

2022 INTERIOR LEAST TERN AND PIPING PLOVER ANNUAL REPORT FOR THE LOWER PLATTE RIVER, NEBRASKA



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PREPARED BY

Elsa M. Forsberg
Mark P. Vrtiska

Tern and Plover Conservation Partnership
School of Natural Resources
University of Nebraska
3310 Holdrege Street
Lincoln, Nebraska 68583
<http://ternandplover.unl.edu>
mark.vrtiska@unl.edu



Joel G. Jorgensen

Nongame Bird Program
Nebraska Game and Parks Commission
2200 North 33rd Street
Lincoln, Nebraska 68521
(402) 471-5440
joel.jorgensen@nebraska.gov

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Central Sand and Gravel	Lower Platte South NRD	Overland Sand and Gravel	Stalp Gravel Company
Flat water Development, Inc	Lyman-Richey Corp.	Papio-Missouri NRD	U.S. Fish and Wildlife Service
Lanoha Development Co.	Martin Marietta Inc.	Preferred Sands of Genoa	U.S. Geological Survey
Loup Power District	Nebraska Natural Legacy Project	Ritz Lake Development	Western Sand and Gravel
Lower Platte North NRD	Nebraska Public Power District	Sandy Pointe Development	

PREFACE



This document reports on our monitoring, research, and management activities during the past 12 months (September 2022 – August 2022). We prepared it to inform our partners, cooperating agencies, funding sources, and other interested parties of our activities and to provide a preliminary summary of our results. To make the information in this document more accessible, it is divided into four sections: Introduction, Monitoring, Research, and Management.

Introduction: This section describes the project area and summarizes conditions encountered during the 2022 field season.

Monitoring: This section describes the data we collect every year for basic demographic analyses and includes the number of nests and chicks found in the focus area. These data are collected and summarized in a form that allows comparison across the ranges of both species.

Research: This section describes our research objectives, research methods, data collection, and data analyses.

Management: This section describes our actions intended to protect Interior Least Terns and Piping Plovers and their nests from interference and disturbance.



Definitions

Off-River Site Definitions

Active mine – an off-river site managed by a sand and gravel mining company that is actively mined and is regulated by the Mine Safety and Health Administration (MSHA).

Inactive mine – an off-river site managed by a sand and gravel mining company but is no longer actively mined and is no longer regulated by the Mine Safety and Health Administration (MSHA).

Lakeshore housing development – an off-river site, usually managed by a homeowners' association, with at least one house on the property that an individual or family occupies for all or part of the year.

Off-river site – Any area used as breeding habitat by terns and plovers located away from a river channel.

Transition site – an off-river site that is no longer managed by a sand and gravel mining company or regulated by the Mine Safety and Health Administration (MSHA) and does not have homeowners in residence on the property; transition sites are primarily managed by the real estate developer rather than a sand and gravel mining company or a homeowners' association.

Age Definitions

Adult – life stage after completing first migration cycle (winter-spring); a bird is in adult plumage one year of age or older and capable of breeding.

After hatch year – a bird in at least its second calendar year of life (Pyle 1997).

Chick – life stage from hatching to when a bird is capable of flight (plover: hatch day to 27 days post-hatch; tern: hatch day to 20 days post-hatch).

Fledgling – Brief period when a juvenile bird is capable of short flights but is still dependent on parental care.

Hatch year – a bird in first-basic plumage during its first calendar year of life (Pyle 1997).

Juvenile – a bird in juvenal plumage, before the first prebasic molt (Pyle 1997).

Introduction

The lower Platte River and its major tributaries provide important nesting and migratory stopover habitat for two bird species of special conservation concern, the Interior Least Tern (*Sternula antillarum athalassos*) and Piping Plover (*Charadrius melodus*). Piping Plovers is protected under the national Endangered Species Act (ESA) and both species are protected under the Nebraska Nongame and Endangered Species Conservation Act. The Tern and Plover Conservation Partnership (TPCP), based at the University of Nebraska-Lincoln, School of Natural Resources, and the Nongame Bird Program (NBP), based at the Nebraska Game and Parks Commission (NGPC), work cooperatively on Interior Least Tern and Piping Plover monitoring, research, and management activities in Nebraska. The TPCP monitoring and research efforts are primarily focused along the lower Platte, Loup, and Elkhorn rivers in the eastern part of the state (Figure 1). However, we also work on tern and plover issues across the state.

Focus Animals

Piping Plovers are small, migratory shorebirds often seen running along sandy shorelines. Adults are approximately 18 cm in length with a 48 cm wingspan. They feed on small invertebrates and insects and are frequently seen probing their bills into sandy substrates along the water's edge. The species was first described in 1824 from a type specimen collected in New Jersey (American Ornithologists' Union 1998). Meriwether Lewis and William Clark saw Piping Plovers, and recorded their observations in what was to become the state of Nebraska, during their 1803–1805 “Voyage of Discovery” across North America. The species was placed on the Endangered Species List on 10 January 1986 (50 Federal Register 50726–50734), and the Northern Great Plains Recovery Plan (which covers Nebraska) was issued in May 1988. The listing status of this species is managed under the auspices of the Federal Endangered Species Act (1973) and the Nebraska Nongame and Endangered Species Conservation Act (Neb. Rev. Stat. § 37-801-11). Critical habitat for the Northern Great Plains breeding population was designated in Montana, Nebraska, South Dakota, and Minnesota on 11 September 2002 (67 Federal Register 57637). The United States District Court vacated the portion of critical habitat located in Nebraska on 13 October 2005; to date, it has not been reinstated.

Our mission is to prevent and mediate conflicts between nesting terns and plovers and people, facilitate communication and promote proactive cooperation between agencies and people, and promote learning among stakeholders.

Interior Least Terns are the smallest tern found in North America. They are feisty, swallow-shaped birds most often seen in flight. Adults are approximately 20 to 23 cm in length with a 50cm wingspan. They feed on small fish and are often observed hovering over water before diving to catch a small fish in their bill. They are colonial, nesting in close proximity to each other and placing their nest and eggs directly on the ground. The Least Tern was first described in 1847 from a type specimen collected in Guadeloupe, West Indies (American Ornithologists' Union

1998). Meriwether Lewis and William Clark recorded their first observation of an Interior Least Tern on 5 August 1804 along the Missouri River, near present day Omaha, Nebraska, while on their 1803—1805 “Voyage of Discovery” across North America. The species was placed on the Endangered Species List on 27 June 1985 (50 Federal Register 21784–21792), and a Recovery Plan was issued in September 1990. As a result of their listing status, Interior Least Terns were protected by the Federal Endangered Species Act (1973) and the Nebraska Nongame and Endangered Species Conservation Act (Neb. Rev. Stat. § 37-80111). The Interior Least Tern was federally delisted on 13 January 2021 (86 FR 2564-2581).

Piping Plovers and Interior Least Terns are integral parts of the fauna of Nebraska. Terns and plovers were described by all of the major expeditions that passed through the region (e.g., Lewis and Clark, John James Audubon, Stephen Long, Duke Paul Wilhelm, Governor Kemble Warren, and Ferdinand Hayden), but they were known by Native Americans well before that period of time. Historically, terns and plovers flourished on sparsely-vegetated midstream sandbars of the Platte, Missouri, Loup, Elkhorn, and Niobrara rivers. However, much of this natural habitat has been lost due to broad-scale alterations of natural river systems. The amount of suitable sandbar habitat has been reduced by the presence of invasive plant species, construction of dams and reservoirs, river channelization, bank stabilization, hydropower generation, and water diversion. Terns and plovers frequently nest on human-created habitats that occur outside of the river channel. These habitats are created by industrial and commercial activities such as sand and gravel (aggregate) mining, dredging, and construction operations. This change in nesting habitat from mostly river sandbars to a combination of on-river and off-river habitats is the result of the decrease in available river nesting habitat and the increase in available human-created off-river nesting habitat.

Piping Plovers and Interior Least Terns are migratory birds that spend significant portions of the year in different parts of the Western Hemisphere. They are present in their nesting areas for about four months of the year. The other eight months are spent on migration and on their wintering areas. Piping Plovers spend the winter along the Gulf of Mexico, southern Atlantic Coast, in the Bahamas, and on other Caribbean Islands. These habitats are characterized by wide sandy beaches and a combination of sand flats, mudflats, tide pools, marshes, lagoons, and large inlets. Interior Least Terns spend the winter well off-shore and along coasts, bays, estuaries, and river mouths near Central and South America. Loss of overwintering habitat contributed to the decline of both species. The principal threats to tern and plover overwintering habitat include habitat loss and degradation, increased coastal residential and industrial development, and stochastic events (e.g., global sea level rise, oil spills, water pollution, and hurricanes).

