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2013 Interior Least Tern and Piping Plover Monitoring, Research, Management, and Outreach Report for the Lower Platte River, Nebraska

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Unless otherwise noted, all photographs by Lauren R. Dinan.



PREFACE

This document reports on our monitoring, research, management, and outreach activities during the past 12 months (2012–2013). 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.

The data, data analyses, results, summaries, and interpretations found in this document are not final and should be considered as such when being cited or referred to in documents, reports, proposals, or presentations. Please contact us before using any of this material and for additional information that may have become available.

In an effort to make the information in this document more accessible, it is divided into five (5) sections: Introduction, Monitoring, Research, Management, and Outreach.

Introduction: This section describes the project area and summarizes conditions encountered during the 2013 field season.

Monitoring: This section describes the data we collect every year for basic demographic analysis and includes the number of nests, adults, eggs, chicks, and fledglings found in the focus area. These data are collected and summarized in a form that allows comparison across the range of each species.

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

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

Outreach: This section describes our efforts to increase public awareness and understanding of Interior Least Terns and Piping Plovers and to promote environmental literacy.

The following icons are used on maps to designate nest locations.



Interior Least Tern nest



Piping Plover nest

“Fortunately protection has come in time to save this beautiful species from complete extermination with which it certainly was threatened.”

Arthur Cleveland Bent
Life Histories of North American Gulls and Terns

ACKNOWLEDGEMENTS

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Support for the monitoring, research, management, and outreach activities described in this report was provided by Lyman-Richey, Nebraska Environmental Trust, Nebraska Game and Parks Commission, Nebraska State Wildlife Grants, Preferred Rocks of Genoa, University of Nebraska-School of Natural Resources, and Western Sand and Gravel.



We extend our thanks to all of our partners including: Arps Gravel and Concrete, Big Sandy Homeowners' Association, Cedar Creek Homeowners' Association, Central Sand and Gravel, Five Nines Technology Group, Lake Allure Homeowners' Association, Lake Socorro Homeowners' Association, Loup Public Power District, Lower Platte North Natural Resources District, Lower Platte River Corridor Alliance, Lower Platte South Natural Resources District, Lyman-Richey, Mallard Landing Homeowners' Association, Nebraska Natural Legacy Project, Nebraska Public Power District, Old Castle Materials, Overland Sand and Gravel, Papio-Missouri Natural Resources District, Paulsen Sand and Gravel, Preferred Rocks of Genoa, Riverview Shores Homeowners' Association, Stalp Sand and Gravel, Tri-County Sand and Gravel, Ulrich Sand and Gravel, United States Army Corps of Engineers, United States Geological Survey, and Western Sand and Gravel.



A one-day old Interior Least Tern chick in its nest cup at an active sand and gravel mine in Nance County.

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 state and federally endangered Interior Least Tern (*Sternula antillarum athalassos*) and threatened Piping Plover (*Charadrius melodus*). The Tern and Plover Conservation Partnership (TPCP), based at the University of Nebraska-Lincoln School of Natural Resources, and Nongame Bird Program (NBP), based at the Nebraska Game and Parks Commission (NGPC), work cooperatively on tern and plover monitoring, research, management, and outreach activities in Nebraska. The TPCP and NBP focus our monitoring and research efforts along the Lower Platte, Loup, and Elkhorn rivers in the eastern part of the state; we also work on tern and plover issues across the state, including Lake McConaughy, and region.

FOCUS ANIMALS

The Interior Least Tern (*Sternula antillarum athalassos*) is the smallest of the terns found in North America. The species 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 this listing status, the Interior Least Tern is protected by the Federal Endangered Species Act (1973) and the Nebraska Nongame and Endangered Species Conservation Act (Neb. Rev. Stat. § 37-801-11). A review of the species' population status is currently being conducted by the USFWS (P. Hatfield, pers. comm.).

The Piping Plover (*Charadrius melodus*) is a small, migratory shorebird; the common name reflects the plaintive whistling sound they produce as one of their primary vocalizations. 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. A review of the species' population status was completed in 2009 and the recovery plan is currently being re-evaluated (C. Aron, pers. comm.).

Interior Least Terns and Piping Plovers are an integral part of the fauna of Nebraska. Terns and plovers were described by all of the major expeditions that passed through the region (i.e., 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. 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 the 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 exclusively 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. Although human-created habitats offer alternative nesting sites during years where river sandbars are limited, they are not likely to provide a suitable long-term substitute for riverine nesting habitat.

Interior Least Terns and Piping Plovers are migratory birds that spend significant portions of the year in different parts of the Western Hemisphere. They are only in their nesting areas about four months of the year. The other eight months are spent on migration and on their overwintering areas. Piping Plovers spend the winter along the Gulf of Mexico, southern Atlantic coast, and in the Bahamas/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 (i.e., global sea level rise, oil spills/pollution and hurricanes).

FOCUS AREA

Our study area includes the Lower Platte River system in eastern Nebraska, including the Loup and Elkhorn Rivers. Our study area includes numerous off-river sites (Fig. 1, Table 1). We concentrate our monitoring and research efforts in our primary study area, an area which includes the Lower Platte and Loup Rivers from the Loup Public Power District Diversion to the Missouri-Platte River confluence (Fig. 2). The TPCP concentrates its monitoring and research efforts on off-river nesting habitats in our primary study area. Additional off-river monitoring also occurs at off-river sites along the North Loup, Middle Loup, and Elkhorn Rivers. The NBP concentrates its monitoring and research efforts on river nesting habitat in our primary study area; these efforts focus solely on the Lower Platte River and do not include the Loup or Elkhorn Rivers. We define the Lower Platte River 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). 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).



Lower Platte River in Sarpy/Saunders County on 18 June 2013.

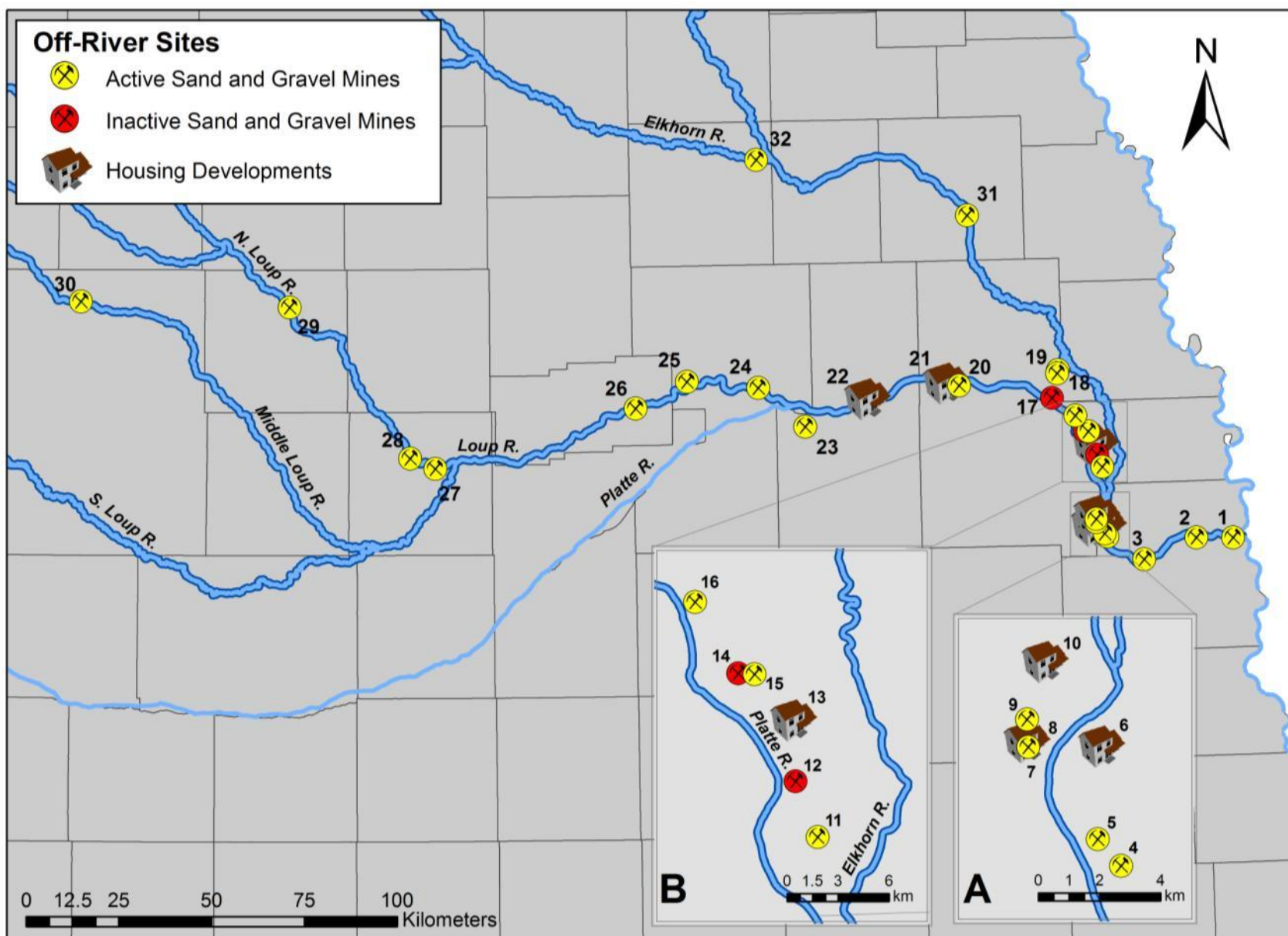


Figure 1. Our study area is highlighted with a dark blue outline. Locations of off-river Interior Least Tern and Piping Plover nesting areas within our study area are marked. Off-river sites can be matched to numbers in Table 1.

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Table 1. Off-river tern and plover nesting sites; site numbers correspond with Figure 1.

#	Site Name	River	Owner	Site Type	County	2013 Nesting
1	Oreapolis #8	Platte	Lyman Richey	Active Mine	Cass	Yes
2	New Collum #3	Platte	Central Sand and Gravel	Active Mine	Cass	No
3	Louisville Lakes	Platte	Western Sand and Gravel	Active Mine	Sarpy	Yes
4	Linoma Beach #50	Platte	Lyman Richey	Active Mine	Sarpy	No
5	Linoma Beach #51	Platte	Lyman Richey	Active Mine	Sarpy	Yes
6	Melia	Platte	Private	Housing	Sarpy	Yes
7	Thomas Lakes	Platte	Western Sand and Gravel	Active Mine	Saunders	Yes
8	Lake Allure	Platte	Homeowners' Association	Housing	Saunders	Yes
9	Sand Creek	Platte	Western Sand and Gravel	Active Mine	Saunders	Yes
10	Big Sandy	Platte	Homeowners' Association	Housing	Saunders	No
11	OMG-Graske Pit	Platte	Old Castle Materials Group	Active Mine	Douglas	Yes
12	Waterloo #40	Platte	Lyman Richey	Inactive Mine	Douglas	No
13	Mallard Landing	Platte	Homeowners' Association	Housing	Douglas	Yes
14	Pleasure Lake #11	Platte	Lyman Richey	Inactive Mine	Douglas	Yes
15	Valley #7	Platte	Lyman Richey	Active Mine	Douglas	Yes
16	KMG	Platte	Mallard Sand and Gravel	Active Mine	Dodge	No
17	Western Fremont	Platte	Western Sand and Gravel	Inactive Mine	Dodge	Yes
18	NE Fremont North	Platte	Lyman Richey	Active Mine	Dodge	Yes
19	NE Fremont South	Platte	Lyman Richey	Active Mine	Dodge	Yes
20	Morse Bluff	Platte	Private Mining Company	Active Mine	Dodge	Yes
21	Riverview Shores	Platte	Homeowners' Association	Housing	Dodge	Yes
22	Socorro Lake	Platte	Homeowners' Association	Housing	Colfax	Yes
23	Bellwood #73	Platte	Central Sand and Gravel	Active Mine	Butler	Yes
24	Columbus #71	Loup	Central Sand and Gravel	Active Mine	Platte	Yes
25	Genoa North #95	Loup	Central Sand and Gravel	Active Mine	Platte	Yes
26	LPPD-Loup Diversion	Loup	Preferred Rocks - LPPD	Active Mine	Nance	Yes
27	North Loup SRA	N. Loup	Central Sand and Gravel	Active Mine	Howard	No
28	E Elba	N. Loup	Tri-County Sand and Gravel	Active Mine	Howard	Yes
29	Haskell Creek	N. Loup	Ulrich Sand and Gravel	Active Mine	Valley	Yes
30	Paulsen Gates	M. Loup	Paulsen Sand and Gravel	Active Mine	Custer	Yes
31	Horseshoe Lake	Elkhorn	Stalp Sand and Gravel	Active Mine	Cumming	No
32	Medelman's Lake	Elkhorn	Central Sand and Gravel	Active Mine	Madison	Yes

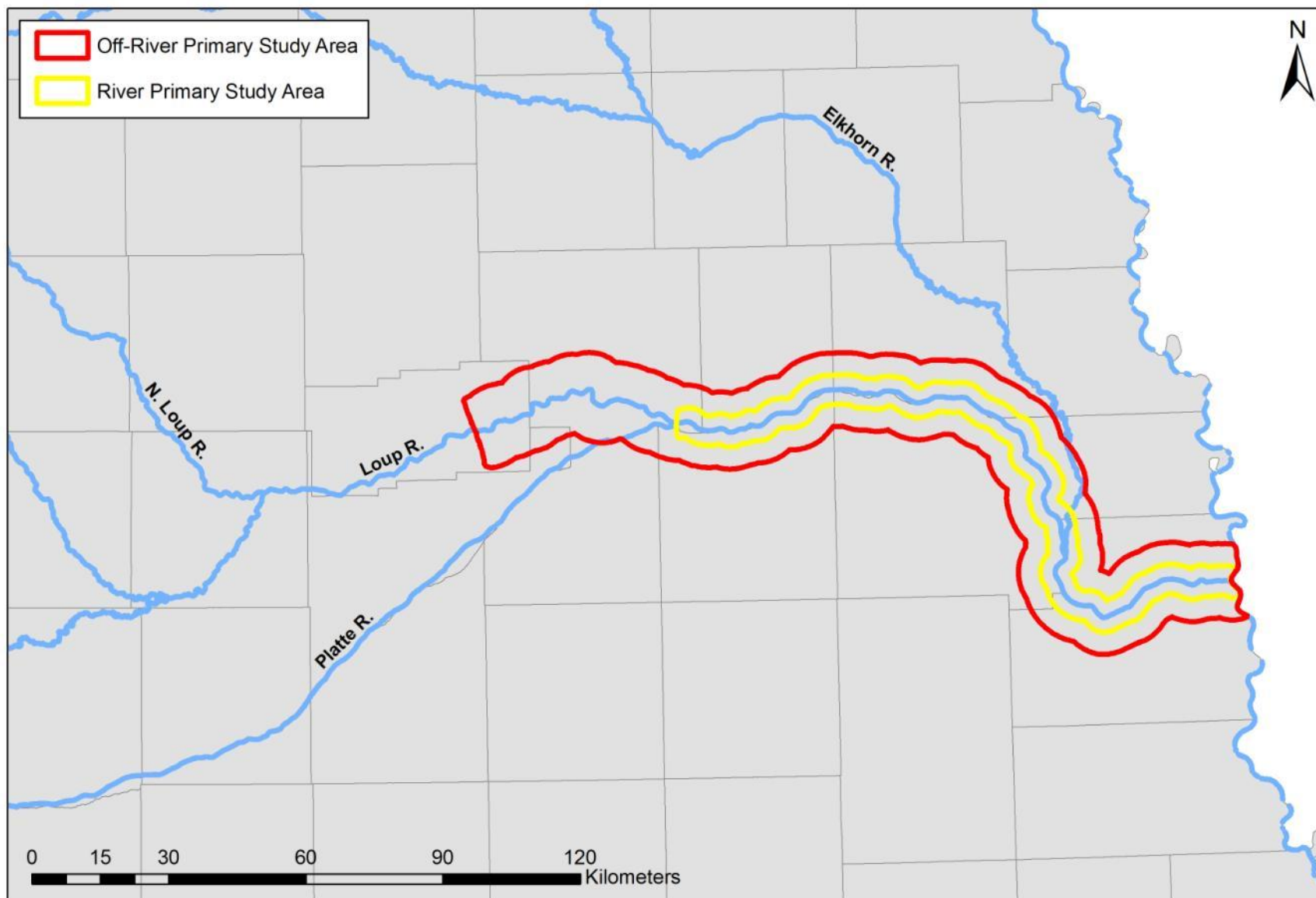


Figure 2. Our primary study area – the red box outlines the area where the TCPN concentrates its off-river monitoring and research efforts, and the yellow box outlines the area where the NBP concentrates its on-river monitoring and research efforts.

2013 OFF-RIVER CONDITIONS

Overall conditions at off-river sites remained relatively similar to previous years with no major changes. In 2013, the sand and gravel mining and the lakeshore housing development industries' activities appeared to increase as local economic conditions improved and new repair and construction projects were undertaken. Several sand and gravel mining companies modified their operations, relocated dredges, and moved slurry pipes; a few new mines opened, several old mines ceased production and others began transitioning into lakeshore housing developments. The pace of home construction appeared to increase at many of our lakeshore housing development sites. Nesting sandbar habitat was limited on the Lower Platte River (see River Conditions, below), which may have increased use on off-river sites.

2013 LOWER PLATTE 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 flow conditions on the Lower Platte River are monitored by the United States Geological Survey (USGS) stream gages (<http://waterdata.usgs.gov/ne/nwis/rt>). In addition to these USGS data, we monitored flow conditions by visual inspection of the river at bridge crossings and by direct inspection of the river via kayak.

River sandbar conditions in 2013 were affected by several years of relatively low water discharges; no notable high flow events occurred before and during the nesting season. The last major high flow event occurred in June 2010 (Brown and Jorgensen 2010). Following a year of historically low water levels in 2012, this was the second consecutive nesting season where river discharge did not reach 25,000 cubic feet per second (cfs) at the Louisville gage (USGS 0680550 Platte River). This value is lower than the recommended flow of 38,170 cfs, necessary to maintain suitable nesting sandbar habitat in the Lower Platte River (Parnham 2007). The absence of high flow events coupled with the relatively mild winters of 2011–2012 and 2012–2013 resulted in high rates of erosion, re-shaping, and reducing elevations of macroform sandbars created during 2010 high flow events (See Brown and Jorgensen 2010).

In 2013, water levels peaked at 12,500 cfs at the North Bend gage (USGS 06796000 Platte River) on 31 May and 24,300 cfs at the Louisville gage on 30 May (Figs. 3 – 4). This peak in water discharge occurred early in the nesting season; before many terns and plovers were nesting. Many sandbars were at least partially inundated by this level of water discharge, but were exposed as water levels decreased throughout the nesting season.

