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California Department of Fish and Game

CALIFORNIA LEAST TERN CENSUS AND NESTING SURVEY, 1973 1/

by

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ABSTRACT

A study of nesting populations of California least terns was conducted in California in 1973. Purposes of the study were to census the total breeding population and determine nesting success. The estimated breeding population of least terns in 1973 was 624 pairs. Nesting activity was recorded at 19 sites. Additional information was collected on nesting status in 1971 and 1972. Current problems at nesting sites were identified and recommendations made for least tern protection and management.

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1/ Supported by Federal Aid in Wildlife Restoration W-54-R-4, "Special Wildlife Investigations," Progress Report, Job II-11 (February 1974).

2/ California State University, Long Beach.

RECOMMENDATIONS

Based on the census herein reported, the following general recommendations are made for the management and preservation of the California least tern. Specific recommendations for selected sites are contained in Appendix A.

1. A Recovery Team be organized to coordinate all efforts to preserve California least tern.

2. Primary emphasis be given to preservation and enhancement of least tern nesting habitat in the following vicinities: San Francisco Bay, Alamitos Bay, Mission Bay and San Diego Airport.

3. Nest sites be developed or enhanced at Buena Vista Lagoon, San Elijo Lagoon and Del Mar, where adequate food supplies are available but suitable nesting habitat is lacking.

4. Fences be erected and signs posted at colonies where human disturbance has been a problem in the past, such as Tijuana River, South San Diego Bay and Playa del Rey.

5. Prior to May each year, excessive vegetation be removed from known nesting sites.

6. Prior to May and again at mid-June each year, known nesting sites be checked for possible predators and appropriate control measures be implemented where needed.

7. Efforts be made to obtain an estimate of the nesting population on the two historical sites in northern Baja California, Mexico.

8. Reaction of least terns to manmade nesting sites at Anaheim Bay and Santa Margarita River be observed for information useable in possible future construction of least tern nesting sites.

9. Census and nesting survey be repeated at regular intervals with similar methods to monitor population changes.

INTRODUCTION

The California least tern (Sterna albifrons browni) once nested in uncounted thousands on the beaches and near the estuaries of the Pacific coast of North America from Monterey Bay, south of San Francisco, to Scammons Lagoon in Baja California (Hellmayr and Conover 1948). Within the last century, these flocks have dwindled rapidly, until in 1970 the remaining population in California was estimated at less than 300 pairs (Craig 1971). The decline has been caused by human appropriation of the nesting grounds for recreation and housing sites and destruction of the estuarine feeding areas by dredging and pollution. The degree of disturbance and impending development of the remaining breeding areas resulted in the subspecies' placement on the endangered species lists of both the U. S. Department of the Interior and the State of California.

Comparatively little research has been done on California least tern, and only a small amount of information is available, most of it unpublished. This situation has been partially remedied by a Department of Fish and Game study of least tern breeding biology (Massey 1972) and a Department survey of existing nesting sites (Craig 1971).

SCOPE AND PURPOSE

Purpose of this study was to census the breeding population of least tern in California and to obtain an estimate of nesting success in 1973. Observations were recorded on behavior, movement patterns, occurrence in nonnesting areas, and other matters relating to least tern biology and management.

ACKNOWLEDGMENTS

The author is grateful to the many people who provided information and assistance in this study; without their help much of the information included here would have been unobtainable. Especially helpful were: Dr. Charles Collins and Mrs. Barbara Massey, who supplied much information on the Orange County and Long Beach area colonies; Bruce Elliott, who contributed most of the information on the sites in San Francisco Bay; and Deane Swickard, who collected and supplied most of the information on the Santa Margarita River colonies. Previously unrecorded least tern groups were brought to the author's attention by several people; Mrs. Elizabeth Copper contributed her observations on Terminal Island; Commander Robert Baker found the flock at Point Mugu; Robert Fordice supplied the information on the Santa Ynez River; Jerome Johnson found the colony at Playa Del Rey; and Harold McKinnie reported the Sweetwater River colony. The following persons contributed information on one or more sites or areas:

San Francisco Bay - Bruce Elliott

Monterey-Ventura area - Robert Baker, Alan Baldridge, Robert Fordice, Eric Johnson, Sanford Wilbur

Los Angeles-Orange County area - Richard Bradley, Charles Collins, Elizabeth Copper, Jerome Johnson, Barbara Massey, Shirley Wells

San Diego County - John Arbaugh, Michael Evans, Richard Field, Alice Fries, Robert and Martha Hall, John and Dorothy Helmer, Nevin Holmberg, Jack Kinsey, Ann Mathewson, Guy McCaskie, John McColm, Harold McKinnie, Walter Pomeroy, Terry Roeder, Shumway Suffel, Deane Swickard

METHODS

Nesting colonies were found by surveying known least tern nest sites recorded in 1969, 1970 and in former years. Additional colonies were found by surveying other possible sites and through correspondence with knowledgeable people.

Each known nesting site, except Bair Island, was visited at bi-weekly intervals from late May through mid-August, and all adults, eggs, chicks and flying young were counted. Where possible, the number of adults incubating or brooding was determined by counting nests. Where direct nest counts were not possible, nesting birds were counted. Such colonies were observed with binoculars and spotting scope for sufficient time to differentiate incubating or brooding birds from those which were simply resting. The total breeding population of each site was estimated at each visit from these counts and from known behavior patterns of the birds. These bi-weekly estimates were summarized for the 1973 season as a whole.

RESULTS

The nesting population of least terns in California in 1973 is estimated at 624 pairs (Table 1). Findings at individual nesting sites together with specific recommendations are contained in Appendix A. Information on nesting in 1971 and 1972 is also included. Locations of sites are shown in Appendix B.

DISCUSSION

Range and Population Changes

A significant development in recent years has been the expansion of the range of the California least tern north to San Francisco Bay from its former northern limit near Monterey. The San Francisco Bay colony numbered approximately 200 pairs in 1972 and about 50 pairs, and possibly many more, in 1973. The flock has used three different nesting sites in San Francisco Bay in the past five years. It is reasonable to assume that the least tern will continue to breed in this area as long as suitable nesting habitat is available.

The population of least terns nesting at the mouth of Santa Margarita River has increased substantially since Craig's survey. In 1970, only 19 pairs nested there. With site protection this colony increased to 250 pairs, or one-third of the State's adult least tern population, in 1973.

In the event of some catastrophy at the Santa Margarita site during the nesting season, a large proportion of the adult least tern population could conceivably be lost. For this reason, management efforts should be directed to protecting and enhancing other least tern nesting sites to encourage the population build-up of other colonies.

TABLE 1

CALIFORNIA LEAST TERN NESTING SITES AND POPULATION IN 1973 1/

Site	No. Pairs	No. Nests	No. Chicks	No. Immatures
Alameda County				
Bay Farm Island	1	---	---	---
Oakland Airport	40	---	---	67
Ventura County				
Point Mugu	7	---	---	---
Los Angeles County				
Playa del Rey	20	11	3	14
San Gabriel River	25	12	4	14
Orange County				
Huntington Harbour	25	49	21	17
Huntington State Beach	16	16	5	1
San Diego County				
Santa Margarita River	250	315	467	---
Buena Vista Lagoon	2	0	0	0
Agua Hedionda Lagoon	6	5	0	0
Batiquitos Lagoon	30	22	17	14
San Elijo Lagoon	1	0	0	0
Del Mar	4	1	0	0
Los Penasquitos Lagoon	15	6	---	---
Mission Bay (all sites)	72	97	---	---
San Diego Airport	50	68	11	16
Sweetwater River	20	4	---	11
So. San Diego Bay	35	24	14	5
Tijuana River	5	7	4	3
Total Recorded	624	637	546	162

1/ Numbers of nesting pairs are conservative estimates; numbers of nests, chicks and immatures are actual counts and are, therefore, minimum figures. Unknown information is indicated by a dash.

Least terns appeared in recent years in small to moderate-size flocks in five areas that have not been used for nesting for several years. Three of these recolonizing efforts were successful for at least one year. Success of one was questionable, and one colony was a definite failure. The colony at Playa del Rey was clearly successful in 1973, although its future will be precarious without protection from human disturbance. The small Tijuana River colony also was successful in 1973 but needs more protection than Park personnel were able to give it this year. The small flock that nested successfully at the Santa Ynez River mouth in 1971 and possibly in 1972 failed to return in 1973. At Point Mugu, a small flock remained through summer 1973, but it is not known whether it nested there. The Terminal Island recolonization attempt in Los Angeles-Long Beach Harbor failed because of earth moving activity on the only available nesting area.

Small colonies of 1 to 25 pairs were found at some of the 1973 sites, such as Buena Vista Lagoon and San Elijo Lagoon, which historically supported greater numbers of nesting birds.

