-16-25	Tern	Avian	Canada Goose	1				1
Newark West	6/23/2025	O-NW-16-25	Tern	Avian	Canada Goose	1				1
Newark West	6/24/2025	O-NW-18-25, O-NW-22-25, O-NW-29-25	Tern, Tern, Tern	Mammalian	Striped Skunk		1		3	1
Newark West	6/25/2025	O-NW-16-25	Tern	Avian	Canada Goose	1				1
Newark West	6/27/2025	O-NW-16-25	Tern	Avian	Canada Goose	1				1
Newark West	6/28/2025	O-NW-16-25	Tern	Avian	Canada Goose	1				1
Newark West	6/29/2025	O-NW-16-25	Tern	Avian	Canada Goose	1				1
Newark West	7/1/2025	O-NW-32-25	Plover	Avian	Canada Goose	1				1
Newark West	7/2/2025	O-NW-31-25	Tern	Mammalian	Striped Skunk		1		1	1
Newark West	7/3/2025	O-NW-32-25	Plover	Amphibian/ Reptilian	Woodhouse's Toad	1				1
Newark West	7/11/2025	O-NW-32-25	Plover	Avian	Great Horned Owl	1				1
Newark West	7/15/2025	O-NW-32-25	Plover	Avian	Red-winged Blackbird	1				1
Newark West	7/16/2025	O-NW-32-25	Plover	Avian	Great Horned Owl	1				1
Newark West	7/16/2025	O-NW-32-25	Plover	Avian	Canada Goose	1				1
Newark West	7/20/2025	O-NW-32-25	Plover	Avian	Great Horned Owl	1				1
Newark West	7/21/2025	O-NW-32-25	Plover	Avian	Great Horned Owl	1				1
Newark East	5/19/2025	O-NE-04-25	Plover	Avian	Great Horned Owl	1				1
Newark East	5/20/2025	O-NE-03-25, O-NE-08-25	Plover, Plover	Avian	Great Horned Owl	1				1
Newark East	5/28/2025	O-NE-01-25	Plover	Avian	Canada Goose	1				1
Newark East	5/28/2025	O-NE-02-25	Plover	Avian	European Starling	1				1
Newark East	5/29/2025	O-NE-01-25	Plover	Avian	Canada Goose	1				1

Table 32 continued

Site	Date	Nest ID	Target Species Nest	Predator Type	Predator Species	Unique Predator Register <sup>A</sup>	Unique Predation Event Captured on Camera <sup>B</sup>	Unique Predation Event Not Captured on Camera <sup>C</sup>	No. of Individual Predated Nests <sup>D</sup>	Unique Events <sup>E</sup>
Newark East	6/1/2025	O-NE-07-25	Plover	Avian	Great Horned Owl		1		1	1
Newark East	6/4/2025	O-NE-04-25 <sup>G</sup> , O-NE-08-25 <sup>H</sup>	Plover, Plover	Avian	Great Horned Owl		1		2	1
Newark East	6/5/2025	O-NE-09-25, O-NE-10-25, O-NE-12-25, O-NE-15-25	Tern, Tern, Tern, Tern	Avian	Great Horned Owl		1		4	1
Newark East	6/6/2025	O-NE-11-25, O-NE-21-25	Tern, Tern	Avian	Great Horned Owl		1		2	1
Leaman	6/5/2025	O-LES-06-25	Tern	Avian	Canada Goose	1				1
Leaman	6/7/2025	O-LES-05-25	Tern	Avian	Canada Goose	1				1
Leaman	6/10/2025	O-LES-06-25	Tern	Avian	Canada Goose	1				1
Leaman	6/13/2025	O-LES-06-25	Tern	Avian	Great Blue Heron	1				1
Leaman	6/14/2025	O-LES-03-25	Plover	Avian	Canada Goose	1				1
Leaman	6/20/2025	O-LES-07-25	Plover	Avian	Great Horned Owl	1				1
Leaman	6/24/2025	O-LES-06-25	Tern	Amphibian/ Reptilian	Woodhouse's Toad	1				1
Leaman	7/1/2025	O-LES-06-25, O-LES-08-25	Tern, Tern	Avian	Canada Goose	1				1
Leaman	7/4/2025	O-LES-06-25	Tern	Avian	Canada Goose	1				1
Leaman	7/8/2025	O-LES-15-25	Tern	Avian	Canada Goose	1				1
Leaman	7/9/2025	O-LES-09-25, O-LES-15-25	Tern, Tern	Avian	Canada Goose	1				1
Leaman	7/9/2025	O-LES-15-25	Tern	Avian	Great Blue Heron	1				1
Leaman	7/12/2025	O-LES-09-25, O-LES-15-25	Tern, Tern	Avian	Canada Goose	1				1
Leaman	7/12/2025	O-LES-15-25	Tern	Avian	Great Blue Heron	1				1
Leaman	7/13/2025	O-LES-15-25	Tern	Avian	Great Blue Heron	1				1
Leaman	7/13/2025	O-LES-15-25	Tern	Avian	Canada Goose	1				1
Leaman	7/14/2025	O-LES-15-25	Tern	Avian	Canada Goose	1				1

Table 32 continued

Site	Date	Nest ID	Target Species Nest	Predator Type	Predator Species	Unique Predator Register <sup>A</sup>	Unique Predation Event Captured on Camera <sup>B</sup>	Unique Predation Event Not Captured on Camera <sup>C</sup>	No. of Individual Predated Nests <sup>D</sup>	Unique Events <sup>E</sup>
Leaman	7/15/2025	O-LES-16-25, O-LES-17-25	Tern, Tern	Avian	Canada Goose	1				1
Leaman	7/16/2025	O-LES-16-25, O-LES-17-25, O-LES-19-25	Tern, Tern, Tern	Avian	Canada Goose	1				1
Leaman	7/17/2025	O-LES-15-25, O-LES-17-25, O-LES-19-25	Tern, Tern, Tern	Avian	Canada Goose	1				1
Leaman	7/19/2025	O-LES-17-25	Tern	Avian	Canada Goose	1				
Leaman	7/20/2025	O-LES-15-25 <sup>I</sup>	Tern	Avian	Great Horned Owl		1		1	1
Leaman	7/20/2025	O-LES-16-25, O-LES-17-25	Tern, Tern	Avian	Canada Goose	1				1
Leaman	7/20/2025	O-LES-17-25	Tern	Amphibian/ Reptilian	Woodhouse's Toad	1				1
Leaman	7/22/2025	O-LES-17-25	Tern	Avian	Canada Goose	1				1
Leaman	7/26/2025	O-LES-17-25	Tern	Avian	Canada Goose	1				1
Leaman	7/28/2025	O-LES-17-25	Tern	Avian	Canada Goose	1				1
Leaman	7/29/2025	O-LES-17-25	Tern	Avian	Canada Goose	1				1
<b>TOTAL</b>						<b>83</b>	<b>24</b>	<b>2</b>	<b>43</b>	<b>108</b>

<sup>A</sup> Predator species registered on the nest camera because they approached the nest and left without predated the nest (i.e., did not consume the eggs and/or chicks in the nest bowl).

<sup>B</sup> Predator predated the nest (i.e., consumed the eggs and/or chicks in the nest bowl) on camera.

<sup>C</sup> Predation event not documented due to camera malfunction, but nest was determined predated by using information from all predator monitoring methods.

<sup>D</sup> Number of individual nests that were predated, either entirely or partially. This accounts for predation that occurred at multiple nests by the same predator species, within 24 hrs. at one nesting site.

<sup>E</sup> Running count of unique events on nests monitored by cameras.

<sup>F</sup> O-BFS-08-25: 3 out of 3 eggs hatched and all chicks were predated by a red-tailed hawk.

<sup>G</sup> O-NE-04-25: 3 out of 4 eggs hatched. All chicks and the remaining egg were predated by a great horned owl.

<sup>H</sup> O-NE-08-25: 3 out of 4 eggs hatched. All chicks and the remaining egg were predated by a great horned owl.

<sup>I</sup> O-LES-15-25: 2 out of 2 eggs hatched and both chicks were predated by a great horned owl.

**Table 33.** Nest fate comparisons for piping plover and least tern nests that were and were not monitored by remote cameras during 2025 at six off-channel sand and water (OCSW) sites adjacent to the central Platte River, Nebraska. All monitoring sources (i.e., outside/inside observers; nest, site, and shoreline camera data; and track surveys) were used to determine nest fates. Nest cameras were removed from Newark East on 10 June, Dyer on 11 June, and Newark West on 21 July due to great horned owls interacting with cameras. Plovers did not initiate any new nests following camera removal at Newark West.

Site	No. Nests		No. Successful Nests w/o Predation		No. Successful Nests w/Predation <sup>A</sup>		No. Nests Failed-Predation		No. Nests Failed-Abandoned		No. Nests Failed-Weather		No. Nests Failed-Unknown		No. Nests Unknown Outcome	
	Camera	No Camera	Camera	No Camera	Camera	No Camera	Camera	No Camera	Camera	No Camera	Camera	No Camera	Camera	No Camera	Camera	No Camera
<b>Piping Plover</b>																
Dyer	9	6		4			8							2	1	
Cottonwood Ranch	2		2													
Kearney Broadfoot South	9	2	3				5				1	1	1			
Newark West	6		1				5									
Newark East	8	6	3	2	2		1							2	2	2
Leaman	4		3					1								
<b>Total Plover</b>	<b>38</b>	<b>14</b>	<b>12</b>	<b>6</b>	<b>2</b>	<b>0</b>	<b>19</b>	<b>0</b>	<b>1</b>	<b>0</b>	<b>0</b>	<b>1</b>	<b>1</b>	<b>5</b>	<b>3</b>	<b>2</b>
<b>Least Tern</b>																
Dyer	4	14		9			1		1				2	2		3
Cottonwood Ranch	10		9				1									
Kearney Broadfoot South	12	1	6		1			1			1		4			
Newark West	16	12	2	3			12	4	1				1	4		1
Newark East	6	35		20			6							11		4
Leaman	13	7	2	2	1				1	3			8	2	1	
<b>Total Tern</b>	<b>61</b>	<b>69</b>	<b>19</b>	<b>34</b>	<b>2</b>	<b>0</b>	<b>20</b>	<b>5</b>	<b>3</b>	<b>3</b>	<b>1</b>	<b>0</b>	<b>15</b>	<b>19</b>	<b>1</b>	<b>8</b>
<b>Overall Totals</b>	<b>99</b>	<b>83</b>	<b>31</b>	<b>40</b>	<b>4</b>	<b>0</b>	<b>39</b>	<b>5</b>	<b>4</b>	<b>3</b>	<b>1</b>	<b>1</b>	<b>16</b>	<b>24</b>	<b>4</b>	<b>10</b>

<sup>A</sup> Predation occurred at successful nests while eggs and chicks were present in the nest bowl.

**Table 34.** Nest, egg, and chick fates for piping plover and least tern nests that were monitored by remote cameras during 2025 at six off-channel sand and water (OCSW) nesting sites adjacent to the central Platte River, Nebraska. All monitoring sources (i.e., outside/inside observers; nest, site, and shoreline camera data; and track surveys) were used to determine nest fates. Nest cameras were removed from Newark East on 10 June, Dyer on 11 June, and Newark West on 21 July due to great horned owls interacting with cameras. Individual egg and chick fates were determined primarily using camera data with limited data available from outside monitoring.

Nesting Site	Nests			Eggs							Chicks				
	No. Monitored	No. Successful	Total No. Camera Days	No. Laid	No. Hatch	No. Failed-Predated	No. Failed-Abandoned	No. Failed-Weather	No. Failed-Unknown	No. Unknown Outcome	No. Left Nest	No. Mortality-Predated	No. Mortality-Weather	No. Mortality-Failed Unknown	No. Unknown Outcome
<b>Piping Plover</b>															
Dyer	9		67	34		30				4					
Cottonwood Ranch	2	2	38	8	6				1	1	6				
Kearney Broadfoot South	9	3	122	33	8	18			5	2	8				
Newark West	6	1	72	23	3	20					3				
Newark East	8	5	121	32	16	6			2	8	10	6			
Leaman	4	3	81	16	10		4		2		10				
<b>Total Plover</b>	<b>38</b>	<b>14</b>	<b>501</b>	<b>146</b>	<b>43</b>	<b>74</b>	<b>4</b>	<b>0</b>	<b>10</b>	<b>15</b>	<b>37</b>	<b>6</b>	<b>0</b>	<b>0</b>	<b>0</b>
<b>Least Tern</b>															
Dyer	4		14	9		3	1	1	4						
Cottonwood Ranch	10	9	184	23	20	1			1	1	19			1	
Kearney Broadfoot South	12	7	126	26	17			1	8		13	3		1	
Newark West	16	2	94	44	6	34	1		3		6				
Newark East	6		8	18		18									
Leaman	13	3	180	28	5		2		19	2	3	2			
<b>Total Tern</b>	<b>61</b>	<b>21</b>	<b>606</b>	<b>148</b>	<b>48</b>	<b>56</b>	<b>4</b>	<b>2</b>	<b>35</b>	<b>3</b>	<b>41</b>	<b>5</b>	<b>0</b>	<b>2</b>	<b>0</b>
<b>Overall Total</b>	<b>99</b>	<b>35</b>	<b>1,107</b>	<b>294</b>	<b>91</b>	<b>130</b>	<b>8</b>	<b>2</b>	<b>45</b>	<b>18</b>	<b>78</b>	<b>11</b>	<b>0</b>	<b>2</b>	<b>0</b>

**Table 35.** Summary of predation events on piping plover and least tern nests that were monitored by remote cameras during May through August 2025. Nest-level cameras were deployed at six off-channel sand and water (OCSW) nesting sites adjacent to the central Platte River, but were removed from Newark East on 10 June, Dyer on 11 June, and Newark West on 21 July due to great horned owls interacting with cameras. Provided for each predated nest are the: predator species, nest status when predation occurred, developmental stage of the nest when predation occurred, number of predated eggs or chicks, and estimated day of incubation when the predation occurred. Percent incubation completed was calculated based on an assumed 28-day incubation period for piping plovers and 21-day incubation period for least terns.

Nesting Site	Species	Nest ID	Predator Species	Nest Status When Predated	Developmental Stage When Predation Occurred	No. of Predated Eggs	No. of Predated Chicks	Incubation Day When Predation Occurred	Percent Incubation Completed
Dyer	Plover	O-DS-01-25	Great Horned Owl	Active	Eggs	4		19	68%
Dyer	Plover	O-DS-02-25	Great Horned Owl	Active	Eggs	3		15	54%
Dyer	Plover	O-DS-03-25	Great Horned Owl	Active	Eggs	4		23	82%
Dyer	Plover	O-DS-04-25 <sup>A</sup>	Great Horned Owl	Active	Eggs	4		23	82%
Dyer	Plover	O-DS-05-25	Great Horned Owl	Active	Eggs	3		7	25%
Dyer	Plover	O-DS-06-25	Great Horned Owl	Active	Eggs	4		7	25%
Dyer	Tern	O-DS-07-25	Great Horned Owl	Active	Eggs	3		13	62%
Dyer	Plover	O-DS-10-25	Great Horned Owl	Active	Eggs	4		12	43%
Dyer	Plover	O-DS-11-25	Great Horned Owl	Active	Eggs	4		8	29%
Cottonwood Ranch	Tern	O-CWR-12-25	American Badger	Active	Eggs	1		15	71%
Kearney Broadfoot South	Plover	O-BFS-01-25	Striped Skunk	Active	Eggs	4		24	86%
Kearney Broadfoot South	Plover	O-BFS-03-25 <sup>A</sup>	Unknown Species	Active	Eggs	4		14	50%
Kearney Broadfoot South	Plover	O-BFS-04-25 <sup>A</sup>	Striped Skunk	Active	Eggs	4		23	82%
Kearney Broadfoot South	Plover	O-BFS-05-25 <sup>A</sup>	Striped Skunk	Active	Eggs	2		19	68%
Kearney Broadfoot South	Tern	O-BFS-08-25	Red-tailed Hawk	Successful	Chicks		3	24	100%
Kearney Broadfoot South	Plover	O-BFS-13-25	Red-tailed Hawk	Active	Eggs	4		25	89%
Newark West	Plover	O-NW-01-25	Striped Skunk	Active	Eggs	4		26	93%
Newark West	Plover	O-NW-02-25	Striped Skunk	Active	Eggs	4		18	64%
Newark West	Plover	O-NW-03-25	Striped Skunk	Active	Eggs	4		8	29%
Newark West	Tern	O-NW-04-25	Striped Skunk	Active	Eggs	3		8	38%

*Table 35 continued*

Nesting Site	Species	Nest ID	Predator Species	Nest Status When Predated	Developmental Stage When Predation Occurred	No. of Predated Eggs	No. of Predated Chicks	Incubation Day When Predation Occurred	Percent Incubation Completed
Newark West	Tern	O-NW-07-25 <sup>A</sup>	Striped Skunk	Active	Eggs	3		4	19%
Newark West	Tern	O-NW-08-25	Striped Skunk	Active	Eggs	3		4	19%
Newark West	Tern	O-NW-09-25	Striped Skunk	Active	Eggs	3		20	95%
Newark West	Tern	O-NW-10-25 <sup>A</sup>	Striped Skunk	Active	Eggs	2		16	76%
Newark West	Tern	O-NW-11-25	Striped Skunk	Active	Eggs	3		16	76%
Newark West	Tern	O-NW-12-25	Striped Skunk	Active	Eggs	3		17	81%
Newark West	Tern	O-NW-14-25	Striped Skunk	Active	Eggs	3		16	76%
Newark West	Tern	O-NW-18-25	Striped Skunk	Active	Eggs	3		20	95%
Newark West	Plover	O-NW-20-25	Striped Skunk	Active	Eggs	4		11	39%
Newark West	Plover	O-NW-21-25	Striped Skunk	Active	Eggs	4		7	25%
Newark West	Tern	O-NW-22-25 <sup>A</sup>	Striped Skunk	Active	Eggs	3		16	76%
Newark West	Tern	O-NW-29-25	Striped Skunk	Active	Eggs	3		2	10%
Newark West	Tern	O-NW-31-25	Striped Skunk	Active	Eggs	2		7	33%
Newark East	Plover	O-NE-04-25	Great Horned Owl	Successful	Eggs/Chicks	1	3	31	100%
Newark East	Plover	O-NE-07-25	Great Horned Owl	Active	Eggs	4		25	89%
Newark East	Plover	O-NE-08-25	Great Horned Owl	Successful	Eggs/Chicks	1	3	28	100%
Newark East	Tern	O-NE-09-25	Great Horned Owl	Active	Eggs	3		15	71%
Newark East	Tern	O-NE-10-25	Great Horned Owl	Active	Eggs	3		15	71%
Newark East	Tern	O-NE-11-25	Great Horned Owl	Active	Eggs	3		16	76%
Newark East	Tern	O-NE-12-25	Great Horned Owl	Active	Eggs	3		10	48%
Newark East	Tern	O-NE-15-25	Great Horned Owl	Active	Eggs	3		10	48%
Newark East	Tern	O-NE-21-25	Great Horned Owl	Active	Eggs	3		8	38%
Leaman	Tern	O-LES-15-25	Great Horned Owl	Successful	Chicks		2	25	100%
<b>Average Incubation Completed for Piping Plovers</b>								<b>17.76</b>	<b>63.4%</b>
<b>Average Incubation Completed for Least Terns</b>								<b>13.50</b>	<b>64.3%</b>

<sup>A</sup> Includes data from indicated nests where plover nest/eggs were predated but the individual predator or predation event was not captured on camera because the camera malfunctioned.

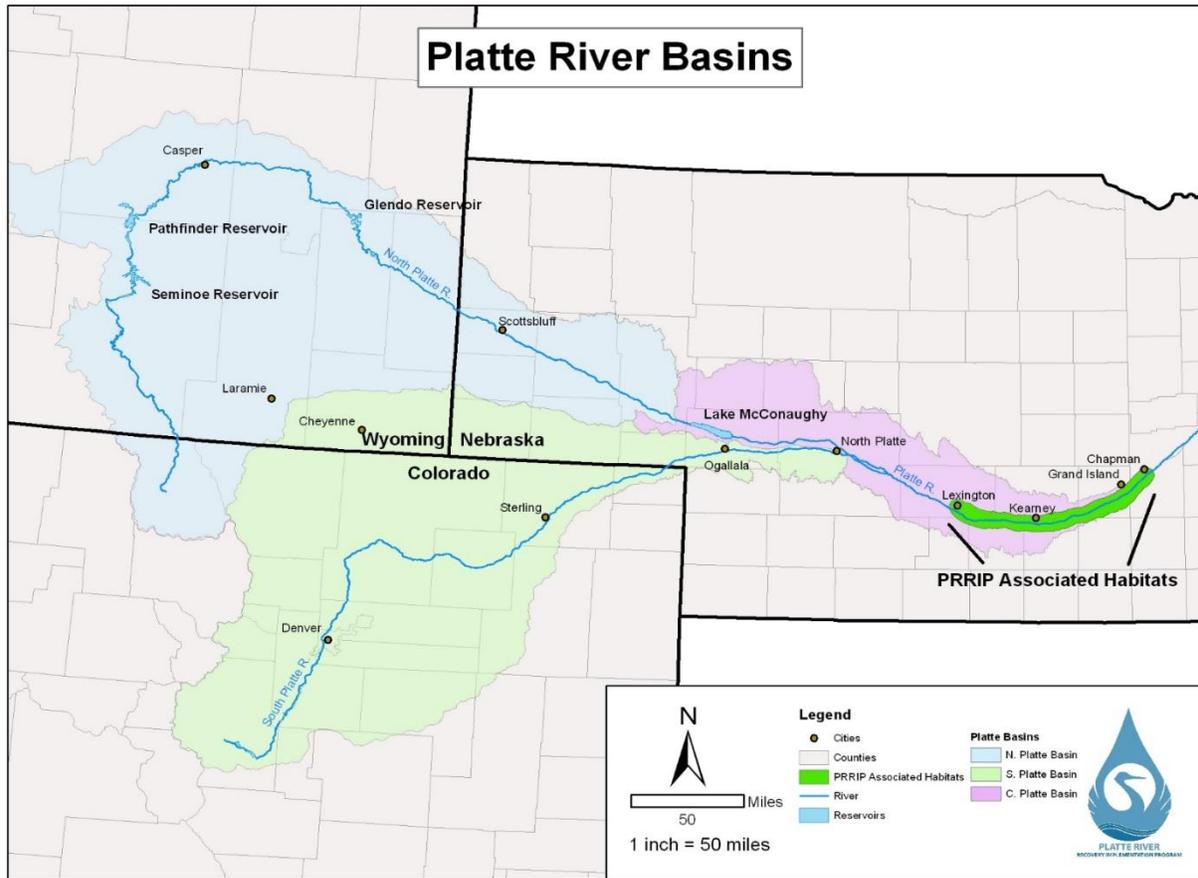
**Table 36.** Covariate coefficient estimates, associated standard errors, and P-values for a model examining effects of nest cameras and site on daily survival rates of piping plover and least tern nests at six off-channel sand and water (OCSW) nesting sites adjacent to the central Platte River in Nebraska.

Covariate	Estimate	Standard Error	P-value
Intercept (Site = Dyer) <sup>A</sup>	4.144	0.409	<0.001***
Camera = yes	-1.972	0.500	<0.001***
Site = Kearney Broadfoot South	-3.090	0.769	<0.001***
Site = Newark West	-1.425	0.529	0.007**
Site = Newark East	-0.265	0.480	0.581
Site = Leaman	-1.240	0.607	0.041*
Camera(yes)*Site(Kearney Broadfoot South)	4.421	0.880	<0.001***
Camera(yes)*Site(Newark West)	1.928	0.654	0.003**
Camera(yes)*Site(Newark East)	1.425	0.652	0.029*
Camera(yes)*Site(Leaman)	2.529	0.744	<0.001***

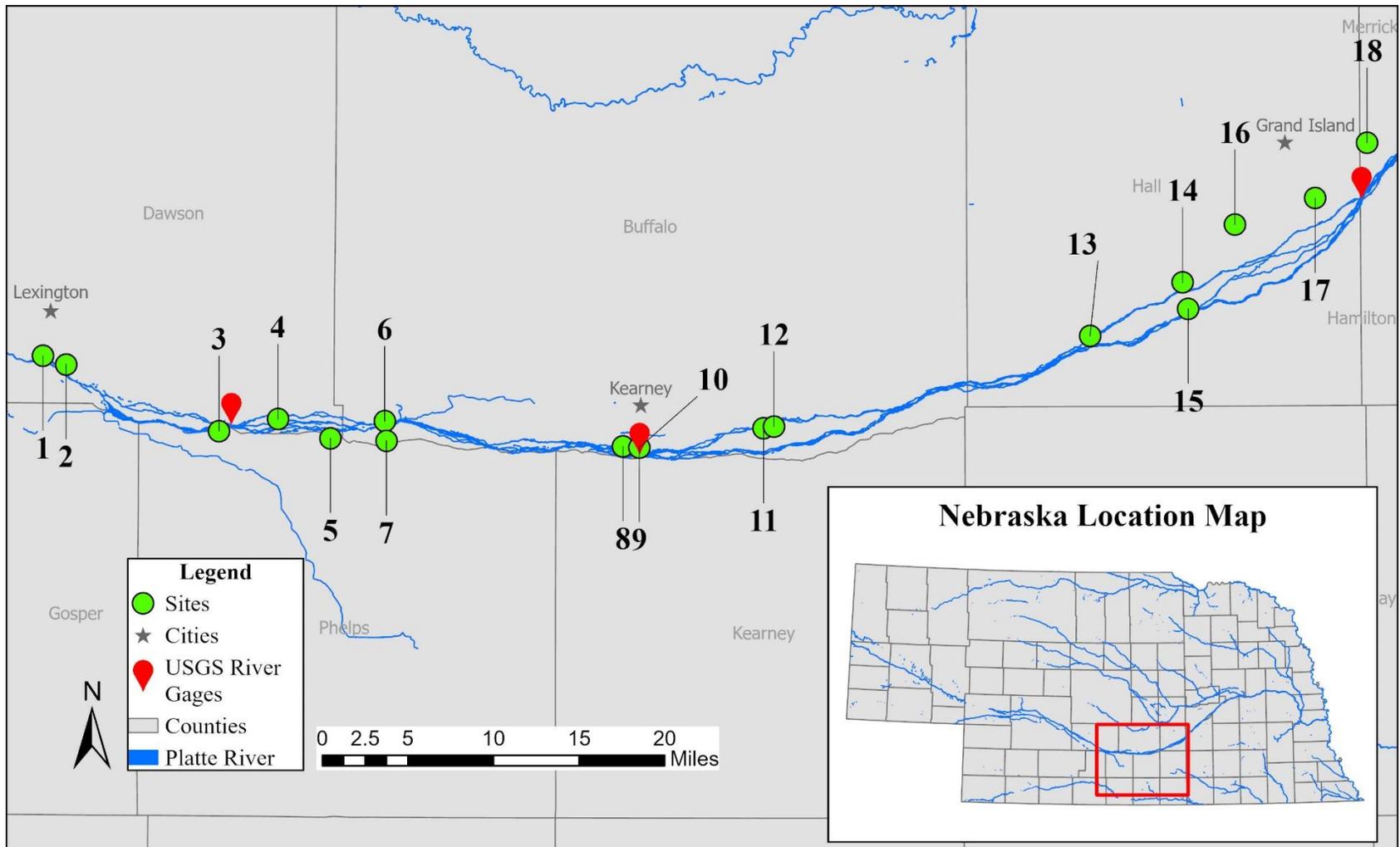
<sup>A</sup> Intercept term includes Site = Dyer

\*p<0.05, \*\*p<0.01, \*\*\*p<0.001

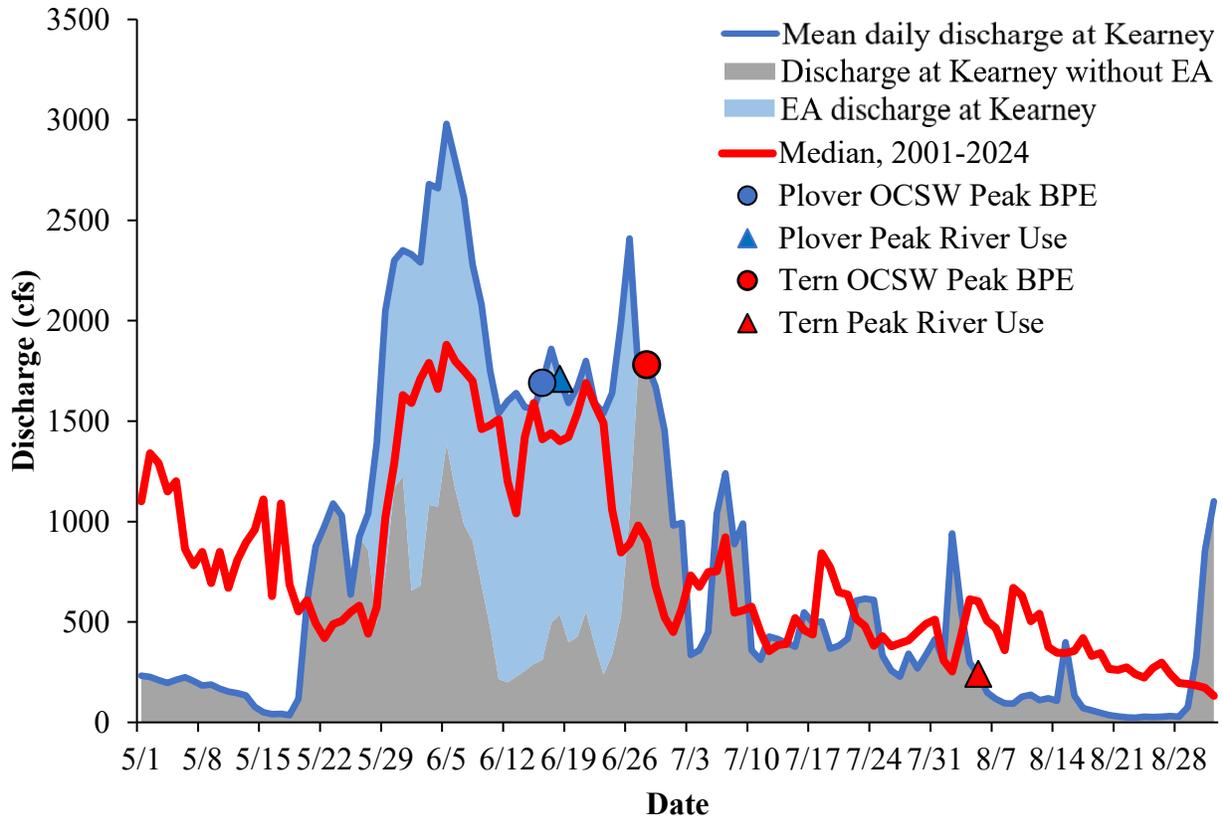
**FIGURES**



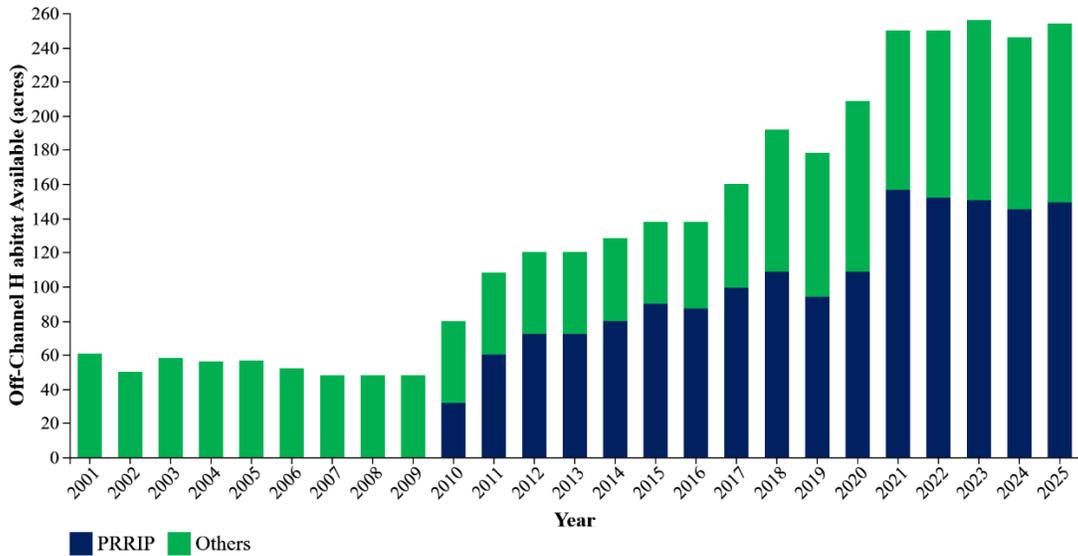
**Figure 1.** Platte River Basins extending from Colorado and Wyoming through Nebraska. The study area for our piping plover and least tern monitoring and research efforts was the PRRIP Associated Habitat Reach (AHR) of the central Platte River located between Lexington and Chapman, Nebraska (in dark green).



