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CALIFORNIA LEAST TERN
CENSUS AND NESTING SURVEY, 1976^{1/}

by
California Least Tern Recovery Team

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ABSTRACT

In 1976, 664 pairs of least terns were found at 20 breeding colonies in California from San Francisco Bay to the Mexico border. Breeding success was generally good, as judged by the number of fledglings.

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RECOMMENDATIONS

On the basis of this survey, the following recommendations are made:

1. Recommendations listed in the 1975 survey report (Massey 1975) continue to be implemented.
2. Special colony protection efforts be instituted in 1977 at Agua Hedionda Lagoon, San Elijo Lagoon, Sweetwater River and Playa del Rey to prevent recurrence of disturbances that threatened or caused nesting failure in colonies in 1976.
3. Initiate field research on feeding habitat requirements and identify key feeding areas of least terns during the breeding season.

INTRODUCTION

The fourth annual breeding survey of least terns in California was conducted under the direction of the California Least Tern Recovery Team. Current information on the breeding status of least terns is needed to serve as the basis for effective management and protection programs for this endangered bird.

Initial surveys of breeding colonies were made in 1969 and 1970 (Craig 1971) and comprehensive surveys and censuses at breeding colonies have been conducted annually since 1973 (Bender 1974a, 1974b; Massey 1975).

PURPOSE

The purposes of the 1976 survey were to document colony use of nesting areas in California, to determine breeding population sizes, to determine the number of nesting attempts and to evaluate nesting success. These have been the main purposes of surveys conducted from 1973 to 1975. In addition, in 1976 special emphasis was placed on identifying disturbance factors at colonies. Concurrent with the survey and census program, banding and marking studies were conducted to gather information on local movements of young and to continue population life history studies begun in 1970.

METHODS

Four censusers were assigned separate survey areas covering the least tern nesting range from San Francisco Bay to the California-Mexico border. All known or suspected nesting sites were visited one or more times during the breeding season. Counts of nesting pairs and evaluation of nesting success were conducted as in previous surveys from 1973 to 1975. Two sites, the Terminal Island and San Gabriel River nesting colonies, were selected for intensive observation, with particular attention focused on causes of disturbance and on banding and marking of chicks. Additionally, chicks were banded and marked at colonies in the San Diego Bay area and at Camp Pendleton. Chicks were banded with Fish and Wildlife Service numbered leg bands and with color leg bands identifying the banding areas (Massey 1974).

RESULTS AND DISCUSSION

In 1976, 664 breeding pairs of least terns were found at 20 breeding sites in California (Table 1). All Mission Bay sites are included as one site. Findings at each nesting area and at other habitats used by least terns in the 1976 breeding season are discussed in the appendices.

Most sites had been documented in previous surveys. In some breeding areas, the colony sites used in 1976 differed from sites used in previous years. Some newly established nesting sites might be explained by such local shifting of breeding colonies from one year to another.

The newly documented site used this year by the Terminal Island breeding colony was also used in 1973 and 1974, but it was not found in surveys those years. Another newly discovered site at the Alameda Naval Air Station also might have

TABLE 1
CALIFORNIA LEAST TERN BREEDING COLONIES
AND NESTING DATA, 1976

<u>County</u>	<u>Site</u>	<u>Estimated No. of Pairs</u>	<u>Comments on Nesting Success</u>
Alameda	Alameda Island	10	At least 10 young
	Oakland Airport	8	Unknown
San Mateo	Bair Island	15	Apparently good
San Luis Obispo	Oso Flaco Lake ^{1/}	?	At least 3 young
Santa Barbara	Santa Ynez River ^{1/}	4	At least 1 young
Ventura	Ormond Beach	16-18	Good
	Mugu Lagoon	10	Good
Los Angeles	Playa del Rey	10	Unknown
	Terminal Island	60	Good
	San Gabriel River	60	Very good
Orange	Huntington State Beach	11	Good
San Diego	Santa Margarita River Mouth	125	Good
	Batiquitos Lagoon	12	Good
	San Elijo Lagoon	26	Good
	Los Penasquitos Lagoon	35	Good
	Mission Bay (total)	(70)	
	FAA Island	23	Good
	North Area	9	Poor
	North Fiesta Island	15	Fair
	South Fiesta Island	23	Good
	San Diego Int'l. Airport	114	Unknown
	Sweetwater River	24	Fair
	South San Diego Bay Saltworks	49	Unknown
	Tijuana River Estuary	5	Good
		<u>664</u>	

^{1/} Location of nesting site unknown

existed in previous breeding seasons. A breeding colony in the Dune Lakes area of San Luis Obispo was suspected in 1975 and again this year, but no colony was found.

Several sites occupied by breeding colonies in recent years were not occupied in 1976. Disturbances early in the breeding season apparently caused the abandonment of the Playa del Rey site, although there was some evidence that the colony renested elsewhere in that area. The continuing problem of off road vehicle activity at the east end of Agua Hedionda Lagoon during past breeding seasons apparently was responsible for the abandonment of the tern colony this year. Only four nesting sites were used this year at Mission Bay, where eight sites were occupied in 1975. In this area, the breeding population and the number and location of colonies have varied unpredictably from year to year.

Although problems of predation and human disturbance at colonies persist, nesting success, as measured by the number of fledglings, was generally good statewide. The successful breeding season of several of the colonies is attributed to effective colony protection efforts.

The number of pairs found at all known colonies in 1976 was greater than the numbers found in the previous three annual surveys. Breeding population index figures were 624 pairs in 1973, 582 pairs in 1974 and 600 pairs in 1975. The higher 1976 figure does not necessarily reflect a population increase, however. It is important to recognize that the population estimates made from 1973 to 1976 are not statistically comparable. The surveys do not provide the type of data that would serve as absolute indices of population trend.

~~There are many difficulties associated with estimating colony size and calculating the statewide breeding population size.~~ The size of a colony changes throughout the breeding season, thus the accuracy of a colony size estimate is influenced by the time and frequency of population counts. Also, all active colonies may not be discovered in a given breeding season, thus statewide population estimates are influenced by the thoroughness of colony detection efforts. Finally, the extent of interchange of breeding pairs from one colony to another in a breeding season is unknown, and the possibility exists that some breeding individuals are counted at more than one colony in a season.

Valuable life history information was gathered this year from the banding of more than 280 least tern chicks. Banding results and discussions are contained in area reports in the appendices.