Two previous population estimates of nesting least terns in California were made in 1970 and 1971. For purposes of determining population trend, these estimates cannot be compared directly with the 1973 estimate because amount of time and methods employed in gathering data were different in each survey. The 1973 nesting population estimate is more than twice Craig's 1970 estimate of less than 300 pairs. However, Craig's survey entailed substantially less field time, and was designed to collect information on nesting sites rather than on total numbers of birds.

Craig (personal communication) collected additional census data in 1971. At 16 known least tern nest sites he estimated the population at between 1,075 and 1,275 birds. The figures were based mainly on correspondence with bird watchers and biologists. Data collected on nesting populations in 1971 and 1973 suggest the possibility of a slight increase in numbers the past two years; however, such a judgment cannot be made with certainty.

Movements and Sightings

After young have fledged, least terns sometimes leave the nesting sites in family groups and aggregate at other sites within the breeding range. Choice of locations for such late-season aggregations appears to depend on ample food supply and freedom from serious disturbance. Aggregations have been noted in recent years at Dune Lakes, a private duck hunting preserve in San Luis Obispo County (E. V. Johnson); Del Mar; bed of San Diego River south of Mission Bay; and mouth of Tijuana River.

Small numbers of apparently nonnesting adult least terns have been reported from several areas during the nesting season. Some may represent remnant groups in former nesting areas, while others may be wanderers that have fledged young or nested unsuccessfully. Areas from which such observations have come in recent years include Monterey-Moss Landing area (Baldridge), Los Angeles Harbor and Cabrillo (Copper), Bixby Slough near Los Angeles Harbor (Wells), Belmont area of Long Beach (Collins), and Salton Sea (McCaskie and Suffel).

LITERATURE CITED

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APPENDIX A

Discussion of Least Tern Use and Reproductive Success on Known Nesting Sites in 1973, with Recommendations for Management.

SITES

A-1. Bair Island
A-2. Bay Farm Island
A-3. Oakland Airport
A-4. Santa Ynez River
A-5. Point Mugu
A-6. Playa Del Rey
A-7. Terminal Island
A-8. San Gabriel River
A-9. Sunset Aquatic Park
A-10. Huntington Harbour
A-11. Huntington State Beach
A-12. Santa Margarita River
A-13. Buena Vista Lagoon
A-14. Agua Hedionda Lagoon
A-15. Batiquitos Lagoon
A-16. San Elijo Lagoon
A-17. Del Mar
A-18. Los Penasquitos Lagoon
A-19. Mission Bay
A-20. San Diego Airport
A-21. Sweetwater River
A-22. South San Diego Bay
A-23. Tijuana River

A-1. BAIR ISLAND

During the summer of 1971 Bair Island was used by 17 adult birds. An initial problem with rats was apparently solved by rodenticide application, and the terns fledged about 8 young that year. Since 1971 this site has not been used by least terns.

Currently the State is acquiring Bair Island as an Ecological Reserve. It is recommended that a habitat management plan be developed to provide nesting sites for least terns.

A-2. BAY FARM ISLAND

The San Francisco Bay area least tern population increased sharply in 1972 when nearly 200 pairs were counted on this site in June. Many were with eggs and young. Judging from the numbers of adults and immatures seen in the general area later in the season, this breeding attempt was quite successful.

Subsequent seeding of the sand area to soil binding grasses destroyed the habitat for least terns. Only two birds were observed attempting to nest there in 1973 (Elliott).

A-3. OAKLAND AIRPORT

At least part of the large flock of least terns that nested on Bay Farm Island in 1972 apparently moved to a new sand fill area at the north end of the airport in 1973. Department personnel counted 171 birds there at the end of July, 1973. Determination of ages of 137 of these birds showed an almost 1:1 ratio of adults to immatures (Elliott). If this ratio held for the entire flock, it represented the highest fledging rate of any site in the State. A ratio of 2:1 adults to immatures is more usual in other colonies that have been sufficiently studied.

It is recommended that efforts be made to maintain this nest site until an alternate site is made available. When a suitable alternate site is developed, efforts should be made to discourage terns from nesting near the airport flight paths.

A-4. SANTA YNEZ RIVER

In 1971 a small colony of least terns nested at the mouth of Santa Ynez River. Department personnel observed 16 adults and 3 immatures. Of three clutches found in the colony, two hatched and one was abandoned. It is believed that young birds successfully fledged from only one of the clutches that hatched (Fordice).

During June and July, 1972, least terns were observed feeding in the lagoon at the river mouth, but no nests were found. The area was checked again in 1973, and no least terns were observed (Fordice).

A-5. POINT MUGU

Least terns were first observed in this area in 1973. A maximum of 15 was counted at once (Baker). The flock remained in the area through the nesting season, but a search of much of the available land failed to discover nests or young. The area available for nesting is extensive, and many parts were not surveyed. It is possible that a flock nested somewhere in this vicinity.

A-6. PLAYA DEL REY

The estuary which is now Marina del Rey formerly had a nesting colony of least terns but the terns had not nested there for at least the last five years. During this period, however, least terns were observed in the Playa del Rey area during spring migrations (J. Johnson).

In 1973 a nesting colony of about 20 pairs used the site successfully; at least 14 flying young were produced (Bradley).

The nesting site is a salt pan in a degraded salt marsh south of the Ballona Creek flood control channel. Although the site is not threatened by imminent development, trespass has been a problem for tern nesting. The area is not fenced and is used regularly by horseback riders, dog walkers and motorcyclists. The last were a considerable problem in past years, but in 1973 security measures by the landowner, Hughes Tool Co., resulted in much less motorcycle use of the site.

It is recommended that arrangments be made with the landowner to close the area to trespass with a fence along the adjacent road.

A-7. TERMINAL ISLAND

Terminal Island in Los Angeles-Long Beach Harbor once supported a nesting colony of least terns until harbor developments displaced the birds. None had been recorded there for many years until late May and early June 1973, when a small flock was observed fishing and courting near Fish Harbor and the Navy Seaplane Basin. Courting activities progressed into courtship feeding that was seen repeatedly. When birds apparently were about to begin nesting, bulldozers began work on the only suitable area of bare sand fill. The least tern population dropped sharply in mid-June until only one or two were present at the end of the month and none in mid-July. In late August, an adult and two flying young were seen at Fish Harbor (Copper) and three birds were observed in Cabrillo.

A-8. SAN GABRIEL RIVER

Least terns nested on this site in 1971 and several chicks were fledged. In 1972 a flock of 60 used the site through the first half of the nesting season. Courting appeared to be normal and human disturbance was relatively minor. The birds abandoned the site in early July for no discernable reason. Only two clutches of eggs were found on the site in a careful search. The nesting birds did not return.

During 1971 and 1972 the site was a dirt covered landfill area with trash, broken concrete and other debris. In connection with planned construction on the northwestern portion, most of the parcel was graded in the fall of 1972.

In 1973 least terns reestablished their nesting colony on a low, flat portion of this graded area. Approximately 30 pairs used the site, but some pairs may not have nested. Twelve nests were located; some were begun very late in the season and two nests were abandoned in early August. Fourteen flying young were counted. The ratio of adults to flying young was about 2:1.

During the 1973 season some earth moving activity took place on the section adjacent to the nesting area. The landowner, contractor and oil lessee cooperated by reducing human disturbance in the area. Apparently only one egg was abandoned due to equipment activity.

This is the only nesting site available for this flock in the Alamitos Bay area of Long Beach. There are plans for eventual construction on this entire parcel, but some provisions may be made for least tern nesting. Widening of the flood control easement along the river to provide nesting habitat should be considered.

A-9. SUNSET AQUATIC PARK

From a large colony in 1971, the nesting population of this site decreased to one or two pairs on the fringe of the former nesting area in 1972.

Least terns did not nest on this site in 1973, although adults were seen or heard over the channels in the nearby wildlife refuge salt marsh and at Huntington Harbour.

The peninsular portion of this site has been set aside by Orange County as a least tern sanctuary. A chain link fence has been placed across the peninsula to restrict access. This protected site can be developed as an ideal nesting area with proper management. It is recommended that the area be cleared of vegetation that has overgrown the area since 1970. In addition, burrowing owls found in or near the nesting site should be relocated to eliminate threat of predation. Owl predation has been a problem here in the past.

A-10. HUNTINGTON HARBOUR

This site is part of an extensive land fill. Construction of a housing community has been in progress on this fill the past 10 years. The area lies immediately south of Sunset Aquatic Park and Seal Beach National Wildlife Refuge.

A small flock of about 6 pairs nested on this site in 1971 and 1972 with unknown success. The area was heavily used by motorcyclists, dog walkers and wandering children both years. As a condition of his construction permit, the landowner was directed by the City of Huntington Beach to build an alternate least tern nesting site in the nearby wildlife refuge in time for the 1973 nesting season. This was not done because of procedural delays. The City then provided protection measures, including a part-time monitor, at the land fill site that season. The colony increased to about 25 pairs in 1973, and hatching and fledging success were good. At least 17 flying young were produced.

