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Department of Fish and Game

CALIFORNIA LEAST TERN CENSUS AND NESTING SURVEY, 1978[1/]

by

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ABSTRACT

In the sixth consecutive annual breeding population survey of California Least Terns (Sterna albifrons browni), 800 breeding pairs were located at 27 colony sites. The estimate of 800 pairs is the largest since annual surveys began, but the apparent increase over the 1977 estimate of 775 pairs may be attributed, in part, to variations in census methods. Nesting success was generally good in Alameda, Los Angeles and Orange counties, but generally poor in San Diego County.

1/ Supported by Endangered Wildlife Program, E-W-2, Nongame Wildlife Investigations, California Department of Fish and Game, Job V-2.13, Job Final Report (July 1979).

RECOMMENDATIONS

1. Colony censusing and protection efforts, documentation of nesting, feeding and roosting areas, and population monitoring be conducted in the 1979 breeding season in the same manner as in 1978.

2. Breeding colony protection efforts be expanded or modified for sites experiencing colony disturbance and harassment in 1978.

CALIFORNIA LEAST TERN
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INTRODUCTION

by

Paul R. Kelly

The smallest North American member of the gull and tern family, the California Least Tern (Sterna albifrons browni), arrives each spring on the west coast of California and Baja California to establish breeding colonies and raise young. Once widespread and common in California coastal habitats from the Mexican border to San Francisco Bay, this tern is currently threatened by numerous human-related environmental disturbances.

Development and recreational use of the coast has resulted in the loss of nesting habitat, while the destruction of coastal wetlands through dredging and filling has resulted in the loss of feeding areas. Other human activities have contributed to the decline of this species indirectly through the introduction of non-native predators, such as the Norway rat (Rattus norvegicus) and the house cat (Felis catus), and the inadvertent enhancement of populations of native predators and scavengers, such as Common Crows (Corvus brachyrhynchos) and California ground squirrels (Spermophilus beecheyi).

By the late 1960's, the California Least Tern population was reduced to such a low level that the subspecies was declared endangered under state and federal laws. Perhaps, more than any other animal, the California Least Tern has served as a sensitive environmental indicator reflecting the destruction of southern California's coastal wetlands.

PURPOSE

The objectives of this study were to: 1) document the location of California Least Tern colonies, 2) census the breeding population in California, 3) evaluate nesting success, and 4) identify management problems. This survey was part of a larger Department project, the overall purpose of which was to protect and manage California Least Tern habitat.

METHODS

Two Department field personnel assumed the responsibility for investigating separate segments of the Least Tern breeding range: central (San Luis Obispo County to Orange County) and southern (San Diego County). The northern (San Francisco Bay) segment was surveyed by a third biologist during a concurrent study, funded by U. S. Fish and Wildlife Service, of Least Tern nesting habitat requirements. Field personnel coordinated with resource agency personnel in Least Tern management efforts by: 1) identifying management and protection needs at known colony sites before the arrival of the birds; 2) assisting in posting, fencing or enhancing nesting areas; 3) notifying landowners, land users and local agencies regarding the need to protect colonies; 4) monitoring the arrival, presence and departure of breeding birds; 5) identifying emergency protection needs during the nesting season, and assisting in necessary management; 6) censusing numbers of

breeding pairs at each colony; 7) evaluating reproductive success and 8) preparing weekly status reports for distribution to resource agencies and cooperators.

RESULTS

Field personnel located approximately 800 nesting pairs of Least Terns at 27 colony sites in California in 1978 (Table 1). This figure represents an approximate mean value derived from the range of maximum and minimum numbers of breeding pairs. Reproductive success, based on the number of young produced, varied considerably throughout the breeding range (Table 1). San Diego County colonies fared poorly with reproductive success dropping to less than one-half the level observed in 1977 (Table 2). The abandonment of the state's largest colony at FAA Island in Mission Bay and the continuing decline of the Santa Margarita River and south San Diego Bay saltworks colonies accounted for most of the losses. Predators of various kinds, mostly unknown, apparently were responsible for the most dramatic and readily observed losses.

Reproductive success was generally good in Orange and Los Angeles counties with the three major colonies, Huntington Beach, San Gabriel River and Venice Beach, showing increases both in the number of breeding pairs and the number of young produced. The only significant nesting observed in the San Francisco Bay area was at the Alameda Naval Air Station, where an estimated 80 breeding pairs were generally successful.

A variety of management techniques were utilized in attempts to enhance breeding success. Routine vegetation removal at Huntington Beach State Park and Federal Aviation Administration (FAA) Island in Mission Bay successfully enhanced nesting habitat as in 1977, but terns were unresponsive to similar attempts at North Island Naval Air Station and at the Friar's Road site on Mission Bay. Artificial shelters for tern chicks were again used successfully at a number of colonies. Sand fencing, erected seasonally, was employed successfully at Venice Beach for the second year; although not a substantial barrier, this fence excluded dogs and most beach-goers. Through local public support and awareness, the Venice Beach colony has become one of the largest and most successful in the state.

Hand painted Least Tern decoys constructed of paper mache were used extensively for the first time in attempts to attract birds to new nesting areas. Terns were observed responding to decoys at established nesting areas and at roosting sites. At one new artificially created area where decoys were employed, the Bolsa Chica State Ecological Reserve, Least Terns were observed in courtship behavior before construction activities disturbed the birds. Whether Least Terns can be attracted to new nesting areas with decoys remains to be seen.

Four hundred and seven Least Tern chicks were banded in 1978 in conjunction with the survey and management work. Also, two complementary studies examined other aspects of Least Tern natural history. Douglas Hay (in prep.) identified key foraging areas and examined foraging behavior. Richard Erickson (in prep.) examined physical and biological characteristics of tern nesting areas in an effort to provide management guidelines for enhancing existing colonies and developing new colonies.

TABLE 1

California Least Tern Breeding Colonies
and Nesting Data, 1978.

County	Site	Estimated No. Pairs	Minimum No. Fledglings
Alameda	Alameda Naval Air Station	80	13
	Alvarado Salt Ponds	2	1
Santa Barbara	Santa Maria River	17-20	15
	San Antonio Creek	8-10	6
	Purisima Point (North)	5	7
Ventura	Santa Clara River	10-15	12
	Mugu Lagoon	10-12	0
Los Angeles	Venice Beach	60-75	75
	Playa del Rey	25-30	30
	San Gabriel River	60-65	70
Orange	Huntington Beach	75-90	100
	Upper Newport Bay	8-10	0
San Diego	Santa Margarita River Mouth	30-40	8
	Agua Hedionda Lagoon	11-15	4
	Batiquitos Lagoon	22-27	0
	San Elijo Lagoon	9	0
	Los Penasquitos Lagoon	18-25	10
	FAA Island	135-155	5
	North Fiesta Island	8-9	8
	Naval Training Center	8-12	5
	San Diego International Airport	43	10
	Sweetwater River	47	15
	North Island Naval Air Station	36	0
	Delta Beach	4	4
	Coronado Cays	8-10	10
	Saltworks	29	2
	Tijuana River Mouth	8-12	8
	Totals	776-887	418

1978 Breeding Population Estimate = 800 pairs

TABLE 2

Comparison of 1977 and 1978 Breeding Population and Reproductive Success

1977[1/]		1978	
No. of Pairs	Minimum No. Fledglings Produced	No. of Pairs	Minimum No. Fledglings Produced
San Diego County			
480	196	416-473	89
Orange County Los Angeles County Ventura County Santa Barbara County			
242	233	278-332	316
San Francisco Bay			
53	20	82	13
Totals			
775	449	776-887	418

1/ 1977 data from Atwood et al. (1977).

* * *

Colony sites and the use by least terns of each one in 1978 are described in Appendices A, B and C. Included in these accounts are descriptions of tern feeding areas and important roosting areas.

DISCUSSION

The 1978 estimate of approximately 800 breeding pairs represents the largest population recorded since annual surveys began. However, the apparent increase from the estimated 775 pairs in 1977 may be attributed in part to variations in census methods, uncertainty associated with the interpretation of renesting and late nesting attempts, and the discovery of previously unknown colonies. In addition, as coverage has improved and as field personnel have developed an increased understanding of the biology of this species, census accuracy may have improved, and this may be reflected in the higher 1978 estimate. Considering the variables and uncertainties involved in arriving at a population estimate, it is safe to conclude only that the 1978 figure represents a stable population relative to 1977.

The 1978 breeding season displayed striking contrasts in reproductive success between nesting areas in San Diego County and those to the north. Severe predator problems, resulting in nest abandonment and poor reproductive success, characterized some of the largest colonies. California's largest colony on FAA Island in Mission Bay failed completely. This seemingly ideal nesting area, which was utilized by 125 successful pairs in 1977, formerly appeared to be free of predator and human disturbance problems that have plagued other colonies. Although 135 to 155 pairs of terns occupied this colony in early June 1978, the island was almost deserted by mid-July, and 123 abandoned eggs were collected. The predator that caused the nest abandonment was not identified. Such large and perhaps unnatural concentrations of nesting Least Terns may be especially susceptible to year to year variability in breeding success. Perhaps this species has not adapted to deal with predators when nesting in such dense concentrations. Whereas Caspian Terns (Sterna caspia), for example, are highly colonial and nest in dense colonies year after year, Least Terns tend to be semi-colonial - relatively small colonies of approximately 30 pairs covering 2 to 8 ha or more, are not unusual.

