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2012 Interior Least Tern and Piping Plover Monitoring, Research, Management, and Outreach Report for the Lower Platte River, Nebraska

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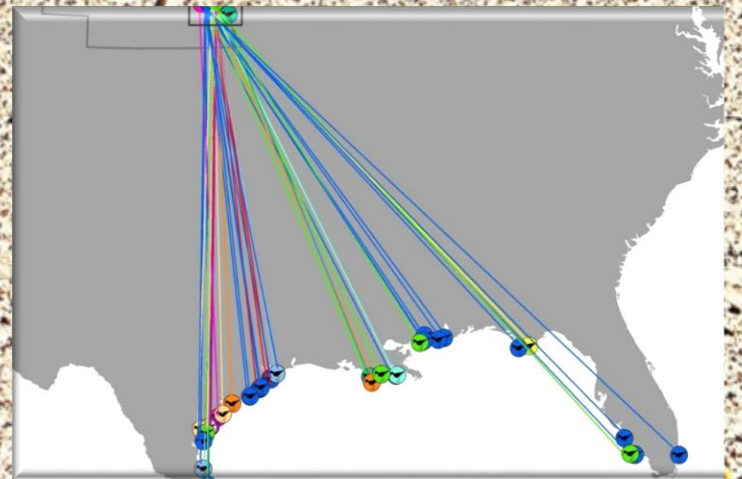
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2012 Interior Least Tern and Piping Plover Monitoring, Research, Management, and Outreach Report for the Lower Platte River, Nebraska



Photo by Gary Rasmussen



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Report
for the Lower Platte River, Nebraska

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Preface

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

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We extend our thanks to all of the people who work and volunteer with us on this program including: Cindy Ahern, Jason Alexander, A.F. Amos, Tony Amos, Carol Aron, Naomi Avissar, Sherrie Bacon, Theodore Below, Stan Benke, Dave Brakenhoff, Mark Brohman, Linda Brown, Keith Carroll, Dan Catlin, Aaron Clark, Josh Clark, Jeff Dale, Karie Decker, Pat DeStefano, Dee Ebbeka, Rangel Diaz, Robin Diaz, Lois Ericson, Betsy Evans, T.J. Fontaine, Michael Forsberg, Elizabeth Forsys, Jolene Foster, Jim Fraser, Samuel Galick, Belinda Gillam, Ellen Goeckler, Cheri Gratto-Trevor, Olivia Graves, David Hanson, Robert Harms, Wayne Hathaway, Berlin Heck, Scott Hecker, Alice Heckman, Leslie Hersherberger, Jeremy Hiller, Caroline Hinkelman, Mike Hodgson, Ian Hoppe, Paula Hoppe, Les Howard, Kelsi Hunt, Gregg Hutchison, Karen Jensen, Paul Johnsgard, Erik Johnson, Rich Karow, Janet Kirk, Aaron Kirk, Michelle Koch, Ron Kruml, Mark Kuzila, Jeanine Lackey, Doris Leary, Patrick Leary, Delaina LeBlanc, Jacki Loomis, Sidney Maddock, Al Menk, Mark Mesarch, Jeff Nothwehr, Melissa Panella, Gregory Pavelka, Gary Pearson, Sue Ellen Pegg, Bob Pelkey, Chris Poole, Larkin Powell, Diane Pratt, Robert Prieksat, Raya Pruner, Gary Rasmussen, Mike Reed, Megan Ring, David Roberts, Jeff Runge, Joel Sartore, Rick Schneider, Ross Silcock, Rachel Simpson, Meghan Sittler, Daniel St-Jacques, Kristal Stoner, Julie Stuckenschmidt, Jennifer Stucker, Bill Summerour, Martha Tacha, Rich Tesar, Chris Thody, Dave Titterington, Jake Walker, David Ward, Franklin Weaver, Ben Wheeler, Carol White, Jennifer Wilson, Angelina Wright, Ron Zelt, and Tim Zuehlke.

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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 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.

All photographs by the authors, except for the photograph of the color banded Piping Plover by Gary Rasmussen found on the cover page and page 16, used with the photographer's permission.



Introduction

The Lower Platte River and its major tributaries provide important nesting habitat for two state and federally protected bird species, the Interior Least Tern (*Sternula antillarum athalassos*) and Piping Plover (*Charadrius melodus*). The Tern and Plover Conservation Partnership (TPCP), based at the University of Nebraska-School of Natural Resources, and the Nongame Bird Program (NBP), based at the Nebraska Game and Parks Commission (NGPC), work cooperatively on Interior Least Tern and Piping Plover monitoring, research, management, and outreach activities in Nebraska. The TPCP and NBP focus on nesting areas along the Lower Platte, Loup, and Elkhorn rivers in the eastern part of the state; however, we also address tern and plover issues across the state and region. Our joint program includes terns and plovers nesting in natural, on-river habitats (midstream river sandbars) and human-created, off-river habitats (sand and gravel mines, dredging operations and lakeshore housing developments). The TPCP leads efforts on the off-river habitats, while the NBP leads efforts on the river habitats.

Focus Animals

The Interior Least Tern (*Sternula antillarum athalassos*) is the smallest tern found in North America. The species was first described in 1847 from a type specimen collected in Guadeloupe, West Indies (Checklist of the Birds of North America 1998. American Ornithologists' Union). Meriwether Lewis and William Clark recorded their historical first observation of the Interior Least Tern on 5 August 1804 along the Missouri River in Nebraska, near present day Omaha. Today, the Interior Least Tern is a state and federally listed endangered species (50 Federal Register 21784–21792). It was placed on the Endangered Species List on 27 June 1985, and a Recovery Plan was issued in September 1990. As a result of its 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. Hartfield, pers. comm.).

The Piping Plover (*Charadrius melodus*) is a small, migratory shorebird. The species was first described in 1824 from a type specimen collected in New Jersey (Checklist of the Birds of North America. 1998.American Ornithologists' Union). Meriwether Lewis and William Clark observed Piping Plovers, and recorded their observations in what became the state of Nebraska, during their 1803–1805 “Voyage of Discovery” across North America. The Piping Plover is a state and federally listed threatened species (50 Federal Register 50726–50734). It was placed on the Endangered Species List on 10 January 1986, and the Northern Great Plains Recovery Plan (which covers plovers in 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. Interior Least Terns and Piping Plovers were among the first birds to be described in Nebraska by western explorers, and were known by Native Americans well before that. Historically, terns and plovers flourished on the sparsely-vegetated midstream sandbars of the Platte, Missouri, Loup, Elkhorn, and Niobrara rivers. However, much of this natural habitat has been lost due to anthropogenic changes in these 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 and are created by industrial and commercial activities such as sand and gravel mining, dredging, and construction. This change in nesting habitat from exclusively on-river sandbars to a combination of on- and off-river habitats is the result of the decrease in availability of river habitat and the increase in availability of human-created off-river habitats. Although human-created habitats offer alternative nesting sites during years where river sandbars are limited in availability, they are not likely to provide a suitable long-term substitute for riverine nesting habitat. Broad-scale alterations of the natural river systems that traditionally provided breeding habitat for Interior Least Terns and Piping Plovers have been a major contributor to population declines.

Loss of overwintering habitat also contributed to the decline of both species. Piping Plovers and Interior Least Terns spend about eight months of the year in their overwintering areas. Overwintering habitat for Northern Great Plains Piping Plovers occurs along the southern Atlantic coast from Florida to South Carolina, the Gulf of Mexico from northeastern Mexico to southwestern Florida, and the Bahamas. These overwintering habitats are characterized by wide beaches and a combination of sand flats, mudflats, tide pools, marshes, lagoons, and large inlets. Interior Least Terns spend the winter off-shore and along coasts, bays, estuaries, and river mouths near Central and South America. The principal threats to tern and plover overwintering habitat include habitat loss and degradation, increased residential and industrial development, and natural disasters (i.e., global sea level rise and hurricanes).

Focus Area

Our broad-scale focus area includes the Lower Platte River system in eastern Nebraska which includes the Loup and Elkhorn rivers. See Figure 1 and Table 1 for a map and listing of the off-river sites that are within our Lower Platte River focus area. The Tern and Plover Conservation Partnership primarily concentrates its monitoring and research efforts on the off-river sites in the study area along the Loup and Lower Platte rivers between the Loup Public Power District Diversion Canal and the Missouri-Platte River confluence (Fig. 2). Efforts on the river focus solely on the Lower Platte River and do not include the tributaries (Fig. 2). 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).

Along the Lower Platte River, on-river habitat includes river sandbars used for nesting, and the river channel, which is used for foraging. Off-river habitats include waste sand piles and beaches for nesting and the pit lakes for foraging. In eastern Nebraska, off-river habitats are rarely found more than three miles from a river, and terns and plovers nesting at these off-river habitats often supplement their diet by traveling to the river to forage along with foraging at the pit lakes.

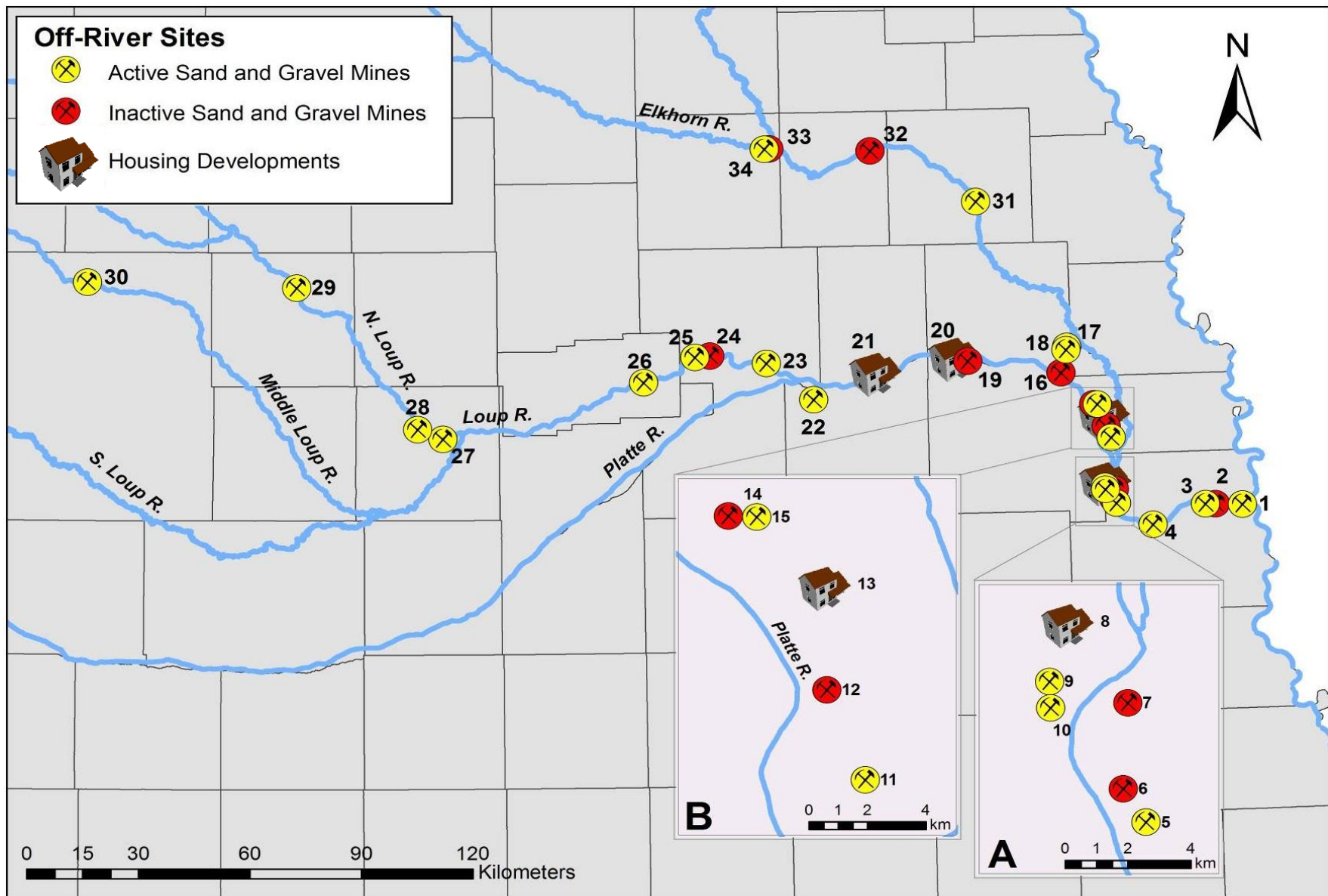


Figure 1. Locations of all known off-river Interior Least Tern and Piping Plover nesting areas within our focus area in eastern Nebraska. Off-river sites can be matched to numbers in Table 1.

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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	2012 Nesting
1	Oreapolis (Four Mile Creek)	Platte	Lyman Richey	Active Mine	Cass	Yes
2	Old Cullom (East Cullom)	Platte	Central Sand and Gravel	Inactive Mine	Cass	No
3	New Cullom (West Cullom)	Platte	Central Sand and Gravel	Active Mine	Cass	No
4	Louisville Lakes (Louisville)	Platte	Western Sand and Gravel	Active Mine	Sarpy	Yes
5	New Linoma Beach (Linoma Beach #57)	Platte	Lyman Richey	Active Mine	Sarpy	Yes
6	Old Linoma Beach (Old Linoma Beach)	Platte	Lyman Richey	Inactive Mine	Sarpy	No
7	Melia (Melia)	Platte	Private	Inactive Mine	Sarpy	No
8	Big Sandy (Big Sandy)	Platte	Homeowners' Association	Housing	Saunders	No
9	Sand Creek (NW Riverside)	Platte	Western Sand and Gravel	Active Mine	Saunders	Yes
10	Thomas Lakes (N Riverside)	Platte	Western Sand and Gravel	Active Mine	Saunders	No
11	OMG-Venice (Graske Pit)	Platte	OldCastle Materials Group	Active Mine	Douglas	Yes
12	Waterloo (Lake Clagus)	Platte	Lyman Richey	Inactive Mine	Douglas	No
13	Mallard Landing (Timber Lake Lodge)	Platte	Homeowners' Association	Housing	Douglas	Yes
14	Pleasure Lake (Pleasure Lake #11)	Platte	Lyman Richey	Inactive Mine	Douglas	No
15	New Valley (Valley #7)	Platte	Lyman Richey	Active Mine	Douglas	Yes
16	Western Fremont (N Woodcliff)	Platte	Western Sand and Gravel	Inactive Mine	Dodge	Yes
17	NE Fremont North (Fremont #2)	Platte	Lyman Richey	Active Mine	Dodge	Yes
18	NE Fremont South (Fremont #47)	Platte	Lyman Richey	Active Mine	Dodge	Yes