Construction has been completed on the alternate nesting site in the wildlife refuge, and this will be available for the birds in 1974. The present Huntington Harbour site will be partially dredged and subdivided for housing.

A-11. HUNTINGTON STATE BEACH

The small flock at this site in 1971 increased to 13 pairs in 1972. Twelve clutches hatched and one was abandoned. Several young were fledged. Although small groups of crows and nearby gulls were predatory threats, crows are known to have taken only the abandoned clutch.

The tern flock increased again in 1973 to about 17 pairs. All hatched their clutches successfully and most apparently fledged some or all of their young.

California Department of Parks and Recreation has protected this site for many years as a least tern nesting sanctuary. The fenced sanctuary is enlarged from its original size, and all of the known nests in 1972 and 1973 were within the protected area. The social flocking area is outside the fence, as were some of the known nests in past years. Park personnel manage the site by removing vegetation and churning the sand in late winter each year to enhance the nesting situation.

Fishing areas available to this colony consist of two flood control channels and the nearly dry Santa Ana River. Availability of food may prove to be a limiting factor to future growth of this colony.

It is recommended that:

1. The sanctuary be enlarged to include the social flocking area.

2. Water quality control measures be initiated in the two nearby flood control channels and Santa Ana River to maintain the food supply of the terns.

A-12. SANTA MARGARITA RIVER

Under stewardship of the U. S. Marine Corps Natural Resources Office, this colony has had the greatest success in the last three years of any in the State. It also has the most secure future of any colony. The population has increased from about 19 pairs in 1970 to 300 pairs in 1971, 250 in 1972, and 250 again in 1973.

Nesting sites are now protected from human or vehicular disturbance during the breeding season. The vegetation is removed and the sand disturbed on the beach sites during the winter to prevent their becoming overgrown. Close watch is kept on the nesting efforts each year, making this the only least tern site in the state for which systematic figures are available on hatching success, fledging success, and losses of adults, eggs, or young.

Now that human disturbance has been controlled, the only significant losses to this colony over the past 3 years have been due to flooding by rains or high tidal water in the salt flats areas and some instances of predation. The food supply has been investigated each year and appears to be ample.

Before the 1973 nesting season, an experimental artificial nesting site was built by spreading sand on a small section of the salt flats previously used by the terns. This proved to be extremely attractive to the birds and accumulated the highest density of nests yet known for the subspecies.

Swickard (Summary 1973 Least Tern Nesting Survey, Unpublished) reported that in 1973 the terns nested on the artificial nesting area. They also nested in the four other areas on the sand beach and salt flats that were used in 1972. In 1973, 250 pairs made 315 nesting attempts resulting in 652 eggs, of which 467 hatched. Estimated recruitment was 200 birds. For the first time in three years predation was a serious problem, and it accounted for the loss of 124 eggs. Predation ceased after many predators were destroyed by shooting and trapping.

A-13. BUENA VISTA LAGOON

No information is available on least tern nesting at this site in 1971 or 1972; it is likely that there was none.

Approximately four birds were seen fishing in various parts of the lagoon throughout the summer, but no nesting area could be found. Food supply is presumed to be adequate to support a colony and the lagoon is protected as an Ecological Reserve. Only a suitable nesting site appears to be lacking.

A large fill area at the head of the lagoon was not used for nesting in 1973. The present fencing around this fill seems to provide an effective barrier, and little sign of motorcycle use was found in the area in 1973.

It is recommended that efforts be directed toward developing a nesting site near the lagoon or constructing a nesting island in it.

A-14. AGUA HEDIONDA

Least terns have been reported in and around Agua Hedionda in the past. In 1973 a small flock of six to eight pairs began a scattered nesting colony on the extensive dried salt flats at the head of the lagoon. This area is not protected from outside disturbance by natural or manmade barriers. Heavy motorcycle activity on these flats destroyed the small nesting colony in early July. No least terns were seen in the area after mid-July.

A-15. BATIQUITOS LAGOON

In late July 1973, an extensive colony of at least 30 pairs was found on the partially dried flats near the mouth of the lagoon between the railroad track and the freeway. Nesting was well advanced and apparently quite successful. A minimum of 14 flying young was counted later in the season. This site is well protected from human interference by its inaccessibility. Most nests appeared reasonably safe from terrestrial predators because of surrounding water channels.

A small colony of about two pairs was also found at the mouth of San Marcos Creek.

A-16. SAN ELIJO LAGOON

No least tern nesting was found in San Elijo Lagoon in 1973. The dike site in the northwest corner of the lagoon is nearly overgrown with vegetation making the area unsuitable for nesting. The water level was high in 1973 and most of the mud flat area east of Interstate 5 was flooded.

One or two birds were seen fishing early in the summer. Later, four adults and one flying young were seen on the mud flat when the water level dropped in mid-August. These birds may have nested elsewhere.

It is recommended that vegetation be removed from the dike tops to provide nesting space for terns in 1974.

A-17. DEL MAR

About four pairs of least terns were present at this site in 1973. Only one nest was established. It was adjacent to the Del Mar race track parking lot, and the clutch was destroyed by human disturbance.

Nesting space was limited. Although there was no room for a significant colony to nest here, the birds remained in the area all summer.

The food supply is apparently abundant. The area supported for a month a flock of 100 or more terns, an after-nesting aggregation of adults and immatures from other sites.

A-18. LOS PENASQUITOS

Approximately 15 pairs used this lagoon in 1973. Main nesting occurred on a salt flat in the middle of extensive marsh vegetation. Six nests were found. The site is well protected by tidal channels and the only access is along the railroad right-of-way across the marsh.

Part of the flock may have tried to nest on a sand bar just inland of Pacific Coast Highway, but considerable human disturbance prevented success here. This bar and another near the parking lot for Torrey Pines North Beach were the social flocking areas for this colony.

The nesting sites recorded by Craig (1971) along the dirt road and in the nearby salt flats were unused by least terns in 1973.

A-19. MISSION BAY

In 1973, the least tern nesting flock in Mission Bay consisted of 72 pairs, the second largest nesting flock in the State. The flock was scattered among eight known nesting sites (Appendix B, B-8). None of these was a natural beach or salt flat area, and each was sub-optimal or marginal as nesting habitat. Most of these sites are subject to much disturbance from humans and dogs and illegal use by off-road vehicles. The flock has no useable, permanent, protected place to nest.

No accurate population figures are available for this flock in past years, but an estimated 200 pairs nested in Mission Bay in 1972.

Nesting sites used in 1973 are discussed below.

Beacon Island is a small, artificial island--the site for an airport navigation beacon. The nesting flock of up to 38 pairs in 1973 was apparently quite successful.

The site appears to be an excellent nesting ground for part of the flock. It is partially fenced and not open to entry. The island is sparsely covered with weeds.

Fiesta Island, north end, had the largest group of nesting least terns in Mission Bay in 1973--at least 30 and up to 50 pairs. The site is composed of dredge fill, much of it powdery and some of it deeply cracked. Vegetation is sparse and some areas are bare. Human disturbance is severe, especially by dog-walkers and off-road vehicles. Only temporary fencing and steady surveillance by Audubon Society and Sierra Club volunteers enabled terns to nest successfully.

Fiesta Island, southwest end, is closed to public access because of its use for sewage settling ponds. Apparently a few pairs nested here and were probably successful. There are no immediate plans for construction on the area.

North area is a small, partially blacktopped site. The nesting flock here numbered about 13 pairs in 1973 and was apparently successful.

West Area site was partially cleared by Sierra Club and Audubon members before the 1973 nesting season. About 12 pairs of least terns nested here and nests were scattered over a large area. Nesting success was undetermined but was apparently low. This is a favorite spot for people to run their dogs.

Vacation Island apparently had one or two nesting pairs in an area south of the model boat basin. Running chicks were seen, but their survival is not known.

Freeway Cloverleaf site is flat, sandy and only sparsely vegetated by weeds. The site was used by 10 pairs in 1972 and by about 15 pairs in 1973. The colonies nested successfully both years.

This site could be maintained as a small tern sanctuary by occasional clearing of vegetation and placement of a low barrier to prevent the chicks from wandering onto the road.

Mud Flat site was used by nesting least terns in 1972 and 1973. Of the five nests made in this powdery area in 1973, three were destroyed by motorcycles. Success was poor in 1972, also.

Plans for landscaping by the City of San Diego are an immediate threat to the nest sites at North Area, Freeway Cloverleaf, Mud Flat and, apparently, West Area and Vacation Island.

