CALIFORNIA BIRDS

Volume 3, Number 3, 1972

STATUS OF THE LEAST TERN AT CAMP PENDLETON, CALIFORNIA

Deane K. Swickard

INTRODUCTION

The California Least Tern *(Sterna albifrons browni)* is on the Department of the Interior's endangered species list. The survival of this tern is in jeopardy due to intensive urban development of its nesting sites and nearly constant human disturbance during nesting. Except for two remnant colonies, the only natural nesting sites remaining in the state of California are located at the mouth of the Santa Margarita River on Marine Corps Base, Camp Pendleton, in San Diego County (Craig, pers. comm.).

This paper summarizes the results of a study conducted during 1971 and 1972 to determine the status of the Least Tern at Camp Pendleton and to recommend methods of protection and enhancement of the nesting sites.

NESTING SITES

Four nesting areas were used in 1971 and 1972. Two are located on beach sites just north and south of the Santa Margarita River mouth and two are located on a large salt flat, one at the base of a LORAC navigation tower. The nesting areas were therefore designated as the North Beach, South Beach, Salt Flat and LORAC nesting sites.

The North Beach site is 1500 feet x 200 feet and is located between the primary and secondary rows of sand dunes which parallel the beach. In 1971 and 1972 this site was protected by a large barrier and signs indicating the nature of the area.

The South Beach site is also located between the primary and secondary rows of sand dunes, but it is 750 feet x 150 feet. A tracked vehicle route went through it in 1971 before the site was discovered. The area was protected by a fence and signs during 1972.

The Salt Flat and LORAC sites are located on a 40-acre salt flat south of the Santa Margarita River. The Salt Flat nesting site encompasses 12 acres and the LORAC site covers about 2½ acres in the Southwest corner of the salt flats.

The North Beach and Salt Flat sites were active in 1969 (Alan R. Longhurst, pers. comm.), but only the North Beach site was active in 1970 (Craig, 1971). No previous nesting had been documented at the South Beach or LORAC sites.

METHODS

Periodic censuses were conducted in all nesting areas from 15 April until the birds' departure. The counts were made with the aid of 7x50 binoculars or a 20x spotting scope. The number of birds in flight during each census was estimated.

On 3 August 1971, and on 17 August 1972, a final juvenile census was conducted to determine fledgling survival and resultant population recruitment.

An attempt was made to locate and mark all nests. The nests were marked with a coded tongue depressor to identify each one. This procedure was not conducted at the same site on consecutive days or for prolonged periods. Nests that had been located previously were inspected, noting nest structure and lining, number and condition of eggs, evidence of predation and, later, hatching. As the season progressed, nest inspections were combined with locating and marking procedures. The terneries were not entered during temperature extremes, nor did we remain in them for more than a few minutes.

Seine samples were taken to determine fish availability and species composition using a minnow seine in the shallow waters in and near the Santa Margarita Estuary. The fish samples were identified by ichthyologists of the National Marine Fisheries Service, Fishery-Oceanography Center, La Jolla, California.

RESULTS

CENSUS

Longhurst estimated a nesting population of 150 adults in 1969. Stephen B. Smith noted only 38 adults present in 1970 (Craig, 1971). The adult population increased to an estimated 600 in 1971 and then declined to approximately 500 in 1972.

The birds were first sighted in the nesting areas on 29 April 1971 and on 21 April 1972. Upon arrival, the birds gathered at areas of social flocking on the sand spit at the mouth of the Santa Margarita River and on low hummocks in the Salt Flat. The population stabilized at an estimated 600 on 31 May 1971, and at approximately 500 between 20-23 June 1972.

NESTING

The nest of the Least Tern has been described as "a shallow depression in sand or gravel" (Hardy, 1957) and a "small scrape on the ground" (Longhurst, pers. comm.).

On the beach sites all nests were shallow depressions scraped in the sand. Slightly more than one-third of these nests contained sea-shell fragments or bits of wood.

The firmness of the clay silt soils of the Salt Flat precluded any nest building. Instead, many of the birds used some of the thousands of track depressions left by military vehicles. Others nested in old footprints, in tiny rills, in almost imperceptible natural depressions and even on flat ground. Approximately one-third of these nests were lined with small bits of wood.