Focus Area

We concentrated our monitoring and research efforts in our primary study area, from the Loup Power District diversion to the Missouri-Platte River confluence; throughout the remainder of this report our primary study area is referred to as the lower Platte River (Figure 1). We defined our study area as the lower Platte River system in eastern Nebraska, including portions of the central Platte, Loup and Elkhorn rivers and numerous off-river sites (Figure 2, Table 1). The TPCP concentrated its monitoring and research efforts on off-river nesting habitats in our primary study area. These off-river nesting habitats include lakeshore housing developments, active and inactive sand and gravel mines, and transition sites. During some years, additional monitoring and research efforts have occurred outside of our primary study area.

We defined the lower Platte River proper as the 103 river miles lying between the Loup-Platte River confluence (near Columbus, Platte County) and the Missouri-Platte River confluence (near Plattsmouth, Cass County) (Figure 1). The NBP has traditionally concentrated its monitoring and research on river sandbars along the lower Platte River proper from the North Bend bridge to Missouri River confluence, but efforts have been reduced in recent years. The lower Platte River passes through eight counties (Platte, Colfax, Butler, Dodge, Saunders, Douglas, Sarpy, and Cass) and four Natural Resources Districts (Lower Platte South, Lower Platte North, Papio-Missouri, and Lower Loup).

2022 Off-River Conditions

Conditions at off-river sites in 2022 were similar to years prior to 2021. Flooding impacts that affected access and nesting at several sites in 2019 were not a concern this year. We monitored 21 sites in 2022. Some sites provided minimal nesting habitat this year as they became increasingly vegetated or the number of houses increased. For example, one housing development (Flatwater Lake, near Valley, Nebraska) that hosted many nesting terns and plovers in 2020-2021 years had only four nests in 2022. However, an abandoned mine site (Flatwater Lake Estates, near Valley, Nebraska) was converted to a transition site in 2022 and hosted the most nests of all off-river sites in 2022. We continued to work closely with sand and gravel mining companies and their staff, developers, construction workers, and homeowners.

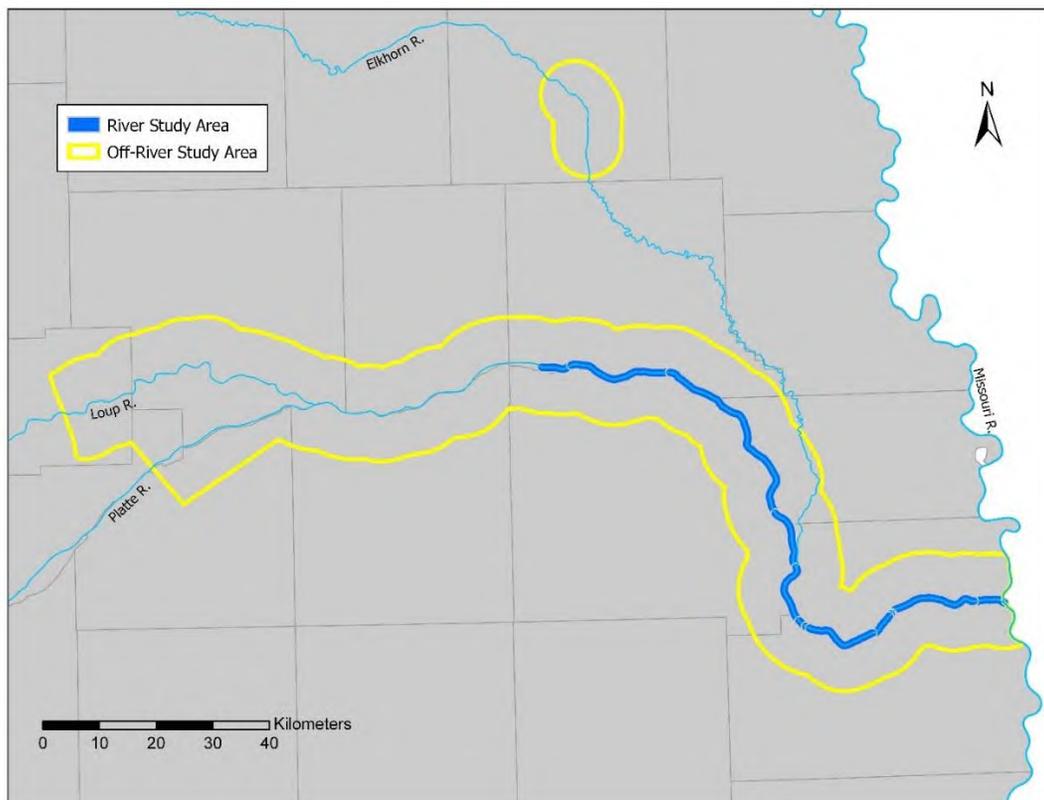


Figure 1. Off-river monitoring and research area for the Tern and Plover Conservation Partnership (outlined in yellow), Nebraska. The dark blue outlines the Platte River and where the U.S. Fish and Wildlife Service has conducted on-river monitoring (on-river monitoring was not conducted in 2022).

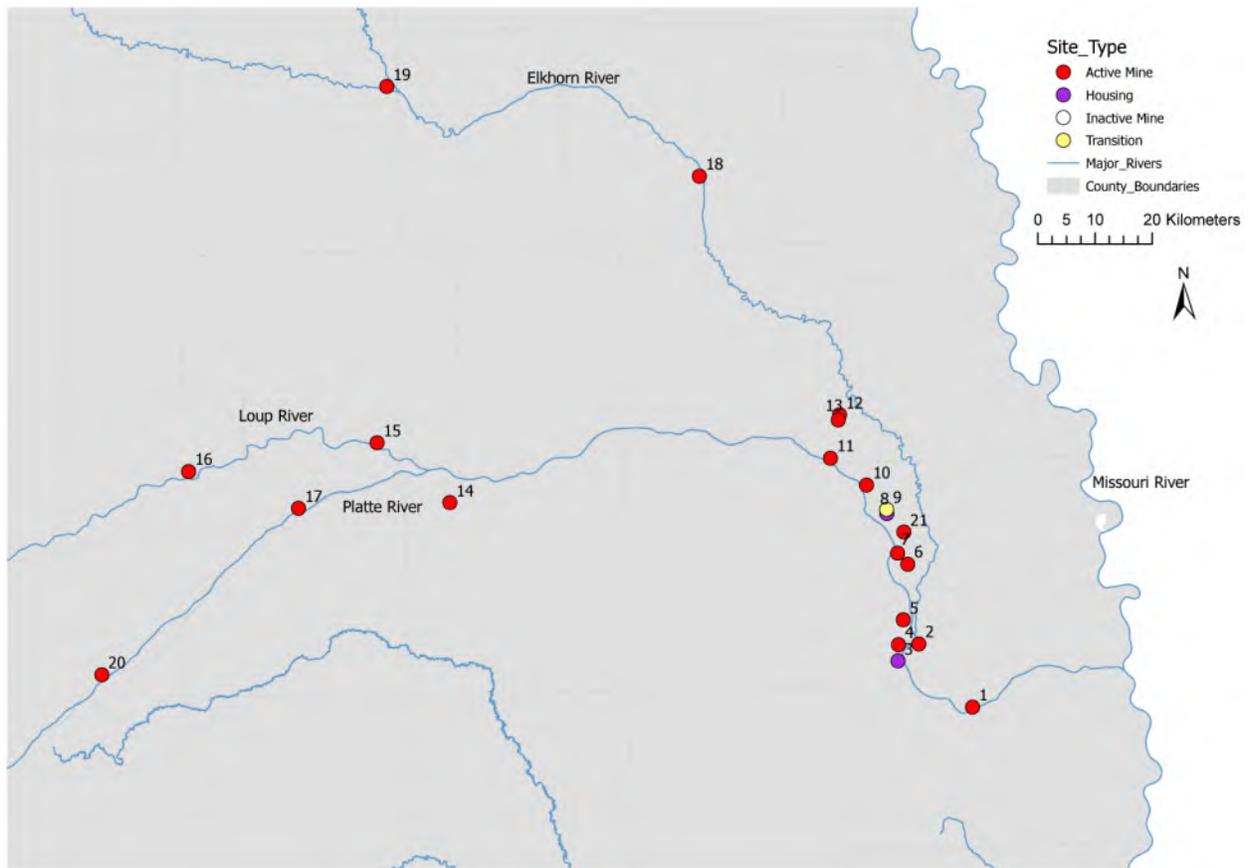


Figure 2. Locations of off-river Interior Least Tern and Piping Plover nesting areas within our study area are marked. Off-river sites can be matched to numbers in Table 1.

