

## Status of the Interior Least Tern in Kansas

*Low reproductive success is causing  
a decline in this already  
small population*

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**T**HE INTERIOR LEAST TERN (*Sterna antillarum athalassos*) is a threatened species in Kansas (KSA 32-504, 32-507, Kansas Fish and Game Commission 1978), locally inhabiting river systems and salt flats. Present numbers are believed to be a remnant of a population once distributed widely throughout the North American interior (Hardy 1957, Ducey 1981). Human manipulation of

nesting habitat, as well as natural changes (Downing 1980, Boyd 1981), have resulted in a decline of breeding terns over much of their former range. Since 1971 the Least Tern has been included on the Blue List of *American Birds*—species suffering non-cyclic population declines (Arbib 1971, Tate and Tate 1982). In a preliminary survey, Downing (1980) estimated only 150 indi-

viduals in both Kansas and Oklahoma. Our study was initiated to document more precisely the status and habitat availability in Kansas. For three years, beginning in 1980, we attempted to find all nesting Least Terns. The objectives of this study were to locate colonies, census breeding populations, determine breeding chronology and habitat use, evaluate nesting success, and to identify predator



**Figure 1.** Interior Least Tern at nest. Quivira National Wildlife Refuge, Stafford Co., Kansas, 1982. Photo by Ed and Jean Schulenberg.

and disturbance factors. This paper presents the results of the survey and examines the present status and future prospects of the Least Tern in Kansas.

## METHODS

**K**NOWN COLONIES and potential habitat were identified from published records, museum collections, and personal contacts. All locations were plotted using U. S. Geological Survey topographical maps and ground-searched for terns. Surveys and censuses were conducted from May 27 to July 28 in 1980, and extended into August in 1981 and 1982, when intermittent flooding prolonged the nesting season.

Surveys were conducted on foot, as this proved the most practical means of travel on the rivers and salt flats. In 1982 a fixed-wing aircraft was used to survey the Cimarron River from the Little Salt Plains, near Edith, Oklahoma, to the Colorado border, the Arkansas River from Garden City to east of Dodge City, portions of the Chickaskia River, and the Oxford and Hazleton salt flats. Rivers in the northern part of the state were not surveyed as flooding occurred there into July. Cheyenne Bottoms, near Great Bend, was also excluded because of high water.

Two types of census were employed. All colonies were censused by actual count of individuals and nests and were considered active if they contained eggs or young. Breeding pairs, defined as those with eggs, chicks, or juveniles in the colony, were counted on all censuses. A post-breeding census was conducted at all colonies and at a feeding aggregation in Comanche County—birds that possibly bred in Oklahoma. As Least Terns remain in family groups during this period, fledging success can be estimated by the ratio of adults to fledged juveniles.

Each colony was visited early in the morning at least three times during the breeding season, coinciding with laying or incubation, hatching, and fledging of young. Whenever possible, all nests were marked and monitored to conclusion. Chicks were banded and also marked with locality-coded colored plastic leg bands. The type of habitat used for nest sites, including physical structure, number and height of all plants present, and any changes from previous visits, were recorded. Cause of losses of eggs or chicks was classified as to weather, predation, or disturbance from traffic, rec-

reation, or cattle. Assumed losses were classified as unknown. Predators were identified by their presence or tracks at a destroyed nest.

## DISTRIBUTION AND NUMBERS

**L**EAST TERNS were found breeding at eight colonies in 1982, all in south-central Kansas. Terns bred at seven colonies in 1980 and six in 1981, with a similar distribution. An additional 1980 breeding record of two young was reported from Kirwin National Wildlife Refuge in Phillips County (Stans 1980). Terns were present, but breeding was not confirmed, at Kirwin in 1981 and 1982.