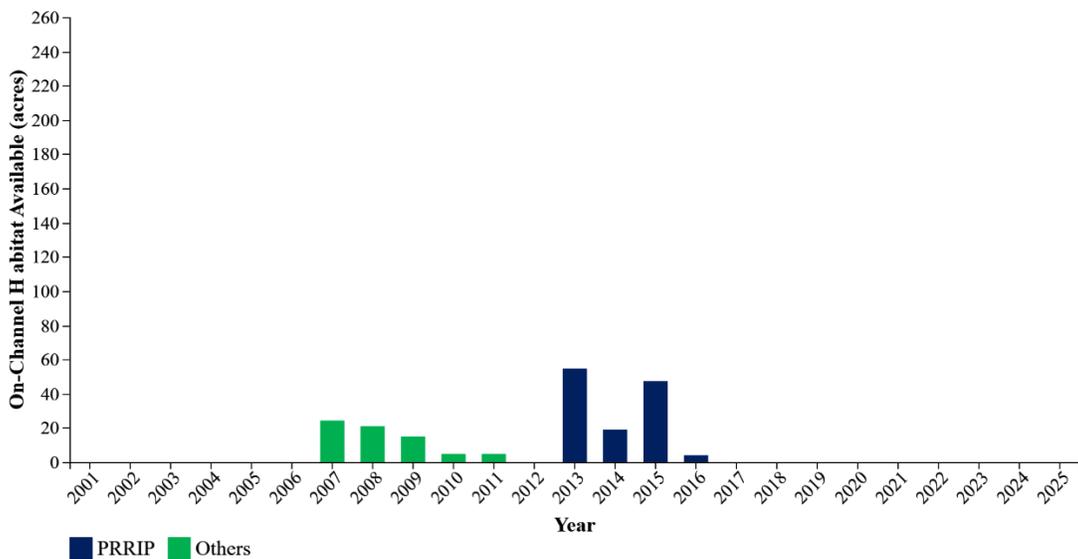
**Figure 2.** Distribution of the 18 off-channel sand and water (OCSW) sites (green circles) and Platte River channels (blue) monitored for piping plover and least tern nesting and foraging activities during 2025 in our study area between Lexington and Chapman, Nebraska. Locations of the three USGS river gage stations along the central Platte River are depicted in red. Sites are: (1) OSG Lexington; (2) NPPD Lexington; (3) Dyer; (4) Cottonwood Ranch; (5) T&F Lakeside; (6) Blue Hole; (7) Johnson; (8) Ed Broadfoot and Sons; (9) Kearney Broadfoot South; (10) Non-Access Islands Kearney Broadfoot South; (11) Newark West; (12) Newark East; (13) Leaman; (14) Follmer; (15) Trust Wildrose East; (16) DeWeese; (17) Hooker Brothers Southeast; and (18) Hooker Brothers East.



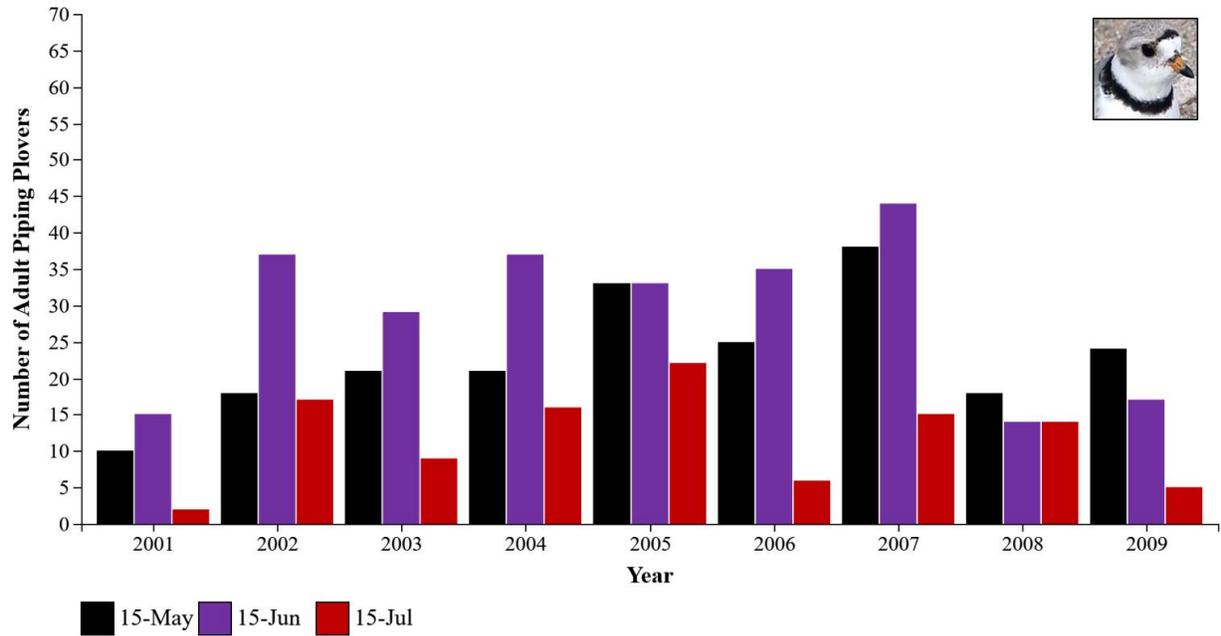
**Figure 3.** Mean daily discharge (cubic feet per second; cfs) at Kearney, Nebraska (USGS gage 06770200; [USGS 2025b](#)) between 1 May and 1 September, 2025 (blue line). See Figure 2 for location of Kearney gage station within our study area. Also depicted in the figure are the: 2025 mean daily discharge without the inclusion of the Environmental Account (EA) release (gray shaded area); 2025 EA release mean daily discharge during 27 May to 26 June at Kearney (light blue shaded area); and median daily discharge during 2001-2024 at Kearney (red line). Plover breeding pairs (BPE) peaked at OCSW sites across the Associated Habitat Reach (AHR) on 16 June (blue circle). Tern BPE peaked at OCSW sites across the AHR on 28 June (red circle). Adult counts observed on river surveys peaked for plovers on 18-19 June (blue triangle) and terns on 5-6 August (red triangle).



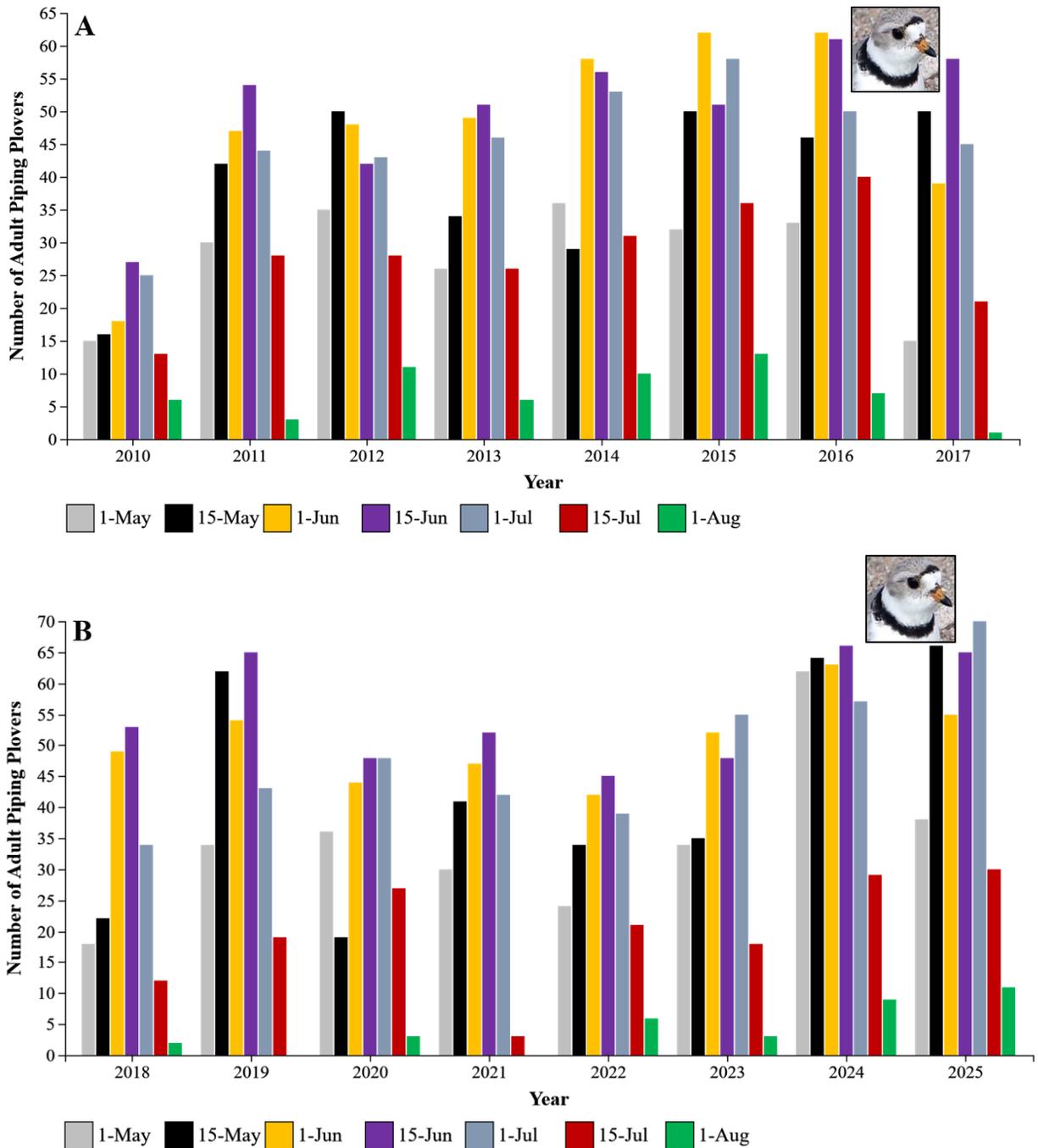
**Figure 4.** Availability of OCSW piping plover and least tern nesting habitat along the Associated Habitat Reach (AHR) between Lexington and Chapman, Nebraska, adjacent to the Platte River during 2001-2025. OCSW habitat is separated into sites owned and/or managed by the Program (PRRIP, indigo shaded bars) and by other organizations (Others, green shaded bars). The OCSW nesting habitat fits the accepted Program habitat requirements for piping plovers and least terns ([PRRIP 2015](#)). Due to access restrictions that limited monitoring at some sites, available OCSW habitat during 2001-2009 only included sites that were used in the reproductive and survival calculations each year.



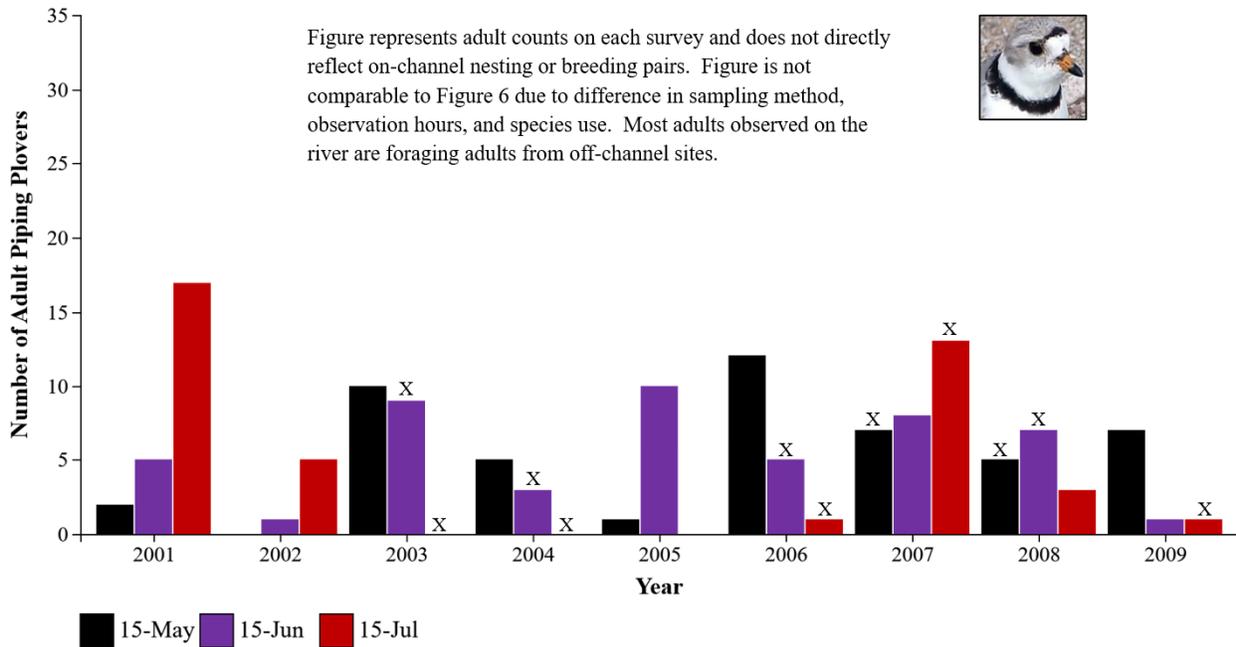
**Figure 5.** Monitored on-channel piping plover and least tern nesting habitat on the Platte River along the Associated Habitat Reach (AHR) between Lexington and Chapman, Nebraska, during 2001-2025 that was created, rehabilitated, and managed by the Program (PRRIP, indigo shaded bars) and other organizations (Others, green shaded bars). The on-channel nesting habitat fits the accepted Program habitat requirements ([PRRIP 2015](#)). On-channel habitat available during 2001-2006 only included sites that were used in reproductive and survival calculations each year; however, no nesting was observed during this period.



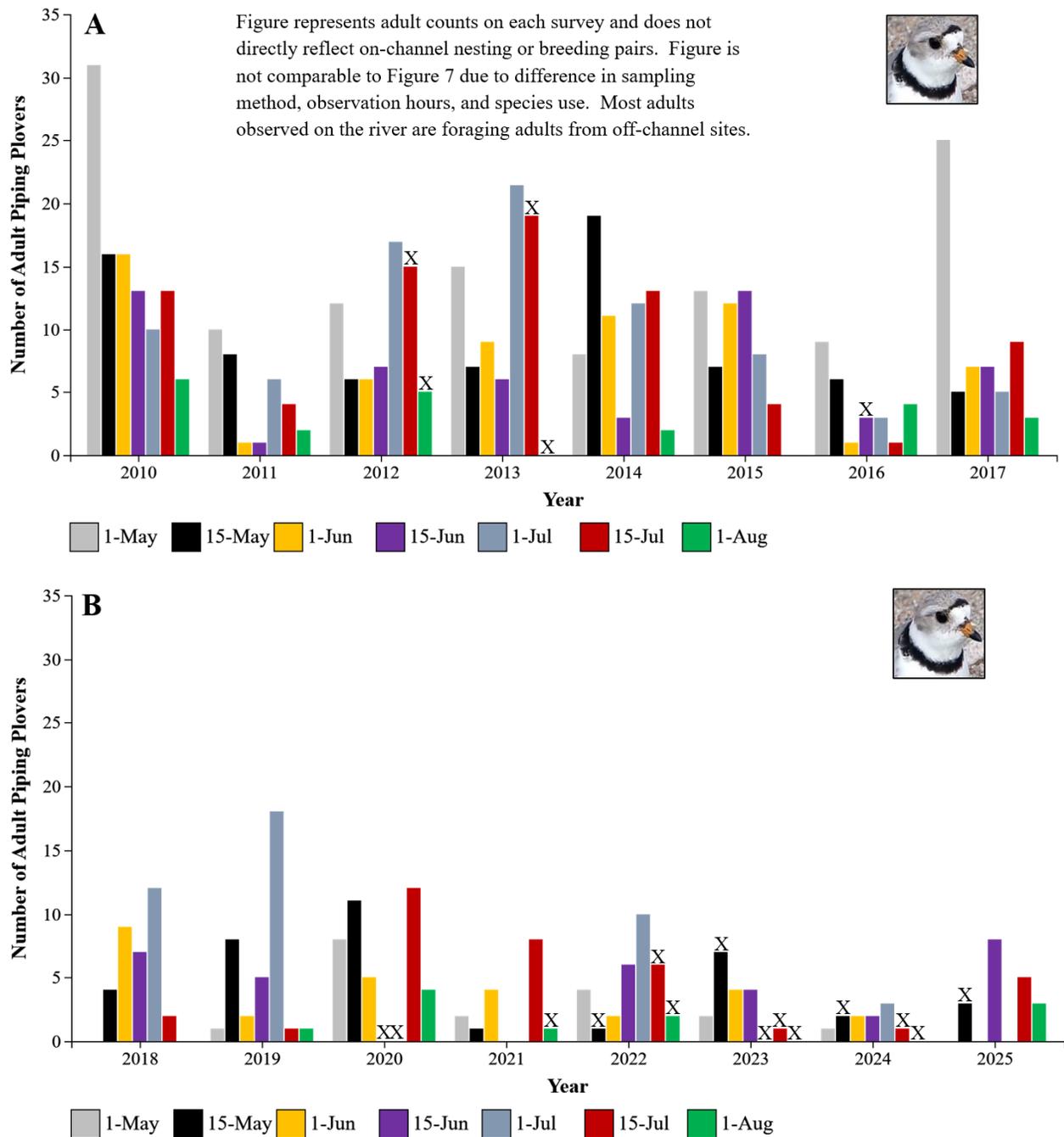
**Figure 6.** Number of adult piping plovers observed during three monthly surveys of OCSW sites along the Platte River between Lexington and Chapman, Nebraska, 2001-2009. Numbers of adults include observations of both non-breeding and breeding piping plovers.

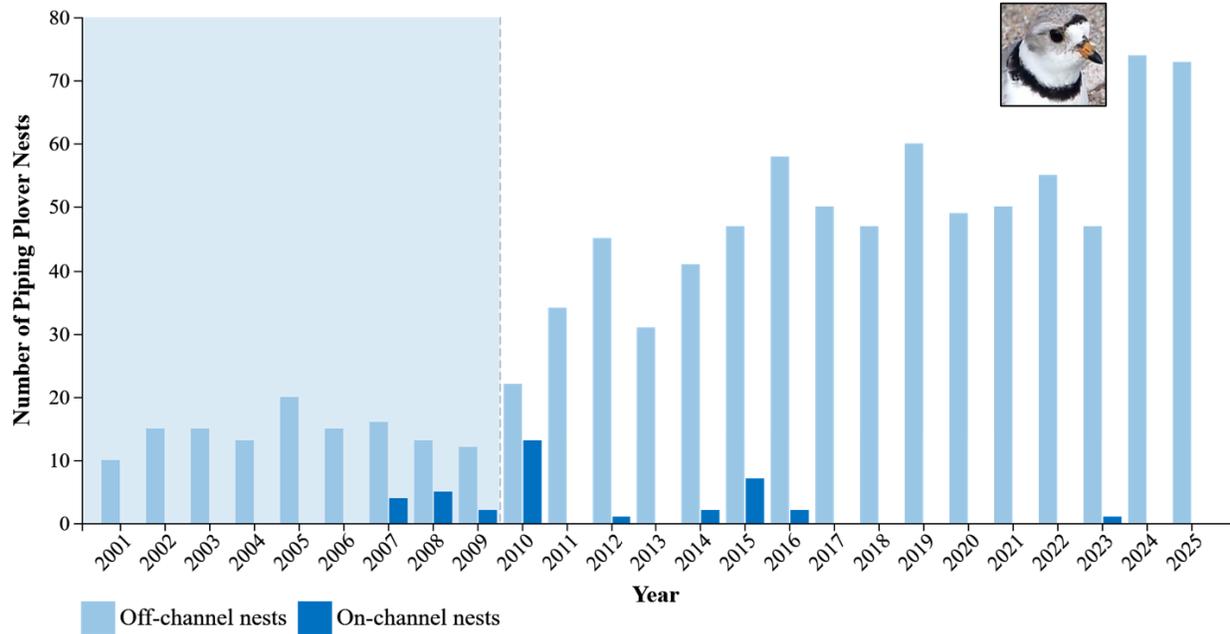


**Figure 7.** Number of adult piping plovers observed during semi-monthly surveys of OCSW sites along the Platte River between Lexington and Chapman, Nebraska, 2010-2025, during the periods of (A) 2010-2017, and (B) 2018-2025. Numbers of adults include observations of both non-breeding and breeding piping plovers.

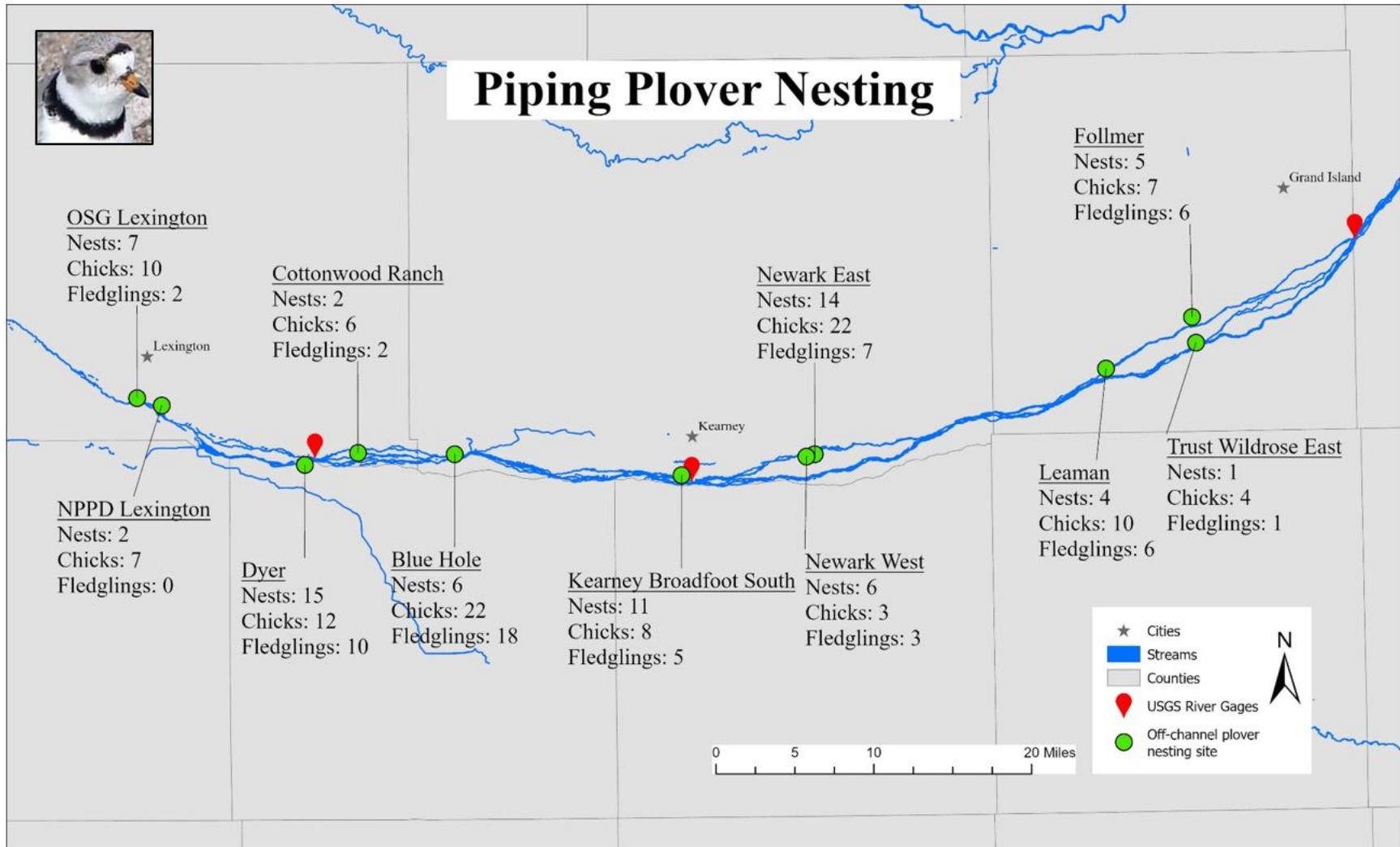


**Figure 8.** Number of adult piping plovers observed during three monthly surveys of the Platte River between Lexington and Chapman, Nebraska, 2001-2009. Numbers of adults include observations of both non-breeding and breeding piping plovers. Sampling periods for which at least one section of the river was not completed due to lack of flow or high flow in the channel, or other restrictions, are denoted with an “X”. These surveys include: 15 May 2007, 2008; 15 June 2003, 2004, 2006, 2008; and 15 July 2003, 2004, 2006, 2007, 2008.

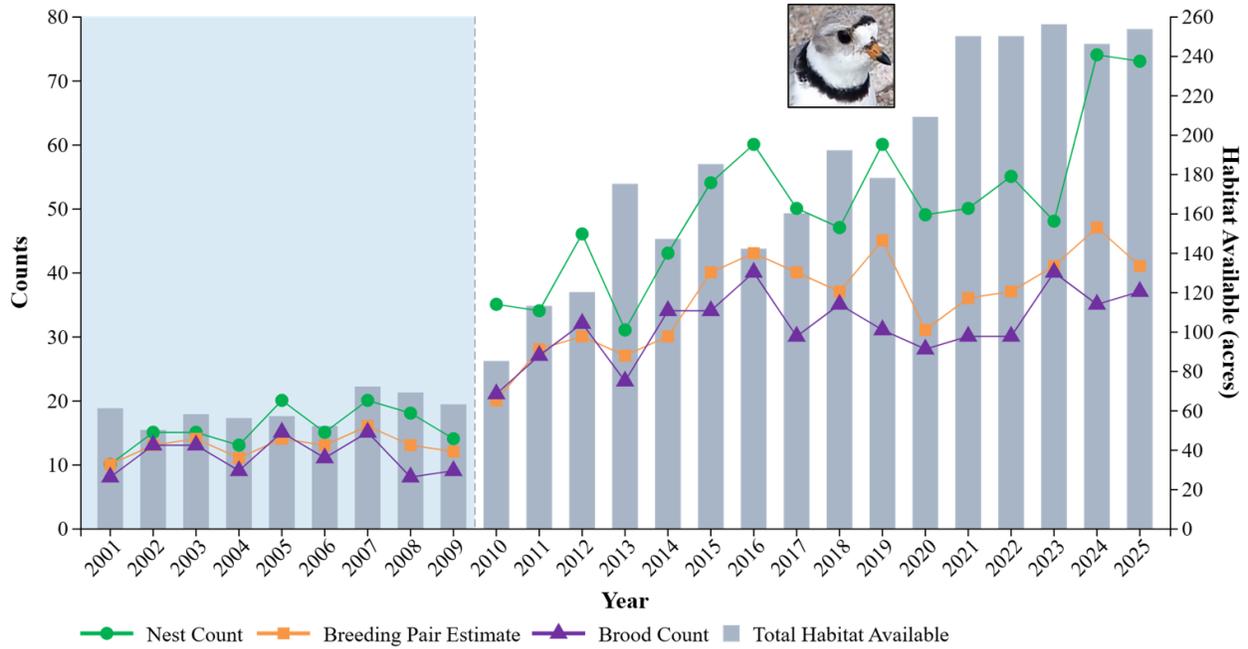




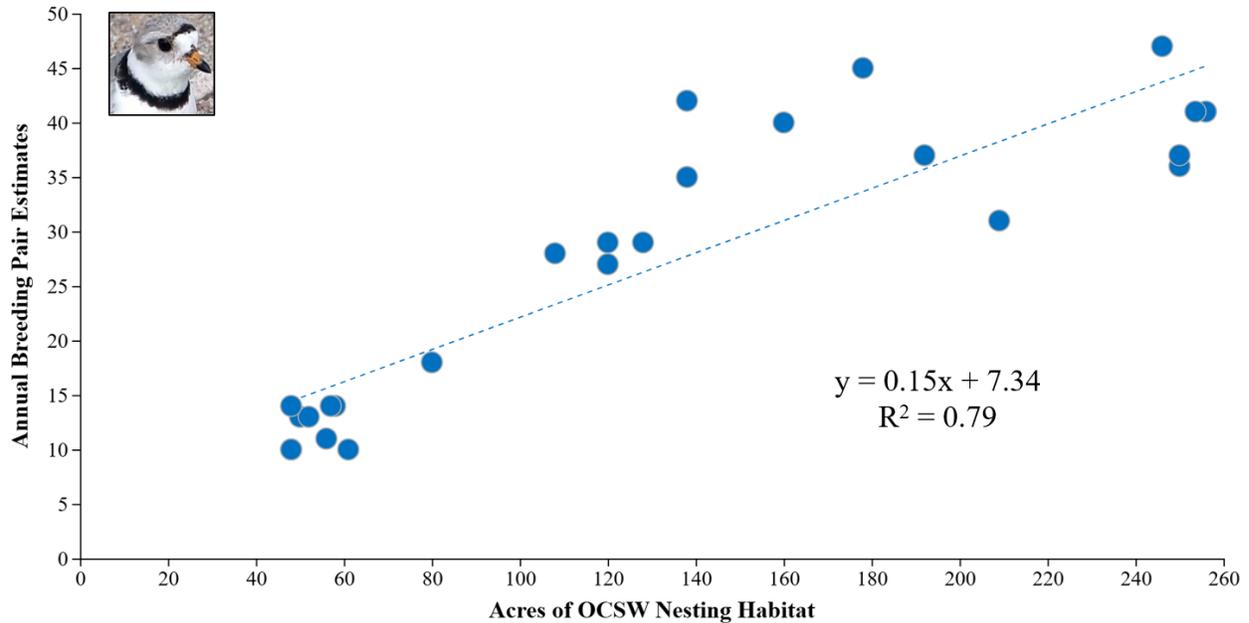
**Figure 10.** Comparison of numbers of piping plover nests found during off-channel (light blue bars) and on-channel (dark blue bars) surveys within the Program Associated Habitat Reach along the Platte River between Lexington and Chapman, Nebraska, 2001-2025. The dashed line represents changes in protocol between 2009-2010, including an increase in monitoring effort. The shaded area represents years in which nest totals are not comparable to recent totals.