2022 River Conditions

The amount of suitable sandbar nesting habitat on the lower Platte River varies from year to year. Daily and seasonal fluctuations in the volume of water flowing in the river caused by annual rainfall, ice and snow accumulation, ground water levels, and river channel morphology influence sandbar development and maintenance. General water flow conditions on the lower Platte River are monitored by the United States Geological Survey (USGS) stream gages.

Compared to some recent years, sandbar-nesting habitat on the lower Platte River in 2022 was plentiful, and similar or better than 2021. Below average precipitation in the Platte River watershed decreased flows throughout the nesting period (Figures 3 and 4). There was a spike in early May and in mid-June that increased flows, but not substantially to inundate sandbars to a large extent (Figures 3 and 4). The March 2019 flooding created sandbars of exceptional size and elevation and relatively average flows in 2020 maintained them. Stream flows in 2022 created favorable conditions for tern and plover nesting. However, no surveys were conducted on the river in 2022.

Table 1. Off-river Interior Least Tern and Piping plover monitoring sites and occurrence of nesting activity, lower Platte River region, Nebraska, 2021.

#	Site Name	River	Owner	Site Type	County	2022 Nesting
1	Louisville Lakes	Platte	Western Sand and Gravel	Active Mine	Sarpy	Yes
2	Lyman-Richey #52	Platte	Lyman Richey	Active Mine	Sarpy	Yes
3	Sandy Pointe	Platte	Sandy Pointe Dev.	Housing	Saunders	Yes
4	Sand Creek	Platte	Western Sand and Gravel	Active Mine	Saunders	Yes
5	Western G Plant	Platte	Western Sand and Gravel	Active Mine	Saunders	Yes
6	West Center*	Platte	Martin Marietta Inc.	Active Mine	Saunders	No
7	Waterloo #40	Platte	Lyman Richey	Active Mine	Douglas	Yes
8	Flatwater Lake	Platte	Flatwater Lake Development	Housing	Douglas	Yes
9	Flatwater Lake Estates**	Platte	Flatwater Lake Development	Transition	Douglas	Yes
10	North Valley***	Platte	Martin Marietta Inc.	Active Mine	Dodge	Yes
11	Western Fremont	Platte	Western Sand and Gravel	Active Mine	Dodge	Yes
12	NE Fremont North	Platte	Lyman Richey	Active Mine	Dodge	Yes
13	Ritz Lake	Platte	Homeowners' Association	Housing	Dodge	Yes
14	Bellwood #73	Platte	Central Sand and Gravel	Active Mine	Butler	Yes
15	Columbus #71	Loup	Central Sand and Gravel	Active Mine	Platte	Yes
16	LPD-Loup Diversion	Loup	Preferred Rocks - LPD	Active Mine	Nance	Yes
17	Overland – Silver Creek	Platte	Overland Sand and Gravel	Active Mine	Merrick	Yes
18	Stalp – West Point	Elkhorn	Stalp Gravel Company	Active Mine	Cumming	Yes
19	Central – Norfolk	Elkhorn	Central Sand and Gravel	Active Mine	Madison	Yes
20	Overland – Central City	Platte	Overland Sand and Gravel	Active Mine	Merrick	Yes
21	Martin Marietta - Waterloo	Platte	Martin Marietta Inc.	Active Mine	Douglas	No

*referred to as OMG in prior reports

**referred to as Valley #7 in prior reports

***referred to as KMG in prior reports

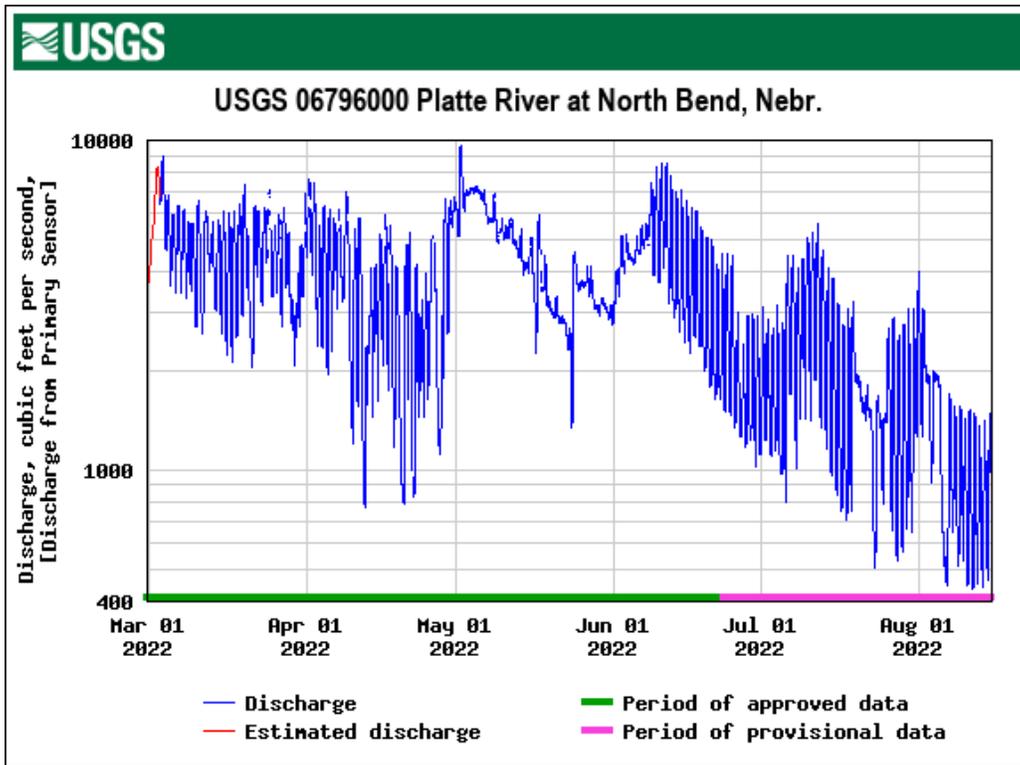


Figure 3. Daily water discharge (cubic feet per second; cfs) from March 1 through August 15, 2022 measured at the North Bend gage, Dodge County, Nebraska

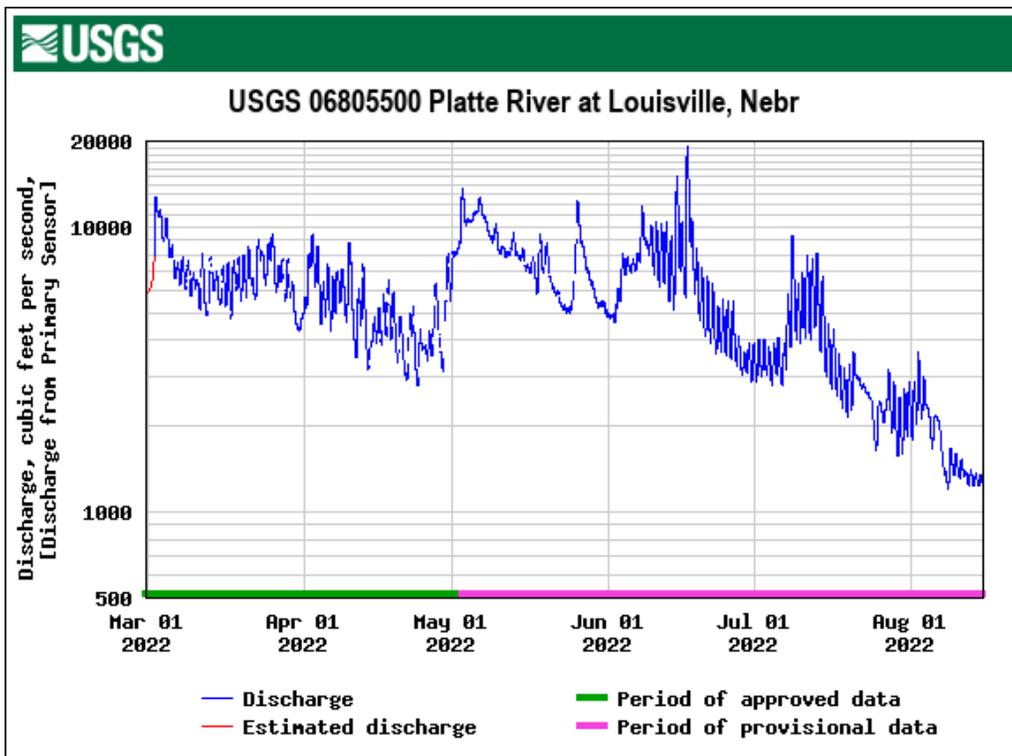


Figure 4. Daily water discharge (cubic feet per second; cfs) from March 1 through August 15, 2022 measured at the Louisville gage, Sarpy County, Nebraska.