The threats to least tern survival--colony disturbance and habitat destruction or restriction--still remain at most colony sites. These annual surveys continue to provide the information needed to plan and implement colony protection and habitat preservation efforts.

ACKNOWLEDGEMENTS

Many people assisted censusers by contributing valuable data or assisting in survey efforts. Without the assistance of these people a survey of this scope could not have been conducted:

Central Coast: (Coordinator: Sanford R. Wilbur)

San Francisco Bay - Leora Feeney, Linda Hale, Tom Harvey, Ron Jurek, Nils Kjellen, Richard Nugent, Cathy Osugi, Lee Remsen, Don Roberson, Elsie Roemer, Paul Roush, Walter Smith, Jim Swanson, William Thomson.

San Luis, Obispo County - Peter Churchward, Jim Lidberg, Kent Smith.

Santa Barbara County - Robert Fordice, Jim Johnson, Helen Matelson.

Ventura County - John Borneman, Elmer Colley, Robert Fordice, Robert Foulk, Earl Lauppe, William Lockhart, Greg Smith.

South Central Coast: (Coordinators: Barbara Massey and Kristen Bender)

Los Angeles County - Jerry Johnson, Bob Margolies, Dorothy Rypka, Sargeant William Smith, Shirley Wells.

Orange County - Jack Hiehle and Huntington State Beach park personnel.

Camp Pendleton - George McCleary and other personnel of the Natural Resources Office and Game Unit, U. S. Marine Corps Base, Camp Pendleton.

San Diego County Coast: (Coordinator: Elizabeth Cooper)

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APPENDIX A

NESTING SITES USED BY CALIFORNIA LEAST TERNS ALONG THE CENTRAL CALIFORNIA COAST IN 1976 by Sanford R. Wilbur

Alameda Naval Air Station (Figure 1)

This is a newly discovered site this year, but terns have been seen nearby for a number of years (Roemer) and the colony's existence has been suspected. On June 14, terns were seen fishing in Ballena Bay and flying into the Air Station (Wilbur). The nesting area was actually found on June 24 after all hatching had occurred. About 20 adult terns and at least 8 chicks were present (Wilbur). The site was checked for additional nesting on August 18, but no terns were present (Swanson).

The apparent location of the nests was in a triangle of hard dirt, gravel and decomposing asphalt along the edge of an aircraft taxiway. The site itself is obviously suitable as a nesting base since eggs hatched there, but might be improved by putting a layer of sand over part of it. Chicks beginning to roam from the nests wander onto the runway and some may be killed by planes or motor vehicles. A barrier perhaps one foot high placed around the triangle might prevent some of this wandering without otherwise interfering with the birds or Station activities.

Bay Farm Island

Although least terns were seen around and over the "Utah Fill", no nests were found on five visits there (Feeney, Wilbur). Probably all the birds seen there were associated with a site nearby on the Oakland Airport (the same one occupied in 1975). Up to 13 adults were seen in that area on June 21, and a total of seven to eight nests was estimated at that time (Wilbur). No nests were found on a return trip August 6, and only seven adult terns were seen in the vicinity (Feeney). Nesting success is unknown.

The site looks like a good one, and no specific management is recommended. Greater effort should be made to monitor nest success in the future.

Bair Island

Two least terns were seen flying near Bair Island on May 21 (Wilbur, W. Smith). On June 19, ten nests were found, one of which had three broken eggs in it. A maximum of 10 terns was in the area. They were very unaggressive and did not remain in the area while nests were being checked (Wilbur, Nugent).

On July 12 it appeared that all the originally found nests were unsuccessful (Nugent, Osugi, W. Smith). Five scrapes still had eggs but they were covered with dirt; one nest appeared broken up by some predator, and no sign was evident of the fate of the others. However, 15 new nests were found in the same area, and adults (at least 30) were present.

An additional check on August 4 (Osugi) confirmed that the original nests were unsuccessful. Of the later 15, 12 were judged to have successfully hatched. Only six adult terns were still present in the area.

The substrate of this colony is a very sticky soil that clings to the eggs, and in some cases cakes on them solidly. It appears that this was the cause of several hatching failures. Since the site appears to be good in other respects, it might be desirable to spread a layer of sand over a portion of the area.

Santa Ynez River

Apparently four pairs were in the area this year. Three terns were seen feeding on May 19 (Wilbur), and through June and early July one or two birds were regularly seen there (Fordice). About July 1, eight terns were present but no nests could be found (Fordice). However, on July 18, there were approximately 10 terns present, including at least one young bird (Matelson).

Ormond Beach

No terns were seen in the area during trips in May and early June (Wilbur). On June 25, 13 nests were found in the same area where least terns nested in 1974 (Foulk). Several early nests were apparently lost (two near the edge of the colony either run over by off road vehicles or stepped on), but by July 9 twelve nests were again located (Wilbur).

Renesting or second nesting occurred well into July, and on July 28, an estimated seven nests were still being incubated. There were 30-40 adult terns in the area then, but only five young could be located during a short search (Wilbur). The hatch occurred over such an extended period, and the young left the colony so quickly that an estimate of overall success is not possible. However, it appeared good.

Department of Fish and Game personnel fenced the colony before the Fourth of July weekend to prevent off road vehicles from entering the main nesting area. This was worthwhile, and should be repeated in future years. Numerous local birders and cooperators knew of the site and visited it regularly; this may have caused the loss of several nests.

Mugu Lagoon

Three least terns were seen in the area May 12 (Colley), but it was not until June 22 that nesting was observed. Nine nests were found on June 29 (Colley); an additional nest was discovered in the same area on July 1 (Wilbur, Colley). These were in the same area occupied by terns in 1975. Success was good, with no evidence of predation. Only one egg was found unhatched, and no dead chicks were found. This is an almost completely undisturbed ocean beach within the Pacific Missile Range and appears to be an excellent site. No specific management is recommended, but the Navy should be encouraged to protect both the beach and the nearby lagoon and marsh areas that provide food for nesting birds.

Observations at other areas north of Los Angeles County

Least terns were seen along the Alameda South Shore on several occasions during spring and summer (Roemer, Feeney). These are assumed to be birds associated with the Bay Farm Island or Alameda Naval Air Station colonies. One tern seen fishing at Alameda Marina June 14 (Wilbur) is some distance from either of the above colonies, but there is no suitable nesting habitat nearer.

