REVISED

CALIFORNIA LEAST TERN

RECOVERY PLAN

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U.S. Fish and Wildlife Service

Portland, Oregon

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Regional Director, Region 1, U.S. Fish and Wildlife Service

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Date

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LITERATURE CITATION SHOULD READ AS FOLLOWS:

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*FORMER RECOVERY TEAM MEMBERS.

CALIFORNIA LEAST TERN RECOVERY PLAN

EXECUTIVE SUMMARY

1. Point or condition when subspecies is considered recovered?

The annual breeding population in California must increase to at least 1200 pairs distributed in at least 20 secure coastal management areas throughout their 1982 breeding range before delisting can be considered. Each of the 20 secure management areas must have a miminum of 20 breeding pairs with a 5-year mean reproductive rate of at least 1.0 young fledged/per breeding pair. Of these 20 secure management areas San Francisco Bay, Mission Bay and San Diego Bay must have a minimum of 4, 6 and 6 secure colonies, respectively. If 1,200 breeding pairs in California occur in 15 secure management areas with a 3-year mean reproduction rate of 1.0, the California least tern may be considered for threatened status. When additional information is available on the extent of nesting in Baja California, the Mexican colonies may be considered in the recovery goal for both threatened status and delisting.

2. What must be done to reach recovery?

Properly managed, suitable habitat of sufficient size must be available for nesting purposes; foraging, roosting, and wintering habitat must be preserved and properly managed. The status of least tern in Baja California, Mexico must be determined and the role of such colonies in the overall recovery must be assessed.

3. What specifically must be done to meet needs of 2?

Various site specific management plans must be developed and implemented; nesting habitat must be preserved and properly managed; colonies must be protected against certain predation pressures and other disturbances; management techniques must be further refined through additional research; a conservation education program should be developed; laws and regulations protecting the tern and its habitat must be enforced. The range, distribution, and population status of California least terns in Baja California, Mexico during the nesting season must be determined; and the range, distribution and status of wintering birds should be adequately identified.

4. What management/maintenance needs have been identified to keep the subspecies recovered?

Implementation of site specific management programs which address future needs of the terns to protect and properly manage tern habitat; periodic review and update of such plans; a continuing effort to inform the public regarding conservation issues to heighten public support.

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PART I

INTRODUCTION

Brief Overview

Once the beaches of southern California teemed with California least terns [Sterna antillarum (=albifrons) browni]. Today, least tern numbers are so depleted that both the U.S. Fish and Wildlife Service (Federal Register 35:16047, October 13, 1970; Federal Register 35:8495, December, June 2, 1970) and California Fish and Game Commission (California Department of Fish and Game 1980) consider the subspecies in danger of extinction and classify it as an endangered species.

The goals of this recovery plan are to prevent extinction and return the California least tern population to a stable, nonendangered status. The plan summarizes available biological information on the terns, identifies their ecologic needs, and proposes orderly and comprehensive actions to restore them to a viable population, and ultimately to delist the species.

Nomenclature

The least tern (Sterna antillarum) of the New World was described by Lesson (1847) as distinct from the cosmopolitan, polytypic species of the Old World (little tern), Sterna albifrons Pallas.

Although known and studied at an early date (Holterhoff 1884, McCormick

1899), the California least tern was not recognized as a separate subspecies until Mearns (1916) published the description. In 1921, Hartert combined antillarum under albifrons, but the common name was kept as least tern (Hartert 1921). The California least tern was then one of 12 recognized subspecies of the least (or little) tern (Brodkorb 1940, Burleigh and Lowery 1942, Peters 1934, Van Rossem and Hachisuka 1937), three of which inhabited the United States (AOU 1957). In 1982, however, the least tern was split from S. albifrons of the Old World and returned to the status of a full species, S. antillarum (AOU 1982, 1983), based upon research by Massey (1976) that documented differences in vocalizations and morphology. The subspecific status of the California least tern has no bearing on its endangered species listing because distinct population segments of a vertebrate species may be listed under the Endangered Species Act of 1973, as amended.