Color Banding Schemes across the U.S. and Canada

Piping Plovers and Interior Least Terns are banded by authorized research groups across their ranges. Plovers have longer legs than terns which makes it much easier to mark them with color bands. Throughout their range plovers receive one to six leg bands and terns generally receive one or two leg bands depending on the site where they are banded (Figure 5). Piping Plover research groups, based across the U.S. and Canada, place different colored flags on a plover's upper leg to indicate where they were originally banded (Figure 6).



Figure 5. Examples of bands on piping plover (left) and Interior Least Tern chick (right; chicks banded previously to 2022).

Piping Plover Banding Regions

Breeding Range

- Canada = Black, Gray, or White Flag
- Great Lakes = Orange Flag
- Northern Missouri River = Yellow Flag
- Southern Missouri River = Green Flag
- Platte River = Light Blue Flag
- Atlantic Coast = no bands

Wintering Range

- Gulf Oil Spill Study = Green Flag
- Texas = Red Flag
- Bahamas = Pink Flag

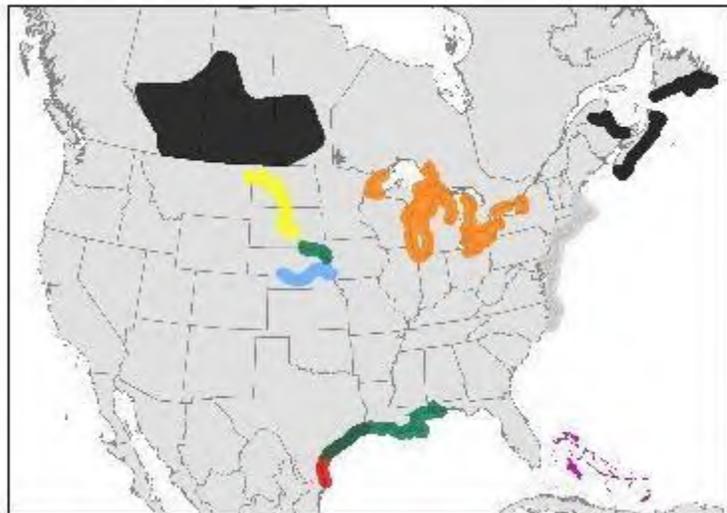


Figure 6. Piping Plover research groups place different colored flags on Piping Plovers to indicate where they were originally banded.



Monitoring

Monitoring Regional Movements of Banded Terns and Plovers

Piping Plover Breeding Season Observations

We banded four Piping Plovers in 2022, and re-sighted eighteen previously banded birds at off-river sites. To date, we have banded 849 plovers; 173 adults and 676 chicks (Table 2). The majority of plovers ($n = 844$) color-banded in our primary study area were captured at off-river sites; we banded five plover chicks with USGS bands only on river sandbars in 2009. Since 2008, we observed plovers in our primary study area originally banded in locations throughout the Great Plains and US Gulf Coast. During the 2022 breeding season, we only observed plovers that were originally banded along the lower Platte River.

Table 2. Number of Piping Plovers banded along the lower Platte River by year.

Year	Adults	Chicks	Total
2008	19	12	31
2009	18	23	41
2010	9	48	57
2011	15	31	46
2012	11	73	84
2013	15	58	73
2014	27	72	99
2015	17	93	110
2016	15	129	144
2017	11	113	124
2018	8	24	32
2019	0	0	0
2020	1	0	1
2021	3	0	3
2022	4	0	4
Total	173	676	849

In 2022, we observed seventeen Piping Plovers previously banded in our primary study area. We observed thirteen plovers with light blue flags and four with alphanumeric blue flags indicating they were originally banded along the lower Platte River.

Over the last 14 years, a number of Piping Plovers originally banded along the lower Platte River have been re-sighted nesting in other locations across the Great Plains (Table 3). Of the 849 plovers banded on the lower Platte River prior to 2022, 283 (33%) have been re-sighted during the breeding season at least one year after they were banded. Two hundred and forty-six (246) returned to nest along the lower Platte River, four have been observed on the central Platte River, 31 have been observed on the Missouri River, seven have been observed on the Niobrara River, and three have been observed in the alkali lakes region of North Dakota. A majority (54%) of lower Platte River plovers that returned to the lower Platte River to nest were originally banded as adults. A majority (77%) of lower Platte River plovers reported outside of the lower Platte River study area during the nesting season were originally banded as chicks. Overall, 53% of the lower Platte River plovers banded as adults and 47% of the lower Platte River plovers banded as chicks have been re-sighted at least once during a breeding season at least one year after they were banded.

In 2022, we did not receive any reports of lower Platte River plovers nesting outside the study area. At time of writing, we have not received any reports of lower Platte River plovers observed on along the Missouri or Niobrara rivers in 2022.

Table 3. Number of Piping Plovers previously banded along the lower Platte River and re-sighted during the breeding season at least one year after they were originally banded.

Age Banded	lower Platte River	central Platte River	Missouri River	Niobrara River	North Dakota	TOTAL
Adults	144	1	7	0	0	152
Chicks	102	3	24	7	3	139
TOTAL	246	4	31	5	3	291

Table 4. Number of Interior Least Terns banded on the lower Platte River each year.

Year	Adults	Chicks	TOTAL
2008	0	168	168
2009	0	199	199
2010	0	118	118
2011	0	120	120
2012	0	76	76
2013	0	93	93
2014	0	190	190
2015	20	202	222
2016	7	121	128
2017	0	126	126
2018	0	0	0
2019	0	0	0
2020	0	0	0

2021	0	0	0
2022	0	0	0
TOTAL	27	1287	1440

Piping Plover Non-Breeding Season Observations

Winter Range

Every year a number of Piping Plovers banded along the lower Platte River are observed in wintering areas during the non-breeding season (Figure 7). As of 1 September 2022, we received 25 reports of lower Platte River plovers in their winter range following the 2021 breeding season; all plovers were observed along the U.S. Gulf Coast.

Over the course of this study, 129 plovers (51 adults; 78 chicks) originally banded in our primary study area have been re-sighted in their winter range during the non-breeding season, with several birds observed more than once. Winter sightings of lower Platte River plovers extend from the southern tip of Texas to the Florida Keys, and north along the U.S. Atlantic Coast to South Carolina. In December 2017, our first lower Platte River plover was reported and photographed wintering outside of the U.S, wintering at Isla Holbox, Quintana Roo state, Mexico, north of Cancun. The same plover was resighted there the following winter, in 2018. Two more lower Platte River plovers were reported overwintering in the same location in 2019 and 2022, respectively.

Lower Platte River plovers have been reported in seven states and 34 counties along the US coast (Table 5). The majority of winter re-sightings have occurred along the US Gulf Coast. The first reports of lower Platte River plovers along the US Atlantic Coast occurred during the winter of 2012–2013. To date, nine lower Platte River Plovers have been observed wintering along the US Atlantic Coast. Since 2008, we have received a total of 839 reports of lower Platte River plovers observed during the non-breeding seasons (2008–2022), with most reports provided by researchers, resident and visiting birders and recreational wildlife photographers.