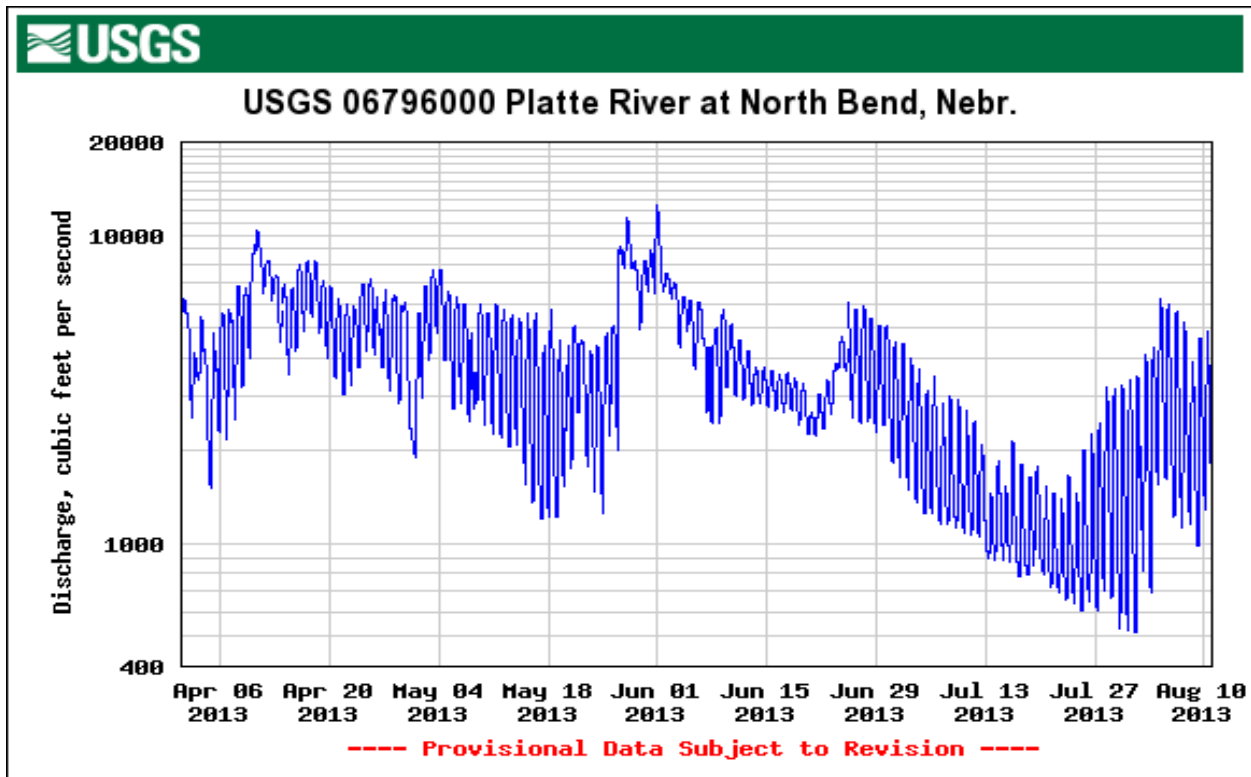


Figure 3. Daily water discharge (cubic feet per second; cfs) measured at the North Bend, Dodge County, USGS gage from April 1, 2013 through August 10, 2013.

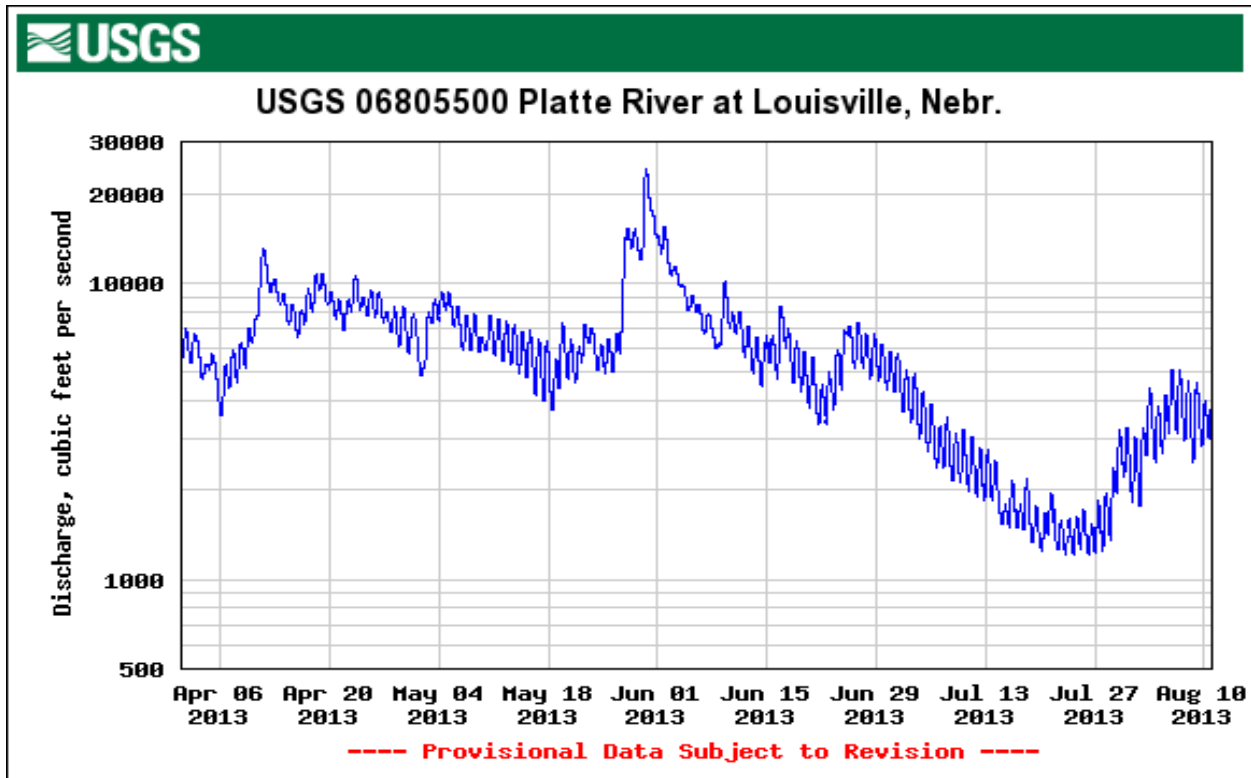


Figure 4. Daily water discharge (cubic feet per second; cfs) measured at the Louisville, Cass County, USGS gage from April 1, 2013 through August 8, 2013.

MONITORING

MONITORING REGIONAL MOVEMENTS OF COLOR-BANDED PIPING PLOVERS

Breeding Season Observations

This was our sixth year placing colored leg bands on Piping Plovers nesting in our primary study area along the Lower Platte River. To date, we have banded 332 plovers; 87 adults and 245 pre-fledging age chicks (28 days and younger). Nearly all plovers (327) banded in our primary study area were banded at off-river sites; however, we banded five plover chicks on river sandbars in 2009. Since 2008, we have observed plovers originally banded in locations throughout the Great Plains and US Gulf Coast. In 2013, we observed plovers that were originally banded along the Lower Platte River, Central Platte River, Missouri River between South Sioux City, NE and Yankton, SD, and the US Gulf Coast. Plovers banded along the Lower Platte and Central Platte Rivers carry a light blue flag on one of their upper legs. Plovers banded along the Central Platte River are banded by USGS biologists (M. Sherfy and M. Ring, pers. comm.). Plovers banded along the Missouri River, and some plovers banded along the US Gulf Coast, carry a green flag on one of their upper legs, and are banded by a research group from Virginia Tech University (D. Catlin, J. Fraser, K. Hunt, M. Friedrich, pers. comm.). Some plovers banded along the US Gulf Coast (Texas) carry a red flag on one of their upper legs and are banded by biologists with the Coastal Bend Bays and Estuaries Program (CBBEP; D. Newstead, pers. comm.). In previous years, we observed a yellow-flagged plover along the Lower Platte River originally banded at Lake Sakakawea in North Dakota.

We observed 54 previously-banded Piping Plovers in our primary study area in 2013; 45 were observed at off-river sites and nine were observed on Lower Platte River sandbars. 50% (27) of the 54 previously banded plovers were observed nesting at a lakeshore housing development near North Bend, Dodge County. In 2013, we observed 31 light blue-flagged plovers that were originally banded along the Lower Platte River, two light blue-flagged plovers that were originally banded along the Central Platte River, and 21 green-flagged plovers in our primary study area. Nineteen of the green-flagged birds were originally banded on the Missouri River (Fig. 5), and two were originally banded on the US Gulf Coast (D. Catlin, J. Fraser, K. Hunt, M. Friedrich, pers. comm.). We also observed two red-flagged plovers that were originally banded near Galveston Island, Texas.

Over the last six years, a number of Piping Plovers originally banded in our primary study area along the Lower Platte River have been re-sighted nesting in other locations: the Missouri, Niobrara, and Central Platte Rivers. In 2013, 12 Lower Platte River plovers were observed nesting on sandbars along the Missouri River and one Lower Platte River Plover was observed nesting at a sand and gravel mine along the Central Platte River.

Approximately 30% of the Piping Plovers banded in our primary study area from 2008 to 2012 have been re-sighted in our primary study area one or more years after they were originally banded; 68% of the plovers banded as adults and 15% of the plovers banded as chicks. Most (78%) of the re-sighted adults have been observed at the same site they were originally banded; only 24% of the re-sighted chicks have been observed at the same site they were originally banded.

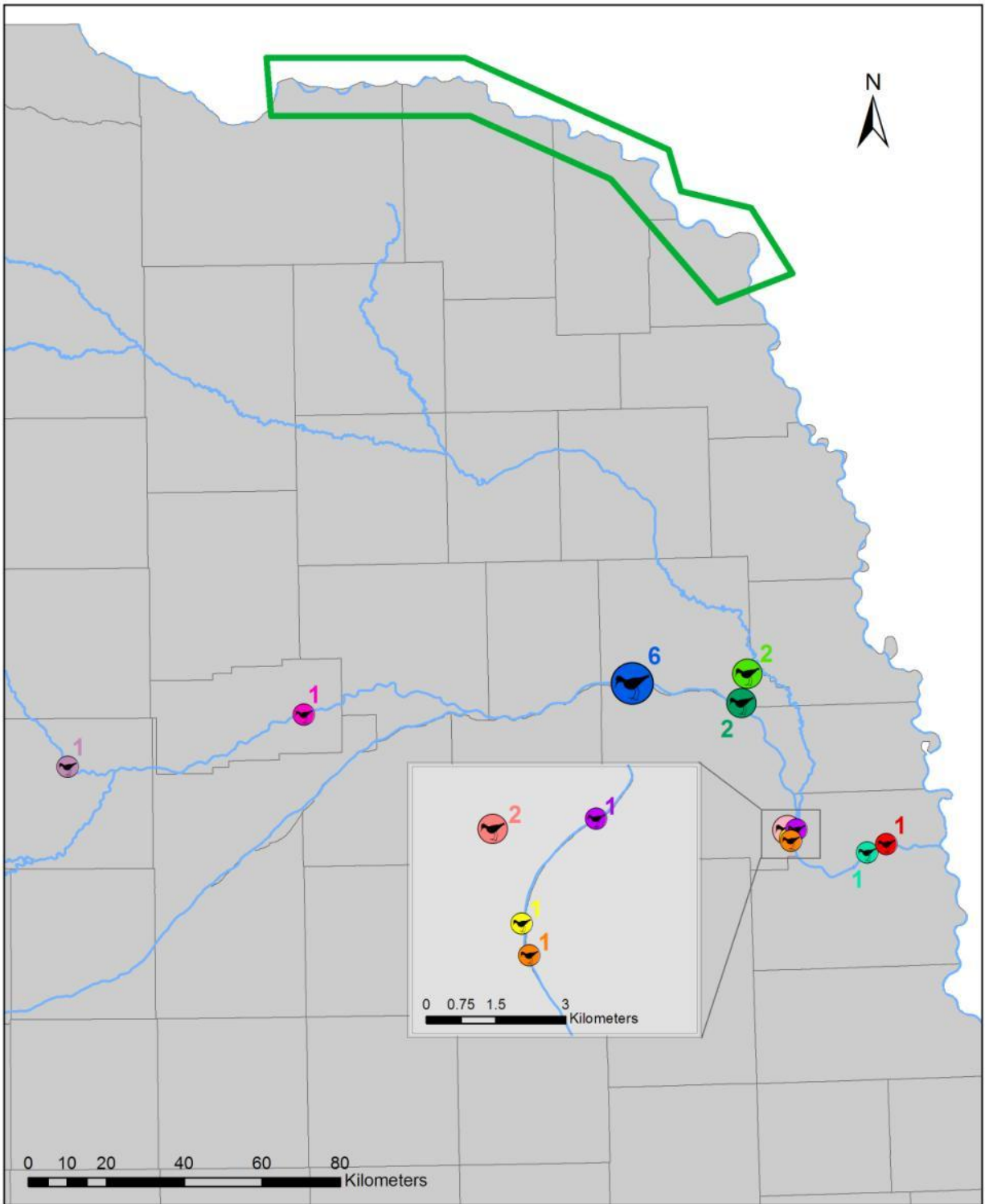


Figure 5. Locations of the 19 green-flagged Piping Plovers originally banded on the Missouri River from South Sioux City, NE to Yankton, SD (green box) and observed in our primary study area in 2013. Each colored marker represents the site where these green-flagged plovers were observed. The numbers represent the number of uniquely marked green-flagged plovers observed at each site.

Non-Breeding Season Observations

A number of Piping plovers banded along the Lower Platte River were observed in wintering areas during the non-breeding season (Fig. 6). As of 3 October 2013 we received five reports of Lower Platte River plovers in their overwintering habitat following the 2013 breeding season. The first Lower Platte River plover reported in its winter range in the fall of 2013 was observed at Mustang Island, TX on 29 July 2013. This plover was originally banded as an adult in May 2013. One plover, originally banded as a chick in 2011 was observed in August 2013 near Fort Myers, FL; one plover, originally banded as a chick in 2012 was observed in September at Honeymoon Island, FL; one plover, originally banded as a chick in 2013 was observed in September near Terrebonne, LA; and one plover, originally banded as a chick in 2013 was observed in October at Caladesi Island, FL.

Over the past six years, 47 individual plovers originally banded in our primary study area have been re-sighted during the non-breeding season, with several birds being observed more than once. We have received 131 reports of Lower Platte River plovers observed during the non-breeding season, with most reports coming from local and visiting bird watchers and recreational wildlife photographers. Of the 47 plovers, 22 were originally banded as adults and 25 were originally banded as chicks. A majority of winter resightings have occurred along the US Gulf Coast. Four Lower Platte River Plovers were observed along the Atlantic Coast during the winter of 2012–2013: the first reports of Lower Platte River plovers along the Atlantic Coast. During the winter of 2012–2013, 11 Lower Platte River plovers were observed during the non-breeding season. Winter sightings of Lower Platte River plovers extend from the southern tip of Texas to the Florida Keys and north along the Atlantic Coast to South Carolina. Resighting locations include: Bolivar Peninsula, Rollover Pass, Mustang Island, and Cedar Lake Pass in Texas; Elmers Island, Raccoon Island, and West Belle Pass in Louisiana; Bunche Beach, Little Crawl Key, Honeymoon Island, Caladesi Island, and Crandon Beach in Florida; Cumberland Island, Georgia and Deveaux Bank and Lighthouse Island, South Carolina.

Two green-flagged plovers and two red-flagged plovers observed along the Lower Platte River in 2013 were originally banded along the US Gulf Coast. The green-flagged plovers were banded as a part of a BP- Deepwater Horizon Oil Spill recovery study being conducted by researchers from Virginia Tech University (D. Catlin, pers. comm.). Seven plovers banded as a part of this oil spill study were observed along the Lower Platte River during the 2011, 2012, and/or 2013 breeding seasons. Both US Gulf Coast green-flagged plovers observed in 2013 were observed nesting at the same off-river site in 2011, 2012, and 2013. 2013 was the first year red-flagged plovers were observed in our study area.

In 2013, we received our first report of a Lower Platte River plover in the Interior United States during spring migration (Fig. 7). This plover was reported at Lake Tyler in northeast Texas on May 2 – 3, 2013.

The Story Continues

Our famous plover that has been observed in Florida so many times during the past couple of winters has finally returned to Nebraska.

This light blue-flagged plover has quite the story to tell. It was banded on 16 June 2011 as a three-day old chick at a housing development in Dodge County, NE. Just a few months later this plover was 1,300 miles away at Bunche Beach Preserve, Fort Myers, FL. The plover was observed many times at Bunche Beach during the winters of 2011–2012 and 2012–2013, and became our most frequently reported plover. However, this plover had not been observed during the breeding season since it was a chick, until now.

This plover finally returned to the Lower Platte River during the 2013 breeding season. It was observed nesting at a sand and gravel mine in Cass County, NE. After returning to Nebraska to nest this Piping Plover returned to its favorite overwintering grounds at Bunche Beach near Fort Myers, FL on 7 August 2013.