Some Least Tern colonies located in relatively natural coastal sand dunes are loosely knit and may occupy 0.4 to 0.8 km of beach front. As a result of destruction and increasing disturbance of historic nesting areas, the California Least Tern is apparently being forced to nest on smaller, often times substandard nesting areas, where unnaturally dense colonies may form. Such high concentrations of birds may serve as strong predator attractants, which enable predators to locate colonies quickly and repeatedly prey upon them. Least Terns appear to have adapted to predators by nesting in loosely knit colonies, mobbing invaders and, if the pressure becomes too severe, by abandoning nests and renesting (if time permits) in other areas. With increasingly fewer options available to them, in terms of suitable nesting habitat, the birds often may not be able to utilize alternate nesting areas, and poor reproductive success results.

The course of action required to alleviate this uncomprising situation includes the protection and management not only of existing colonies but also some historical and potential nesting habitat to provide alternate nesting areas. These areas should be as large as possible to reduce the likelihood of predator problems. In areas where alternate nest sites are not yet available and colonies have high nest densities, intensive management practices similar to the predator control program employed at the Huntington Beach colony in 1978 may be required.

In areas where nesting habitat is not managed, terns may nest on areas that cannot be readily protected. In such situations it is desirable to maintain the flexibility to implement immediate protection measures, such as placement of chain-link fencing. Up to this time, funds have not been available to erect fencing capable of excluding off-road vehicles. The presently used techniques of enclosing colonies with posts, signs, flagging tape and twine, has proved relatively ineffective in excluding ORV's, which have done serious damage to several colonies.

The growth of native plants and exotic weeds is a serious management problem on several nesting areas. Mechanical weed removal, including mowing and discing, can retard plant growth, but since these techniques must be used before the terns arrive (to prevent any possibility of disturbance), sufficient time may remain for subsequent plant growth to make a site unattractive to the birds. Discing may also disturb certain substrates, leaving unnatural furrows and darkening the surface. Sites should be disced at least one month and preferably two months prior to the nesting season to allow for weathering by wind and rain.

Mechanical plant control has been used successfully by responsible and knowledgeable personnel with agencies such as Huntington Beach State Park. In many cases it is impractical, however, to rely on local government agencies to control plant growth on nesting areas. In the future, funds should be provided to contract for mechanical plant control, or alternate methods of plant control should be investigated. Herbicides with short-lived toxicity or natural plant retardants, such as saltwater, should be considered. Saltwater could perhaps be applied via pumps and sprinklers to achieve soil salinities sufficient to inhibit germination of many terrestrial plants.

Increased consideration must also be given to the management of Least Tern foraging areas. The disturbance of intertidal mudflats, eel grass beds and other natural, shallow water habitats, are likely to adversely affect Least Tern food resources. In addition, housing developments in the watersheds of some coastal bays and lagoons are causing accelerated erosion and siltation, which is rapidly destroying foraging habitat.

APPENDIX A

LEAST TERN BREEDING SEASON IN NORTHERN CALIFORNIA, 1978

by
Richard A. Erickson

Alameda Naval Air Station

Once again this Alameda County site hosted northern California's largest Least Tern colony. Perhaps due in part to the total lack of nesting in the Bay Farm Island area, the colony nearly doubled in size over last year's estimated 45 pairs. The area used was that shown by Manolis (in Atwood et al. 1977). Conversations with airfield personnel (E. Craw et al.) revealed that the area shown by Wilbur (in Jurek 1977) has probably never been used.

As suggested by Wilbur (op. cit.), Naval Air Station personnel placed a log barrier around the site this year. Logs about one foot in diameter completely surrounded the nesting area and effectively isolated the colony from the rest of the airfield. Vehicular traffic, apparently a problem in the past, was eliminated. Many chicks managed to exit through cracks in the barrier but generally did not wander far. Aside from the log barrier there was no site preparation. Concrete blocks provided for shelter in 1977 (Manolis in Atwood et al. 1977) were well used this year, and the log barrier provided additional shelter for chicks.

The colony was first visited on 18 May when at least 35 birds were present. Most birds were engaged in various stages of courtship but at least eight nests apparently contained eggs. Only two of these were examined, one with one egg, one with two. On 26 May there were at least 53 incubating birds. The contents of only five nests were seen, four with two eggs, one with three, none of which were observed on 18 May.

An adult which had been dead for about a week appeared unmolested. An estimated 130-150 birds were present on 21 June. About 50 of these were chicks and about 55 were single incubating birds. Assuming the 50 chicks represented about 25 nesting pairs, at least 80 (55 + 25) pairs were believed to be nesting. Considering that there were courting and copulating pairs present and the difficulty of locating and counting chicks, this is probably a conservative estimate. The contents of six nests were observed; two eggs each in two nests and two nestlings each in four nests.

By 19 July only 10-15 adults were present with 12-15 fledglings and near-fledglings. Also present were two downy young, two active nests with two eggs each and two single abandoned or infertile eggs. There was no evidence of significant failure at the site and it is assumed that most young had fledged successfully. On 29 July the site was being used by roosting gulls and no terns were present. Apparently the last two nests had failed though one pair of terns with two large young was present some 500-600 m to the west across the airfield. No terns were seen at the site or in the vicinity on 8 August.

Little information was obtained on the foraging habits of birds from this colony. Most observations were made on San Francisco Bay to the southwest of the nesting site, the nearest possible foraging location, and birds foraging there were visible from the nesting site. Observations included: three birds on 18 May, three on 21 June, five on 19 July and two to five on 29 July. Other observations were made in the Oakland Inner Harbor just east of the main gate to the Naval Air

Station (two birds on 18 May and 21 June) and on San Francisco Bay off the "Perimeter Road" just west of the nesting site (one adult and three unknown aged birds on 19 July).

Observation in previous years (ABF; pers. obs.) has shown regular use of the area just north of the San Francisco-Oakland Bay Bridge toll plaza (about 4.8 km to the north) by foraging Least Terns. Greatest use occurs in May when up to 15 have been seen and only sporadic use is made of the area through the rest of the summer. Farther north, Pt. Isabelle and the Emeryville Marina have received occasional use as well. Observations at Lake Merrit, the Oakland Estuary and especially the coast of Alameda may have pertained to birds from the Bay Farm Island area.

Ballena Bay, Alameda

Least Terns were first suspected of nesting on San Francisco Bay in the Alameda area in 1959 (ABF). Confirmation did not come until 1967 when three nests were found on a recent fill (Chandik and Baldridge 1967). Nesting at this site had been suspected in 1965 (ABF) and 1966 when 60 adults and 15 immatures were seen on 29 July (Chase and Chandik 1966). However, nesting was first suspected at the Alameda Naval Air Station, 3.2 km to the west, in 1966 (ABF) and it is possible that the Ballena Bay site was originally used only for loafing by birds from the Naval Air Station. Four pairs used the site in 1968 (Chandik and Baldridge 1968) and apparently none thereafter. Condominiums now cover the site, making it unsuitable for nesting.

Bay Farm Island

Nesting occurred at one or two locations on the extensive "Utah Fill" from 1969 to 1975 with an estimated 200 pairs, the maximum number, observed in 1972 (Anderson 1970; Gill 1972; Bender 1974a, 1974b; Massey 1975; Roemer 1976).

Alameda's South Shore and San Leandro Bay have been heavily used by foraging Least Terns over the last 10 or 15 years (ABF; pers. obs.). It is likely that most of these birds were nesting on Bay Farm Island.

A visit to the site on 26 May revealed that the main former nesting area was grown over with weeds. An adjacent area had been recently graded, however, and appeared suitable for nesting. The area was visited again on 21 June and 20 July but at no time were Least Terns actually on the site. Intensive construction began during the summer and it is unlikely that the site will ever be used again.

Elsie Roemer's (1976) experiences with what was possibly another nesting colony at the Hegenberger Marsh on south San Leandro Bay in July 1971 should be included here: "Some of us were especially concerned about the filling of 200 acres of marsh between San Leandro Creek and Airport Channel. Many birds were being disturbed. I saw so many Least Terns that I tried to find their nesting colony. I thought I'd found it, but bulldozers were at work and covered the area as I watched. Workmen told me later that they had covered many nests." This may have represented the only known nesting in a natural situation on San Francisco Bay. Reference to "nest scraping and copulation" at San Leandro in May 1973 (ABF) is an error (B.G. Elliott pers. comm.).

Oakland Airport

Unexplainably this area was abandoned by both Least Terns and Snowy Plovers (Charadrius alexandrinus) this year. Conditions seemed excellent for nesting

during visits on 26 May, 21 June and 20 July, but no terns were seen nor were any seen by airport personnel. Forty pairs nested here in 1973 (Bender 1974a) and lesser numbers from 1975 to 1977 (Massey 1975, Jurek 1977, Atwood et al. 1977).

Alvarado Salt Ponds

This new nesting locality was discovered by Gary Page of Point Reyes Bird Observatory while surveying nesting Snowy Plovers. The site is near the community of Alvarado (now incorporated with Union City), but within the city limits of Hayward, between the old Alameda Creek channel and the new Alameda County Flood Control Channel. The present San Francisco Bay shoreline lies nearly 3.2 km westward and the nearest landmark is Turk Island, 1.2 km to the south-southeast. Nesting occurred on a narrow dike surrounded in all directions by salt evaporating ponds operated by the Leslie Salt Company. Public access is prohibited and disturbance is minimal. Likewise, predation was unapparent. Caspian Terns (Sterna caspia) nest on the same dike about 0.5 km to the west. The substrate is rather powdery and vegetation is limited to scattered low clumps of iceplant (Mesembryanthemum sp.) and pickleweed (Salicornia sp.). Foraging was observed only on the salt ponds.

Two nests with two eggs each and four attending adults were present upon discovery during the week of 18 June. On 24 June two very young chicks were found in the vicinity of one nest and, though all four adults were present, there was no activity in the vicinity of the second nest. The second pair was assumed to have failed as only two adults and one juvenile were seen foraging on the adjacent salt ponds on 20 July and no Least Terns were seen on 29 July. Nevertheless on 8 August one chick, apparently several days old, was being defended by both parents in the area where the second nest had originally been.