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#	Site Name	River	Owner	Site Type	County	2012 Nesting
19	Morse Bluff (Morse Bluff)	Platte	Private Mining Company	Inactive Mine	Dodge	Yes
20	Riverview Shores (Riverview Shores)	Platte	Homeowners' Association	Housing	Dodge	Yes
21	Socorro Lake (Lake Socorro)	Platte	Homeowners' Association	Housing	Colfax	Yes
22	Bellwood #73 (Wilson Creek)	Platte	Central Sand and Gravel	Active Mine	Butler	Yes
23	Columbus #71 (Shady Lake Road)	Loup	Central Sand and Gravel	Active Mine	Platte	Yes
24	W Lookingglass Creek (Monroe)	Loup	Central Sand and Gravel	Inactive Mine	Platte	No
25	Genoa North (Genoa North #95)	Loup	Central Sand and Gravel	Active Mine	Platte	Yes
26	LPPD-Loup Diversion (Genoa Sandpile)	Loup	Preferred Rocks – LPPD	Active Mine	Nance	Yes
27	North Loup SRA (Batenhorst St. Paul)	Loup	Central Sand and Gravel	Active Mine	Howard	No
28	E Elba (Tri-County)	Loup	Tri-County Sand & Gravel	Active Mine	Howard	Yes
29	Haskell Creek (Ulrich's)	Loup	Ulrich Sand and Gravel	Active Mine	Valley	Yes
30	Paulsen Gates (Gates)	Loup	Paulsen Sand and Gravel	Active Mine	Custer	Yes
31	Horseshoe Lake (Stalps')	Elkhorn	Stalp Sand and Gravel	Active Mine	Cumming	Yes
32	Andy's Lake (Pilger/Norfolk)	Elkhorn	Pilger Sand and Gravel	Inactive Mine	Madison	No
33	Red Fox WMA (Pilger)	Elkhorn	Pilger Sand and Gravel	Inactive Mine	Stanton	No
34	Medelman's Lake (Norfolk #92)	Elkhorn	Central Sand and Gravel	Active Mine	Madison	Yes

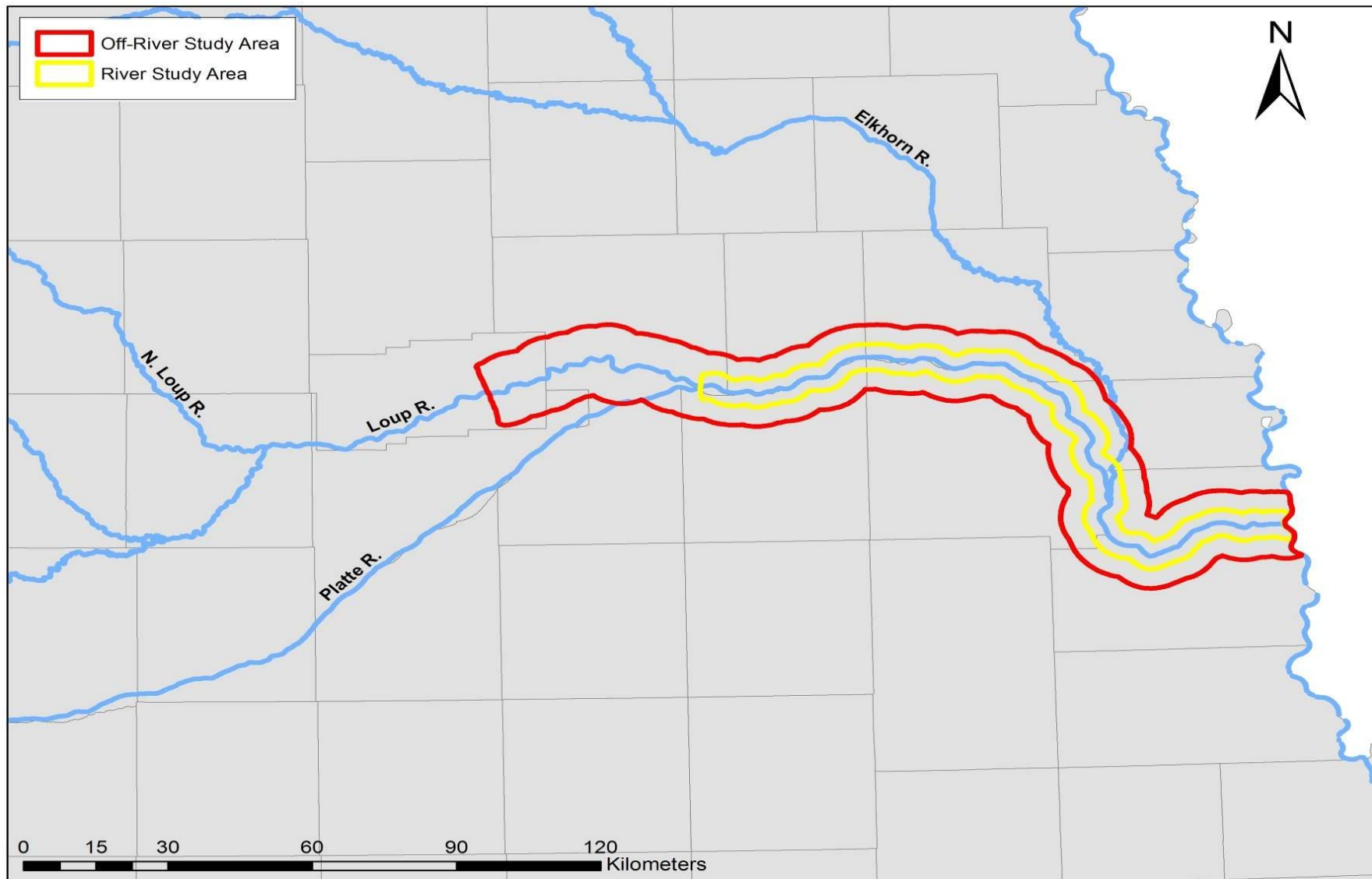


Figure 2. The Lower Platte River study area. The red box outlines the Tern and Plover Conservation Partnership's primary off-river monitoring and research area. The yellow box shows the Lower Platte River study area where the NGPC Nongame Bird Program's on-river tern and plover monitoring and research efforts occur.



Figure 3. Lower Platte River near Ashland, Saunders County on 4 August 2012. The photograph shows the low discharge and extensive areas of emergent sand that occurred on the Lower Platte River during the 2012 breeding season. Photo taken from the Mahoney State Park tower.

2012 Off-River Conditions

In 2012, off-river conditions changed from those experienced in 2008, 2009, 2010 and 2011. The continued easing of the nationwide economic downturn affected the sand and gravel mining and lakeshore housing development industries and increased activities in both areas. Several sand and gravel mining companies modified their operations by expanding existing sandpits, relocating dredges and separating plants or moving slurry pipes. Several new sandpits were opened; these new sandpits have not produced enough waste sand to attract nesting birds, but within the next 2 – 3 years we expect to find birds at these sites. Several mine sites that ceased production in previous years remained closed, which allowed the birds to nest at those locations without significant human interference. The pace of home construction at lakeshore housing developments increased, which reduced or eliminated nesting habitat at some locations. Flooding along the Missouri and Platte rivers eliminated most on-river nesting habitat in 2011. This flooding, when combined with seasonal precipitation and releases from upstream reservoirs deposited significant amounts of sand in the Lower Platte River. The extreme drought of 2012 reduced flows in the Lower Platte River which exposed wide expanses of mid-river sand. The lack of water flows and resulting lack of foraging habitat reduced the number of birds that nested on sandbars. These conditions caused terns and plovers to range widely in effort to find nesting locations; many of these birds chose to locate their nests at the off-river sites, but some did nest on sandbars.

2012 Lower Platte River Conditions

The amount of sandbar nesting habitat in the Lower Platte River available to Interior Least Terns and Piping Plovers varies from year to year. Daily and seasonal fluctuations in the volume of water flowing in the river, annual amounts of rain, ice and snow, ground water levels, and river channel morphology all influence sandbar development and maintenance. General flow conditions on the Lower Platte River are monitored by USGS stream gages (<http://waterdata.usgs.gov/ne/nwis/rt>). In addition to these data, we monitor flow conditions by visual inspection of the river at bridge crossings and by direct inspection via canoe and kayak.

Following several years (2008–2011) of generally high discharges and several notable high flow events, 2012 was dry with notably low discharge and an absence of any high flow events during the breeding season (Figs. 4 – 5). During 2012, river discharge never reached or exceeded 20,000 cubic feet per second (cfs) at the Louisville gage (USGS 0680550 Platte River). During the breeding season, river discharge decreased to historic or near-historic low levels from mid-June through the remainder of the breeding season (Fig. 3). In fact, by the end of June, water levels were too low to support kayaks passing down the river. Macro-form sandbar remnants from the 2010 high flow (138,000 cfs at Louisville) generally did not persist into the 2012 nesting season. Higher than average flows during 2011, and a warm winter, led to the reformation and reshaping of macro-form sandbars as a result of erosion. The presence of ice around sandbars during winter, which was not present during the winter of 2011-12, is believed to limit erosion by protecting the borders of the sandbar from the abrasive action of flowing water. Reshaped macro-form sandbars are generally at lower elevation than the original macro-form sandbars created by a high-flow event (J. Alexander, pers. comm.).

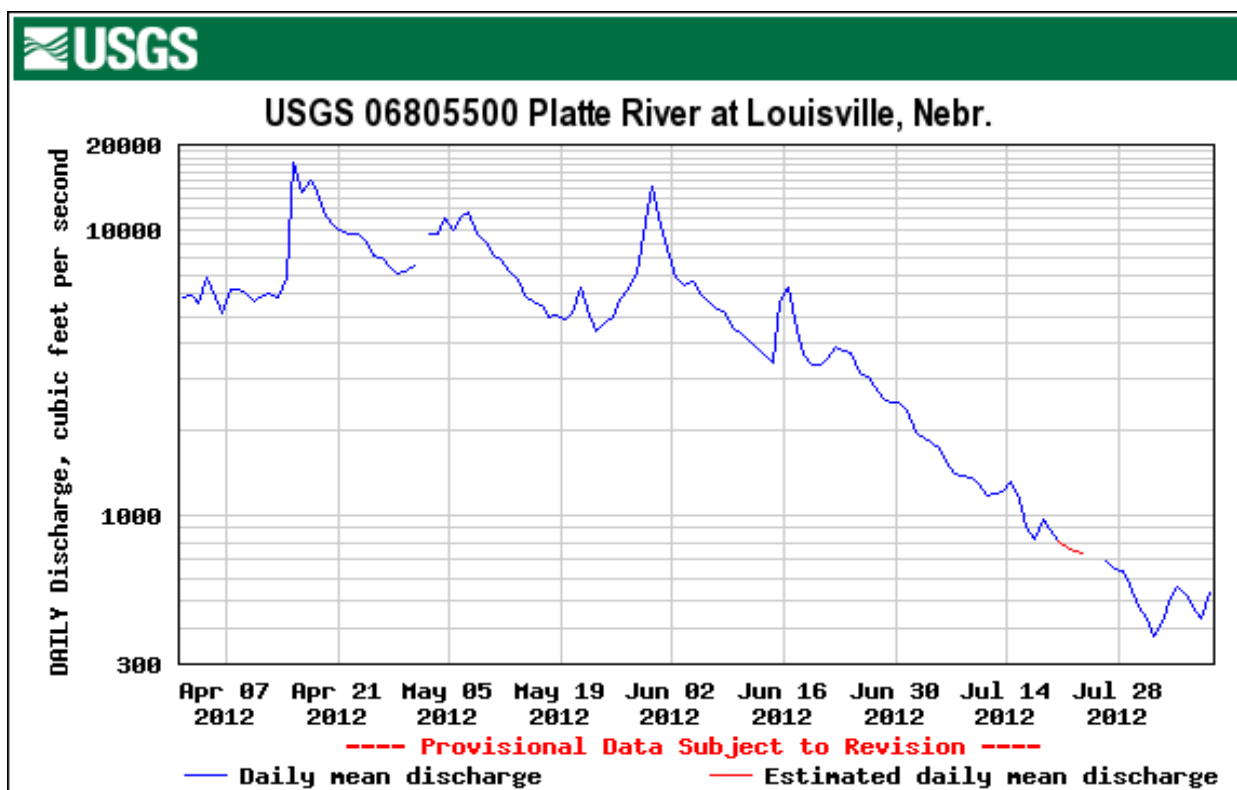


Figure 4. Daily water discharge (cubic feet per second; cfs) measured at the Louisville, Cass County, USGS gage from April 1, 2012 through August 8, 2012.

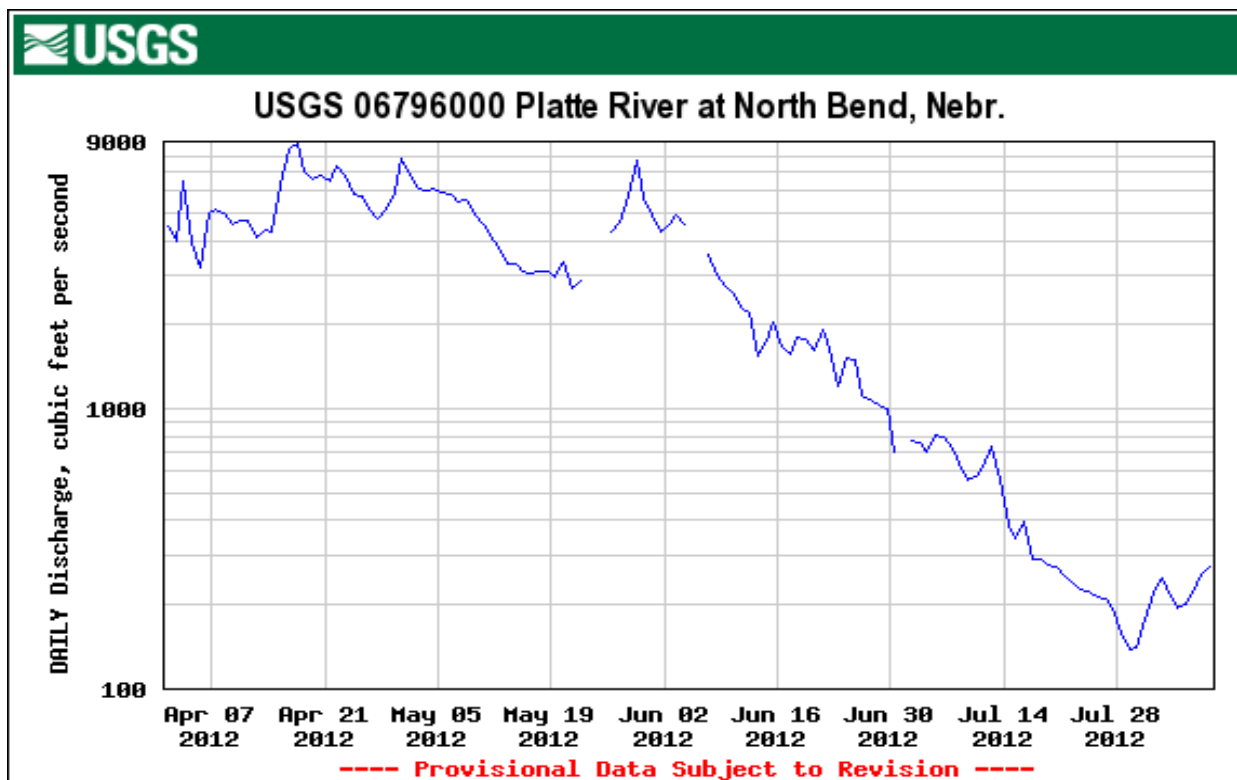


Figure 5. Daily water discharge (cubic feet per second; cfs) measured at the North Bend, Dodge County, USGS gage from April 1, 2012 through August 8, 2012.

Monitoring

Monitoring Regional Movements of Color-banded Piping Plovers

Breeding Range

We have been placing color-bands on Piping Plovers nesting along our Lower Platte River study area every year since 2008. We have banded a total of 260 plovers; 73 adults and 187 pre-fledging age chicks. Over the succeeding five years, we observed color-banded plovers that were originally banded along the Lower Platte River and others that were originally banded in other areas throughout the Great Plains and U.S. Gulf Coast. In 2012, we observed plovers that were originally banded along the Lower Platte River, Central Platte River, Missouri River between Sioux City, NE and Yankton, SD, and the U.S. Gulf Coast. Plovers banded along the Central Platte River have a light blue flag on their upper leg, similar to plovers banded along the Lower Platte River, and are banded by United States Geological Survey (USGS; M. Sherfy, pers. comm.). Plovers banded along the Missouri River and U.S. Gulf Coast carry a green flag on one of their upper legs, and are banded by a research group from Virginia Tech University (J. Fraser, D. Catlin, K. Hunt, pers. comm.). In previous years, we observed a yellow-flagged plover along the Lower Platte River which was originally banded at Lake Sakakawea in North Dakota. The majority of the color banded plovers observed nesting along the Lower Platte River study area in 2012 were originally banded along the Lower Platte River and the Missouri River.