Photo by Mary Goetzinger

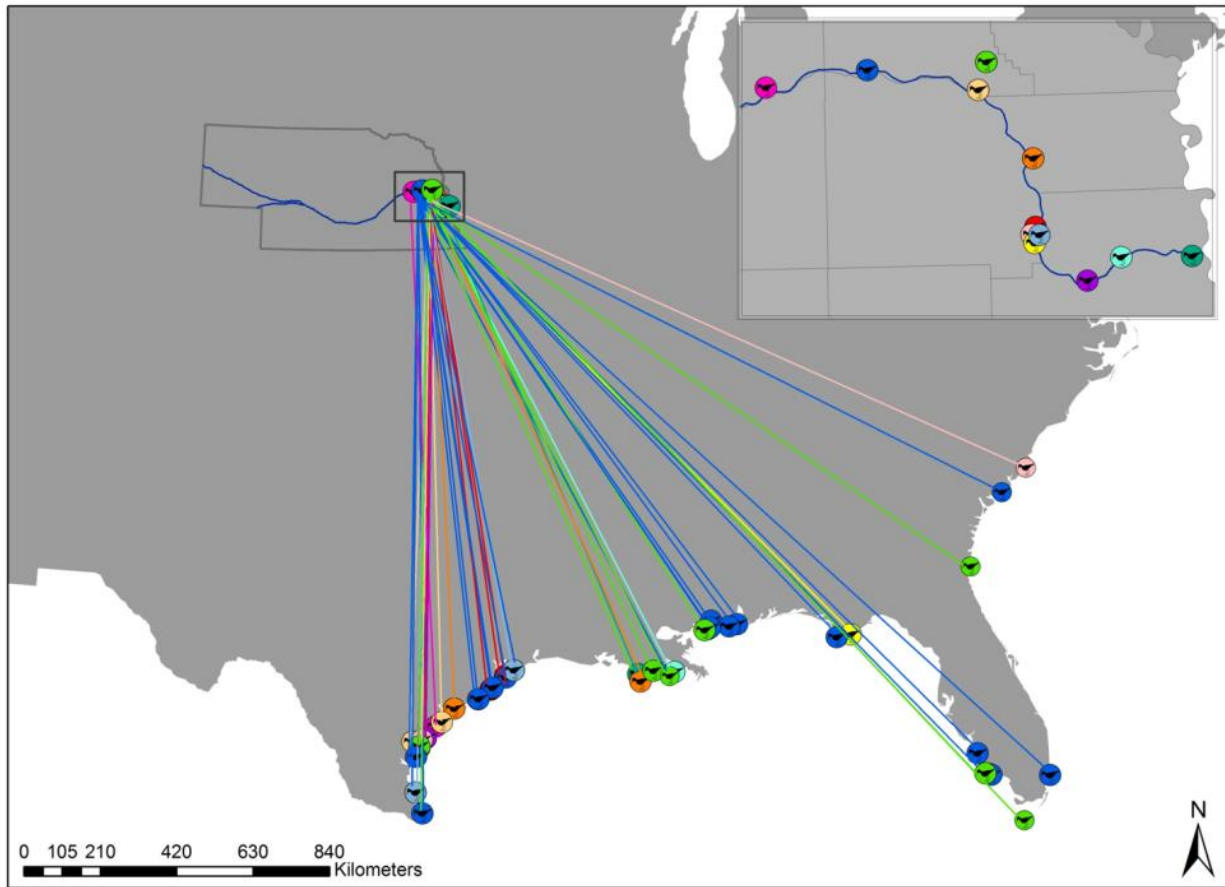


Figure 6. Locations where light blue-flagged plovers, originally banded in our primary study area, have been seen during the non-breeding season on the US Gulf and Atlantic coasts from 2008 to 2013. Each colored marker in Nebraska represents a nesting site where plovers have been banded and each marker on the coast shows the location where an individual light blue-flagged plover has been re-sighted during the winter.



Piping Plover banded along the Lower Platte River and re-sighted at Honeymoon Island, FL in September 2013. This plover was banded as a chick on 19 June 2012 at a sand and gravel mine near Ashland, Saunders County, NE. Photo by Danny Sauvageau.



Figure 7. Lower Platte River plover observed in the Interior United States during spring migration. The blue dot represents the location where this plover was banded as a chick in 2012. The blue star represents the location in northeast Texas where this plover was observed on 2 – 3 May 2013. We do not know where this plover spent the winter.



Piping Plover banded along the Lower Platte River and re-sighted at Lake Tyler, Smith County, TX on 2 May 2013. This plover was banded as a chick on 21 June 2012 at a housing development near North Bend, Dodge County, NE. Photo by Mike Bloodsworth.

MONITORING NESTS AND CHICKS

Methods: Off-River Habitat

We started conducting Interior Least Tern and Piping Plover surveys at each off-river site in late April. We surveyed each site every five to seven days. We searched for terns and plovers and their nests or evidence of nest scrapes. Each nest was assigned a unique identification number. We recorded nest locations using a handheld GPS unit (Garmin Oregon 550t). 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). A majority of the nests were located one to seven days after the first egg was laid. 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. We located nests throughout the season. All nests at off-river sites were visited every five to seven days. During each subsequent nest visit, we counted the number of terns and plovers present, located new nests, checked known nests, and searched for and banded tern and plover chicks. We only “floated” eggs on the day the nest was first found. We determined the status of each tern and plover nest based on the following criteria:

Confirmed Successful: ‘pipped’ eggs or newly-hatched chick(s) observed in or in the immediate vicinity (< 1 meter) of the nest cup

Likely Successful: empty, but intact nest cup located on or after the expected hatch date; nest cup may contain small pieces of eggshell

Confirmed Failed: nest cup and/or eggs found destroyed or abandoned

Likely Failed: nest not relocated on repeat visits prior to expected hatch date

Undetermined: nest not re-checked prior to hatch date or not enough evidence to determine nest fate

At some off-river sites, Interior Least Terns and Piping Plovers placed their nests in areas not accessible to us for safety reasons. Some areas of active mine sites present possible cave-in hazards and we work with the mine company to avoid these areas. In these cases, we only recorded the number of nests, eggs, adults, chicks, juveniles, and fledglings that were visible from a distance.

We recorded the total number of active nests and the total number of terns and plovers of each age class. The age classes we used were:

Adults: birds at least one year old and in adult plumage

Chicks: 1 – 3 days, 4 – 10 days, 11 – 15 days, 16 – 20 days post-hatch

Fledglings: birds older than 20 days or capable of flight, but still dependent on their parents

Juveniles: birds capable of sustained flight.

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 recorded the band combinations of all terns and plovers observed and recaptured with leg bands.

Results: Off-River Habitat

In 2013, we located 55 Piping Plover nests and 192 Interior Least Tern nests at off-river sites in our primary study area (Table 2). These nests were distributed across 21 off-river sites, three sites along the Loup River and 18 sites along the Lower Platte River (Figs. 8 – 9). This included five lakeshore housing developments and 16 sand and gravel mines. 53% of plover nests and 21% of tern nests were confirmed successful, while 31% of plover nests and 43% of tern nest were confirmed to have failed (Tables 3–4). We observed 77 plover chicks and 88 tern chicks on these off-river sites.

In 2013, we recorded a high proportion of nesting birds at one lakeshore housing development near North Bend, Dodge County, NE. This housing development supported 29% of the off-river plover nests and produced 40% of the plover chicks observed on off-river sites. This year we did not have large concentrations of tern nests at any one off-river site. However, this same lakeshore housing development hosted 28 Interior Least Tern nests which was the largest number of tern nests at any one off-river site in 2013. It supported 15% of the tern nests and produced 40% of the tern chicks observed on off-river sites.

In 2013, two Piping Plover nests and 39 Interior Least Tern nests were found in our study area but outside our primary study area. Two plover nests and 20 tern nests were on off-river sites along the Loup River west of the Loup Diversion Canal, and 19 tern nests were on an off-river site along the Elkhorn River (Table 5). For more information on these nests see Appendix A and B.



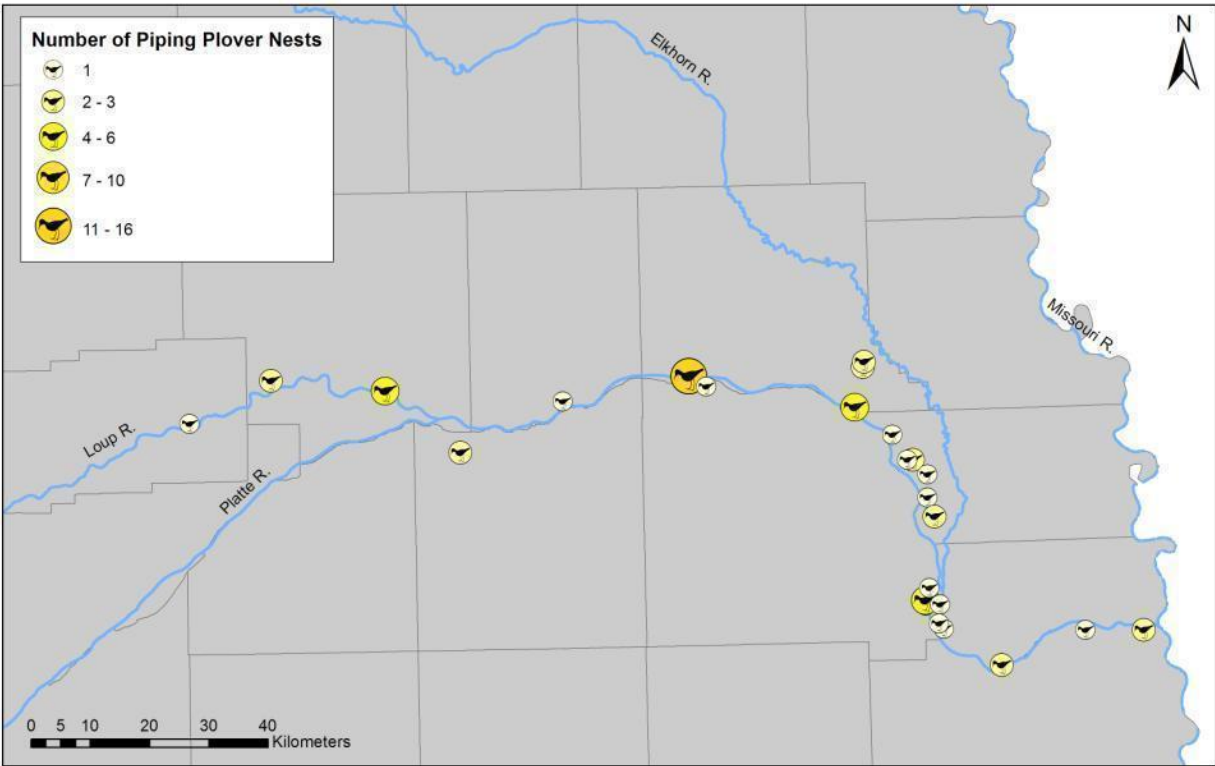


Figure 8. Location of off-river Piping Plover nesting colonies in our primary study area in 2013.

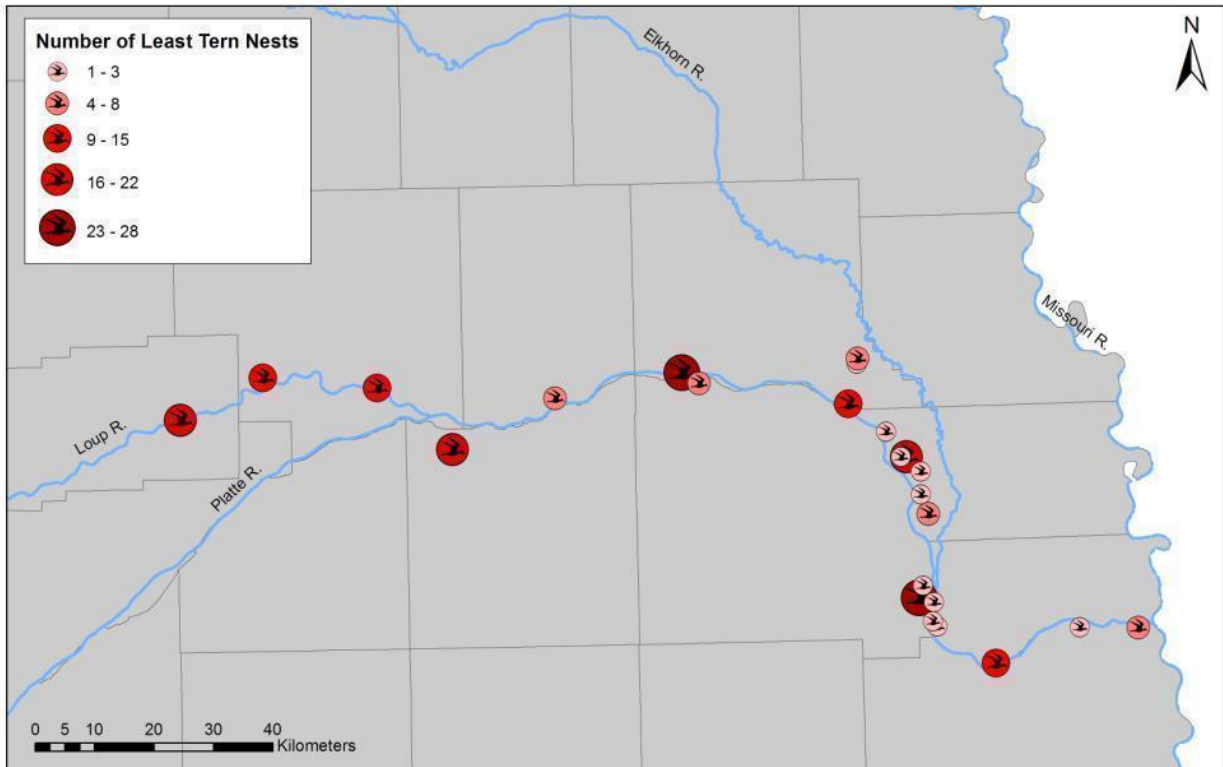


Figure 9. Location of off-river Interior Least Tern nesting colonies in our primary study area in 2013.

2013 Interior Least Tern and Piping Plover Report for the Lower Platte River, Nebraska

Table 2. The number of Interior Least Tern and Piping Plover nests and chicks observed at each off-river site in our primary study area in 2013.

Off-River Site	Habitat	Piping Plover		Interior Least Tern	
		# Nests	# Chicks	# Nests	# Chicks
LPPD Loup Diversion	Mine	1	0	18	12
Genoa North #95	Mine	2	2	10	0
Columbus #71	Mine	4	0	13	0
Bellwood #73	Mine	2	5	19	1
Socorro Lake	Housing	1	3	4	3
Riverview Shores	Housing	16	31	28	35
Morse Bluff	Mine	1	0	8	0
NE Fremont South	Mine	3	2	1	0
NE Fremont North	Mine	2	7	7	5
Western Fremont	Mine	6	2	11	1
Valley #7	Mine	3	1	18	2
Pleasure Lake #11	Mine	1	0	0	0
Mallard Landing	Housing	1	1	2	0
OMG Graske Pit	Mine	2	8	7	2
Thomas Lakes	Mine	1	0	2	2
Lake Allure	Housing	1	4	1	0
Sand Creek	Mine	4	7	25	22
Melia	Housing	0	0	2	0
Linoma Beach #51	Mine	0	0	1	0
Louisville Lakes	Mine	2	0	9	0
Oreapolis #8	Mine	2	4	6	3
TOTAL		55	77	192	88

Table 3. The fate of Lower Platte River Piping Plover nests on off-river sand and gravel mines and housing developments in our primary study area in 2013.

Nest Fate	Mines		Housing		Total	
	#	%	#	%	#	%
Confirmed Successful	14	39%	15	79%	29	53%
Likely Successful	5	14%	2	11%	7	13%
Confirmed Failed	15	42%	2	11%	17	31%
Likely Failed	0	0%	0	0%	0	0%
Undetermined	2	6%	0	0%	2	4%
TOTAL	36	100%	19	100%	55	100%

Table 4. The fate of Lower Platte River Interior Least Tern nests on off-river sand and gravel mines and housing developments in our primary study area in 2013.

Nest Fate	Mines		Housing		Total	
	#	%	#	%	#	%
Confirmed Successful	25	16%	15	41%	40	21%
Likely Successful	29	19%	9	24%	38	20%
Confirmed Failed	72	46%	11	30%	83	43%
Likely Failed	5	3%	0	0%	5	3%
Undetermined	24	15%	2	5%	26	14%
TOTAL	155	100%	37	100%	192	100%

Table 5. The number of Interior Least Tern and Piping Plover nests at off-river sites in our study area but outside of our primary study area in 2013.

Off-River Site	Habitat	# of Piping Plover Nests	# of Least Tern Nests
Ulrich	Mine	0	7
Paulsen – Gates	Mine	1	12
Tri-County	Mine	1	1
Medelman’s Lake	Mine	0	19
TOTAL		2	39



A one-day old Interior Least Tern chick being weighed at a sand and gravel mine in Saunders County.

Methods: On-River Habitat

Our access to river sandbars differs from access to off-river sites, so we take a different approach monitoring terns and plovers nesting on midstream river sandbars. We monitored river conditions for the presence of sandbar habitat early in the nesting season. All river surveys were conducted by kayak; kayaks provide the advantage of moving slowly and quietly on the river, which limits disturbance to nesting terns and plovers.

We visually scanned for the presence of terns and plovers and behaviors suggestive of nesting or breeding. When a colony was located, we surveyed the sandbar for nests. Once nests were found, we used the same nest monitoring method as for off-river nests. We recorded nest locations, using a handheld GPS unit (Garmin Oregon 550t), and the number of eggs in the nests. We floated the eggs to determine the nest initiation date (Hays and LeCroy 1972). We visited nesting colonies every seven to ten days to search for new nests, determine nest fate, and band chicks. We scored the status of each tern and plover nest based on the following criteria:

Confirmed Successful: 'pipped' eggs or newly-hatched chick(s) observed in or in the immediate vicinity (< 1 meter) of the nest cup

Likely Successful: empty but intact nest cup located on or after the expected hatch date; nest cup may contain small pieces of eggshell

Confirmed Failed: nest cup and/or eggs found destroyed or abandoned

Likely Failed: nest not relocated on repeat visits prior to expected hatch date

Undetermined: nest not re-checked prior to hatch date or not enough evidence to determine nest fate

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

Results: On-River Habitat

In 2013, we conducted river surveys for river mile 0 (near Plattsmouth, Cass County) to river mile 57 (near Fremont, Dodge County) from early June to mid-July. We concentrated our efforts on the lower 57 river miles of the Lower Platte River because this portion is where most nesting typically occur. In 2013, we conducted nest and chick monitoring and assessed habitat on used (with nests) and unused (without nests) sandbars (for more information on the habitat assessments see page 31). We surveyed the entire 57 river mile stretch during the first week of June. We subsequently monitored nests in selected portions of the river.

We located 11 Piping Plover nests and 53 Interior Least Tern nests on six Lower Platte River sandbars (Figs. 10 – 11, Table 6); Colony sizes ranging from two to 28 nests. We monitored four of the six sandbars throughout the nesting season to determine nest fates (Table 7). We observed eight tern chicks on river sandbars.