An aerial survey of the Cimarron River on July 1, 1982, recorded 88 Least Terns, 44 on Kansas portions of the river (Table 1). All were found at previously known locations except for one unrecorded colony of six pairs in Meade County. A previously unrecorded colony also was found in Beaver County, Oklahoma. Least Terns were not found on the Arkansas and Chickaskia Rivers or the Oxford and Hazleton salt flats.

The maximum number of breeding pairs in the colonies surveyed in 1982 was 41, which was less than the totals of 55 in 1980 and 50 in 1981. The maximum numbers of breeding pairs obtained from June censuses refer to pairs with active nests prior to the first hatching wave or the occurrence of major losses. Pairs nesting later, *i.e.*, renesters, late arrivals, or delayed nesters, were count-

ed on subsequent censuses but not included in the maximum counts. A mean number of breeding pairs was computed for each colony for each year (Table 2). The mean number of breeding pairs remained relatively stable at the three largest colonies in 1980 and 1981, but declined in 1982 in Meade and Clark counties due to high water on the Cimarron River that reduced suitable nesting habitat. Loss of most of the oxbow site at Meade No. 2 to encroaching vegetation also contributed to the decline there. The Meade No. 3 colony, 5.6 kilometers west, was not known to exist prior to 1982 and may have represented a shift of pairs from Meade No. 2. Stafford No. 2 was a new site in 1982 where terns nested on a recently constructed oil-well pad, perhaps in response to the flooding of traditional nesting areas 1.2 kilometers away. Terns nesting at Stafford No. 1 during 1982 were forced by flooding to select peripheral and less optimal nest sites, but still maintained numbers similar to 1981. The overall population in the colonies did not differ markedly among the three years surveyed. Only the number of actual breeding pairs declined in 1982.

A post-fledging census was conducted to determine the numbers of adults and juveniles in the three counties (Stafford, Meade, and Clark) where breeding occurred and in the Comanche County feeding aggregation (Fig. 2). Totals in 1980 and 1981 were relatively stable, but declined in 1982. While no evidence of Least Terns nesting in Comanche County

**Table 1. Results of Least Tern Aerial Survey, July 1, 1982.**

River	Location	No. sighted	Nesting colony
Cimarron	T35S, R20W, sec. 3 Comanche County	5	No
	T34S, R23W, sec. 38 Clark County	4	Yes
	T35S, R23W, sec. 3 Clark County	2	No
	T35S, R23W, sec. 4 Clark County	2	No
	T35S, R23W, sec. 9 Clark County	6	Yes
	T35S, R23W, sec. 8 Clark County	1	Yes
	T35S, R29W, sec. 9 Meade County	3	Yes
	T35S, R29W, sec. 17 Meade County	2	No
	T35S, R29W, sec. 16 Meade County	1	No
	T35S, R30W, sec. 13 Meade County	12	Yes
	T35S, R30W, sec. 14 Meade County	4	No
	T35S, R30W, sec. 31 Meade County	2	No

**Table 2. Mean number of breeding pairs (number of censuses) of Least Terns per colony.**

Colony	1980	1981	1982
Meade No. 1	1 (1)	—	—
Meade No. 2	7.5(2)	6.6(3)	2.6(3)
Meade No. 3	—	—	3.5(2)
Clark No. 1	1 (1)	—	—
Clark No. 2	10 (1)	10.6(3)	2.5(2)
Clark No. 3	3 (1)	5.5(2)	2 (3)
Clark No. 4	2 (1)	1 (1)	2 (1)
Clark No. 5	—	5 (1)	—
Clark No. 6	—	—	1 (1)
Stafford No. 1	8.5(2)	10.6(3)	10.8(4)
Stafford No. 2	—	—	4.5(2)

was found, adults and juveniles were recorded on the post-fledging censuses. In August of 1982, six banded terns (color-banded in 1982 by Roger L. Boyd at the Little Salt Plains, near Edith, Oklahoma, 11 kilometers downstream) were observed, indicating that at least some of the population originated there.