A total of 43 previously banded Piping Plovers were observed in the Lower Platte River study area in 2012. Forty of these banded plovers were observed at off-river sites, and three were observed on Lower Platte River sandbars. Of the 40 banded plovers observed at off-river sites, 19 were observed at a lakeshore housing development near North Bend, Dodge County. We observed 23 light blue-flagged plovers that were originally banded along the Lower Platte River, and two light blue-flagged plovers that were originally banded along the Central Platte River. We observed 18 green-flagged plovers along our Lower Platte River study area in 2012. Thirteen of these green-flagged birds were originally banded along the Missouri River (Fig. 6), and five were originally banded along the U.S. Gulf Coast as a part of a Deepwater Horizon Oil Spill recovery study (D. Catlin, pers. comm.). The banding location of these five plovers ranged from the coast of Texas to the coast of Mississippi. Three of the five plovers originally banded along the U.S. Gulf Coast were observed at the same off-river site along the Lower Platte River in 2011 and in 2012.

Over the last five years, Piping Plovers originally banded along the Lower Platte River have been re-sighted nesting in other location (the Missouri, Niobrara, and Central Platte rivers). In 2012, three Lower Platte River plovers were observed nesting along the Missouri River and one Lower Platte River Plover was observed nesting at a sand and gravel mine along the Central Platte River.

About 35 percent of the Piping Plovers banded along the Lower Platte River from 2008 to 2011 have been re-sighted in Nebraska at least once after the year they were originally banded; 61 percent of the banded adults have been re-sighted and 21 percent of the banded chicks have been re-sighted. About 82 percent of these re-sighted adults were observed at the same site that they were originally banded; only 21 percent of the re-sighted chicks were observed at the same site that they were originally banded.

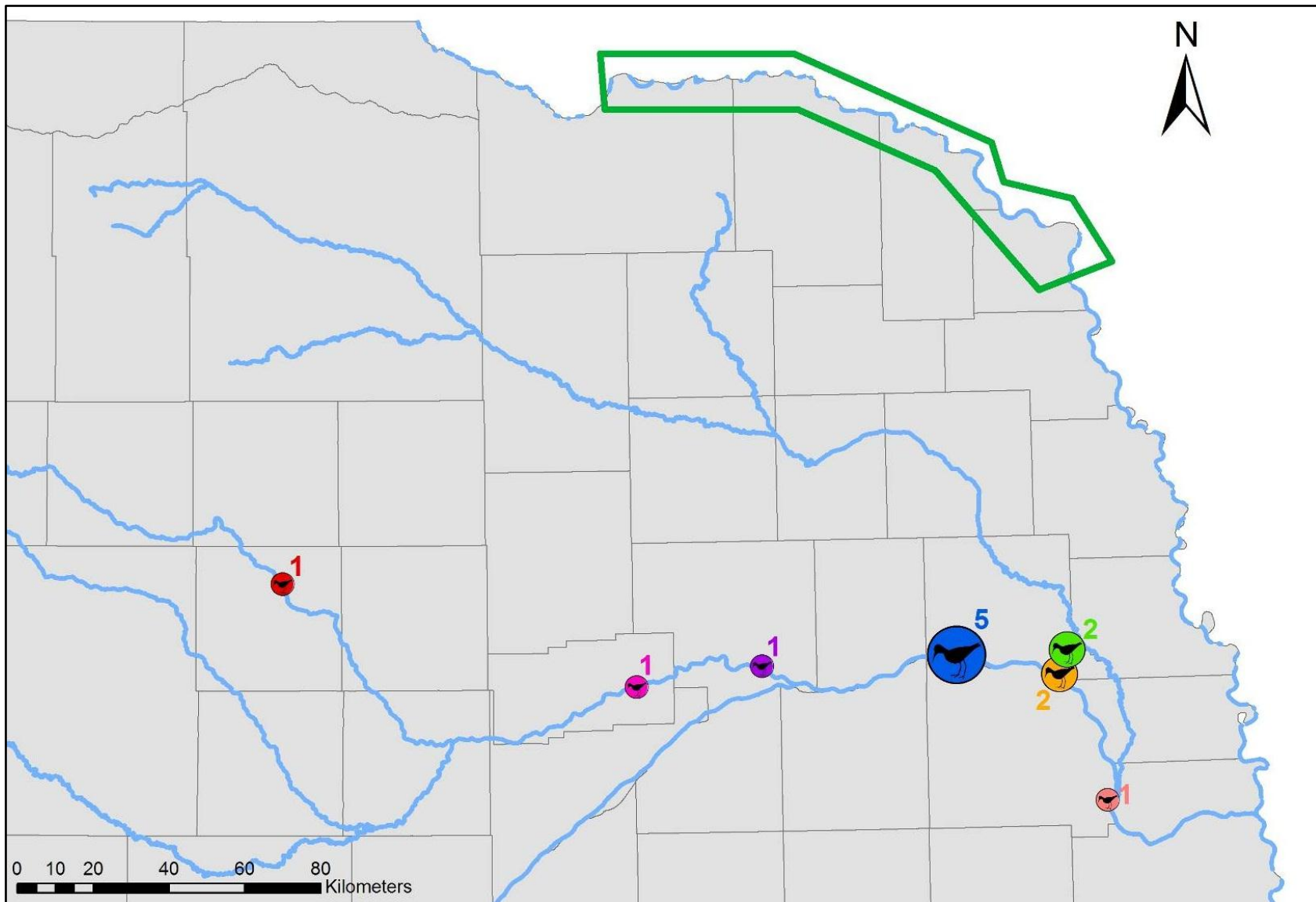


Figure 6. Locations of green-flagged Piping Plovers originally banded on the Missouri River from Sioux City, NE to Yankton, SD (green box) and observed along the Lower Platte River in 2012. Each colored marker represents the site where these green-flagged plovers were observed. The numbers represent the number of uniquely marked green-flagged plovers observed at each site.

Over-wintering Observations

A number of Piping Plovers banded in the Lower Platte River study area from 2008 to 2012 have been observed in their wintering range during the non-breeding season (Fig. 7); many of these reports have been received from volunteers or visiting birders. There have been 41 Lower Platte River light blue-flagged plovers re-sighted during the non-breeding season, and a total of 78 winter reports, with several birds being observed more than once. All of these re-sightings have occurred along the U.S. Gulf Coast except for one which was reported along the Atlantic Coast of Florida in July 2012. This plover was banded as a one-day old chick on 24 May 2012 near North Bend, Dodge County. This is the first report of a Lower Platte River plover being sighted along the U.S. Atlantic Coast. During the winter of 2011–2012, 12 Lower Platte River light blue-flagged plovers were observed along the U.S. Gulf Coast. These sightings stretched from southern Texas to southern Florida including: Bolivar Peninsula, Texas, Corpus Christi, Texas, Galveston Island, Texas, Mustang Island, Texas, Sargent Beach, Texas, Elmers Island, Louisiana, Ship Island, Mississippi, Fort Myers, Florida and Marcos Island, Florida. One light blue-flagged plover, banded as a chick in 2011 at a lakeshore housing development near North Bend, Dodge County, was re-sighted along the U.S. Gulf Coast of Florida ten times from November 2011 to March 2012. This plover was observed and photographed in the same area along the Florida coast on 11 August 2012. To date in fall/winter 2012, five Lower Platte River plovers have been reported from their wintering range.

Five green-flagged Piping Plovers observed along the Lower Platte River in 2012 were originally banded along the U.S. Gulf Coast as a part of the Deepwater Horizon Oil Spill recovery study being conducted by researchers from Virginia Tech University (D. Catlin, K. Hunt, pers. comm.). Seven plovers banded as a part of this oil spill study have been observed along the Lower Platte River during the breeding season in 2011 and/or 2012 (Fig. 8). Three of the five plovers observed in 2012 were also observed nesting along the Lower Platte River in 2011.



Piping Plover banded as a one day old chick at a sand and gravel mine near Ashland, Saunders County on 20 July 2009 and re-sighted along the Gulf Coast of Texas on 13 October 2011.

Photo by Gary Rasmussen



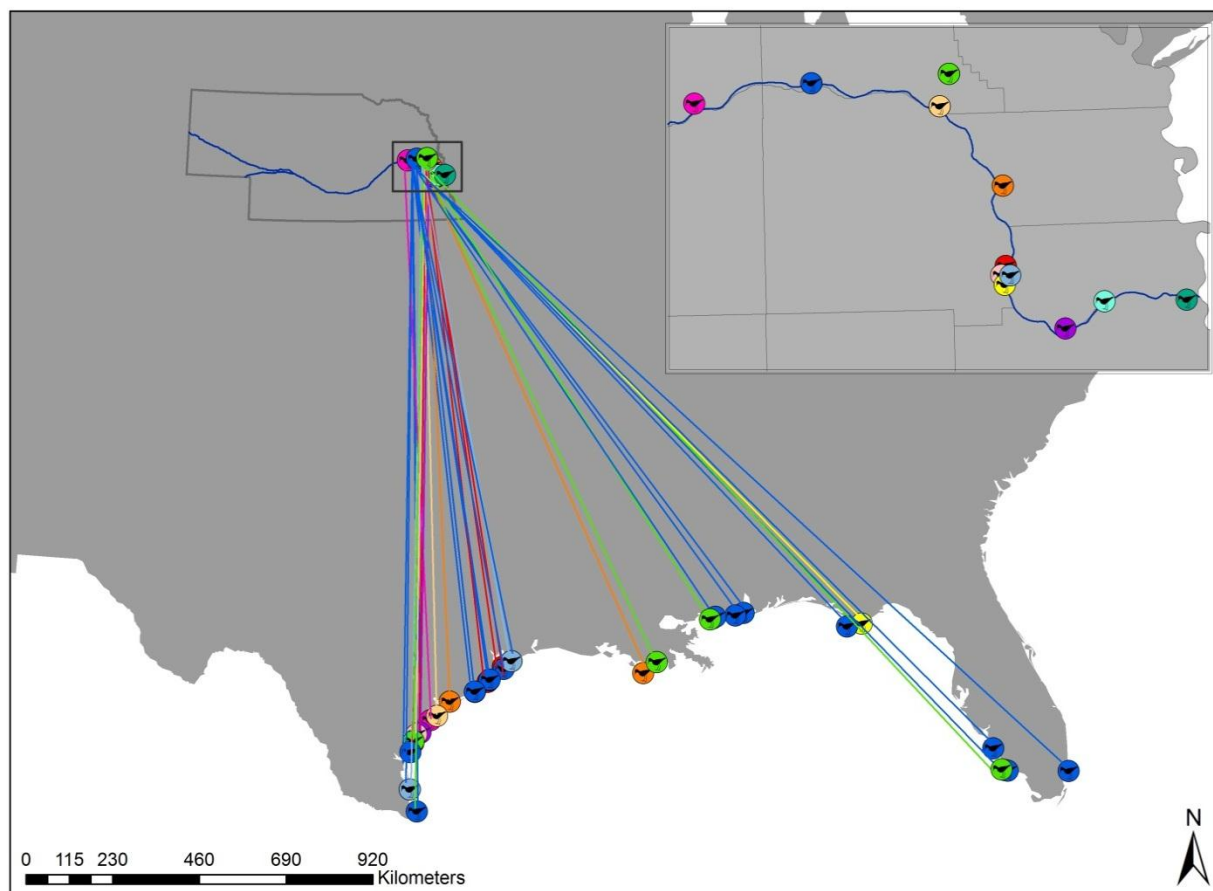


Figure 7. Locations where light blue-flagged Piping Plovers, originally banded in the Lower Platte River study area, have been seen during the non-breeding season on the U.S. Gulf Coast from 2008 to 2012. Each colored marker in Nebraska represents a nesting site where plovers have been banded and each marker on the U.S. Gulf Coast shows the location where light blue-flagged plovers have been re-sighted during the winter. The yellow dot represents a plover, originally banded at Lake Sakakawea, North Dakota that was observed along the Lower Platte River during the 2009, 2010, and 2011 breeding seasons, and was observed along the Gulf Coast in 2010.



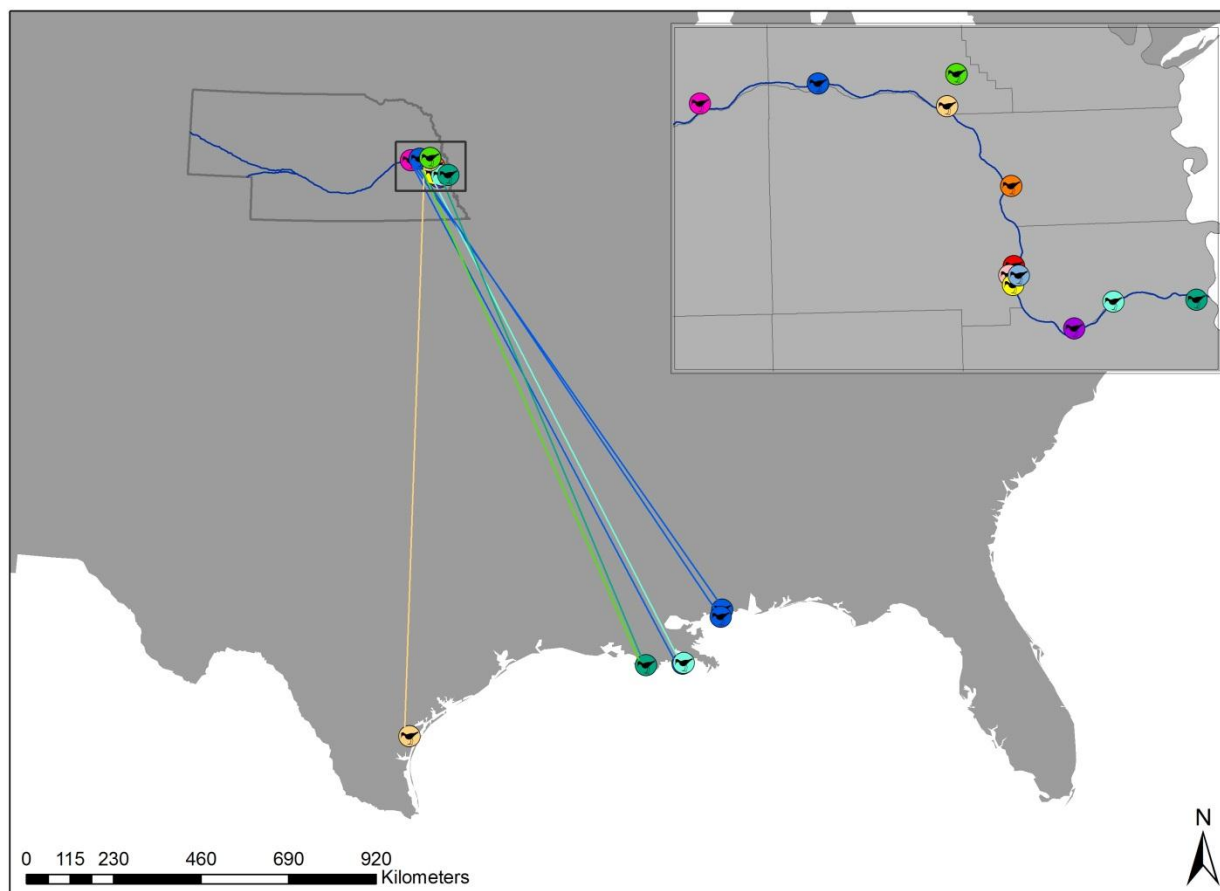


Figure 8. Locations where the seven green flagged Piping Plovers banded as part of the Deepwater Horizon Oil Spill study, and observed in the Lower Platte River study area in Nebraska, were banded along the U.S. Gulf Coast during the winter of 2010–2011. Each colored marker represents a specific nesting site along the Lower Platte River.