This represents the first documented nesting of Least Terns in southern Alameda County, though they have long been known to congregate after breeding on the salt evaporating ponds in this area (Chandik and Baldridge 1969) and Gill (1972) suspected nesting in this area in 1971. On 31 July 1965 H. L. Cogswell observed a group of 15 birds near the mouth of Alameda Creek, including adults carrying fish to juveniles and scolding the observer (Chase and Paxton 1965). Eighty birds were seen at the east end of the Dumbarton Bridge on 30 July this year (Winter and Manolis 1978b).

Bair Island

San Francisco Bay National Wildlife Refuge personnel report that no Least Terns nested here in 1978. One or two dikes were broken during winter storms allowing bay water to flood the nesting area. Water covered the site throughout the nesting season and there are no immediate plans to remedy the situation. Bair Island had been used by up to 15 pairs every year since 1969 with a two year lapse in 1972 and 1973 (Anderson 1970; Craig 1971; Bender 1974a, 1974b; Massey 1975; Jurek 1977; Atwood et al. 1977).

In Foster City at Little Coyote Point, about 8 km northwest of Bair Island, P. J. Metropulos (pers. comm.) observed an adult Least Tern feeding a juvenile on 3 September 1978. Dredge spoils have been dumped here and he stated that the area appears to have potential as a nesting site.

Redwood City Salt Ponds

In 1976 Barry Sauppe photographed a few pairs of Least Terns nesting near Forster's Terns on a dried salt evaporating pond south of Westpoint Slough (S. R. Wilbur, P. J. Metropulos pers. comm.). This is 3 to 5 km southsoutheast of the Bair Island site (between Harbor Boulevard and the end of Marsh Road). This information was previously unpublished and thus no visits were made to the site this year. The area is said to have been under water in 1977 and 1978 (S. R. Wilbur, P. J. Metropulos pers. comm.).

Farther southeast, the Palo Alto Baylands has traditionally been a post-breeding haunt for Least Terns (D. F. DeSante pers. comm.). In 1978 a maximum of 18, including numerous juveniles, was present on 12 August (Bailey 1978). Although local nesting has been suspected (D. F. DeSante pers. comm.), there is no solid evidence for the statement by Luther (1978) that "Least Terns nest near the dump."

Monterey Bay Sites

Records of nesting in the Moss Landing area span the period from 1903 (Beck 1907) to 1956 (Wilbur 1977). Point Reyes Bird Observatory staff and volunteers walked all the sandy beaches along Monterey Bay this summer and are certain Least Terns did not nest on the bay (J. Warriner pers. comm.). In addition, extensive field work was done on the salt ponds at Elkhorn Slough this year. Forster's (Sterna forsteri) and Caspian Terns nest on dikes there and suitable conditions probably exist for Least Terns as well. One bird was present there briefly this summer (P. J. Metropulos pers. comm.). Public access is denied so it could prove to be an important area; nesting should be watched for and encouraged in the future.

At least three different sites on Monterey Bay were formerly used by Least Terns and there has been considerable confusion between them. The Pajaro River mouth is about 5.6 km (3½ miles) north of Moss Landing at the boundary between Santa Cruz and Monterey counties. Definite records of nesting extend from 1930 (Wilbur 1977) to 1954 (Pray 1954) but two chicks taken in 1919 (California Academy of Sciences collection - hereafter CAS) are labeled "Moss Landing, Santa Cruz Co." Up to 25 birds present in July 1955 and 12 in July 1956 (ABF) indicate nesting may have occurred in those years as well. Nesting primarily occurred north of the river at Palm Beach though eight egg sets taken by G. L. Bolander in 1931 (Museum of Vertebrate Zoology egg collection - hereafter MVZ) are labeled "3½ miles north of Moss Landing, Monterey Co."

In 1967 the Pajaro Dunes housing development was begun (J. Warriner pers. comm.). John and Ricky Warriner have frequented the area since early in this decade and have recorded Least Terns only as migrants, with a maximum of 13 on 7 May 1978 (Winter and Manolis 1978a). The beach is now heavily used by people and will probably never again support nesting Least Terns unless it is managed for this species (J. Warriner pers. comm.).

Beck (1907) first found Least Terns nesting at "Moss Landing, Monterey County near the Salinas River mouth" in 1903. The river mouth is about 6.5 km south of Moss Landing. Specimens and egg sets taken by Beck in 1907 and 1911 (CAS) are labeled simply "Moss Landing, Monterey Co." and a 1903 egg set (MVZ) is labeled "Castroville," thus apparently leading to some confusion. Nesting at the Salinas River mouth continued until at least 1932, as evidenced by an egg set labeled "Neponset" (MVZ). June and August specimens were taken there as late as 1937 (Wilbur 1977). This area underwent considerable disturbance during World War II when it was used as an amphibious base (B. G. Elliott pers.

comm.). Visits on 17 May and 31 July of this year revealed no terns but apparently suitable habitat. The Department of Fish and Game now controls access and nesting is a possibility in the future.

As mentioned above, it is unclear where nesting occurred in 1919 but from 1921 to 1936 (Wilbur 1977) nesting apparently occurred at the old mouth of Elkhorn Slough, about 1.6 km north of today's harbor mouth (MacGinitie 1935). Specimen labels (MVZ and Western Foundation of Vertebrate Zoology - hereafter WFVZ) all indicate Monterey County and include: "Moss Landing," "near Moss Landing," "northern Monterey Co." and "Monterey Bay." Recorded nesting from 1948 (WFVZ) to 1956 (Wilbur 1977) also occurred at that site and possibly in the salt pond area as well (H. L. Cogswell pers. comm.). Plant growth threatened the suitability of the site in 1955 (Cogswell 1955) and today it is heavily used by beachgoers (J. Warriner, H. L. Cogswell pers. comm.).

Los Banos

To complete this discussion of northern California's nesting Least Terns, two unusual egg sets (nos. 4996 and 4997) in the Museum of Vertebrate Zoology must be mentioned. They are labeled "near Los Banos, Merced Co., 13 May 1932, C. Hopkins" and contain a subsequent reviewer's comments as well: "To be doubted until further documentation is obtained." The identity of the eggs is not in question, but lacking any further documentation, the location must still be doubted.

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APPENDIX B

LEAST TERN BREEDING SEASON FROM SAN LUIS OBISPO COUNTY TO ORANGE COUNTY, 1978

by

Jonathan L. Atwood

Santa Maria River

The nesting area used by this colony in 1978 was slightly more extensive than that used in 1977, but was located in the same basic portion of this extensive sand dune system. On 5 June approximately 12 pairs were present in the area; most of these appeared to be in the early stages of courtship behavior, although one 2 egg clutch was seen. By 29 June approximately 12-15 pairs were observed; one 2 egg clutch, two 1 egg clutches and two pairs of recently hatched chicks were observed. By 18 July approximately 15-20 pairs were in the vicinity of the nesting area, and on 31 July approximately 15 fledglings and at least one 1 egg clutch were present.

Based on these rather limited observations, I estimate that 17-20 pairs of Least Terns nested at the Santa Maria River in 1978, and that they produced a minimum of 15 fledglings. Moderate amounts of ORV activity in the nesting area undoubtedly had some adverse impact on the colony's success; nests were scattered over such an extensive area that it was virtually impossible to adequately fence or post the portion of the dune system being used by the terns.

Observations at Oso Flaco Lake, San Luis Obispo County, were somewhat difficult to interpret during 1978. On 5 June at least 6 adult Least Terns were present, on 29 June and 18 July, 8 adults were seen, and on 31 July, 15 adults and 10 fledglings were present. Although Least Terns regularly foraged at this site, they were never observed carrying fish away from the lake as might be expected if there were a nearby nesting area. No extensive areas of level sand could be located within the large, steeply sloped dune system surrounding the lake; however, it is possible that limited areas of suitable nesting habitat do exist in the area and that a small breeding colony may have been present in 1978. Based on 1) the consistent presence of Least Terns at Oso Flaco Lake throughout the breeding season and 2) the simultaneous count of 15 fledglings at the Santa Maria River and 10 fledglings at Oso Flaco Lake on 31 July (this total number of 25 fledglings is considerably higher than was probably produced from the nearby Santa Maria River colony), I suspect that 6-8 pairs of Least Terns may have nested in the vicinity of Oso Flaco Lake in 1978. Additional surveys of this region, using a dune buggy or similar sand vehicle, are recommended for the 1979 Least Tern population survey.

San Antonio Creek (Figure B-1)

Subsequent to observations on 18 June of Least Terns on Vandenburg Air Force Base, Santa Barbara County (fide Point Reyes Bird Observatory), suitable nesting habitat for the species was surveyed in this previously poorly explored area. On 28 June a breeding colony consisting of 8-10 pairs was located in an area of extensive sand dunes approximately 0.6 km south of San Antonio Creek. Three nests were found in a large, barren sand area located approximately 150 m inland from the high tide line; other active nests were probably present, since the behavior of the birds indicated that the colony had progressed to the early stages of incubation. On 18 July at least 3 recently fledged young were observed; 8-10 pairs of adults were still present in the area, indicating that little, if

any, post-breeding dispersal had occurred since the previous visit to the colony. On 18 July the activity of the colony had shifted noticeably toward the low sand dunes adjacent to the high tide line, where the behavior of the adults suggested that chicks were probably hiding in the considerable amounts of driftwood and dune vegetation present in this portion of the beach. Similar shifts in location of the colony's main activity were also noted at the Santa Maria River and Purisima Point nesting sites; such behavior suggests that in these ecologically similar nesting areas the entire beach and sand dune system, rather than merely the specific area in which nests were located, is significant in the overall success of the breeding effort. By 1 August the colony had declined in numbers, probably as a result of post-breeding dispersal; 2-3 fledglings were seen and 3 pairs of adults which had unfledged chicks were present. Virtually all of the activity was in the low dune system behind the high tide line approximately 0.4 km south of San Antonio Creek.