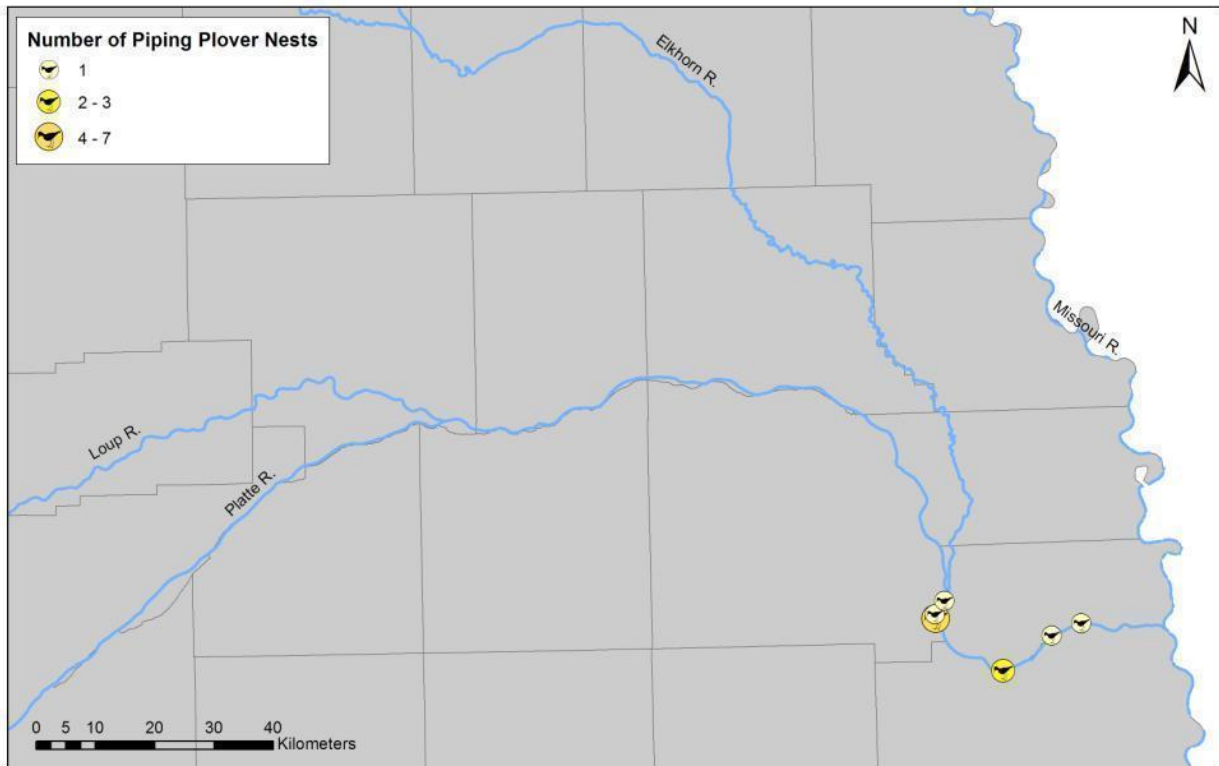


Figure 10. Location of Piping Plover colonies on river sandbars along the Lower Platte River in 2013.

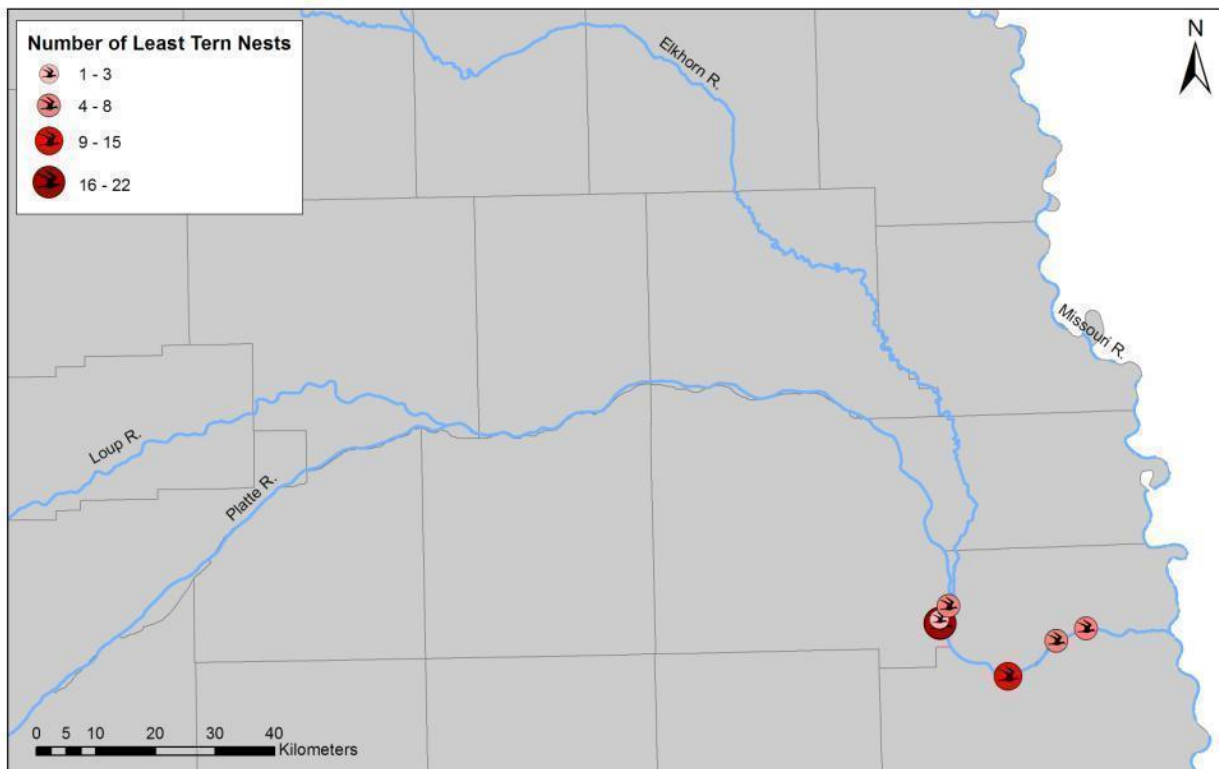


Figure 11. Location of Interior Least Tern colonies on river sandbars along the Lower Platte River in 2013.

Table 6. The location of Interior Least Tern and Piping Plover nesting colonies and the number of nests and chicks observed in each colony on Lower Platte River sandbars in 2013.

River Sandbar	River Mile	Piping Plover		Interior Least Tern	
		# Nests	# Chicks	# Nests	# Chicks
Gun Club Sandbar	9	1	0	5	0
East Cedar Creek Sandbar	12.75	0	0	5	0
Louisville Sandbar	19.25	2	0	15	2
South Camp Ashland Sandbar	29.25	7	0	22	6
North Camp Ashland Sandbar	29.75	1	0	1	0
River Mile 31 Sandbar	31.5	0	0	5	0
TOTAL		11	0	53	8

Table 7. The fate of Interior Least Tern and Piping Plover nests on Lower Platte River sandbars in 2013.

Nest Fate	Piping Plover		Interior Least Tern	
	#	%	#	%
Confirmed Successful	0	0%	6	11%
Likely Successful	4	36%	3	6%
Confirmed Failed	4	36%	27	51%
Likely Failed	0	0%	6	11%
Undetermined	3	27%	11	21%
TOTAL	11	100%	53	100%



Adult Interior Least Tern incubating eggs on a river sandbar in Sarpy/Saunders County.

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. In 2013, we improved our estimates of nest, adult, and chick survival by using capture-mark-recapture and statistical modeling techniques (Program MARK). We also constructed growth curves for tern and plover chicks.

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 U.S. Fish and Wildlife Service through an inter-agency agreement with the Nebraska Game and Parks Commission (MBB holds Federal Master Bird Bander Permit # 23545, with Threatened and Endangered Species endorsements and Nebraska Educational and Scientific Permit # 905; the TPCP holds Federal Threatened and Endangered Species handling permit #TE 070027-1; JGJ holds Federal Master Bird Bander Permit #20259, with Threatened and Endangered Species endorsements). Color-band combinations were coordinated prior to field season with the Bird Banding Laboratory and others with an interest in tern and plover research.

At off-river sites, we captured, banded, and color marked adult Piping Plovers during incubation. Our capture, handling, and banding protocols used in 2013 were the same as those used in the previous five years. We used a simple box trap placed over the nest for capture because it was effective and minimized risk of injury to the adult and eggs (Fig. 12). Box traps have no moving parts, so nesting birds and their eggs are not injured during capture; the bird walks through the door, settles on its nest, and is captured. We exercised caution when handling and banding birds. We did not capture or band birds during extreme weather (cold, windy, rainy, or when inclement weather was forecast) or when the temperature was above 85° F (30° C). Birds were observed after banding and on subsequent visits to determine if there were any behavioral changes or signs of injury. As part of our protocol, we were 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 2008, 2009, 2010, 2011, 2012, or 2013.



Figure 12. Wire box trap placed over a Piping Plover nest showing the bird approaching the trap (A), entering through the open “door” (B), and settling on the nest (C). Time elapsed is less than one minute.

We banded each Piping Plover, adult and chick, with an individually-numbered metal USGS band (size 1A) on one upper leg. We placed a light blue flag on the opposite upper leg; the light blue flag indicates that this bird was banded in Nebraska along the Platte River. We placed two color bands in one of two combinations (yellow over green or green over red) on one of the bird's lower legs; indicating that this bird was banded along the Lower Platte River in 2013. We placed a unique combination of two color bands (red, yellow, green, black, gray, and occasionally orange) on the opposite lower leg. The unique color band combination as a whole indicates each bird's individual identity (Fig. 13).

We measured the mass of each Piping Plover by placing the bird in a cloth bag and suspending it from a Pesola scale ($\pm 0.3\%$ accuracy). We measured the following morphological characters for adult plovers: length of the left and right flattened wing chord (wrist to the distal end of the outermost primary feather), length of the left, right, and middle tail feathers, length of the left and right tarsus (unfeathered leg above the hallux), length of the culmen (exposed midline ridge of the beak), width of the beak at the nostrils, and length of the total skull (distal end of the beak to the posterior end of the skull). All measurements were taken by one individual (MBB) to minimize measurement error. We measured the left and right sides of each bird so bilateral symmetry could be calculated. Symmetry is a commonly used measure of an individual bird's "quality." The symmetry of skeletal parts and feathers reflects an individual's nutrition and health during development; this gives us a metric to assess the "quality" of birds produced at different nesting habitats (on-river versus off-river) and in different years. Symmetry also gives us a way to assess the quality of overwintering habitat for birds; better foraging habitat provides better overwintering survival, nutrition and health for nesting birds.

We captured Piping Plover and Interior Least Tern chicks by picking them up from the sand or from their nests. We banded plover chicks using the same protocol as adult plovers (Fig. 13). We did not place color bands on tern chicks because their legs are very short. We place an individually-numbered USGS band (size 1A) on each tern chick's lower right leg (Fig. 13). We measured each chick's body mass using a digital scale (Ohaus SP401) that was accurate to ± 0.1 gram. Scales were calibrated using a standardized weight to ensure accuracy. We did not take any morphological measurements of tern or plover chicks.

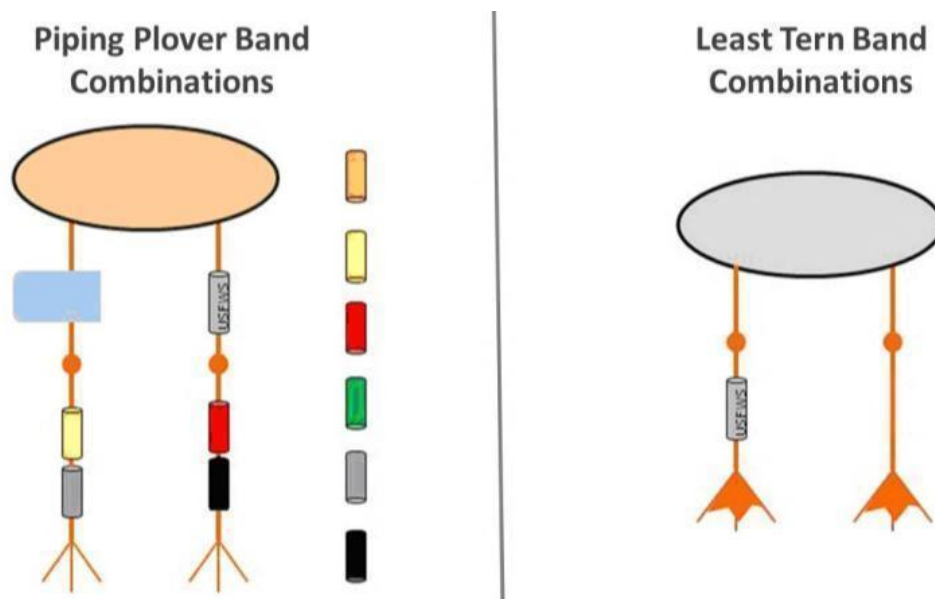


Figure 13. Diagram illustrating the banding scheme used on Piping Plovers and Interior Least Terns banded along the Lower Platte River. The flags, color bands, and metal bands may be on either leg and plover color combinations vary.

Daily and Seasonal Survival Analyses

We monitored Piping Plover and Interior Least Tern nests throughout the nesting season (see Monitoring section for details). We used nest monitoring data to calculate daily and seasonal nest survival probabilities. We attempted to re-sight banded terns and plovers every five to seven days. If birds were recaptured, we weighed them. We used this capture-mark-recapture dataset to calculate daily and seasonal survival probabilities for each individual.

We estimated survival probabilities using the software program MARK (White and Burnham 1999). We used the general methods of Lebreton et al. (1992), Burnham and Anderson (2002), and Dinsmore and Dinsmore (2007). We assessed model fit for each analysis using the Akaike's Information Criterion (AIC); the model with the lowest AIC value was considered the model that best fit the data.

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 (j). Due to small sample sizes we did not include any covariates in our model and assumed constant survival across the season. We provide both apparent daily survival probability and apparent seasonal survival probability. Apparent seasonal survival is the probability a nest will survive the 21- or 28-day incubation period and it is estimated by extending the daily survival probability to the appropriate number of incubation days.

Within Year Individual Survival Analysis

We constructed individual encounter histories for all terns and plovers captured, recaptured or observed at off-river sites. We used this data to determine the probability of adults and chicks surviving the 2013 nesting season. We provide both apparent daily survival probability and apparent seasonal survival probability for adults and chicks. Adult plovers included in this analysis were color-banded along the Lower Platte River, Central Platte River, Missouri River, or the U.S. Gulf Coast. Tern and plover chicks included in this analysis were produced and banded on our primary study area. We did not include any covariates in the models. We attempted to fit models with varying degrees of time-dependence to the data, but the model that included constant survival and constant recapture probabilities $\{\phi(c), p(c)\}$ was always the best-fitting model based on AIC; this is most likely due to our relatively small sample sizes.

Between Year Individual Survival Analysis

We constructed individual encounter histories for all plovers that have been captured, recaptured, or observed in our primary study area from 2008 through 2013. We used this data to determine the probability of Piping Plovers surviving from one year to the next. We do not have enough re-sightings of Interior Least Terns to consider them in this type of analysis.

Growth Curve Analysis

Our growth curve analysis for 2013 included only tern and plover chicks produced at off-river sites. We weighed chicks every time they were encountered. In cases where the chick was banded while still in or very close to the nest, we 'age' them based on the nest's known hatching date. If chicks were banded after they left the nest, we estimated their age using an age-based time series of photographs.

Statistical Analysis

All statistical analyses were performed using either SAS (2004) or Prism (2000). Due to small sample sizes, we used nonparametric statistical tests; statistical significance was set at $P < 0.05$. Means (± 1 SE) are reported.

Results

Banding and Re-sighting

In 2013, we banded 73 Piping Plovers and 93 Interior Least Terns; most of our banding occurred on off-river sites in 2013.

At off-river sites, we captured and banded 15 plover adults and 58 plover chicks. We re-sighted 27 plovers that were originally banded along the Lower Platte River in previous years, 12 plovers that were originally banded along the Missouri River, two originally banded along the Central Platte River, and three originally banded along the US Gulf Coast.

At river sandbars, we re-sighted four plovers originally banded along the Lower Platte River in previous years, four plovers originally banded along the Missouri River, and one plover originally banded along the US Gulf Coast. We did not band any plover adults or chicks on river sandbars in 2013.

At off-river nesting sites, we captured and banded 85 tern chicks. Most tern chicks were less than one week old when banded. One adult tern with a metal band on its lower right leg was sighted at a housing development in Dodge County. We did not recapture this bird so we do not know when or where it was originally banded but, because this bird had a single metal band on its lower right leg and no color-bands, it was likely banded along the Lower Platte River.

At river sandbars, we banded eight tern chicks. All tern chicks were less than three days old when banded.



Two-day-old Piping Plover chick banded at a sand and gravel mine in Dodge County on 17 June 2013.

Daily and Seasonal Survival

Piping Plover Nest Survival

We estimated Piping Plover nest survival from 53 plover nests located at off-river sites (19 at lakeshore housing developments and 24 at sand and gravel mines). We did not include two plover nests in which nest fate was undetermined. In 2013, off-river plover nests had an apparent daily survival probability of 0.976 ± 0.005 . The apparent seasonal survival probability, over the 28-day incubation period, was 0.507 ± 0.074 . The apparent daily survival probability for plover nests at lakeshore housing developments was 0.992 ± 0.006 and the apparent seasonal survival probability was 0.799 ± 0.119 . The apparent daily survival probability for plover nests at sand and gravel mines was 0.970 ± 0.008 ; the apparent seasonal survival probability was 0.426 ± 0.099 . Due to the small sample size we were unable to estimate nest survival for plover nests on river sandbars.

In 2013, we placed protective exclosures around 31 of the 53 off-river Piping Plover nests. Nests with protective exclosures had higher daily and seasonal survival probabilities than nests without protective exclosures. Nests with protective exclosures had a daily survival probability of 0.986 ± 0.005 and a seasonal survival probability of 0.674 ± 0.100 ; while nests without protective exclosures had a daily survival probability of 0.963 ± 0.010 and a seasonal survival probability of 0.348 ± 0.101 (Figure 14).

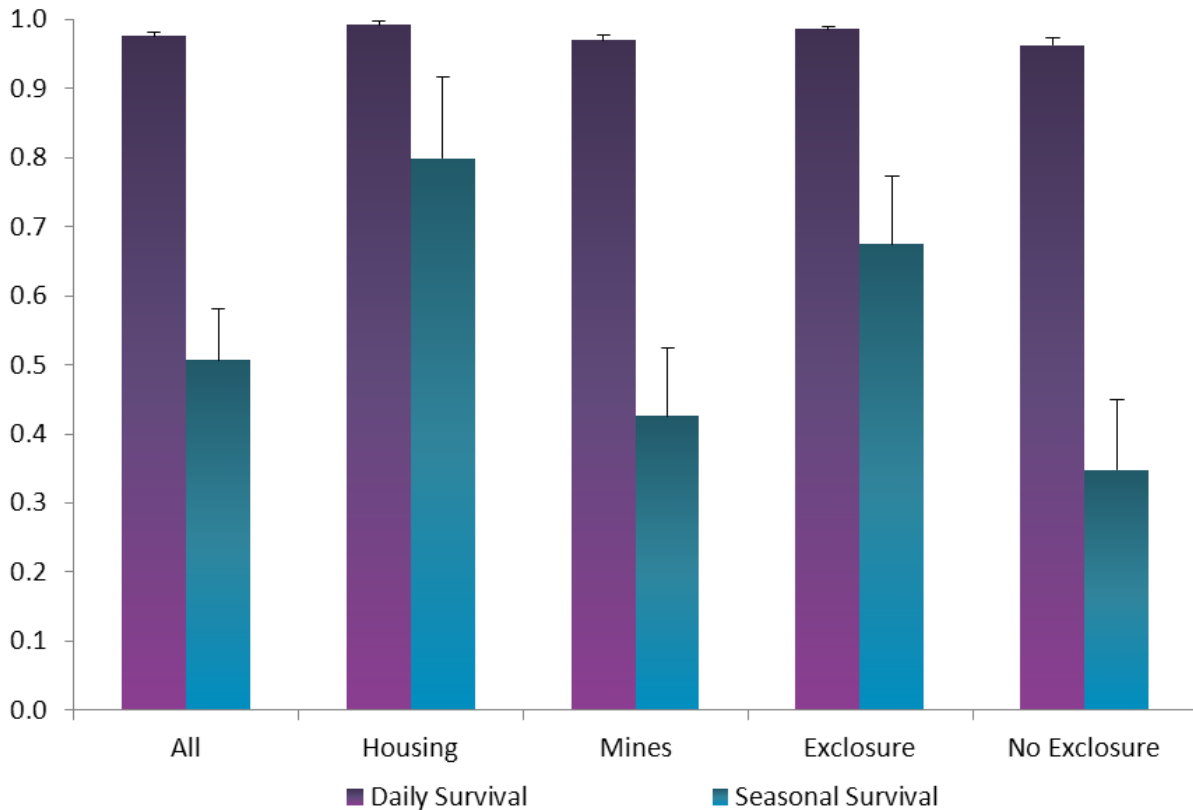


Figure 14. Daily and seasonal survival probabilities of Piping Plover nests on off-river sites in 2013.