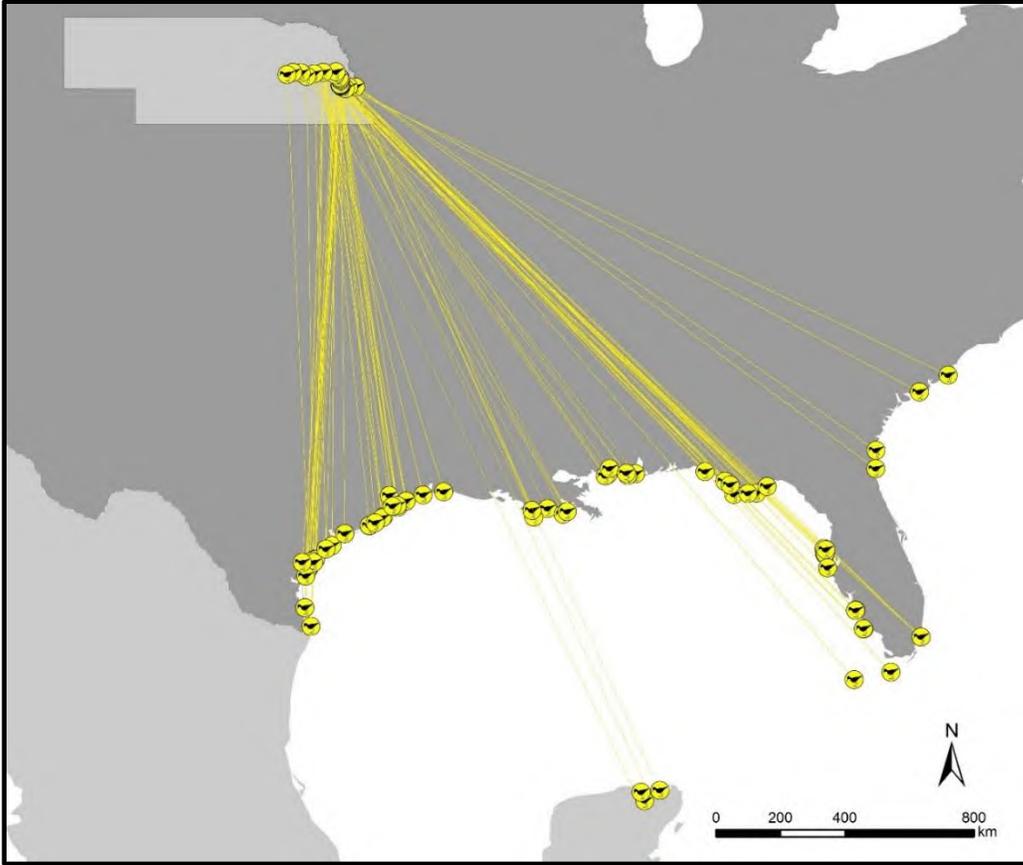


Figure 7. Locations where Piping Plovers marked with light blue-leg tags banded in the lower Platte River region, Nebraska, have been observed during the non-breeding season on the US Gulf and Atlantic coasts and the Yucatan Peninsula from 2008 to 2021.

Table 5. States/Countries where lower Platte River, Nebraska, Piping Plovers have been observed overwintering.

State	Number of LPR Plovers	Percent of Total
Alabama	3	2.3%
Florida	26	20.3%
Georgia	2	1.6%
Louisiana	17	13.3%
Mississippi	6	4.7%
South Carolina	2	1.6%
Texas	69	53.9%
Mexico	4	2.3%
TOTAL	129	100%

MONITORING NESTS and CHICKS

Methods: Off-River Habitat

In 2022, we began conducting Least Tern and Piping Plover surveys at off-river sites in late April. Throughout the breeding season (late April – early August), we surveyed off-river sites at least once every five to seven days. Site visit frequency was modified at some sites depending on tern and plover presence and activity, especially during the latter part of the nesting season. During each visit to off-river sites, we searched for adult birds, located new nests, checked the status of known nests, and searched for tern and plover chicks. In 2022, we minimized banding efforts (four adult plovers), and focused on tracking nest and chick status. Every time a new nest was found, we assigned it a unique identification number and recorded the nest location using a handheld GPS unit (Garmin Oregon 550t, Garmin Ltd., Olathe, KS, USA). We recorded the number of eggs in each nest and “floated” the eggs in water to determine the nest initiation date (Hays and LeCroy 1972). Using the egg floating data, we calculated the eggs’ expected hatch date, assuming a 28-day incubation period for plovers and a 21-day incubation period for terns. A majority of the nests were located one to seven days after the first egg was laid. During each subsequent nest check, after the day the nest was found, we checked eggs for any damage and recorded the status of each nest. We determined the status of each tern and plover nest based on the following criteria:

<u>Confirmed Successful</u> : ‘pipped’ eggs or newly-hatched chick(s) observed in or in the immediate vicinity (< 1 meter) of the nest cup
<u>Likely Successful</u> : empty, but intact nest cup located on or after the expected hatch date; nest cup may contain small pieces of eggshell
<u>Confirmed Failed</u> : nest cup and/or eggs found destroyed or abandoned
<u>Likely Failed</u> : nest not relocated on repeat visits prior to expected hatch date
<u>Undetermined</u> : nest not re-checked prior to hatch date or not enough evidence to determine nest fate

At some off-river sites, Least Terns and Piping Plovers placed their nests in areas not accessible to us for safety reasons. In these cases, we only recorded the number of nests, eggs, adults, chicks, fledglings and juveniles that were visible from a distance. We recorded the total number of active nests and the total number of terns and plovers into one of the defined age classes (adults, chicks, fledglings, or juveniles; see Definitions).

We recorded any notable observations including weather conditions, bird injuries, and evidence of disturbance caused by humans, dogs, cats, vehicles, natural predators, or recent severe weather events. We also recorded the band combinations of all least terns and piping plovers observed or recaptured with leg bands.

Results: Off-River Habitat

In 2022, we located 33 Piping Plover nests and 181 Least Tern nests at off-river sites in our primary study area (Table 6). These nests were distributed across 19 sites, two sites along the Loup River, 14 sites along the lower Platte River, one site along the central Platte River and two sites along the Elkhorn River (Figures 8–9). Nests were located at one transition site, two lakeshore housing developments, and sixteen sand and gravel mines. In 2022, 80.6% of plover nests and 68.6% of tern nests were determined to be confirmed or likely successful, while 19.4%

of plover nests and 31.4% of tern nests were classified as confirmed or likely failed (Tables 7–8; excluding one plover nests and nine tern nests with undetermined fate). We observed 26 plover chicks and 70 tern chicks at off-river sites (Table 6).

Table 6. The number of Interior Least Tern and Piping Plover nests and chicks observed at each off-river site along the lower Platte River, Nebraska, 2022.

Site Name	Site Type	Piping Plover		Interior Least Tern	
		# Nests	# Chicks	# Nests	# Chicks
Louisville Lakes	Active Mine	2	3	1	0
Linoma Beach #52	Active Mine	1	0	23	5
Sandy Pointe	Housing	2	1	0	0
Sand Creek	Active Mine	0	0	10	3
G Plant	Active Mine	0	0	1	0
West Center	Active Mine	0	0	0	0
Flatwater	Housing	2	4	2	3
Flatwater Lake Estates	Transition	6	4	33	10
North Valley	Active Mine	1	1	10	5
Western Fremont	Active Mine	1	0	7	0
Ritz Lake	Housing	3	0	5	4
NE Fremont North	Active Mine	1	0	7	8
Bellwood #73	Active Mine	5	5	29	13
Columbus #71	Active Mine	2	0	7	5
LPD-Loup Diversion	Active Mine	2	3	8	1
Overland – Silver Creek	Active Mine	3	5	20	8
Stalp - West Point	Active Mine	0	0	10	3
Central - Norfolk	Active Mine	0	0	6	2
Overland – Central City	Active Mine	0	0	2	1
Martin Marietta - Waterloo	Active Mine	1	0	0	0
Waterloo #40	Active Mine	1	0	0	0
TOTAL		33	26	181	70