Monitoring Nests

Methods: Off-River Habitat

We conducted Interior Least Tern and Piping Plover surveys at each off-river site in our focus area beginning in late April. We concentrated our early-season attention on sites that supported nesting terns and plovers in the past. We did this because terns and plovers are philopatric and tend to return to areas where they nested successfully in the past. Each site was visited every five to seven days and surveyed for terns and plovers. When birds were observed at a site, we searched the open sandy areas for nests or evidence of nest scrapes. Most nests were located by observing adult birds sitting on nests. We recorded the location of every tern and plover nest we found using a handheld GPS unit (Garmin Oregon 550t), and each nest was assigned a unique number. We 'floated' the eggs in water to determine the age of the eggs (H. Hays and M. LeCroy 1972 Wilson Bulletin 83: 425 – 429); the 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 hatching date, assuming a 28-day incubation period for plovers and a 21-day incubation period for terns. We continued to locate nests throughout the season. All nests at off-river sites were visited every five to seven days during the incubation period. Each time a site was visited we counted the number of terns and plovers present, located new nests, checked nests that we were aware of, and looked for tern and plover chicks. We only "floated" the eggs in water 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; may contain small pieces of eggshell in nest cup

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

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

At some off-river sites, Interior Least Terns and Piping Plovers placed their nests in areas that were not accessible to us for safety reasons. In these cases, we only recorded the number of nests, eggs, adults, chicks, juveniles, and fledglings that were visible from a safe distance.

On each regular visit to the sites, the total number of active nests and the total number of terns and plovers of each age class were recorded. The age classes we used were:

Adults: birds in full adult plumage

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

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

Juveniles: chicks capable of sustained flight and independent of their parents

If any adults or chicks were observed with leg bands, the color band combination was recorded. Any miscellaneous observations, including evidence of disturbance, vehicle tracks, weather conditions, or injuries were also recorded.

Results: Off-River Habitat

Summarized below are the results from the off-river sites that are in the Tern and Plover Conservation Partnership's primary study area (Fig. 2).

In 2012, nesting Interior Least Terns and Piping Plovers were distributed across 17 off-river sites in our primary study area, three sites along the Loup River and 14 sites along the Lower Platte River (Figs. 9 – 10). This included three lakeshore housing developments and 14 sand and gravel mines. Most of these off-river sites have been used as nesting sites in previous years. However, three relatively new sand and gravel mine sites, which have not been used as tern and plover nesting sites in the past, had nesting terns and/or plovers this year. See Table 1 for description and location information for all sites, used and unused, in the focus area.

Piping Plovers arrived in the focus area in late April. The first off-river sighting was near North Bend, Dodge County on 23 April 2012 when three plovers were observed at a lakeshore housing development. Interior Least Terns arrived in the focus area in mid-May. The first off-river sighting was near Fremont, Dodge County on 15 May 2012 when three adult terns were observed at an inactive sand and gravel mine.

Based on egg 'floating' data, the first off-river Piping Plover egg was laid on 21 April 2012 at an inactive sand and gravel mine near Fremont, Dodge County and the last egg was laid on 25 June 2012 at an inactive sand and gravel mine near Morse Bluff, Dodge County. The first off-river plover egg hatched on 24 May 2012 at a lakeshore housing development near North Bend, Dodge County and the last hatched on 18 July 2012 at a dredging operation near Genoa, Nance County; a span of fifty-five days. The first off-river Interior Least Tern egg was laid on 26 May 2012 at an inactive sand and gravel mine near Fremont, Dodge County. The last off-river tern egg was laid on 9 July 2012 at an active sand and gravel mine near Columbus, Platte County. The first off-river tern egg hatched on 17 June 2012 at an active sand and gravel mine near Valley, Douglas County and the last hatched on 19 July 2012 at a dredging operation near Genoa, Nance; a span of 32 days. The last sighting of terns and plovers at an off-river site was on 8 August 2012 when one juvenile plover, one juvenile tern, and one adult tern were observed at a lakeshore housing development near North Bend, Dodge County.

In 2012, we located a total of 204 Interior Least Tern nests and 64 Piping Plover nests on the off-river sites in the Lower Platte River study area (Table 2). Forty-seven of the tern nests and 28 of the plover nests were confirmed as being successful. See Table 3 for nest fate information on the Lower Platte River off-river sites. Two off-river sites were particularly productive in 2012. A single sand and gravel mine near Ashland, Saunders County, contained 87 tern nests and nine plover nests, and a single lakeshore housing development near North Bend, Dodge County contained 24 tern nests and 15 plover nests. These two sites together contained 54 percent of the off-river tern nests and 38 percent of the off-river plover nests. They also produced about 47 percent of the tern chicks and about 44 percent of the plover chicks that were produced on all of the off-river sites along the Lower Platte River primary study area in 2012.

In 2012, eight Piping Plover nests and 36 Interior Least Tern nests were found in our focus area but outside the TPCP's primary study area. Seven plover nests and 22 tern nests were on off-river sites along the Loup River west of the Loup Diversion Canal, and one plover nest and 14 tern nests were on off-river sites along the Elkhorn River (Table 4). These nests were distributed across five sand and gravel mines; three sites along the Loup River and two sites along the Elkhorn River (Appendix A).

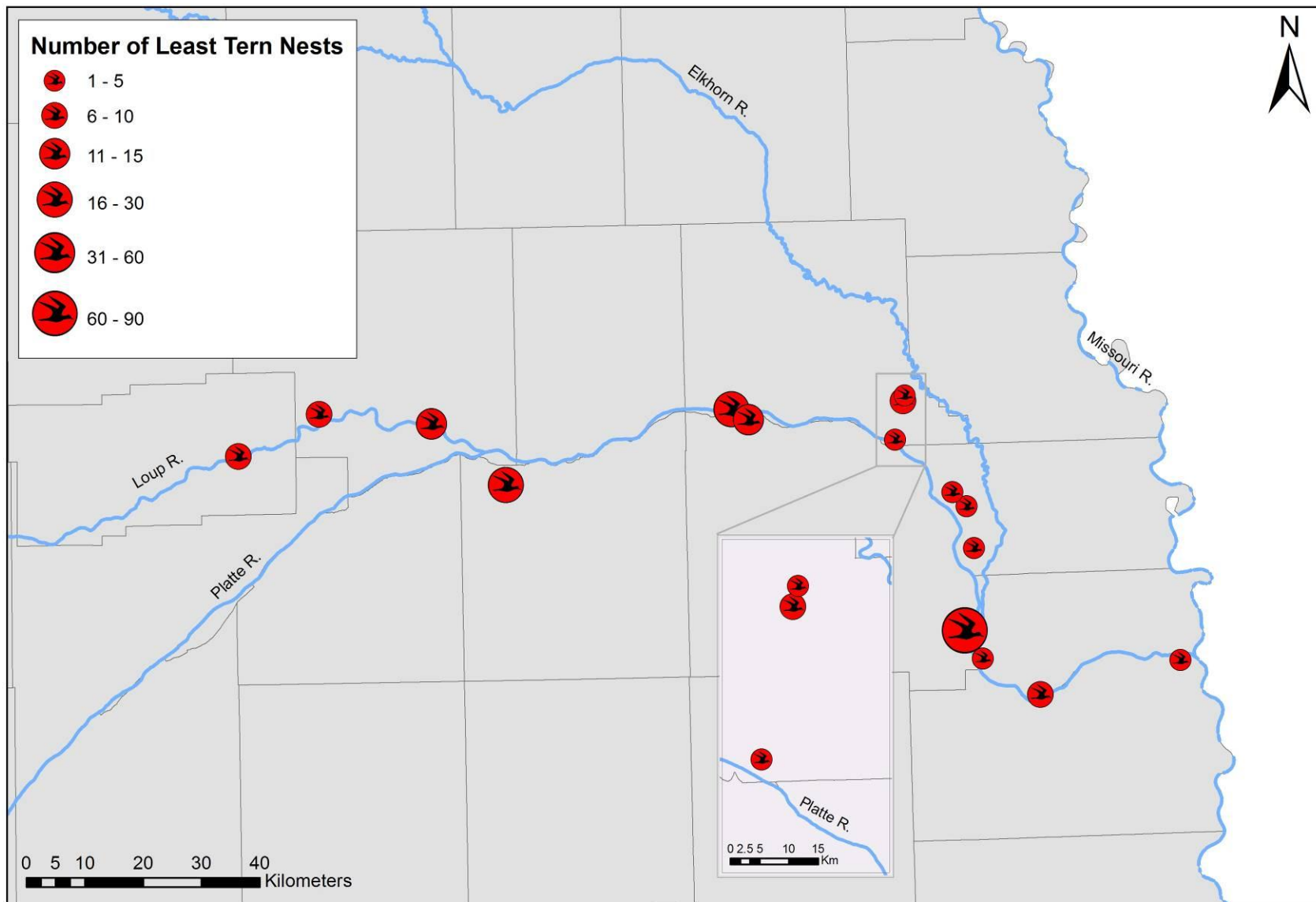


Figure 9. Location of off-river Interior Least Tern nesting colonies in the TPCP's primary study area in 2012.

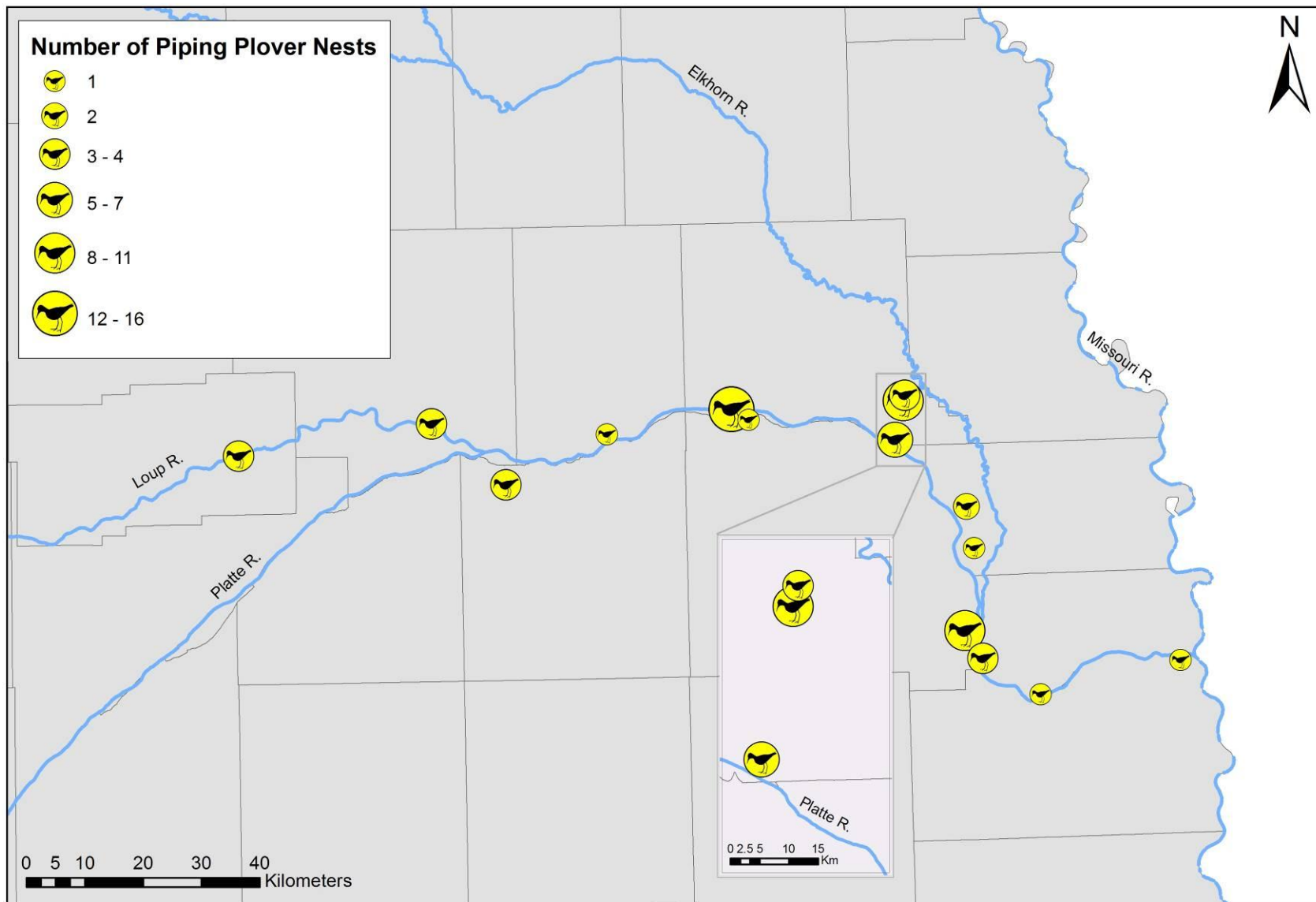


Figure 10. Location of off-river Piping Plover nesting colonies in the TPCP's primary study area in 2012.

Table 2. The number of Interior Least Tern and Piping Plover nests and chick observed at each off-river sites in the TPCP's primary study area in 2012.

2012 NESTING COLONIES ON OFF-RIVER SITES					
Off-River Site	Type	Interior Least Terns		Piping Plovers	
		# of Nests	# of Chicks	# of Nests	# of Chicks
Oreapolis	Mine	1	0	1	3
Louisville Lakes	Mine	8	8	1	3
New Linoma Beach	Mine	1	0	4	3
Sand Creek	Mine	87	30	9	10
OMG Graske Pit	Mine	4	4	1	0
Mallard Landing	Housing	4	0	2	3
New Valley	Mine	1	0	0	0
Western Fremont	Mine	2	0	6	0
NE Fremont North	Mine	4	0	4	5
NE Fremont South	Mine	9	0	8	13
Morse Bluff	Mine	12	7	1	0
Riverview Shores	Housing	24	12	15	26
Socorro Lake	Housing	0	0	1	2
Bellwood #73	Mine	17	11	4	9
Columbus #71	Mine	16	4	4	4
Genoa North	Mine	8	13	0	0
LPPD Loup Diversion	Mine	6	1	3	0
TOTAL		204	90	64	81

Table 3. The fate of Lower Platte River Interior Least Tern and Piping Plover nests on off-river sand and gravel mines and housing developments in the TPCP's primary study area in 2012.

2012 NEST FATE ON OFF-RIVER SITES				
Nest Fate	Interior Least Terns		Piping Plovers	
	Mines	Housing	Mines	Housing
Confirmed Hatched	40	7	18	10
Likely Hatched	48	5	8	1
Depredated	8	1	10	2
Weather	4	9	0	0
Abandoned	9	1	5	1
Failed (unknown)	32	1	2	3
Human/Dog Take	6	3	1	1
Undetermined	29	1	2	0
TOTAL	176	28	46	18

Table 4. The number of Interior Least Tern and Piping Plover nests at off-river sites outside of the TPCP's primary study area in 2012.