Interior Least Tern Nest Survival

We estimated Interior Least Tern nest survival from 166 nests at off-river sites (35 at lakeshore housing developments and 131 at sand and gravel mines). We did not include 26 tern nests in which nest fate was undetermined. In 2013, the apparent daily survival probability of off-river tern nests was 0.961 ± 0.004 . The apparent seasonal survival probability, over the 21-day incubation period, was 0.434 ± 0.038 . Tern nests at lakeshore housing developments had an apparent daily survival probability of 0.978 ± 0.007 and an apparent seasonal survival probability of 0.627 ± 0.110 . Tern nests at sand and gravel mines had an apparent daily survival probability 0.955 ± 0.005 and an apparent seasonal survival probability of 0.380 ± 0.039 (Fig. 15). Due to the small sample size we were unable to estimate nest survival for tern nests on river sandbars.

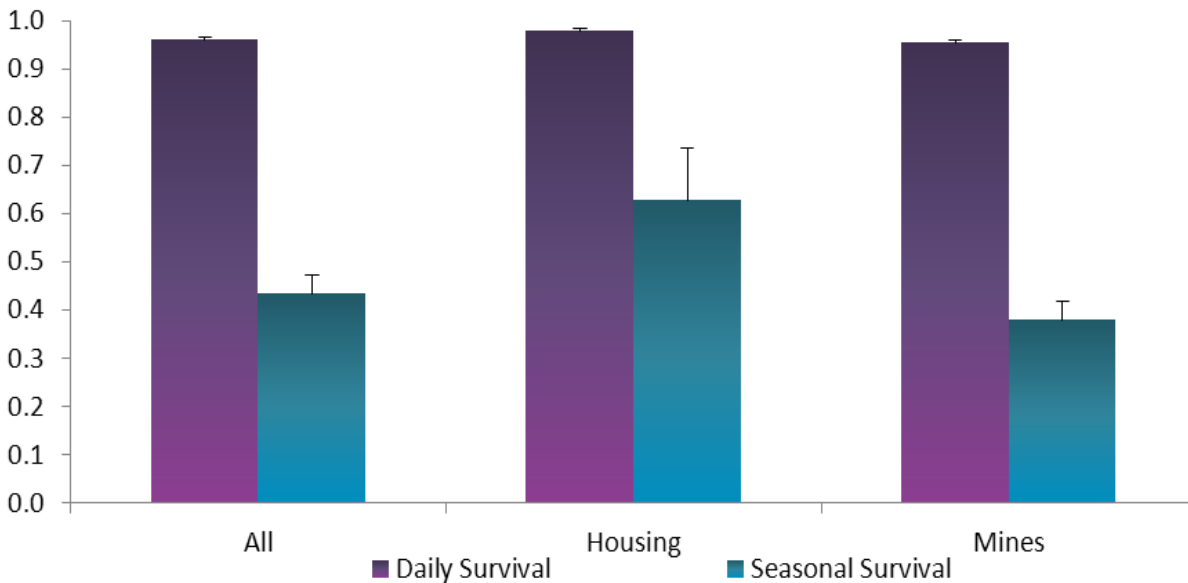


Figure 15. Daily and seasonal survival probabilities of Interior Least Tern nests on off-river sites in 2013.



Three one-day-old tern chicks hatched at a lakeshore housing development in Dodge County on 24 June 2013.

Within Year Individual Survival

The apparent daily survival probability for adult plovers nesting at off-river sites was 0.962 ± 0.007 . The apparent seasonal survival probability was 0.338 ± 0.068 (Fig. 16). Adult plovers had an apparent daily recapture probability of 0.181 ± 0.013 . Adult plovers had slightly higher survival probability at housing developments than at sand and gravel mines (Fig. 17).

The apparent daily survival probability for plover chicks reared at off-river sites was 0.883 ± 0.025 . The apparent seasonal survival probability was 0.031 ± 0.020 (Fig. 16). The apparent daily recapture probability for plover chicks was 0.011 ± 0.022 . We found that plover chicks had higher survival probability at sand and gravel mines than at housing developments (Fig. 18).

Based on our population of banded Interior Least Tern chicks, the apparent daily survival probability for terns reared on off-river sites was 0.763 ± 0.103 . Tern chicks had an apparent seasonal survival probability of 0.004 ± 0.001 (Fig. 16). The apparent daily recapture probability for tern chicks at off-river sites was 0.040 ± 0.021 . We found that tern chick survival was relatively similar when comparing housing developments and sand and gravel mines (Fig. 19).

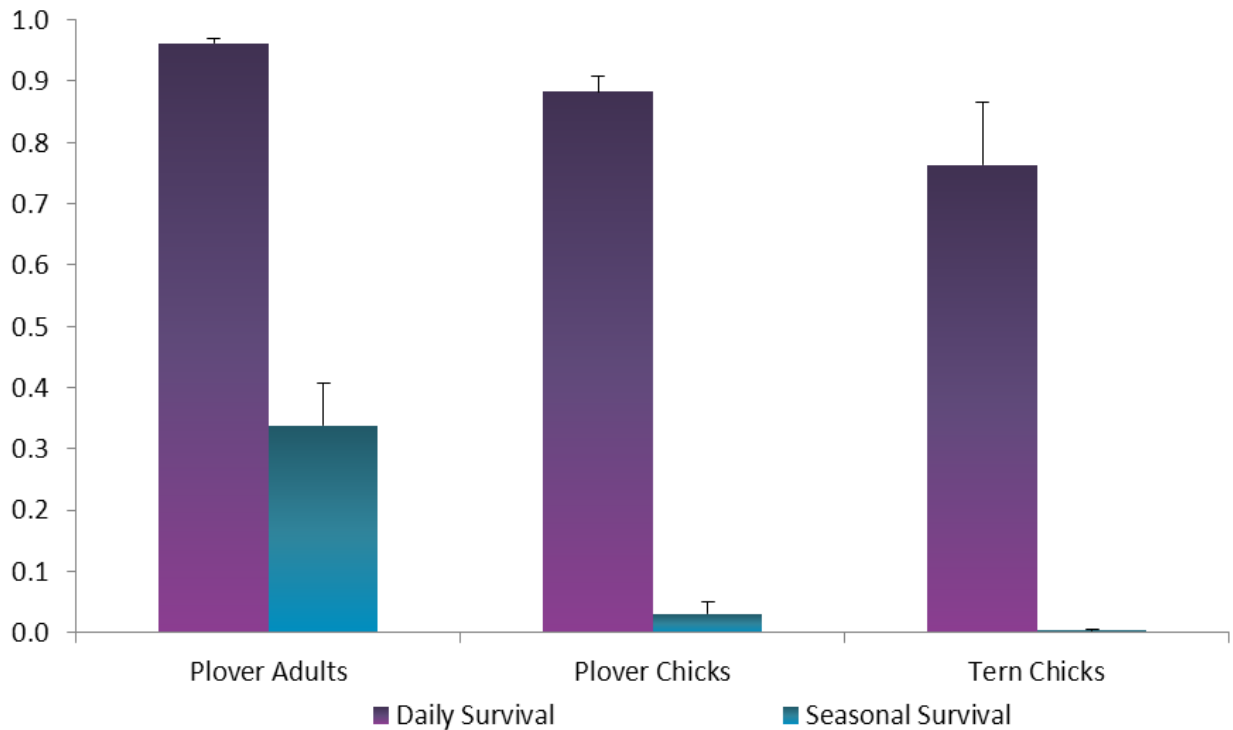


Figure 16. Piping Plover and Interior Least Tern within year daily and seasonal survival probabilities on off-river sites in 2013.

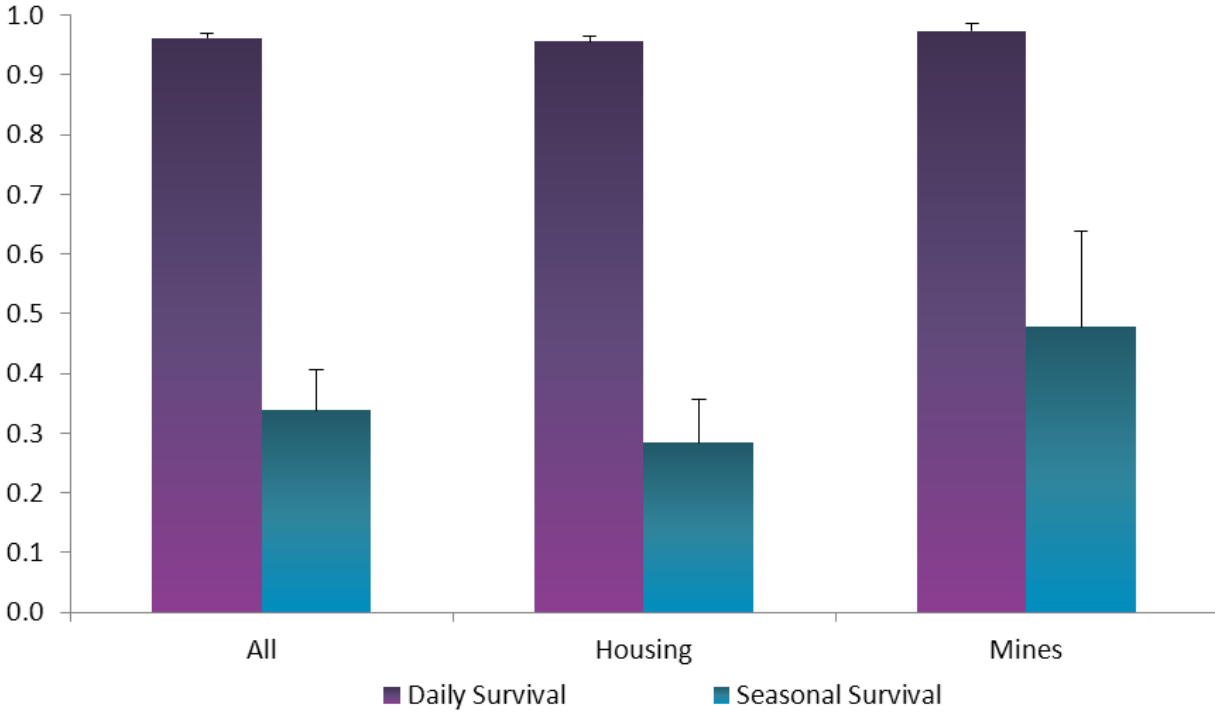


Figure 17. Piping Plover adult daily and seasonal survival at off-river sites in 2013.

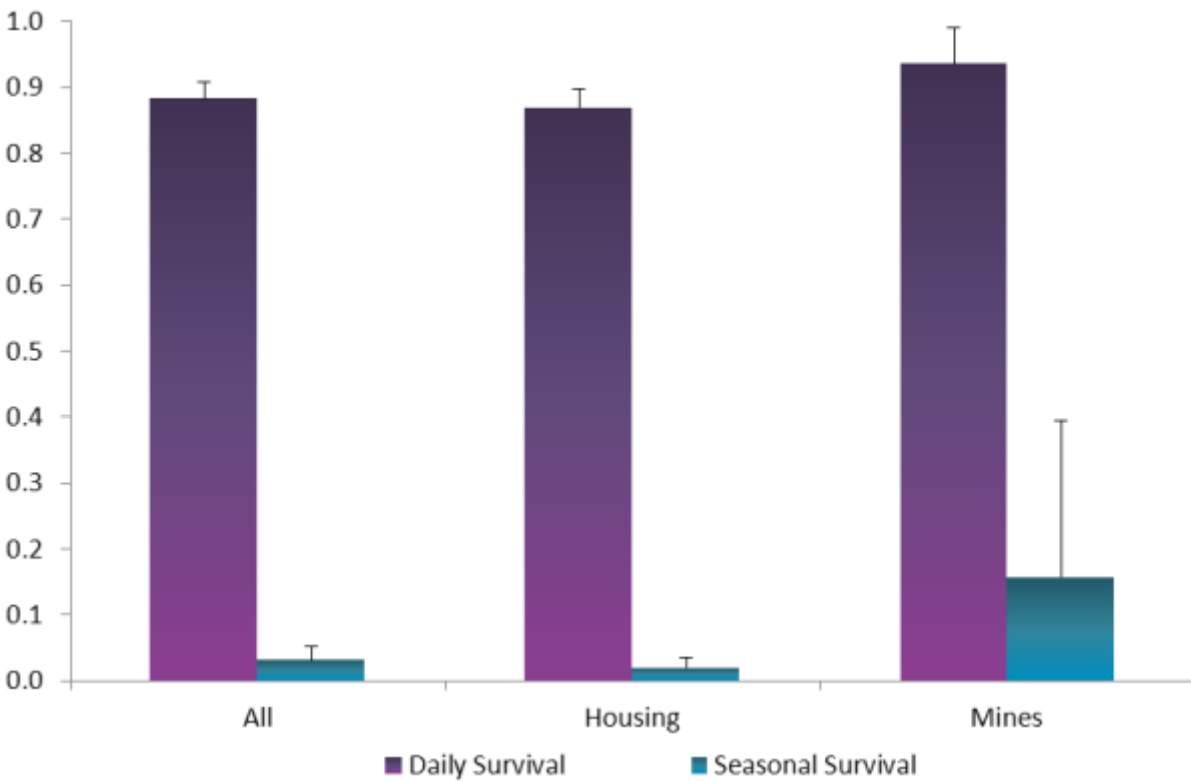


Figure 18. Piping Plover chick daily and seasonal survival at off-river sites in 2013.

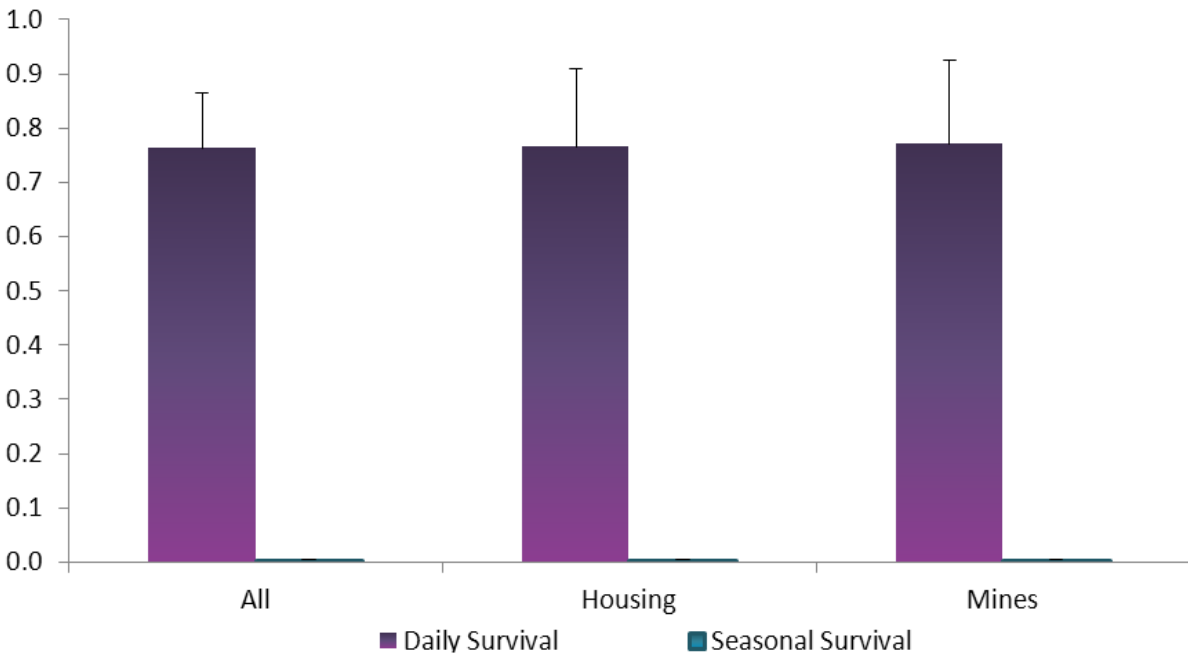


Figure 19. Interior Least Tern chick daily and seasonal survival at off-river sites in 2013.

Between Year Individual Adult Survival

The apparent annual survival probability for adult plovers banded along the Lower Platte River, 2008 to 2013, was 0.734 ± 0.045 and the annual recapture probability was 0.640 ± 0.064 (Fig. 20). We found apparent annual survival was slightly higher for adults banded at lakeshore housing developments than sand and gravel mines. The apparent annual survival probability for adults banded at lakeshore housing developments was 0.772 ± 0.048 and the annual recapture probability was 0.693 ± 0.068 . The apparent annual survival probability for adults banded at lakeshore housing developments was 0.660 ± 0.111 and the annual recapture probability was 0.492 ± 0.139 (Fig. 20).