About 8-10 pairs of Least Terns nested at San Antonio Creek in 1978, and at least 6 fledglings were produced. Only minimal human disturbance occurred, mainly in the form of unauthorized ORV activity. Although the effects of sonic booms associated with nearby missle launches are currently unknown, it is probable that this factor may represent the greatest potential source of disturbance to Least Terns nesting in the Vandenburg area. It is recommended that efforts be made to restrict nearby missle launching activity during the period 15 April-31 July.

During recent years Least Terns have regularly been observed at the Santa Ynez River, located approximately 13 km south of the two Vandenburg Air Force Base nesting sites (see also Purisima Point). This year 1 adult was seen at the mouth of the Santa Ynez River on 6 June, 6 adults were present on 28 June, none were observed on 19 July, and 10 adults and 1 fledgling were present 31 July. Although the origin of these birds is uncertain, it is possible that they were associated (either as late-arriving breeders or, in the case of those seen 31 July, post-breeding wanderers) with the Purisima Point and San Antonio Creek breeding colonies. No suitable Least Tern nesting habitat was located either north or south of the immediate area of the Santa Ynez River mouth, and the beach near the river mouth itself (where nesting was documented in 1971; Bender 1974a) is receiving increasing amounts of human use during the summer months.

Purisima Point (North) (Figure B-1)

Initially found by personnel of the Point Reyes Bird Observatory on 18 June, this colony was located approximately 1.9 km south of San Antonio Creek on Vandenburg Air Force Base, Santa Barbara County. The site was about 1.2 km south of the San Antonio Creek nesting area. The colony at Purisima Point was not located until hatching was underway, at which time most of the activity was in the low dune system immediately behind the high tide line. On 28 June 3-5 pairs were present, and 2 nearly fledged chicks (including 1 which had been killed less than an hour prior to our arrival at the site by an unauthorized ORV) were found; behavior of the adults indicated that other chicks were probably present. Nesting at this colony apparently began somewhat earlier than at the nearby San Antonio Creek site. On 18 July a total of 7 fledglings were observed resting on the beach near the Purisima Point nesting site, and by 1 August the colony was deserted, presumably due to post-breeding dispersal.

Approximately 5 pairs of Least Terns nested at Purisima Point in 1978, and at least 7 fledglings were produced. Only minimal ground disturbance (ORV activity)

was encountered at the site, but even this slight amount was known to have had relatively serious impacts on the nesting success of the colony. The Purisima Point nesting site is near several missle launching pads on Vandenburg Air Force Base, and may be adversely impacted by sonic booms during the period 15 April-31 July.

Santa Clara River

Due to considerable changes caused by heavy storms during the winter of 1977-78, the major Least Tern breeding colony at the mouth of the Santa Clara River was located in a different portion of this estuarine system than had been used in 1977. The principal nesting area used in 1978 was located on a small peninsula of land northeast of the river mouth itself; early in the season this sandy area was quite open, but by mid-July it had become mostly overgrown with shrubby vegetation. A second nesting site, used by 2 pairs of Least Terns, was located on the beach north of the Santa Clara River channel and approximately 50 m inland from the high tide line; this site was approximately 300 m northwest of the principal nesting area, and was near the location used by 1 pair of nesting Least Terns in 1977. Additionally, 2 pairs of territorial Least Terns were observed on 18 August in a large, open sandy portion of the river bottom located approximately 1.6 km east of the Santa Clara River mouth (R. Webster pers. comm.); although no chicks or eggs were found at this site, it is probable that 2 pairs did nest in this area in 1978.

Approximately 3 pairs of Least Terns were present in the Santa Clara River area throughout May, but nesting was not documented until 7 June when 6-8 pairs were present and four clutches (one with 3 eggs and three with 2 eggs) were found. The Santa Clara River channel regularly plugs up during the summer months, thereby causing considerable flooding of normally dry areas of the river bottom. In 1978 this plugging and subsequent flooding occurred approximately 1 June. On 7 June three of the four clutches which were located on sand that was wet due to the rising water level; on 16 June one nest was located which was within 0.3 m of the water's edge. By 23 June the river mouth had opened and the water level had dropped; at least 5 pairs of terns, most of which appeared to have chicks, were observed. On 6 July 7 pairs were seen near the principal nesting area and four nests (all 2 egg clutches) were found; additionally, 2 pairs (each with 2 egg clutches) were found nesting on the beach north of the river channel. On 28 July 5 fledglings were seen, on 6 August at least 8 fledglings were present (R. Websters pers. comm.) and on 25 August 4 previously uncounted fledglings were observed.

I estimate that 10-15 pairs of Least Terns nested at the Santa Clara River in 1978, and that at least 12 fledglings were produced. The effects of flooding on the colony are unknown, but probably caused the loss of several nests which were found abandoned; also, the rapid growth of vegetation in the principal nesting area may have had an adverse impact on the colony's success. Some ORV activity occurred in the principal nesting area, and the colony was occasionally disturbed by local birdwatchers; however, these sources of disturbance appeared to have little adverse impact on the colony's breeding success.

Mugu Lagoon

During the 1978 breeding season Least Terns in the Pt. Mugu Pacific Missle Range nested on the same general portion of beach used during the last 3 years; however, the specific nesting site in 1978 was approximately 200 m south of the area used in 1977. On 5 June approximately 10 pairs were present in this area,

with no indication that incubation had begun. By 8 June, 6-8 pairs were observed, two of which behaved as if in the early stages of incubation. On 23 June, 10 pairs were present, and nine clutches were found (two with 3 eggs and seven with 2 eggs). Between 23 June and 28 June a serious predator problem developed at the colony; by 3 July all previously located nests had been destroyed, and only five active nests, possible re-nesting attempts, were observed. By 6 July these nests were no longer present, and no terns were seen in the vicinity of the nesting area.

The failure of this colony in 1978 was caused by red fox (Vulpes fulva) predation. A sizable population of this species exists in the Pt. Mugu/Ormond Beach area (R. Dow pers. comm.) and fox tracks, including some leading directly to Least Tern nest scrapes, were extremely common throughout the nesting area. The speed with which a seemingly stable Least Tern colony can be destroyed by predators during the period of incubation is remarkable.

Census data are complicated by the loss of clutches and probable re-nesting attempts, but I estimate that 10-12 pairs of Least Terns nested at Mugu Lagoon in 1978. I saw no indication of any clutches surviving to hatching age, and certainly no fledglings were produced.

Least Terns did not attempt to nest at nearby Ormond Beach in 1978. The increasing use of this area by ORV's is very likely the primary factor in the abandonment of this nesting area in 1978.

Venice Beach

Least Terns returned in 1978 to the same portion of Venice Beach used for nesting in 1977; once again, the Los Angeles County Department of Beaches provided invaluable assistance in erecting a large protective enclosure of sand fencing around the nesting area. The site was visited on 20 dates between 27 April and 1 September.

On 27 April 10-12 Least Terns had arrived in the Venice Beach area and were involved in courtship behavior at the nest site. By 5 May numbers had greatly increased, as evidenced by a pre-dawn count of 79 individuals roosting near the high tide berm between the nesting enclosure and Ballona Creek channel. By 17 May nesting was underway and on 5 June, 45 nests were counted, with an additional 5 pairs courting in the area. On 16 June hatching had begun and 20-25 chicks were present in addition to approximately 30 incubating pairs. By 17 July 60-70 fledglings were present, as well as 10-15 large chicks and 8 incubating birds. The colony dispersed from the nesting area fairly rapidly during late July and August; by 1 September only 8 Least Terns were observed in the area. Up to 5 fledglings that had been color-banded at either Venice Beach or nearby Playa del Rey (see 1978 banding report) were observed at Harbor Lake during July and August.

About 60-75 pairs of Least Terns nested at Venice Beach in 1978, producing a minimum of 75 fledglings. No evidence of predation or egg abandonment was found, and human disturbance of the nesting birds was very minimal.

In terms of future management of this breeding colony, I would make two strong recommendations concerning the erection of the sand fencing. First, the nesting enclosure should be completed by 1 May. This year gaps remained in the fence until 5 June, at which time 45 pairs were incubating eggs; had a dog wandered into the area at this time, major problems would have resulted. Second, it is extremely important that the lower tier of the sand fencing rest on the sand.

This year most of the enclosure had a 3 to 10 cm space between the sand and the lower tier. Even such small spaces are sufficient to allow Least Tern chicks to wander from the nesting enclosure onto the public beach. If the sand fencing is not placed so as to prevent such wandering, chick mortality will likely result from regular maintenance activities, such as trash collection and vehicular access to lifeguard stations.

Playa del Rey

Although this area was not used for nesting by Least Terns in 1977, the species returned in 1978 to the same alkali flats that have been used in recent years. The site was visited on 13 dates between 27 April and 28 August.

When Least Terns first arrived in the Venice Beach/Playa del Rey area in 1978, the Playa del Rey nesting site was mostly flooded due to exceptionally heavy winter rains. However, the northeast portion of the largest salt flat dried quickly, and on 17 May approximately 10 pairs of Least Terns were engaged in courtship behavior in this area, with one 1 egg clutch being located. By 16 June numbers had increased to approximately 22 pairs; hatching had begun and four nests were placed in portions of recently dried salt flats located northeast and southwest of the principal nesting area. Although these four nests were not contained within the posted nesting enclosure, at least three were known to have successfully produced fledglings. On 17 July at least 25 fledglings were present in the general area, with approximately 15 large chicks and one 2 egg clutch also seen. Numbers gradually declined during late July and August due to post-breeding dispersal. By 28 August only 4 fledglings, none of which were included in previous counts, and their parents remained in the area.