The 1982 post-fledging population in four Kansas counties was 206—132 adults and 74 juveniles. Excluding Comanche County, the total was 87 (including 22% juveniles); down from previous counts of 128 (27% juveniles) in 1980 and 140 (27% juveniles) in 1981. The 1982 decline was due to a decrease in the reproductive success of the adult terns since juveniles made up 5% less of the total population than in the other two years.

### REPRODUCTIVE SUCCESS

**T**HE NUMBERS of downy young counted on the censuses represent the best estimates of hatching success for each

colony visited during the nesting season. The inherent errors in the techniques used were estimated to be similar for all colonies censused. Total numbers of chicks recorded at each colony during the three years are compared in Figure 3. Replacement habitat affected nesting success in Stafford County. The oil-well platform site (Stafford No. 2) had the highest rate of success in 1982. Nine chicks were hatched from a total of nine nests (one per nest). At Stafford No. 1, where nest sites were subject to flooding, 0.2 were hatched per nest. Based on total numbers of nests, 44% (4 of 9) hatched at Stafford No. 2 while 9% (4 of 43) hatched at Stafford No. 1.

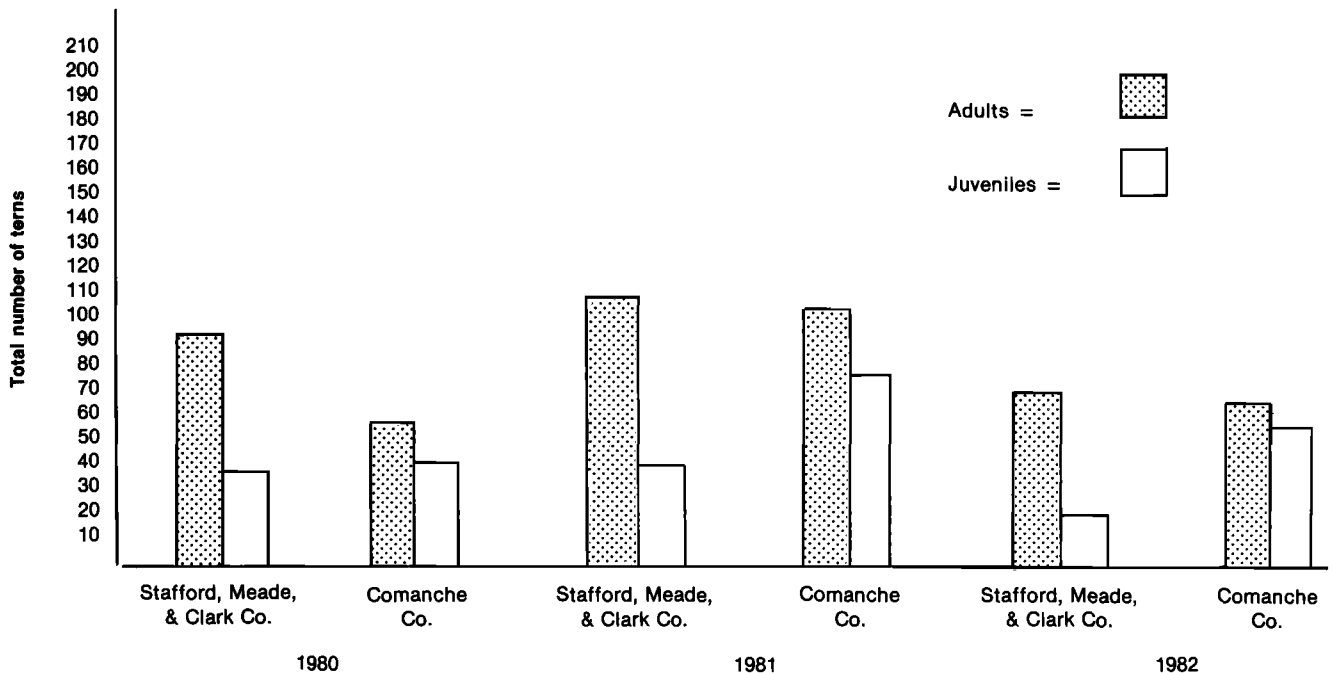
An estimate of fledging success for each colony and staging area was obtained by counting both the number of juveniles and breeding pairs (Table 3). This method is not totally accurate as some adults, parents of older juveniles, may leave the colonies prior to the census, so it is necessary to include all known staging areas. In Clark County, terns from six colonies staged at the confluence of Big Sandy Creek on the Cimarron River. It seems likely that more Stafford County juveniles fledged from the oil-well site (Stafford No. 2) than the flooded flats (Stafford No. 1) but most were aggregated on the flats when censused. Fledging success varied among colonies, staging areas, and years.