No nesting occurred at the mouth of the Santa Clara River (Ventura County) this year. Up to 23 least terns were reported there on July 23 (G. Smith), and on July 28 there were four adults and three flying young there (Wilbur). These birds probably were from the Ormond Beach colony. Two terns seen at Hollywood Beach in Oxnard on July 28 (Wilbur) may also have been Ormond Beach birds.

Searches of the San Luis Obispo County shoreline between Pismo Beach and the Santa Maria River failed to reveal any least tern nesting (Lidberg, Wilbur), but for the second year in a row, terns showed up in the Oso Flaco - Dune Lakes area nearby on several occasions. Three birds were seen at Dune Lakes the first week in June (Churchward), and at least 30 were at Oso Flaco Lake July 9 (K. Smith). On July 23 there were 6 adults and 3 immatures at Oso Flaco (Lidberg). There are no known colonies closer than the Santa Ynez River on the south or San Francisco Bay on the north, so those birds must be nesting somewhere in the Santa Maria - Pismo Beach area.

The entire coastline from San Mateo County to Ventura County was checked for least tern activity this summer. There appear to be very few places where undiscovered least tern colonies might exist. Besides the areas discussed above, only the Pajaro River - Elkhorn Slough - Salinas River beach area seems to have much potential. Recreational use is heavy in the northern part of that area, but a few terns might find nesting habitat. The area near the mouth of the Salinas River is a historic nesting location and still seems to have all the attributes of a good colony site. It should be checked regularly in future years.

APPENDIX B

NESTING SITES USED BY CALIFORNIA LEAST TERNS IN SOUTHERN LOS ANGELES COUNTY IN 1976 by Barbara Massey

TERMINAL ISLAND (Figure 2)

The nest site used by least terns in 1975 was visited several times early in 1976, but while there were a few birds in air, no serious pre-nesting ground activity was observed. A heavy growth of weeds over most of the area was very likely the major cause of abandonment. A second factor was use of the site for low hovering by police helicopter training flights.

On May 25, the relocated colony was found 1/2 mile northeast on Reeves Field. This abandoned airstrip, now property of the Los Angeles Harbor Department, is mostly asphalt-covered, with patches of sand and scattered weeds. It has been used for the past several years as a storage yard for arriving imported cars, but this year it was empty. The field is roughly 250 x 550m and the birds nested in the central portion of the field. The west end is used as a driver-training facility by the Los Angeles Police Department (LAPD). The east end and a strip along the south border are hovering sites for police helicopter training flights. Although the existence of a nesting colony on Terminal Island was suspected in 1973 and 1974, it was not actually known to us, nor given official protection until 1976. But the birds nested at Reeves Field in 1973 and 1974, and were protected by the LAPD on their own initiative. According to Sgt. William Smith, about 14 nests were on the ground both years at the west end in the police driver-training facility. The training course was moved to circumvent the nests, and when the chicks began to run there was great difficulty in working around them. In 1975 there was no nesting there, as apparently all the birds moved to the site 1/2 mile southwest.

When the colony was found this year on May 25, nesting was already well underway, and on June 8 there were 49 nests by actual count, and probably 60 altogether. Nests were in 3 groups, with one a rather compact cluster of 13 on a 10 x 18m patch of sand. The rest were widely scattered, the birds finding small patches of drifted sand to nest on.

Hatching began on June 8. A second wave of nesting was underway by June 15, and by June 29 there were 25 more nests.

Fledging began about June 30. Fledging success was high, with 50 juveniles known to have fledged, and presumably there were many more. By July 10, a mixed flock of adults and juveniles was at Harbor Lake, Wilmington, and some of the juveniles wore yellow bands (S. Wells). The Terminal Island colony apparently moves to Harbor Lake as soon as the young are able to fly. On July 22, 100-125 least terns were using the lake, and 33 of them were juveniles.

The birds used the mudflats along the shoreline of the lake in 1975 and early this season for roosting. But there was increased human activity this year and in mid-July the flock began roosting on the roof of the boathouse at the southwest end. By the end of the month as many as 60 terns were seen there at one time. This phenomenon suggests a possible route by which least terns have learned to use flat roofs for nesting, as has become habitual in south Florida.

By August 3, nesting was about complete at Terminal Island, with only a handful of pre-fledged chicks running around.

Disturbance and predation

There was little disturbance of the colony as far as could be determined. A meeting between Department of Fish and Game personnel and the LAPD in mid-June resulted in cancellation of all flights over Reeves Field for the duration of the nesting season. The field was fenced and quite inaccessible, and also was not inviting. Human disturbance was not a problem.

There was no egg predation and no evidence of abnormal predator pressure on the chicks. At the end of July, 15 nests (totalling 25 eggs) were abandoned, rather a large number for a colony of 60 pairs. There may therefore have been some late-season disturbance undetected by us.

At Harbor Lake, spraying for mosquito control was being done in mid-July, just at the time of peak use by least terns. One dying juvenile was picked up off the water August 2, and is available for pesticide analysis. Judging from the emaciated condition of the bird, however, death was more likely caused by starvation, presumably as a result of separation from its parents.

SAN GABRIEL RIVER

The birds returned to the same site used in 1975, marking the sixth consecutive year that least terns have used this area. A partially built shopping center now occupies about half the land that was available to the birds last year.

The first birds arrived May 4, and the first eggs were laid May 14. The colony was visited every 2-3 days between May 4 and August 16. By June 4, 53 nests could be counted, and there were probably 60 altogether. The majority of nests held 3 eggs rather than the usual 2, a phenomenon increasingly noted in the past few years here. There was one clutch of 4 eggs, 3 of which hatched. (Only one other 4 egg clutch has been reported for the least tern, at the Santa Margarita River colony in 1971; Swickard, 1971). Hatching began June 5, and by June 15 a second wave of nesting was well underway. There were 25 new nests by late June. Overall hatching success was high, with very few abandoned eggs at the season's end.

The first chick to fledge was airborne on June 26. The birds left the colony within a few days of fledging, and did not return to roost at night. It was thus difficult to get an accurate count of fledglings, although a minimum count was obtained. At least 65 youngsters fledged, but there were many more.

After leaving the nesting ground, the colony apparently roosted on the beach at Belmont Shore in Long Beach at night. It was discovered there on the evening of July 22 when a mixed flock of 92 adults and juveniles arrived just about dusk to spend the night (D. Rypka). On July 27, a high count of 171 birds was recorded there. A pre-dawn visit on August 10 was rewarded with the quick sight of 50 adults and 40 juveniles, before all 90 birds took off for the day. After the high count of July 27, numbers diminished gradually and by August 30 only 8 birds remained (half of them adults). It was not possible to check for bands on the juveniles, as the light had waned too far before the birds arrived for the night. Nor did I find out where the flock spent the day, although it was probably somewhere in the Los Angeles-Long Beach harbor.