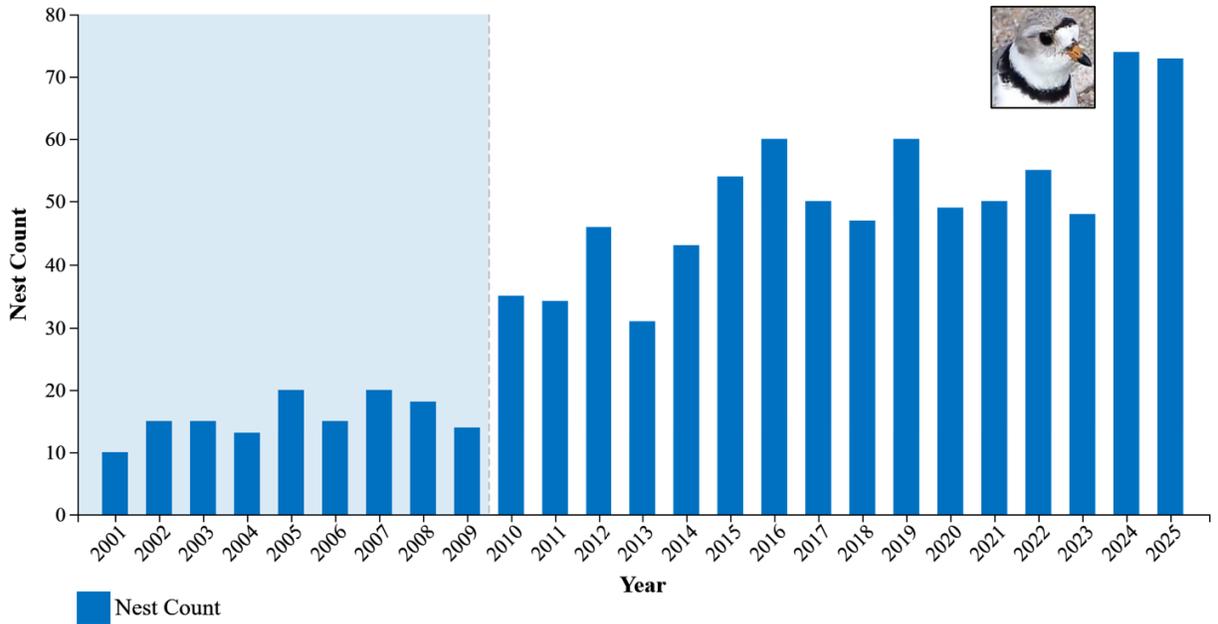
**Figure 11.** Distribution and numbers of piping plover nests, chicks, and fledglings observed within Program associated habitats during 2025 surveys along the Platte River between Lexington and Chapman, Nebraska. Piping plover nests and chicks were observed and monitored at 11 of 18 off-channel sites during 2025. The locations of the Overton (USGS gage 06768000, [USGS 2025a](#)), Kearney (USGS gage 06770200, [USGS 2025b](#)) and Grand Island (USGS gage 0670500, [USGS 2025c](#)) river gages are marked with a red pin.



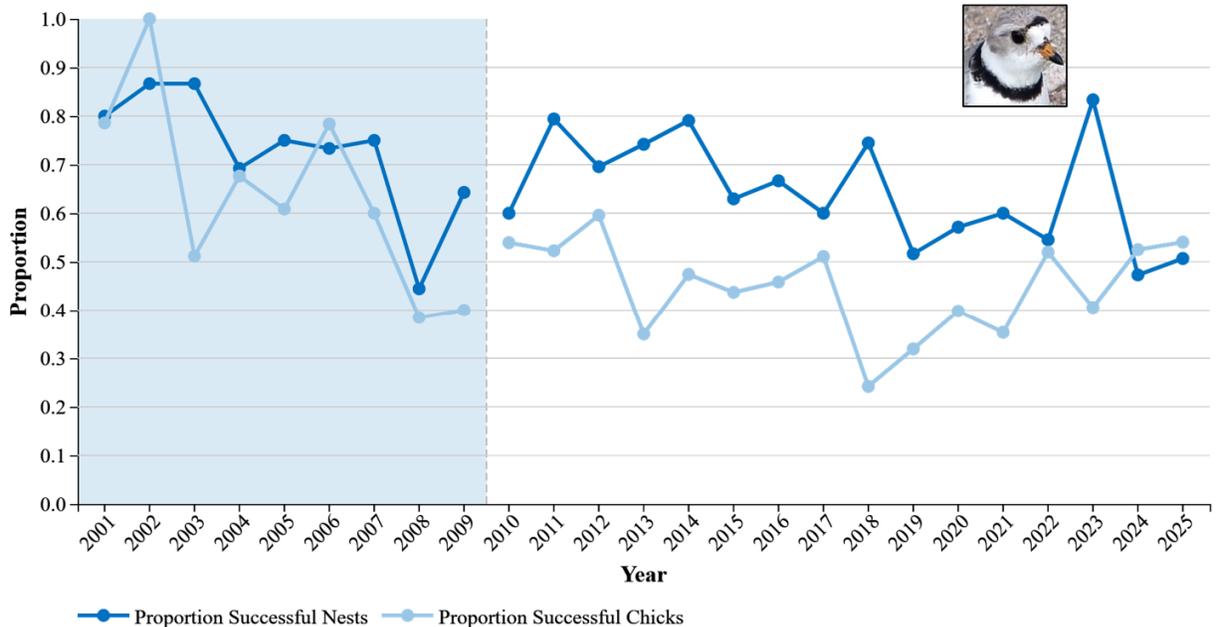
**Figure 12.** Annual variation in the total numbers of piping plover nests (green line), breeding pair estimates (orange line), brood counts (purple line), and total on- and off-channel habitat available (acres; blue bars) observed within the Program Associated Habitat Reach (AHR) along the Platte River between Lexington and Chapman, Nebraska, during 2001-2025. The dotted line represents changes in protocol that occurred between 2009 and 2010, including an increase in monitoring effort. Data from 2001-2009 (shaded area) may not be comparable to data from 2010-2025. Due to access restrictions that limited monitoring at some sites, available habitat from 2001-2009 only included sites that were used in the reproductive and survival calculations each year.



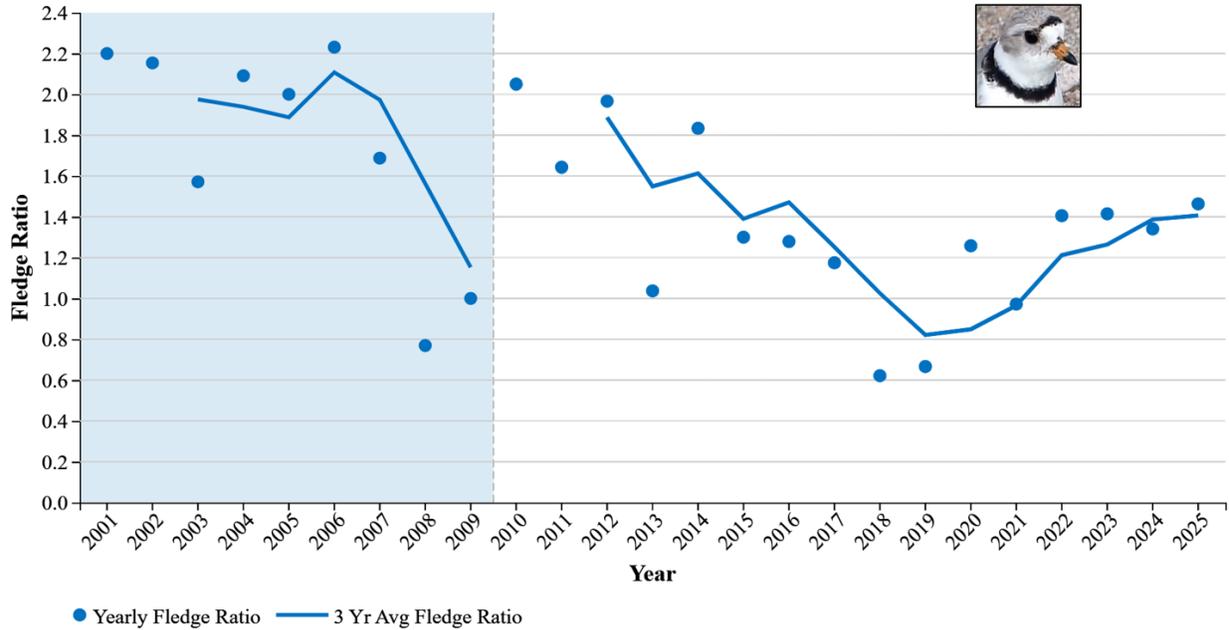
**Figure 13.** Relationship between the annual estimated number of OCSW piping plover breeding pairs and availability (acres) of monitored off-channel habitat (OCSW sites) within the Program Associated Habitat Reach (AHR) between Lexington and Chapman, Nebraska, during 2001-2025. For every acre of OCSW habitat increase, an increase of 0.15 piping plover breeding pairs occurred (95% CI: 0.11-0.18 breeding pairs) at OCSW sites in the AHR and the results were statistically significant ( $P < 0.001$ ). The linear line of best fit with corresponding equation and  $R^2$  value are depicted. Due to access restrictions that limited monitoring at some sites, available habitat from 2001-2009 only included sites that were used in the reproductive and survival calculations each year.



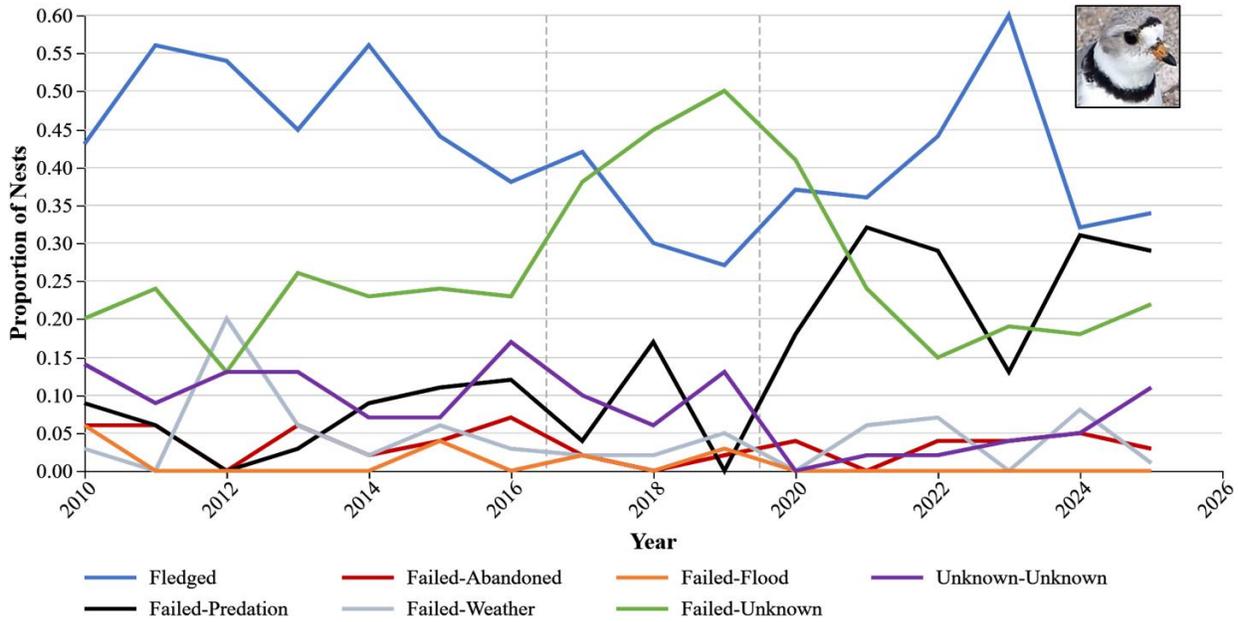
**Figure 14.** Total number of piping plover nests (nest count) observed during on- and off-channel surveys within the Program Associated Habitat Reach (AHR) along the Platte River between Lexington and Chapman, Nebraska, 2001-2025. The dashed line represents changes in protocol between 2009 and 2010, including an increase in monitoring effort. The shaded area represents years in which nest totals are not comparable to recent totals.



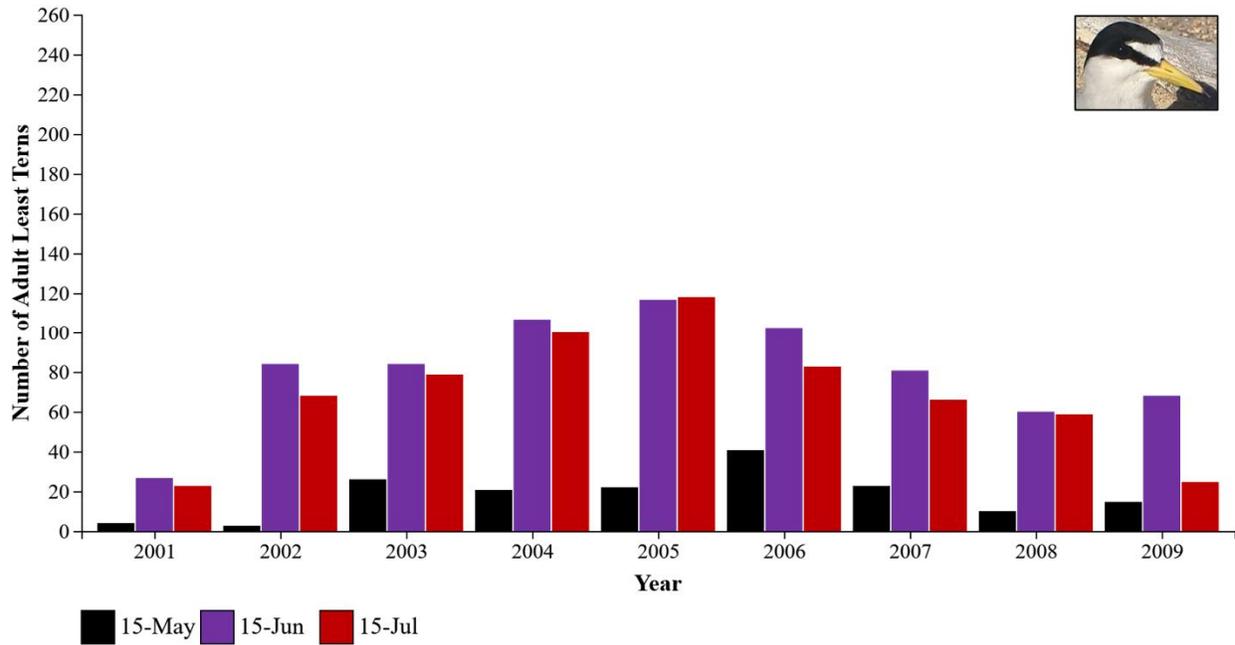
**Figure 15.** Proportion of successful nests and proportion of successful chicks for piping plover nests monitored during 2001-2025 within the Program Associated Habitat Reach (AHR) along the Platte River between Lexington and Chapman, Nebraska. The dotted line represents changes in protocol between 2009 and 2010, including the fledge age being increased from 15-days to 28-days for piping plover chicks. The shaded area represents years in which proportions of successful nests and chicks are not comparable to recent totals.



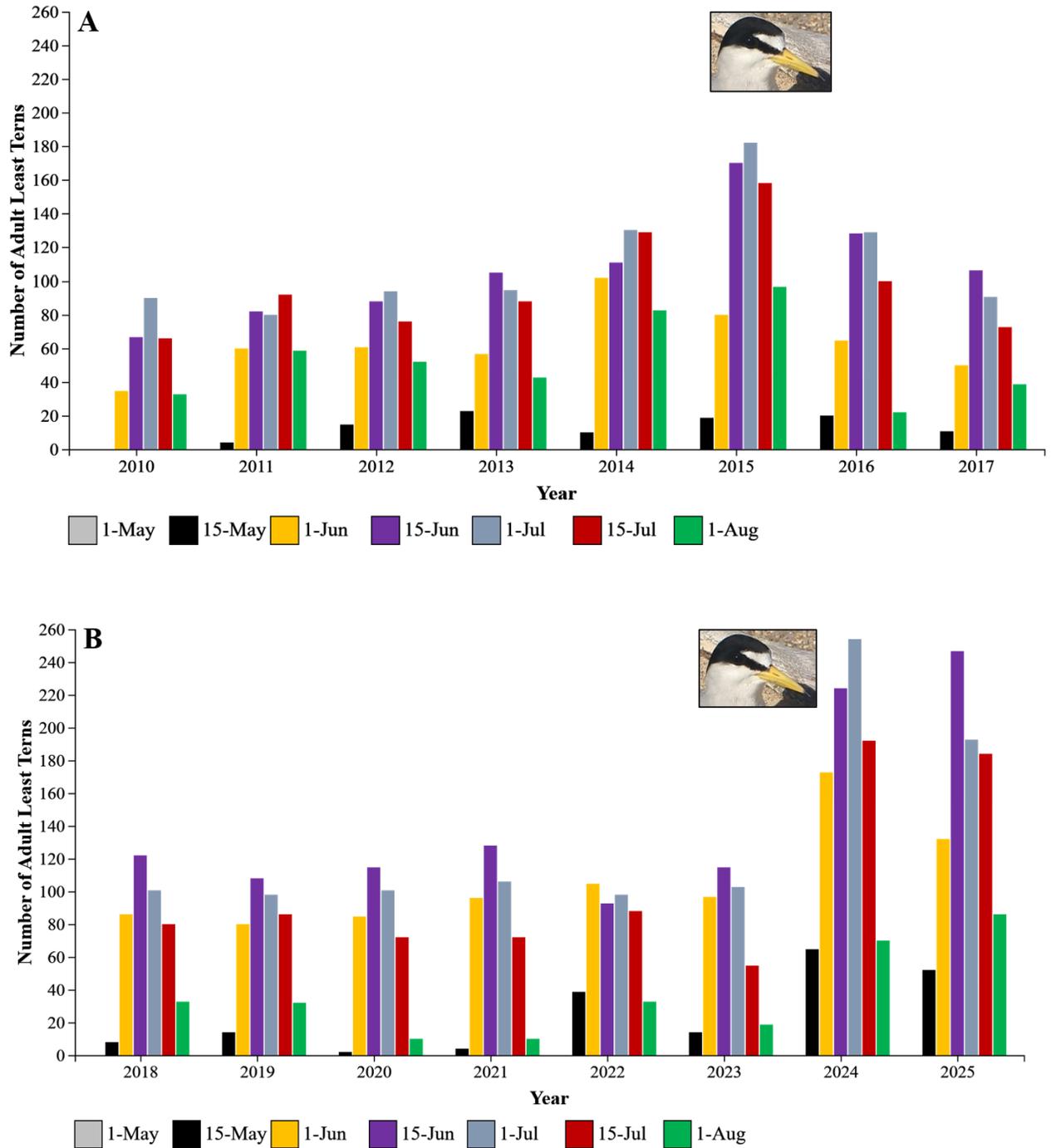
**Figure 16.** Piping plover fledge ratios (chicks fledged/estimated breeding pair [BPE]) on annual (point) and three-year running average (lines) bases during 2001-2009 and 2010-2025 within the Program Associated Habitat Reach (AHR) along the Platte River between Lexington and Chapman, Nebraska. The dotted line represents changes in protocol between 2009 and 2010, including the fledge age being increased from 15-days to 28-days for piping plover chicks. The shaded area represents years in which fledge ratios are not comparable to recent fledge ratios.



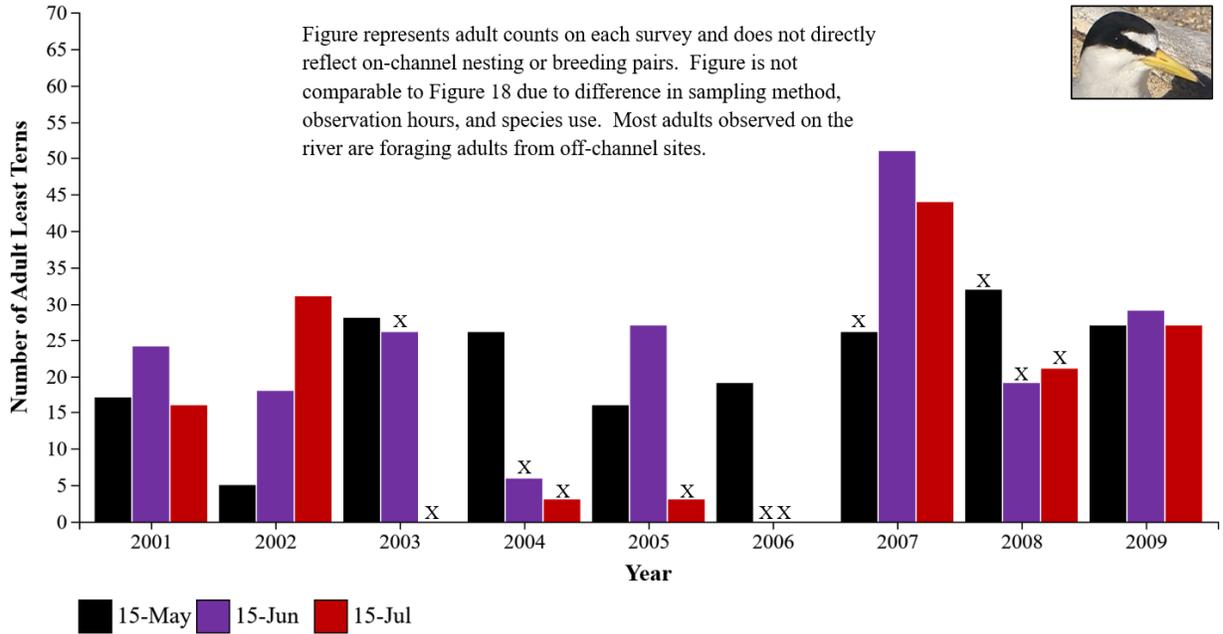
**Figure 17.** Proportion of piping plover nest successes with fledglings and nest or brood failures (incurred during incubation or before fledging) by year during 2010-2025 across the Program Associated Habitat Reach (AHR) along the Platte River between Lexington and Chapman, Nebraska. Each nest success or failure represents a unique reproductive attempt. Assigned causes of nest or brood failures include: abandonment, flooding, predation, weather, and failed due to unknown causes. The dotted line represents changes in monitoring protocol that occurred between 2016 and 2017, and 2019 and 2020. During 2010-2016, monitoring protocols included twice weekly inside and outside surveys at all sites with nesting and twice monthly river surveys. During 2017-2019, monitoring included twice weekly outside surveys at all sites with nesting, use of incidental evidence to fate nests, and twice monthly river surveys. During 2020-2025, monitoring included twice weekly outside surveys at all sites with nesting; camera monitoring at a sample of nests, nest sites, and shorelines to fate nests; use of incidental evidence to fate nests; and additional predator management. Semi-monthly river surveys were conducted from 2020-2024 and monthly river surveys were conducted in 2025.



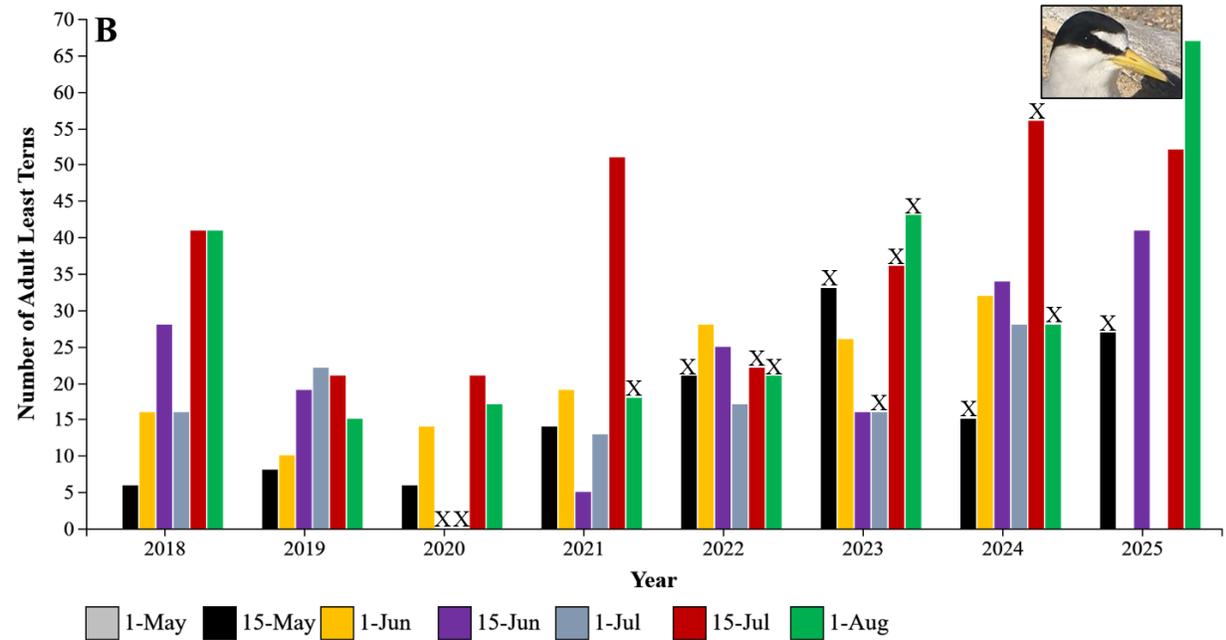
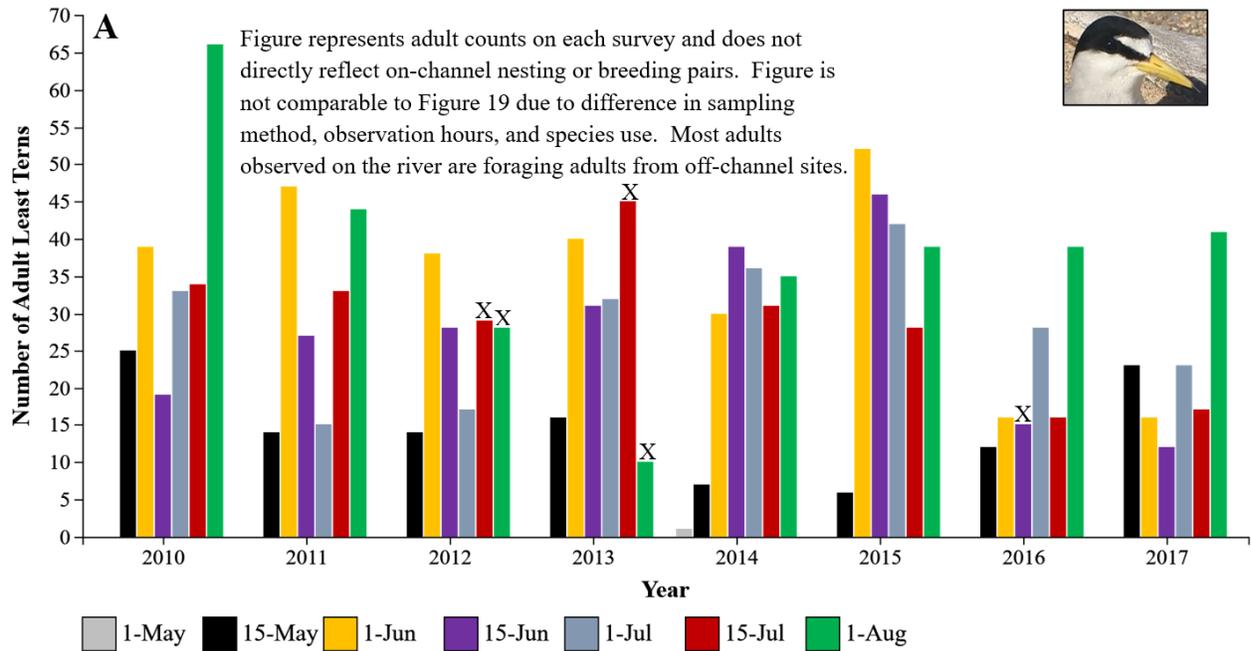
**Figure 18.** Number of adult least terns observed during three monthly surveys of OCSW sites along the Platte River between Lexington and Chapman, Nebraska, 2001-2009. Numbers of adults include observations of both non-breeding and breeding least terns.