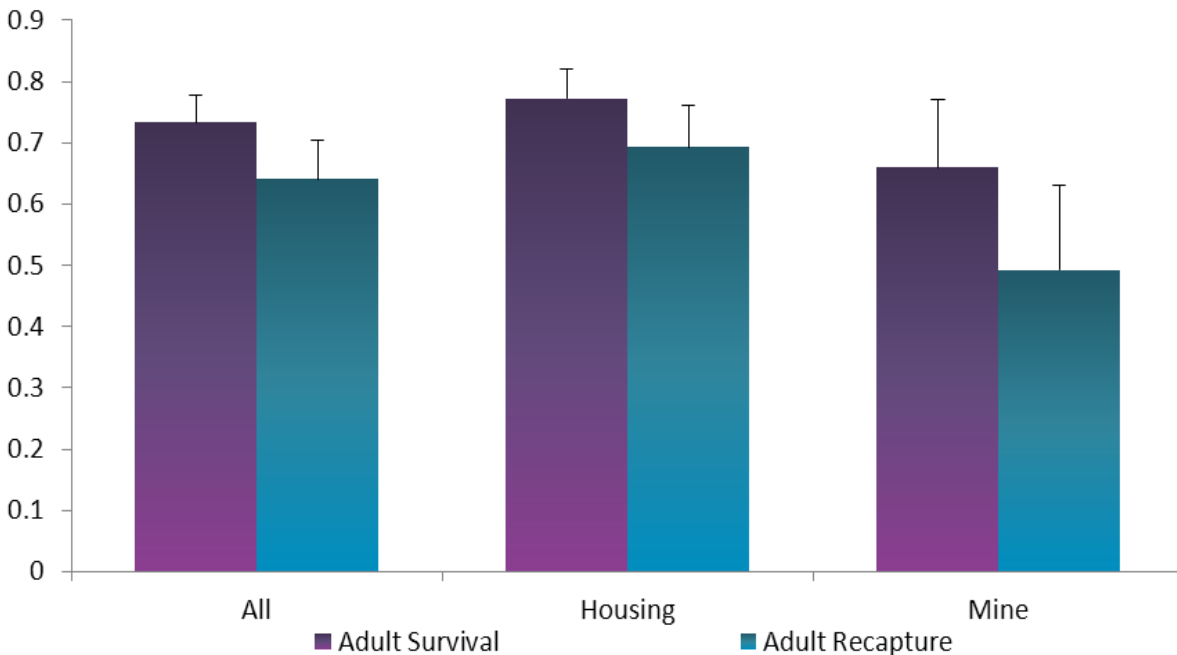


Figure 20. 2008 to 2013 Piping Plover between year adult annual survival and recapture probabilities.

Growth Curves

We created Piping Plover and Interior Least Tern growth curves from the 58 plover chicks and 85 tern chicks banded on off-river sites in 2013. The best fit regression lines for tern and plover chick growth curves were second order polynomials. The regression line that best fit our 2013 plover chick data showed that plover chicks grew at a fairly constant rate with their growth rate increasing slightly as they came closer to fledging (Fig. 21). The regression line that best fit our 2013 tern chick growth data showed that tern chicks reared on off-river sites grew more rapidly when they were younger and the growth rate decreased as they came closer to fledging (Fig. 22).

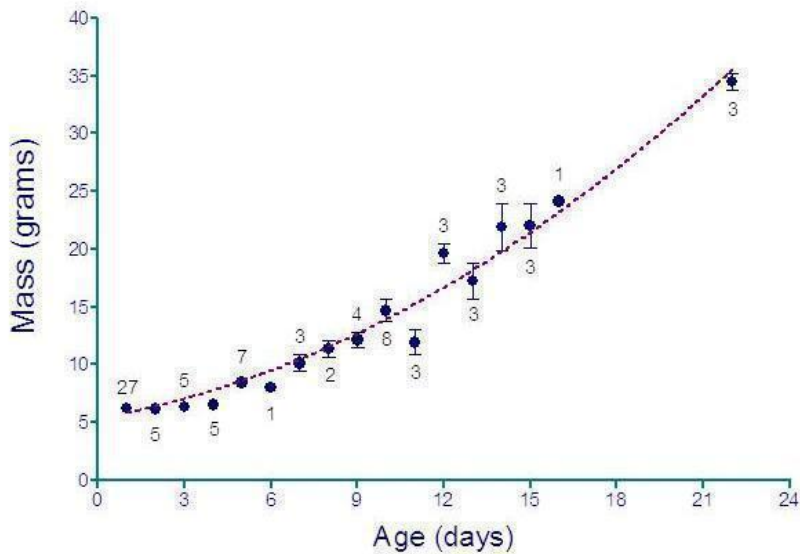


Figure 21. Growth rate of Piping Plover chicks reared on off-river sites in 2013. The graph shows the data represented as mean body mass, standard error, sample size (number weighed at each age) and the best fitting second order polynomial trend line describing plover chicks' growth rate ($R^2 > 0.99$).

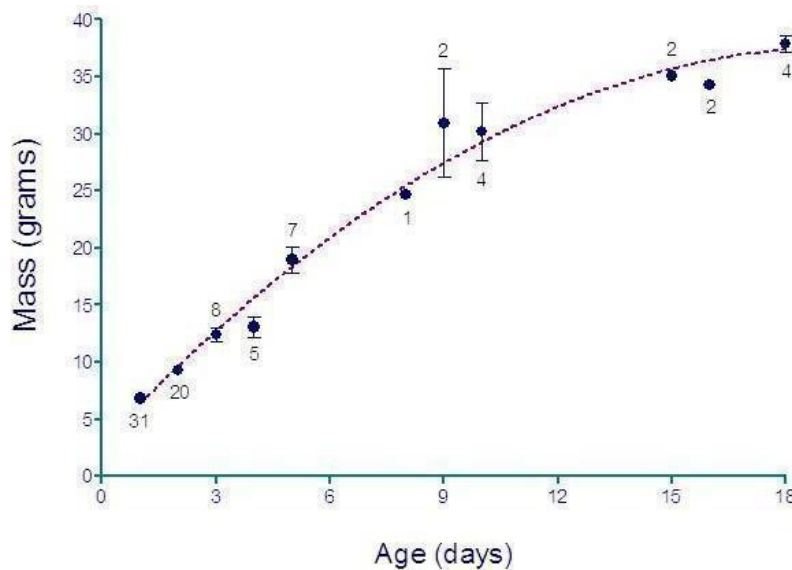


Figure 22. Growth curve of Interior Least Terns chicks reared on off-river sites in 2013. The graph shows the data represented as mean body mass, standard error, sample size (number weighed at each age) and the best fitting second order polynomial trend line describing tern chicks' growth rate ($R^2 > 0.99$).

INTERIOR LEAST TERN HABITAT SELECTION ON LOWER PLATTE RIVER SANDBARS

Habitat selection in birds is a complex and individualized process. Birds evaluate and distinguish among the various components of their environment and chose to occupy those which best enhance their survival and fitness (Johnson 1980, Block and Brennan 1993, Jones 2001). Identifying habitat features that influence habitat selection and increase individual fitness is important in implementing effective conservation strategies (Jones 2001, Catlin et al. 2011). In natural systems, it is reasonable to expect birds to select resources that optimize their individual fitness. However, in altered systems birds may not choose, or may not have the option to choose, optimal habitats (Kirsch 1992). Assessing the habitat features and resultant productivity of Interior Least Tern nests on natural river sandbars in comparison with habitat features at sandbars without nests, will provide a better understanding of habitat characteristics that attract terns and those that lead to the most successful reproductive outcomes; making the connection between habitat quality and breeding productivity (Sherfy et al. 2008).

In 2013, we studied nesting habitat selection of Interior Least Terns on the Lower Platte River. The purpose of this study was to determine whether differential resource selection occurs and how this affects reproductive success. This study consisted of two parts: 1) habitat assessments and 2) monitoring reproductive success. During the habitat assessment component, we quantified three habitat variables on used (with nests) and unused (without nests) sandbars: sandbar surface area, sandbar elevation, and river channel width. We also monitored reproductive success on used sandbars. The following methods describe how we conducted the habitat assessments (for more information on monitoring reproductive success and chick survival on the river see pages 22–24 and 28–34). Due to limited habitat in 2013, we were unable to complete our study as intended. However, we provide a brief summary of the data and comment on habitat conditions.

Methods

We defined the habitat assessment study area as the lower 57 river miles of the Lower Platte River, from Fremont, Dodge County, Nebraska to Plattsmouth, Cass County, Nebraska. We divided the study area into five segments (Fig. 23). We identified sandbars as our sampling unit, rather than individual nests, because Interior Least Terns are social and nest in aggregations. We defined used sandbars as sandbars that had at least one tern nest during the nesting season. Unused sandbars were defined as sandbars that had no tern nests during the nesting season and a surface area greater than 0.2 hectares. Previous work determined that the minimum sandbar surface area size needed for Interior Least Terns to establish a nesting colony is approximately 0.2 hectares (Ziewitz et al. 1992). Thus, we excluded sandbars with a surface area less than 0.2 hectares from our study.

Habitat Assessments

We measured three variables: sandbar surface area, sandbar elevation, and river channel width. All habitat assessments were conducted during a two week period from 7 June to 18 June 2013. We used the same systematic approach as Brown and Jorgensen (2009) to select sandbars for habitat assessments. We measured the three habitat variables on all used sandbars in the study area. We selected unused sandbars located at every third river mile, as measured from river mile 57 (Fig. 23). The unused sandbar located closest to the selected river mile was evaluated. If no unused sandbars were found within one half mile of the selected river mile, then “no habitat” was recorded for that river mile.

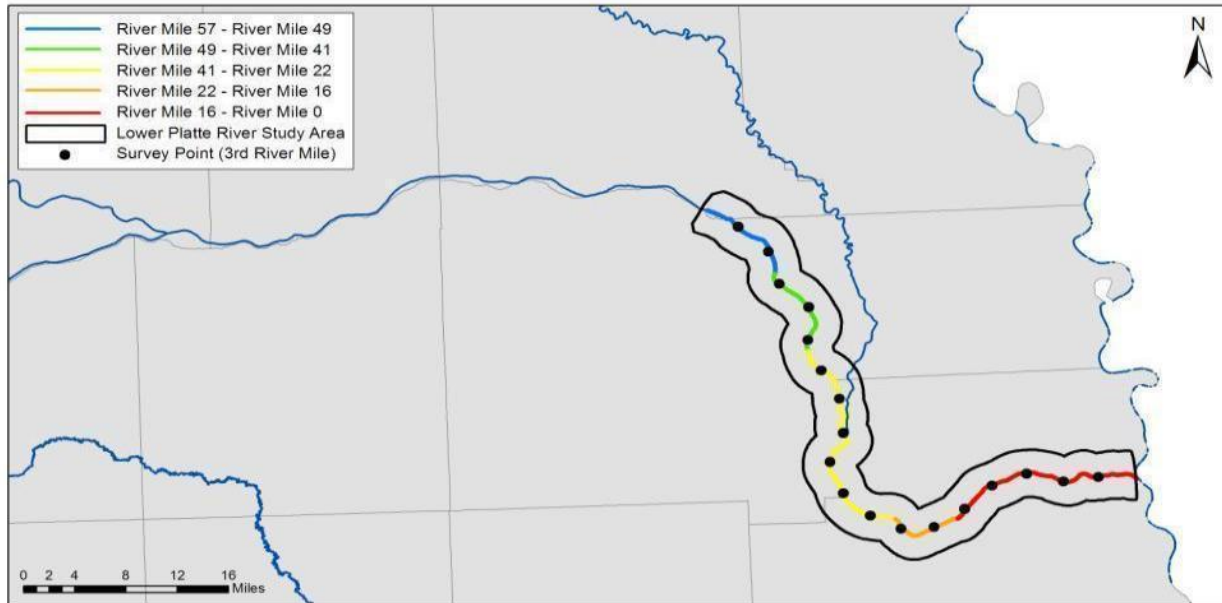


Figure 23. Study Area - the black box outlines the study area along the Lower Platte River, the five colored lines represent the survey segments, and the black dots show the river miles selected for habitat assessments.

We measured sandbar surface area at used and unused sandbars by walking the perimeter of the sandbar with a handheld GPS unit and marking waypoints at approximately 10 meter intervals. Sandbar size and elevation are dependent on variable river flow conditions; sandbar surface area is best considered an approximation, or an index, of sandbar size due to variation in river flow (or discharge). During the assessment period river flow showed limited variation; discharges at the Louisville Gage ranged from 5,510 cfs to 8,720 cfs. We measured sandbar elevation using an automatic level (CST Berget PAL/SAL "N" Series) and stadia. We visually estimated the center point location of each sandbar. All elevation measurements were taken from that central point. The same individual (LRD) recorded all elevation measurements. On used and unused sandbars, we measured the elevation of the sandbar-water interface (waterline) at two to four locations around the perimeter of the sandbar. At each sandbar we measured elevation using two different methods: random points and line transects. We selected random points using a list of random directions and distances (e.g., 7 steps at 35 degrees). On each sandbar, two to three transects were measured perpendicularly to the river channel, beginning and ending at the sandbar-water interface (waterline). We recorded measurements at 5 to 20 m intervals along the length of the transect. At each random and transect point we recorded the GPS location and elevation measurement. We also measured elevation at each nest on used sandbars.

Unlike sandbar size and elevation, which are ephemeral, river channel width remains stable under variable water discharge and flow regimes (Jorgensen et al. 2012). We used the same approach to define channel boundaries and measuring channel width as used by Jorgensen et al. (2012). We recorded channel width measurements, using 2012 aerial imagery using ArcGIS (version 9.2). We measured channel width from the center point of each used and used sandbar.

Statistical Analyses

The sandbar perimeter waypoints were downloaded and imported into ArcMap (ArcGIS version 9.2). We created polygons outlining the perimeter of each used and unused sandbar. We estimated the size of each polygon using an ArcMap utility. We calculated the mean surface area (± 1 standard error) for

all used and unused sandbars. We calculated minimum and maximum sandbar elevation of each random point, transect point, waterline point, and nest location, adjusting sandbar measurements to a standardized average sandbar height (15 June average), so results could be compared between different years. We then calculated the mean maximum sandbar elevation (± 1 standard error) of each used and unused sandbar.

We compared the mean surface area, channel width, and maximum elevation of used and unused sandbars in 2013 using an independent *t*-test. We used a scatterplot to illustrate the differences between elevations of used and unused sandbars in 2013.

Our initial study was hampered because of the limited amounts of sandbar habitat present. Therefore, we chose to compare data collected in 2013 with data collected using the same approach in 2009. We chose to compare metrics between these two years because we felt that sandbar habitat conditions represented the two extremes, or near extremes, of habitat conditions possible on the Lower Platte River. Sandbar habitat conditions in 2009 were the result of a high flow event in late May–early June of 2008. Sandbar habitat conditions and bird response to that sandbar habitat is summarized in Brown and Jorgensen (2009). As noted above, river processes preceding the 2013 nesting season, which included the absence of a major recent high flow event and warm winters which resulted in increased erosion rates on macro-form sandbars, produced low elevation sandbars and poor quality habitat for nesting terns and plovers. We compared the maximum mean elevations and surface areas of used and unused sandbars in 2009 with the maximum mean elevations and surface areas of used and unused sandbars in 2013 using a *t*-test. We used ArcMap to examine differences between sandbar surface area in 2009 and 2013. We used a scatterplot to illustrate the differences between elevations in 2009 and 2013.

Results

In 2013, we assessed habitat on five used sandbars and four unused sandbars, and recorded “no habitat” at 12 survey locations (Table 8). The small sample size limited the scope of our analyses.

Used sandbars had a mean surface area of 1.25 ± 0.57 ha, a mean channel width of 525.09 m, and a mean maximum elevation of 0.46 ± 0.09 m; unused sandbars had a mean surface area of 0.61 ± 0.29 ha, a mean channel width of 422.06 m, and a mean maximum elevation of 0.34 ± 0.08 m. In 2013, none of the three variables were significantly different between used and unused habitats (elevation $t = 0.98$, $P = 0.36$, $df = 7$; surface area $t = 0.93$, $P = 0.38$, $df = 7$; channel width $t = 1.74$, $P = 0.13$, $df = 7$; Figure 24).

Sandbars were in greater abundance, were higher in elevation and covered greater surface area in 2009 than 2013. In 2009, we surveyed 27 sandbars; 22 used sandbars, five unused sandbars, and six locations with “no habitat” on the lower 57 river miles of the Lower Platte River. In 2013, we surveyed nine sandbars; five used sandbars, four unused sandbars, and 12 locations with “no habitat”. Surface area was significantly greater in 2009 (5.65 ± 1.21 ha) than in 2013 (0.96 ± 0.34 ha; $t = 2.21$, $P = 0.03$, $df = 34$; Figs. 25 – 26). Sandbar elevation was significantly greater in 2009 (0.69 ± 0.06 m) than in 2013 (0.40 ± 0.06 m; $t = 2.71$, $P = 0.01$, $df = 34$; Figs. 27 – 28).

The small sample size of nests and chicks in 2013 did not allow us to evaluate associations between our three habitat variables and nesting success.

Table 8. Lower Platte River (RM 0 – RM 57) sandbar measurements in 2013.

River Mile (RM)	Type	Surface Area (ha)	Channel Width (m)	Elevation (m)
3.0	No Habitat	0.00	434.60	0.00
6.0	No Habitat	0.00	372.45	0.00
9.0	Used	0.47	529.69	0.25
12.5	Used	0.39	506.05	0.38
15.0	Unused	1.40	335.98	0.56
18.0	No Habitat	0.00	584.07	0.00
19.3	Used	2.26	643.98	0.81
21.0	No Habitat	0.00	480.99	0.00
24.0	No Habitat	0.00	510.73	0.00
27.0	No Habitat	0.00	450.97	0.00
29.3	Used	2.95	517.89	0.45
29.8	Used	0.17	427.82	0.40
33.0	No Habitat	0.00	354.86	0.00
35.8	Unused	0.70	468.01	0.20
38.8	Unused	0.16	341.79	0.28
42.0	No Habitat	0.00	787.21	0.00
45.3	Unused	0.17	542.45	0.31
48.0	No Habitat	0.00	490.81	0.00
51.0	No Habitat	0.00	392.72	0.00
54.0	No Habitat	0.00	1073.19	0.00
57.0	No Habitat	0.00	420.34	0.00

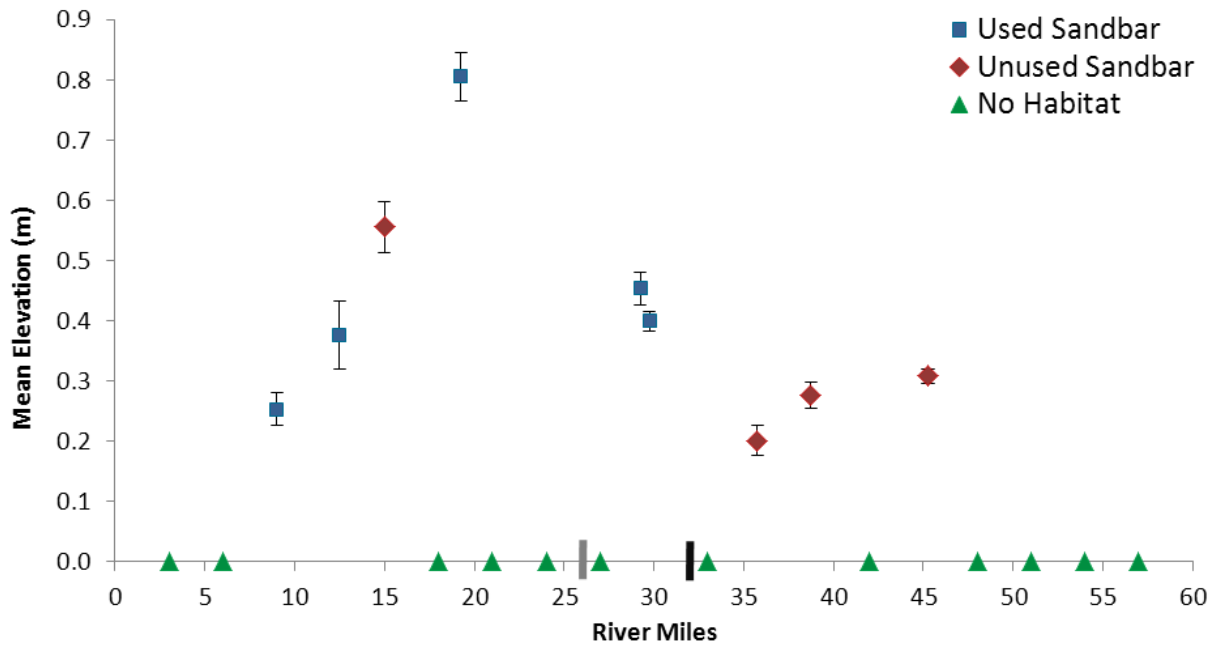


Figure 24. Elevations of used sandbars, unused sandbars, and “no habitat” locations along the Lower Platte River in 2013. Graph shows maximum mean sandbar elevation (± 1 standard error) and river mile. The gray vertical line on the x-axis shows the river mile location (RM 26) where the Salt Creek enters the Lower Platte River. The black vertical line on the x-axis shows the river mile location (RM 32) where the Elkhorn River enters the Lower Platte River.