Successful nests were defined as those hatching one or more chicks. Success was highest in the drought year of 1980 (Table 4). Severe weather and predation accounted for the highest number of

losses in 1981 and 1982. Storms altered nest-site structure and repeatedly washed out nests in Stafford County in both years. Two colonies in Clark County were totally eliminated by severe weather in 1981, while Clark No. 2 survived. All Clark County colonies suffered from reduced habitat and weather-related losses in 1982. Colonies that were partially destroyed by weather appeared to suffer some increased predation. Predator tracks identified were Coyote (*Canis latrans*), Striped Skunk (*Mephitis mephitis*), and gulls (*Larus* sp.). Potential predators were herons, American Kestrels (*Falco sparverius*), Mississippi Kites (*Ictinia mississippiensis*), Mink (*Mustela vison letifera*), Raccoon (*Procyon lotor hirtus*), rats (*Rattus* sp.), and snakes. Prolonged high water and the instability of the riverbed in Meade County in 1982 increased the use of the firmer sandbars by cattle. Meade No. 3 was 80% destroyed by trampling.

### CURRENT STATUS

**O**UR SURVEYS indicate that populations of Least Terns in Kansas are small, with a localized and widely separated distribution pattern. The highest number of breeding pairs, excluding any that were possibly nesting outside the survey area, was 55 in 1980. Nesting populations in each colony did not fluctuate widely between 1980 and 1981 but were down in 1982, primarily due to flooded nest sites. Numbers of adults and fledged juveniles also declined in 1982. Ratios of total adults to nests suggest that



**Figure 2. Post-fledging census for 1980, 1981, and 1982.**

**Table 3. Least Tern fledging success in 1980, 1981, and 1982**

Counties	1980			1981			1982		
	Breeding Pairs	Juv.	No. fledged per nest	Breeding Pairs	Juv.	No. fledged per nest	Breeding Pairs	Juv.	No. fledged per nest
Meade No. 2	8	10	1.25	9	5	0.55	5	2	0.40
Meade No. 3							4	1	0.25
Clark*	30	9	0.30	32	30	0.93	8	12	1.50
Stafford No. 1	8	16	2.00	10	3	0.30	17	4	0.23
Stafford No. 2							2	1	0.50

\*Staging area.

some adults were present in the colonies but were unable to breed.

**IMPACT OF HABITAT ALTERATION, WEATHER, AND PREDATION**

LEAST TERNS prefer to nest on unvegetated, alkali-covered salt flats and sandbars in wide, shallow prairie rivers. Favorable water levels to support a food supply of small fishes—*Fundulus*, *Notropis*, *Camptostoma*, *Pimephales*, *Gambusia*, and *Lepomis*—are essential (Schulenberg *et al.* 1980). Habitat is formed, altered, and eliminated by flooding. Of 11 colony locations, only four were used all three years. Inundation restricts nest sites, forcing terns to settle on the first sandbars that become available (Hardy 1957). Sustained flooding forces pairs to explore less favorable alternatives, *i.e.*, more vegetated sites, roads, dikes, and smaller sandbars, such as occurred at Stafford No. 1 in 1982. A small number of these nests successfully hatched

young, but due to repeated flooding and human interruptions most failed.