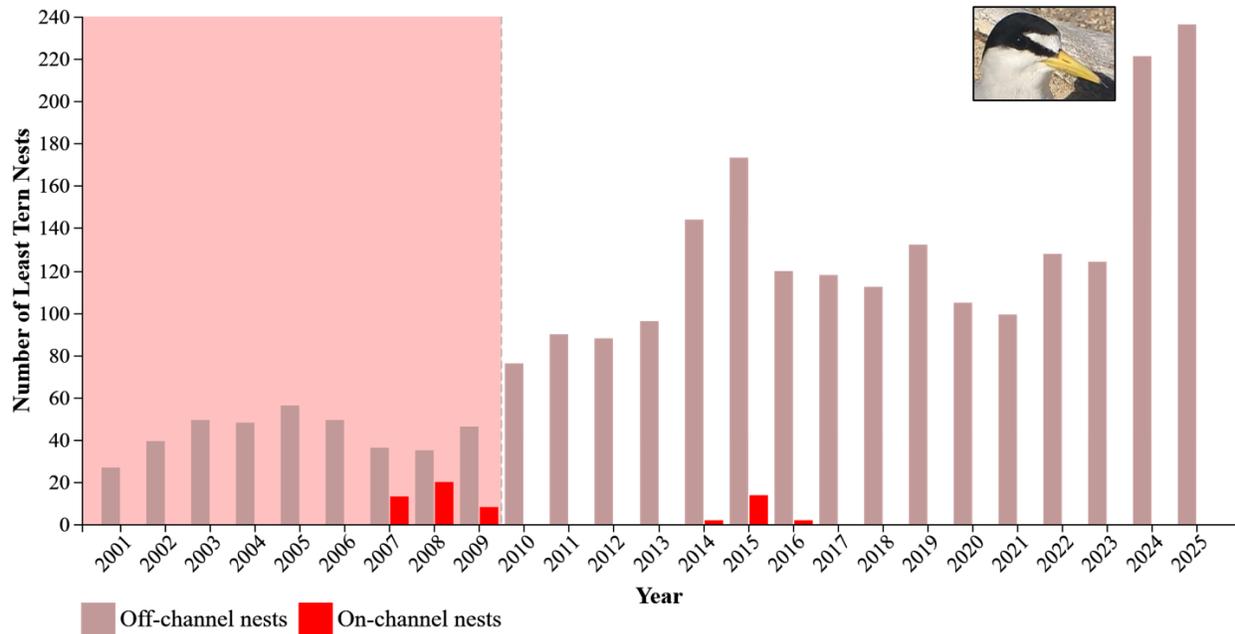
**Figure 19.** Number of adult least terns observed during semi-monthly surveys of OCSW sites along the Platte River between Lexington and Chapman, Nebraska, 2010-2025, during the periods of (A) 2010-2017, and (B) 2018-2025. Numbers of adults include observations of both non-breeding and breeding least terns.



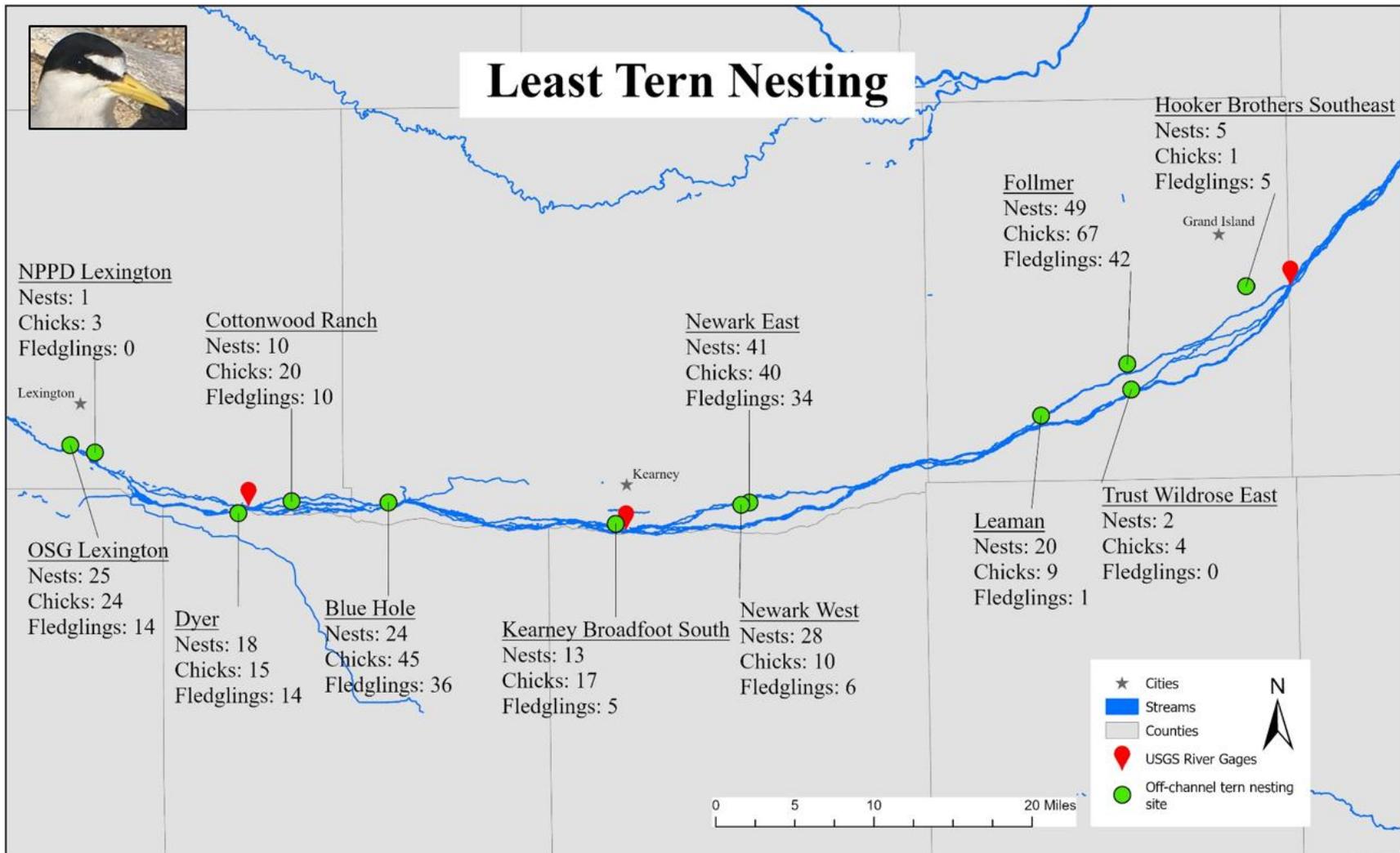
**Figure 20.** Number of adult least terns observed during three monthly surveys of the Platte River between Lexington and Chapman, Nebraska, 2001-2009. Numbers of adults include observations of both non-breeding and breeding least terns. Sampling periods for which at least one section of the river was not completed due to lack of flow or high flow in the channel, or other restrictions, are denoted with an “X”. These surveys include: 15 May 2007, 2008; 15 June 2003, 2004, 2006, 2008; and 15 July 2003, 2004, 2005, 2006, 2008.



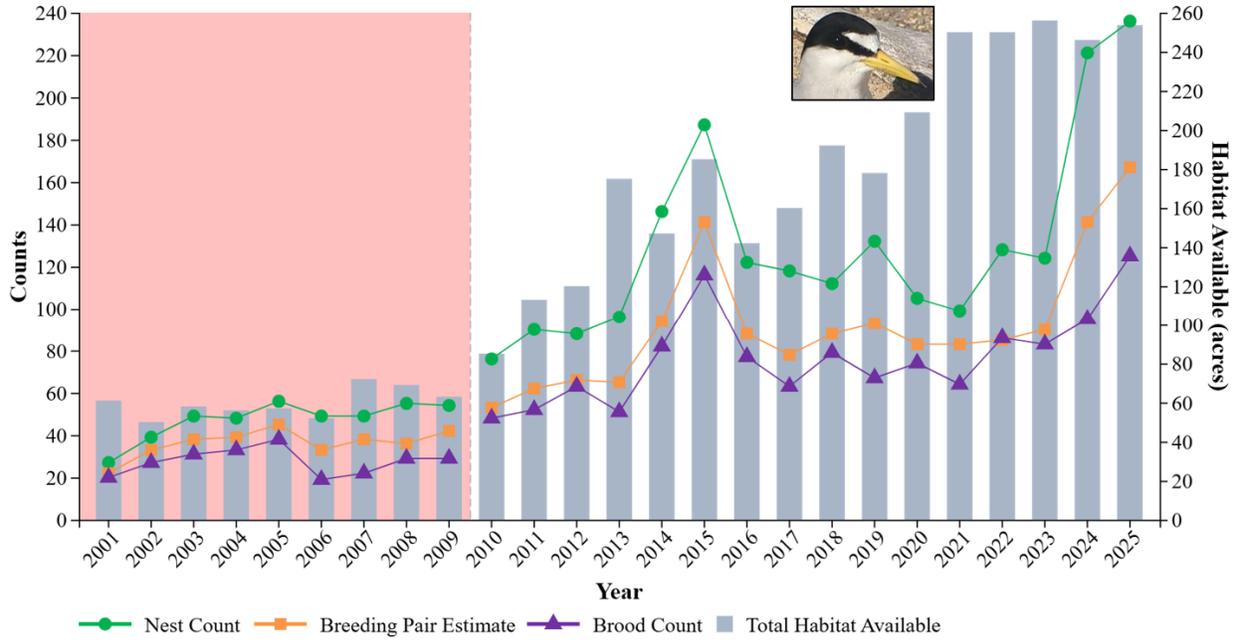
**Figure 21.** Number of adult least terns observed during semi-monthly (2010-2024) and monthly (2025) surveys of the Platte River between Lexington and Chapman, Nebraska, during the periods of (A) 2010-2017, and (B) 2018-2025. Sampling periods for which at least one section of the river was not completed due to lack of flow or high flow in the channel, or other restrictions, are denoted with an “X”. These survey dates include: May 2025; 15 May 2022, 2023, 2024; 15 June 2016, 2020; 1 July 2020, 2023; 15 July 2012, 2013, 2022, 2023, 2024; and 1 August 2012, 2013, 2021, 2022, 2023, 2024.



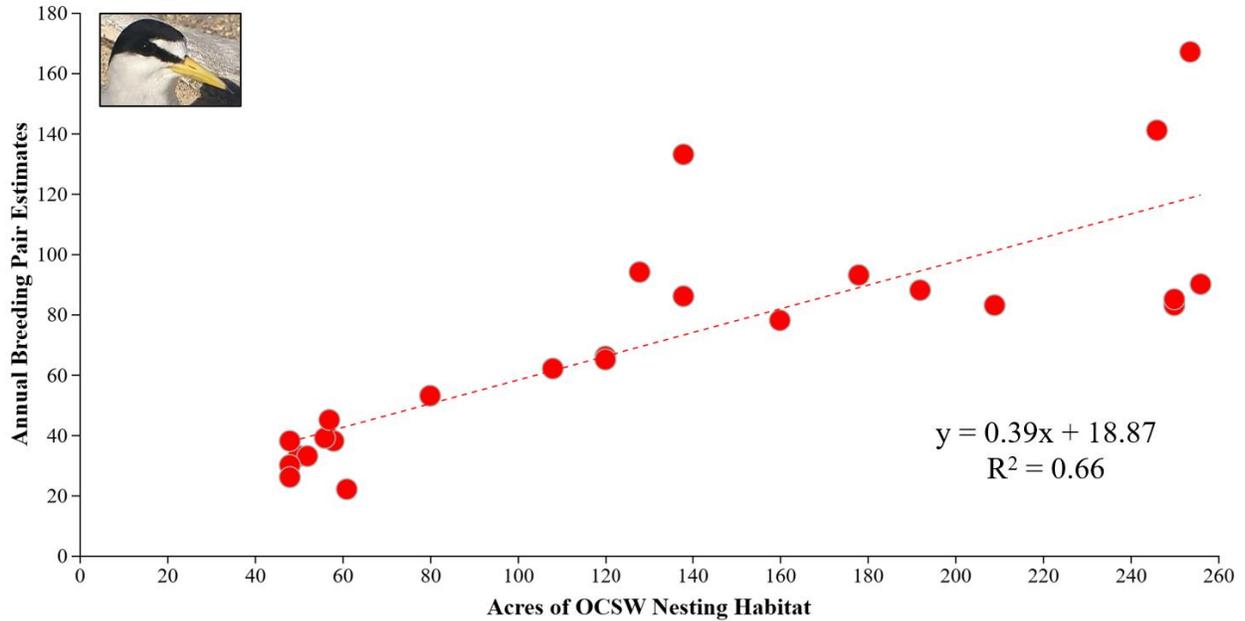
**Figure 22.** Comparison of numbers of least tern nests found during off-channel (light red bars) and on-channel (dark red bars) surveys within the Program Associated Habitat Reach (AHR) along the Platte River between Lexington and Chapman, Nebraska, 2001-2025. The dashed line represents changes in protocol between 2009-2010, including an increase in monitoring effort. The shaded area represents years in which nest totals are not comparable to recent totals.



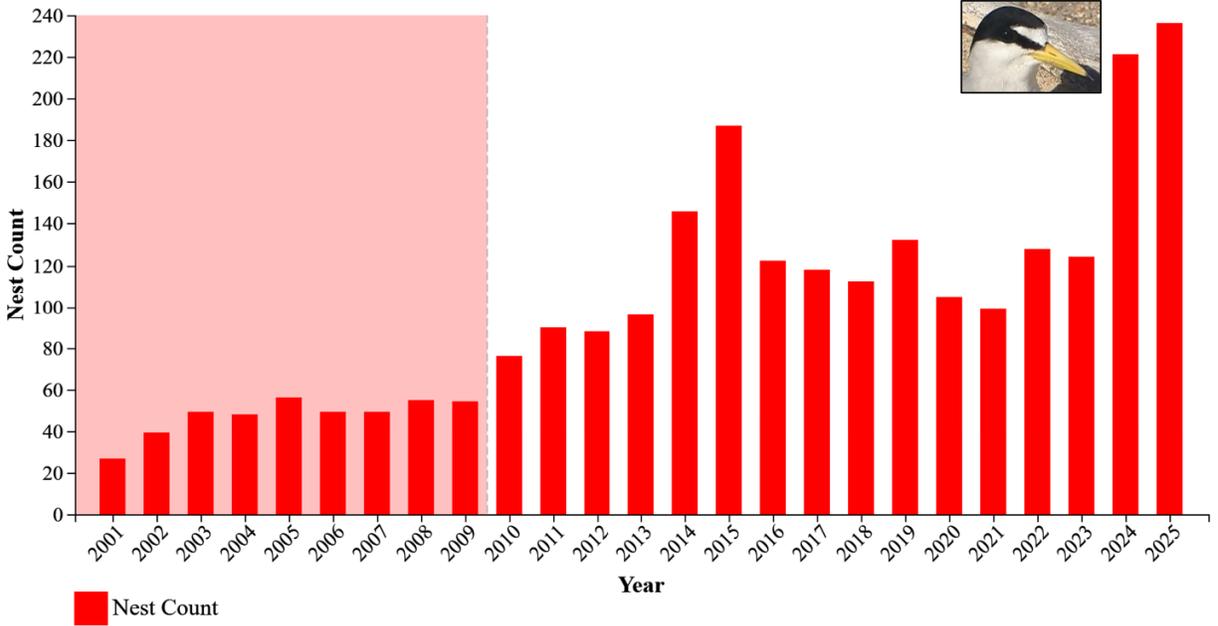
**Figure 23.** Distribution and numbers of least tern nests, chicks, and fledglings observed within Program associated habitats during 2025 surveys along the Platte River between Lexington and Chapman, Nebraska. Least tern nests and chicks were observed and monitored at 12 of 18 off-channel sites during 2025. The locations of the Overton (USGS gage 06768000, [USGS 2025a](#)), Kearney (USGS gage 06770200, [USGS 2025b](#)) and Grand Island (USGS gage 0670500, [USGS 2025c](#)) river gages are marked with a red pin.



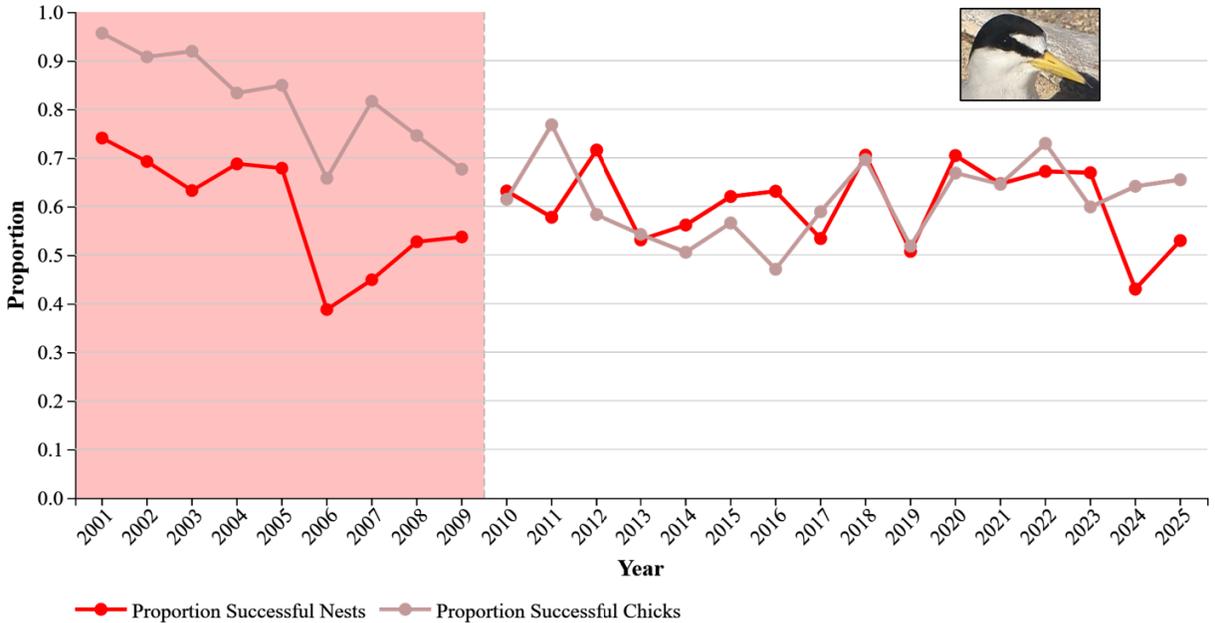
**Figure 24.** Annual variation in the total numbers of least tern nests (green line), breeding pair estimates (orange line), brood counts (purple line), and total on- and off-channel habitat available (acres; blue bars) observed within the Program Associated Habitat Reach (AHR) along the Platte River between Lexington and Chapman, Nebraska, during 2001-2025. The dotted line represents changes in protocol that occurred between 2009 and 2010, including an increase in monitoring effort. Data from 2001-2009 (shaded area) may not be comparable to data from 2010-2025. Due to access restrictions that limited monitoring at some sites, available habitat from 2001-2009 only included sites that were used in the reproductive and survival calculations each year.



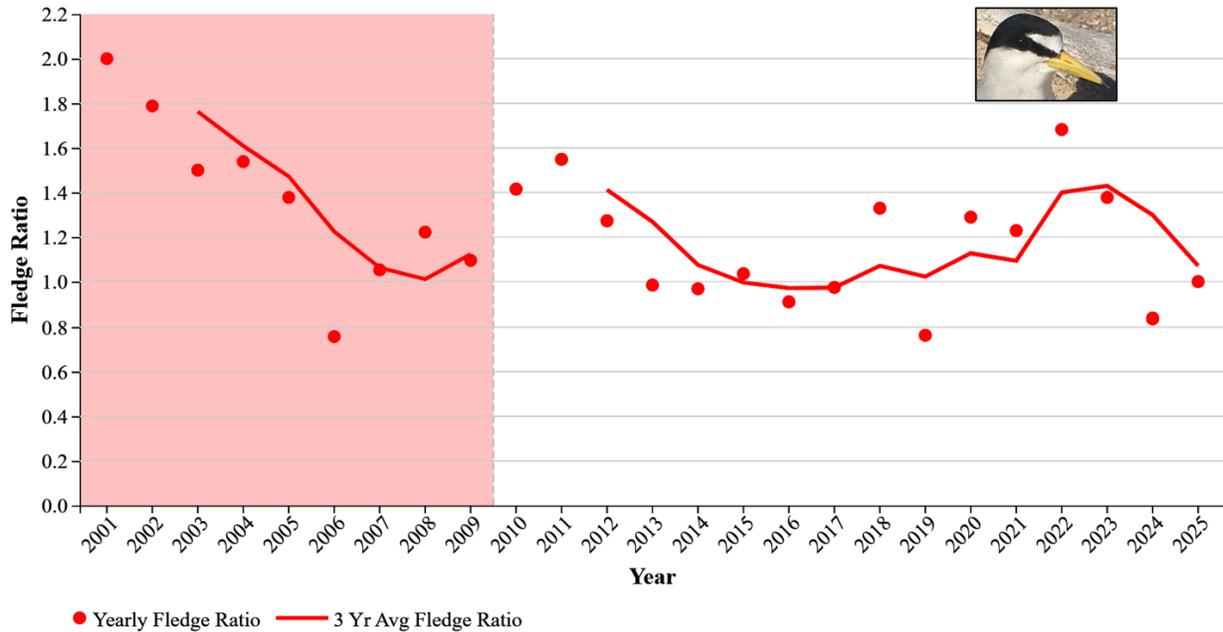
**Figure 25.** Relationship between the annual estimated number of OCSW least tern breeding pairs and availability (acres) of monitored off-channel habitat (OCSW sites) within the Program Associated Habitat Reach (AHR) between Lexington and Chapman, Nebraska, during 2001-2025. For every acre of OCSW habitat increase, an increase of 0.39 least tern breeding pairs occurred (95% CI: 0.27-0.52 breeding pairs) at OCSW sites in the AHR and the results were statistically significant ( $P < 0.001$ ). The linear line of best fit with corresponding equation and  $R^2$  values are depicted. Due to access restrictions that limited monitoring at some sites, available habitat from 2001-2009 only included sites that were used in the reproductive and survival calculations each year.



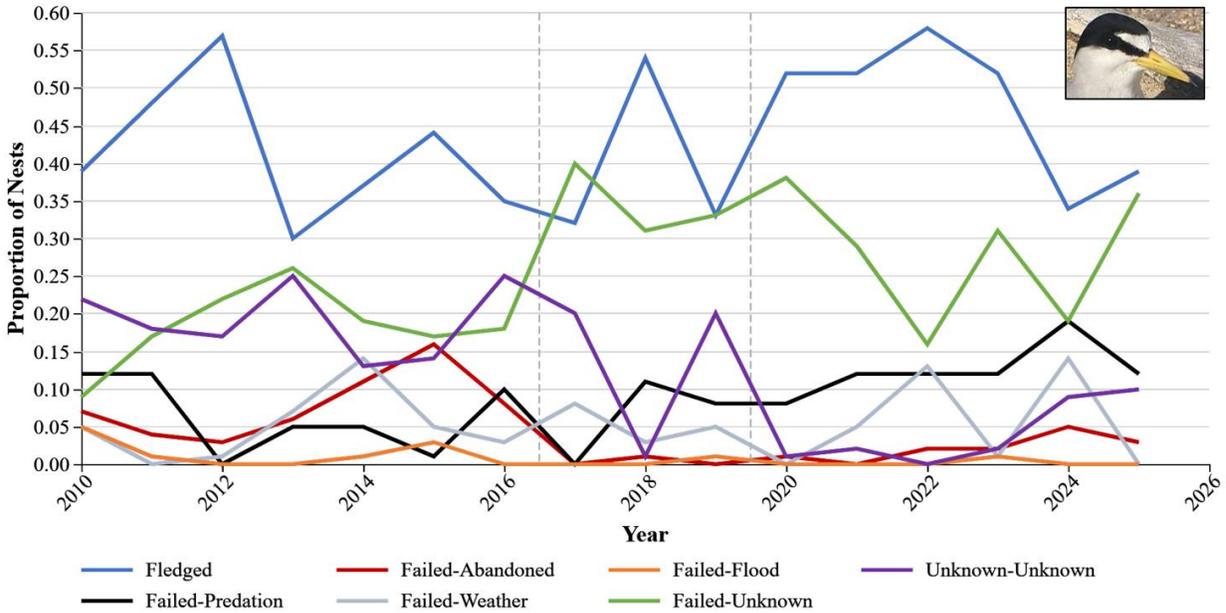
**Figure 26.** Total number of least tern nests (nest count) observed during on- and off-channel surveys within the Program Associated Habitat Reach (AHR) along the Platte River between Lexington and Chapman, Nebraska, 2001-2025. The dashed line represents changes in protocol between 2009 and 2010, including an increase in monitoring effort. The shaded area represents years in which nest totals are not comparable to recent totals.



**Figure 27.** Proportion of successful nests and proportion of successful chicks for least tern nests monitored during 2001-2025 within the Program Associated Habitat Reach (AHR) along the Platte River between Lexington and Chapman, Nebraska. The dotted line represents changes in protocol between 2009 and 2010, including the fledge age being increased from 15-days to 21-days for least tern chicks. The shaded area represents years in which proportions of successful nests and chicks are not comparable to recent totals.



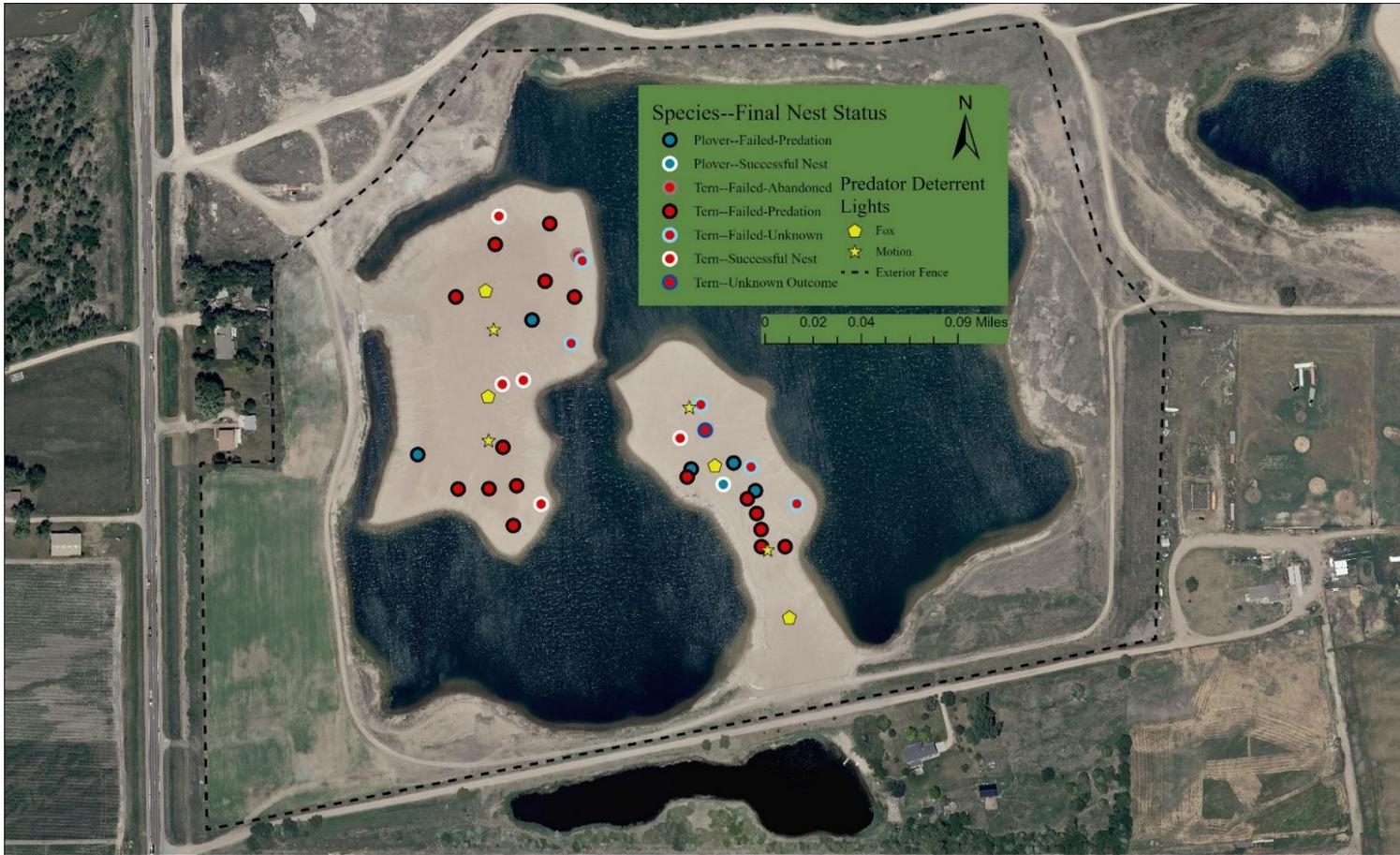
**Figure 28.** Least tern fledge ratios (chicks fledged/estimated breeding pair [BPE]) on annual (point) and three-year running average (lines) bases during 2001-2009 and 2010-2025 within the Program Associated Habitat Reach (AHR) along the Platte River between Lexington and Chapman, Nebraska. The dotted line represents changes in protocols between 2009 and 2010, including the fledge age being increased from 15-days to 21-days for least tern chicks. The shaded area represents years in which fledge ratios are not comparable to recent fledge ratios.