An estimated 25-30 pairs of Least Terns nested at Playa del Rey in 1978, producing a minimum of 30 fledglings. No definite evidence of predation or unusual egg abandonment was encountered, and various sources of human disturbance (overflying helicopters, horseback riders, etc.) appeared to have little adverse impact on the colony's success.

One event at this nesting site in 1978 deserves special mention. During mid-August the marsh system in this area was restored to tidal influence by an unknown party who opened the tide gates to the Ballona Creek channel. Although this action greatly increased the value of this area for migrating shorebirds, had tidal flow been restored 2 months earlier it would have resulted in complete flooding of the Least Tern nesting area. Precautions should be taken in the future to ensure that tide gates are not opened during the period 1 April-15 August.

Least Terns did not breed at the nearby Beethoven Street Fill in 1978. Large mounds of sandy dredge material from the Ballona Creek channel were placed on the site prior to this year's breeding season, rendering the area unsuitable for Least Tern nesting.

San Gabriel River

For the eighth consecutive year, Least Terns nested on the fill area located adjacent to "The Market Place" shopping center in Long Beach. Due to increased vegetation cover and continued development of the site, the available nesting habitat in 1978 was approximately 10% smaller than in 1977. The site was visited on 45 dates between 17 April and 6 September. Nesting was scattered throughout the relatively large fill area. Additionally, 4 pairs nested in a small depressed area located west of Pacific Coast Highway and the main nesting area. This property is currently under lease to Chevron Oil, Inc.

Least Terns arrived in numbers in the Long Beach area during the last week of April, as evidenced by the following counts of night roosting birds at Belmont Shore beach: 21 April - 5 individuals; 23 April - 63; 24 April - 114; 26 April - 125; 27 April - 134; 28 April - 150; 29 April - 194; 1 May - 250; 2 May - 260. However, very little activity was noted at the San Gabriel River nesting site until 15 May, at which time approximately 10 pairs were involved in courtship behavior at the site. By 18 May at least 40 pairs were present in the area, and approximately 15 pairs had begun incubation. On 22 May, 55 nesting pairs were counted, and 7-10 additional pairs were courting in the area. By 14 June hatching was well underway, and on 21 June large numbers of chicks, as well as approximately 25 incubating pairs, were present. On 3 July approximately 65 fledglings were counted. Subsequently, the colony declined in numbers due to post-breeding dispersal. Several color banded fledglings and adults from the San Gabriel River colony were observed at Harbor Lake during late July and August. By 25 July only a single incubating pair remained; this late clutch of 1 egg hatched on 3 August, with the chick disappearing on 18 August (probably taken by a predator). The San Gabriel River nesting site was used for nocturnal roosting by this colony from the period early June - mid-August. In 1978 the Belmont Shore roost site was not used during the latter portion of the breeding season. Details summarizing nocturnal roosting in the California Least Tern during the period 1976-78 will be presented elsewhere (Atwood and Hay in prep.).

About 60-65 pairs of Least Terns nested at the San Gabriel River in 1978, producing a minimum of 70 fledglings. Some evidence of predation on eggs and chicks was obtained, and cat tracks were frequently encountered in the nesting area. The impact of predation on the success of the colony is uncertain, but presumably was quite minimal considering the number of fledglings produced. Slight amounts of human disturbance appeared to have little adverse impact on the overall success of the colony.

Least Terns were observed during early May in courtship activity on the same portion of Reeves' Field (Terminal Island) that was used for nesting during 1976-77. However, erection of several chain link fences in this area by the Los Angeles Harbor Department, and subsequent use of a portion of the nesting site for auto storage apparently resulted in abandonment of this area in 1978. It is uncertain whether the placement of these fences rendered the site unsuitable for Least Tern nesting or if the construction activity involved in erecting the fences disturbed the birds away from the area during site selection.

Huntington Beach State Park

In 1978 the first Least Tern was observed near the Huntington Beach State Park nesting area on 19 April. Numbers gradually increased throughout late April and May. On 22 May, when 15-20 pairs had begun incubation, approximately 130 individuals were observed roosting at night adjacent to the nesting area. By 19 June approximately 70 pairs were in the area, and hatching was well underway. In spite of relatively major losses due to predation (see below), approximately 90 fledglings were counted on 20 July. Post-breeding dispersal occurred during late July and August. Fledglings color banded at this colony were observed at the San Gabriel River nesting site and at Harbor Lake during this period. By 24 August only 3 Least Terns were observed at the Huntington Beach State Park site.

On the morning of 21 June Kristen Bender and Dorothy D. Rypka observed a flock of 10 Common Crows (Corvus brachyrhynchos) capturing and killing chicks in the midst of the Huntington Beach State Park colony. Subsequent inspection of

the nesting area revealed at least 30 freshly dead chicks (most approximately 5 days old) and 2 freshly broken eggs (Bender pers. comm.). Efforts to eliminate crows at a nearby roosting site appeared to be largely successful, since there were no other major instances of crow-related mortality in the Least Tern colony throughout the remainder of the breeding season. It is interesting that there was no evidence of nest or colony abandonment as a result of this predator disturbance. Instead, it appeared that considerable amounts of successful re-nesting took place following the loss of a major portion of the colony's initial nesting effort. In fact, the number of fledglings produced at this colony in 1978 was greater than at any other California Least Tern colony. The fact that the nesting season had begun relatively early at this site in 1978 provided adequate time for a strong re-nesting effort. Also important was the fact that the predator occurrence was timed after the first major wave of hatching. In contrast, significant amounts of predator disturbance during the incubation period may result in total abandonment of the nesting effort at that site (see Pt. Mugu and FAA Island).

I estimate that 75-90 pairs of Least Terns nested at Huntington Beach State Park in 1978, and that at least 100 fledglings were produced. The variation in the estimated number of breeding pairs is due to the relatively long breeding season and the probability of significant re-nesting activity.

Least Tern activity in the Bolsa Chica area (between Huntington Beach and Seal Beach) was difficult to interpret in 1978. On 8 May 3-4 pairs were observed in Bolsa Chica Ecological Reserve in the vicinity of the northern site being prepared by the Department of Fish and Game as a Least Tern nesting area. Ground courtship was observed at this site. Unfortunately, the contractor responsible for the Bolsa Chica restoration project was allowed to complete his work on the Least Tern nesting area, presumably disturbing the birds during the critical period of nest site selection. Although small numbers of Least Terns continued to be seen in the Bolsa Chica area throughout the summer, no nesting activity was known to have occurred east of Pacific Coast Highway. However, the probable observation on 6 or 7 July of a Least Tern defending a several day old chick suggests the possibility that some nesting may have taken place west of Pacific Coast Highway on Bolsa Chica State Beach near lifeguard station 43 (N. Villa pers. comm.). Since this portion of beach receives extremely heavy human use throughout the summer months, the only possible nest sites west of Pacific Coast Highway are the 2 m wide planters between the road and beach parking lot or on the flat roofs of the restroom facilities in this area. Either possibility would be rather amazing.

Upper Newport Bay

Least Terns returned in 1978 to the nest site located in the abandoned saltworks of the Upper Newport Bay Ecological Reserve. Heavy winter rains had deposited several centimeters of sediment in this area, making the site much more amenable to vegetation growth. By the end of the breeding season extensive plant cover had developed over most of the nesting area. Unless this site is cleared prior to the 1979 breeding season, Least Terns will very likely abandon this as a nesting area. The Upper Newport Bay colony was visited on 10 dates between 26 April and 7 September.

Least Terns arrived in the vicinity of Upper Newport Bay between 18 May and 24 May, and by 19 June 8-10 pairs were present, with both eggs and chicks being observed. The colony appeared stable on 21 June, but on 5 July only 1 pair (with a recently hatched chick) could be found. Two eggs were found on 5 July which had been eaten by an unknown predator, and two clutches (one 1 egg clutch

and one 2 egg clutch) were found abandoned. On 20 July no Least Terns were present in the nesting area, but 3-5 fledglings and 9 adults were seen in other portions of Upper Newport Bay Ecological Reserve.

I estimate that 8-10 pairs of Least Terns nested at Upper Newport Bay in 1978. Since the fledglings seen on 20 July could have come from the relatively close Huntington Beach State Park colony, it is difficult to determine the success of the Upper Newport Bay colony. It is doubtful that more than 5 fledglings could have been produced at Upper Newport Bay in 1978, and it is likely that no breeding pairs were successful in fledging young. The causes of the colony's relative failure in 1978 are uncertain, but probably involved disturbance by an unknown egg predator and/or the effects of extensive vegetation growth in the nesting area following the initiation of incubation.

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APPENDIX C

LEAST TERN BREEDING SEASON IN SAN DIEGO COUNTY, 1978

by

Philip Unitt

Approximately 435 pairs of Least Terns nested at 15 sites in San Diego County in 1978, a decrease from an estimated 480 pairs in 1977. The decrease was due principally to a dramatic drop in the number of nesting pairs at the Santa Margarita River mouth (120 to 35) and at the saltworks at the south end of San Diego Bay (69 to 29).

Breeding success was considerably reduced from that observed in 1977. Predation was the major cause of mortality and was responsible for the decline in, or lack of, fledging success at the Santa Margarita River mouth, Batiquitos Lagoon, FAA Island, North Island Naval Air Station, and the saltworks. Off-road vehicle disturbance continued to be a problem at the Sweetwater River mouth and at Agua Hedionda Lagoon. Flooding by high tides destroyed all the nests at San Elijo Lagoon and some of those at Agua Hedionda Lagoon. The highest rates of fledging success were achieved among the smaller colonies at North Fiesta Island, Delta Beach and Coronado Cays on the Silver Strand, and Tijuana River mouth.