By August 9, the nest site at the San Gabriel River was all but deserted; just one pre-fledged chick was being fed on the river bank by its parents.

Disturbance and predation

As soon as we verified that nesting had begun, the site was protected. The development company in charge of constructing the shopping center cooperated fully. The west end was sealed off by dumping large mounds of soft dirt along the border of the construction area, and by fencing one corner. The border along Pacific Coast Highway was posted with signs and string. These measures proved effective in eliminating almost all human disturbance.

I visited the colony every few days and drove slowly through the nesting area on the same course each time. During the incubation period the birds were not disturbed by the car until it was within about 7m. Then the incubating birds would fly off, returning to the eggs immediately after I passed by. If I stopped to observe, at the same distance, the birds would return to their routine within a few minutes. Individual differences were noted, with some birds decidedly more skittish than others. After the chicks hatched, parents were noticeably more excitable about my presence, and also more alarmed by gulls, kestrels, blackbirds and shrikes flying over. All alarms triggered by such intruders were transient in nature, and part of the usual pattern of behavior during the breeding season.

The birds were not disturbed by bicyclists riding along the coast highway, nor by people walking fast along the highway. However, they were put up by someone standing still or walking towards the colony, even as far away as 30m.

Banding of chicks caused temporary alarm to the colony but had no detectable effects of a permanent nature. Chicks banded at 1-2 days of age were seen repeatedly thereafter on the nesting ground until they fledged; and color-banded chicks were seen after fledging at other sites, as has been noted. The success rate for fledging was greater than one chick per nesting pair, a very good ratio for least terns.

An egg predator took 26 eggs from 10 nests on the west end by the river in early June. Fortunately, the predation was noted after the first night and a trap was immediately set. Next morning there was a rat in the trap, and its tracks could be traced onto the nesting ground from the riverbank, and to a nest it had destroyed before it walked into the trap. There was no further predation, but it is sobering to document the high toll one predator can take in two nights.

Banding Summary

One hundred and three chicks were banded - 59 at San Gabriel River and 44 at Terminal Island. Fifty-nine of them were also color-banded - 34 at San Gabriel with black, 15 at Terminal Island with yellow.

Chicks color-banded at the San Gabriel River were sighted as fledglings in mid-July at Terminal Island and Harbor Lake. Banding at the San Gabriel was not as productive of information about survival and post-fledging success as we had hoped, because their post-season fishing site was not found. We hope to remedy this gap in our knowledge in 1977.

At Terminal Island, banding and color-banding proved invaluable. Yellow-banded juveniles showed up at Harbor Lake in early July and stayed around until the end of the month. As many as 9 were in view at once, out of 15 originally color-banded with yellow. A direct line apparently exists between the Terminal Island nesting colony and Harbor Lake. The birds' fortuitous use of a boathouse roof enabled us to observe them at a distance of a few meters and see their bands with ease.

Early in June a female banded on the left leg was observed at Terminal Island incubating a 3 egg clutch. She was trapped just before the hatching date in order to read the band, and proved to have been banded as a nestling at Huntington Harbour, Orange County, in 1973. This banding recovery documented the probable age of first breeding for the California least tern. (Another banded adult found dead in the south San Diego Bay saltworks colony, and presumably breeding, was also banded as a chick at Huntington Harbour in 1973). The Huntington Harbour nest site was rendered unusable to the terns after the 1973 season, and they have dispersed to other sites.

The mate of the banded female was trapped a few days later and banded on the right leg. When the chicks hatched (only 2 of the 3 eggs hatched) they were banded on opposite legs. We thus had a well-marked family, with individual members identifiable, to observe during the post-hatching period. On almost daily visits throughout July, Shirley Wells kept track of this family first at Terminal Island and then at Harbor Lake. She obtained the following valuable information:

- 1) From a 3 egg clutch, only 1 chick fledged; 1 egg failed to hatch and 1 chick disappeared at about a week of age.
- 2) The surviving chick fledged at 20 days.
- 3) Two days after fledging, it was with its parents at Harbor Lake, several miles from the nesting ground.
- 4) Fifteen days after fledging, the juvenile was apparently on its own, the parents were not seen again.
- 5) The juvenile stayed at Harbor Lake during the day for another 20 days before it left for good. During that time it spent a lot of time fishing, and also pirated food from other chicks.

APPENDIX C

NEST SITES USED BY CALIFORNIA LEAST TERNS AT PLAYA DEL REY, HUNTINGTON STATE BEACH AND CAMP PENDLETON IN 1976 By Kristen Bender

The colonies at Playa del Rey in Los Angeles County, Huntington State Beach Park in Orange County, and the Santa Margarita River mouth (Camp Pendleton Marine Base) in San Diego County, were visited at approximately two week intervals between the end of May and early August. Counts were made of nesting birds, actual nests (where possible), and individual adults and young, including fledglings on later visits.

Fledging success was more difficult to estimate than usual at the Huntington Beach and Camp Pendleton colonies this year due to the apparent departure from the colonies of pairs and their young as soon as the young could fly. The population of adults at these sites dropped steadily from the third week of June onward, and very few flying young were seen. The overall nesting season was short at these sites, with most of the birds gone by the end of July or the first week of August. Disturbance was apparently not a factor in this, as both sites were well protected.

Playa Del Rey

Ten pairs were observed on May 30 in various stages of courtship and nest site selection. In early June the colony was abandoned after repeated use of the salt flats for practice landing and takeoff maneuvers by helicopters. Better communication with the landowner and control over land use during the nesting season is urgently needed at this site. In past years this colony has been subject to disturbance by motorcyclists and horseback riders. As was recommended in previous years, the site also needs to be heavily posted at all access points and a barrier set up around the actual nesting area once the birds have chosen nest sites. With regular protection this could be a viable colony for many years in the future.

After the small colony deserted the Playa del Rey site, there may have been another nesting attempt in the Ballona Creek channel. In early July Bob Margolies saw 6 pairs on a sandy area that appeared to him to be a suitable nest site. Copulation was observed. In late July Jerry Johnson was attacked by adults in the same place and left the area quickly, assuming that nesting was underway. He also reported seeing 27 adults feeding fledglings on Ballona Creek Marina Peninsular Beach in early August (Los Angeles Audubon Society).

