Causes of nest failure and mortality of least terns and piping plovers along the central Platte River

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Nest failure and low recruitment (high chick mortality) plague many least tern and piping plover populations, including those along the central Platte River, NE. In this study I examined factors contributing to poor recruitment and compared success between riverine and sand-pit colonies.

An 80-mile reach of the Platte River valley between Lexington and Chapman was the study area (Fig 1). Riverine habitat and sand pits within 3 miles of the Platte were searched for nesting terns and plovers from 1985 through 1990. All occupied sand pits were within 1 mile of the Platte or Wood rivers, and over 90% of these were within 0.5 mile of a river.

Nest sites were located by ground and aerial reconnaissance during May through June. Nests were marked with 2-inch-square surveying flags placed 3 feet north of the nest bowl. The flag was rolled around the wire and inserted into the sand so that only the upper 1 inch was visible. Nests were visited at regular intervals to chart their fate. A nest was considered successful if at least one egg hatched. The perimeters of certain colonies were posted with signs to discourage recreationists from disturbing the birds and their nests.

During 1985-1990, 318 days ($\bar{x}$ = 53 days/yr) were spent in the field and 22,200 mi ($\bar{x}$ = 3,770 mi/yr) were driven. Field work was conducted between April 14 and September 4, with the greater part from June 1 to August 10. I monitored 501 least tern and 246 piping plover nests.

Habitat use and hatching success

Thirty nesting sites were located; 21 were sand pits and nine were riverine sites (Fig 1). Only a portion of these sites was used in any given year, as old sites became unavailable and new sites became usable as habitats changed. Sand pits contained 84% of the least tern and 67% of the piping plover nests. The percentage of nests on the river generally declined from 1985 to 1990 (Fig 2).

Average hatching success for both terns and plovers was greatest on sand pits although not always (Table 1). Least tern hatching success was similar to that of plovers on sand pits but was lower than plovers on the river.

Fledging success (defined as the number of chicks surviving to flight stage per nest) was difficult to determine. Estimates are presented in Table 2. The lower values represent a minimum while the larger values represent a maximum estimate.

Least tern nest fates

Predation and flooding accounted for 74% (37% each) of nest failures on river habitat (Fig 3). Predation was the greatest cause of nest failure on sand pits, followed by human disturbance and weather (Fig 4). Only 3% of the sand pit nests were lost to flooding, compared to 37% of the river nests. However, human disturbance and abandonment accounted for 27% of sandpit nests that failed and only 17% of the failed river nests. (It should be noted than some of the losses attributed to abandonment may have been due to predators killing adults, therefore this category is somewhat subjective).

Weather took a larger toll of sand pit nests, since the uniform substrate on the spoil piles was more susceptible to wind and water erosion than the riverine substrates.

Overall, predation was the major cause of nest mortality (Table 3). Dogs/coyotes (*Canis latrans*) were suspected in 38 (78%) cases; skunks (*M. mephitis*) in three

Fig 1. Study area, showing nest sites.