The City of San Diego has designated an area at the southeast corner of Mission Bay as a temporary least tern sanctuary. This site was previously used in great numbers by the birds, and it had been partially fenced through volunteer efforts. However, the site was not cleared of its vegetation before the 1973 nesting season, and no least terns used it.

Of the two alternate areas discussed by Craig (1971), the linear site on the flood control channel bank has already been landscaped. The site near the preserved remnant of salt marsh on the north side of the bay remains undeveloped, but it has never been used by least terns. The Park and Recreation Board has grown more receptive to the idea of modifying this area as a least tern sanctuary.

It is recommended that:

1. The Park and Recreation Board be advised of the probable effects of their landscaping plans on this endangered species.

2. The temporary sanctuary be cleared of vegetation well before the onset of the 1974 nesting season.

3. Beacon Island site be cleared of vegetation. Moving the fence to the perimeter of the island and topping the site with sand should also be investigated.

4. Feasibility of creating a nesting site next to the marsh at the north side of the bay be explored.

5. Efforts be made to protect part of north Fiesta Island as a permanent least tern nesting site.

A-20. SAN DIEGO AIRPORT

During 1971 and 1972 the least terns nested in the area described by Craig near the airport fire station. Increasingly the birds shifted to the southeast end of the airport, nesting on gravel areas at the end of the main runway and in the gravel strips between the main runway and the parallel south taxiway. In 1973, all the nesting was in these areas and none was attempted in the area near the fire station. The airport flock included 100 to 150 adult birds in 1973. This represented a maximum of 75 breeding pairs. Hatching and fledging were apparently at least partially successful, and 16 flying young were counted.

Before the 1973 nesting season, the airport management, which is understandably unhappy with the existence of a nesting colony of birds by the end of the main runway, oiled or blacktopped all of the gravel nesting areas. In addition, these areas are sprayed with herbicide at midsummer each year. The nature of the chemical and its possible effects on least tern eggs and chicks which are sprayed with it are unknown. The 1973 eggs were laid on the blacktop, sometimes in weed cracks, tiny depressions, and little patches of wind drifted sand. The chicks and sometimes the eggs were blown about in the jet blast from turning airplanes, and some of the adults have apparently been killed by collisions with the airplanes.

This is the third largest least tern colony in the State, even at the 1973 population level. Some past information is available on this flock, and the population has declined steadily over the last three years. A nest count in 1972 found 107 nests, and the population for that year was estimated at 125 to 150 breeding pairs. The 1973 flock was less than half this size.

It is recommended that an alternate nesting site be established and that efforts then be directed to discouraging least terns from nesting near the runways.

A-21. SWEETWATER RIVER

A flock of least terns was discovered in 1973 nesting on two-year-old sandy dredge fill at the mouth of the Sweetwater River. Approximately 20 to 25 pairs used the site, producing a minimum of 11 flying young. The site is used quite heavily by motorcyclists and drivers of other off-road vehicles. This area is zoned for industrial development, and construction is apparently imminent.

It is recommended that efforts be directed to protecting part of the land fill area for least tern nesting.

A-22. SOUTH SAN DIEGO BAY

No quantitative information is available on least tern use of the salt pond dikes in 1971 and 1972. The flock numbered about 35 pairs in 1973, and both hatching and fledging rates were probably good.

The problem of motorcycle disturbance, mentioned by Craig (1971) for previous years, was apparently minimal in 1973.

A-23. TIJUANA RIVER

This historical nesting site was used again by least terns in 1973. The colony contained at least five pairs on the barrier beach south of the river mouth. Most of the earliest nests were washed out when the spring tide of June partially overtopped the beach. The birds apparently renested, with good success.

State Park personnel from nearby Border Field State Park erected fencing and posted signs at the site to protect the nesting area. Public cooperation was generally very good, but one regrettable stone throwing incident resulted in the death of one adult bird and the partial blinding of another.

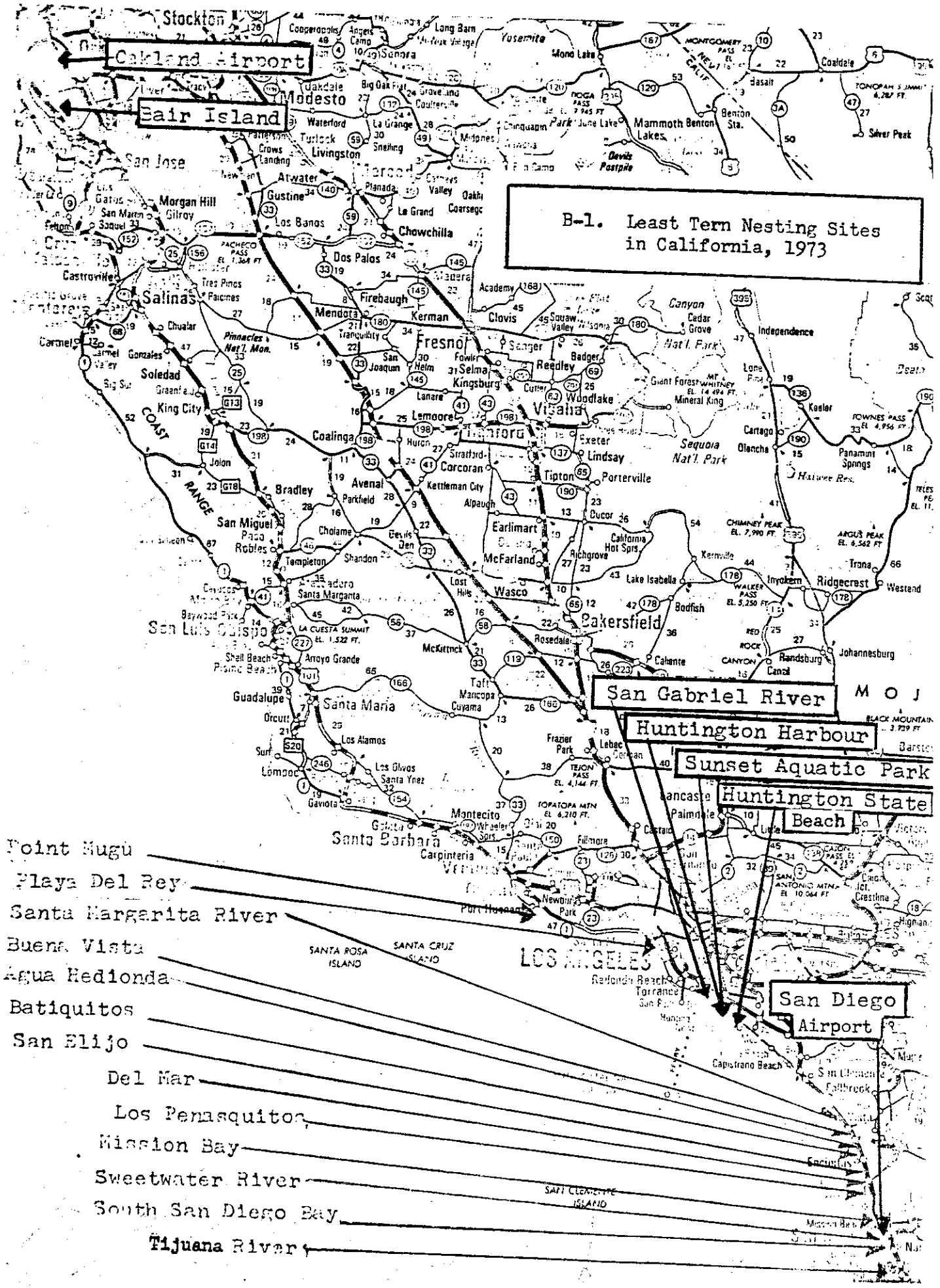
It is recommended that explanatory signs at this site be written in both Spanish and English.