2012 NESTING COLONIES ON OFF-RIVER SITES			
Off-River Site	Type	# of Piping Plover Nests	# of Least Tern Nests
Haskell Creek	Mine	1	10
Paulsen – Gates	Mine	2	8
East Elba	Mine	4	4
Horseshoe Lake	Mine	1	4
Medelman's Lake	Mine	0	10
TOTAL		8	36

Methods: On-River Habitat

Access to on-river nesting sites differs substantially from access to off-river sites, so we took a different approach to monitoring terns and plovers nesting on midstream river sandbars. We began monitoring river conditions for the presence of sandbar habitat early in the nesting season. We conducted tern and plover surveys on the river by kayak and airboat. Kayak surveys provide the advantage of moving slowly (< 10 kph) and quietly on the river, which limits the amount of disturbance to nesting terns and plovers. Airboat surveys were conducted when the water levels were too low for kayaking.

The presence of birds foraging in the river indicated that birds might be nesting on a nearby sandbar. When a colony was located, the sandbar was thoroughly surveyed for nests. Once nests were found, we used the same nest monitoring method as for off-river nests. Nest locations were recorded with a handheld GPS unit (Garmin Oregon 550t), the number of eggs was recorded, and the eggs were 'floated' to determine the nest initiation date (H. Hays and M. LeCroy. 1971. Wilson Bulletin 83:425 – 429). Ideally, nesting colonies are visited every two to seven days to search for new nests, determine nest fate, and band chicks. Due to historically low water level conditions in 2012 we were not able to return to nesting colonies to determine nest fate. Typically, we score 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; may contain small pieces of eggshell in nest cup

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

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

Results: On-River Habitat

Historically low water levels limited our ability to conduct Interior Least Tern and Piping Plover surveys on Lower Platte River sandbars in 2012. We conducted river surveys throughout the month of June, but were unable to continue surveys in July due to very low water levels. These surveys covered river mile 0 (near Plattsmouth, Cass County) to river mile 103 (near Columbus, Platte County); some stretches were only surveyed once and some were surveyed more than once. The western section of the Lower Platte River from Columbus to North Bend was surveyed by airboat in cooperation with the U.S. Fish and Wildlife Service in late June. During the river surveys, we located 74 Interior Least Tern nests and four Piping Plover nests on Lower Platte River sandbars (Figs. 11 – 12, Table 5). We did not determine nest success because we were not able to make repeated surveys to all nesting areas. Our surveys likely detected only a proportion of the nests that actually were present on the Lower Platte River in 2012. Caution should be used when interpreting these survey results.

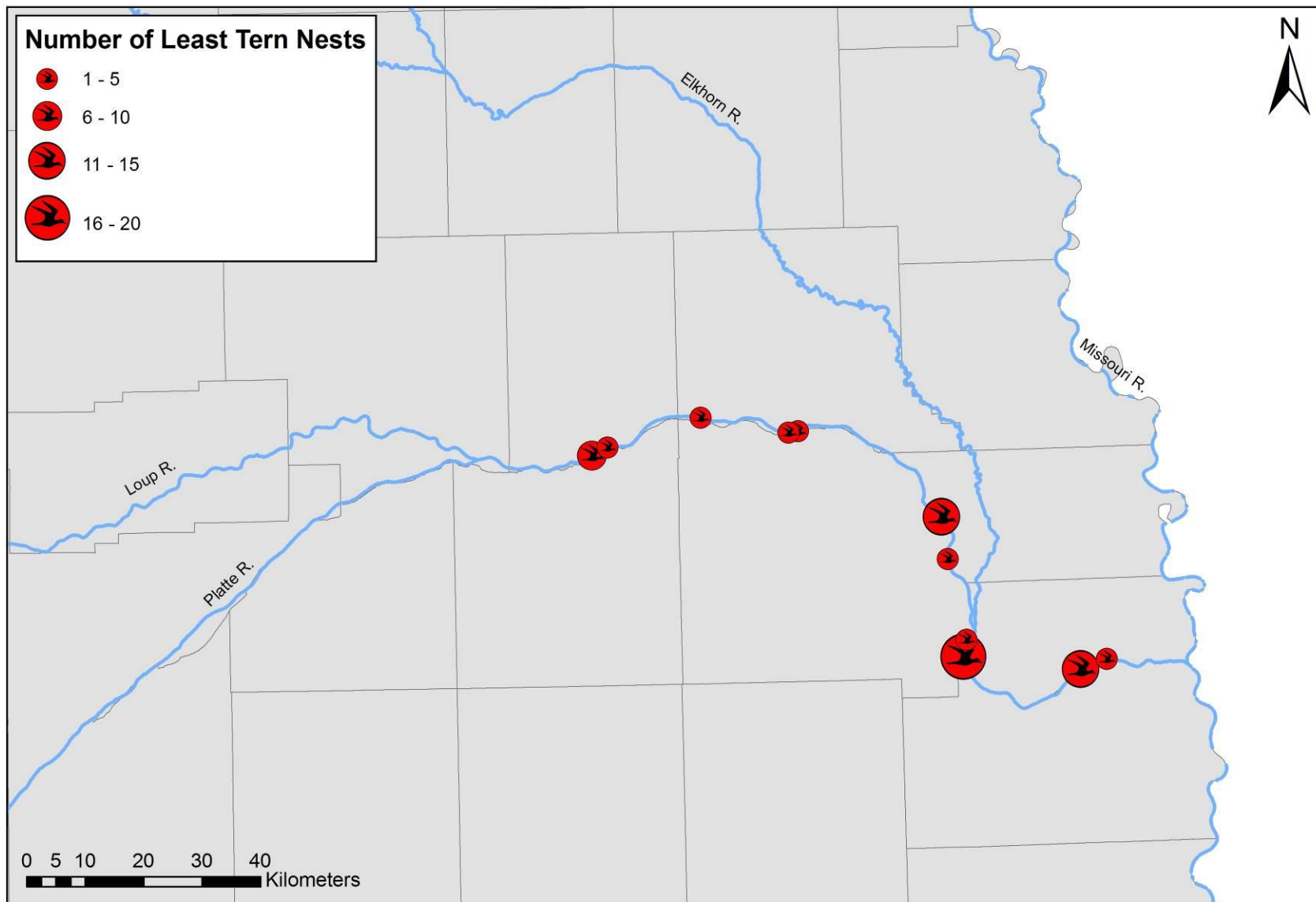


Figure 11. Location of on-river sandbars with Interior Least Tern nesting colonies in 2012.

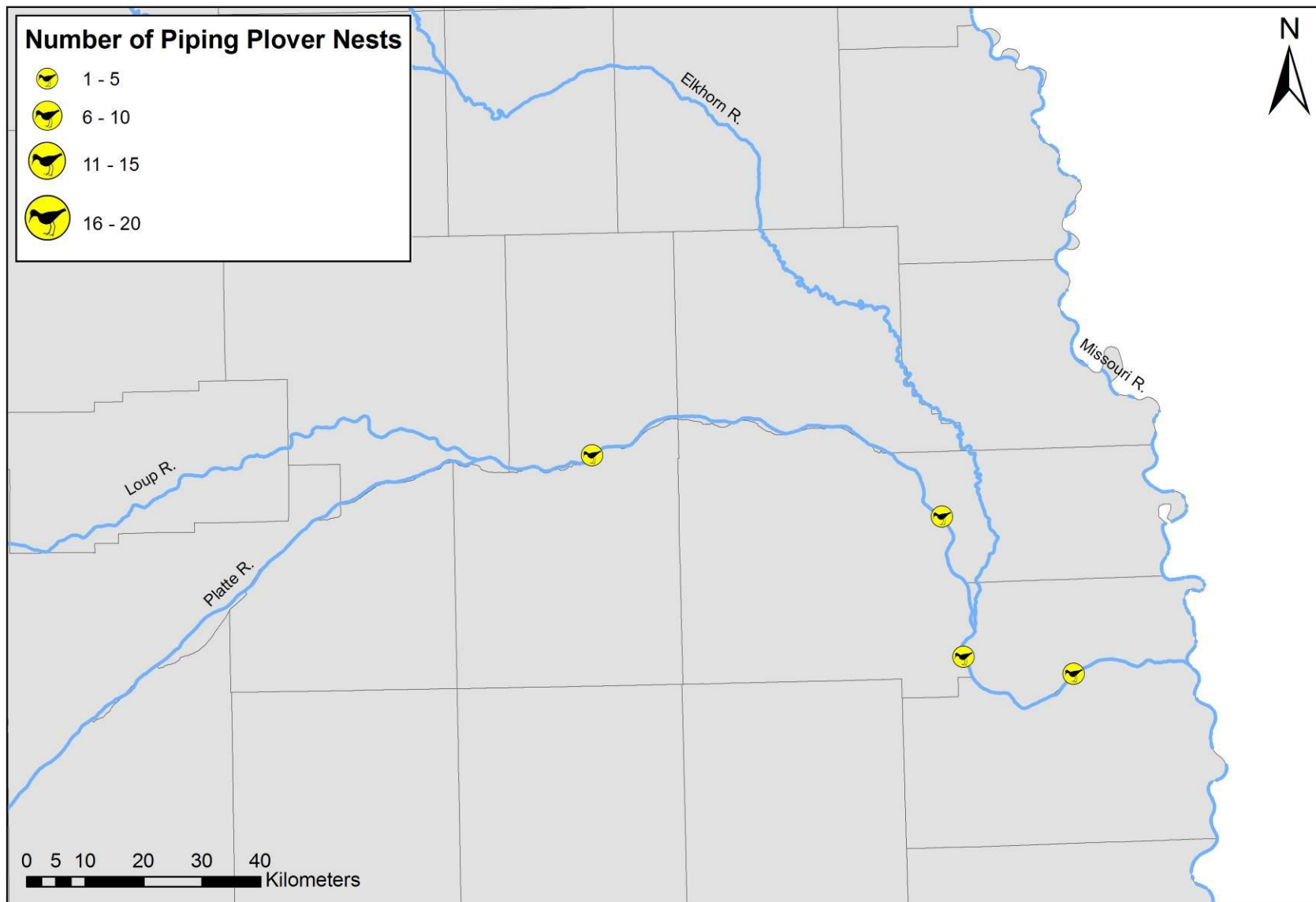


Figure 12. Location of on-river sandbars with Piping Plover nesting colonies in 2012.

Table 5. The location of Interior Least Tern and Piping Plover nesting colonies and the number of nests in each colony found on Lower Platte River sandbars in 2012.

2012 NESTING COLONIES ON RIVER SANDBARS			
River Sandbar	River Mile	# of Interior Least Tern Nests	# of Piping Plover Nests
Gun Club Sandbar	9	4	0
West Cedar Creek Sandbar	13	0	1
East Cedar Creek Sandbar	12	15	0
North Camp Ashland Sandbar	29	18	1
River Mile 31 Sandbar	31	1	0
Two Rivers Sandbar	41	5	0
River Mile 46 Sandbar	46	13	1
River Mile 66 Sandbar	66	6	0
River Mile 77 Sandbar	77	4	0
River Mile 88 Sandbar	88	1	0
River Mile 90 Sandbar	90	7	1
TOTAL		74	4



Research

Estimating Survival Rates

Accurately estimating demographic parameters, such as daily and seasonal survival probabilities for individual birds and nests, will lead to a better understanding of local and regional population dynamics of Interior Least Terns and Piping Plovers. This will allow us to develop and implement effective management strategies for these two species. In 2012, we continued to improve 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 the 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 2012 were the same as those used in previous four years. Out of concern for the birds' safety, we used a simple box trap placed over the nest for capture (Fig. 13). Box traps have no moving parts, so the 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, or 2012.



Figure 13. 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.

Each Piping Plover, adult and chick, received an individually-numbered metal USGS band (size 1A) on one upper leg (Fig. 14). On the opposite upper leg, each bird received a light blue flag; the light blue color indicates that the bird was banded in Nebraska along the Platte River (light blue flags are placed on plovers along the Lower Platte River and Central Platte River). Plovers banded along the Lower Platte River receive light blue flags that are “half length” and not crimped when placed on the bird’s leg. On one lower leg, each bird received a unique combination of two different color bands (black, gray, green, red, yellow and occasionally orange) indicating its individual identity. On the opposite lower leg, each bird received two color bands in one of four combinations (yellow over gray, yellow over red, black over gray, or yellow over green); these color combinations indicate that the bird was banded at a Lower Platte River off-river site in 2012.

We did not band any adult Interior Least Terns along the Lower Platte River in 2012. However, the Virginia Tech University tern and plover research group working along the Missouri River recaptured two adult Interior Least Terns that were originally banded as chicks in our Lower Platte River study area. One tern found nesting at Lewis and Clark Lake in 2012 was originally banded as a chick on a Lower Platte River sandbar in Sarpy County on 19 July 2008. The other tern found nesting along Gavin’s Point Reach in 2012 was originally banded as a chick at an active sand and gravel mine near Ashland, Saunders County on 1 July 2010. After banding over 500 Interior Least Tern chicks over the past five years, these are the first documented recoveries of Lower Platte River tern outside of the Lower Platte River study area.

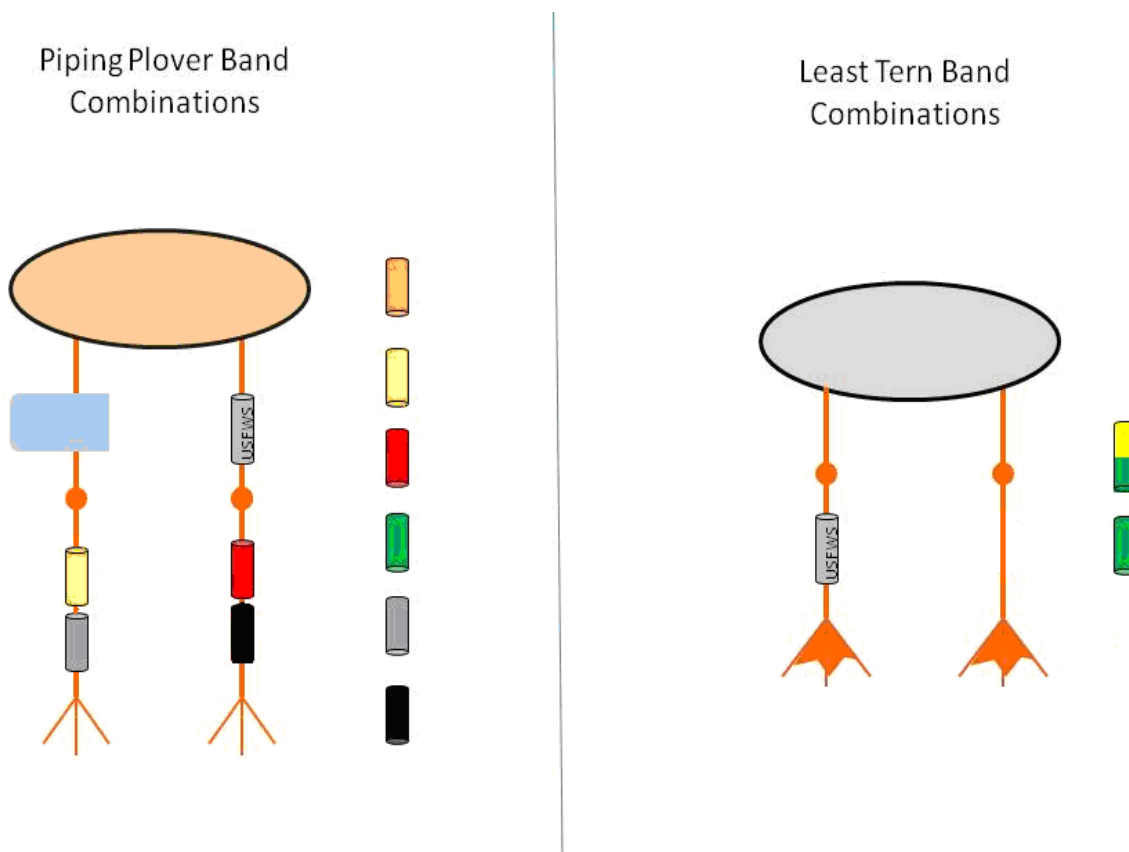


Figure 14. Diagram illustrating the color banding scheme used with Piping Plovers and Interior Least Terns in the Lower Platte River focus area. The flags, color bands, and metal bands may be on either leg and plover color combinations vary.