Large post-breeding flocks were found only at Batiquitos Lagoon and Delta Beach. At the San Dieguito River mouth, which was the site of the largest post-breeding concentrations found in 1977, flooding by winter rains apparently altered the habitat and rendered it unsuitable for Least Tern feeding.

Santa Margarita River Mouth

The number of Least Terns nesting in the Santa Margarita River mouth area was sharply reduced from 120 pairs in 1977 to 30 to 40 pairs in 1978. Twenty visits were made to the area from 17 April to 30 August. The first arrival at this colony was a single bird on 17 April. By 2 May, the number of terns in this area had increased to about 65. The total number of adults remained essentially constant from this date through 19 July. The maximum number recorded was 75 $\pm$ 15 on 16 June. Numbers decreased during August until 30 August, when one adult and two juveniles remained.

The vast majority of the nests were on the barrier dune on the north side of the river mouth. The only nests observed on the south beach were 5 on 22 May, which were the first nesting attempts in the Santa Margarita River mouth area. All of these nests were gone by 30 May, the eggs apparently having been destroyed by predators. On the dry mudflats east of the beach dunes and south of the river, a small number of terns attempted to nest. One or two nests were found on several visits between 30 May and 11 July, and it appeared that no more than three pairs were active in this area on any one date. It is unlikely that chicks were produced from any of these nests. Most eggs disappeared the week after they were first observed. The only predators actually seen around the nests were Great Blue Herons (Ardea herodias). Once, four of these herons were observed being vigorously harassed by a pair of Least Terns. Common Ravens (Corvus corax) and Western Gulls (Larus occidentalis) were also seen nearby, and could also have preyed on eggs and chicks.

On the north beach, the first four nests were found on 30 May. On the next visit, 6 June, 30 incubating birds were observed. Two chicks were observed on 18 and 22 August, but it is unlikely that these individuals fledged. Accurate counts of nests and birds were difficult to obtain as both were dispersed over a large area and there was no elevated vantage point from which to survey the incubating adults.

Fledging success at this colony was poor. The maximum number of juveniles counted was 8 on 2 August, and it is unlikely that the total number of young fledged could be over twice this number. Predation was most likely responsible for the widespread failure. Several eggshells with large holes were found on the north beach as well as on the south beach. Human disturbance was apparently minimal. Marine Corps personnel erected a conspicuously posted barrier of elastic cord and metal posts extending the length of the beach on the seaward side of both the north and south dunes. Although tanks were seen rolling along the beach on almost every visit, they stayed outside the barrier and did not flush the birds off their nests. However, tanks did pose a threat to the chicks that wer large enough to run outside the barrier towards the ocean. One half-grown chick was found hiding in a tank track on one occasion. Joggers frequently ran by on the beach, but only once was one seen crossing the barrier.

Agua Hedionda Lagoon

At least 11 and possibly as many as 15 pairs nested at the upper end of Agua Hedionda Lagoon in 1978, showing little if any change from the 13 pairs observed in 1977. The area was surveyed 25 times between 17 April and 30 August. The entire colony was surveyed from an elevated position along the shoulder of Park Drive.

An individual observed on 2 May was the first known arrival. Numbers increased to 15 on 30 May, when the first five nests were present. The maximum number of adults was 35 on 5 July, the only day when over 20 individuals were counted. The maximum number of nests, 11, was also observed on this date. The last nest observed contained two eggs, which were being incubated on 4 August. The last birds present at this colony were two juveniles on 26 August.

Most of the nests were on a flat area just east of the bend in Park Drive, an area bounded on the north and east by a barbed-wire fence. However, four nesting attempts, representing the effort of at least three pairs, were observed on the mudflat about 0.3 km to the west, south of Park Drive just east of its intersection with Valencia Avenue. Three nests were first found at the latter area on 23 June. All were destroyed by high tides between 11 and 19 July before the eggs hatched.

At the principal nesting area success was poor, but at least four young fledged. There were apparently frequent renesting attempts after the first eggs or small chicks disappeared. There was frequent human activity near the nests but the failures cannot be attributed to this disturbance. Initially, I posted and surrounded with twine the entire flat where the birds were nesting, outside the barbed wire fence described above. Twine was also placed across a 2 m wide gap in the wire fence. The outside twine barrier had been largely destroyed by the next week, and most of the signs were torn down. However, the twine across the gap in the wire fence remained intact for several weeks thereafter, indicating there was no human intrusion at this time. Nevertheless, many of the first eggs disappeared during this interval, suggesting that a predator was involved, though no direct evidence was obtained. In July and August this barrier was destroyed repeatedly after having been repaired weekly, and there were fresh motorcycle tracks through the colony. Ironically, the only successful

fledglings were produced from eggs laid or hatched during this interval. Two chicks several days old were found dead but undamaged on 11 August, suggesting abandonment or disease.

If the terns use the same area next year, repairing the gap with barbed wire rather than twine may eliminate off-road vehicle activity in the vicinity of the nests. About 4 m of barbed wire would be required.

Batiquitos Lagoon

At least 22 pairs of Least Terns, and possibly as many as 27, nested at the east end of Batiquitos Lagoon in 1978, a considerable increase from 11 pairs in 1977. However, the colony fledged few, if any, young. I made 25 visits to the area between 17 April and 30 August. The first arivals were 5 terns observed on 8 May. The first egg was found on 22 May, by which time the number of adults had increased to 25. The maximum size of the colony was noted on 23 and 28 June, when 22 incubating or brooding birds were present and 50 $\pm$ 5 adults were in the area. The first nesting attempts were all at the northeastern corner of the lagoon on dried mud. The number of nests here gradually decreased through July until 27 July, when only two nests were found. During July, nesting activity shifted to the southeastern corner of the lagoon, where a new mudflat had gradually dried during June. The number of birds in this area increased at a rate consistent with the decrease at the northeastern area, and it appears that the second site was occupied by birds renesting after failure at the first site. The first two nests in the southeastern area were found on 5 July, and eight were observed on 19 July. Three and two nests with eggs were still present on 9 and 11 August respectively, though they may well have been abandoned by the latter date. Four half-grown chicks were also present on 11 August but could not be found during subsequent visits.

The situation at Batiquitos Lagoon was complicated by the arrival of a large post-breeding flock from some other area on 19 July, when 80 adults and 2 juveniles were present at the southeastern corner of the lagoon. This flock increased to about 90 adults and 20 juveniles on 15 August, the largest concentration of Least Terns known in San Diego County in 1978. The birds departed abruptly in late August, and only one adult and one juvenile were present on 26 August. While it is possible that a few of these juveniles were produced at Batiquitos, I believe it is more likely that they were all from another colony, as they arrived and associated with the post-breeding flock of adults.

There was no evidence of any human disturbance on the ground in either of the nesting areas. However, helicopters from nearby Palomar Airport had been conducting test flights over the lagoon, at times hovering low over the colony site. The company in charge of the helicopter operations was asked to move their activities away from the colony, and by the next week the helicopter acitivity had ceased. Although the helicopters undoubtedly caused some disturbance, it appeared that predation was more likely to have been the principal cause of failure at this colony. Dismembered remains of an adult and a chick were found in the northeastern area, and raccoon tracks were present at the southeastern corner of the lagoon.

San Elijo Lagoon

Nine pairs attempted a late nesting at San Elijo Lagoon. The area was surveyed 20 times between 17 April and 20 August, but only occasionally were terns seen

from 2 May until 5 July. On the latter date, 16 adults and two nests with eggs were present. By 14 July, the number had increased to 20 adults and 9 nests. The nests were near the northeastern corner of the central basin of the lagoon on alluvial sand, which had been deposited during the previous winter's rains. The sand had just dried when the terns started nesting on 5 July. Between 14 and 19 July, high tides flooded the area and washed away all the eggs. Eleven adults were still present on 19 July, as were six juveniles, which were undoubtedly produced at some other colony. The only Least Terns seen after this date were one adult and one juvenile on 20 August.

An area of approximately 6 m x 50 m on top of a dike at the northwestern corner of the central basin was cleared of all vegetation by a California Conservation Corps crew on 18 May, but the area was not used by the terns. Since they did nest later in the season as soon as drying of the lagoon exposed habitat elsewhere, it appears that the dike as prepared was inadequate as a Least Tern nesting site.

Los Penasquitos Lagoon

At least 18 pairs, and possibly as many as 25, nested at the northeastern corner of Los Penasquitos Lagoon this year in the area adjacent to the intersection of Sorrento Valley Road and Carmel Valley Road. This is an increase over the estimated 14 pairs observed in 1977. The lagoon was surveyed on 17 occasions between 17 April and 18 August. The first arrivals were two individuals observed on 2 May. By the time the first nest was found (15 May), 30 adults were present. The maximum count of incubating birds was 18 on 6 and 16 June, and 44 $\pm$ 4 adults were observed on 23 June.

Fledging success was difficult to determine because of the vegetative cover on the colony site, but it was probably at least fair. No evidence of either human disturbance or predation was seen. The maximum number of fledglings seen on the site was 3 to 5 on 14 July. During late July, a flock of Least Terns congregated at the mouth of the lagoon. Though it was impossible to determine the relationship between these birds and the ones that nested at the northeastern corner of the lagoon, the similarity in numbers of adults (34 at the mouth on 22 July, when only 5 were still on the colony site) suggested that the post-breeding flock and the nesting individuals were probably the same. Eight juveniles were at the lagoon mouth on 22 July when 3 to 4 were still on the colony site, so at least 11 to 12 young fledged.