Huntington State Beach Least Tern Natural Area

This colony was visited 5 times between June 6 and July 29, at 10 day to 2 week intervals. Eleven nesting pairs used the site, with 8 apparently on eggs by June 6 and 2 or 3 pairs renesting in late July. Hatching success was apparently excellent and fledging success good. Renesting efforts were apparently less successful than first efforts. Most of the pairs left the colony as soon as the young were flying, leaving only a few birds using the site by the end of July. Some of the chicks wandered seaward out of the fenced portion of the Natural Area, where they were actively defended by the adults. Park plans call for eventual fencing of the entire Natural Area. This will provide more protected nesting area and will protect the chicks which use this seaward area before they reach flying age.

Maintenance of this Least Tern Natural Area by the State Park is good. The surface was well prepared before the birds' arrival. Before the nesting season, Park personnel placed short clay pipes (terra-cotta tiles) on the ground in the nesting area to test whether chicks would use an artificial cover. The experiment was successful. The chicks used these pipes actively for shelter from the sun and possible aerial predators. The adults also used the pipes as resting posts. This may be appropriate management technique in the future at other sites where the natural shelter is sparse.

The sanctuary fence should be inspected before the 1977 nesting season and patched if any holes develop over the winter. The sanctuary gate should be kept locked throughout the nesting season.

One interesting behavioral item was noted at this site. The colony was visited by bicycle on occasion, and the adult least terns were equally defensive against a bicycle rider as against a walking human. Defense behavior began at the same distance from the colony and was conducted with the same degree of vigor and group participation. This should be remembered in the design of any bicycle paths in this area by the State Park, or near other least tern colonies by other agencies.

Santa Margarita River Mouth (Camp Pendleton)

On the first visit of June 6, 100 pairs of least terns were counted in the areas of more concentrated nesting activity. This large colony is impossible to census accurately without marking nests and checking them at weekly intervals. A small but significant portion of the nesting sites are widely scattered through extensive salt flats, rather than concentrated in beach and sand-surfaced salt flat areas with the major portion of the nest sites. Based on past years' distributions when marked-nest census data were available, combined with the observed distribution of adult birds in the salt flats in 1976, this scattered portion of the colony was estimated at 25 pairs, for a total of 125 nesting pairs in the colony. Nesting concentrations were found in the same favored places as in previous years: the beaches north and south of the river mouth and the areas of sand which were spread on sections of the salt flats in experiments to enhance the appearance of the surface to attract the nesting birds. These sanded areas continue to be used, though their vegetation cover will soon become excessive for the least terns' purposes.

Hatching and fledging success were apparently excellent in this colony. The site was visited at approximately two week intervals through August 9. The number of birds present dropped steadily from late June onward as adults apparently left the area with their flying young. A renesting colony developed in July on the North Beach section. The proportion of adults to juveniles in this late group ranged from 3:1 to 4:1 rather than the more usual 2:1, indicating a substantially lower success rate for these late nesters.

There is no readily apparent reason for the steady decline in the total nesting population at this site over the last four years. Protection from disturbance is good and preparation of the beach nesting sites by the Marine Corps is excellent. No data are available on the food supply for the terns in these recent years; perhaps the populations of small fish have declined somewhat.

Actions were taken during the year by the Marine Corps Base to assure that planned movement by the Southern California Edison Company of heavy equipment along the beach will not jeopardize the least tern colony. Such movement will not be permitted during the time when the terns occupy this nesting area.

APPENDIX D

NEST SITES USED BY CALIFORNIA LEAST TERNS IN SAN DIEGO COUNTY SOUTH OF OCEANSIDE IN 1976

By Elizabeth B. Copper

A prolonged least tern nesting season in San Diego County, with birds hatching from the first week of June through the first week of August, resulted in a productive year for the species, with over 350 nests observed, excluding the Camp Pendleton colony.

The census of the sites from Agua Hedionda Lagoon south was conducted for the most part at least once a week from the end of May through August. Approximately 150 young of the year were banded with U. S. Fish and Wildlife Service bands, and young from the airport colony and the saltworks colony were additionally color-banded with green and white bands respectively. The fledging success of the majority of the colonies was very good. The saltworks colony was, however, plagued by a predator problem.

There was certainly some variation between the choice of nesting sites this year and those selected in previous years. Only four sites in Mission Bay were used by the terns this year and, while the site in Quivera Basin would undoubtedly have been more appealing had it been cleared, there is no apparent explanation for the absence of the birds from other Mission Bay sites. The fenced sanctuary should be cleared much more extensively than it was this year, in the hope of attracting the birds to a nesting area where they will be less subject to the whims of the public. Variation was also noted in selection of nest sites at the lagoons. The number of nests of least terns at both Los Panasquitos and San Elijo was higher than in previous years, while no nesting occurred at either Agua Hedionda or Del Mar.

These variations indicate not only the continuing need for censusing nesting least terns to determine what factors are most important in determining the choice of nesting sites, but also the variation in choice of nesting areas indicates the need for preservation of any areas used by the terns until a determination of preference factors is made.

Agua Hedionda Lagoon

No least terns were found to nest in Agua Hedionda Lagoon in 1976, though the area was checked regularly and one or two terns were found feeding or roosting on almost every visit from mid-May on. The mudflats where the terns have nested in previous years were used extensively by motorcyclists and the terns were never seen in this area. The terns were seen consistently on the mudflats west of the previous nesting site, but this area remained quite wet until mid-July. The mudflat which the terns have used in the past is the only area which was sufficiently dry for nesting throughout the period. Clearly, if this lagoon is to serve as a continued nesting site for least terns, the motorcyclists will have to be excluded during the nesting season.

Batiquitos Lagoon

The water level at Batiquitos Lagoon was sufficiently high to confine the nesting efforts of the least terns to a sandspit and an isolated sandbar at the east end of the lagoon. Nesting did not begin until fairly late, with 9 nests found June 25 and 3 additional nests found July 9. The fledging success

of this group was good, despite the fact that dogs had been through the colony and evidence of raccoons was found. On July 1, approximately 30 terns were seen in the lagoon between the railroad tracks and Interstate 5. One pair of these birds was observed copulating, but the mudflats were very damp and there was no evidence of nesting at this location.