The size and dispersion of the nesting colonies precluded finding all nests. Therefore, an estimated 10 to 20 per cent of all nesting attempts were not discovered. Examination of the nests showed a decline in 1972 in total nesting attempts, in egg production, in the number of nests in the Salt Flat and North Beach sites (Table 1), and in average clutch size at each nesting site (Table 2). There was, however, an increase in the number of nesting attempts in the LORAC and South Beach sites and an increase in hatching success at every site except the North Beach site.

TABLE 1. Nesting results of California Least Tern, 1971-1972, Camp Pendleton, California

	Salt Flats		LORAC		North Beach		South Beach		TOTALS	
	1971	1972	1971	1972	1971	1972	1971	1972	1971	1972
Nests	201	111	9	20	86	33	40	66	336	230
Eggs Produced	437	203	19	40	191	62	86	114	734	419
Eggs Hatched	189	165	6	36	180	45	71	109	446	335
Hatching Success %	43.5	81.3	31.5	90.4	94.2	72.6	81.6	95.6	60.8	79.9

TABLE 2. Clutch size of California Least Tern, Camp Pendleton, California, 1971-1972.

Clutch Size	Salt Flat		LORAC		North Beach		South Beach	
	1971	1972	1971	1972	1971	1972	1971	1972
1 Egg	28	30	0	6	3	5	1	18
2 Eggs	113	70	8	8	61	27	32	48
3 Eggs	58	11	1	6	22	1	7	0
4 Eggs	1	0	0	0	0	0	0	0
5 Eggs	1	0	0	0	0	0	0	0
Average	2.17	1.83	2.11	2.00	2.22	1.88	2.15	1.72

MORTALITY

Egg Destruction. Thirty-nine eggs were destroyed during the 1971 nesting season and 13 in the 1972 season. The major cause of egg destruction in 1971 was vehicular traffic. Rerouting traffic eliminated that threat. The remaining major threats to the safety of the eggs are gulls and domestic dogs.

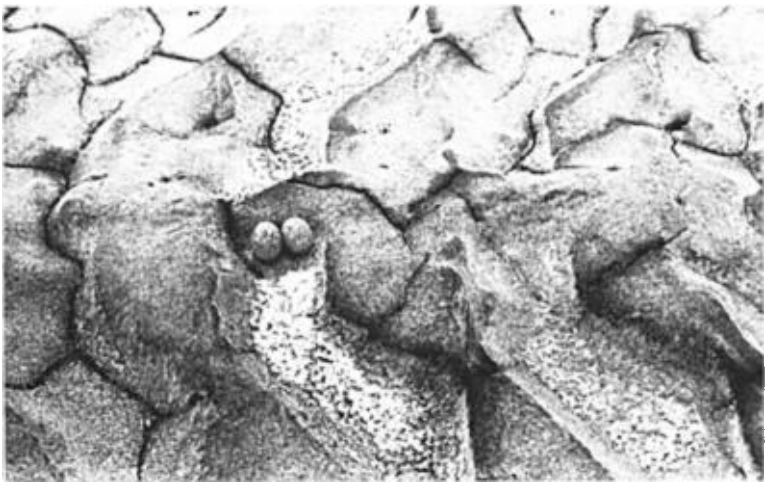
Egg Abandonment. On 28 May 1971 a heavy rain shower occurred. The rainfall measured .39 inches at the nearest weather station, 10 miles inland, and was probably heavier at the nesting site. The shower was of short duration and high intensity. The fine soils of the Salt Flat site prevented the water from infiltrating while the track depression nests impounded the water, flooding many eggs. The terns moved these eggs to the highest side of the nests before eventually abandoning them. Rain showers occurred on 19 and 22 May 1972 but measured only .12 and .07 inches, respectively, and egg flooding and abandonment was not common.

Adult Mortality. The remains of three adult least terns in 1971 and one in 1972 were found. All three adults found in 1971 were dismembered, suggesting predation. The lone adult found dead in 1972 appeared to have died from natural causes and was found intact.

Fledgling Mortality. Occasionally chicks were found dead. Without exception the chicks did not exhibit evidence of predation. In most cases parental abandonment, exposure and starvation were thought to be the contributing factors leading to death.

Mortality Rate. The total hatch was 446 eggs in 1971 and 355 eggs in 1972. The juvenile census resulted in a count of 195 birds in 1971 and 92 birds in 1972. These figures indicate a mortality rate of 56 per cent in 1971 and 74 per cent in 1972. The fledgling censuses undoubtedly left some juveniles uncounted. The calculated mortality rate is therefore believed to be higher than the actual mortality rate.