Though the colony could be surveyed from an elevated vantage point along Sorrento Valley Road, censusing was very difficult after mid-June because of dense vegetation on the site. The nesting area, which had been a salt flat in 1977, was covered with sand during heavy winter rains. Although there was little plant growth on the site when the terns first arrived in May, dense vegetation covered much of the area during the summer. This vegetation did not appear to disturb the birds while they were nesting, but it will be necessary to clear the site if Least Terns are to use it again next year.

Mission Bay

The two sites used in the Mission Bay area in 1978 and the North end of Fiesta Island were the same as those used in 1977. Two other sites were prepared for the terns but were not used. The Friars Road Sanctuary, in the northeastern corner of the intersection of Friars Road and Sea World Drive, was cleared by the City of San Diego during early to mid-May. Seven Least Tern decoys

placed on the site failed to attract Least Terns. However, preparation of this site for possible Least Tern nesting should continue in future years, particularly in view of the drastic decline in reproductive success at the FAA Island this year. An area of approximately 30 m x 75 m was cleared by the City of San Diego Division of Water Quality at the sludge disposal area at the southwest corner of Fiesta Island. A vegetative cover of cherry tomato plants quickly grew over the area, rendering it unsuitable for Least Tern nesting. The sludge basins themselves, which the terns used for nesting in 1976, were too wet in 1978 to offer nesting habitat.

FAA Island. This island was used by 140-150 pairs in 1978, an increase over the 125 pairs present in 1977. However, fledging success was drastically reduced. FAA personnel cleared the vegetation on the island to the same extent as in 1977, finishing the job on 27 April. The island was surveyed on 10 occasions from 27 April to 20 July. Eight adults were present on the first visit and on 11 May, when the first four nests were found, 65 terns were on the island. The maximum count of 190 $\pm$10 adults, 145 $\pm$ 5 of which were incubating, was made on 8 June. Many chicks had hatched by 15 and 22 June, and 24 were banded on the latter date. Unfortunately, transportation to the island was not available during the week of 25 June - 1 July. On 6 July, only three juveniles of fledging age and one small chick were present. Numbers of adults had dropped to 75, 35 of which were incubating. The colony was rapidly deserted during mid-July, as only four adults were still on the island on 20 July. One hundred twenty-three abandoned eggs were collected on this date. Perhaps as many as 10 young fledged between 22 June and 6 July, but I do not believe any fledged after the latter date.

As there was apparently no human disturbance at this site, it is likely that predation was responsible for the loss of chicks and the abandonment of the colony. Although one adult was found decapitated, the few dead chicks appeared to be intact. Most of the chicks simply disappeared. The large number of abandoned eggs found indicated that the predator attacked only chicks and ignored eggs. The only potential predator actually observed on the island was a Loggerhead Shrike (Lanius ludovicianus), one of which was seen on each of the last four visits to the island. Other predators likely were involved, however. Great Blue Herons and Black-crowned Night Herons (Nycticorax nycticorax) are numerous in the Mission Bay area, and a Burrowing Owl (Athene cunicularia) burrow was found at the nearby Friars Road Sanctuary.

North Fiesta Island. Eight or nine pairs of Least Terns nested at the north end of Fiesta Island. Eighteen surveys were made between 10 April and 10 August. The first four individuals near the colony site were seen on 16 April, and the first egg was found on 16 May. Six nests were found on 7 June, but the 17 adults observed on 20 June appeared to represent 8 or 9 pairs nesting at that time. Two chicks had hatched from the first nest by 7 June. At least eight and possibly as many as ten juveniles fledged from this colony. Eight fledglings and one half-grown chick were found on 7 July, and six juveniles were counted on both 12 and 18 July. On 12 July, however, some 24 adults were in the area, indicating a post-breeding influx from some other area. Twelve adults and one juvenile observed on 25 July were the last Least Terns seen at this site. All the fledglings were produced from the first nesting attempts; the two pairs which attempted a second or late nesting during July were unsuccessful.

One adult was found dead but intact, and there was no other indication of possible predation. Although off-road vehicles occasionally entered the area, they apparently confined their activities to the area devoid of vegetation, and avoided the area with a light cover of scattered Mesembryanthemum sp. where the tern nests were located.

Naval Training Center

At least 8 and possibly as many as 12 pairs nested at the Naval Training Center in 1978, a decrease from 35 in 1977. The site was visited on 14 occasions between 16 April and 25 July. The first arrivals were two individuals observed on 3 May, and the first nest was found on 23 May. The maximum of 25 ± 3 adults was counted on 5 and 12 June, and 8 nests were counted on both of these dates. Nests were difficult to find, and incubating birds were impossible to see at a distance because of the thick vegetation that had grown on much of the site during the winter. On 12 July four fledglings and 1-2 chicks were counted, so it is likely that at least 5 juveniles fledged from the first nesting attempts. Late arrivals or birds whose first attempt failed were nesting in early July, as 7 nests were found on both 7 and 12 July. These later nests were placed a bit farther east then the first ones, as most of them were at the back of the bare dirt area which borders the paved road, adjacent to the airport parking lot, and were placed among the low scattered Mesembryanthemum sp. None of the later nests were successful. Apparently all adults left the colony along with the fledglings in mid-July. Eggs were seen in deserted nests on 18 and 25 July.

No evidence of either predation or human disturbance was observed in this colony. The Navy plans to build an athletic field at the north end of the land where the colony is situated, covering most of the present nesting area. Clearing of the rest of the land south of this proposed athletic field could provide nesting habitat for a greater number of pairs than used the area this year. A great increase in the vegetative cover on the site during the winter was apparently responsible for the decrease in number of Least Terns using the site between 1977 and 1978.

San Diego International Airport

The San Diego International Airport was used by 43 pairs in 1978, compared with 25 in 1977. Six of these pairs nested at the north end of the north triangle area, which lies east of the airport fire station. The remainder of the pairs nested in the ovals at the east end of the airport, all but four of them in the ovals between the main runway and taxiway.

The colony was surveyed nine times from 8 June to 10 August. On 8 June, 50 ± 5 adults and 31 nests were located. All of the nests contained eggs except one with two recently hatched chicks. The maximum of 60-70 adults, 43 of which were incubating or brooding, was counted on 22 and 29 June. Eighteen chicks were seen on 29 June and six fledglings were found on 13 July. I estimate that 10 to 15 juveniles fledged at this colony. The last Least Tern seen at the site was a single recently fledged juvenile on 10 August.

Apparently the only disturbance to which this colony was subjected was from aircraft. One of the airport supervisors informed me that he would move chicks from the runway or taxiway back into the ovals before airplane activity started in the morning when he was working that shift. However, I found one large chick near fledging age flattened on the taxiway, and two other dead birds which appeared to have been struck by aircraft.

Sweetwater River Mouth

Forty-seven pairs nested on the fill on the north side of the Sweetwater River mouth, up from 40 in 1977. The site was censused on 21 occasions from 16 April

to 10 August, and many other visits were made to repair the twine fence around the colony. Four adults on 28 April were the earliest arrivals at this site. The first nest was found on 31 May, at which time the site was posted and the twine barrier was erected. The maximum of 47 ± 2 incubating or brooding birds was counted on 21 June. Eighteen chicks on 14 July was the maximum number of chicks counted at one time. On 21 July, 15 fledglings were present. Possibly as many as 25 juveniles fledged from this colony. Least Terns had vacated the area by 10 August.

The major disturbance at this site was from off-road vehicles. While the twine fence around the colony definitely reduced the amount of disturbance, fledging success would have been considerably greater in the absence of the off-road vehicles. It was necessary to repair the twine fence to some extent on every visit, and occasionally large sections of it were found torn down. Apparently some off-road vehiclists used the posts as a slalom course. One motorcyclist informed me that he had seen one vehicle break into the nesting area at night, get "trapped" inside, and circle back and forth looking for a way out. Fortunately, most of the vehicle activity appeared to be concentrated on the edge of the colony around the barrier rather than in the center where most of the nests were located. The fenced area eventually was used as a racetrack for the off-road vehicles, as drivers continually circled around it. The chicks were thus exposed to considerable danger if they wandered outside the fence, as was observed on several occasions. Three chicks near fledging age were found dead, apparently having been struck by vehicles. A large sign that was used last year, which states that continued ORV use of the area depends on vehicles honoring the barrier, was posted by Fish and Game warden Bill Basom. This had considerable effect, as several people expressed their concern that the area might be closed, as a result of damage to the barrier. It seems possible, however, that a failure to enact a closure will result in decreased respect for the barrier.

Predation at this site was apparently minimal. One adult was found dead with the skin stripped from the neck and back of head.

I would repeat last year's recommendation that a temporary chain link fence be used to exclude off-road vehicles from the colony. If this is impossible, barbed wire would likely prove a considerably more effective material for constructing a barrier than twine. Barbed wire could also be reused each year rather than having to be replaced several times during one season, as is the case with twine. The Sweetwater River mouth colony could grow much larger with adequate protection.

North Island Naval Air Station

At least 36 pairs of Least Terns attempted to nest on the asphalt helicopter landing area north of the control tower. While this represents a considerable increase over the 13 pairs on North Island in 1977, very little, if any, success was acheived this year. Eighteen surveys were made between 17 April and 10 August. Least Terns were first observed on the helicopter landing area on 11 May, when 18 individuals were present. By 18 May, the number of adults had increased to 40, and the first 10 nests were found. On 24 May, 80 ± 10 adults were observed, and 36 nests were counted on 6 June. Almost all of the nests were in cracks about 4-8 cm wide in the asphalt. Most of the eggs were laid where these cracks intersected white lines painted on the asphalt. Numbers of both adults and nests dropped off rapidly after early June, and no more than 6 adults were seen on any date after 21 June. A few pairs attempted to nest repeatedly until 31 July, when two small chicks and one adult were seen.

One chick was close to fledging age on 20 July. I do not believe that more than one or two juveniles could have fledged from this colony.