San Elijo Lagoon

On June 7, at the east end of San Elijo Lagoon, nine nests were found and hatching was observed shortly thereafter. Sixteen new nests were present at the same location on July 1, and on this date stakes were found marking half of the nests. This nest marking was done by persons unknown with presumably good intentions. None of the nests were disturbed, and on subsequent visits I found no evidence that the nesting area had been visited by these persons again.

At the west end of the lagoon, on the north end of the dirt road which parallels the railroad tracks, a nest with two newly hatched young was found on June 6. On June 12, an additional nest was found, and two more nests were discovered June 25. On June 17, the island and dikes at this end of the lagoon were checked, and while no evidence of nesting was found, birds were observed copulating and a number of scrapes were found. These dikes and islands were noted by Craig to be nesting sites for the least terns and it is recommended that some clearing of vegetation be done prior to the nesting season to make the habitat more suitable. The dirt road at the west end of the southeast lagoon is frequently used by motorcyclists, horseback riders, etc., and if the site is used by terns in future nesting seasons, it is recommended that signs be posted immediately and that some temporary barricade be erected on the road south of the nesting site.

At the east end of the lagoon the nesting site is not easily accessible. Nevertheless, a number of people, often with dogs, wander through the area and it is recommended that signs be posted away from the road, relatively near the nesting area.

The potential hazard to the least tern in this area is the mosquito abatement personnel who were seen periodically with their large caterpillar tractors spraying refined oil around the nesting area.

San Dieguito Lagoon

No nests were found in this area, but on June 6, 12 least terns were seen feeding in the area between the railroad tracks and the freeway, and by June 20, 45 birds were present feeding here and up the channel by the fairgrounds and two pairs were courtship feeding. Unfortunately, the San Diego County Fair began the next day and the number of birds seen in the area after June 20 was considerably diminished and no nesting was attempted. The nesting area here used by least terns in previous years is overrun with motorcyclists and some effort should be made to curtail off-road vehicle activity if the site is to be used by least terns in the future.

Los Penasquitos Lagoon

At Los Penasquitos, the birds nested in two areas in the northeast corner of the lagoon. The first site was along the San Diego Gas and Electric Company service road. Five nests were found on the road itself. The birds presumably moved to this end of the lagoon to find an area that would remain dry during

high tides. On May 22, 6 nests were found, and by June 3, hatching had begun. On June 12, there were 20 nests, and 5 additional nests were found on June 20. In all, 28 nests were found at this site throughout the season.

The second site is immediately northeast of the first site, and 12 nests and four young birds were found there in late June. The fledging success at these sites was apparently good, and even though the area is quite close to a road and there is easy access to the nesting sites, there appears to have been minimal disturbance. Signs should be posted south of the nesting site along the dirt road to discourage the horseback riders and motorcyclists who use the area. A weasel was seen quite close to the nesting sites, but there were no indications of predation. Most of the birds left the area as soon as the young were fledged in late July.

The feeding area is somewhat limited here and relatively small numbers of birds were seen feeding in the channels and at the mouth of Los Penasquitos Lagoon. At the same time, fairly large numbers of birds were seen consistently feeding at San Dieguito Lagoon through the nesting season, with no evidence of nesting observed. These observations suggest that the birds from Los Penasquitos may have been using San Dieguito Lagoon as a feeding site.

Mission Bay

Least terns nested at only 4 of the 8 sites used in previous years and neither the prepared site at Crown Point nor the fenced sanctuary north of Friars Road was used by the terns. The amount of vegetation may have accounted for the absence of birds at both the Quivera Basin site and the Friars Road sanctuary. There is no apparent reason for the abandonment of the west area, the mudflats or the cloverleaf, but at Vacation Isle, no nesting habitat was available.

The Federal Aviation Agency (FAA) beacon island was the most successful site in Mission Bay and the FAA personnel were most cooperative in providing access to the island. On June 15, 11 nests were visible from the compound on the island and at least 20 young and 8 new nests were present when the area was visited on July 9. Fledging success at this location was excellent. The site has the advantage of being free from human disturbance, which is a prime factor in accounting for both the large number of birds nesting in a small area and the high fledging success rate observed. As in previous years, FAA personnel coordinated vegetation removal actions to enhance nesting conditions on the island before the breeding birds arrived.

Nine nests were found in the area north of the fenced sanctuary on Friars Road. This site is subject to a great deal of human disturbance, and numerous dog, bicycle and motorcycle tracks were observed. The fledging success of this colony was presumably rather poor, as only 6 flying young were ever observed. Hopefully the terns using this area can be induced to nest across the road in the sanctuary, but in the event they cannot, fencing and sign posting would be very much in order.

Between late May and mid-July, 21 nests were found on the north end of Fiesta Island, scattered over the mudflats and in relatively dense vegetation. The area is subject to very heavy use from motorcyclists, dogs and people on foot. After the Memorial Day weekend, 5 of 8 nests were either destroyed or abandoned. These birds presumably re-nested and the fledging success, 11 flying young, was surprisingly good, given the obvious handicaps.

On the sludge beds at the south end of Fiesta Island, there were 23 nesting pairs of least terns, 9 on the southeast tip of the sludge beds and 14 on and along the sand dike running around the periphery of the sludge beds. The City of San Diego was accomodating about leaving the area undisturbed while the birds were nesting. This location is desirable as a nesting site because it is located on city property and is not readily accessible to the public. The colony appeared quite successful in fledging young.

As noted, the tern sanctuary bordering Friars Road was not used this year by the birds. Even though the area was cleared of some vegetation prior to the nesting season this year, it would be advisable to remove much more vegetation in future years in the hope of encouraging the terns to use the site.

The Quivera Basin site would also become much more attractive to the terns if some vegetation were removed. As for the north end of Fiesta Island, there seems to be little that can be done unless some of the area can be completely isolated from the public. At this site, it is unclear whether posting would deter or encourage interference with nesting birds. The sludge beds, because they comprise an area of limited access, provides a more desirable location than the site at the north end of Fiesta Island. It is recommended that the City of San Diego be contacted early in the year to determine which areas of the sludge beds will be unused during the nesting season, and that an effort then be made to make these areas as appealing as possible to least terns. The FAA Island is clearly the most successful site in Mission Bay, and it is recommended that clearing again be done on the island to enable it to accommodate the maximum number of nesting birds.