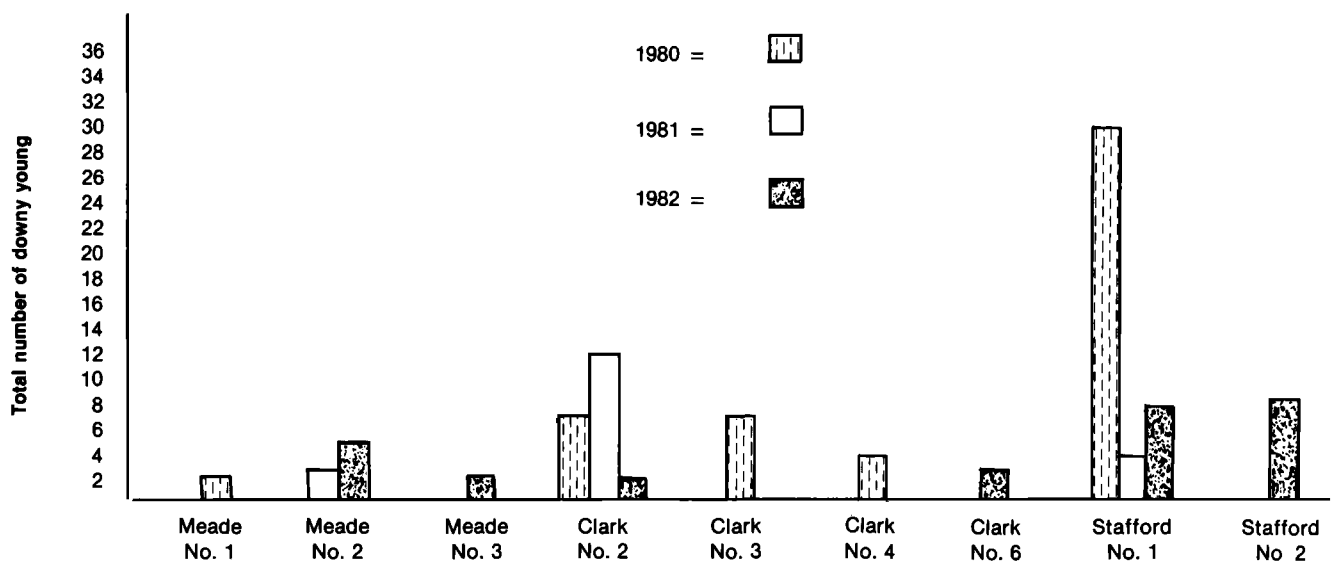
Nest sites selected on the Cimarron River were on the more stable sandbars or on a dry oxbow. River terns located nests near creeks with sustained flow throughout the summer, providing a dependable source of water and food when much of the flow in the river was underground.

In Clark County, nest-site selection appeared to be related to the annual cessation of surface flow on the river. Nesting in 1980 and 1981 occurred after the agricultural draw-down left the riverbed dry. Draw-down was delayed until mid-July by above-normal rainfall in 1982. Terns nested in smaller colonies and were less successful because of the intermittent flooding.

Increased growth of vegetation also limits available habitat. Meade No. 1, on a dry oxbow, supported seven active nests in 1980. By 1982, extensive growth of Tamarisk (*Tamarix ramosissima*) and sedges (*Carex*) nearly covered the flat, which along with some additional flood-

ing, reduced the number of attempted nests. Without a substantial rise in the river to remove the vegetation or cover it with sand, the Meade No. 2 site may cease to support nesting terns in a few years. Terns responded to the loss of oxbow habitat by attempting to nest on sandbars in the river immediately to the east, north, and west. Nesting in widely fluctuating habitat demands flexibility in selecting nest sites, but shifting from one unstable or intermediately stable habitat to another may not prove successful every year (McNicholl 1975).