APPENDIX B

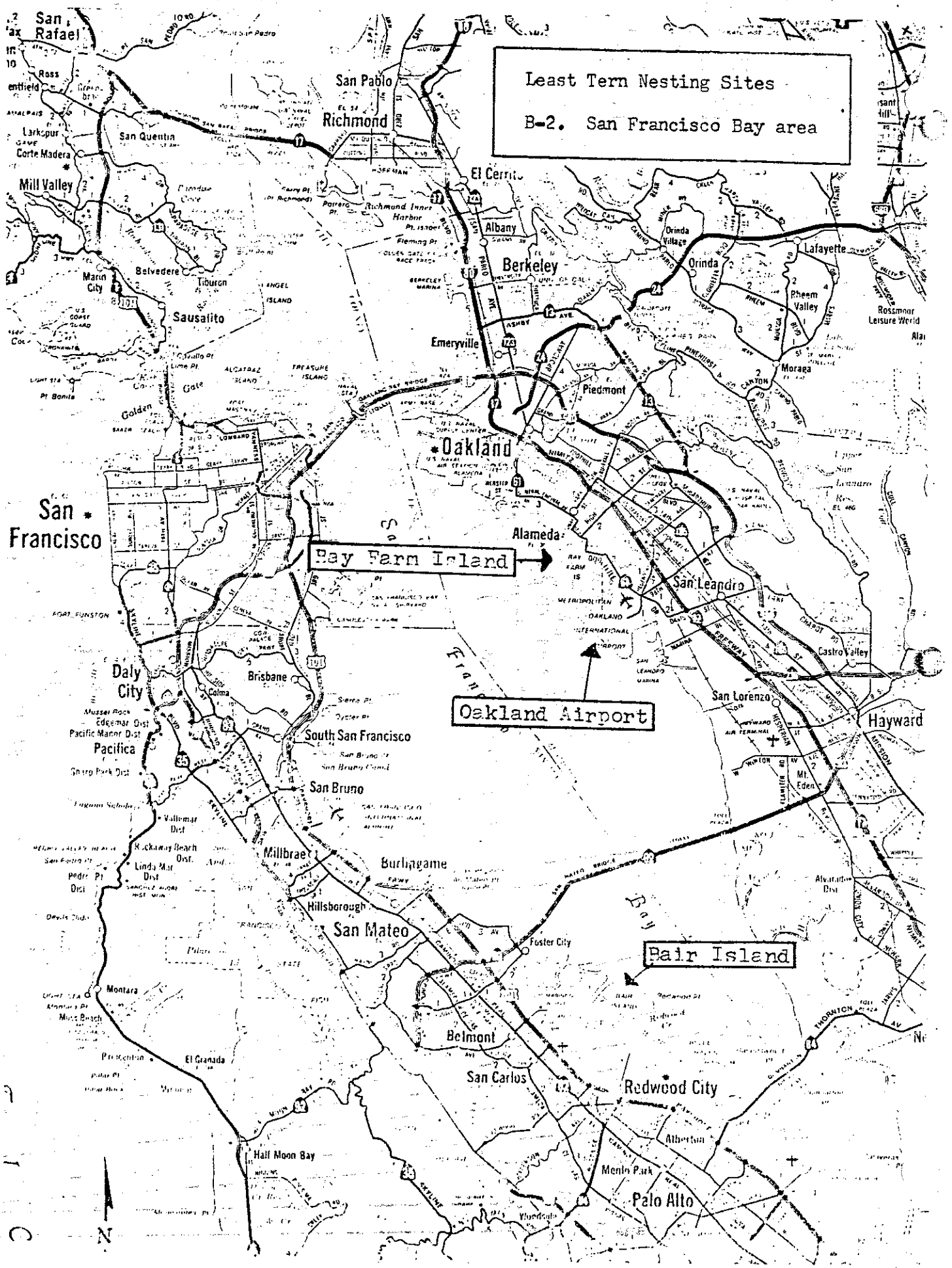
Location maps of least tern nesting sites used since the 1970 survey.