Description

Least terns are the smallest members of the subfamily Sterninae (family Laridae), measuring about nine inches long with a 50.8 cm (20 inch) wingspread. Sexes look alike, being characterized by a black cap, gray wings with black wingtips, orange legs, and black-tipped yellow bill. Immature birds have darker plumage and a dark bill, and their white heads with dark eye stripes are quite distinctive. The California least tern cannot be reliably differentiated from other races of the least tern on the basis of plumage characteristics alone (Burleigh and Lowery 1942).

Distribution

The California least tern is migratory, usually arriving in its breeding area by the last week of April and departing again in August (Davis 1968, Massey 1974, Swickard 1971). However, terns have been recorded in the breeding range as early as 13 March and as late as 31 October (Sibley 1952) and 24 November (San Diego Natural History Museum specimen records).

The historical breeding range of this subspecies has usually been described as extending along the Pacific Coast from Moss Landing, Monterey County, California, to San Jose del Cabo, southern Baja California, Mexico (AOU 1957, Dawson 1924, Grinnell 1928, Grinnell and Miller 1944). However, least terns were nesting several miles north of Moss Landing at the mouth of the Pajaro River, Santa Cruz County, California, at least from 1939 (W.E. Unglish, Western Foundation of Vertebrate Zoology egg collection) to 1954 (Pray 1954). Also, although nesting at San Francisco Bay was not confirmed until 1967 (Chandik and Baldridge 1967), there are numerous spring and summer records for the area, so nesting may have occurred previously (Allen 1934, Chase and Paxton 1965, De Benedictis and Chase 1963, Grinnell and Wythe 1927, Sibley 1952). Since 1970, nesting sites have been recorded from San Francisco Bay to Bahía de San Quintín, Baja California (Figure 1). The nesting range in California has apparently always been widely discontinuous, with the majority of birds nesting in southern California from Santa Barbara County south through San Diego County. Between the

city of Santa Barbara and Monterey Bay, a distance of over 322 km (200 miles), the only known regularly used breeding locations are within 16.1 km (10 miles) of the mouths of the Santa Ynez and Santa Maria rivers in Santa Barbara County. Local sources have also reported least terns once nesting at Morro Bay, San Luis Obispo County, and in 1980 a small nesting colony was present near Oso Flaco Lake, San Luis Obispo County. While San Francisco Bay appears to be the usual northern limit of the least tern's range, there are four records of single birds at Humboldt Bay (Yocom and Harris 1975, P. Springer[1] pers. comm.), two specimens collected at Fort Stevens, Clatsop County, Oregon (Walker 1972), and a single bird observed at Ocean Shores, Washington (Hunn and Mattocks 1979). These extra-limital records probably represent misoriented, migrating individuals.

In Baja California, two nest sites are identified in the literature: Scammons Lagoon (Bancroft 1927, Grinnell 1928), and San Jose del Cabo (Grinnell 1928, Lamb 1927). In 1975, a nesting colony was found near Ensanada (Massey 1977) and in 1976, a small colony was discovered at Bahía de San Quintín (Wilbur [2] pers. comm.). Several other nesting areas in Baja California, including Magdelena Bay, San Felipe, and Bahía del Los Angeles are suspected.

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1 Dr. Paul Springer, Research Biologist, U.S. Fish and Wildlife Service, Arcata, CA.

2 Mr. Sanford Wilbur, Refuge District Supervisor Oregon/Washington U.S. Fish and Wildlife Service, Portland, OR

KEY TO FIGURE 1

ALAMEDA COUNTY
1. Alameda Naval Air Station
2. Oakland Airport
3. Alvarado Salt Ponds

SAN MATEO COUNTY
4. Bair Island

SAN LUIS OBISPO COUNTY
5. Pismo Beach
6. Oso Flaco Lake

SANTA BARBARA COUNTY
7. Santa Maria River
8. San Antonio Creek
9. Purisima Point (North and South)
10. Santa Ynez River

VENTURA COUNTY
11. Santa Clara River
12. Ormond Beach
13. Mugu Lagoon (Naval Pacific Missle Test Center)