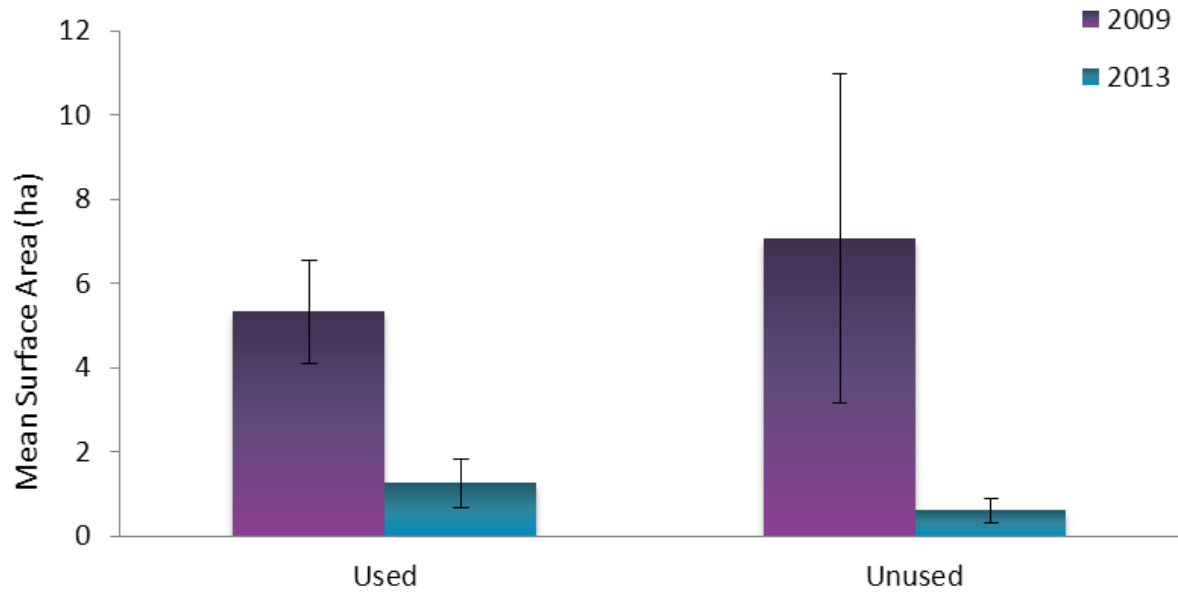


Figure 25. Mean sandbar surface area of used and unused sandbar 2009 and 2013 (\pm 1 standard error).

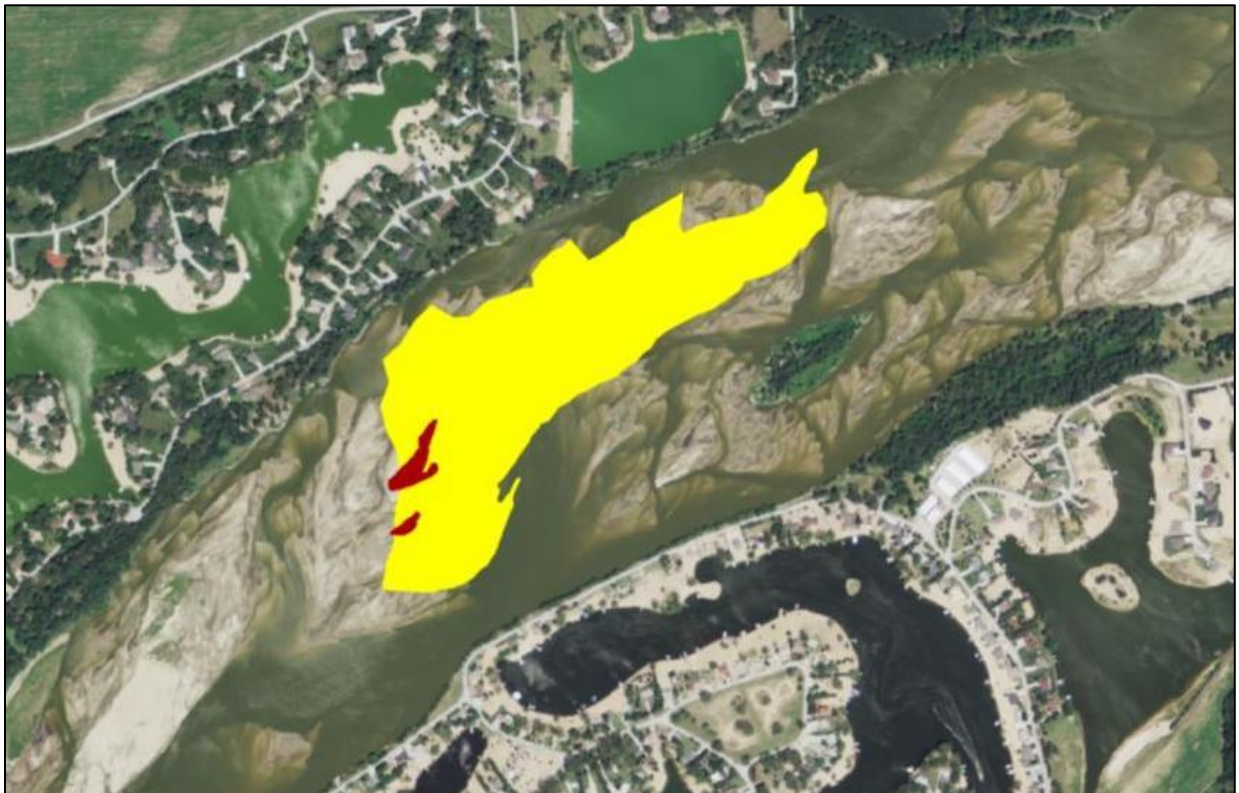


Figure 26. East Cedar Creek Sandbar (RM 12.5) measured on 29 May 2009 and 13 June 2013 under nearly identical discharges; mean water discharge was 5,700 cfs on 29 May 2009 and 5,770 cfs on 13 June 2013. The 2009 surface area (17.50 ha) is in yellow. The 2013 surface area (0.39 ha) is in red. The difference in surface area (exposed above the waterline) is the result of antecedent river processes (i.e., erosion). The 2009 sandbar was measured one year after a major high flow event and the 2013 sandbar was measured three years after a major high flow event.

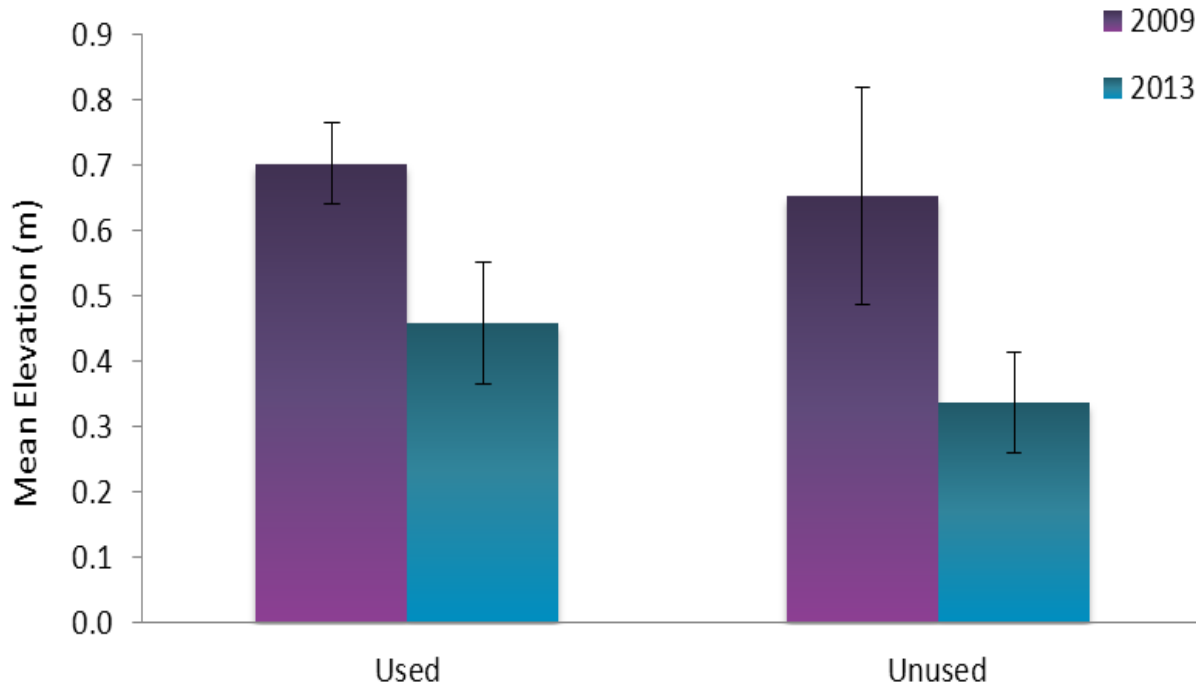


Figure 27. Maximum mean sandbar elevation of used and unused sandbars in 2009 and 2013 (± 1 standard error).

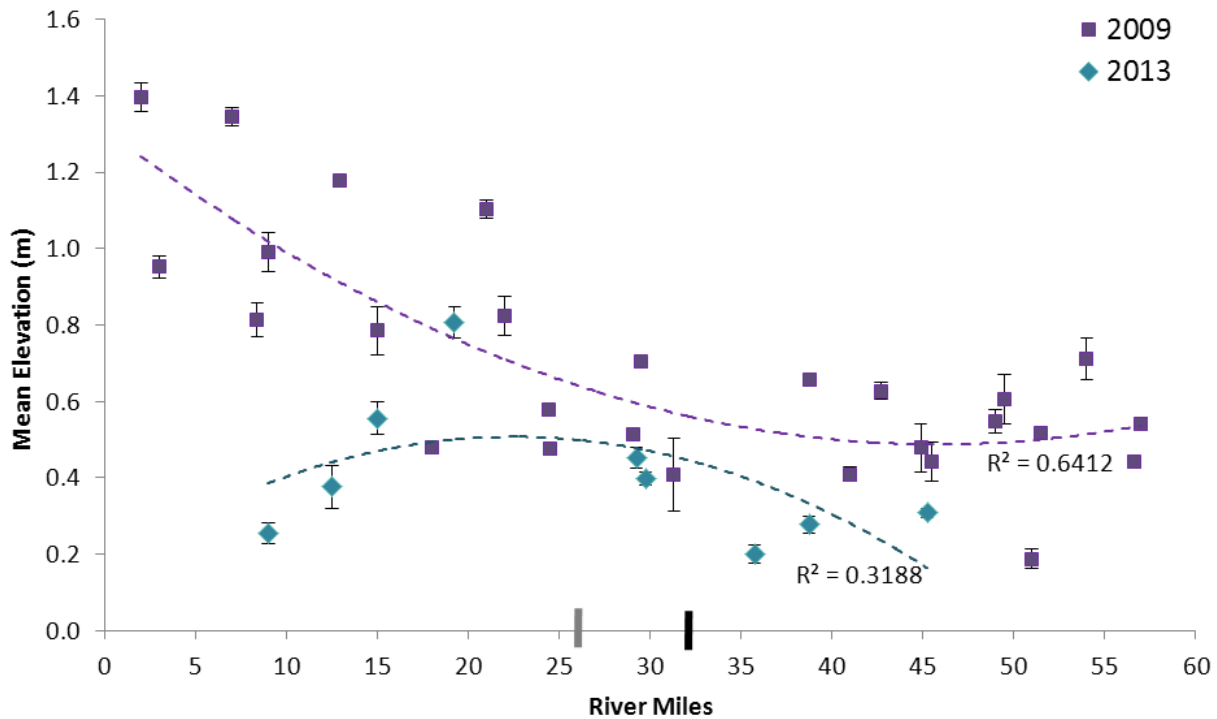


Figure 28. Maximum mean sandbar elevations (± 1 standard error) in 2009 and 2013. Graph shows the best fitting secondary polynomial trend line for 2009 and 2013. The gray vertical line on the x-axis shows the river mile location (RM 26) where the Salt Creek enters the Lower Platte River. The black vertical line on the x-axis shows the river mile location (RM 32) where the Elkhorn River enters the Lower Platte River.

Discussion

In 2013, used and unused sandbars did not differ significantly in surface area, elevation, or channel width. Our results were likely influenced by small sample sizes and the small number of large, high, and sparsely vegetated sandbars in the Lower Platte River during the 2013 nesting season. Among the small number of large and high sandbars present during the 2013 nesting season, most were covered in vegetation and therefore not available to nesting birds.

Sandbar features are determined by a suite of processes (i.e., erosion) occurring and interacting with one another at different rates and intensities at different temporal and spatial scales. Parham (2007) showed that high, or peak, river flows occurring within the previous 1.5 years are an important variable determining a sandbar's elevation. We compared sandbar features between 2009 and 2013, the former year was within 1.5 years of a major high flow event and the latter was approximately 3 years after a major high flow event.

Two important processes that affect sandbars created by high flow events are erosion and vegetation colonization. The mild winters of 2011–2012 and 2012–2013 appear to have resulted in relatively high rates of sandbar erosion (Alexander 2013). The historic drought of 2012 and low water discharges throughout the summer allowed vegetation to colonize exposed sandbars. These differences in the post-high flow event period between 2009 (1 year) and 2013 (3 years) is why the sandbar features we observed were different in 2013 when compared to 2009.

The amount of sandbar nesting habitat, measured by sandbar surface area and elevation, on the Lower Platte River was significantly different in 2009 compared to 2013. While we were unable to draw direct links to causation, our observations provide insights on how river flow conditions may affect habitat conditions for terns and plovers during a nesting season. We believe sandbar habitat conditions observed in 2009 and 2013 represent two ends of the spectrum of habitat conditions that are expected on the Lower Platte River system under the current flow regime. Appreciably different regimes or unprecedented flow conditions may create different habitat conditions outside of what is currently seen. We recommend future research continue to understand how variable river conditions affect sandbar habitat on the lower Platte River.



Conducting habitat assessments on a used sandbar in Sarpy/Cass County. Photo taken by Joel Jorgensen.

MANAGEMENT

The TPCP uses a voluntary, proactive approach to reduce human-bird conflicts and avoid 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, the TPCP meets with the production and property managers of all area sand and gravel mines. We discuss the mining companies' production plans for the 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 Mine Safety and Health Administration (MSHA) policy as it applies to non-mine personnel. We also meet with 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 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.

Protecting Interior Least Tern and Piping Plover Nests

We erect "Keep Out" signs around the perimeter of all off-river nesting areas to protect nesting terns and plovers; 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 considerable human foot or vehicle traffic is to be expected, 'psychological' barriers are added. These barriers consist of black cord tied between all of the "Keep Out" sign posts with red-silver Mylar streamers attached to the cord to make it more visible.



Wire mesh enclosure with a roped and signed off boundary around a Piping Plover nest at a sand and gravel mine in Dodge County that is transitioning from a mine to a housing development.

Based on conversations with mine production managers and homeowners' associations before the nesting season begins, we mark off the areas where it would be safest for the 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 is going to be operating. At housing developments, these are areas where construction is planned to occur. We know that terns and plovers avoid nesting in areas where substrate is frequently (every day) disturbed by raking, vegetation is present, substrate particle size is unattractive to the birds, or where there are major physical disturbances (Marcus et al. 2007).

In 2013, we placed protective wire mesh nest enclosures around 31 off-river plover nests; the remaining 22 nests did not have enclosures. These enclosures help to protect plover nests from both human disturbance and predation. We did not place wire mesh enclosures around tern nests; rather, we placed protective boundaries around tern nesting colonies that were in areas with human activity. We did this by placing a ring of 3-foot tall rebar poles around the nesting area; black cord with red-silver Mylar strips was tied between each of the poles. These roped off areas only help to protect tern nests from human disturbance; they do not reduce natural predation.

MSHA (Mine Safety and Health Administration)

Every year, all TPCP personnel receive MSHA (Mine Safety and Health Administration) training and certification for scientific (non-miner) workers. In 2013, the training was 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.

Lower Platte River Weed Management Area sandbar restoration project

In cooperation with the Lower Platte South, Lower Platte North and Papio-Missouri Natural Resource Districts and the Lower Platte River Weed Management Area, we continued our cooperative project to clear vegetation from sandbars in the Lower Platte River (river mile 0 – 103). In late summer 2011, 2012 and 2013, weedy vegetation on sandbars, including invasive phragmites and purple loosestrife, was sprayed with herbicide using GIS controlled helicopter sprayers (SkyCopters, Ulysses, KS) and handheld sprayers. Winter ice jams and high spring flows overtop the sandbars and remove any standing dead vegetation making the sandbars attractive to nesting terns and plovers.

Preferred Rocks of Genoa-Loup Public Power District Bird Management Area

In March 2008, the United States Fish and Wildlife Service, Nebraska Game and Parks Commission, and Preferred Rocks of Genoa entered into a Memorandum of Understanding (MOU) outlining the management of the Interior Least Terns and Piping Plovers nesting on the North Sand Management Zone (NSMZ). The NSMZ is adjacent to the LPPD's Loup Diversion and settling basin near Genoa, Nance County, NE. Sand slurry is dredged from the settling basin and pumped onto the NSMZ. As part of their standard operating policy, LPPD ceases dredging the settling basin when the birds arrive and begin nesting; dredging resumes after the birds depart. With the assistance of Preferred Rocks of Genoa employees Dave Kendle (Plant Manager) and Gary Pearson (LPPD Headworks Supervisor), TPCP monitored the birds nesting at the NSMZ in 2013.