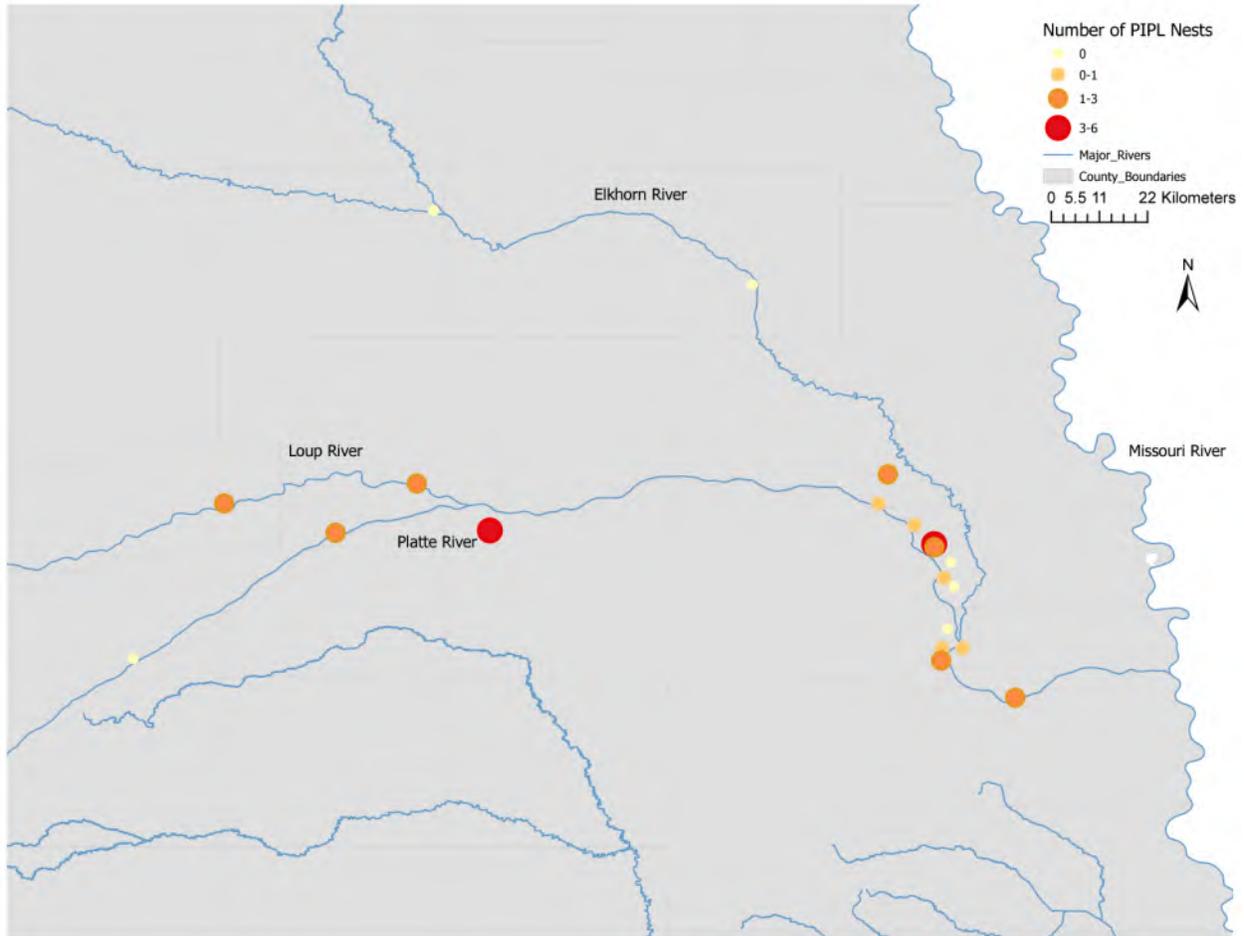


Figure 8. Locations of off-river Piping Plover nest sites along lower Platte River, Nebraska, 2022.

Table 7. Piping Plover nest fates on off-river sites along the lower Platte River, Nebraska, 2022.

Nest Fate	Mines	Housing	Transition	Total
Confirmed Hatched	6	2	0	8
Likely Hatched	7	4	5	16
Confirmed Failed	5	0	1	6
Likely Failed	0	1	0	0
Undetermined	1	0	0	2
TOTAL	20	7	6	33

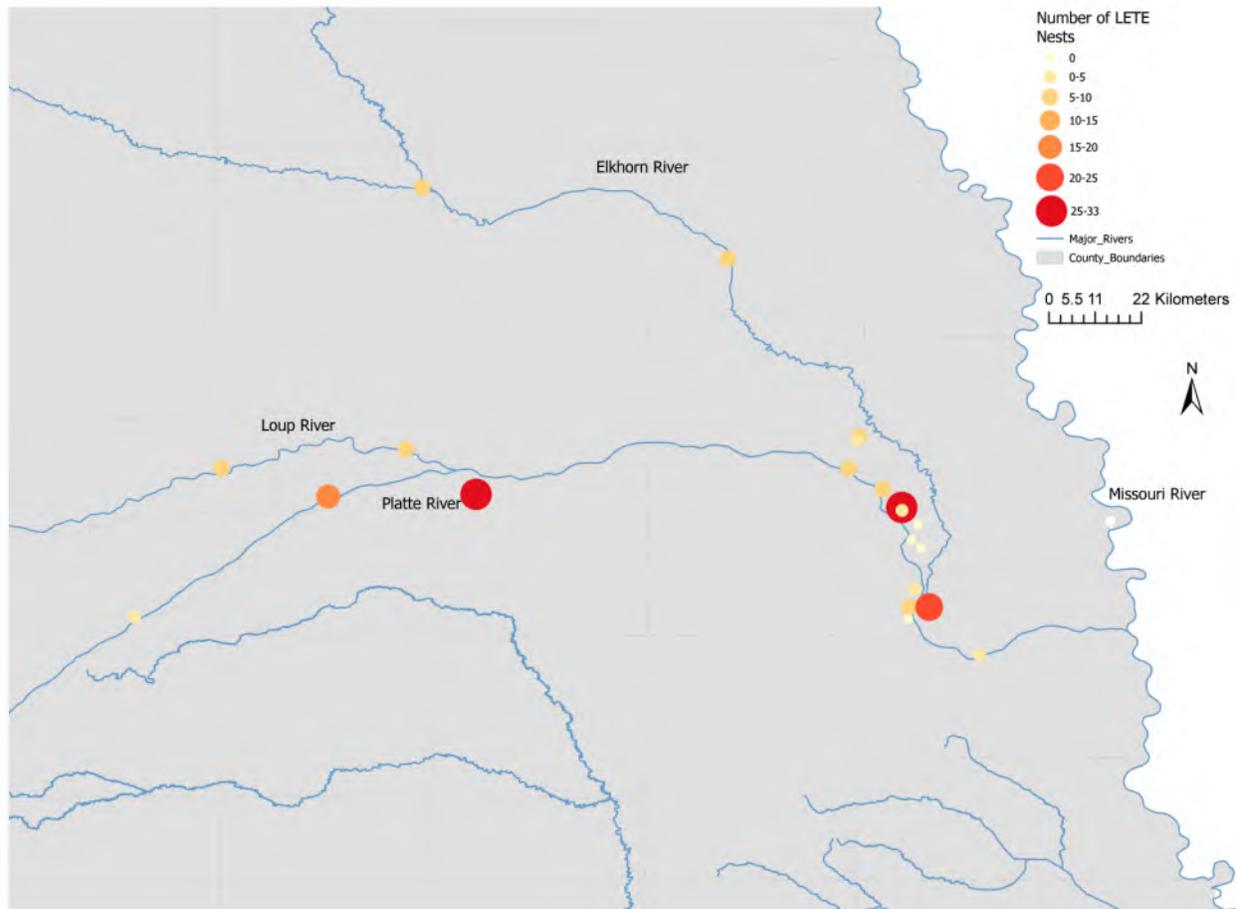


Figure 9. Locations of off-river Interior Least Tern nest sites along lower Platte River, Nebraska, 2022.

Table 8. Interior Least Tern nest fates on off-river sites along the lower Platte River in 2022.

Nest Fate	Mines	Housing	Transition	Total
Confirmed Hatched	30	2	5	37
Likely Hatched	58	2	20	81
Confirmed Failed	46	2	6	54
Likely Failed	0	0	0	0
Undetermined	7	0	2	9
TOTAL	141	7	33	181

Methods: On-River Habitat

The lower Platte River was not surveyed in 2022.

Results: On-River Habitat

In 2022, two Piping Plover nest and seven Least Tern nests were discovered by TPCP personnel on a sandbar adjacent to a mine site. Both Piping Plover nests was determined to be likely successful while all of the Least Tern nests were classified as confirmed failed.

Research

Estimating Survival Rates

Accurately estimating demographic parameters, such as daily and seasonal survival probabilities for individual birds and nests, leads to a better understanding of Interior Least Tern and Piping Plover population dynamics. This allows us to develop and implement more effective management strategies for these two species. We estimated nest, adult, and chick survival by using capture-mark-recapture and statistical modeling techniques.

Methods

Banding and Re-sighting

We conducted all bird capture and banding under the authorization of the USGS Bird Banding Laboratory (Patuxent Wildlife Research Center; <http://www.pwrc.usgs.gov/bbl>) and the USFWS through an inter-agency agreement with the NGPC (the TPCP holds Federal Threatened and Endangered Species handling permit #TE 070027; JGJ holds Federal Master (Station) Bird Bander Permit #20259 with Threatened and Endangered Species endorsements). Color-band combinations are coordinated prior to the beginning of the field season with the Bird Banding Laboratory and others with an interest in tern and plover research.

In 2022, we reduced our banding effort and only captured and banded four adult Piping Plovers; we did not capture and band any adult or chick Interior Least Terns in 2022. The capture, handling, and banding protocols used for plovers were the same as those used in previous years. Adult Piping Plovers were captured using a simple box trap placed over the nest. This method is effective and minimizes risk of injury to the adult and eggs. Box traps have no moving parts; the bird walks through the door, settles on its nest, and is captured.

We exercise great caution when handling and banding birds. We do not capture or band birds during extreme weather (cold, windy, rainy, or when inclement weather was forecast) or when the temperature was above 90° F (32.2° C). Birds are observed after banding and on subsequent visits to determine if there are any behavioral changes or signs of injury. As part of our protocol, we are to suspend all banding activities if problems or injuries were observed at any time. We did not observe any problems or injuries to birds as a result of monitoring, capture, handling, or banding in 2021.

We banded Piping Plover adults with an individually numbered metal USGS band (size 1A) on one of the upper legs. We placed a blue alphanumeric flag on the opposite upper leg; the blue flag indicates that this bird was banded in Nebraska along the Platte River. This season, we placed only dark blue alphanumeric flags on the upper leg of birds with no plastic color bands on the lower legs. The unique color band combination indicates each bird's individual identity (Figure 11).