San Diego International Airport

The colony this year numbered a minimum of 115 nests distributed between two sites. The airport personnel were very cooperative and generous with their time in making access to the sites possible. On the surcharge area south of the west end of the runway there were approximately 60 nests, with an additional 21 nests located immediately below the surcharge area at its eastern end. When the site was first visited in early June, there were many fresh shell fragments in evidence, indicating early nesting. The birds left this area very abruptly and very few adults or fledged young were in evidence on June 29. On this date, no birds were found below the surcharge area, but several chicks had moved out onto the west end of the runway, a total of 8 non-flying and 4 fledged birds of the year.

The second site was near the east end of the runway between the main runway and the north taxiway. The eggs were laid in cracks or depressions in the blacktop and approximately 25 to 30 nests were noted there in early June, with an additional 15 nests present by the end of the first week of July. On July 14, there were at least 10 young between one day and one and one-half weeks old, but when the site was visited one and one-half weeks later, there were no terns found anywhere in the airport. A cursory inspection of the nesting site yielded neither any dead young nor any discernable reason for the abrupt departure of the least terns.

The mortality of the birds nesting along the runway was apparently fairly high, particularly among the adults. On each visit to the site, several dead birds were noted on the runway. It was not possible to walk out on the runway to make an accurate count of dead terns. An inspection of the Marine Recruit Training Depot, located near the airport, showed that the nesting site established there in 1975 was again unused this year.

The San Diego Airport is still one of the largest least tern colonies in the state and certainly has the distinct advantage of being protected from human disturbance. The site along the runway is, however, certainly undesirable for many reasons, and if sufficient habitat can be found to accommodate these birds elsewhere, it would be advisable to discourage the terns from using this site in the future. Because of the size of this colony, it would seem that a high priority should be given to maintaining or providing a useable nesting area for the birds in succeeding years. If the surcharge area is available in the future, some clearing of vegetation might well enable this site to accommodate additional nesting terns.

Sweetwater River

In early June the least tern colony at the fill area consisted of 24 pairs of birds with nests scattered widely through the site. An effort was made by Department of Fish and Game Warden Bassom to post signs and mark off the site and to work with the motorcyclists using the area. Unfortunately, these efforts ultimately produced minimal results and the disturbance in the area was great. An attempt at renesting was evident in early and mid-July, with 9 additional nests present. Young were hatching out of these nests as late as the first week of August. The fledging success, 18 flying young were observed on August 13, was much better than expected under the circumstances, most probably because the nests were so scattered. If this colony is to continue, it is imperative that motorcycle and off-road vehicle activity in the area be completely eliminated during the nesting season. Given the persistence of the birds at this site and the size of the colony, if development of the property is to take place, it is recommended that some part of the fill area be reserved for tern nesting.

South San Diego Bay - Saltworks

On June 12, the least tern colony consisted of 49 pairs nesting on the inner dikes of the saltworks. In mid-July, a single abandoned egg was found, indicating some attempt had been made, though of unknown extent. Renesting occurred on the more northerly of the inner dikes, with 8 nests, one with a hatching egg present on July 20. The last of these birds hatched in the first week of August.

This colony suffered from a serious predation problem throughout the nesting season. A minimum of 30 adult least terns was found dead, the majority of them decapitated. The problem was confined to the more southerly of the inner dikes and the outer dike. The more northerly of the inner dikes was left undisturbed and fledging success was excellent. On the southerly inner dikes, the young would disappear within a few days of hatching, presumably moving to a heavily vegetated dike near the nesting colony. The movement of young away from the colony made it very difficult to assess the predator's impact on the young. The dead adults were for the most part found near the nests, suggesting the probability of an avian predator. Three chicks were found dead in nests near dead adults, presumably having died because there were no parents to care for them. In addition, 2 nests were never hatched out, and these may have belonged to adults that had been killed. An intensive search by Norm Holgerson, Division of Wildlife Service, Fish and Wildlife Service, did not reveal the identity of the depredating animal.

The percentage of adult birds taken here was distressingly high and, given the incidents here as well as predator problems that have arisen in the past at other sites, need for greater efforts in the future to the identification of predators and the solution of predation problems. It is also recommended that the personnel at Western Salt Works be requested to discourage visitors such as school classes, when the nesting season begins. Apparently school field trips were taken into the area until the close of school in June. In addition, it is recommended that the various school districts be contacted and advised of the situation so that field trips could be halted when the nesting season begins.

Coronado Cays

The Coronado Cays were checked periodically through the season. There was no evidence of nesting, but 4 to 6 birds were seen feeding in the area, though these could easily have been birds from the saltworks colony. There were construction activities in the area through the summer, and this may well have discouraged any potential nesting birds.

Tijuana River Estuary

On June 13, 4 nests, one with hatching young, were found scattered in the sand dunes just north of the Border Field State Park boundary. An additional nest was found two weeks later. Signs posted to protect the nesting area seemed effective and fledging success was good.

Feeding Areas

Least terns were observed feeding at several inland sites after the nesting season was completed. Fifteen birds were seen fishing at Lake Val Serrano inland from San Elijo Lagoon on July 22. Approximately 5 to 6 birds were observed at a borrow pit pond in the Tijuana River Valley on August 15 (Phil Unitt). The number increased to about 20 birds on August 22, and one immature was still present September 5 (Jon Dunn).