In 2009, Loup Public Power District, which operates the North Sand Management Zone near the Loup Diversion and settling basin near Genoa, Nance County, NE initiated the process of renewing their 25-year license to operate hydropower-generating facilities near Monroe and Columbus, Platte County, NE. The TPCP cooperates with FERC, LPPD, HDR Engineering, United States Fish and Wildlife Service,

Nebraska Game and Parks Commission, United States National Parks Service, and others on this relicensing project. Our role is to serve as threatened and endangered species experts, in general, and Interior Least Tern and Piping Plover experts, in particular.

Lake McConaughy Piping Plover human dimensions study

In 2013, we initiated a research project aimed at helping resource managers better understand the impacts of human recreation on the success of Piping Plovers nesting on the beaches of Lake McConaughy, Keith Co., NE. During this first season, we conducted surveys of people using the beaches (day and overnight) and observed Piping Plover nests. The surveys addressed knowledge of wildlife protection laws and beach use regulations and opinions on the birds. The observations addressed the birds' responses to human-caused disturbances.

OUTREACH

Essential to our mission to protect Interior Least Terns and Piping Plovers is our outreach program. The TPCP is an important member of Nebraska's conservation and environmental education community. We are frequently called upon to give presentations, assist with symposia, workshops and festivals, participate in workgroups, and serve on committees. While the majority of our outreach efforts are focused on terns and plovers nesting in Nebraska's Lower Platte River, we appreciate that we play a broader role in improving environmental literacy locally, regionally, and nationally. We take advantage of opportunities to reach as many different constituencies as possible with our message of common-sense conservation. The number of adults and children we are able to reach across the state has grown substantially over the past few years (Figs. 23 – 24). The TPCP is now one of the go-to programs in Nebraska's environmental education community. We have evolved from being an organization that needed to seek out events to participate in to one that receives a stream of requests for participation. It is gratifying for us to meet people who know what the TPCP does and who commend us for our work.



Lauren Dinan talking about Piping Plover color-banding at the Nebraska Ornithologists' Union meeting in May 2013. Photo by Joel Jorgensen.

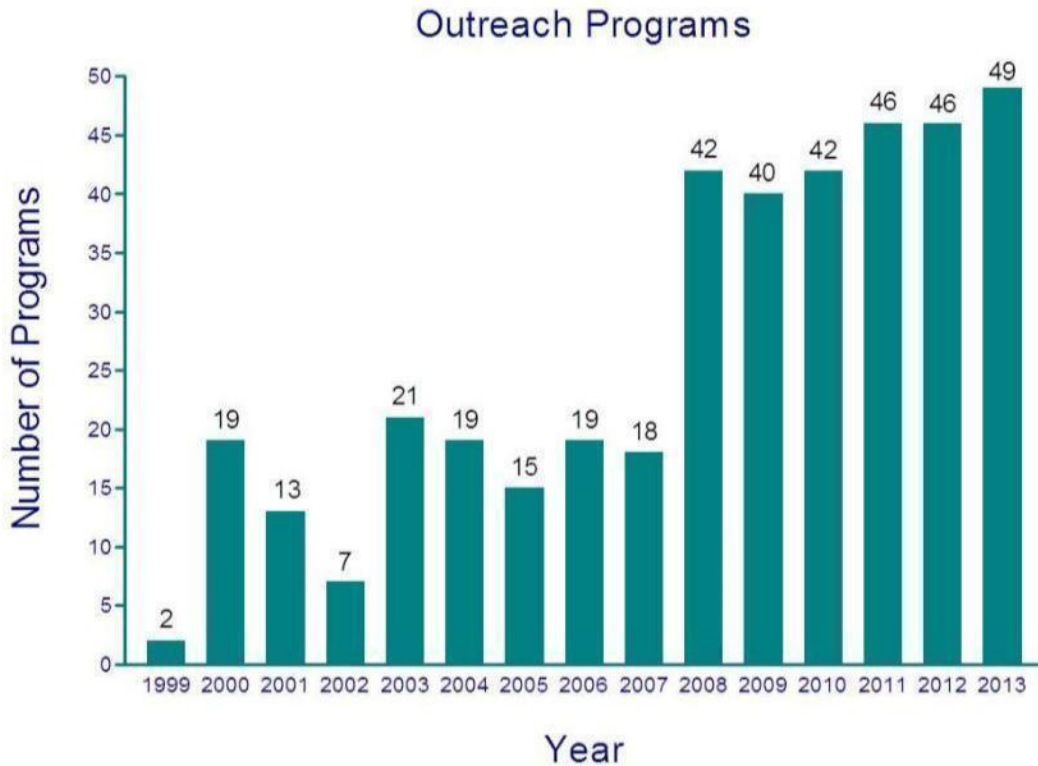


Figure 23. Number of programs delivered by the TCP from 1999 through 2013 (this only includes scheduled programs; we frequently deliver impromptu presentations).

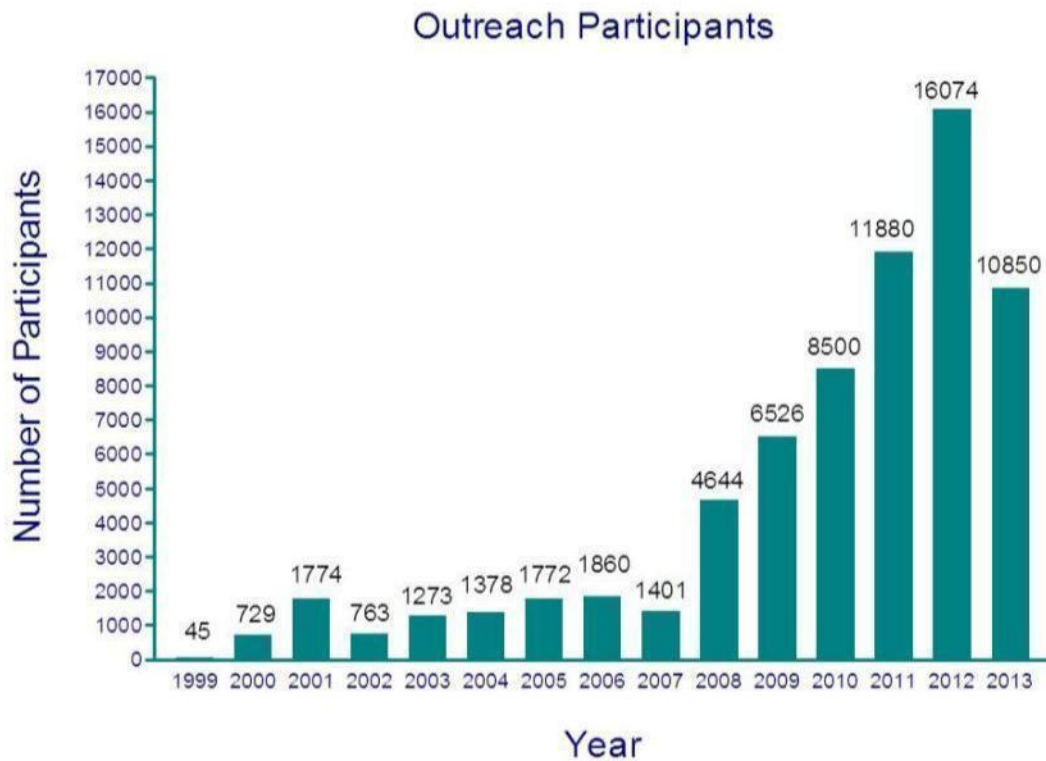


Figure 24. Number of participants in TCP programs from 1999 through 2013 (this only includes scheduled programs; we frequently deliver impromptu presentations).

TernCam: Five Nines Technology Group (Eric Schoenleber) of Lincoln, NE, Mark Mesarch (SNR UNL) and Ben Wheeler (Ord, NE; NGPC) helped us present “TernCam” in 2013—a streaming video camera based at a sand and gravel mine near Gates, NE . The video streamed live and could be viewed on our web page during the nesting season. In 2013, the camera focused on two nests, the first was destroyed in a severe storm and the other successfully hatched two chicks. According to Google Analytics, TernCam received 6,708 visitors from 100 countries around the world; many visitors also visited other sections of our web page.

SwallowCam: Working with Michael Forsberg, Jeff Dale, Nebraska Educational Television, students from UNL course NRES 319 (Digital Imaging and Storytelling) and the Platte River Time-Lapse Project (<http://plattebasintimelapse.com>), we placed a streaming video camera on the Lied Hiker-Biker Trail Bridge over the South Platte River near South Bend, NE. The camera can be turned to focus on the Cliff Swallow nests on the bridge or turned to look, upstream towards the west, at sandbars that have supported nesting terns and plovers in the past.

ChimneySwiftCam: Working with Michael Forsberg, Jeff Dale, the Lincoln Public Schools (Irving Middle School) and Westminster Presbyterian Church in Lincoln, NE, we placed several cameras in and on chimneys at the school and the church that supports nesting and migratory roosting colonies of Chimney Swifts. Students at IMS will be included in several research and curriculum projects associated with the camera.

On-Line Activities: The internet and social media have become important tools in expanding our outreach program. Our website (<http://ternandplover.unl.edu>) underwent a complete redesign during the past year and it is frequently updated with information about the Partnership. Our *YouTube* videos, “Respect the Signs, Respect the Birds”, “Plover at Nest” and “Points about Plovers” continue to generate interest in the TPCP.

Programs for the General Public

Arnold Family Nature Night, Lincoln, NE
Conestoga Elementary School Family Nature Night, Lincoln, NE
Dimensions Pre-School Family Nature Night, Lincoln, NE
Durham-Smithsonian Museum Teacher’s Night Out, Omaha, NE
Earth Day Celebration at Antelope Park, Lincoln, NE
EarthWellness Festival, Lincoln, NE
Eastridge Elementary Family Nature Night, Lincoln, NE
Elmwod-Murdock Family Nature Night, Lincoln, NE
Fremont Eco-Fair, Fremont, NE
Lincoln Public Schools Science Fair, Lincoln, NE
Lower Platte River Corridor Alliance Water Quality Open golf tourney, South Bend, NE
Macy School Earth Day Celebration, Macy, NE
NGPC Expo, Ponca, NE
Rivers and Wildlife Celebration Wild Experience Room, Kearney, NE
Wachiska Audubon Society Lyman Award panel discussion, Lincoln, NE
Wahoo Bird Club, Wahoo, NE
West Lincoln Elementary School Family Nature Night, Lincoln, NE
Winnebago School Earth Day Celebration, Winnebago, NE
Youth in the Great Outdoors, Rowe Audubon Sanctuary, Gibbon, NE

Homeowners' Associations

Big Sandy, Cedar Creek, Lake Allure, Lake Socorro, Mallard Landing, Riverview Shores, Thomas Lakes

University of Nebraska-Based Education Programs

SNR Applied Ecology seminar
SNR Career Day
SNR Environmental Studies Showcase
SNR NaturePalooza at Morrill Hall
SNR Outreach seminar
SNR Weatherfest
UNL Cedar Point Biological Station seminar
UNO Environmental Studies class seminar

Education-Curriculum Development Activities

Informal Educators of Lincoln Network
Iowa Western Community College Environmental Studies
Lincoln Public Schools
Nebraska Alliance of Conservation and Environment Educators
Nebraska Bird Library
Project BEAK

Conferences

American Ornithologists' Union, Chicago, IL
Nebraska Chapter of the Wildlife Society, Chadron, NE
Nebraska Natural Legacy Project Conference, Nebraska City and North Platte, NE
Nebraska Ornithologists' Union, Hordville, NE
Rivers and Wildlife Celebration, Kearney, NE
USGS-CERC Interior Least Tern sandbar morphology workshop, Columbia, MO
Wilson Ornithological Society, Williamsburg, VA

Professional Committees and Workgroups

Conservation and Science Advisory Workgroups, Nebraska Bird Partnership
Lower Platte River Weed Management Area
Lower Platte South NRD Integrated Water Management Plan focus group
Nebraska Bird Partnership Steering Committee
Nebraska Environmental Trust Technical Advisory Committee
PACE (Planning, Aggregate, Community, Environment)
Rivers and Wildlife Celebration Committee

Miscellaneous

Nebraska State Fair 4-H: participated in judging 4-H Wildlife exhibits at the Nebraska State Fair.

Interior Least Tern 5-year review: provided assistance to the review team.

Educational Bird Banding Station and Nature Camp: in cooperation with USFWS and Rowe Audubon Sanctuary, Gibbon, NE, provided assistance to the educational staff.

Sandbar Summit: attended meeting in Columbia, Missouri discussing river processes and Interior Least Tern habitat.

Featured in the Media

August 2013, “Endangered/Protected Birds”, Preferred Rocks of Genoa newsletter

March 2013, “Wader Quest: Colour-ringed Piping Plovers in Florida”
<http://www.waderquest.org/2013/03/colour-ringed-piping-plovers-in-florida.html>

May 2013, “Conservation from the Piping Plovers’ Perspective”, Prairie Fire newspaper (contributed by Lauren Dinan)

Spring 2013, “Lower Platte River Piping Plovers Get Out and See the World”, Lower Platte River Corridor Alliance newsletter

February 2013, “A strong partnership protects Interior Least Terns and Piping Plovers”, USFWS Endangered Species Success Stories webpage (contributed by Angelina Wright)

Fall 2012, “Tern and Plover Conservation Partnership”, Resource Nebraska Environmental Trust 2012 annual report

October 2012, “Ding Darling NWR and Bunche Beach Preserve”, Florida Wildlife Blog,
<http://swfloridabirder.blogspot.com/>

September 17, 2012, “For the birds”, Kearney Hub, Kearney, NE

Grants and Fundraising

Imperiled Birds and their Habitat in Nebraska, Nebraska Environmental Trust, year 2 (2012–2015)

Toward Adaptive Management: Evaluating Piping Plover Management at Lake McConaughy, Nebraska State Wildlife Grant, Nebraska Game and Parks Commission, awarded 2013–2015

Publications

Brown, M.B. and P.A. Johnsgard. 2013. *Birds of the Central Platte Valley and Adjacent Counties*. Zea Books, University of Nebraska, Lincoln, NE.

Brown, M. B. 2012. [Invited Book Review] Implementing the Endangered Species Act on the Platte Basin Water Commons. *Great Plains Research* 22: 209.

Brown, M.B., J.G. Jorgensen and L. Dinan. 2012. “2012 Interior Least Tern and Piping Plover monitoring, research, management, and outreach report for the lower Platte River, Nebraska. Joint report of the Tern and Plover Conservation Partnership and the Nebraska Game and Parks Commission Non-game Bird Program, Lincoln, NE.

Dinan, L. R., J.G. Jorgensen, and M.B. Brown. 2012. Interior Least Tern power line collision on the lower Platte River. *Prairie Naturalist* 44:109-110.

Jorgensen, J. G., M.B. Brown, and A.J. Tyre. 2012. Channel width and Interior Least Tern and Piping Plover nesting incidence on the lower Platte River, Nebraska. *Great Plains Research* 22: 59 – 67.

Reviewers for Professional Publications and Organizations

Auk (American Ornithologists Union)
Ecology and Evolution
Great Plains Research (Center for Great Plains Studies)
Nebraska Environmental Trust
Nebraska Game and Parks Commission
United States Fish and Wildlife Service
Wilson Journal of Ornithology (Wilson Ornithological Society)

Miscellaneous

Hold UNL IACUC#877 research approval certificate

Hold UNL IRB#20130213371EX research approval certificate

Hold NGPC Scientific and Educational permit # 905. Authorized to trap, net, band, release, and salvage endangered Least Tern, threatened Piping Plover, and incidental species

Hold USFWS Master Bander permit # 23545, with authorization to trap, use mist nets, and band all species except waterfowl, eagles and all endangered/threatened species except Interior Least Terns and Piping Plovers

Hold USFWS Threatened and Endangered Species permit # TE070027-0. Authorized to handle endangered Interior Least Terns and threatened Piping Plovers

Completed Human Research/Social and Behavioral and Responsible Conduct of Research training, University of Nebraska, Lincoln, NE

Completed Equity, Access and Diversity, IACUC and IRB training, University of Nebraska, Lincoln, NE

Spring 2013: UNL ENVR 319/NRES 489 Environmental Engagement in the Community (client)

Fall 2012/Spring 2013/Fall 2013: UNL NRES 260 Environmental Communication (client)

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APPENDIX A.

Summary of off-river sites located along the Loup and Elkhorn rivers that are outside of the our primary study area but supported nesting Interior Least Terns and Piping Plovers in 2013 (data and summaries provided by Ben Wheeler and Diane Pratt).

Tri-County Sand and Gravel

Tri-county Sand and Gravel, located along the North Loup River in Howard County, had one Piping Plover nest and one Interior Least Tern nest in 2013. The Piping Plover nest successfully hatched on 25 June 2013. One of the adults attending this nest was banded and carried a green flag on its upper left leg; this plover was originally banded in May 2011 along the Lower Niobrara River (M. Friedrich, Virginia Tech Univ., pers. comm.). The tern nest failed due to unknown causes. Habitat conditions at this site have deteriorated considerably over the past couple of years as vegetation has encroached on the open sand.

Paulsen – Gates

The Paulsen, Inc. sand and gravel operation near Gates, Custer County, Nebraska supported 12 Interior Least Tern nests and one Piping Plover nest in 2013. The plover nest was confirmed successful on 3 July when a one-day-old chick was observed in the nest cup. Seven tern nests were successful and five failed. On 21 June, a severe storm passed through Custer County causing damage consistent with winds greater than 100 mph (S. Jacobs, National Weather Service, pers. comm.). As a result of this storm, three tern nests were confirmed failed. This site includes approximately 25 acres of gently undulating, sparsely vegetated sand; only about two acres of this area is actively used by nesting Interior Least Terns and Piping Plovers.

Ulrich Sand and Gravel

Ulrich Sand and Gravel, located along the North Loup River in Valley County, had seven Interior Least Tern nests in 2013. Five nests were successful, one nest failed likely due to predation by an unidentified mammal, and one nest failed likely do to unauthorized recreational ATV traffic. This site continues to be relatively unvegetated providing an adequate amount of suitable nesting habitat.

Medelman's Lake

Medelman's Lake, a sand and gravel mine operated by Central Sand and Gravel, located along the Elkhorn River in Madison County supported 19 Interior Least Tern nests in 2013, which is a notable increase from past years. Ten tern chicks were observed at this site throughout the season.

APPENDIX B.

Locations of Interior Least Tern and Piping Plover nesting colonies found at off-river sites outside of our primary study area.