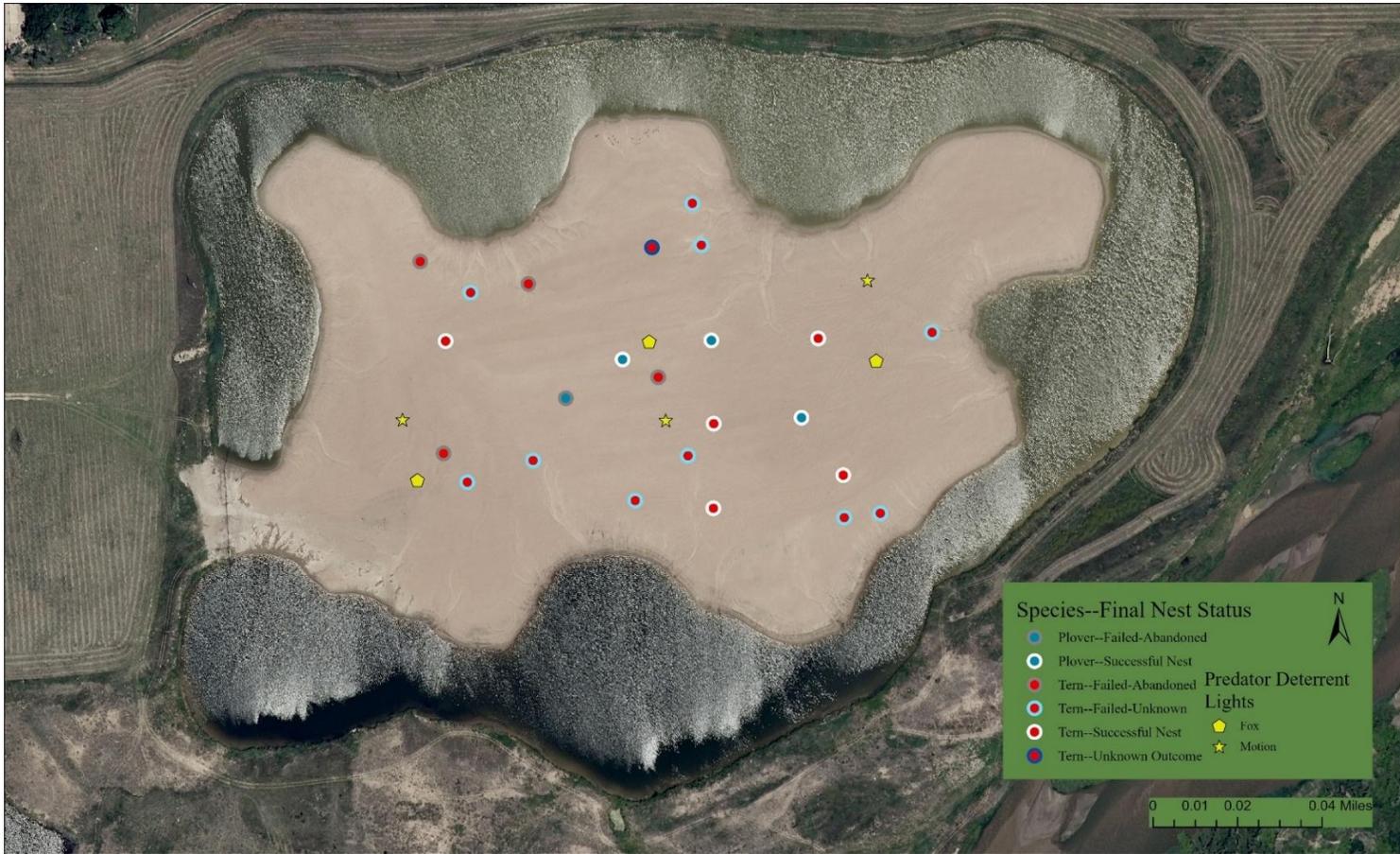
**Figure 29.** Proportion of least tern nest successes with fledglings and nest or brood failures (incurred during incubation or before fledging) by year during 2010-2025 across the Program Associated Habitat Reach (AHR) along the Platte River between Lexington and Chapman, Nebraska. Each nest success or failure represents a unique reproductive attempt. Assigned causes of nest or brood failures include: abandonment, flooding, predation, weather, and failed due to unknown causes. The dotted line represents changes in monitoring protocol that occurred between 2016 and 2017, and 2019 and 2020. During 2010-2016, monitoring protocols included twice weekly inside and outside surveys at all sites with nesting and twice monthly river surveys. During 2017-2019, monitoring included twice weekly outside surveys at all sites with nesting, use of incidental evidence to fate nests, and twice monthly river surveys. During 2020-2025, monitoring included twice weekly outside surveys at all sites with nesting; camera monitoring at a sample of nests, nest sites, and shorelines to fate nests; use of incidental evidence to fate nests; and additional predator management. Semi-monthly river surveys were conducted from 2020-2024 and monthly river surveys were conducted in 2025.



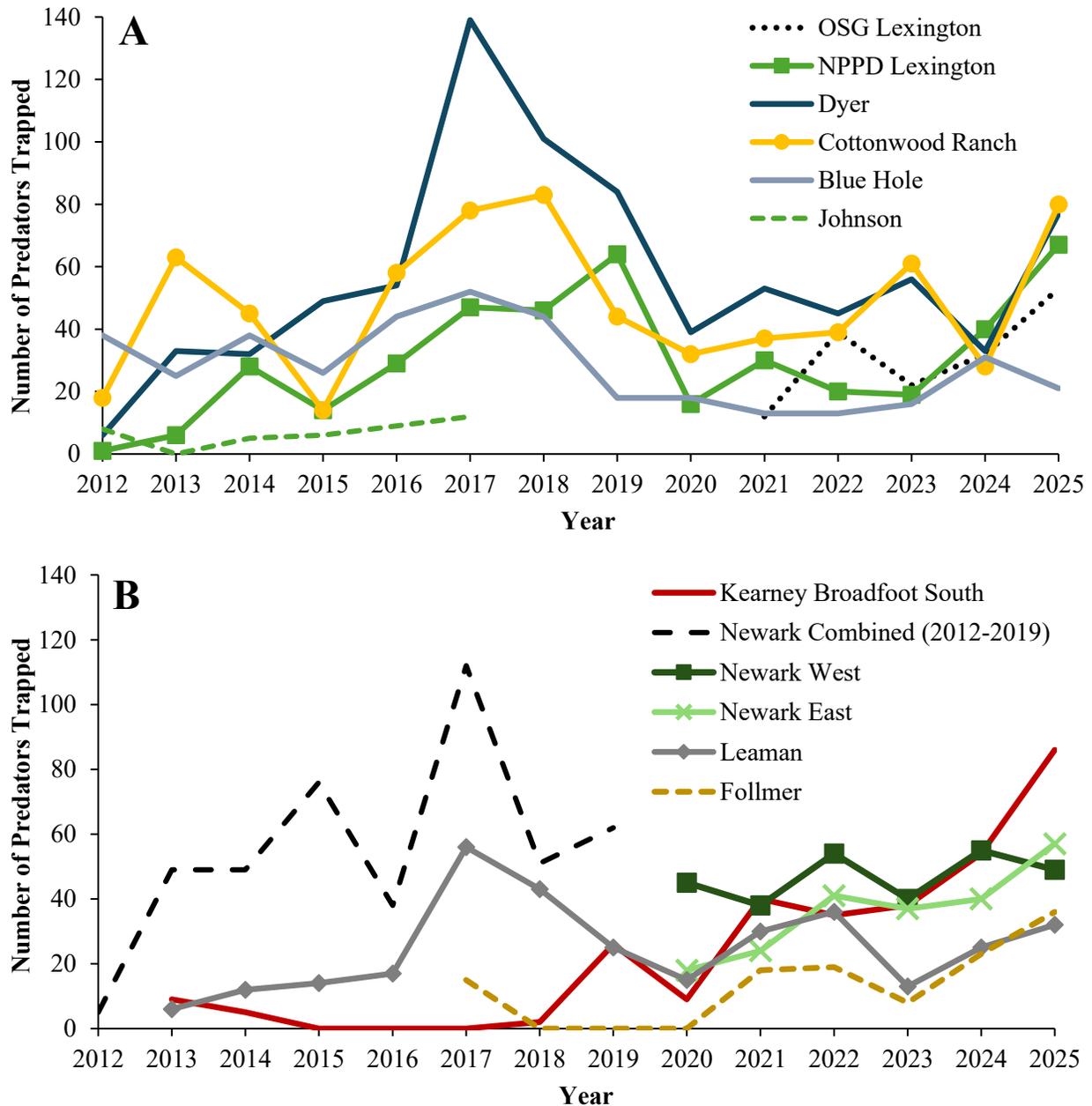
**Figure 30.** Piping plover (Plover, blue inner circle) and least tern (Tern, red inner circle) nest locations and corresponding final nest status at the Kearney Broadfoot South off-channel sand and water (OCSW) site during May through August 2025. Also depicted are predator management efforts including: blinking walking lights (yellow asterisks) mounted to the fence line to give the illusion of movement; random pattern lights (yellow pentagons) and motion-activated lights (yellow stars) deployed in sets and evenly distributed; and an interior predator exclusion fence (black dashed line) placed along the shoreline. The final nest status denotes whether the nest was successful and at least one chick hatched, or the nest failed during the incubation stage. Final nest status for successful nests is denoted by a blue circle with a white outer ring for plovers and a red circle with a white outer ring for terns. Nests that failed due to predation are denoted with a black outer ring; nests that failed due to unknown causes are denoted with a light blue outer ring; and nests that failed due to weather are denoted with a purple outer ring.



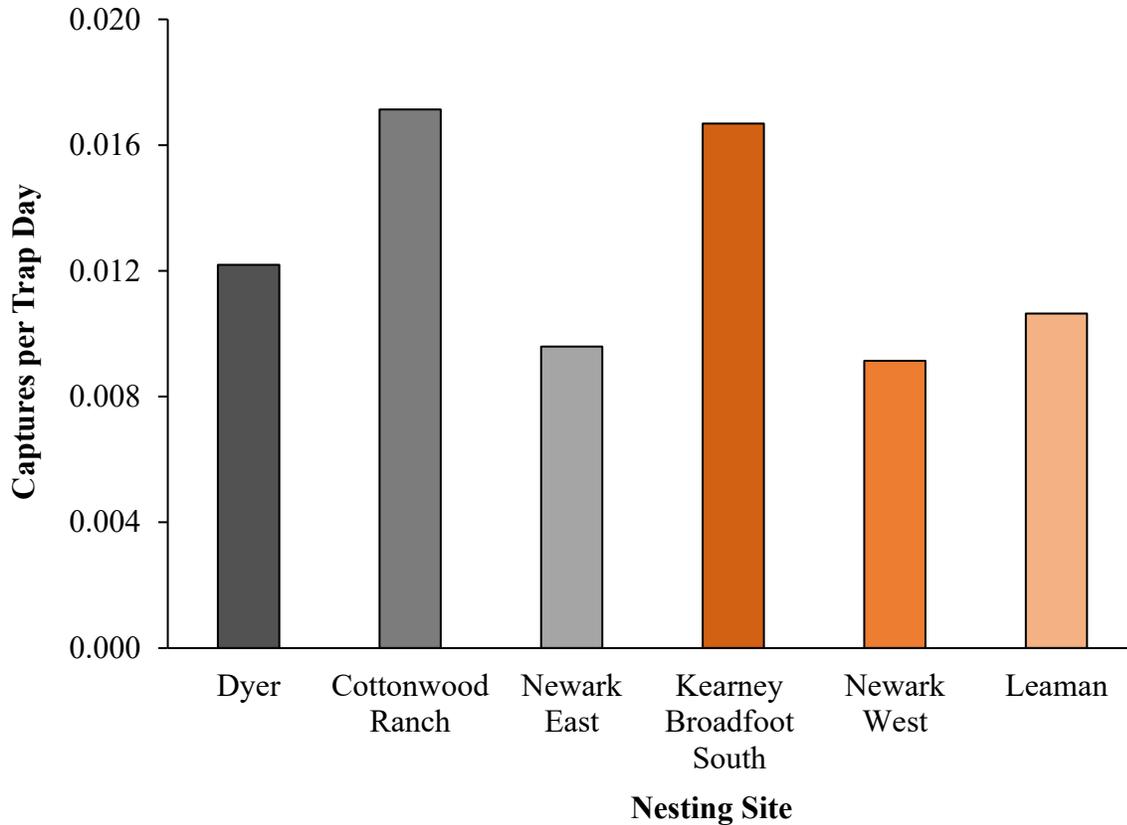
**Figure 31.** Piping plover (Plover, blue inner circle) and least tern (Tern, red inner circle) nest locations and corresponding final nest status at the Newark West off-channel sand and water (OCSW) site during May through August 2025. Also depicted are predator management efforts including: random pattern lights (yellow pentagons) and motion-activated lights (yellow stars) deployed in sets and evenly distributed; and an exterior fence (black dashed line) placed around the site. The final nest status denotes whether the nest was successful and at least one chick hatched, or the nest failed during the incubation stage. Final nest status for successful nests is denoted by a blue circle with a white outer ring for plovers and a red circle with a white outer ring for terns. Nests that failed due to predation are denoted with a black outer ring; nests that failed due to abandonment are denoted with a gray outer ring; nests that failed due to unknown causes are denoted with a light blue outer ring; and nests that had an unknown outcome are denoted with a dark blue outer ring.



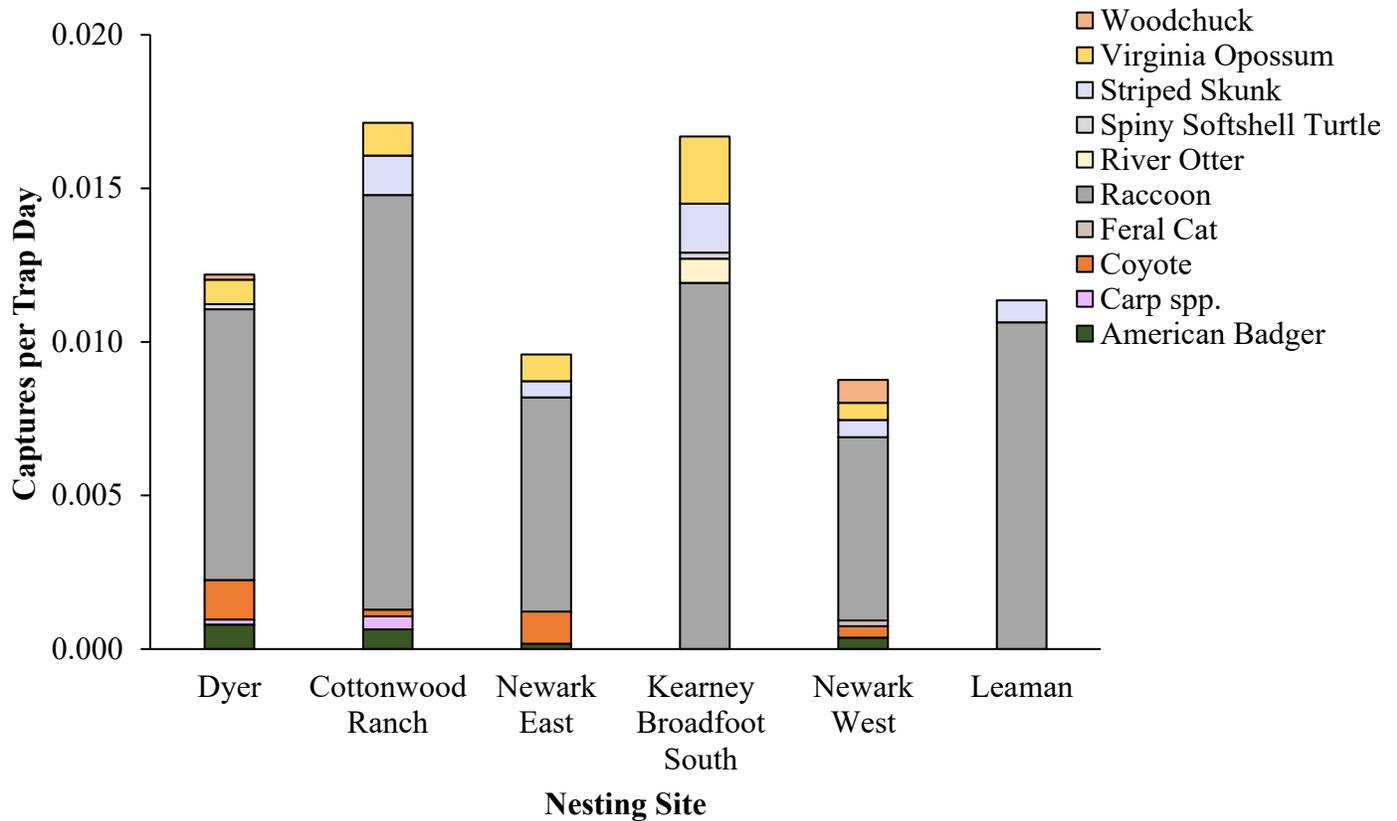
**Figure 32.** Piping plover (Plover, blue inner circle) and least tern (Tern, red inner circle) nest locations and corresponding final nest status at the Leaman off-channel sand and water (OCSW) site during May through August 2025. Also depicted are predator management efforts including: random pattern lights (yellow pentagons) and motion-activated lights (yellow stars) deployed in sets and evenly distributed. The final nest status denotes whether the nest was successful and at least one chick hatched, or the nest failed during the incubation stage. Final nest status for successful nests is denoted by a blue circle with a white outer ring for plovers and a red circle with a white outer ring for terns. Nests that failed due to abandonment are denoted with a gray outer ring; nests that failed due to unknown causes are denoted with a light blue outer ring; and nests that had an unknown outcome are denoted with a dark blue outer ring.



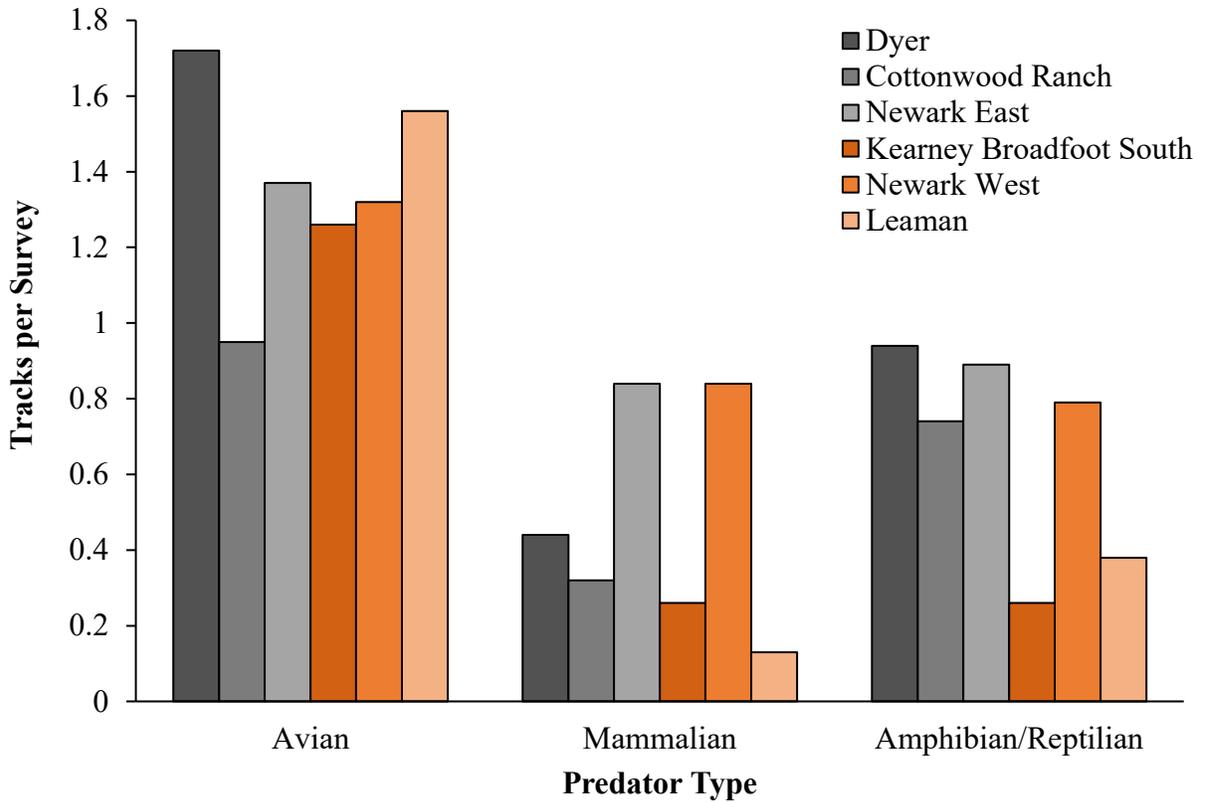
**Figure 33.** Annual variability in the total number of predators trapped at Program-managed and Nebraska Public Power District OCSW piping plover and least tern nesting sites during 2012-2025 between (A) Lexington and Kearney, and (B) Kearney and Alda, Nebraska. Predator trapping occurred during March through August of most years and trapping efforts increased substantially in 2017 at OCSW sites. Trapping did not occur at Kearney Broadfoot South during 2012. Captures only occurred at Follmer in 2017 and during 2021-2025 despite annual trapping efforts during 2017-2025. Predators trapped at Newark West and Newark East were previously reported as a total for both sites and are labeled here as Newarks Combined (2012-2019) until 2020 when Newark East was reported separately from Newark West. Predators trapped at Kearney Broadfoot South and NAI Kearney Broadfoot South are reported as a total for both sites and are labeled as Kearney Broadfoot South.



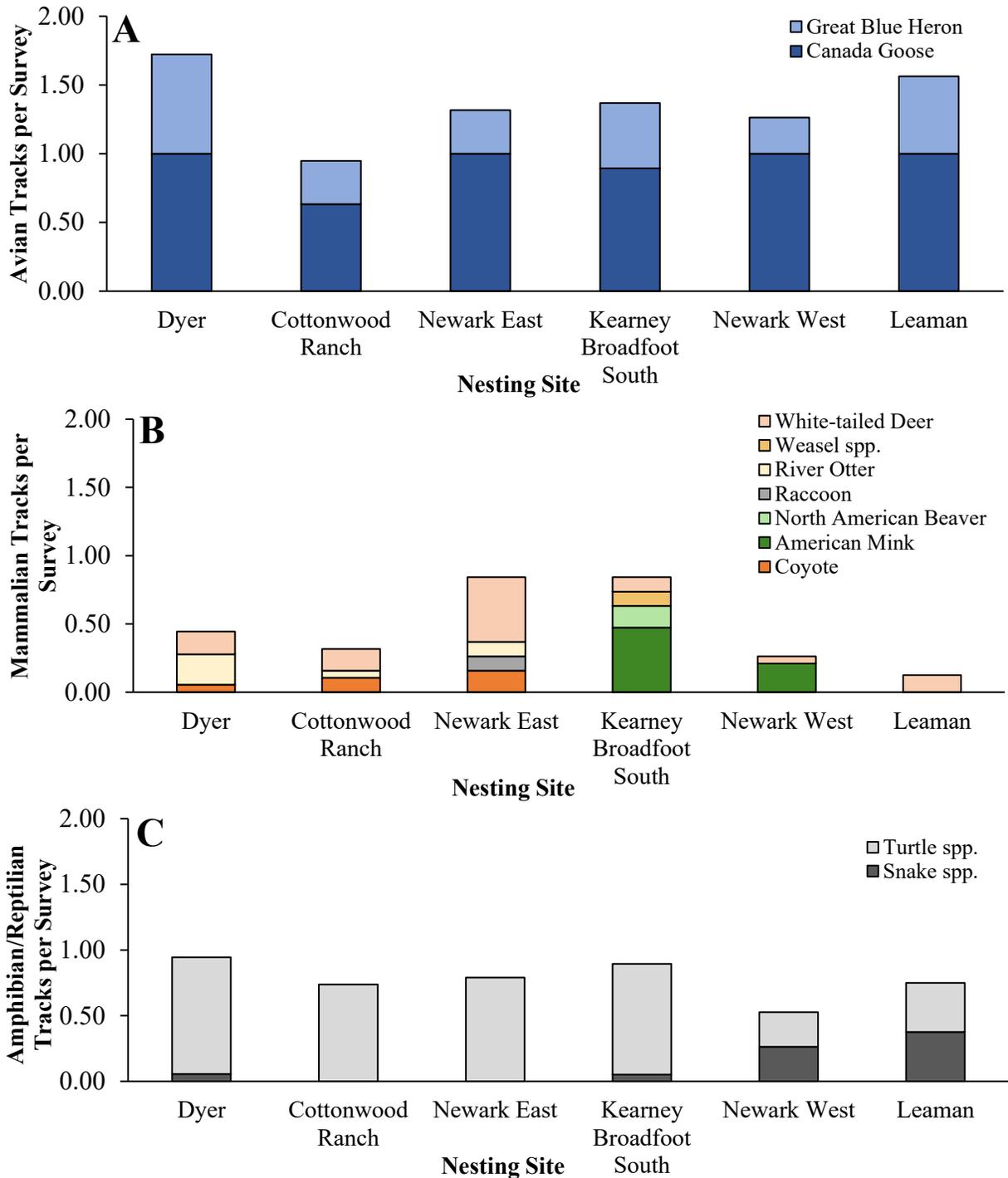
**Figure 34.** Captures of potential predator species per trap day at six OCSW piping plover and least tern nesting sites adjacent to the central Platte River, Nebraska, during mid-March through early September 2025. Captures per trap day was calculated by dividing the total number of potential predator species captured in traps by the total number of trap days at each site. The total number of trap days at each site was calculated based on the number of traps deployed at each site and the number of days each trap was active for trapping. Sites had basic predator management (gray bars) or additional predator management (orange bars). Sites with basic predator management were Dyer, Cottonwood Ranch, and Newark East. Sites with additional predator management were Kearney Broadfoot South, Newark West, and Leaman.



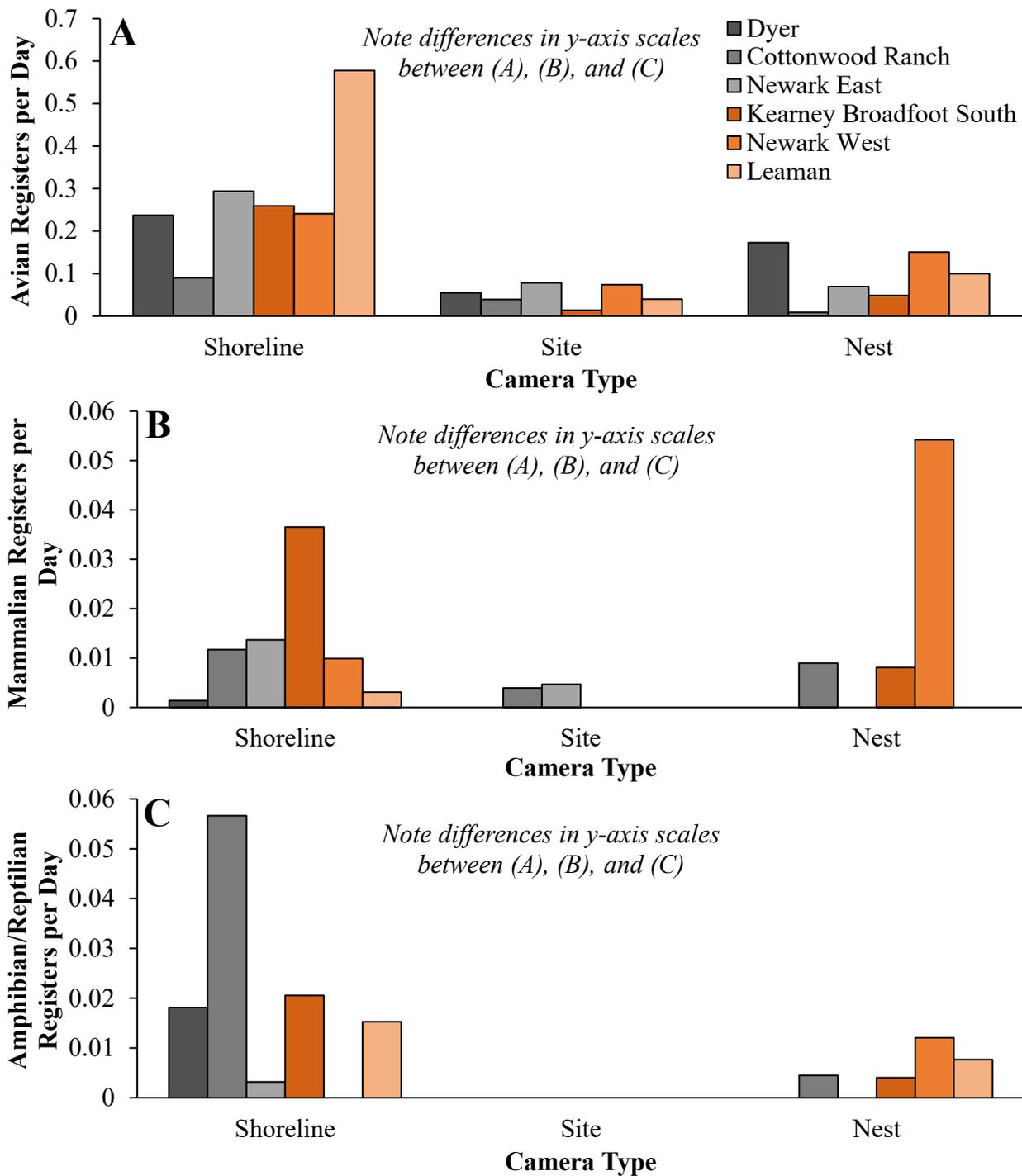
**Figure 35.** Captures of potential predator species per trap day by species at six OCSW piping plover and least tern nesting sites adjacent to the central Platte River, Nebraska, during March through early September 2025. Captures per trap day for each species was calculated by dividing the total number of each species captured in traps at each site by the total number of trap days at each site. The total number of trap days at each site was calculated based on the number of traps deployed at each site and the number of days each trap was active for trapping. Sites with basic predator management were Dyer, Cottonwood Ranch, and Newark East. Sites with additional predator management were Kearney Broadfoot South, Newark West, and Leaman. spp. = not identified to species.