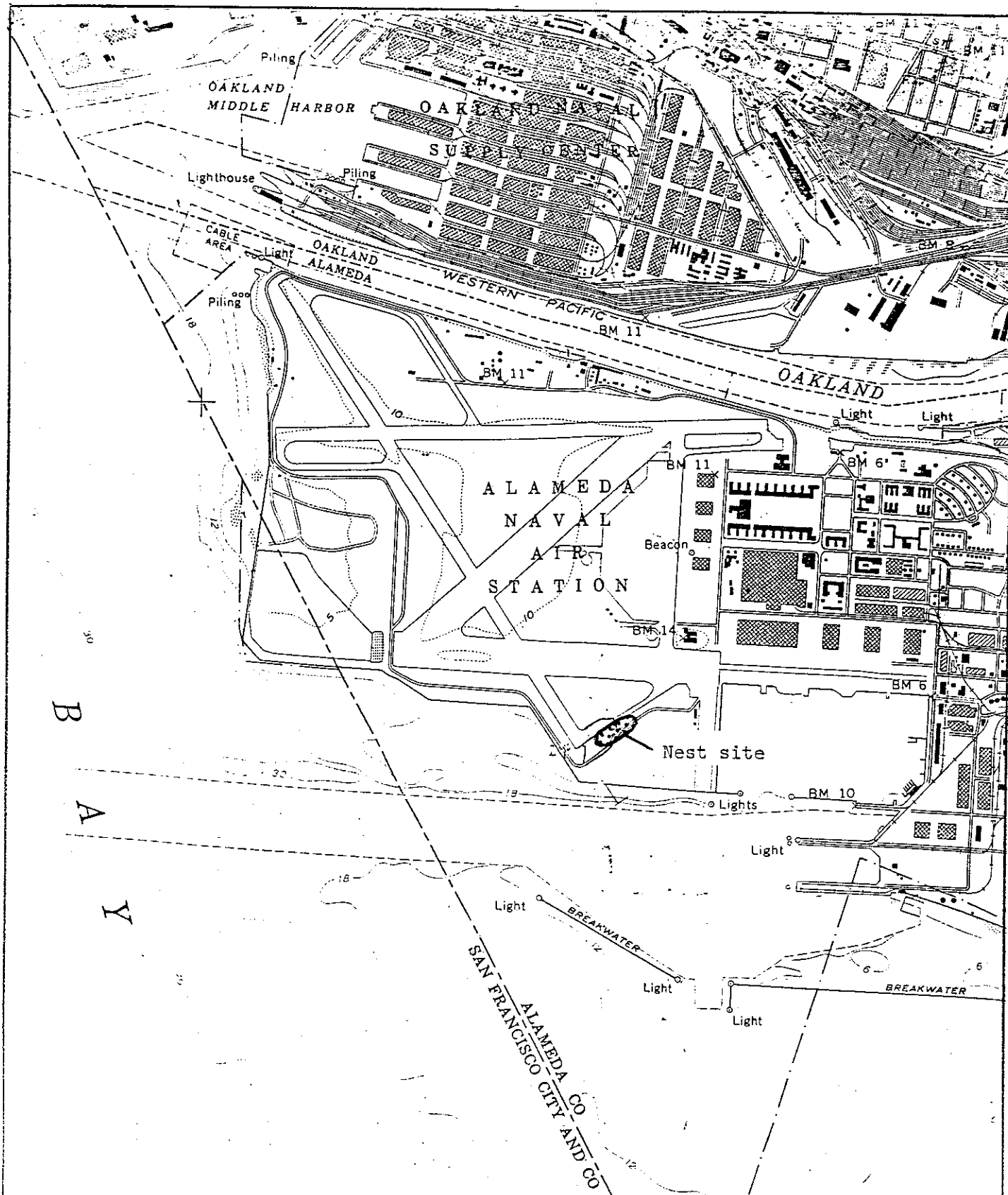


Figure 1. Site of Least Tern Breeding Colony at Alameda Naval Air Station, Alameda County, in 1976.

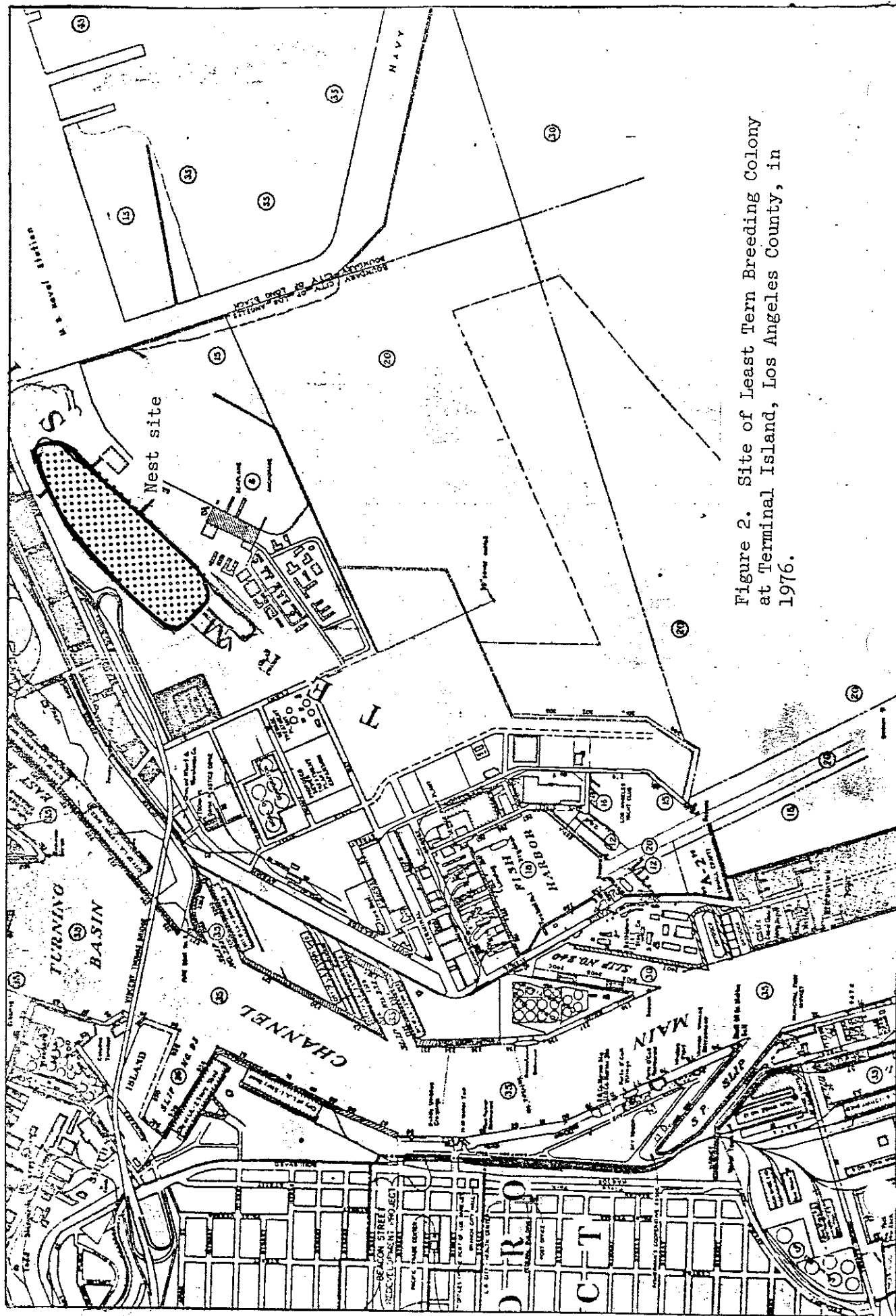


Figure 2. Site of Least Tern Breeding Colony at Terminal Island, Los Angeles County, in 1976.