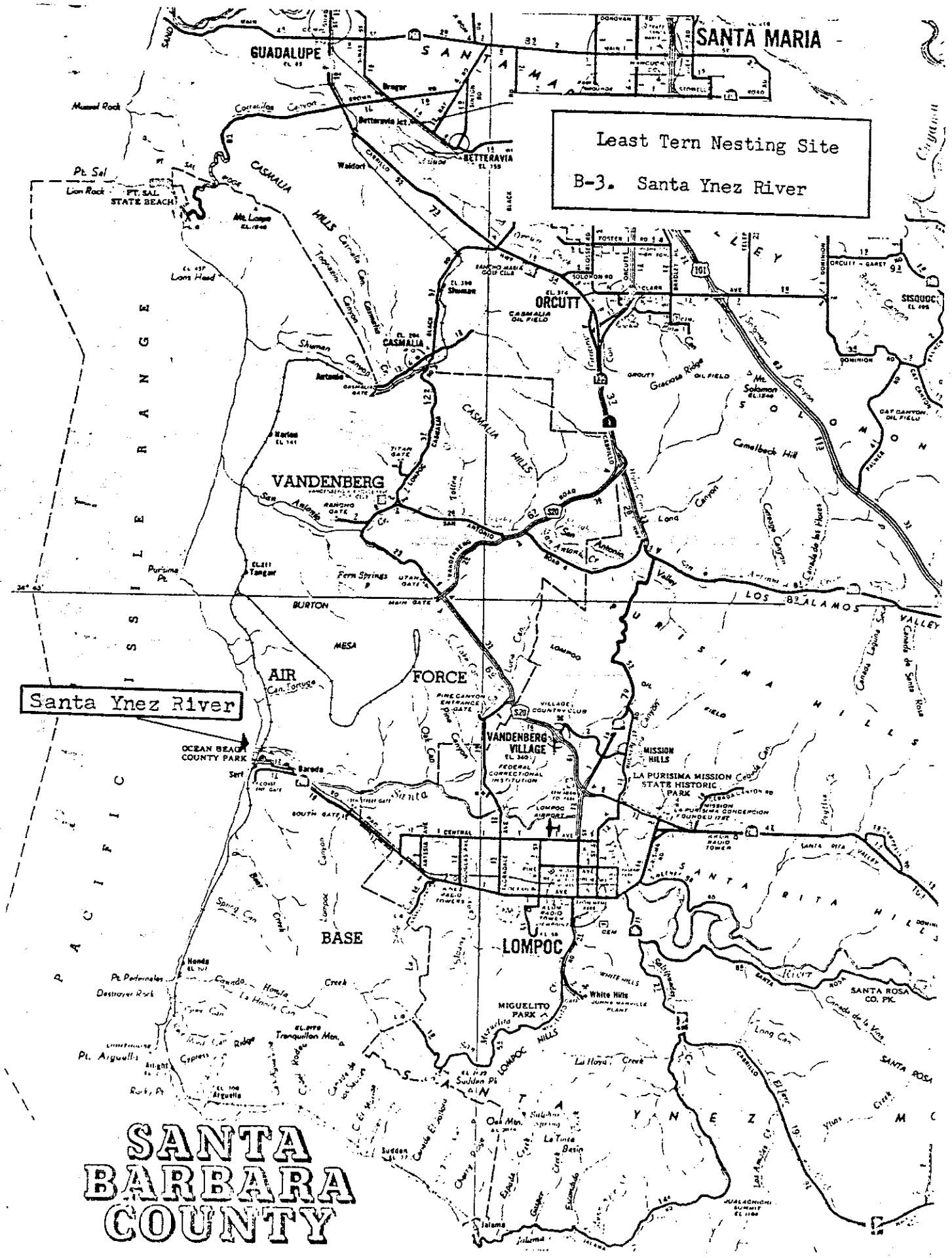
SITES

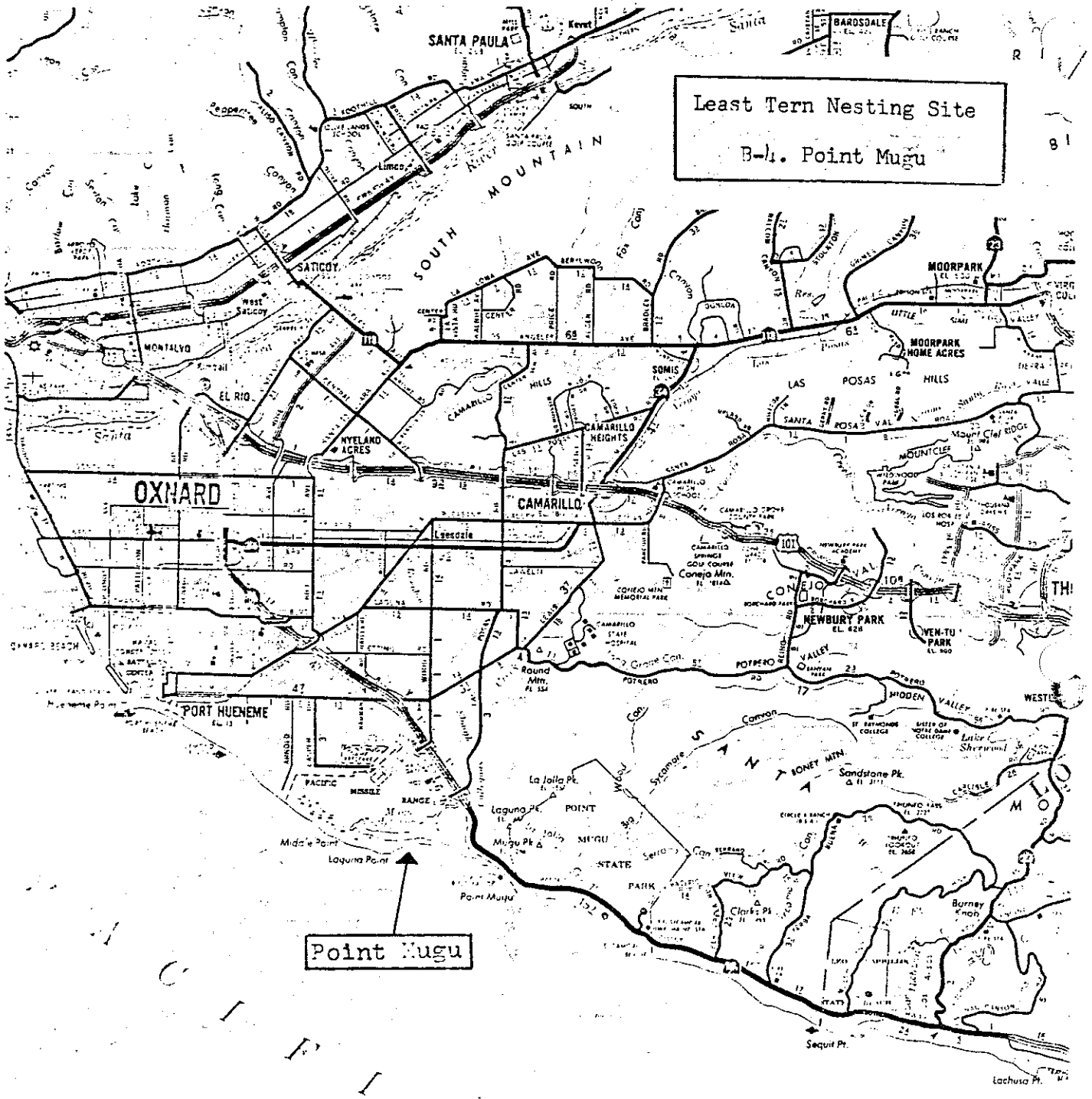
B-1. Least Tern Nesting Sites in California, 1973
B-2. San Francisco Bay Area
B-3. Santa Ynez River
B-4. Point Mugu
B-5. Los Angeles area
B-6. San Gabriel River
B-7. Huntington Harbour area
B-8. Mission Bay
B-9. San Diego area

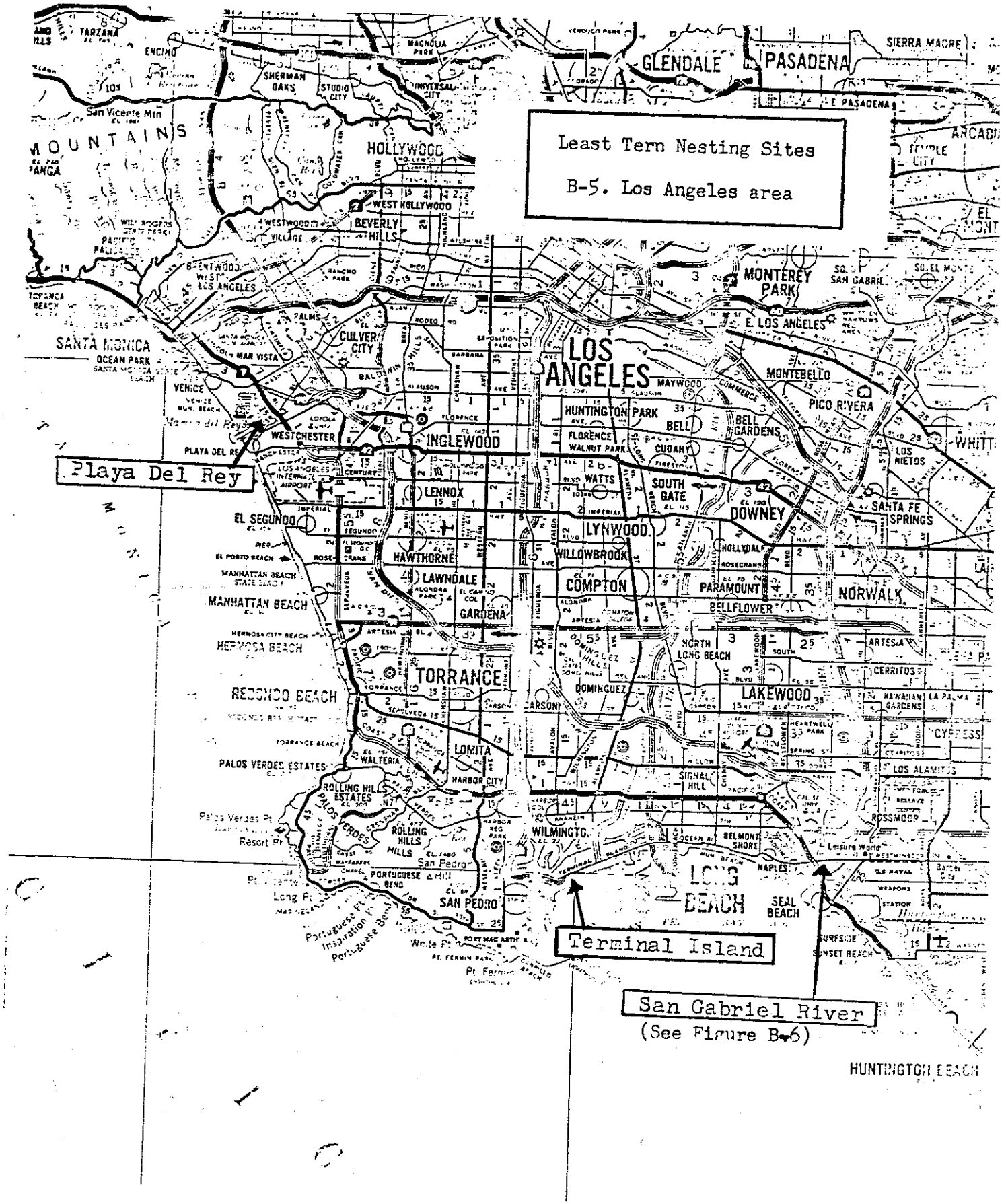


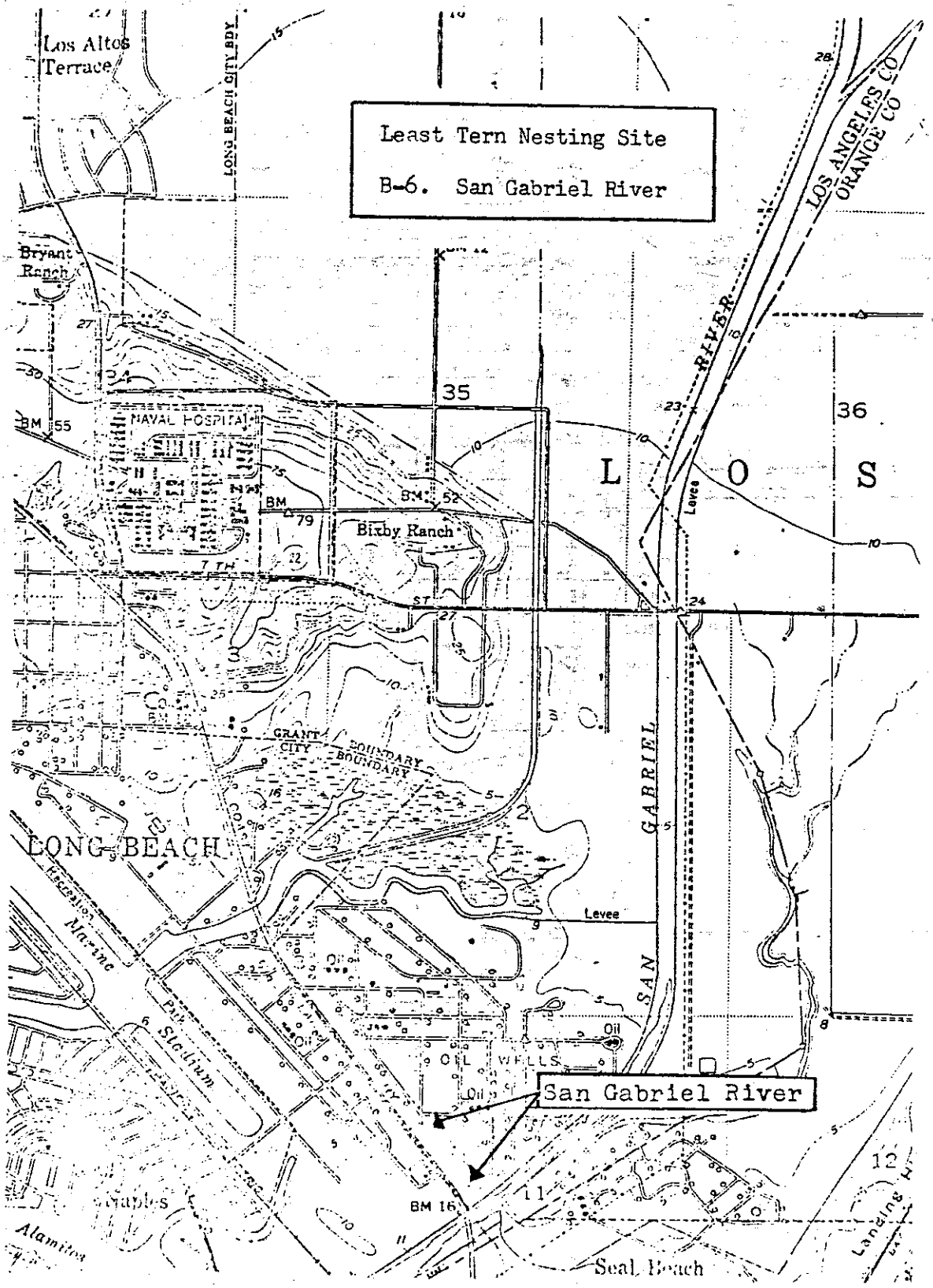
B-1. Least Tern Nesting Sites in California, 1973