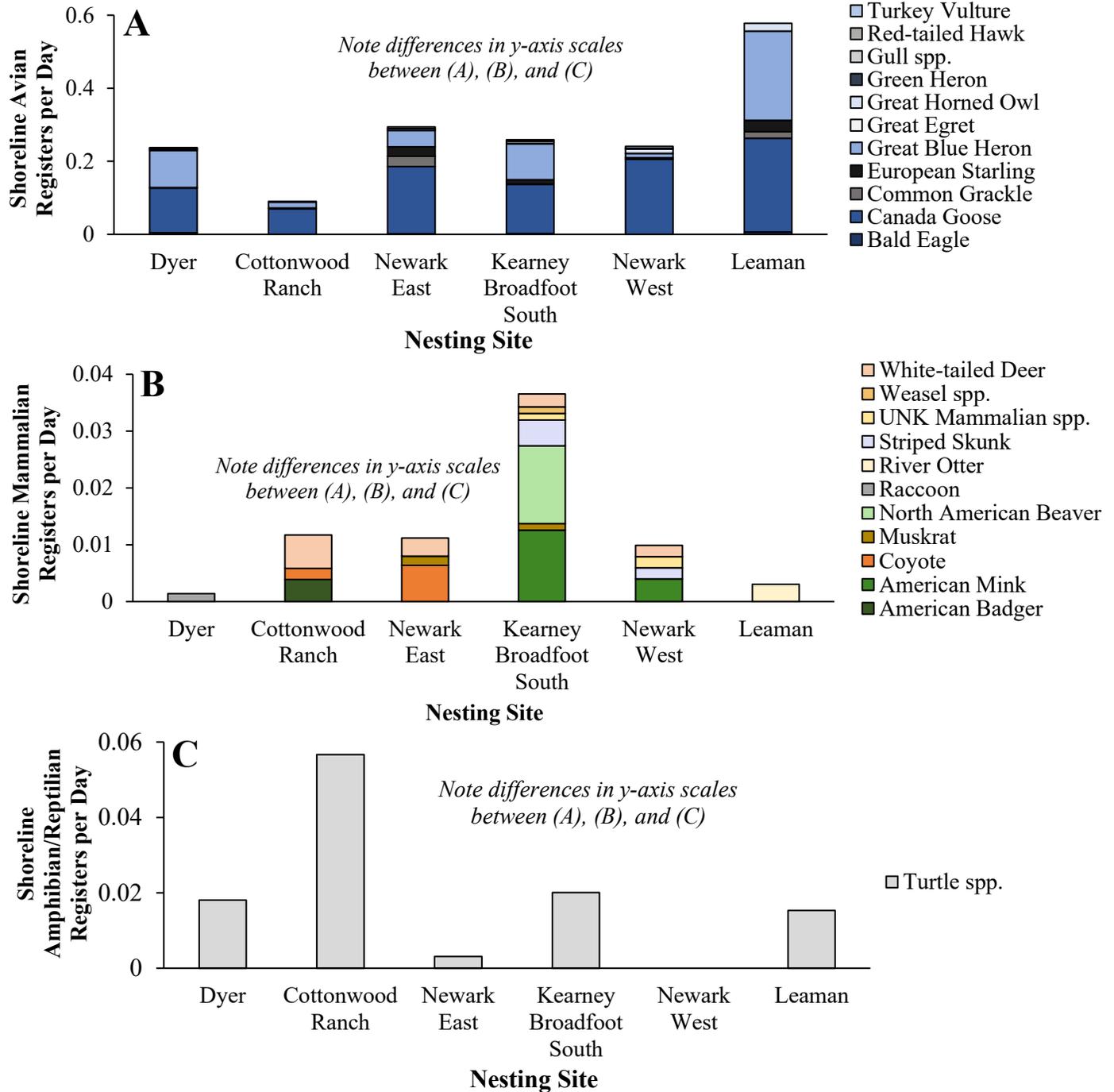
**Figure 36.** Potential avian, mammalian, and amphibian/reptilian predators registered per track survey at six OCSW piping plover and least tern nesting sites adjacent to the central Platte River, Nebraska. Tracks of potential predator species were identified using weekly track surveys at each site during May through early September 2025. Number of tracks per survey was calculated using the number of unique potential predator tracks at a site divided by the number of total weekly track surveys for each site. Sites had basic predator management (gray bars) or additional predator management (orange bars). Sites with basic predator management were Dyer, Cottonwood Ranch, and Newark East. Sites with additional predator management were Kearney Broadfoot South, Newark West, and Leaman.



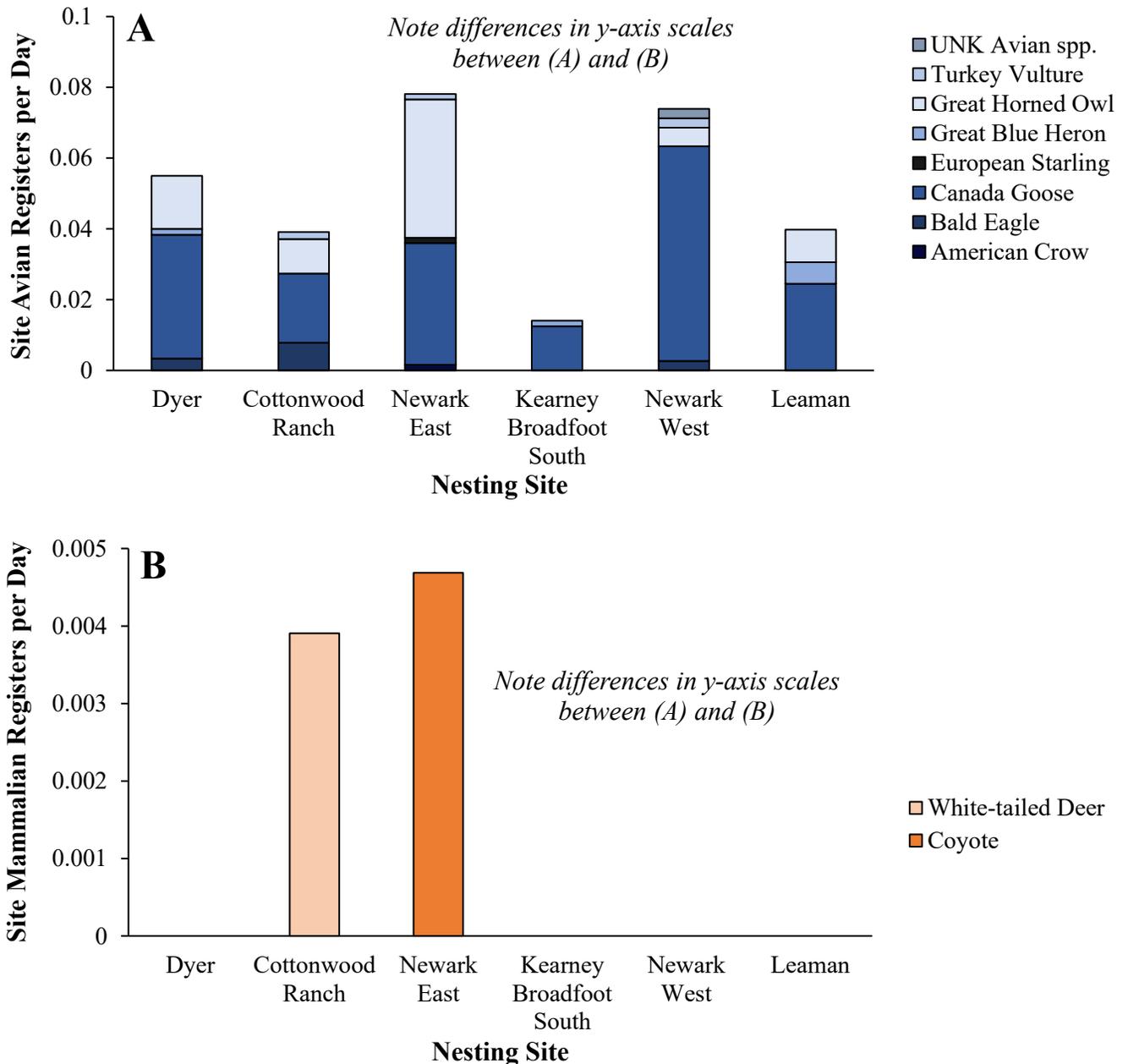
**Figure 37.** Potential (A) avian, (B) mammalian, and (C) amphibian/reptilian predator species registered per track survey at six OCSW piping plover and least tern nesting sites adjacent to the central Platte River, Nebraska. Tracks of potential predator species were identified using weekly track surveys at each site during May through early September 2025. Number of tracks per survey was calculated using the number of unique potential predator tracks at a site divided by the number of total weekly track surveys for each site. Sites with basic predator management were Dyer, Cottonwood Ranch, and Newark East. Sites with additional predator management were Kearney Broadfoot South, Newark West, and Leaman. spp. = not identified to species.



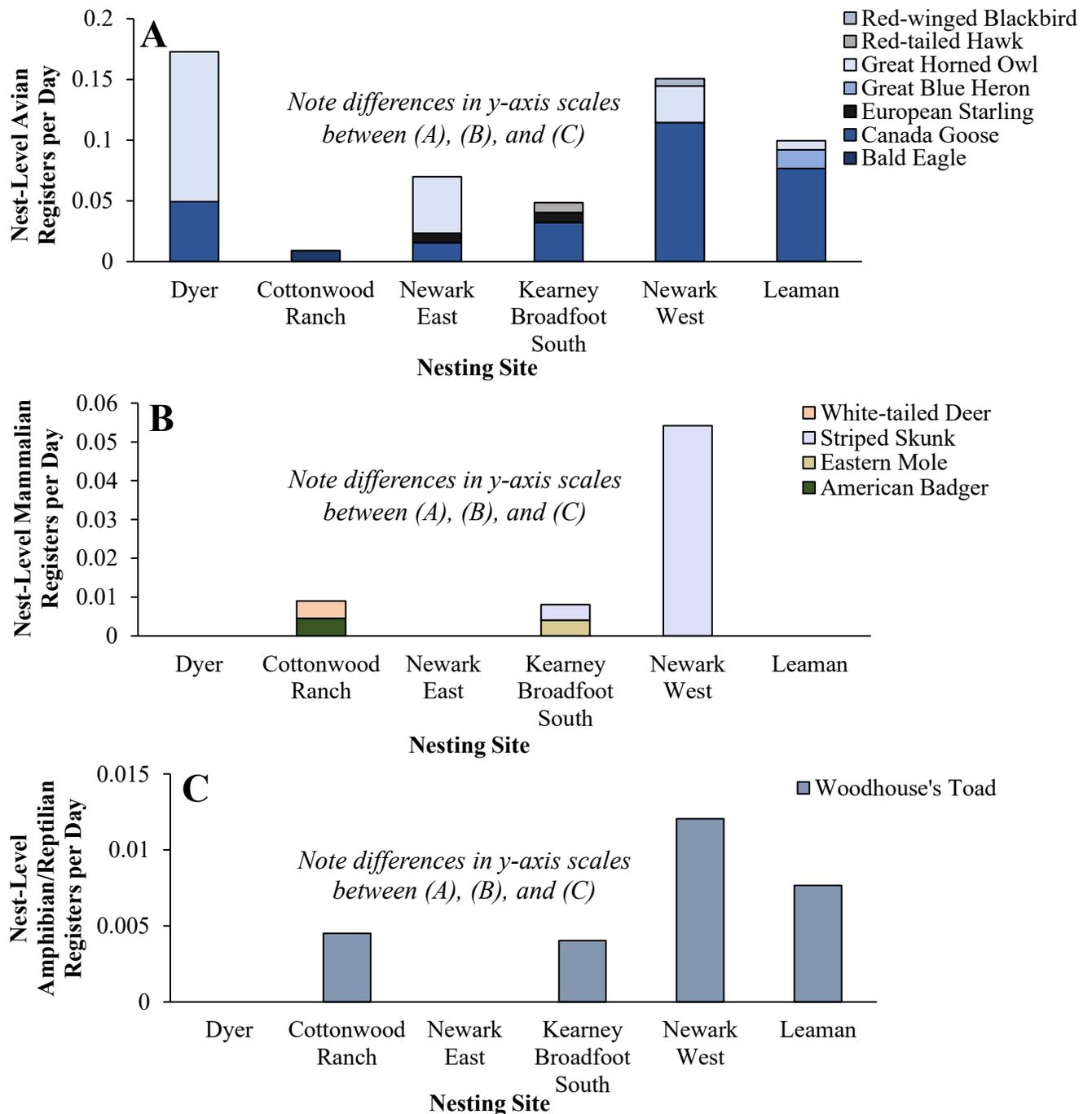
**Figure 38.** Registers of potential (A) avian, (B) mammalian, and (C) amphibian/reptilian predators captured by shoreline, site, and nest monitoring cameras per day at six OCSW piping plover and least tern nesting sites adjacent to the central Platte River, Nebraska. *Note the differences in scale of the y-axis among (A), (B), and (C).* The number of unique potential predator registers observed at a site via the indicated monitoring method was divided by the total number of camera days dedicated to the indicated monitoring effort at each site. Nest-level registers include predation events. Number of predation events per camera day is in Table 31. Sites had basic (gray bars) or additional predator management (orange bars).



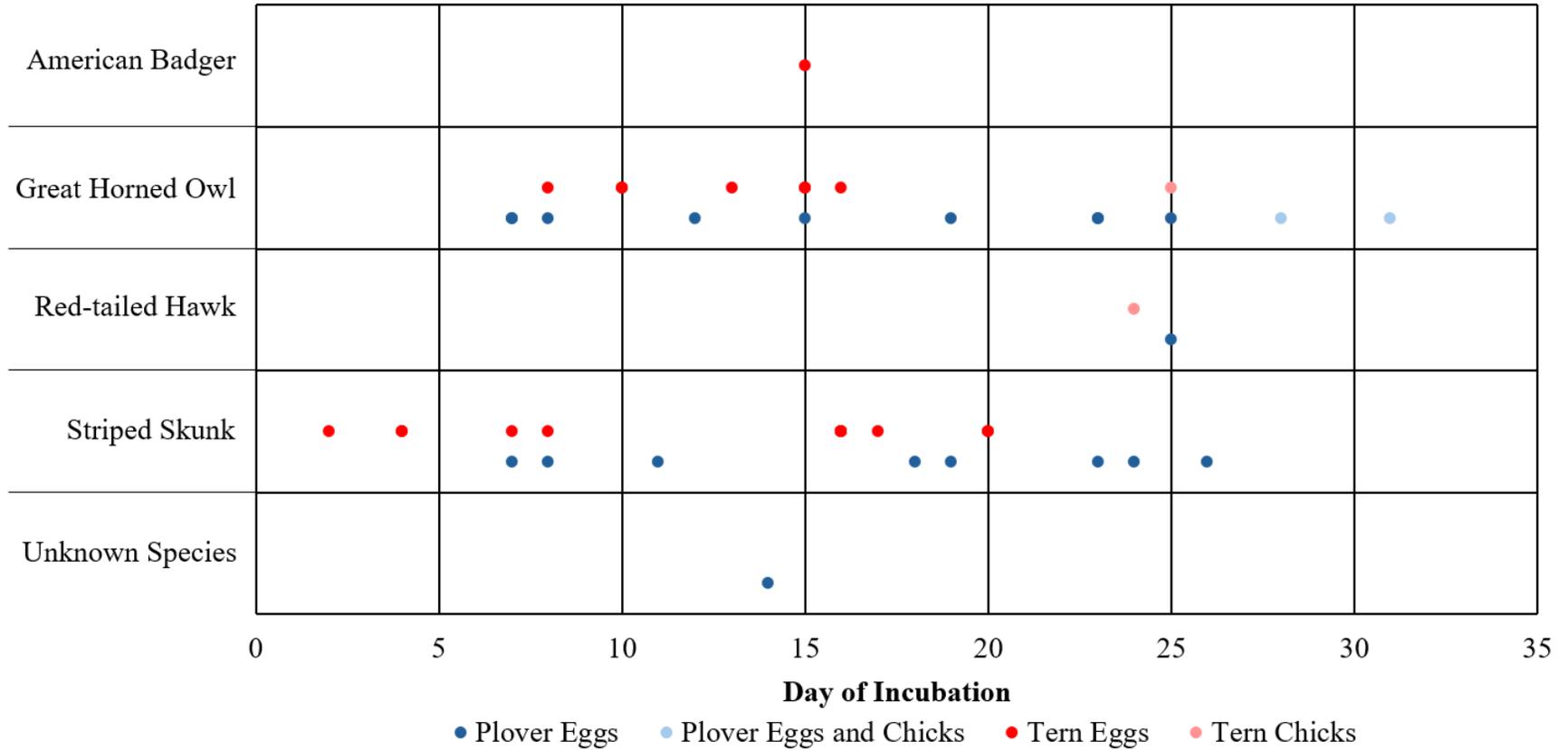
**Figure 39.** Potential (A) avian, (B) mammalian, and (C) amphibian/reptilian predator species registered by shoreline cameras at six off-channel sand and water (OCSW) piping plover and least tern nesting sites adjacent to the central Platte River, Nebraska. *Note the differences in scale of the y-axis among (A), (B), and (C).* The number of unique potential predator registers observed at a site using shoreline cameras was divided by the total number of camera days dedicated to the shoreline camera monitoring effort at that site. Sites with basic predator management were Dyer, Cottonwood Ranch, and Newark East. Sites with additional predator management were Kearney Broadfoot South, Newark West, and Leaman. UNK = unknown. spp. = not identified to species.



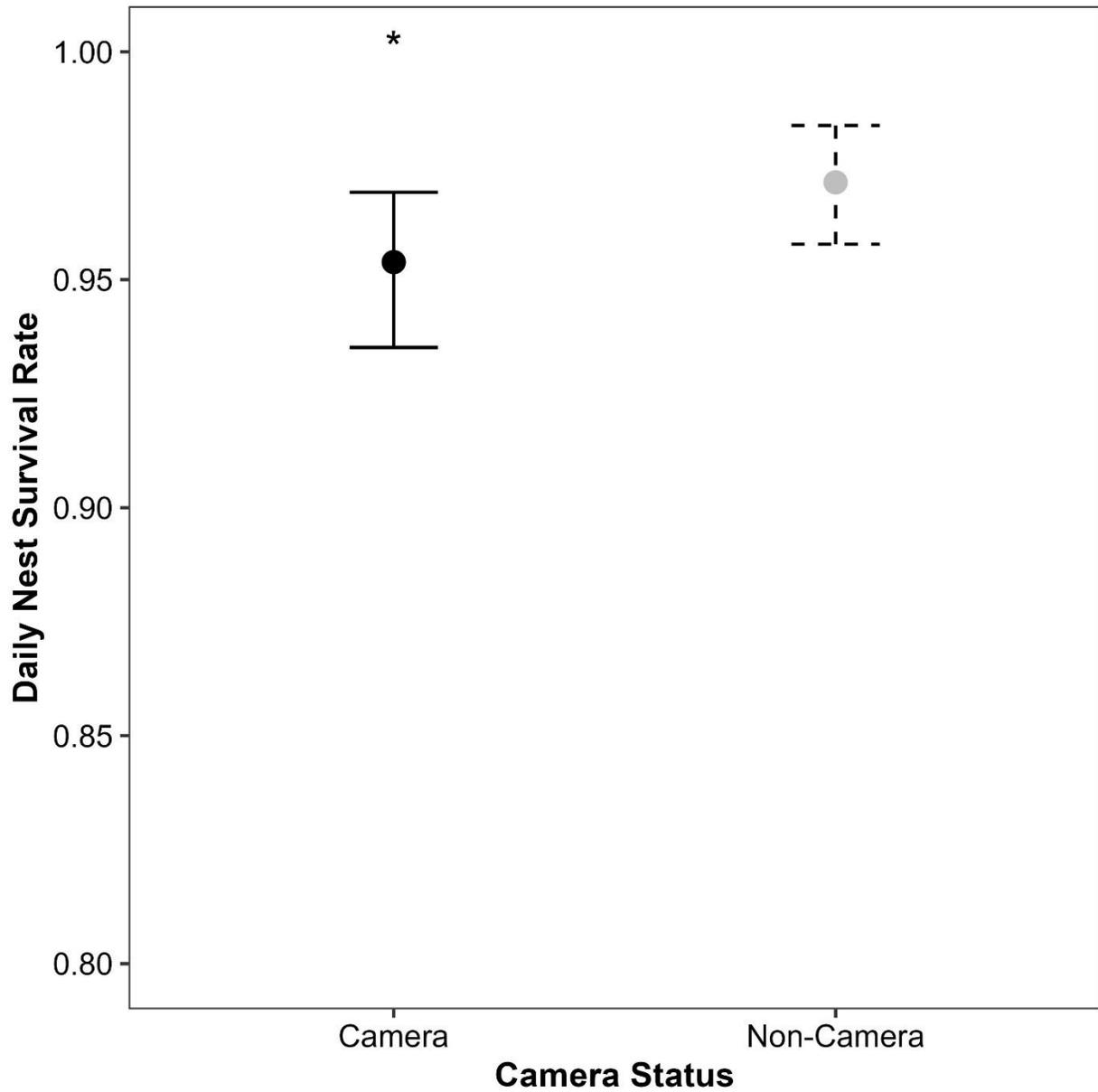
**Figure 40.** Potential (A) avian and (B) mammalian predator species registered by site-level cameras at six off-channel sand and water (OSCW) piping plover and least tern nesting sites adjacent to the central Platte River, Nebraska. *Note the differences in scale of the y-axis between (A) and (B).* No amphibian/reptilian predator species were recorded on site-level cameras at the six sites. The number of unique potential predator registers observed at a site using site-level cameras was divided by the total number of camera days dedicated to the site-level camera monitoring effort at that site. Sites with basic predator management were Dyer, Cottonwood Ranch, and Newark East. Sites with additional predator management were Kearney Broadfoot South, Newark West, and Leaman. UNK = unknown. spp. = not identified to species.



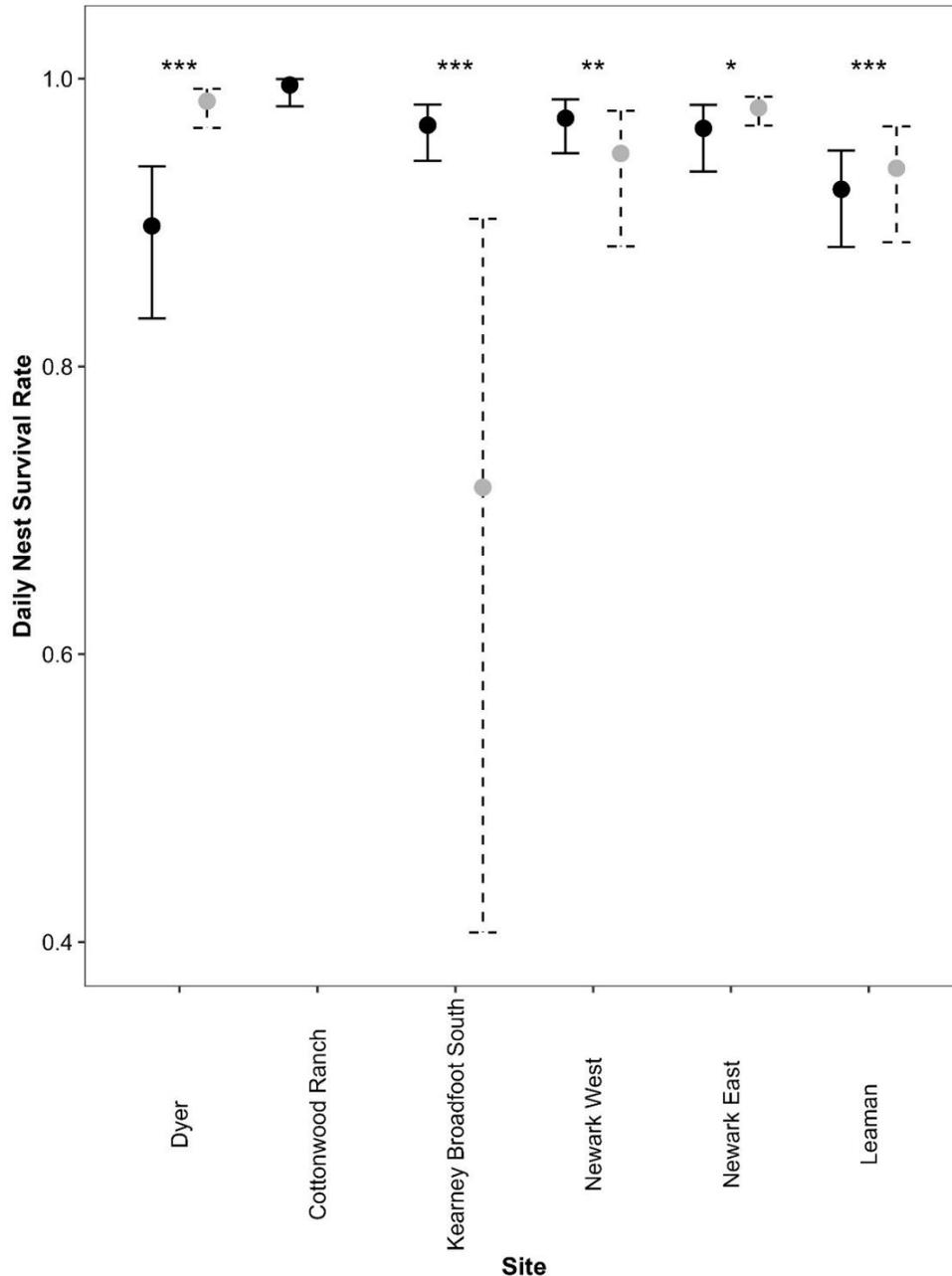
**Figure 41.** Potential (A) avian, (B) mammalian, and (C) amphibian/reptilian predator species registered by nest-level cameras at six off-channel sand and water (OSCW) piping plover and least tern nesting sites adjacent to the central Platte River, Nebraska. *Note the differences in scale of the y-axis between (A), (B), and (C).* The number of unique potential predator registers observed at a site using nest-level cameras was divided by the total number of camera days dedicated to the nest-level camera monitoring effort at that site. Nest-level registers include predation events. Number of predation events per camera day is provided in Table 31. Sites with basic predator management were Dyer, Cottonwood Ranch, and Newark East. Sites with additional predator management were Kearney Broadfoot South, Newark West, and Leaman.



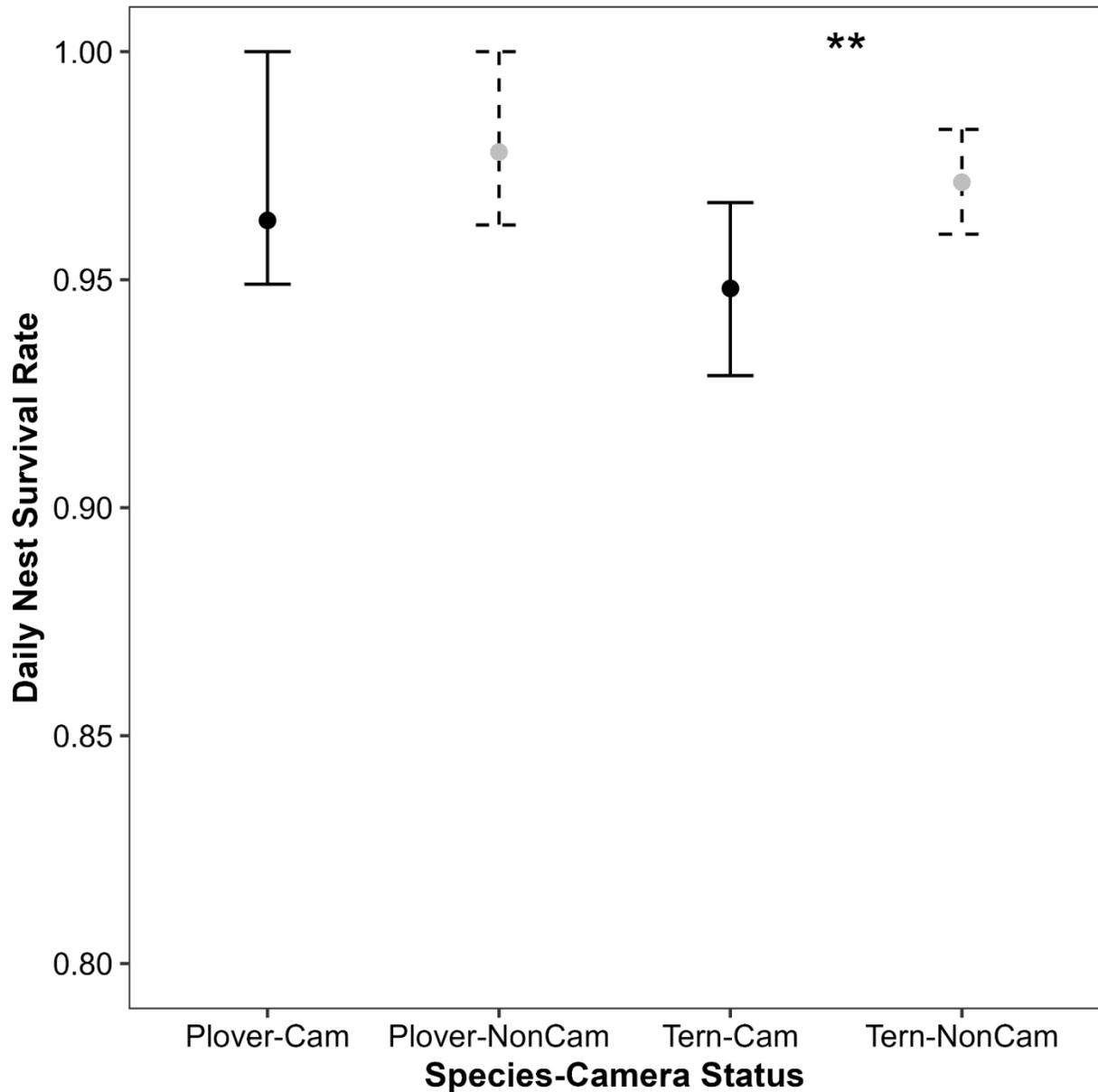
**Figure 42.** Incubation timeline indicating the day predation occurred on a total of 21 piping plover nests (blue circles) and 22 least tern nests (red circles) by an American badger, great horned owl, red-tailed hawk, striped skunk, and unknown species on nests monitored by remote cameras during 2025. Losses of multiple nests on the same day of incubation by the same predator species are represented by a single point. Nests were located at Dyer (9 nests), Cottonwood Ranch (1 nests), Kearney Broadfoot South (6 nests), Newark West (17 nests), Newark East (9 nests), and Leaman (1 nest). Data from all nest monitoring sources (i.e., outside/inside observers; nest, site, and shoreline camera data; and track surveys) were used to determine nest fates. Shades of blue/red differentiate which developmental stage the nest was at when predation occurred.