After banding adult Piping Plovers, we measured the mass of each individual by placing the bird in a cloth bag and suspending it from a Pesola™ scale ($\pm 0.3\%$ accuracy). We took the following morphological measurements for every adult plover we captured: 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. Each measurement was taken twice so a “repeatability index” could be calculated. We calculated a composite metric of all measurements (the geometric mean) to provide an index of each bird’s overall size. The left and right sides of each bird were measured so a measure of 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 over-wintering habitat for birds; better foraging habitat provides better over-wintering survival, nutrition and health for nesting birds.

We captured Piping Plover chicks at off-river sites by picking them up from the sand or from their nests. Plover chicks’ legs are long enough that we were able to color band them using the same protocol as we did with adult plovers. We measured each chick’s body mass by placing chicks on 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 plover chicks.

We captured Interior Least Tern chicks at off-river sites by picking them up from the sand or from their nests. Tern chicks’ legs are very short, so we only put an individually-numbered USGS band (size 1A) on each bird’s lower right leg (Figure 14). In previous years tern chicks also received a single (green or yellow/green split band) colored band on their opposite lower leg. We measured each tern chick’s body mass by placing chicks on a digital scale (Ohaus® SP401) that was accurate to ± 0.1 gram. We did not take any morphological measurements of tern chicks. In 2012, tern chicks were not banded on river sandbars due to the low water levels which prevented us from getting out on the river in July.



Daily and Seasonal Survival Analyses

After individual Interior Least Tern and Piping Plover nests were located, we monitored them throughout the nesting season (see Monitoring section for details). We used information from this nest monitoring dataset to calculate daily and seasonal nest survival probabilities. After banding individual terns and plovers, we attempted to re-sight them as frequently as possible. Upon re-sighting we noted where they were seen, which birds they were seen with, and what they were doing. 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 (G.C. White and K.P. Burnham 1999. Bird Study 46: S120 – S139). We used the general methods of J.D. Lebreton et al. (Ecological Monographs 1992. 62: 67 – 118), K. P. Burnham and D. R. Anderson (2002. Model Selection and Multimodel Inference: a Practical Information-Theoretic Approach 2nd edition, New York: Springer), and S.J. Dinsmore and J.J. Dinsmore (Studies in Avian Biology 2007. 34: 73 – 83). Model fit for each analysis was assessed by the AIC (Akaike's Information Criterion); the model with the lowest AIC was considered the model that best fit the data.

Nest Survival Analysis

We used data from nest monitoring (see Monitoring section) to analyze nest survival. Nest survival probabilities were calculated using the nest-survival utility in Program MARK. We constructed encounter histories by summarizing the day each nest was found (k), the last day the nest was found active (l), the last day the nest was checked for activity (m), and the fate of the nest (f). Due to small sample sizes we did not include any covariates in our model and assumed constant survival across the season.

Within Year Individual Survival Analysis

Individual encounter histories were constructed for all terns and plovers that were captured, recaptured or observed at off-river sites throughout the nesting season. We used this data to determine the probability of Piping Plover adults and chicks and Interior Least Tern chicks surviving the 2012 nesting season. All adult plovers included in this analysis were color-banded along the Lower Platte River, Missouri River, or the U.S. Gulf Coast. All plover and tern chicks included in this analysis were produced and banded along the Lower Platte River study area.

We did not include any covariates in the models. We tried 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

Individual encounter histories have been constructed for all plovers that have been captured, recaptured, or observed in our Lower Platte River study area from 2008 through 2012. We used this data to determine the probability of Piping Plovers surviving from one year to the next. We do not yet have enough re-sightings of Interior Least Terns to consider them in this type of analysis.

Growth Curve Analysis

Our growth curve analysis for 2012 included only Piping Plover and Interior Least Tern chicks that were produced at off-river sites. All tern and plover chicks were banded and weighed when they

were first encountered. They were re-weighed every time they were subsequently encountered. In cases where the chick was banded while still in or very close to the nest, we were able to 'age' them based on the nest's known hatching date. If chicks were banded after they left the nest, we estimated their age from an age-based time series of photographs.

Statistical Analysis

All statistical analyses were performed using either SAS (SAS Institute. 2004. SAS/STAT User's Guide, Version 9.1. SAS Institute, Cary, NC) or Prism (GraphPad Prism, Version 3.00 for Windows, Graph Pad Software, San Diego, CA). 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

At the off-river sites we captured and banded 11 Piping Plover adults and 73 plover chicks. We re-sighted 22 adult plovers that we had banded along the Lower Platte River in 2008, 2009, 2010, or 2011, 13 adult plovers that were banded along the Missouri River (green flags), and five adult plovers that were banded along the U.S. Gulf Coast after the Deep Horizon oil spill (green flags and cobalt blue bands).

At the on-river sites we re-sighted one adult Piping Plover that was originally banded along the Lower Platte River (light blue flag), and two adult plovers that were banded along the Central Platte River (crimped light blue flag). We did not band any plover chicks on river sandbars in 2012.

At the off-river nesting sites we captured and banded 76 Interior Least 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 near Valley, Douglas County. We did not recapture this bird so we do not know when or where it was originally banded.

At the on-river sites we did not band any Interior Least Tern chicks in 2012.

Daily and Seasonal Survival

Piping Plover Nest Survival

We based our calculation of Piping Plover nest survival on a population of 62 nests located at off-river sites (18 at lakeshore housing developments and 44 at sand and gravel mines). We did not include the two plover nests that had an undetermined nest fate in this analysis. Overall, off-river plover nests in 2012 had an apparent daily survival probability of 0.9685 ± 0.0052 . When those daily survival probabilities are extended over the 28-day incubation period, off-river plover nests in 2012 had an apparent seasonal survival probability of 0.4081 ± 0.0617 . The nests at lakeshore housing developments had a daily survival probability of 0.9716 ± 0.0084 and a seasonal survival probability of 0.4463 ± 0.1093 . While the nests at sand and gravel mines had a daily survival probability of 0.9657 ± 0.0067 and a seasonal survival probability of 0.3762 ± 0.0731 .

We place protective exclosures around 42 of the 62 off-river Piping Plover nests. We found that the nests with protective exclosures around them had a higher daily and seasonal survival probability than those nests without protective exclosures. The nests with protective exclosures around them had a daily survival probability of 0.9706 ± 0.0059 and a seasonal survival probability of 0.4336 ± 0.0745 ; while the nests that did not have protective exclosures around them had a daily survival

probability of 0.9463 ± 0.0174 and a seasonal survival probability of 0.2132 ± 0.1053 . See Figure 15 for a graphical illustration of the daily and seasonal survival probabilities of plover nests at off-river sites in 2012.

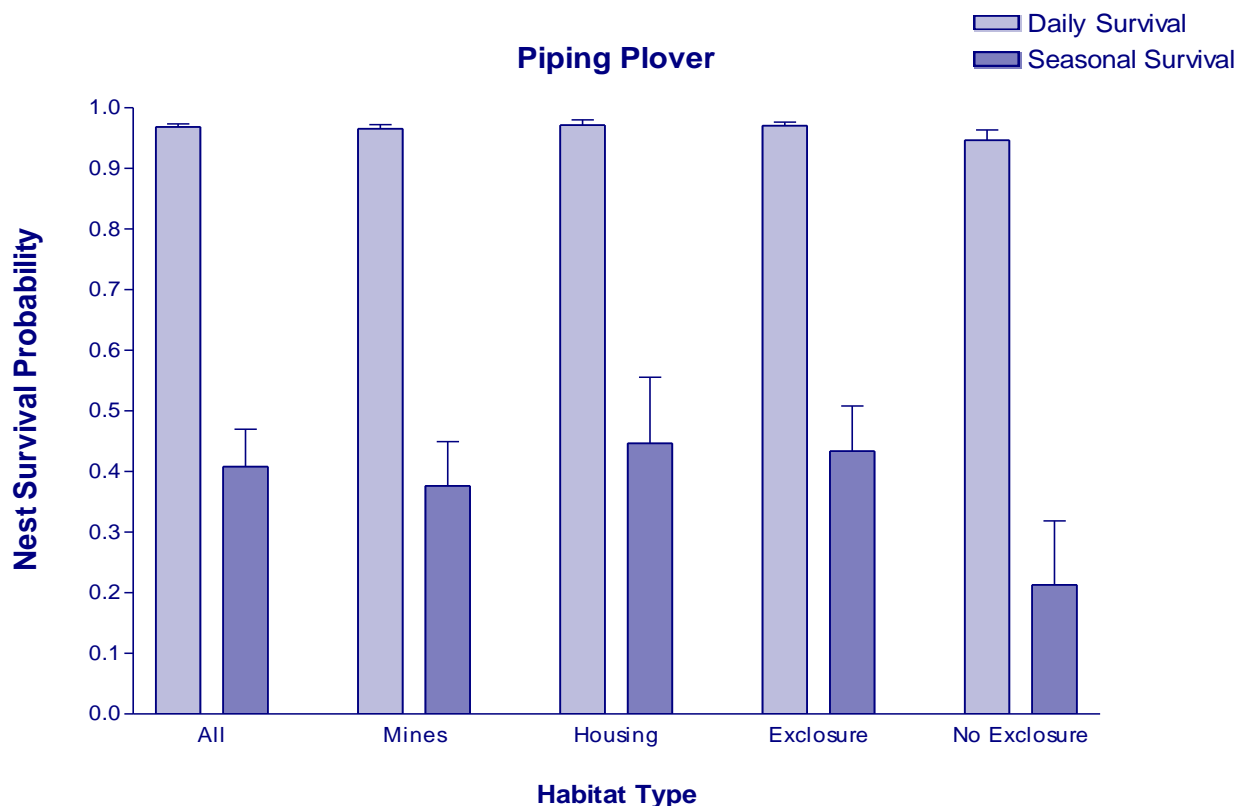


Figure 15. Daily and seasonal survival probabilities of Piping Plovers nests on off-river sites in 2012.

Interior Least Tern Nest Survival

For the off-river Interior Least Tern nests, we based our calculation of nest survival on a population of 174 nests (27 at lakeshore housing developments and 147 at sand and gravel mines). We did not include the 30 tern nests that had an undetermined nest fate in this analysis. In 2012, off-river tern nests had an apparent daily survival probability of 0.9714 ± 0.0034 . When the daily survival probability is extended over the 21-day incubation period, tern nests had an apparent seasonal survival probability of 0.5437 ± 0.0440 . We estimate that tern nests at lakeshore housing developments had an apparent daily survival probability of 0.9592 ± 0.0036 and an apparent seasonal survival probability of 0.4170 ± 0.0923 . We estimate that tern nests at sand and gravel mines had an apparent daily survival probability 0.9733 ± 0.0036 and an apparent seasonal survival probability of 0.5665 ± 0.0493 (Fig. 16). Due to the inaccessibility of many nests, we did not calculate nest survival for on-river tern nests in 2012.

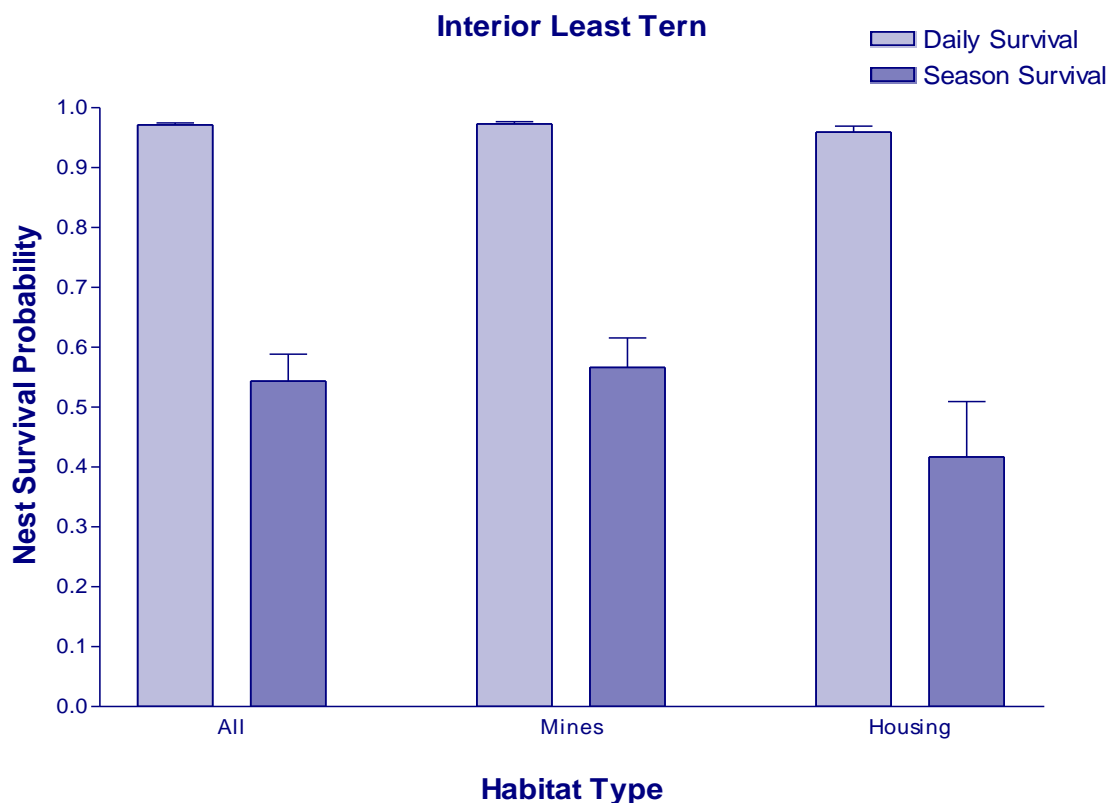


Figure 16. Daily and seasonal survival probabilities of Interior Least Tern nests on off-river sites in 2012.

Within Year Individual Survival

Based on our population of color-marked adult Piping Plovers, the apparent daily survival probability for adult plovers nesting at off-river sites was 0.9618 ± 0.0080 . When that daily survival probability is extended over the 28-day incubation period, adult plovers nesting on off-river sites had an apparent survival probability of 0.3360 ± 0.0776 (Fig. 17). The apparent daily recapture probability for adult plovers was 0.1269 ± 0.0129 .

Based on our population of color-marked Piping Plover chicks, the apparent daily survival probability for plover chicks reared at off-river sites in 2012 was 0.9265 ± 0.0406 . When that daily survival probability is extended over the 28-day fledging period, plover chicks at off-river sites had an apparent seasonal survival probability of 0.1179 ± 0.1331 in 2012 (Fig. 17). The apparent daily recapture probability for plover chicks was 0.0338 ± 0.0121 .

Based on our population of banded Interior Least Tern chicks, the apparent daily survival probability for birds reared on off-river sites was 0.6786 ± 0.02716 in 2012. When that daily survival probability is extended over the 21-day fledging period, tern chicks at off-river sites in 2012 had an apparent survival probability of 0.0003 ± 0.0001 (Fig. 17). The apparent daily recapture probability for tern chicks at off-river sites in 2012 was 0.0142 ± 0.0175 .