Selective pressures of weather and predation are major factors influencing the breeding chronology and ultimate success of a colony. Weather and predation acted separately and together to cause failure. Severe weather accounted for the highest number of losses in most colonies. Above-average rainfall in 1981 and even more unfavorable weather conditions in 1982 caused higher than normal water levels on the Cimarron River and on the salt flats. The Stafford County No



**Figure 3.** Total number of downy young produced in each colony in 1980, 1981, and 1982.

**Table 4. Percent loss in Least Tern colonies in 1980, 1981, and 1982**

Year	Colonies	Total Nests	% Success	% Weather Loss: Desertion	% Predation	% Cattle	% Unknown	% Chick Mortality
1980	Meade No. 1	1					100.0	
	Meade No. 2	7					100.0	
	Clark No. 1	1					100.0	
	Clark No. 2	4	50.0				50.0	
1981	Stafford No. 1	12	67.0				33.0	
	Meade No. 2	16	12.5	6.2	6.2		75.0	
	Clark No. 2	18	22.2				77.8	
	Clark No. 3	9		100.0				
	Clark No. 4	1		100.0				
1982	Clark No. 5	5		100.0				
	Stafford No. 1	36	2.8	58.3	11.1		25.0	2.8
	Meade No. 2	10	30.0	40.0			30.0	
	Meade No. 3	5				80	20.0	
	Clark No. 2	7	14.2	71.4	14.2			
	Clark No. 3	3					100.0	
	Clark No. 4	2					100.0	
	Clark No. 6	1	100.0					
	Stafford No. 1	48	6.2	35.4	22.9		33.3	2.0
Stafford No. 2	10	40.0	30.0			30.0		

1 salt flat is easily inundated by 2.5 to 5 centimeters of rain, and the colony suffered near-wipeouts of the first wave of nests in both years. Most of the initial nests were lost in Meade and Clark counties in 1982. Chick deaths from hail were recorded in Stafford and Meade counties. Height and drainage of the site were important factors affecting survival of the nests. Some colonies were lost or partial-

ly destroyed while apparently some survived. Nesting in small, separated colonies may be adaptive in providing alternatives during flood years when a single, large colony could be easily wiped out.

In Stafford No. 1 more instances of predation occurred in mid- to late July after nests had been flooded. As terns abandoned eggs, both scavenging and

predation at still-active nests increased. Burger and Lesser (1979) found increased predation in Common Tern (*Sterna hirundo*) colonies that had been partially destroyed by flooding, and suggested that sufficient numbers of protective adults must be maintained for successful mobbing of predators. The few remaining terns in a partially destroyed colony did not attempt to chase Frank-



**Figure 4. Pair of Interior Least Terns at nest. Meade Co., Kansas, 1980. Photo by Ed and Jean Schulenberg.**

lin's Gulls (*Larus pipixcan*) that landed near nests, although they would have earlier. Nesting synchronization in Laridae as a communal defense against predators has been discussed by Nisbet (1975) and Burger (1980). Disrupted late nesters may be more vulnerable due to smaller numbers and perhaps to waning reproductive intensity.

#### HUMAN IMPACT

FOR THE most part, nest sites in Kansas were located in protected or restricted areas with little human disturbance. Cattle grazing on the floodplain of the Cimarron River caused some nest losses. Colonies were more vulnerable to trampling when cattle congregated at water holes and crossing sites.

The greatest threat to the Least Tern in Kansas is man's modification of nesting habitat. Extensive use of irrigation wells in the western and southwestern part of the state have lowered the water table in the Ogallala aquifer. Withdrawal is estimated to average 14 times the recharge rate (Final Report of the Governor's Task Force on Water Resources, 1978). The Arkansas River, which historically supported nesting Least Terns (Long 1940:

444) is now dry west of Dodge City during the summer months.