Although disturbance from helicopter operations certainly occurred, it was apparently not the primary reason for failure of the colony. Naval Air Station personnel cooperated by suspending use of the helicopter pad closest to the main concentration of nests. Jan Larson, biologist at North Island Naval Air Station, painted lines on the asphalt to direct taxiing helicopters away from the nests. Only one egg was found which had been rolled out of its nest and broken by the blast of air from a landing helicopter. Predation was most likely the cause of failure of this colony. Although I observed no direct evidence, North Island fire department personnel frequently mentioned the abundance of feral cats in the area. Jan Larson set out traps baited with canned fish in an unsuccessful attempt to catch feral cats. Several other species of potential predators occur on North Island. Burrowing Owls and Loggerhead Shrikes both bred nearby.

Early in May, four sandy areas were cleared of vegetation around North Island to encourage the terns to nest in an area away from aircraft activity. These proved ineffective, I suspect because of their small size compared with the vastly larger nearby helicopter field. As the terns are evidently unable to acheive success in the helicopter area, I suggest that an alternate site be cleared again next year, and that the effort be concentrated on clearing a single large continuous area. Predator problems are likely to continue in this area, and it may be wise to trap and remove the Burrowing Owls from the area before the Least Terns arrive. Several owl burrows were in or adjacent to the cleared sites this year.

Delta Beach

On a recent fill on Navy property just south of the Naval Amphibious Base, a colony of four Least Tern pairs nested. The site was visited 13 times from 19 June until 31 August. On 19 June three nests, two with eggs and one with an egg and a recently hatched chick were observed. One of these pairs failed on the first attempt and nested a second time, while a fourth pair had a single egg on 10 July. Two of the pairs at this site were successful in fledging two young apiece. The young from the first pair had fledged by 10 July, while the two chicks from the other pair were almost ready to fledge on 25 July.

The nearby beach was used considerably by birds from other areas as a post-breeding resting area. Maximums of 42 adults and 23 juveniles were counted on 8 August.

Although the site was posted and a twine fence placed around the area, human disturbance was a serious problem in this colony. Whereas there was little activity on weekdays, many people including some motorcyclists and "three-wheelers," gathered on the beach on weekends, and particularly on 4 July. Destruction of the twine fence was not a chronic problem; nevertheless, off-road vehicles and even some automobiles crossed the fence. Two pedestrians ignored the signs and walked under the twine on one occasion. No evidence of predation was seen.

Although this new colony was very small this year, I believe it has considerable potential for growth. The terns this year used only a small portion of the fill. If larger numbers use the site in the future, I suggest a temporary chain link fence be considered here. The Naval Amphibious Base should consider limiting human access to the area.

Coronado Cays (Crown Isle)

While no Least Terns nested at the site used in 1974 and 1977, 8-10 pairs nested on a recently graded fill on Crown Isle at the north end of the Coronado Cays development. The colony was visited 13 times from 14 June, when it was first called to my attention, to 23 August. On 14 June, 17 ± 2 adults were present. Seven nests were found, five with eggs, one with an egg and a recently hatched chick, and one with two small chicks. Twenty adults were observed on 19 and 21 June. The maximum number of fledglings counted was 10 on 31 July, and a recently fledged juvenile was seen on 8 August, so at least 11 young were successfully raised at this colony. Twelve adults and two juveniles on 14 August were the last terns seen at this site.

Human disturbance of the colony was relatively minor. The Coronado Cays developers did some earthmoving on the fill in mid-June before a twine fence across the base of the peninsula was erected, but the nesting area was not affected. Pedestrians were seen on the fill on a few occasions, but they kept to the shoreline, away from the nests. Off-road vehicles do not have access to the colony site. There was no evidence of predation. This colony had the highest reproductive success of any in San Diego County, but the site is unlikely to be available next year, as the Coronado Cays company plans to develop the area.

South San Diego Bay Saltworks

Twenty-nine pairs of Least Terns nested in the saltworks at the south end of San Diego Bay in 1978, representing a considerable decrease from the 69 pairs recorded in 1977. The terns nested in three distinct areas: along dikes 5/33 and 34/33 near the intersection of dike 5/34, and extending about 50 m west on dike 33/37; along dike 5/33 about halfway between ponds 34 and 4; and along dike 5/7, in the portion west of pond 6. Evidently, only the last of these three areas had any success.

The saltworks were surveyed 17 times from 28 April to 14 August. Four adults were seen on the first visit, but the first egg was not found until 17 May. Most eggs were laid within 2 weeks, as the maximum of 29 nests was counted on 5 June. Hatching had begun by 15 June, when four chicks were found. Up to 12 chicks were counted on 21 June, but the largest number of fledglings seen was only two on 12 July, and it is doubtful that more than five young were successfully raised in this colony.

Predation was a serious problem at this site, as it was in 1977. Both adults and chicks were found dismembered in significant numbers (up to 5 chicks on 4 July). The large number (at least 7, and probably more) of abandoned nests found was likely due to mortality of incubating adults. Mike Evans saw and attempted to trap a Long-tailed Weasel (Mustela frenata) in the saltworks, but his efforts were unsuccessful. I found several caches of Forster's Tern (Sterna forsteri) eggs and chick parts in crevices on the side of the dike that separates ponds 33 and 36 from pond 37. As one of the sections of the Least Tern colony was only about 100 m to the east along this same dike, it is likely the predator responsible for these caches, presumably the weasel, had been preying on Least Terns as well. In the future, an effort to trap mammalian predators in the saltworks before the terns arrive in the spring may be appropriate. Another predator that could have been involved was Barn Owl. Pellets of this species were found underneath palm trees in a nearby trailer court on Palm Avenue, but tern parts were not identified. Human disturbance was minimal, but dog tracks were occasionally seen on the dikes.

Tijuana River Mouth

On the barrier beach just south of the mouth of the Tijuana River estuary, 8-12 pairs of Least Terns nested. Twenty-two surveys were made between 11 April and 3 September. Six birds on 28 April were the first arrivals observed, and the first nest was found on 25 May. Four nests were found on 5 June, but five pairs appeared to be active in the area on that date. Evaluation of the nesting situation at this site was made difficult by the lack of an elevated vantage point and the presence of a number of additional individuals arriving in late June, some of which nested. The maximum number of adults counted in this area was 30 on 10 July, but no more than 12 pairs actually bred. Seven or eight juveniles on 1 August likely had been produced from the early nests, but a recently fledged bird observed on 14 August indicated that the late nesting individuals had some success as well. The maximum number of juveniles counted was 11 on 23 August, but some of these could easily have been produced at other colonies. Fourteen adults and four juveniles were still present on 27 August, and one adult on 3 September was the last bird seen.

Predation was not a problem at this site, and although human disturbance did occur, it was evidently not a serious problem. Border Field State Park rangers posted the area conspicuously on all sides, and strung plastic twine along the beach-facing side of the nesting area. Twice I saw sunbathers walk through the colony, ignoring the signs. Equestrians, pedestrians, and state park trucks flushed the birds off the nests as they skirted the colony outside the signs.

Nonbreeding Areas

The "Stuart Mesa ponds," just north of the Santa Margarita River and about 2.4 km east of the beach, were checked on 28 June and five times from 2 August to 30 August. Two adults were found on 28 June, four adults and one juvenile were seen foraging on 9 August, and a single adult was present on 22 August.

Buena Vista Lagoon was visited by Alice Fries or me eight times from 28 June to 22 August. Ten adults were present on the former date, while 12 adults and 3 juveniles were found on the latter. Maximum numbers counted were 22 adults and 7 juveniles on 10 August. Activity centered in the upper end of the lagoon rather than in the central basin where the old boat house roof, used as a roost platform last year, is situated. Alice Fries reported that the roof was used less frequently in 1978 than in 1977.

O'Neill Lake, Guajome Lake and Lake Val Sereno were visited from four to seven times each in late July and throughout August, and San Dieguito Reservoir was checked on 18 August. No Least Terns were observed at any of these areas.

I visited the San Dieguito River mouth in Del Mar 15 times from 25 April to 22 August. In marked contrast to the large post-breeding flock found here last year (up to 80 adults and 60 juveniles on 14 August), no Least Terns were seen in this area after 6 June (the maximum of 4 individuals was present on that date). Flooding during the winter had washed out the dikes separating the river channel into ponds, and had probably eliminated or drastically reduced the availability of fish.

The San Diego River mouth was checked 10 times from 7 April to 10 August. The first two Least Terns found in San Diego County in 1978 were seen here on 8 April. The sandbars at the lower end of the flood control channel were used to some extent as a resting and post-breeding concentration area. The largest number of terns counted here was 45 adults and one juvenile on 13 July. The

maximum number of juveniles seen was two, on 1 August. This area receives very heavy use from vehicles, and dogs frequently run loose on the sandbars.

The Tijuana River Valley was the only area where large numbers of Least Terns were found inland in San Diego County in 1978. Two areas were used: the "19th Street ditch," extending west from 19th Street north of Sunset Street, and the "Dairy Mart ponds," in the Tijuana River bed on the west side of Dairy Mart Road. These areas were checked on 19 May, 5 June, and on 11 dates from 26 July to 10 September. Two adults were seen at each on 19 May, and three were flying east over alfalfa fields adjacent to the 19th Street ditch on 5 June. During the fall, Least Terns were found in these areas from 8 August (3 adults at each spot) to 2 September, when one adult and one juvenile were still present at the Dairy Mart ponds. At the 19th Street ditch, the maximum number recorded was 3 adults and 2 juveniles on 21 September; at the Dairy Mart ponds, 12 adults and 6 juveniles on 13 August. The Dairy Mart ponds may be threatened by construction of the dissipator system in the Tijuana River bed.

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