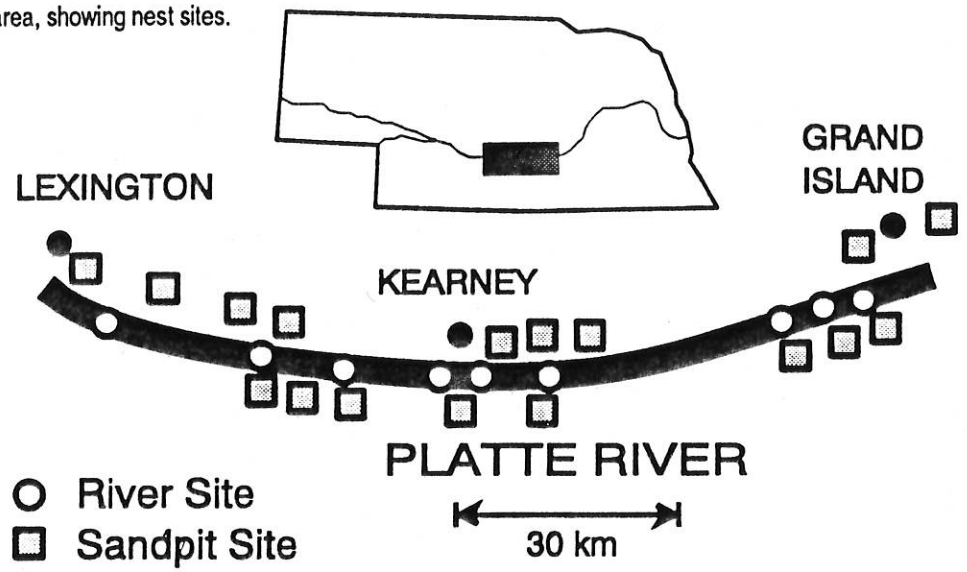
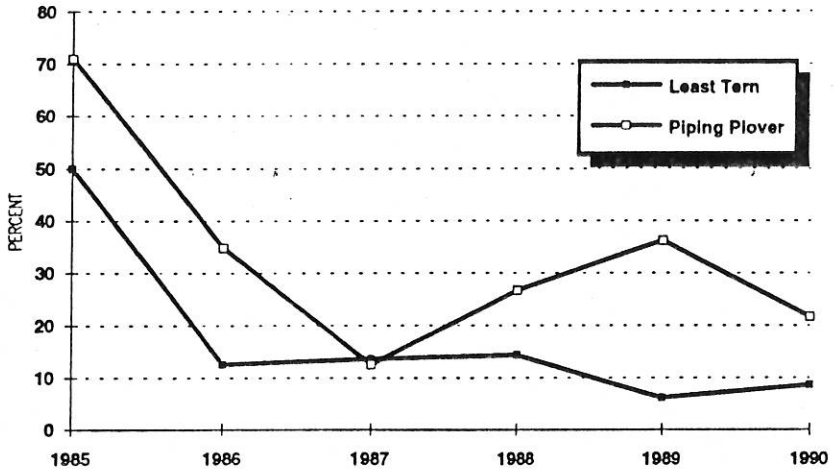


Fig 2. Percentage of nests located on riverine habitat.



(6%); raccoon (*Procyon lotor*), great horned owl (*Bubo virginianus*,) and American crow (*Corvus brachyrhynchos*) in two (4%) each; and great blue heron (*Ardea herodias*) and snake in one (2%) each. Other potential predators included mink (*Mustela vison*), American kestrel (*Falco sparverius*), black-billed magpie (*Pica pica*), bullsnake (*Pituophis melanoleucus sayi*), and garter snake (*Thamnophis* spp). Coyotes were particularly adept at finding hatching nests. I believe they used auditory cues to locate such nests since the chicks were quite noisy during hatching as they pecked at the eggshell and peeped.

Piping plover nest fates

The greatest cause of plover nest failure on the river was flooding (61%), followed by predation (19%) (Fig 5). Predation (42%) and abandonment (21%) were the leading causes on sand pits (Fig 6). Overall, predation accounted for 35% of the nest losses (Table 3). Suspected predators were dog/coyote in eight (73%) cases and skunk, American crow, and snake in one case each (9%).

Chick and adult mortality

Chick and adult mortality factors were determined by examining evidence (primarily tracks) surrounding a carcass or remains. Circumstantial evidence suggested causes of mortality on 21 occasions involving 38 birds (33 terns and five plovers) (Table 4). About 53% of the adult deaths was due to predation, 33% to weather, and 13% to humans.

Weather killed 43% of the chicks, vehicles 39%, and predators 17%.

The incidence of predation was undoubtedly higher than these data imply. Often, direct evidence was not found. In one case, great horned owl predation was suspected in the near total fledgling failure at a sand pit near Kearney. On June 21, 1987, only five of a possible 18 tern chicks were found. Forty eggs were laid in this colony, and 29 were known to have hatched. Only two chicks were known to fledge from this site. In 1988, this colony did not produce any fledglings out of a potential of 44 eggs when 17 chicks were known to have hatched. The nesting area was a small island; therefore, it is unlikely that chicks wandered away or were overlooked.

On July 9, 1988, the head of a young skunk was found on top of the spoil pile; the rest of the body had apparently been eaten. Since no mammalian tracks were found on this island, the idea of predation by an owl was reinforced.

Management implications

The data provide evidence that nesting has increased on sand pits since 1985 and that hatching rates are much higher there than on riverine sites.

Unfortunately, some of these pits are not producing any fledglings, and the fledging rate is low. Sandpit nesting habitat is short-term as plant succession or human development encroaches on suitable nesting habitat. Likewise, riverine nesting habitat continues to degrade as a result of vegetative encroachment. Low recruitment rates suggest that this popu-

Fig 3. Causes of least tern nest failure on the river 1985-1990 (N = 46).