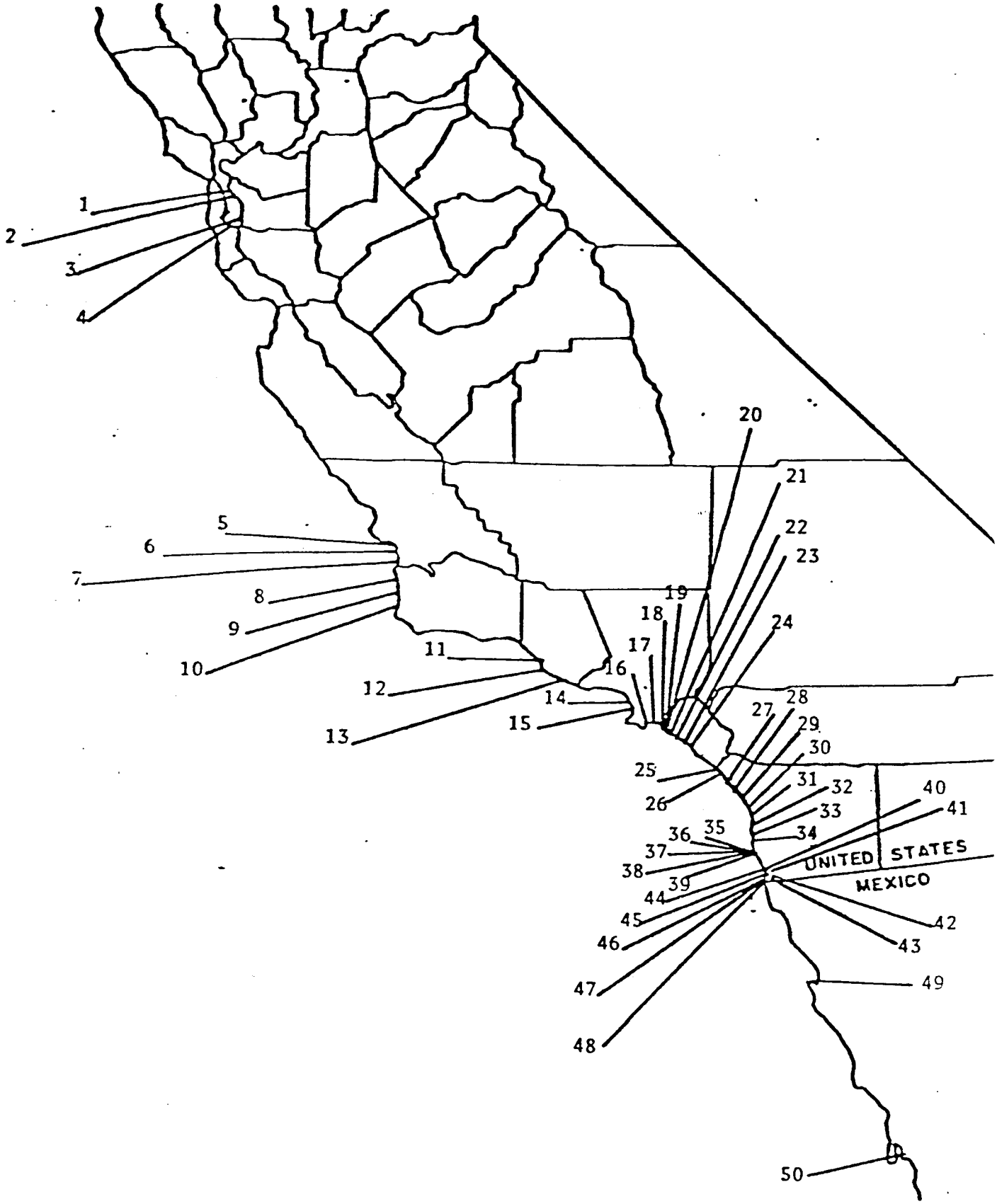
LOS ANGELES COUNTY
14. Venice Beach
15. Playa del Rey
16. Terminal Island
17. Costa Del Sol
18. San Gabriel River
19. Cerritos Wetlands

ORANGE COUNTY
20. Anaheim Bay (Seal Beach Naval Weapons Station)
21. Surfside Beach
22. Bolsa Chica
23. Huntington Beach
24. Upper Newport Bay