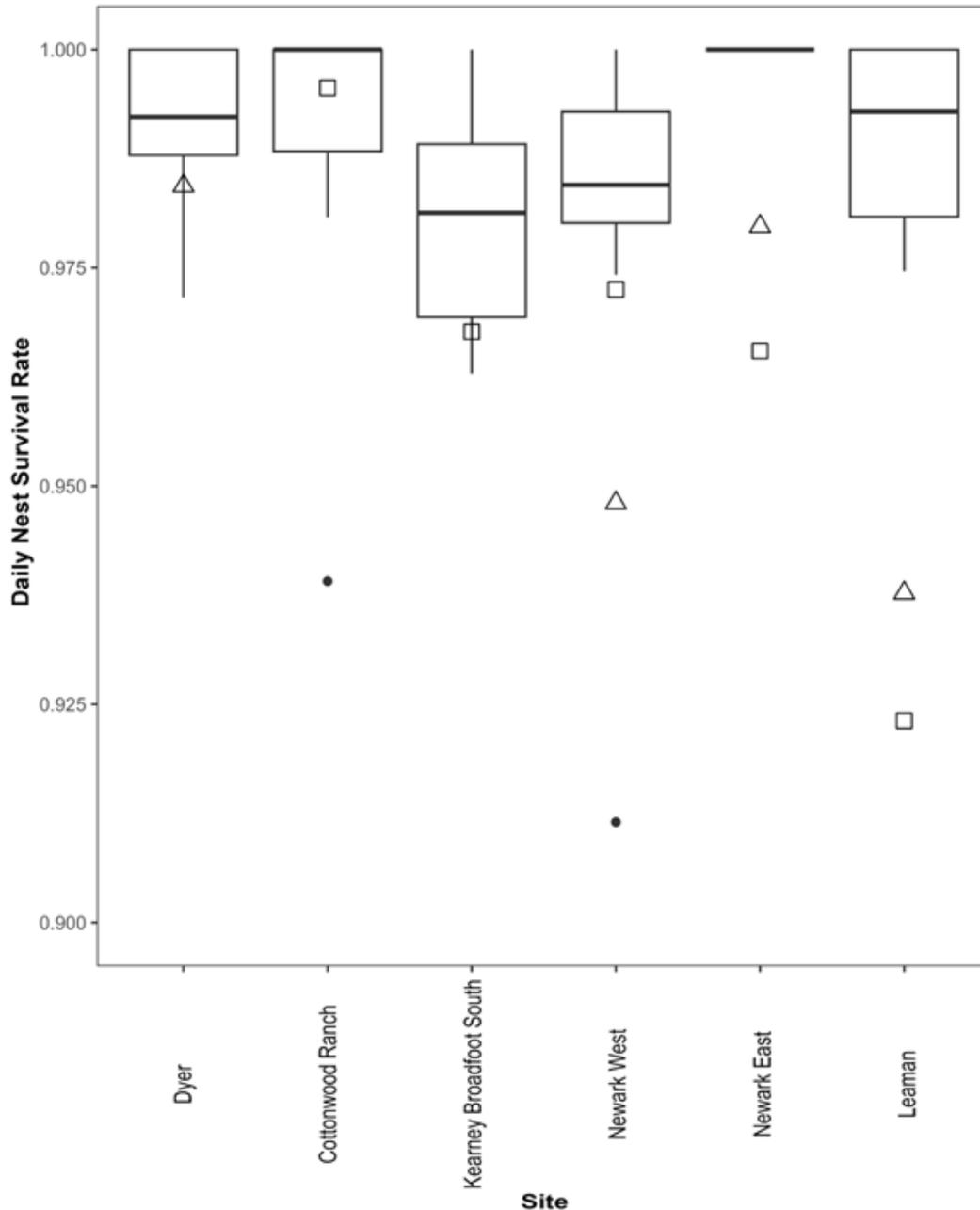
**Figure 43.** Average daily nest survival rate (DSR) of plover and tern nests with a nest camera present (Camera, black circle) or without a nest camera present (Non-camera; gray circle) at five off-channel sand and water (OCSW) sites during 2025. All nests at Cottonwood Ranch had a camera present, so it was excluded from comparison of DSR by camera presence. The 95% confidence intervals are depicted as a solid line for nests with a camera and a dashed line for nests without a camera. Nests with a camera had significantly lower DSR than nests without a camera during 2025 ( $p = 0.044$ ; \*).



**Figure 44.** Average daily nest survival rate (DSR) of plover and tern nests by site with a nest camera present (black circles) and without a nest camera present (gray circles) during 2025. EDO biologists deployed nest-level cameras at six off-channel sand and water (OCSW) sites during 2025. All nests at Cottonwood Ranch had a camera present, so no comparison of DSR by camera presence occurred. The 95% confidence intervals are depicted as a solid line for nests with a camera and a dashed line for nests without a camera. Significant differences in DSR among nests with and without cameras were found at 5 sites. DSR was significantly lower for nests with a camera at Dyer ( $p < 0.001$ ; \*\*\*), Newark East ( $p = 0.029$ ; \*), and Leaman ( $p < 0.001$ ; \*\*\*). Sites with significantly higher DSR for nests with a camera included Kearney Broadfoot South ( $p < 0.001$ ; \*\*\*) and Newark West ( $p = 0.003$ ; \*\*).



**Figure 45.** Average daily nest survival rate (DSR) of plover nests with a nest camera present (Plover-Cam, black circle), plover nests without a nest camera present (Plover-NonCam, gray circle), tern nests with a nest camera present (Tern-Cam, black circle), and tern nests without a nest camera present (Tern-NonCam, gray circle) at five off-channel sand and water (OCSW) sites during 2025. All nests at Cottonwood Ranch had a camera present, so it was removed due to an inability to statistically evaluate differences of DSR by camera presence. The 95% confidence intervals are depicted as a solid line for nests with a camera and a dashed line for nests without a camera. There was no significant difference in DSR at nests with and without cameras for plovers during 2025. For terns, DSR was significantly lower for nests with a camera present ( $p = 0.015$ ; \*\*).



**Figure 46.** Average daily nest survival rate (DSR) of nests with a camera present (hollow squares) and nests without a camera present (hollow triangle) at six off-channel sand and water (OCSW) sites during 2025. The distribution (boxplots) of DSR prior to nesting site camera usage (2010-2016) are shown. DSR estimates not included in the figure are nests with a camera present at Dyer in 2025 (DSR = 0.898) and nests without a camera present at Kearney Broadfoot South in 2025 (DSR = 0.742), and a Cottonwood Ranch 2010-2016 outlier (DSR = 0). Only one site (Cottonwood Ranch) did not have a nest without a camera present, thus it was removed due to inability to statistically evaluate differences between nests and camera presence. The sample size for Newark East during 2010-2016 was one plover nest and one tern nest that were both successful, resulting in a DSR equal to 1.

## APPENDIX A

**Table A1.** Research relevant to the Program’s objectives and to our understanding of piping plover ecology.

Publication Year	Study Topic	Citation	Document Title	Study Years	Summary	Primary Findings
2025	Tern and Plover Conservation Partnership annual reports	<a href="https://ternandplover.unl.edu/additional-information/annual-reports/">Tern and Plover Conservation Partnership https://ternandplover.unl.edu/additional-information/annual-reports/</a>	Interior least tern and piping plover annual report for the lower Platte River, Nebraska	2008-2025	Annual reports for terns and plovers on the lower Platte River, Nebraska	These reports provide a synthesis of the respective annual monitoring and research efforts for piping plovers and least terns along the lower Platte River, Nebraska and the reproductive data collected.
2025	Population trend inferences	<a href="https://doi.org/10.3390/land14091846">Bohnett E, Schulz J, Dobbs R, Hoctor T, Ahmad Bilal, Rashid W, and Waddle JH. Land 14:1846. https://doi.org/10.3390/land14091846</a>	Assessing survey design for long-term population trend detection in piping plovers	2012-2019	Authors assessed how spatial and temporal scales influence population trend inference for piping plovers.	Authors applied dynamic occupancy models and conducted a comprehensive power analysis to plover detection and occupancy data but found that the sensitivity of occupancy estimates varied considerably across spatial scales and model types. Continued monitoring over longer periods of time and incorporating additional ecological and environmental variables could enable more robust and accurate model results.
2025	Nest exclosures	<a href="https://doi.org/10.1675/063.048.0104">Forsberg EM, Jorgensen JG, Swift RJ, Powell LA, and Vrtiska MP. Waterbirds 48(1):1-11. https://doi.org/10.1675/063.048.0104</a>	Effects of nest exclosure on nest and adult survival of piping plover ( <i>Charadrius melodus</i> ) in the lower Platte River system, Nebraska	2008-2024	Effects of nest exclosures were tested on nest survival and weekly within-season apparent survival of plovers.	Authors found that nest exclosures marginally improved nest survival, although there was weak evidence. There was no evidence of an effect for within-season survival of breeding adults when using nest exclosures.

2025	Breeding dispersal probabilities	<a href="#">Swift RJ, Anteau MJ, Ellis KS, MacDonald GJ, Ring MM, Sherfy MH, Toy DL, and Koons DN. Ecological Applications 35:e70037.  https://doi.org/10.1002/eap.70037</a>	Not all spatially structured populations are metapopulations : re-examining paradigms for a threatened shorebird	2014-2019	Authors examined annual adult survival and breeding dispersal probabilities at two spatial scales within the northern Great Plains plover breeding population.	Annual survival of plovers varied minimally among breeding regions but varied across years. Authors found that breeding dispersal probabilities were temporally variable, high, and unbalanced at both spatial scales examined, suggesting high connectivity in contrast to metapopulation dynamics. Therefore, results contradict the paradigm that northern Great Plains piping plovers are structured as a metapopulation.
2024	Platte River Recovery Implementation Program tern and plover monitoring reports	<a href="#">Available on Program Online Library:  https://platteriverprogram.org/program-library.  Keywords: least tern, piping plover, technical reports</a>	Annual piping plover and least tern synthesis reports	2001-2024	Annual reports for terns and plovers on the central Platte River, Nebraska	These reports provide a synthesis of the respective annual monitoring and research efforts for piping plovers and least terns along the Program's Associated Habitat Reach on the central Platte River, and the reproductive data collected.
2024	Grackle predation of a plover nest	<a href="#">Arneson JR, Peloquin DA, Prestby TG, and Saunders SP. 2024. Waterbirds 47(1):1-6.  https://doi.org/10.1675/063.047.0111</a>	Common grackle ( <i>Quiscalus quiscula</i> ) predation of a Great Lakes piping plover ( <i>Charadrius melodus</i> ) nest and its conservation implications	June 2023	A common grackle was observed consuming eggs from a protected Great Lakes plover nest, the first photographic documentation of grackle predation of a plover nest.	After documenting a common grackle consuming eggs from an enclosed (protected) Great Lakes plover nest, common grackles have been added to the suite of egg predators for plovers. This has critical implications for plovers, particularly in the Great Lakes region. Piping plovers are listed as federally endangered in this region and common grackles are relatively abundant. Current nest protection efforts rely on enclosures with openings that enable access by grackles. Authors recommend identifying plover nesting locations across the Great Lakes region that are frequently used by common grackles and subsequent alteration of enclosure use and/or habitat or predator management at locations where grackles are particularly problematic.

2024	Plover nest site selection	<a href="https://hdl.handle.net/1091/117400">Dorsey SS. 2024. Masters Thesis, Virginia Tech. https://hdl.handle.net/1091/117400</a>	Factors affecting piping plover ( <i>Charadrius melodus</i> ) nest site selection following landscape and predator community changes	2010-2020	Authors assessed changes in vegetation succession, plover nesting habitat selection, and suitable habitat availability from 2010 until 8 years after Hurricane Sandy.	Plovers exhibited a preference for nest sites with increased predator visibility compared to random selection, indicating a strategic selection process. Topographical variation caused greater visual obstruction at nest sites than vegetation.
2024	Plover monitoring program and costs	<a href="https://doi.org/10.1002/2688-8319.12308">Ellis KS, Anteau MJ, MacDonald GJ, Ring MM, Sherfy MH, Swift RJ, and Toy DL. 2024. Ecological Solutions and Evidence 5:e12308. https://doi.org/10.1002/2688-8319.12308</a>	Assessing trade-offs in developing a landscape-scale nest monitoring programme for a threatened shorebird	2000-2019	Authors assessed the effectiveness of multiple plover monitoring program scenarios and their associated costs.	Authors found that precision increased and bias decreased around plover nest survival estimates with greater survey coverage and nest visit frequency. However, there are monitoring programs where survey costs outweigh the statistical benefits.
2024	Consequences of off-river nesting	<a href="https://digitalcommons.unl.edu/natresdiss/377">Forsberg EM. 2024. School of Natural Resources: Dissertations, Theses, and Student Research 377. https://digitalcommons.unl.edu/natresdiss/377</a>	Demographic consequences of off-river nesting for piping plover ( <i>Charadrius melodus</i> ) and interior least tern ( <i>Sternula antillarum athalassos</i> ) in the Lower Platte River System, Nebraska	2008-2023	The author assessed consequences of off-river nesting at sandbars and off-river sites. Nest initiation and hatch date, extreme temperature, conspecific and heterospecific nesting proximity, and nest enclosure usage were also investigated.	No evidence was found for demographic consequences between off-river sites and sandbars. Demographic consequences among off-river site types varied. Vital rates were affected by seasonal date, nest age, proximity to tern nests, nest enclosures, and temperature factors.

2024	Habitat changes and nesting responses	<a href="#">Guild R and Wang X. 2024. Remote Sensing 16:4764. https://doi.org/10.3390/rs16244764</a>	Piping plover habitat changes and nesting responses following post-tropical cyclone Fiona on Prince Edward Island, Canada	2020-2023	Open sand areas created by cyclone Fiona were minimally used by plovers and resulted in mixed nest success.	Following tropical cyclone Fiona on Prince Edward Island, Canada, open sand areas increased but the following piping plover breeding season showed no change in abundance, minimal use of new habitats, and mixed nest success. Plovers may have not used the new habitat created by Fiona because of high site fidelity or unmeasured factors like topography, microhabitat features, or disturbance levels.
2024	Spatiotemporal and weather effects	<a href="#">Guild R, Wang X, Hirtle S, and Mader S. 2024. Ecology and Evolution 14:e11581. https://doi.org/10.1002/ece3.11581</a>	Spatiotemporal and weather effects of the reproductive success of piping plovers on Prince Edward Island, Canada	2011-2023	Authors employed a spatiotemporal modeling approach to investigate how location, nest timing, and weather conditions influence reproductive success rates of plovers in Prince Edward Island, Canada.	Modeled results did not support a negative impact of extreme high temperatures and strong precipitation events on reproductive outcomes of plovers. Spatiotemporal variability in apparent hatch success over the study period was identified in models along with worse hatch outcomes across popular beachgoing regions and for delayed nesting attempts.
2024	Effects of marking schemes on plovers	<a href="#">Wails CN, Catlin DH, Robinson SG, Bellman HA, Oliver KW, VanDerwater HL, Dorsey SS, DeRose-Wilson A, Karpanty SM, and Fraser JD. 2024. Journal of Ornithology. https://doi.org/10.1007/s10336-024-02211-x</a>	Comparing the effects of marking techniques on the survival of Piping Plover chicks	2013-2023	Authors studied the effects of color bands and uniquely engraved flags on piping plover injury and survival rates.	Injuries associated with the two marking schemes were detected in some years. Authors compared survival of chicks between the two different marking schemes and found that pre-fledged survival of plovers with uniquely coded flags was similar to those that received color bands. The relatively high injury rate in some years, however, remains a concern.
2023	Missouri River Recovery Program annual reports	<a href="#">Missouri River Recovery Program https://www.nwo.usace.army.mil/mrrp/Library/</a>	MRRP ESA adaptive management compliance report	2001-2023	Annual reports for terns and plovers on the Missouri River	These reports provide a synthesis of the respective annual monitoring and research efforts for piping plovers and least terns along the Missouri River and the reproductive data collected.

2023	Camera monitoring of nests	<a href="#">Call MN, Wilke AL, Poulton Z, Boettcher R, Karpanty SM, Kwon E, Lipford A, Gardner ED, Anderson L, Fraser JD, Catlin DH, Wails CN. 2023. Waterbirds 45:312-327. <a href="https://doi.org/10.1675/063.045.0310">https://doi.org/10.1675/063.045.0310</a></a>	Comparing in-person versus camera monitoring of shorebird reproductive success	2019	Tested effectiveness of in-person compared to camera-based monitoring to quantify productivity of plover nests in Virginia.	Cameras validated in-person monitoring conclusions, highlighted threats that surveys missed, and characterized the predator community. They also provided insight into the effectiveness of mammalian predator removal. However, cameras produced large quantities of data, and they failed to capture causes of mortality for mobile chicks. Cameras also did not consistently document chicks where monitoring in-person confirmed successful broods.
2023	Species distribution modeling of plover breeding density	<a href="#">Ellis KS, Anteau MJ, MacDonald GJ, Swift RJ, Ring MM, Toy DL, Sherfy MH, Post van der Burg M. 2023. Scientific Reports 13:6087. <a href="https://doi.org/10.1038/s41598-023-32886-w">https://doi.org/10.1038/s41598-023-32886-w</a></a>	Data integration reveals dynamic and systematic patterns of breeding habitat use by a threatened shorebird	2000-2019	Authors developed a spatiotemporal model of piping plover breeding habitat use in Montana, North Dakota, and South Dakota using a 20-year eBird dataset and nest monitoring data to examine effects of dynamic and long-term environmental processes on breeding density.	Plover breeding habitat use and density were related to dynamic covariates including percentage of surface water within 90 m, vegetation coverage within 30 m, and percentage of crop and hay pasture surrounding the location. Habitat use was also related to a static layer that quantified distance to permanent lakes as a decreasing exponential function. The authors found that use of the eBird dataset provided more complete spatial coverage than nest monitoring data alone, but eBird data was related to surrounding road density due to site accessibility. The authors developed a predictive species distribution map for breeding plovers across portions of Montana, North Dakota, and South Dakota to inform conservation efforts.

2023	Use of predator exclosures at plover nests	<a href="#">Peters SH, Engley L, Rezanoff A, Prescott DRC, Jones PF. 2023. Conservation Science and Practice 5(4):e12909.  https://doi.org/10.1111/csp2.12909</a>	The effectiveness and cost efficiency of different predator exclosure designs to increase piping plover ( <i>Charadrius melodus</i> ) nest success and fledging rate in Alberta, Canada.	1998-2010	The authors compared daily nest survival, nest productivity, and cost using three types of nest exclosures (large, medium, small) and no exclosures.	The authors used data from 1998–2010 from 820 plover nests in Alberta, Canada. During 1998–2001 when large, medium, and small nest exclosures were used, there was no significant difference in daily nest survival rate between nests with and without an exclosure. During 2002–2010 when only small exclosures were used, nests with exclosures had significantly higher daily nest survival rates than those without exclosures. Nests with small exclosures hatched more chicks and produced more fledglings than those without exclosures. When considering only successful nests, there was no difference in number of fledglings between nests with and without exclosures, indicating no added benefit of exclosures beyond protecting the nest. The authors found that cost per chick was lowest using small exclosures that were cylindrical and measured 40-cm x 60-cm.
2023	Relationship between a suite of predators and plover chick survival	<a href="#">Robinson SG, Black KM, Catlin DH, Wails CN, Karpanty SM, Bellman H, Oliver KW, Ritter SJ, and Fraser JD. 2023. The Journal of Wildlife Management 88:e22538.  https://doi.org/10.1002/jwmg.22538</a>	Red fox trap success is correlated with piping plover chick survival	2015-2018	Authors used camera detections in a survival model to assess potential relationships between predator species detection and plover chick survival.	Authors found that plover chick survival was negatively related with red fox detection but not with raccoon or domestic cat detection. Although there was no direct evidence of red foxes taking plover chicks, there was a correlation between fox trap success and plover chick survival which suggests that foxes affect plover reproductive output.

2023	Use of predator exclosures at plover nests	<a href="#">Stantial ML, Cohen JB, Darrah AJ, Masio B. 2023. Ornithological Applications 2023:duad047. https://doi.org/10.1093/ornithap/duad047</a>	Predator exclosures increase nest success but reduce adult survival and increase dispersal distance of piping plovers, indicating exclosures should be used with caution.	2011-2018	Authors evaluated the impact of predator exclosures around plover nests on plover demography using a seven-year dataset from the New Jersey plover population.	Predator exclosures around plover nests increased nest success by 62% over a 34-day period. Exclosed nests were 4.7 times more likely to be abandoned, likely due to adult mortality. Abandoned nests were associated with lower adult survival. The authors found that after the male of a breeding pair had died and the nest was abandoned, the surviving female dispersed 10 times farther than birds whose first nest attempts were lost to other causes (e.g., flooding). This emigration effectively resulted in the loss of a local breeding pair. The authors used an online population projection model (PiperEx) to demonstrate exclosures were not expected to improve plover population growth rates in New Jersey and encouraged managers to consider whether exclosures are worth protecting eggs from predators with the trade-offs of reduced adult survival and increased emigration rates.
2023	Population viability analysis of northern Great Plains piping plover population	<a href="#">Swift RJ, Anteau MJ, Ellis KS, MacDonald GJ, Ring MM, Sherfy MH, Toy DL. 2023. Frontiers in Bird Science 2:1157682. https://doi.org/10.3389/fbirs.2023.1157682</a>	Estimating population viability of the northern Great Plains piping plover population considering updated population structure, climate change, and intensive management	2006-2022	<a href="#">Authors updated a population viability model constructed by McGowan et al. (2014) using new data on plover vital rates and connectivity, potential management actions, and stochastic climate variability to predict the extinction probability of the northern Great Plains piping plover population over 50 years.</a>	Using new information on metapopulation dispersal rates and connectivity, the authors predicted the risk of plover extinction to be between 0.088 and 0.373 over 50 years based on a 2006 population estimate. This represented an increase over the 0.033 probability of extinction predicted by the McGowan et al. (2014) model. However, in only one of eight scenarios did the median of the estimated plover population from 1,000 simulations decrease relative to the 2006 estimate. Reduction in adult survival due to a simulated effect of nest caging increased extinction probability to 0.267–0.373 and decreased the median of the estimated population size over time. In contrast, simulated increases in fecundity due to nest caging reduced extinction probability to 0.088–0.103 only if there was no negative effect on adult survival. Increasing variance around fecundity estimates to represent climate stochasticity had little effect on predicted population viability.

2023	Breeding habitat selection	<a href="#">Swift RJ, Anteau MJ, Ellis KS, Ring MM, Sherfy MH, and Toy DL. 2023. Ecosphere 14(5): e4524. <a href="https://doi.org/10.1002/ecs2.4524">https://doi.org/10.1002/ecs2.4524</a></a>	Conspecific density and habitat quality affect breeding habitat selection: support for the social attraction hypothesis	2014-2019	Authors tested five hypotheses of plover habitat selection.	Authors found that adult plovers moved to new breeding locations as often as staying at the same breeding location. They also found that adult plovers use social cues for settlement decisions. Habitats were selected not because of the amount of habitat but rather the higher presumed quality with intermediate conspecific densities.
2023	Report to provide scientific information to inform future recovery planning	U.S. Fish and Wildlife Service. 2023. U.S. Fish and Wildlife Service Missouri River Recovery Office. 20 June 2023.	Biological Report for the northern Great Plains piping plover population ( <i>Charadrius melodus circumcinctus</i> ).	NA	Literature review and summary of updated information regarding northern Great Plains plover life history, breeding, habitat use, dispersal, and connectivity.	This USFWS literature review provided a summary of plover life history; current status of the northern Great Plains population in relation to habitat use and environmental conditions for breeding and brood rearing; and factors influencing species viability and future conditions needed to maintain sufficient resiliency, redundancy, and representation on the breeding range for a projected 50-year period.
2022	Population dynamics	<a href="#">Swift RJ, Anteau MJ, Ellis KS, Ring MM, Sherfy MH, Toy DL, Koons DN. 2022. <a href="https://doi.org/10.1002/ecs2.4190">https://doi.org/10.1002/ecs2.4190</a></a>	Implications of habitat-driven survival and dispersal on recruitment in a spatially structured piping plover population	2014-2017	The authors estimated hatch-year survival to adulthood and natal dispersal rates between Missouri River and Alkali Wetlands breeding groups. They examined the role of habitat availability in natal dispersal and recruitment.	Hatch-year survival to adulthood was slightly higher for individuals hatched on the Missouri than on the Alkali Wetlands but declined over time. Those hatched on the Alkali Wetlands were more likely to disperse to breed on the Missouri than vice versa. The Missouri River showed higher natal fidelity, thus higher recruitment; but declining breeding group abundance was responsible for a declining trend in the number of recruits to the Missouri over time. Unbalanced, high natal dispersal rates within the Northern Great Plains indicate high connectivity among regions driven by fluctuating availability of habitat.

2021	Effectiveness of predator management	<a href="#">Anteau MJ, Swift RJ, Sherfy MH, Koons DN, Ellis KS, Shaffer TL, Toy DL, Ring MM. 2021. Journal of Wildlife Management 86:e22139.  https://doi.org/10.1002/jwmg.22139</a>	Experimental evaluation of predator exclosures on nest, chick, and adult survival of piping plovers	2014-2016	Authors evaluated the survival of nests, chicks and adults at wetlands across the Northern Great Plain with and without nest exclosures.	Exclosed nests at treatment wetlands had greater cumulative survival than unexclosed nests at treatment or control wetlands. Survival to fledging was highest for chicks hatched from exclosed nests, and similar between chicks hatched from unexclosed nests at treatment and control wetlands. Adults associated with exclosed nests and unexclosed nests at treatment wetlands had greater survival than those associated with unexclosed nests at control wetlands. The positive influence of exclosures on nest survival was not offset by a reduction in chick or adult survival, indicating that exclosures are a viable tool for piping plover conservation.
2021	Piping plover survival and migratory connectivity	<a href="#">Ellis KS, Anteau MJ, Cuthbert FJ, Gratto-Trevor CL, Jorgensen JG, Newstead DJ, Powell LA, Ring MM, Sherfy MH, Swift RJ, Toy DL, Koons DN. 2021. Biological Conservation 264: 1-11.  https://doi.org/10.1016/j.biocon.2021.109371</a>	Impacts of extreme environmental disturbances on piping plover survival are partially moderated by migratory connectivity	2012-2019	This study evaluates survival at nonbreeding areas due to extreme environmental disturbances and estimates the connectivity between breeding vs. non-breeding areas using data from piping plover individuals from 2002-2019.	Hurricanes and algal blooms are negatively associated with nonbreeding season survival, though no negative association was detected for oil spills in this study. There was low migratory connectivity observed across nonbreeding areas for individuals from separate breeding areas. Survival among breeding states averaged 0.91, with the highest average belonging to the Great Lakes population. Mortality for the non-breeding season was consistently higher. The non-breeding states had an estimated survival of 0.81. A small degree of temporal synchrony in survival was found for the Northern and Southern Great Plains among the breeding states, and between Texas and the Eastern Gulf for the non-breeding states.
2021	Habitat availability	<a href="#">Jorgensen JG, Brenner SJ, Greenwalt LR, Vrtiska, MP. 2021. Ecosphere 12(4): e03474.  https://doi.org/10.1002/ecs2.3471</a>	Decline of novel ecosystems used by endangered species: the case of piping plovers, least terns, and aggregate mines	1993-2020	Authors evaluated how the number, size, and spatial distribution of different site types hosting different numbers of nesting plovers and terns along the Platte, Loup, and Elkhorn Rivers have changed over time and how current trends in the number of different site types will affect future habitat and bird abundance.	Overall area and total number of sites declined between 1993-2020. Traditional mines are being replaced by modern mines, which host lower numbers of nests of both species. Traditional mines are projected to decline in the future, reducing overall nesting habitat. Piping plovers and least terns are expected to continue to nest within the study area, but numbers are expected to be smaller compared to what has been observed in the past.

2021	Predator monitoring via remote cameras	<a href="#">Keldsen KJ. 2021. Masters Thesis, University of Nebraska at Kearney. ProQuest Dissertations Publishing 28645869.</a>	Efficacy of predator exclusion methods and ID of nest predators for interior least terns and piping plovers at off-channel nesting sites along the central Platte River, Nebraska, USA	2017-2019	The author investigated the avian and mammalian predator presence and mode of access at off-channel nesting sites along the central Platte River. Effectiveness of a panel wing system were investigated as were predator communities.	The author found that predator approaches to the panel wing system were much higher than breaches and that the panel wing system was effective 90.6% of the time. When looking at predator communities, mammalian registers on camera traps were less abundant than avian registers at off-channel nesting sites. Great horned owl was the most frequent avian species registered and coyote the most frequent mammalian species. Developed landcover was positively correlated with presence of raccoons and skunks and tall vegetation was negatively correlated with presence of raccoons and skunks.
2021	Habitat selection	<a href="#">Robinson S, Bellman H, Walker K, Catlin D, Karpanty K, Ritter S, Fraser J. 2021. Ecosphere 12(12):e03870. <a href="https://doi.org/10.1002/ecs2.3870">https://doi.org/10.1002/ecs2.3870</a></a>	Adult piping plover habitat selection varies by behavior	2016-2018	Plovers were monitored on Fire Island and Westhampton Island, New York, during 2016-2018 to record locations of adult birds. Authors used resource selection functions to determine whether breeding status or instantaneous behavior class best explained relationships with landscape characteristics.	Plovers displaying parental behavior (incubating, brooding, and accompanying chicks) selected locations closer to bay intertidal habitats and with proportionally more dry sand in the surrounding landscape. Non-parental plovers avoided areas with more dry sand and did not select for or against bay intertidal habitats. Birds exhibiting both types of behaviors avoided development and higher elevation areas throughout the landscape, but non-parental plovers avoided them more than parental plovers.
2021	Plover chick habitat selection	<a href="#">Robinson SG, Walker KM, Bellman HA, Gibson D, Catlin DH, Karpanty SM, Ritter SJ, Fraser JD. 2021. Journal of Wildlife Management 87: e22325. <a href="https://doi.org/10.1002/jwmg.22325">https://doi.org/10.1002/jwmg.22325</a></a>	Piping plover chick ecology following landscape-level disturbance	2013-2019	Piping plovers on Fire and West Hampton Island, New York, were studied from 2013-2019 following hurricane Sandy which created abundant nesting habitat on these barrier islands in 2012. The study examined the effects of landscape features on habitat selection, behavior, and survival of plover broods.	Plover broods selected flatter sites with less dense vegetation than available at random. Chick foraging rates were highest in moist substrates and were lower in areas of higher nesting plover density. Chick survival was greater for broods that hatched earlier in the season and increased as chicks aged. Natural landscape disturbance was important for creating non-vegetated, open sand habitat for both nesting and foraging.