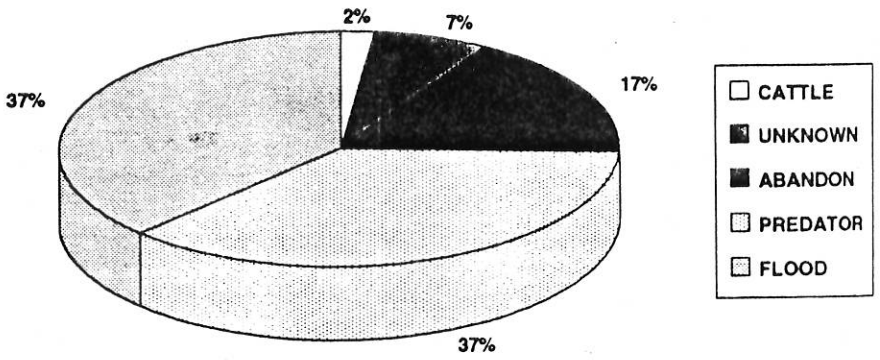


Fig 4. Causes of least tern nest failure on sandpits 1985-1990 (N = 135).

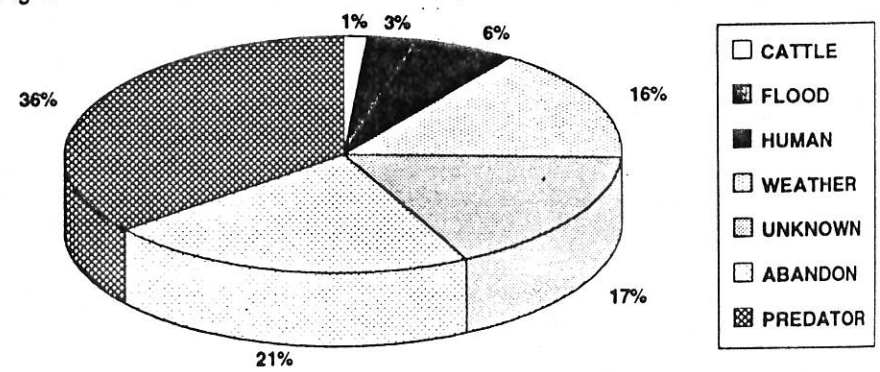


Fig 5. Causes of piping plover nest failure on the river 1985-1990 (N = 31).

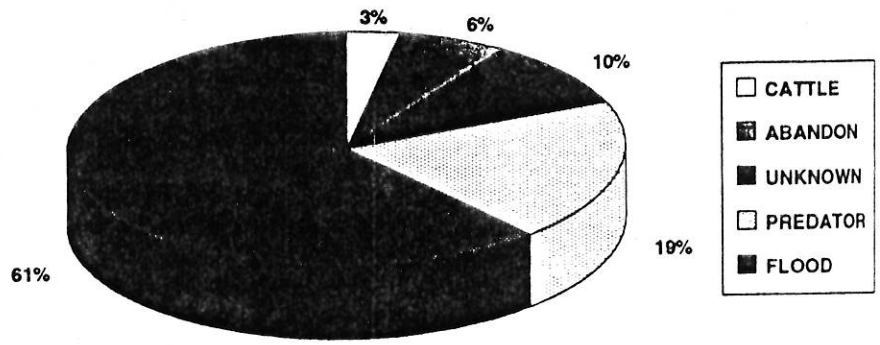


Fig 6. Causes of piping plover nest failure on sandpits 1985-1990 (N = 48).

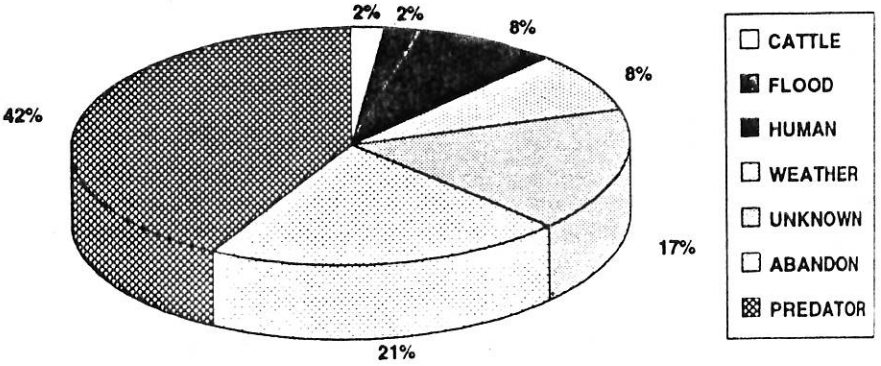


Table 1. Piping plover and least tern nest success (includes only nests with known fates).