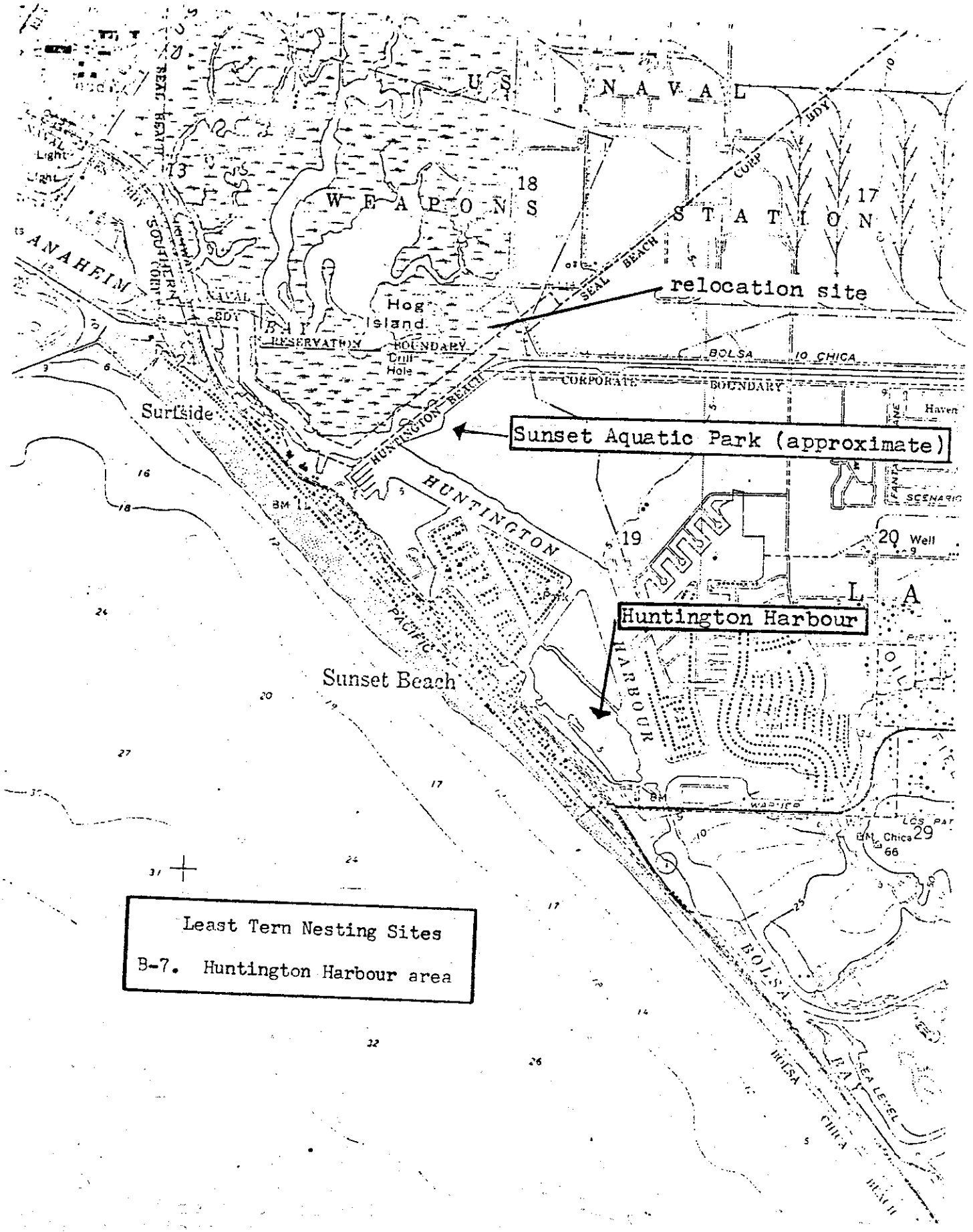

Least Tern Nesting Sites
B-2. San Francisco Bay area
Bay Farm Island
Oakland Airport
Bair Island
San Rafael
Ross
Larkspur
Corte Madera
Mill Valley
San Quentin
San Pablo
Richmond
El Cerrito
Albany
Berkeley
Orinda Village
Orinda
Lafayette
Pheem Valley
Rossmoor Leisure World
Moraga
Belvedere
Tiburon
Marin City
Sausalito
Emeryville
Piedmont
Oakland
San Francisco
Alameda
San Leandro
Castro Valley
Daly City
Brisbane
Colma
South San Francisco
San Lorenzo
Hayward
Mt. Eden
Pacifica
San Bruno
Millbrae
Burlingame
Hillsborough
San Mateo
Foster City
Montara
Moss Beach
El Granada
Belmont
San Carlos
Redwood City
Atherton
Menlo Park
Palo Alto
Half Moon Bay
N


Least Tern Nesting Site
B-3. Santa Ynez River
Santa Ynez River
SANTA MARIA
GUADALUPE
BETTERAVIA
ORCUTT
CASMALIA
VANDENBERG
AIR FORCE BASE
VANDENBERG VILLAGE
LOMPOC
MISSION HILLS
LA PURISIMA MISSION STATE HISTORIC PARK
MIGUELITO PARK
OCEAN BEACH COUNTY PARK
PT. SAL STATE BEACH
SANTA ROSA CO. PK.
SANTA BARBARA COUNTY


Least Tern Nesting Site
B-4. Point Mugu
Point Mugu
SANTA PAULA
SOUTH MOUNTAIN
SATICOY
MONTALVO
EL RIO
NYELAND ACRES
OXNARD
CAMARILLO
CAMARILLO HEIGHTS
SOMIS
LAS POSAS HILLS
MOORPARK
MOORPARK HOME ACRES
NEWBURY PARK
VEN-TU PARK
PORT HUENEME
PACIFIC MISSILE RANGE
Laguna Point
Point Mugu
POINT MUGU STATE PARK
Sandstone Pk.
Sequit Pt.
Lachusa Pt.