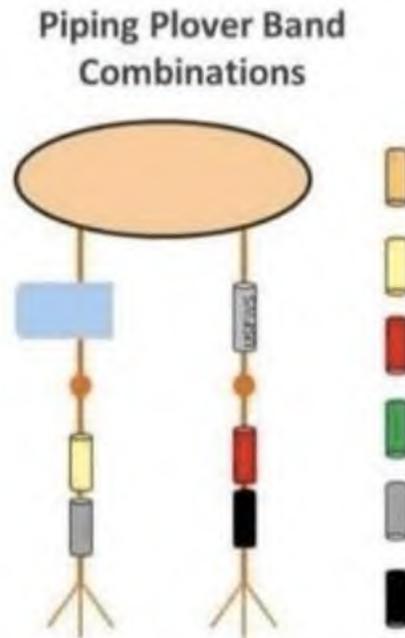


Figure 11. Diagram illustrating the banding scheme used on Piping Plovers banded along the lower Platte River, Nebraska, prior to 2021. The flags, color bands, and metal bands may be on either leg and plover color combinations vary. The flags may be light blue or dark blue with white alphanumeric characters.

Nest Survival Analysis

We used data from nest monitoring (see Monitoring section) to estimate nest survival. We estimated nest survival probabilities using the nest survival utility in Program MARK. We constructed encounter histories by summarizing the day each nest was found (k), the last day the nest was found active (l), the last day the nest was checked for activity (m), and the fate of the nest (f). Due to small sample sizes, we did not include any covariates in our model and assumed constant survival across the season. We provide both daily survival probability and the probability of nest success. Nest success is the probability a nest will survive the 21- (least tern) or 28-day (piping plover) incubation period to hatch at least one chick, and it is estimated by extrapolating the daily survival probability to the appropriate number of incubation days.

Results

Banding and Re-sighting

We banded four Piping Plovers and no Least Terns in 2022; all banding occurred at off- river sites. Seventeen plovers were re-sighted that were previously banded along the lower Platte. No analysis of survival using banding and re-sighting was conducted in 2022.

Piping Plover Nest Survival

We estimated Piping Plover nest survival probabilities from 31 nests located at off-river sites (7 at lakeshore housing developments, 20 at sand and gravel mines, and 6 at a transition site; Table 7).

One nest with undetermined fate and one nest that was found hatched were excluded from analysis. In 2022, all off-river plover nests had a daily survival probability of 0.990 (confidence interval 0.978, 0.995) and nest success probability of 0.748 (confidence interval 0.544, 0.871). Plover nests at lakeshore housing developments had a daily survival probability of 0.994 (confidence interval 0.961, 0.999) and a nest success probability of 0.852 (confidence interval 0.326, 0.978). Plover nests at sand and gravel mines had a daily survival probability of 0.987 (confidence interval 0.968, 0.994) and a nest success probability of 0.685 (confidence interval 0.404, 0.855). Plover nests at transition sites had a daily survival probability of 0.992 (confidence interval 0.947, 0.999) and a nest success probability of 0.804 (confidence interval 0.218, 0.970). In addition to off-river nests, we also estimated Piping Plover nest survival probabilities for two nests located at a sandbar site adjacent to an off-river sand and gravel mine. Plover nests at the sandbar had a daily survival probability of 1.00 (confidence interval 1.00, 1.00) and a nest success probability of 1.00 (confidence interval 1.00, 1.00).

In 2022, we placed protective exclosures around 10 out of 33 off-river Piping Plover nests. Nests with protective exclosures had a daily survival probability of 0.996 (confidence interval 0.971, 0.999) and a nest success probability of 0.891 (confidence interval 0.445, 0.984); nests without protective exclosures had a daily survival probability of 0.986 (confidence interval 0.970, 0.994) and a nest success probability of 0.677 (confidence interval 0.421, 0.840) (Figure 13).

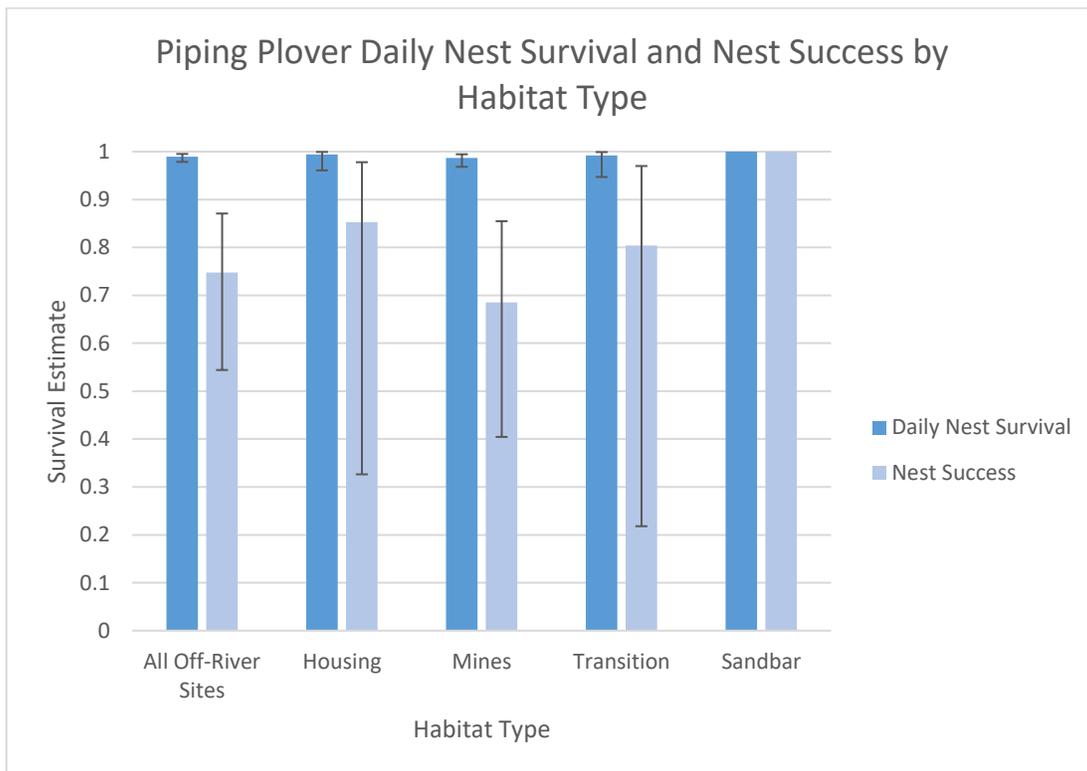


Figure 12. Daily survival and nest success probabilities of Piping Plover nests at all off-river sites, lakeshore housing developments, sand and gravel mines, transition sites, and sandbars, lower Platte River, Nebraska, 2022.

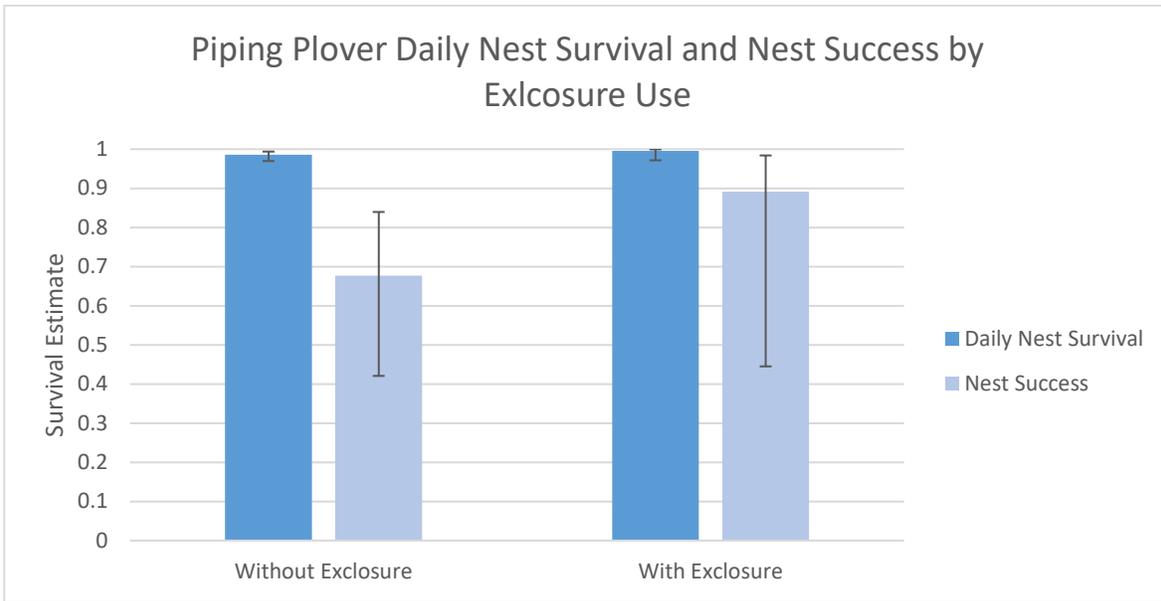


Figure 13. Daily survival and nest success probabilities of Piping Plover nests at off-river sites with protective exclosures and those without protective exclosures, lower Platte River, Nebraska, 2022.