Barrier tripod constructed from old telephone poles to protect North Beach nesting site. A one inch diameter steel cable stretched between 75 of these tripods along three sides of the site effectively prevented vehicular traffic on the site. *Official Marine Corps Photo by Deane K. Swickard*



Vehicle track depression nest and abandoned eggs. Abandonment occurred after heavy rain showers flooded the nest and after the terns had moved the eggs to the highest side of the nest. *Official Marine Corps Photo by Deane K. Swickard*

This five egg Least Tern clutch was completed on 25 May 1971. All eggs were eventually abandoned. Four eggs were found in another nest in the same area. Two of these hatched. *Official Marine Corps Photo by Deane K. Swickard*

Least Tern feeding young at Santa Margarita River Colony, Marine Corps Base, Camp Pendleton, California. *Photo by Randy Crew*

RECRUITMENT

Based on the juvenile census, Camp Pendleton produced a minimum of 195 least terns in 1971 and 92 least terns in 1972. Assuming that only 80 per cent of the nesting attempts were discovered and nesting attempts actually numbered 400 in 1971 and 275 in 1972, the estimated recruitment is calculated to be 233 terns in 1971 and 110 terns in 1972.

AVAILABLE FOOD

Seinings were conducted in the Santa Margarita River estuary three times in 1971 and once in 1972. The seinings produced eight species of fish. Species identified, and length range of those measured, were Anchovy *(Anchoa compressa)* (75-89mm), Top Smelt *(Atherinops affinis)* (12-13mm), Sand Bass *(Paralabrax maculatofasciatus)* (252mm), Flatfish *(Paralicthys californicus)* (175-240mm), Killifish *(Fundulus parvipinnis)* (38-72mm), Least Perch *(Micrometrus minimus)* (86mm), Sculpin *(Leptocottus armatus)*, and Largemouth Bass *(Micropterus salmoides)*. Diamond Turbot *(Hypsopsetta guttulata)*, and Spotfin Croaker *(Roncador stearnsi)* were found during a creel census near the beach nesting sites.

Though the number of each species seined was not recorded, Top Smelt and Killifish were most abundant. Hundreds of each species were collected with every seining in 1971. Each was far less abundant in 1972. Remains of fish representing five species (Top Smelt, Killifish, Anchovy, Sculpin and Least Perch) were found in the nesting sites, probably dropped or discarded by the terns.

DEPARTURE

The terns began to depart in late August and by 13 September 1971, and 17 September 1972, all had departed. The total period of residence was 137 days in 1971 and 149 days in 1972.

CONCLUSIONS

As Massey noted (1971), the California Least Tern needs three conditions to nest successfully: (1) a large expanse of open sand as a nesting area; (2) an estuary adjacent to the ternery with a good supply of small fish; and (3) freedom from disturbance and predation. All three conditions were met on Camp Pendleton.

To increase the productivity of the beach nesting sites, two additional conditions must be met. The vegetation must be removed and the sand within the site must be highly disturbed and displaced. These conditions existed in the North Beach site in 1971 and in the South Beach site in 1972 and each had the highest hatching success for that year.

Removal of the vegetation without sand displacement resulted in a decline in nesting attempts and hatching success. This occurred in 1972 on the North Beach site.

The Salt Flats can best be enhanced by creating additional nest depressions and by depositing sand on the site to improve drainage and camouflage. This will be accomplished in April 1973.

All nesting areas must be afforded as much protection as possible. A fence with large signs indicating the nature of the area has proven adequate on Camp Pendleton.

ACKNOWLEDGEMENTS

I would like to thank Jerry Meronk, Jackie Rielly, and Alice Fries for their help in data collection and the members of the Base Wildlife Management Unit for their construction of the protective barriers.

LITERATURE CITED

Craig, A. M. 1971. Survey of California Least Tern nesting sites. Calif. Dep. of Fish and Game, Wildl. Manage. Branch.

Hardy, J. W. 1957. The Least Tern in the Mississippi Valley. Publ. of the Mus., Mich. State Univ. 1:1.

Massey, Barbara W. 1971. A breeding study of the California Least Tern. Calif. Dep. of Fish and Game, Wildl. Manage. Branch Admin. Rep. No. 71-9.

Natural Resources Office, Marine Corps Base, Camp Pendleton, California 92055.