	Sand pits						Riverine						Combined					
	Plover			Tern			Plover			Tern			Plover			Tern		
	Hatch	Total	%	Hatch	Total	%	Hatch	Total	%	Hatch	Total	%	Hatch	Total	%	Hatch	Total	%
1985	7	8	88%	17	29	59%	12	16	75%	15	29	52%	19	24	79%	32	58	55%
1986	16	27	59%	39	59	66%	6	15	40%	3	9	33%	22	42	52%	42	68	62%
1987	21	34	62%	47	64	73%	1	4	25%	7	11	64%	22	38	58%	54	75	72%
1988	22	27	81%	49	80	61%	2	10	20%	0	14	0%	24	37	65%	49	94	52%
1989	18	25	72%	47	79	59%	7	13	54%	1	5	20%	25	38	66%	48	84	57%
1990	13	24	54%	37	60	62%	6	7	86%	4	8	50%	19	31	61%	41	68	60%
Total	97	145	67%	236	371	64%	34	65	52%	30	76	39%	131	210	62%	266	447	60%

lation may not be self-sustaining. Certain measures must be taken if viable nesting populations are to be maintained in this region:

1. Reduce factors responsible for nest failure to enhance nest and fledging success. On the river, that could be accomplished by reducing chances of flooding after June 20. Ensure adequate instream flows during nesting season and adequate channel maintenance flows to provide suitable nesting habitat. Peak flows in May and June are needed for this. Low flows or peak flows in July or early August destroy nests, young, and the food base for terns.

2. Practice carefully considered predator removal or deterrence if necessary.

3. Post nesting areas to reduce mortality caused by human disturbances. Enforcement may be needed at particular sites.

4. Continue a public education policy, especially in schools, so that the public is aware of the critical need to avoid disturbing these birds.

5. Explore the possibility of captive propagation using chicks or eggs salvaged at sites in imminent danger of destruction. Many viable eggs are lost each year which could be used.

6. Periodically monitor populations to determine their status. Every year may not be necessary, but a frequency of at least every 3 years would be desirable. Ideally, monitoring would be coordinated throughout the nesting range so that a better measure of the health of this population could be obtained.

Table 2. Piping plover and least tern fledging success.*

	Plover	Tern
1986	ND	0.26
1987	ND	0.11
1988	0.24	0.33-0.46
1989	0.26-1.06	0.44-1.44
1990	ND	0.19

*Expressed as the number of chicks attaining flight per nest.

Table 3. Piping plover and least tern nest fates (expressed as percent of known losses).

	N	Predator	Abandoned	Flood	Weather	Human	Cattle	Unknown
Plover	79	33%	15%	25%	5%	5%	3%	14%
Tern	181	36%	20%	12%	12%	4%	2%	14%
Combined	260	35%	19%	15%	10%	5%	2%	14%

Table 4. Suspected causes of piping plover and least tern mortality.

	Age	#	Date	Cause
Tern	Adult	1	8 June 78	Dog and ATV
Tern	Adult	1	12 Jul 85	Gunshot
Tern	Adult	1	22 Jul 86	Great horned owl
Tern	Adult	1	26 Jun 87	Great horned owl
Tern	Adult	1	28 Jun 88	Great horned owl
Tern	Adult	1	11 Jul 88	Great horned owl
Tern	Adult	1	5 Jun 89	Great horned owl
Tern	Adult	5	16 Jun 90	Hail
Tern	Adult	1	24 Jun 90	Great horned owl
Tern	Chick	2	14 Jul 78	Avian
Tern	Chick	1	8 Jul 85	ATV
Tern	Chick	3	6 Jul 87	Gravel truck
Tern	Chick	2	15 Jul 87	Gravel truck
Tern	Chick	1	21 Jul 88	Abandoned
Tern	Chick	1	28 Jul 88	Coyote
Tern	Chick	2	5 Aug 88	Abandoned during thunderstorm
Tern	Chick	1	13 Jul 89	Great horned owl
Tern	Chick	7	16 Jun 90	Hail
Plover	Adult	1	28 Jun 86	Trauma associated with capture
Plover	Adult	1	23 Jun 90	Hail
Plover	Adult	1	26 Jun 90	Raptor
Plover	Chick	1	7 Jul 86	ATV
Plover	Chick	2	14 Jul 86	ATV

Acknowledgments

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