Interior Least Tern Nest Survival

We estimated Interior Least Tern nest survival probabilities from 167 nests at off-river sites (7 at lakeshore housing developments, 129 at sand and gravel mines, and 29 at a transition site; Table 8). Nine nests with undetermined fate (seven at mine sites, two at transition sites), four nests that were found failed (three from mine sites, one from transition sites), and one nest that was found hatched were excluded from analysis. The daily survival probability of off-river tern nests was 0.978 (confidence interval 0.971, 0.983) and nest success probability was 0.625 (confidence interval 0.538, 0.701). Tern nests at lakeshore housing developments had a daily survival probability of 0.984 (confidence interval 0.938, 0.996) and a nest success probability of 0.711 (confidence interval 0.260, 0.919). Tern nests at sand and gravel mines had a daily survival probability of 0.976 (confidence interval 0.968, 0.982) and a nest success probability of 0.603 (confidence interval 0.505, 0.687). Tern nests at transition sites had a daily survival probability of 0.985 (confidence interval 0.964, 0.994) and a nest success probability of 0.727 (confidence interval 0.467, 0.876) (Figure 14).

In addition to off-river nests, we also estimated Interior Least Tern nest survival probabilities for six nests located at a sandbar site adjacent to an off-river sand and gravel mine. One nest that was found failed was excluded from analysis. Tern nests at the sandbar site had a daily survival probability of 0.712 (confidence interval 0.425, 0.892) and a nest success probability of 8.01×10^{-4} (confidence interval 1.59×10^{-8} , 0.091).

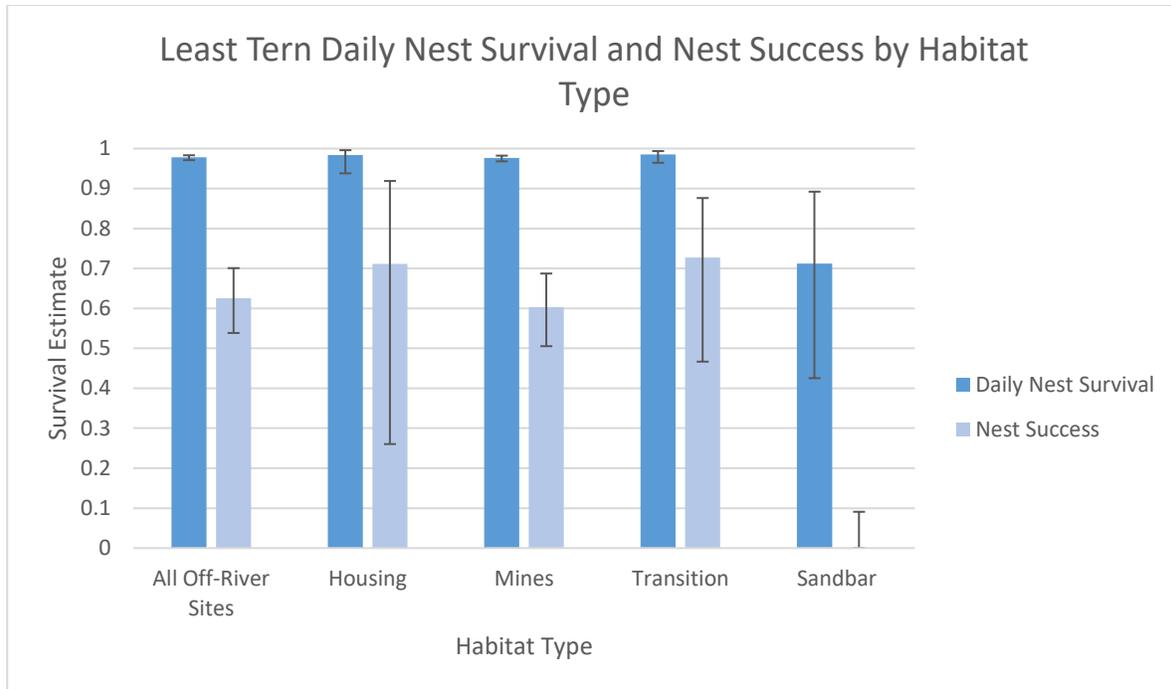


Figure 14. Daily survival and nest success probabilities of Least Tern nests at all off-river sites, lakeshore housing developments, sand and gravel mines, transition sites, and sandbars, lower Platte River, Nebraska, 2022.

Management

The TPCP uses a voluntary, proactive approach to reduce human-bird conflicts and avoid the need for law enforcement actions in Interior Least Tern and Piping Plover management. Before terns and plovers return to Nebraska in the spring and the field season begins, TPCP personnel meet with the production crews and property managers of the aggregate (sand and gravel) mines in our focus area. We discuss production plans for the upcoming season, safety regulations, and site access. We pay particular attention to concerns mine personnel have regarding on-site activities of the TPCP and changes to federal MSHA (Mine Safety and Health Administration) policy as it applies to non-mine personnel. We also meet with real estate developers and homeowners' associations at the lakeshore housing developments. At these meetings, we discuss the construction plans for the area and site access. We pay particular attention to property owners' concerns regarding on-site activities of the TPCP.

The result of these meetings is a set of site-specific management and monitoring plans; an equally valuable result is the TPCP becoming better acquainted with the people living and working at these sites. This makes our management efforts easier to implement and more effective as the nesting season progresses. We maintain close contact with these individuals throughout the season, so we can quickly respond to any on-site changes that develop.

Mine Safety and Health Administration (MSHA) and Institutional Animal Care and Use (IACUC)

Every year, all TPCP personnel receive MSHA training and certification for scientific (non-miner) workers. In 2021, our training was again provided by Tim Zuehlke, a MSHA certified trainer, and included mine safety, Red Cross First Aid, CPR and AED training. Copies of TPCP personnel certification cards are provided to the mining companies for their records. The Program’s Coordinator completed University of Nebraska Institutional Animal Care and Use Committee (IACUC) training and maintains IACUC protocols and reporting. In 2021, we also observed workplace guidance intended to limit the spread of COVID-19. This included our individual employers’ (University of Nebraska–Lincoln, NGPC, USFWS) guidance, as well as guidance in place at the sites we visited.

Protecting Interior Least Tern and Piping Plover Nests

To protect tern and plover nesting areas, we erect “Keep Out” signs around the perimeter of all off-river nesting areas; these signs were designed in 2008 by the TPCP and have been widely adopted for use across Nebraska and other parts of the northern Great Plains. In areas where human foot or vehicle traffic is to be expected, ‘psychological’ barriers are added. These barriers consist of black or orange cord tied between the “Keep Out” sign posts with red-silver Mylar™ streamers attached to the cord to make it more visible.

Based on conversations with mine personnel and homeowners’ associations before the nesting season begins, we mark off the areas where it would be safest for terns and plovers not to nest. At mines, these are areas that are going to be dredged during the nesting season or where heavy equipment will be operating. At housing developments, these are areas where buildings are to be constructed or utilities are to be installed. We know that terns and plovers avoid nesting in areas where the 1) substrate is disturbed by raking, 2) vegetation is present, 3) substrate particle size is unattractive to the birds or 4) areas are physically disturbed in some other way (Marcus et al. 2007). In addition to planting vegetation, resurfacing the sand, and raking the substrate, we often opt for a physical method of discouraging birds from nesting in an area. Before the birds arrive, we put up grids of three-foot tall fiberglass poles with 16-foot-long streamers of red-silver Mylar™ flagging attached to them. The poles are set 16 feet apart. When the streamers blow in the wind, they make a crackling sound and sweep the ground, which discourages the birds from attempting to nest in the area.

We use protective wire mesh nest enclosures around plover nests, but not tern nests because of the birds’ behavior around their nests—plovers walk up to their nests, while terns fly up to their nests. These enclosures help to protect plover nests from both human disturbance and natural predation.

For terns, we place protective boundaries around tern nesting colonies that are in areas with human activity. We do this by placing a ring of 3-foot tall rebar poles around the nesting area; black cord with red-silver Mylar™ strips are tied between each of the poles. These marked off areas only help to protect tern nests from human disturbance; they do not reduce natural predation.

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Photo by Elyse Watson.