2021	Foraging movements and colony attendance	<a href="#">Sherfy MH, Ring MM, Stucker JH, Anteau MJ, Shaffer TL, Sovada MA. 2021. Waterbirds 44(1): 38-54. https://doi.org/10.1675.063.044.0104</a>	Foraging movements and colony attendance of least terns ( <i>Sterna antillarum</i> ) on the central Platte River, Nebraska, USA	2009-2010	Documented least tern foraging movements and colony attendance during the breeding season on the central Platte River through the use of VHF transmitters and a network of datalogging receivers.	During daylight hours, terns typically remained within 8 km of nesting areas, but up to 17.5 km away at night. Moving distances were longer post-fledging. Colony attendance was higher during incubation and lower post fledge. Frequency and success of foraging were lowest on sandpit sites, intermediate on riverine sites, and highest at the Kearney Diversion Dam.
2021	Population dynamics	<a href="#">Swift RJ, Anteau MJ, Ellis KS, Ring MM, Sherfy MH, Toy DL. 2021. Movement Ecology 9:59. https://doi.org/10.1186/s40462-021-00293-3</a>	Dispersal distance is driven by habitat availability and reproductive success in northern Great Plains piping plovers	2014-2019	Authors examined sources of variation for natal dispersal and interannual breeding for piping plovers in the northern Great Plains between 2014-2016.	Natal dispersal was, on average, longer than adult breeding movements. Individuals moved shorter distances when hatched, previously nested, or settled on river habitats. Hatch-year individuals moved shorter distances when there was more habitat available on their natal site than the year prior. Adults also moved shorter distances when more habitat was available at the settling site and when in closer proximity to other nesting areas.
2020	Population model for nest exclosure use	<a href="#">Darrah AJ, Cohen JB, Castelli PM. 2020. Wildlife Society Bulletin 1-13. https://doi.org/10.1002/wsb.1115</a>	A decision support tool to guide the use of nest exclosures for piping plover conservation	2013-2018	Authors developed a decision support tool (PiperEx) that uses site-specific nest-fate data to inform a stochastic population project model to predict plover population growth rate at the site level with and without exclosure use.	Authors found that the probability of making the correct decision on whether to use exclosures or not increased with sample size. They used real data pooled across years and were able to predict the best decision for a particular year up to 100% of the time for a given area. If data for PiperEx is collected annually, the data from the previous 5 or 6 years can be used for decision making at the start of the season.
2020	Shorebird productivity monitoring protocols	<a href="#">Farrell PD, Baasch, DM. 2020. Waterbirds 43(2): 123-133. https://doi.org/10.1675/063.043.0201</a>	Reducing effort when monitoring shorebird productivity	2013-2016	This study is a comparison of the accuracy of two monitoring protocols; one from inside nesting colonies, and one from outside the nesting colonies.	Both inside and outside monitoring result in reasonable estimates of abundance and productivity for both least terns and piping plovers. Outside monitoring of least terns resulted in higher fledge counts and lower breeding pair estimates, increasing reported fledge ratios. No consistent over or underestimates were found upon implementation of outside monitoring of piping plovers due to annual variability. Outside monitoring reduces effort, cost, and potential disturbance.

2020	Nest cameras	<a href="#">Hunt KL, Gibson D, Friedrich MJ, Huber CJ, Fraser JD, Karpanty SM, Catlin DH. 2020. Ibis 162:1–12.  https://doi.org/10.1111/ibi.12726</a>	Using nest captures and video cameras to estimate survival and abundance of breeding piping plovers ( <i>Charadrius melodus</i> )	2005-2017	Authors used video cameras at plover nests to resight previously banded individuals.	Individual plovers were captured on nests and marked and recaptured from 2005 to 2014. From 2015 to 2017, individuals were resighted using video cameras deployed at nests. The number of marked and unmarked breeding individuals were counted and authors estimated apparent survival. Estimates of the abundance of breeding individuals and population growth each year were derived showing that camera data can be used to produce demographic parameters and abundance estimates for an avian species.
2020	Population dynamics of piping plovers	<a href="#">Swift RJ, Anteau M, Ellis K, Ring M, Sherfy M, Toy D, Koons D. 2020. U.S. Geological Survey Open-File Report 2020–1152, 211 p.</a>	Spatial variation in population dynamics of northern Great Plains piping plovers	2014-2019	The purpose of this study was to determine movement and connectivity within and among the various populations of piping plovers in the Great Plains and factors that affect their success and survival. This study looked at survival, dispersal, reneesting, and reproductive success of the birds.	River and alkali wetlands seem to be higher quality habitat for plovers than reservoirs, but river habitat had higher survival, reproductive output, and fidelity probabilities than alkali wetlands. Dispersal, both natal and adult, was highly affected by habitat availability and reproductive success, as well as by population density. Reneesting propensity and reneest success were low. The data indicates that there is high connectivity between the U.S. Alkali Wetlands and the norther river units of the Missouri River.
2020	Renesting in piping plovers	<a href="#">Swift RJ, Anteau MJ, Ring MM, Toy DL, Sherfy MH. 2020. The Condor: Ornithological Applications 122:1–18.  https://doi.org/10.1093/condor/duz066</a>	Low reneesting propensity and reproductive success make reneesting unproductive for the threatened piping plover ( <i>Charadrius melodus</i> )	2014-2016	Authors studied reneesting propensity, reneesting intervals, and reneest reproductive success in the northern Great Plains.	First nests had higher reproductive success and daily nest survival than reneests. For reproductive attempts that failed in the nest stage, the apparent reneesting rate for individuals was 25%. The apparent reneesting rate dropped to 1.2% for reproductive attempts when broods were lost. Nests failing due to predation, reproductive failure occurring later in the breeding season, or individuals that had previously reneested that year also decreased reneesting propensity. Plovers nesting on reservoirs were less likely to reneest than those nesting in other habitats.

2020	Heterospecific breeding association	<a href="#">Swift RJ, Anteau MJ, Roche EA, Sherfy MH Toy DL, Ring MM. 2020. Oikos 129: 1504-1520. <a href="https://doi.org/10.1111/oik.07256">https://doi.org/10.1111/oik.07256</a></a>	Asymmetric benefits of heterospecific breeding association vary with habitat, conspecific abundance and breeding strategy	2007-2016	Authors tested how piping plover and interior least tern associations during breeding influence nest and chick survival.	Authors studied nest and chick survival for piping plovers and interior least terns on Lake Sakakawea, Garrison River Reach, and the Gavins Point Reach between 2007-2016. Plover nest and chick survival improved with the presence and abundance of terns, but terns only benefited from plover presence for certain study areas and breeding stages. Associations between these two species are mutualistic, but asymmetric, moderated by habitat, abundance on conspecifics, and breeding stage. Nesting requirements of both species should be considered when managing habitat for target species.
2019	Nest fate classification	<a href="#">Andres AK, Shaffer TL, Sherfy MJ, Hofer CM, Dovichin CM, Ellis-Felege SN. 2019. Ibis 161:286-300. <a href="https://doi.org/10.1111/ibi.12629">https://doi.org/10.1111/ibi.12629</a></a>	Accuracy of nest fate classification and predator identification from evidence at nests of least terns and piping plovers	2013-2015	Authors evaluated nest fate misclassification rate and studied factors resulting in misclassification of least tern and piping plover nests.	Video cameras were used to evaluate nest fate misclassification rate. Ordinal logistic regressions were used to examine whether monitoring interval, clutch age, or temporal factors influenced a correct, partially misclassified, or misclassified nest fate classification. As clutch age and monitoring interval increased, researchers were less likely to correctly classify nest fates. Least tern nests were less likely to be correctly fated than piping plover nests. Also, causes of failure disagreed for 53.5% of nests when using field evidence vs video.
2018	Piping plover and least tern nest and brood survival	<a href="#">Farrell PD, Baasch DM, Farnsworth JM, Smith CS. 2018. Avian Conservation and Ecology 13(1): 1. <a href="https://doi.org/10.5751/ACE-01133-130101">https://doi.org/10.5751/ACE-01133-130101</a></a>	Interior least tern and piping plover nest and brood survival at managed, off-channel sites along the central Platte River, Nebraska, USA 2001–2015	2001-2015	This study assessed the influence of several biotic and abiotic variables on the survival of least tern and piping plover nests and broods to inform Program management.	Productivity of least terns and piping plovers was reduced during both the nesting and brood rearing stage primarily by climactic factors rather than factors the Program can manage. At that point, we concluded that habitat management activities implemented at off-channel sites to date were sufficient for maintaining high levels of productivity for least terns and piping plovers along the central Platte River.

2018	Population dynamics	<a href="#">Saunders SP, Cuthberg FJ, Zipkin EF. 2018. Journal of Applied Ecology 55:1380–1392.  https://doi.org/10.1111/1365-2664.13080</a>	Evaluating population viability and efficacy of conservation management using integrated population models	1993-2016	Authors developed a coupled integrated population model and Bayesian population viability analysis to assess impact of demographic rates on past population dynamics and predict population viability 10 years into the future for the Great Lakes piping plover population.	The authors' Bayesian population viability analysis indicates that the Great Lakes piping plover population does not face a high and immediate risk of quasi-extinction under current conditions. All possible environmental influences on population viability could not be accounted for. However, their model indirectly captures some of the inherent variation in plover population responses to these factors through the inclusion of environmental stochasticity.
2017	Nest-site selection by piping plovers and least terns	<a href="#">Baasch DM, Farrell PD, Farnsworth JM, Smith CS. 2017. Journal of Field Ornithology 88(3): 236-249.  https://doi.org/10.1111/jofo.12206</a>	Nest-site selection by interior least terns and piping plovers at managed, off-channel sites along the Central Platte River in Nebraska, USA	2001-2015	This study investigated habitat measurements that may influence nest site selection, nest placement, and productivity in an effort to gather information needed to design OCSW sites in a way to encourage tern and plover nesting and improve productivity.	Plovers preferred not to nest near each other, their probability of use for nesting was maximized when distance to was ~50 m, and an effective site design for them would be linear to maximize area of nesting habitat near the water. Least terns are colonial nesters, their nesting probability increased as distance to water was maximized, and an efficient design for them would be circular to maximize the area for nesting habitat away from the shoreline. Both species' probability of use was maximized when nearest predator perches were ≥150 m and elevation above water was ≥3 m. An efficient site design for both species would be lobate, incorporating centralized nesting habitat for least terns and increased access to foraging areas for nesting and brood-rearing piping plovers.
2016	Meta-population viability and habitat change	<a href="#">Catlin DH, Zeigler SL, Bomberger Brown M, Dinan LR, Fraser JD, Hunt KL, Jorgensen JG. 2016. Movement Ecology 2016 4:6  https://doi.org/10.1186/s40462-016-0072-y</a>	Metapopulation viability of an endangered shorebird depends on dispersal and human-created habitats: piping plovers ( <i>Charadrius melodus</i> ) and prairie rivers	2008-2013	Authors studied effect of high flow events on plover metapopulation dynamics on lower Platte and Missouri Rivers	High flow events were associated with increased emigration, decreased immigration, and decreased survival in the subpopulation that experienced high flows. However, following the event, immigration into that subpopulation increased. Dispersal rates among subpopulations were negatively correlated with distance. Under the current disturbance interval and associated dispersal and survival rates, the metapopulation had a low probability of extinction but persistence depended on relatively stable, human-created habitats, not the dynamic, natural habitat.

2016	Population dynamics	<a href="#">Roche EA,</a> <a href="#">Shaffer TL,</a> <a href="#">Dovichin CM,</a> <a href="#">Sherfy MH,</a> <a href="#">Anteau MJ,</a> <a href="#">Wiltenthuth MT.</a> 2016. <i>Condor</i> 118:558–570. <a href="https://doi.org/10.1650/CONDORR-15-195.1">https://doi.org/10.1650/CONDORR-15-195.1</a>	Synchrony of piping plover breeding populations in the U.S. Northern Great Plains	1993-2011	Authors assessed population synchrony, population stability, and factors influencing these metrics for plovers on the Northern Great Plains	Authors found that the abundance of breeding plover populations nesting in riverine and reservoir habitats were the most synchronous, while populations nesting in alkaline lake habitats exhibited the greatest stability. Changes in local breeding population abundances were not explained by a single factor across habitat types which suggests that dispersal across those habitats may have an overall stabilizing effect on the persistence of the Great Plains piping plover metapopulation.
2016	Demographics and movements	<a href="#">Roche EA,</a> <a href="#">Sherfy MH,</a> <a href="#">Ring MM,</a> <a href="#">Shaffer TL,</a> <a href="#">Anteau MJ,</a> and <a href="#">Stucker JH.</a> 2016. U.S. Geological Survey Open-File Report 2016–1061, 27 p.	Demographics and movements of least terns and piping plovers in the central Platte River valley, Nebraska.	2009-2014	Authors summarized data from banding and resighting piping plovers and least terns along the central Platte River to evaluate reproductive success, colonization, adult survival and recruitment, dispersal, and renesting.	There was no relationship between site age and plover chick and nest survival, but this was most likely due to the low sample size. Least tern nest and chick survival was correlated with the age of the site. Least tern nest survival at older sites was associated with higher nest survival and lower chick survival. Site age correlated with increased use for both species. Between species, least terns were more likely to use sites with newly available habitat than plovers, and within a species, young and inexperienced plovers were more likely to use newly created habitat compared to older adults. No natal site fidelity was observed in plovers, but instances of birds returning to the same general area were recorded. Adult plovers did have high breeding site fidelity year to year. Dispersal for piping plovers was dependent on habitat availability and reproductive success; when these were high, site fidelity was high. Dispersal distance for plovers was affected by age, as typically juveniles dispersed farther. Low natal site fidelity was observed in terns and breeding adult dispersal year to year was highly variable. No renesting was observed by terns, and there were few instances of renesting for plovers. Of these few attempts, about half were after losses that occurred in the brood stage. Most plover renesting attempts were on the same site as the first failure and had a high success rate. Renesting initiation after initial loss had high variability, 7.5 days ± 7.3.

2015	Breeding population estimators	<a href="#">Baasch DM, Hefley TJ, Cahis SD. 2015. Ecology and Evolution 5(18): 4197-4209.  https://doi.org/10.1002/ece3.1680</a>	A comparison of breeding population estimators using nest and brood monitoring data	2001-2014	This study details the method developed by the Program to estimate the number of breeding pairs using counts of nests and broods where multiple surveys were made throughout a single breeding season; it also compares the results of this method with other commonly used estimation methods.	When using data from multiple nest and brood surveys, this method results in reasonably precise estimates of the number of breeding pairs. Each method has its own biases, and either over- or underestimates based on data and frequency collected.
2015	Double brooding in plovers	<a href="#">Hunt KL, Dinan LR, Friedrich MJ, Bomberger Brown M, Jorgensen JG, Catlin DH, Fraser JD. 2015. Waterbirds 38:321-434.  https://digitalcommons.unl.edu/natrespapers/641?utm_source=digitalcommons.unl.edu%2Fnatrespapers%2F641&amp;utm_medium=PDF&amp;utm_campaign=PDFCoverPages</a>	Density dependent double brooding in piping plovers ( <i>Charadrius melodus</i> ) in the northern Great Plains, USA	2005-2013	Authors studied instances of plovers raising two broods per season on the Missouri River and lower Platte River.	Across the 9-year duration of the study on the Missouri River, there were 25 confirmed instances of double brooding. Double brooding was not observed locally on the lower Platte River. However, in 2013, two female plovers successfully hatched eggs and fledged chicks from nests on the lower Platte River and later were observed nesting for the second time on the Missouri River. Early nest initiation, male biased sex ratio, age of breeding adults, and decreased nest density are all factors predicted to increase the frequency of double brooding. Density appears to be an important factor that accounts for some of the difference in the proportion of double brooding on the Missouri River compared to the lower Platte River.
2014	Population viability analysis models	<a href="#">McGowan CP, Catlin DH, Shaffer TL, Gratto-Trevor CL, Aron C. 2014. Biological Conservation 177:220-220.  https://doi.org/10.1016/j.biocon.2014.06.018</a>	Establishing endangered species recovery criteria using predictive simulation modeling	NA	Authors used a population viability analysis model to simulate extinction probability of piping plovers in the Great Plains.	Authors simulated extinction probabilities of plovers in the Great Plains and estimated the relationship between extinction probability and various demographic parameters. They found that binomial regression models with mean population growth rate and the natural log of initial abundance were the best predictors of extinction probability 50 years into the future.

2012	Predator exclosures at nests	<a href="https://dalspace.library.dal.ca/items/8aebb513-7295-43d8-a535-7707a837dd12">Beaulieu G. 2012. Masters Thesis, Dalhousie University, Halifax, Nova Scotia. https://dalspace.library.dal.ca/items/8aebb513-7295-43d8-a535-7707a837dd12</a>	The implications of predator management for an endangered shorebird; do nest exclosures affect the behaviour of piping plovers and their predators?	2010-2011	The author examined the effects of nest exclosures on incubating plovers and their predators using behavioral observations, video observations, and an artificial nest experiment.	Plover behavior did not differ between exclosed and unexclosed nests, although different predator types seemed to have an effect on plover attentiveness. Predators visited and spent more time in the vicinity of exclosed nests than unexclosed nests.
2012	Foraging ecology	<a href="#">Sherfy MH, Anteau MJ, Shaffer TL, Sovada MA, Stucker JH. 2012. U.S. Geological Survey Open-File Report 2012-1059, 50 p.</a>	Foraging ecology of least terns and piping plovers nesting on central Platte River sandpits and sandbars	2009-2010	This study looked at movement acquired via telemetry, behavior data, foraging habitat data, and productivity results in order to evaluate the use of foraging habitats by least terns and piping plovers.	When foraging, terns were more likely to be located outside their nesting area, while plovers were more likely to be within the nesting area. Terns rely more heavily on the nearby central Platte River and are more mobile. Plovers forage more often along sandpit shorelines while in the nesting or brooding stages.
2011	Predator trapping	<a href="https://doi.org/10.1002/jwmg.56">Catlin DH, Felio JH, Fraser JD. 2011. Journal of Wildlife Management 75:458-462. https://doi.org/10.1002/jwmg.56</a>	Effect of great-horned owl trapping on chick survival in piping plovers	2008-2009	Authors examined the effect of removing great-horned owls on plover hatchling survival on Missouri River sandbars.	In 2008, daily survival of plover chicks increased with owl removal, but the effect decreased with increasing age of the chick. In 2009, results were similar but not significant. Chick survival was higher in 2008 than in 2009, regardless of owl capture. Therefore, even if owl capture consistently were effective at increasing survival, the overall survival resulting from trapping may vary annually.
2011	Population viability analysis models	<a href="https://doi.org/10.1016/j.biocon.2011.01.005">McGowan CP, Runge MC, Larson MA. 2011. Biological Conservation 144:1400-1408. https://doi.org/10.1016/j.biocon.2011.01.005</a>	Incorporating parametric uncertainty into population viability analysis models	NA	Authors developed a method for adding uncertainty in parameter estimates into population models and used data from the Northern Great Plains piping population to demonstrate its utility.	Authors compared abundance projections and extinction probabilities from simulations that excluded and included parametric uncertainty. Final abundance was very low for all sets of simulations, but estimated extinction risk was much greater for the simulation that incorporated parametric uncertainty in the replication loop.

2010	Predator exclosures at nests	<a href="#">Barber C, Nowak, A, Tulk K, Thomas L. 2010. Avian Conservation and Ecology 5:6.  http://www.ace-eco.org/vol5/iss2/art6/</a>	Predator exclosures enhance reproductive success but increase adult mortality of piping plovers ( <i>Charadrius melodus</i> )	1984-2006	Authors examined reproductive success and adult mortality for plover nests with and without predator exclosures at Prince Edward Island National Park, Canada.	Nests with exclosures had higher reproductive success than nests without exclosures. Significantly fewer exclosed nests were depredated than nonexclosed nests, but significantly more exclosed nests were abandoned by adults than nonexclosed nests and exclosed nests had significantly greater adult mortality.
2009	Population dynamics	<a href="#">Catlin DH. 2009. Ph.D. Dissertation, Virginia Polytechnic Institute, Blacksburg, Virginia.  http://hdl.handle.net/10919/27442</a>	Population dynamics of piping plovers ( <i>Charadrius melodus</i> ) on the Missouri River	2004-2007	Six-hundred and twenty-three nests on 16 sandbar complexes were monitored to evaluate plover habitat selection, nest success, and adult and juvenile survival.	Plovers selected for engineered sandbars and against natural and natural/modified habitats and engineered habitats had a significantly higher daily survival rate than natural or natural/modified habitats. After the 2006 breeding season when water discharge was higher, nesting densities were higher, reproductive success was lower due to predation, and adults and juveniles emigrated from the study area at a higher rate. Decreased productivity over time and associated predicted negative population growth suggest that the amount of engineered habitat created was inadequate to sustain population growth, and/or that relatively high water discharge and nesting densities coupled with low reproductive rates and high emigration rates could lead to rapid declines in the plover population.
2003	Nest predator exclosures	<a href="#">Murphy RK, Michaud IMG, Prescott DRC, Ivan JS, Anderson BJ, French-Pombier ML. 2003. Waterbirds 26:150-155.  https://doi.org/10.1675/1524-4695(2003)026[0150:POAPPA]2.0.CO;2</a>	Predation on adult piping plovers at predator exclosure cages	1993-2002	Authors compared adult plover mortality at nests surrounded by predator exclosures to those without exclosures.	Predator exclosures were placed at 1,355 plover nests on alkali lake beaches in Alberta, Saskatchewan, North Dakota, and Montana from 1993-2002. At the 420 plover nests not covered by cages, no losses of adult plovers were detected. However, 68 (5%) of the nests with cages had nesting plovers killed near them, apparently by raptors. Predation was greatest at small diameter cages with wire mesh tops at sites with low or moderate tree cover within two km. Predation decreased in areas with low tree cover when large diameter cages with soft netting tops were used. Of the 393 nests with small cages in relatively treeless areas, no predation was documented.

2002	Species recovery	Lutey JM. 2002. Final Report Prepared for U.S. Fish and Wildlife Service	Species recovery objectives for four target species in the central and lower Platte River (whooping crane, interior least tern, piping plover, pallid sturgeon)	NA	Author provided a literature review and a summary of recovery objectives for four threatened or endangered species along the Platte River	To be summarized later
2002	Nest Fates	<a href="#">Williams GE, Wood PA. 2002. Auk 119:1126-1132. https://doi.org/10.1093/auk/119.4.1126</a>	Are traditional methods of determining nest predators and nest fates reliable? An experiment with wood thrushes ( <i>Hylocichla mustelina</i> )	1998-2000	Authors used miniature infrared video cameras to monitor wood thrush nests to determine if evidence at nests can be used to predict predator identities and nest fates prior to reviewing footage.	Authors predicted predator class (avian, mammalian, or snake) on depredated nests before reviewing video footage and were incorrect 57% of the time. However, when predicting fate (fledged or failed), 23 of 27 nests were classified correctly. Therefore, they concluded that traditional methods of monitoring nests appeared to be effective for classifying success or failure of nests but ineffective at classifying nest predators.
2000	Population viability	<a href="#">Plissner JH, Haig SM. 2000. Biological Conservation 92:163-173. https://doi.org/10.1016/S0006-3207(99)00050-6</a>	Viability of piping plover <i>Charadrius melodus</i> metapopulations	NA	Authors used a metapopulation viability analysis to examine viability and recovery objectives for plovers for the Atlantic Coast, Great Plains, and Great Lakes populations.	Baseline models indicated that Atlantic Coast plover populations, under current management practices, are at little risk of near extinction. However, Great Plains and Great Lakes populations require 36% higher mean fecundity for a significant probability of persisting for the next 100 years. Spatially-structured metapopulations exhibited lower viability than single-population models.
1993	Population dynamics	<a href="#">Ryan MR, Root BG, Mayer PM. 1993. Conservation Biology 7:581-585. https://doi.org/10.1046/j.1523-1739.1993.07030581.x</a>	Status of piping plovers in the Great Plains of North America: a demographic simulation model	NA	Authors developed a stochastic population growth model using empirical demographic data for plovers in the northern Great Plains.	When using a stochastic population growth model using empirical demographic data, the plover population of the Great Plains of North America is declining by more than 7% annually. If left unchecked, this will result in extirpation in about 80 years. Annual population increases of 1% and 2% required 1.16 and 1.19 chicks per pair, respectively, which would allow the population to reach the level (2550 pairs) needed for delisting in 53 and 30 years respectively.

## APPENDIX B

### STUDY DATA AND MONITORING FRAMEWORK

Daily survival of plover and tern nests and broods in 2025 was generally high; however, site-specific differences and reduced nest survival during the camera monitoring period, particularly for tern nests, suggested that small daily effects could accumulate into biologically meaningful differences in reproductive success. Accordingly, we evaluated whether nest-level camera deployment influenced daily nest survival and whether any camera effects varied among sites. To further assess whether cameras influenced specific failure pathways, particularly predator-driven events, we conducted complementary fate-based analyses to evaluate whether camera deployment was associated with the odds of nest predation. These analyses used nest monitoring data collected from 2021 through 2025 at six off-channel sand and water (OCSW) sites, where cameras were installed to identify predators, support nest fate classification, and confirm predation events.

Analyses focused on nests classified as successful, failed due to confirmed predation, or failed due to unknown causes (likely predation but lacking sufficient evidence for confirmation). To address uncertainty in fate classification, we conducted two sensitivity analyses: (1) excluding nests fated as failed-unknown, and (2) treating failed-unknown nests as predation events to evaluate the sensitivity of estimated camera effects to uncertainty in fate assignment.

#### *STATISTICAL ANALYSES*

Nest fate outcomes (successful, failed-predation, failed-unknown) were evaluated using a suite of complementary statistical approaches. These tests were designed to assess whether camera presence was associated with differences in nest failure rates due to predation, and whether those effects varied across site and year. First, a chi-squared test of independence was used to compare the proportion of failed-predation versus successful nest outcomes between camera and non-camera treatments. Effect sizes were quantified using Cohen's  $h$  and Cramér's  $V$ , and a post-hoc power analysis based on observed sample sizes and effect magnitudes was conducted to evaluate whether the dataset had sufficient power to detect meaningful proportional differences.

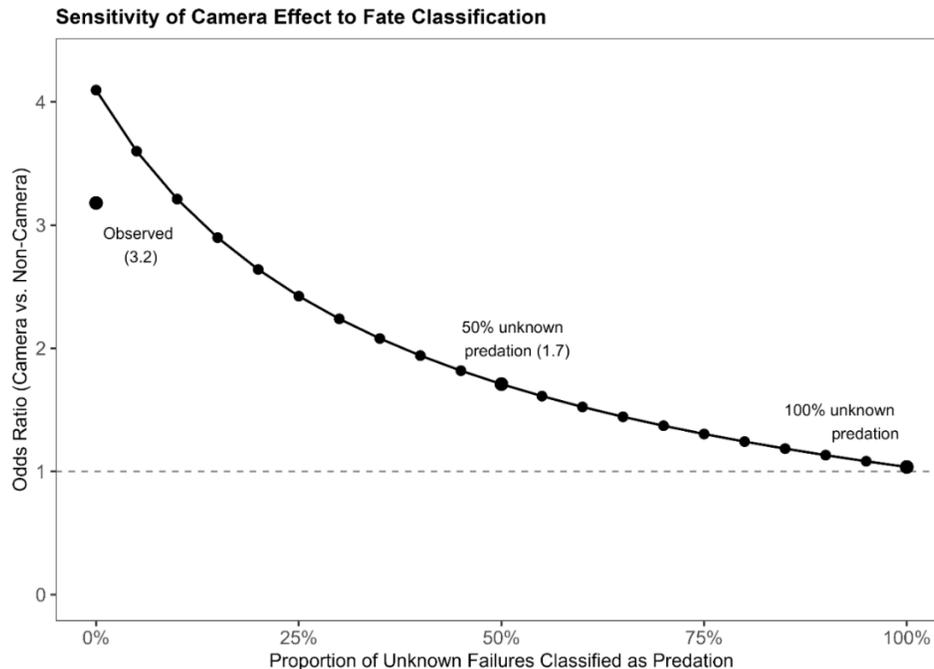
Next, a generalized linear model (GLM) with a binomial error distribution and logit link function was fit to estimate the relationship between camera presence and nest failure due to predation. Nest fate was modeled as a binary response (successful vs. failed-predation), with camera presence included as a binary predictor (0, 1), and model outputs were used to derive odds ratios and predicted probabilities of failure. To examine whether camera effects varied across site and year, additional GLMs were fit that included interaction terms between camera presence and year, and between camera presence and site. These interaction models explicitly tested whether the magnitude or direction of camera effects differed across years or OCSW sites.

Finally, generalized linear mixed models (GLMMs) were used to account for hierarchical structure and non-independence in the data. Separate models included random intercepts for year and for site, allowing baseline nest failure probabilities to vary across these grouping factors while estimating the fixed effect of camera presence. For all models, estimated coefficients, standard errors, odds ratios, and significance values were reported. For mixed-effects models, variance

components for random effects were extracted to quantify between-year and between-site variability, and model performance was evaluated using information-theoretic and likelihood-based metrics, including AIC, residual deviance, and log-likelihood.

## RESULTS

When failed nests due to confirmed predation and unknown causes are combined, overall nest success does not differ between camera nests (38%) and nests without cameras (37%), with negligible effect sizes and no detectable association with camera presence across years or sites. Post-hoc power and effect size diagnostics indicate that this lack of difference is not attributable to insufficient sample size or analytical sensitivity. In contrast, when analyses are restricted to confirmed predation events, camera nests exhibit substantially higher odds of failure (odds ratio  $\approx 3.2$ ), reflecting the role of cameras in enabling definitive classification of predation events. Sensitivity analyses demonstrate that the estimated camera effect is highly dependent on assumptions regarding the fate of nests classified as failed due to unknown causes: assuming 50% of unknown failures represent predation moderates the estimated effect to approximately 1.7, whereas treating all unknown failures as predation results in an estimated effect approaching no difference between camera and non-camera nests (odds ratio  $\approx 1.0$ ; Figure A1). This range of estimates reflects genuine uncertainty in fate classification rather than model misspecification or analytical error.



**Figure A1.** Sensitivity of the estimated camera effect on nest failure to uncertainty in fate classification. Odds ratios compare failure risk between camera-equipped and non-camera nests across assumptions about the proportion of unknown failures attributable to predation, ranging from higher odds under confirmed predation only ( $\approx 3.2$ ) to no difference when all unknown failures are treated as predation ( $\approx 1.0$ ). The solid line shows the continuous change in effect size, and the dashed line indicates no difference (odds ratio = 1).

Collectively, behavioral observations and nest survival analyses indicate that camera deployment may be associated with increased predation risk at some nests, but the magnitude of that risk is highly uncertain and sensitive to fate classification assumptions. At the same time, cameras provide essential information for identifying predators and informing targeted management actions, creating a clear trade-off between potential disturbance risk and known monitoring benefits. These analyses explicitly quantify uncertainty, disentangle treatment effects from site- and year-specific environmental variation, and improve interpretation of nest survival patterns in a management context. In response, EDO biologists are working with the Program's Technical Advisory Committee (TAC) to adapt the predator monitoring study for 2026 toward a more reactive design that prioritizes cameras at likely predator entry points (e.g., fences, gates, shorelines) while limiting routine nest-level camera deployment. Under this approach, nest cameras would be used selectively when unexplained predation occurs, balancing uncertain risk with the demonstrated value of cameras for detecting predators and guiding effective predation management.