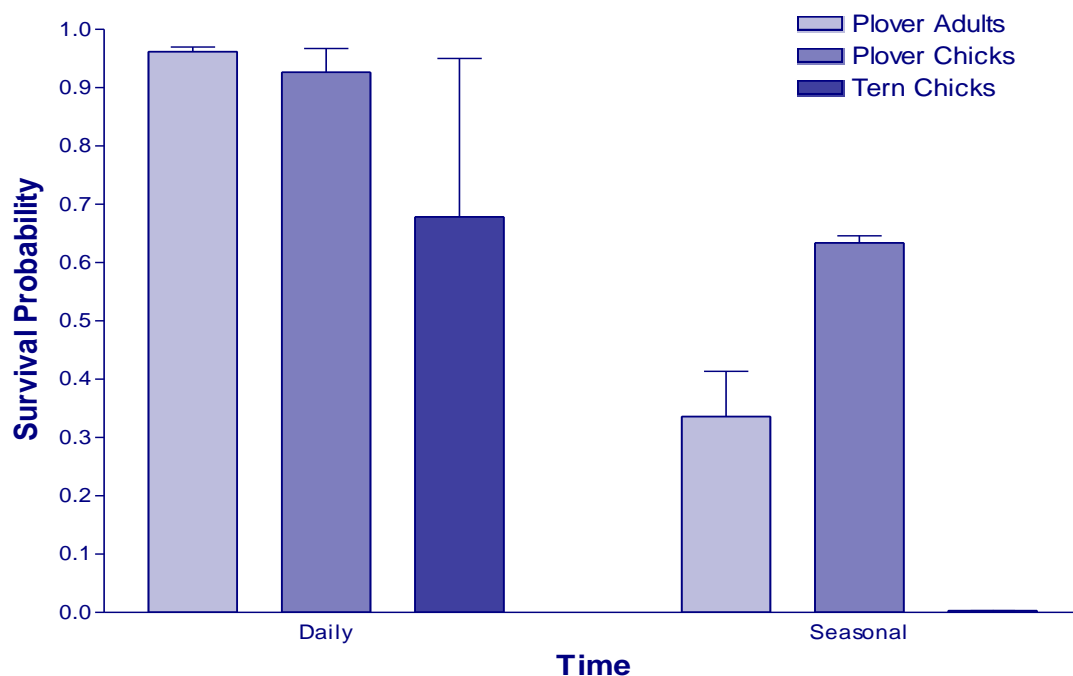


Figure 17. Piping Plover and Interior Least Tern within year daily and seasonal survival probabilities on off-river sites in 2012.

Between Year Individual Survival

Based on our data of banded Piping Plovers that have been re-sighted along the Lower Platte River focus area from 2008 to 2012, the apparent annual survival probability is 0.7163 ± 0.0605 and the annual recapture probability is 0.6362 ± 0.0803 (Fig. 18).

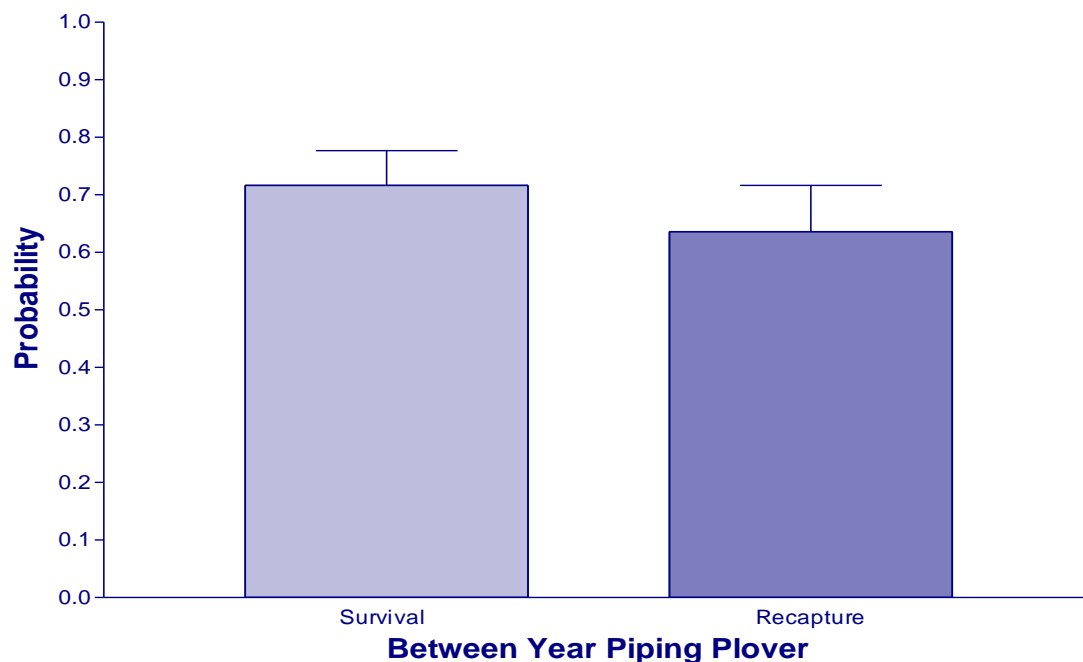


Figure 18. 2008 to 2012 Piping Plover between year survival and recapture probabilities.

Growth Curves

We based the calculation of our Piping Plover and Interior Least Tern growth curves on our population of banded plover and tern chicks produced at off-river sites in 2012. The regression line that best fit our 2012 plover chick data is similar to that of 2010 and 2011, and shows that plover chicks grew at a fairly constant rate until fledging, in contrast to 2008 and 2009 when they grew rapidly for the first two weeks of life and then less rapidly until they fledged (Fig. 19). The regression line that best fits our 2012 tern chick data shows that tern chicks reared on off-river sites grew more rapidly as they were younger than when they got closer to fledging (Fig. 20).

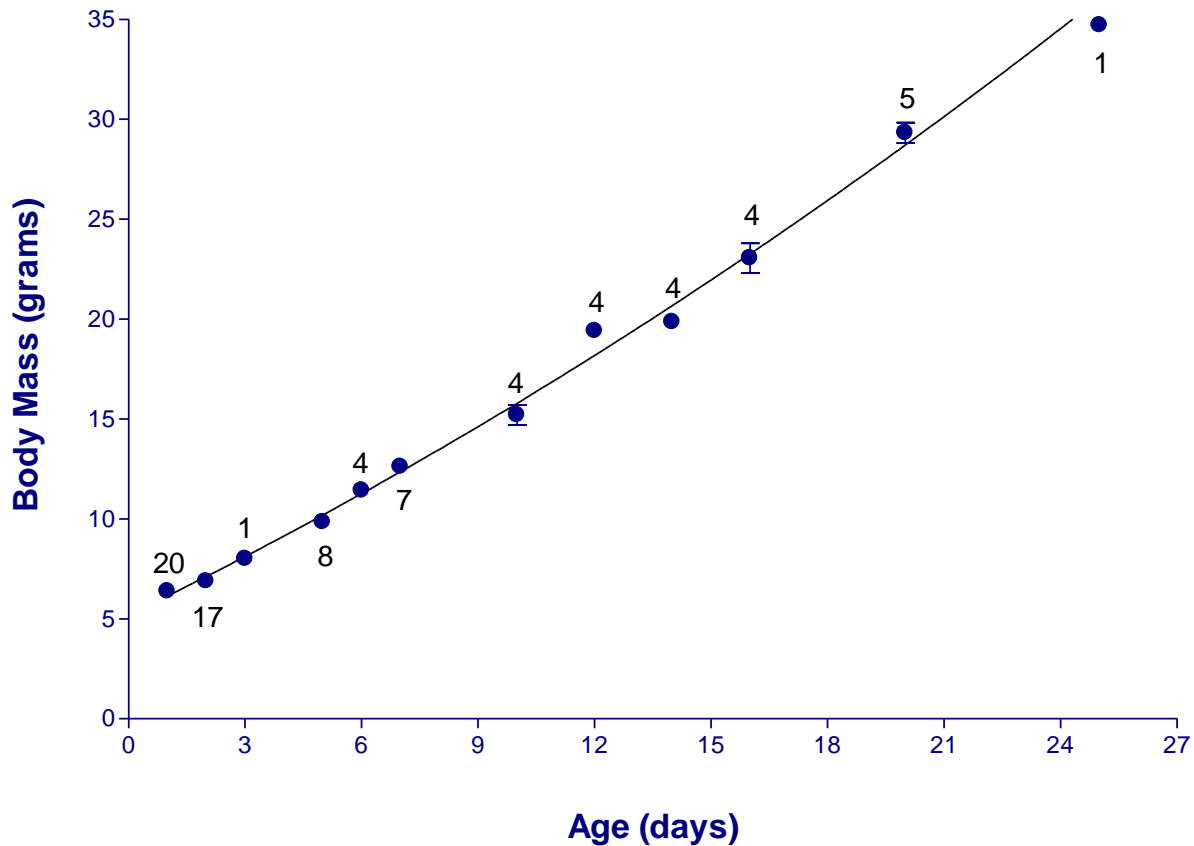


Figure 19. Growth rate of Piping Plover chicks reared on off-river sites in 2012. The graph shows the data represented as mean mass, standard error and sample size (number of individuals weighed at each age).

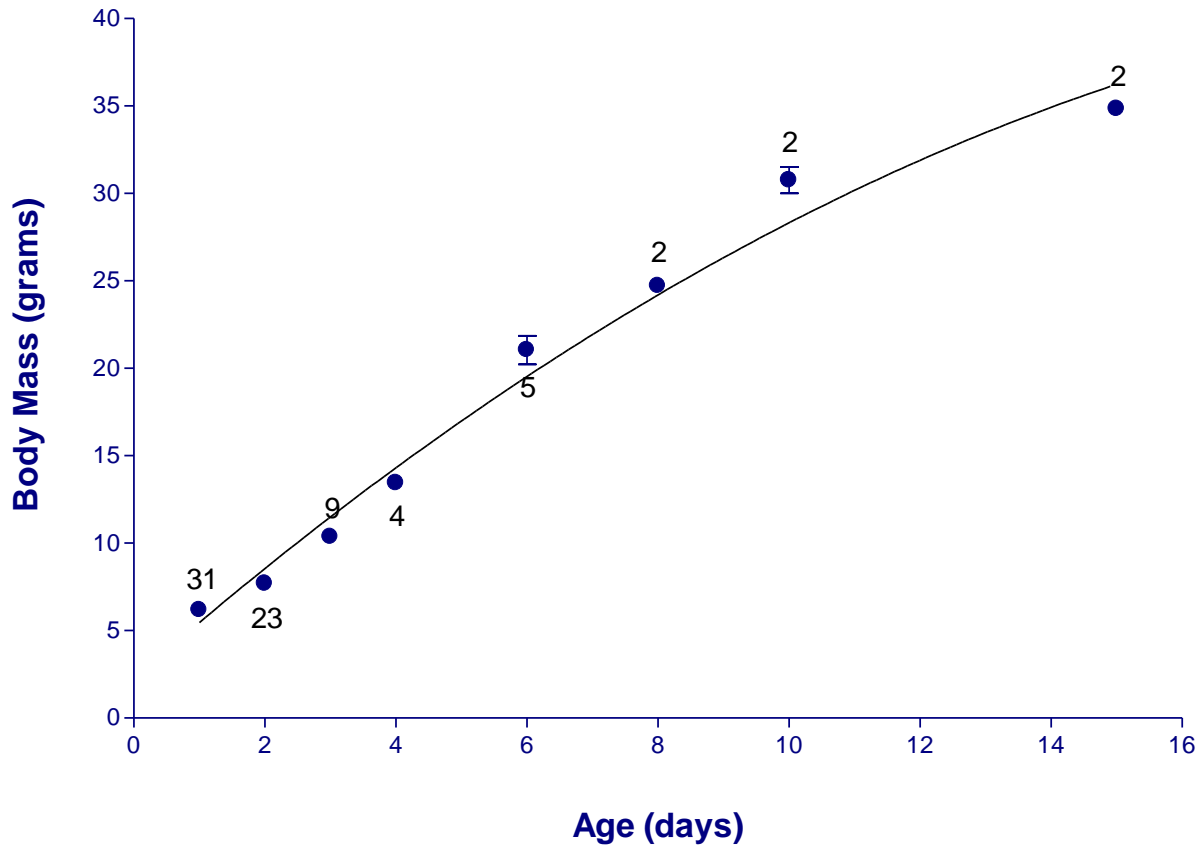


Figure 20. Growth curve of Interior Least Terns chicks reared on off-river sites in 2012. The graph shows the data represented as mean mass, standard error and sample size (number of individuals weighed at each age).

Identification of Lice and Fish

Piping Plovers are the avian host for four species of louse. We collected two adult lice from an adult plover at a sand and gravel mine in Columbus, Platte County on 30 May 2012. The lice were both identified as Ischnocera: Philopteridae: *Quadriceps macrocephalus*. Matt Paulsen, the Entomology Collection Manager in the UNL Museum and Robert C. Dalgleish from the Department of Entomology at the San Diego Natural History Museum, San Diego, CA, identified the lice. This is the same species of lice that was found on a plover chick along the Lower Platte River study area in 2009.

We also collected one dead fish we found near an Interior Least Tern nests. This fish was identified as a larval buffalo fish (2 inches in length, *Ictiobus* sp.). In previous years, we collected larval gizzard shad (1 inch or less in length, *Dorosoma cepedianum*), red shiner (2 inches or less in length, *Cyprinella lutrensis*), emerald shiner (2 inches or less in length, *Notropis atherinoides*), and sunfish (2 inches or less in length, Family Centrarchidae). We assume that these fish represent a sample of the Lower Platte River tern diet. Fish identifications were made by Mark Pegg and Kevin Pope (UNL SNR).

Management

The Tern and Plover Conservation Partnership uses a voluntary, proactive approach to avoid human-bird conflicts and to reduce the need for law enforcement actions in Interior Least Tern and Piping Plover management.

Before terns and plovers returned to Nebraska and the field season began, TPCP met with the production and land managers of all area sand and gravel mines. We discussed the mining companies' production plans for the season, safety regulations, and site access. We paid particular attention to concerns mine personnel had regarding previous on-site activities of the TPCP and changes to federal MSHA (Mine Safety and Health Administration) policy as it applies to non-mine personnel. We also met with homeowners' associations at the lakeshore housing developments. At these meetings, we discussed the construction plans for the area and site access. We paid particular attention to property owners' concerns regarding previous on-site activities of the TPCP.

The result of these meetings was a set of site-specific management and monitoring plans; an equally valuable result was becoming acquainted with the people living and working at these sites. This made our management efforts easier to implement as the season progressed. We maintained close contact with these individuals throughout the season, so we could respond to any on-site changes that developed.

Protecting Interior Least Tern and Piping Plover Nests

In order to protect Interior Least Tern and Piping Plover nests, we placed "Keep Out" signs around the perimeter of all off-river nesting areas; these signs were designed in 2008 by the TPCP and are being 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 were added. These barriers consisted of black cord tied between all of the "Keep Out" sign posts; we tied red-silver Mylar™ streamers to the cord to make it more visible.

Based on conversations with mine production managers and homeowners' associations before the nesting season began, we mapped out the areas where it would be best if the terns and plovers did not nest. These were areas within the mine property that were going to be dredged during the nesting season or where heavy equipment was going to be operating. At lakeshore housing developments these were areas where buildings were to be constructed or utilities were to be installed. We know that terns and plovers prefer not to nest in areas where the substrate is disturbed by raking, where there is any surface vegetation, where the substrate particle size is unattractive to the birds or where there is any physical disturbance (J. Marcus, J. Dinan, R. Johnson, E. Blakenship, and J. Lackey 2007. *Waterbirds* 30: 251 – 258). Planting vegetation, resurfacing the sand, and raking the substrate are labor intensive, so we usually opt for the physical disturbance method of discouraging birds from nesting in an area. In areas where we did not want the birds to nest, we put up grids of three-foot-tall poles with 16-foot-long streamers of red-silver Mylar™ flagging attached to them. The poles are set about 16 feet apart. When the streamers blow in the wind, they make a crackling sound and sweep the ground, which discourages the birds from attempting to nest in the area.