Least Terns were found to have adapted to agricultural use of water in Clark County. The Ditch Valley irrigation project in Oklahoma leaves the Cimarron essentially dry by mid-summer. Terns utilized the dry riverbed for nesting near where flowing water entered from several creeks. Vast stretches of the river west of Meade County had no flowing creeks and no Least Terns.

Encroachment by vegetation on nesting sites is another serious problem. Reduction in the frequency, severity, and the seasonal scouring action of floods have left the flood plain choked with vegetation. Tamarisk, brought in with the first oil wells (Tom Finney, *pers. comm.*), is a major pest species that defies most eradication efforts.

Undoubtedly the greatest threat is the Arkansas-Red River Basin Chloride Control Project (U.S. Army Corps of Engineers). This series of desalinization projects would divert fresh water around permanently flooded alkaline evaporation basins and release it downstream when needed for agricultural and domestic use. The Kansas site recommended for the project is Quivira National Wild-

life Refuge in Stafford County. If implemented, the project would result in less shallow water for feeding and the salt flats would be lost as nesting habitat for Least Terns. Even with a limited release of water, it is not certain whether fish populations could be effectively maintained. Similar projects are proposed for the Great Salt Plains National Wildlife Refuge, on the Salt Fork of the Arkansas River in Alfalfa County, Oklahoma, and the Big and Little Salt Plains on the Cimarron River in Woods County, Oklahoma; both are nesting areas for Interior Least Terns. The by-pass channels and planned reservoirs would not only alter habitat on the Oklahoma salt plains (Grover 1979), perhaps irreparably, but would further slow the flow of the river, negate the devegetating and sandbar-forming force of seasonal rises, and increase detrimental plant growth on the flood plain. It is not known whether or not efforts to mitigate these changes would be successful.

#### FUTURE PROSPECTS

THE FUTURE of the Least Tern in Kansas depends on the preservation of its habitat. Human manipulation and natural



Figure 5. Young Interior Least Terns at nest. Quivira National Wildlife Refuge, Stafford Co., Kansas, 1980. Photo by Ed and Jean Schulenberg.

alterations have limited the acceptable habitat and ultimately affected reproductive success. Vital nesting sites, off-colony resting and staging areas, and water levels to support fish populations must be maintained. This can best be done by limiting human impact on the integrity of the river systems and salt flats.

Additional replacement habitat should be provided for Least Terns at state wildlife management areas, federal wildlife refuges, and at federally operated reservoirs. Management plans at Cheyenne Bottoms Wildlife Management Area and Quivira National Wildlife Refuge in Kansas call for using sand to construct raised nesting habitat above high water levels in these marshes. The successful use of a manmade oil well site at Stafford No 2 in 1982, demonstrated that if offered alternative sites, Least Terns will accept them. Vegetation control is needed at artificial sites but probably only immediately prior to the terns' nesting season. Vegetation that had grown by midsummer was found to provide beneficial shade and protection for chicks. Some vegetation control and electric fencing of sandbar colonies to restrict cattle, where possible on private land, is recommended.

Remnant populations of the Interior Least Tern are widely dispersed throughout the Great Plains and Mississippi River drainages because few sites are now suitable for nesting (Ducey 1981). If not declining, present numbers in Kansas are low, reproductive success is low, and the terns' breeding habitat is threatened. The Committee on Conservation of the American Ornithologists' Union (1975) reported that interior populations are lower than those of the California Least Tern (*Sterna antillarum browni*), a federally endangered bird. With such a sparse density, 100 individuals in Kansas and probably no more than 550 to 700 individuals in the four states of Nebraska,

Oklahoma, Texas, and New Mexico, the subspecies could be easily lost for genetic reasons alone. Endangered status may be required before managing agencies fully realize the importance of maintaining habitat (Downing 1980). A cooperative management effort by all is needed to assure the survival of existing Interior Least Tern populations and vital river and salt flat habitat.

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