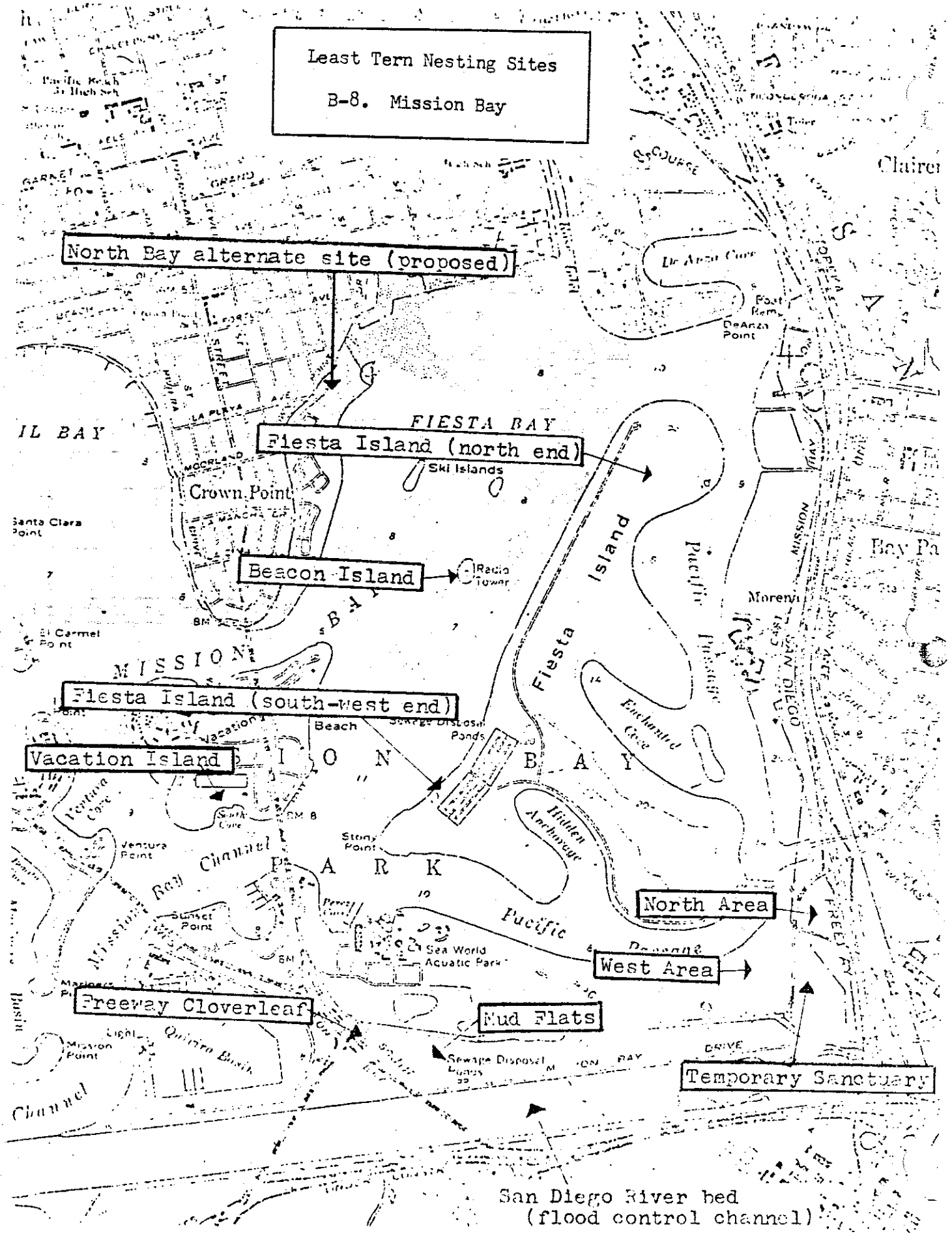

Least Tern Nesting Sites
B-5. Los Angeles area
Playa Del Rey
Terminal Island
San Gabriel River
(See Figure B-6)
GLENDALE
PASADENA
HOLLYWOOD
WEST HOLLYWOOD
BEVERLY HILLS
MONTEREY PARK
E. LOS ANGELES
LOS ANGELES
SANTA MONICA
CULVER CITY
VENICE
WESTCHESTER
INGLEWOOD
HUNTINGTON PARK
BELL
BELL GARDENS
MONTEBELLO
PICO RIVERA
LENNOX
WATTS
SOUTH GATE
DOWNEY
SANTA FE SPRINGS
EL SEGUNDO
HAWTHORNE
LYNWOOD
WILLOWBROOK
LAWNDALE
COMPTON
PARAMOUNT
NORWALK
MANHATTAN BEACH
GARDENA
BELLFLOWER
HERMOSA BEACH
TORRANCE
NORTH LONG BEACH
LAKEWOOD
REDONDO BEACH
DOMINGUEZ
CARSON
LOMITA
HARBOR CITY
PALOS VERDES ESTATES
ROLLING HILLS ESTATES
ROLLING HILLS
WILMINGTON
SIGNAL HILL
BELMONT SHORE
LONG BEACH
SAN PEDRO
SEAL BEACH
HUNTINGTON BEACH

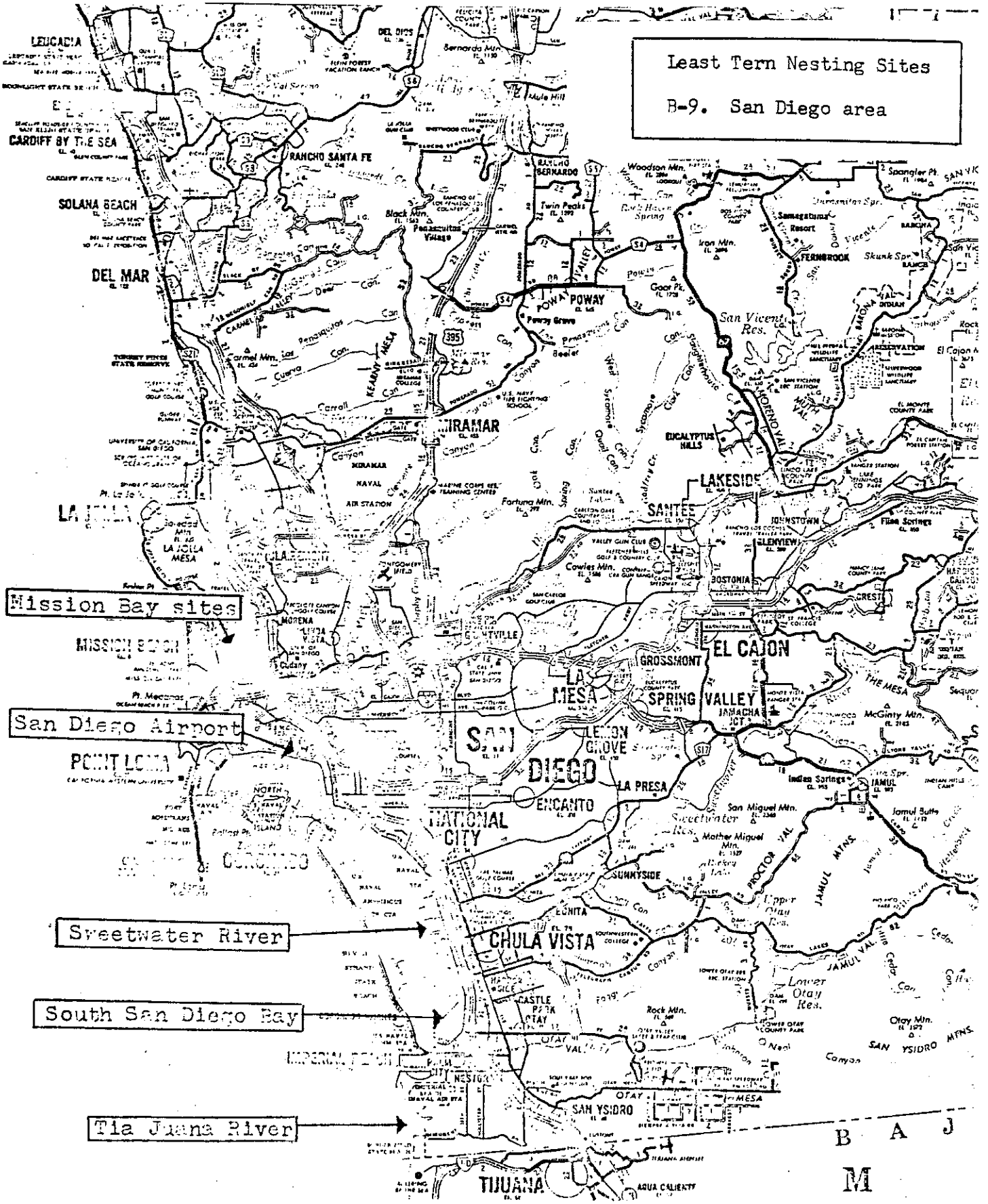

Least Tern Nesting Site
B-6. San Gabriel River
Los Altos Terrace
LONG BEACH CITY BDY
Bryant Ranch
NAVAL HOSPITAL
BM 55
BM 79
BM 52
Bixby Ranch
7 TH
ST
35
36
L
O
S
LOS ANGELES CO
ORANGE CO
RIVER
Levee
GRANT CITY BOUNDARY
LONG BEACH
Recreation
Marine
Park
Stadium
SAN GABRIEL
Levee
OIL WELLS
Oil
San Gabriel River
BM 16
Stables
Alamitos
Seal Beach
Landing



Least Tern Nesting Sites

B-7. Huntington Harbour area


Least Tern Nesting Sites
B-8. Mission Bay
North Bay alternate site (proposed)
Fiesta Island (north end)
Beacon Island
Fiesta Island (south-west end)
Vacation Island
North Area
West Area
Freeway Cloverleaf
Mud Flats
Temporary Sanctuary
San Diego River bed
(flood control channel)
FIESTA BAY
Crown Point
Ski Islands
Radio Tower
Fiesta Island
Pacific Passage
Enchanted Cove
Hidden Anchorage
Stony Point
Sea World Aquatic Park
Sewage Disposal Ponds
Ventura Point
Sunset Point
Mission Point
Quivira Basin
Mission Bay Channel
Beach
Vacation
Santa Clara Point
El Carmel Point
Morena
DeAnza Point
Bay Pa
Clairem
MISSION BAY
PARK
Pacific Passage
Channel

Least Tern Nesting Sites

B-9. San Diego area