We placed protective wire mesh nest exclosures around 43 off-river Piping Plover nests; the remaining 21 nests did not have exclosures. These exclosures help to protect plover nests from both human disturbance and natural predation. We did not put any exclosures around Interior Least Tern nests; however, we did place protective boundaries around tern nesting colonies that were in areas with considerable human activity. We did this by placing a ring of rebar poles around

the nesting area; black cord 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.

Other Management Projects

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 initiated a cooperative project to clear vegetation from sandbars in the Lower Platte River (river mile 0 – 103). In late summer 2011 and 2012, weedy vegetation on sandbars was sprayed with herbicide using GIS controlled helicopter sprayers (SkyCopters, Ulysses, KS) and handheld sprayers. Winter ice jams and high spring flows are expected to overtop the sandbars and remove any standing, dead vegetation, which should make the sandbars more attractive to nesting terns and plovers.

Loup Public Power District – Federal Energy Regulatory Commission relicensing project

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 Federal Energy Regulatory Commission (FERC) 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.

MSHA (Mine Safety and Health Administration)

In 2012, the TPCP delivered presentations on terns and plovers to the MSHA training sessions for Lyman-Richey and Central Sand and Gravel employees.



Outreach

A critical part of our mission to protect Interior Least Terns and Piping Plovers involves outreach. 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 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 every opportunity to reach as many different constituencies as possible with our message of common-sense conservation.

Essential to the mission of the Tern and Plover Conservation Partnership is the continued growth of our outreach program. The number of adults and children that we are able to reach across the state has grown substantially over the past five years (Figs. 22 – 23). The TPCP is now one of the go-to programs in Nebraska's environmental education community. The TPCP has evolved from being an organization that needed to seek out events to participate in to one that receives a continuous stream of requests for participation. It is very gratifying for us to meet people who know what the TPCP does and who commend us for our work.

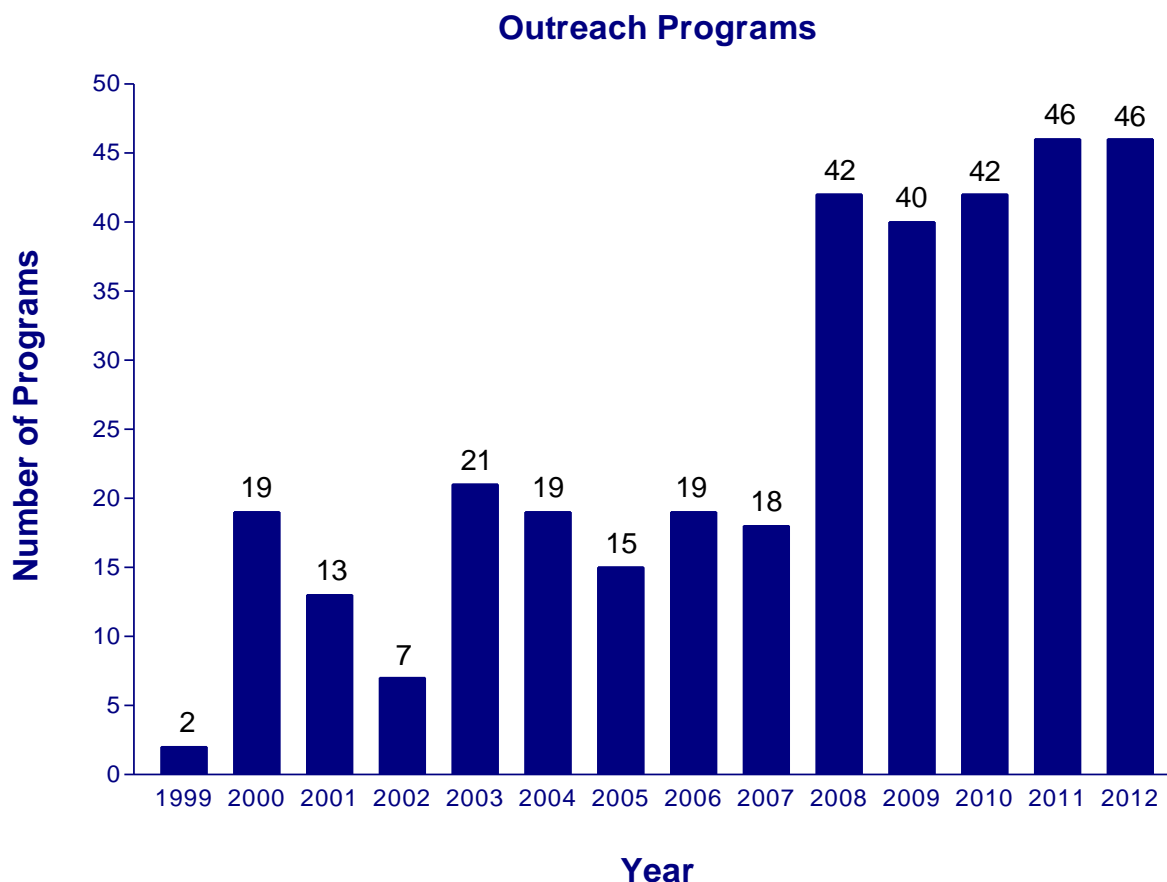


Figure 22. The number of programs delivered by the TPCP each year from 1999 to 2012. This only includes scheduled programs; we frequently deliver impromptu presentations.

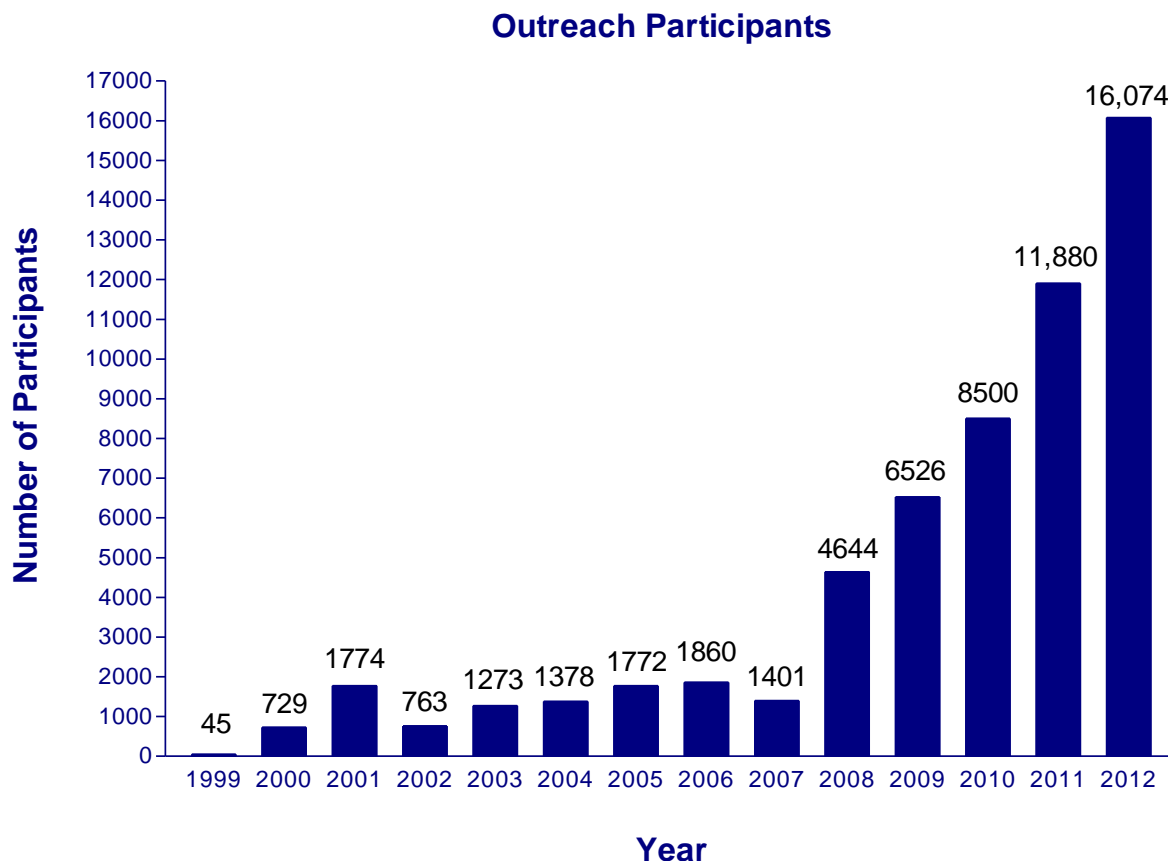


Figure 23. The number of participants that have participated in TPCP programs each year from 1999 to 2012. This only includes participants at scheduled programs; we frequently deliver impromptu presentations.

Outreach Projects

TernCam

Five Nines Technology Group (Aaron Clark) of Lincoln, NE and Ben Wheeler (NGPC) helped us maintain “TernCam” based at a sand and gravel mine near Ord, NE in 2012; the video streams over the TPCP web page. In 2012, the camera was focused on a tern nest where one of the attending adults was wearing color bands put on by Jennifer Stucker of the USGS in Jamestown, ND.

SwallowCam

The TPCP worked in cooperation with Michael Forsberg, Jeff Dale, NET and the Platte River Time-Lapse Project (<http://plattebasintimelapse.com>), to place a streaming video camera on the Lied Hiker-Biker Trail Bridge over the Lower 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 down the river to the west (the view includes potential tern and plover nesting sandbars). The video will stream over the TPCP web page.

ChimneySwiftCam

The TPCP is working with Michael Forsberg, Jeff Dale, Nebraska Educational Television, the Lincoln Public Schools and Irving Middle School in Lincoln, NE, to place several cameras at Irving Middle School that supports a nesting and migratory roosting colony of Chimney Swifts. The video will stream over the TPCP web page. Students at Irving Middle School 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.

Outreach Programs

Programs for the General Public

Becoming an Outdoors Woman (BOW), Halsey, NE
Bird EnCOUNTers at the Library, Lincoln, NE
Bluebirds across Nebraska, Kearney, NE
Calvert Family Nature Nights, Lincoln, NE
Cavett Family Nature Nights, Lincoln, NE
Conestoga Family Nature Nights, Murray, NE
Council Bluffs Home Show, Council Bluffs, IA
Dimensions Family Nature Nights, Lincoln, NE
Durham-Smithsonian Museum Teacher’s Night Out, Omaha, NE
Earth Day Celebration at Antelope Park, Lincoln, NE
EarthWellness Festival, Lincoln, NE
Fremont Eco-Fair, Fremont, NE
Hill Family Nature Nights, Lincoln, NE
Holmes Family Nature Nights, Lincoln, NE
Lake McConaughy Audubon Christmas Bird Count, Ogallala, NE
Lakeview Family Nature Nights, Lincoln, NE
Lower Platte River Corridor Alliance Kayak Tour, Leshara, NE
Meadowlane Family Nature Nights, Lincoln, NE
Migration of the Sandhills Cranes: a World Class Experience Elderhostel, Kearney, NE
NGPC Expo, Ponca, NE
Pioneers’ Park Nature Center Bird Banding, Lincoln, NE
Prescott Family Nature Nights, Lincoln, NE
Rivers and Wildlife Celebration Wild Experience Room, Kearney, NE
Riley Family Nature Nights, Lincoln, NE
Rowe Audubon Sanctuary Bird Banding, Gibbon, NE
The Big Year movie premiere, Grand Theater, Lincoln, NE
Wachiska Audubon Christmas Bird Count, Lincoln, NE
Wachiska Audubon Society, Lincoln, NE
Wahoo Bird Club, Wahoo, NE

Homeowners' Associations

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

University of Nebraska-Based Education Programs

Career Day at School of Natural Resources
Center for Great Plains Studies
IANR 150 Years of the Land Grant Mission-Life Sciences
NaturePalooza at Morrill Hall
Nebraska Master Naturalist
OLLI (Osher Lifelong Learning Institute) Seminar
SNR Applied Ecology Seminar
SNR Summer Nature Camp
SNR Fall Outreach Seminar
SNR Weatherfest
Women in Science Weekend (for Nebraska secondary school students)

Education-Curriculum Development Activities

Informal Educators of Lincoln Network
Iowa Western Community College Environmental Studies
National Institutes of Health-Science Education Partnership Award (through University of Nebraska Medical Center)
Nebraska Alliance of Conservation and Environment Educators
Nebraska Bird Library
Project BEAK

Conferences

Atlantic Coast Piping Plover Workshop, Shepherdstown, WV
Range-wide Interior Least Tern Workshop, St. Louis, MO
Nebraska Natural Legacy Project Conference, Conservation Café and Bird Symposium (Grand Island and North Platte, NE)
Northern Great Plains Piping Plover meeting, Omaha, NE
River Summit, LPRCA, Fremont, NE
Wilson Ornithological Society, Tucson, AZ and Buffalo, NY

Professional Committees and Workgroups

Conservation and Science Advisory Workgroups, Nebraska Bird Partnership
Steering Committee, Nebraska Bird Partnership
Lower Platte River Weed Management Area
Nebraska Environmental Trust Technical Advisory Committee
PACE (Planning, Aggregate, Community, Environment)
Rivers and Wildlife Celebration Committee
University of Nebraska SNR Managers and Staff Advisory Committees

Miscellaneous Outreach Activities

Earth2Lincoln: Volunteer Chris Thody hosts this 30-minute talk show on Lincoln's KZUM community radio. Guests included Caroline Hinkleman (NGPC) and Karie Decker (Nebraska Invasive Species Project)

Nebraska State Fair 4-H: The TPCP helped coordinate and participated in judging the 4-H Wildlife and Conservation exhibits at the Nebraska State Fair in Grand Island, NE.

Display in the Rotunda of the Nebraska State Capital: celebrating the 20th anniversary of the Nebraska Environmental Trust, Lincoln, NE.

Harry Hann Lecture in Ornithology and Harry Hann Lecture in Research: presented at the University of Michigan Biological Station, Pellston, MI.

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

Data Sharing Agreement: completed a data sharing agreement (primarily Piping Plover color-band recovery data) with NGPC and Virginia Tech University researchers.

Featured in the Media

"Fourth-graders learn about a variety of different topics at Eco-Fair", Fremont Tribune (article and video), 19 April

"Terns and Plovers at Home on the Sand", Generator (LPPD employee newsletter), Winter

Grants and Fundraising

Nebraska Environmental Trust "Tern and Plover Conservation Partnership: Protecting Imperiled Birds and their Habitat in Nebraska", awarded 2012–2015

Publications

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

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.

Brown, M.B., S. J. Dinsmore, and C. R. Brown. 2012. Birds of Southwestern Nebraska. Conservation and Survey Division, University of Nebraska, Lincoln, NE.

Brown, M.B., J.G. Jorgensen and L.R. Dinan. 2011. "2011 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.

Brown, M.B. and P.A. Johnsgard. 2012. Birds of the Central Platte, Conservation and Survey Division, University of Nebraska, Lincoln, NE, in press.

Reviewers for Professional Publications and Organizations

Auk (American Ornithologists' Union)
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)



“...so now that man is no longer its deadly enemy, there is little to check the species from repopulating its breeding haunts in its former numbers...”

A.C. Bent, Life Histories of North American Shorebirds
1929

Appendix A. Maps of the 2012 Interior Least Tern and the Piping Plover nesting colonies on off-river sites outside of the TPCP's primary study area.