SAN DIEGO COUNTY
25. San Mateo Creek
26. Aliso Creek
27. Santa Margarita River
28. Buena Vista Lagoon
29. Agua Hedionda Lagoon
30. Batiquitos Lagoon
31. Whispering Palms
32. San Elijo Lagoon
33. San Dieguito Lagoon
34. Los Penasquitos Lagoon
35. FAA Island
36. North Fiesta Island
37. Stony Point
38. South Sea World Drive
39. Cloverleaf
40. Naval Training Center
41. San Diego International Airport
42. Sweetwater River
43. Chula Vista Wildlife Reserve
44. North Island NAS
45. Delta Beach (Coronado Naval Amphibious Base)
46. Coronado Cays
47. Saltworks
48. Tijuana River Mouth

BAJA CALIFORNIA
49. Estero de Punta Banda
50. Bahía de San Quintín

Figure 1. Distribution of ~~Nesting Sites~~ of California Least Terns. 5



Life History

Night Roosting--Early in the breeding season, California least terns display rather stereotyped night roosting behavior. Prior to incubation terns sleep during the night at varying distances from the actual nesting sites. In natural breeding sites consisting of open sandy beaches, birds generally roost on the beach within 0.4 km (¼ mile) of the locality where eggs are eventually laid. Birds inhabiting colonies in more unnatural areas such as small islands constructed in estuarine areas, land fills, etc. may travel early in the season up to 16.1 km (10) miles from the colonies to nocturnal roosting sites on open sandy beaches.

Once incubation begins, birds roost at night on the actual nesting site. Such nocturnal roosting continues at the colonies through the remainder of the season, except where late season nocturnal predators pressure the family units to return to roosting sites used during the early, pre-incubation period.

The use of roosting sites away from breeding colonies prior to egg laying appears to be related to predator avoidance. By not sleeping on the colony until eggs are laid, the terns delay by 2-3 weeks the time at which the colony might be discovered by nocturnal predators. The usual difference in nesting success between early and late nesting terns, with late-nesters showing decidedly reduced nesting success as the result of predation, suggests that this 2-3 week delay in advertisement by early-nesting birds, may be an important reproductive strategy.

Breeding Biology--Least terns arrive in the vicinity of the nesting areas from mid-April to early May. Some pair bonds may form before arrival in the nesting areas, others begin to form within the group almost immediately, and active courtship may be observed within the first few days after arrival (Davis 1968, Swickard 1971, Massey 1974).

Courtship follows a well-defined pattern, beginning with "fish flights" wherein a male carrying a fish is joined by one or two other terns in high flying aerial display. Aerial glides (pairs flying in unison) follow. Posturing and parading on the ground occur in the late stage of courtship with the male holding a small fish in his beak as he courts the female. During copulation, the female takes the fish from the male and eats it (Wolk 1954, Hardy 1957, Davis 1968, Massey 1974).

Nest Location and Construction--The least tern usually chooses nesting locations in an open expanse of light-colored sand, dirt, or dried mud close to a lagoon or estuary with a dependable food supply (Craig 1971, Swickard 1971, Massey 1974). Formerly, sandy ocean beaches regularly were used, but increased human activity on most beaches has made many of them uninhabitable. As a result, terns have been forced to nest on mud and sand flats back from the ocean, and on man-made "habitats" such as airports and land fills (Longhurst 1969, Craig 1971). Least terns are colonial but do not nest in as dense concentrations as other tern species. Although nests have been found as close together as 0.8 m (2.5 feet) (Davis 1968), usual minimum distances between nests are 3.0m-4.6m (10-15 feet), with averages usually much greater (Wolk 1954, Hardy 1957, Massey 1974). At one site, Swickard (1971) found nest densities

to be 40-45 per ha (16-18 per acre). In other instances, colonies are widely dispersed with over 91 m (300 feet) between nests. In northern Santa Barbara County, where nesting occurs in almost limitless expanses of coastal dune habitat, as few as 15 nesting pairs can be widely scattered in colonies with a 1.6 km (1 mile) perimeter or more. Thus, nesting densities are highly variable and seem to be related to amount of available habitat. In general, nesting colonies are located near coastal lagoons and estuaries.

The nest is a small depression in which the eggs are laid. In sand, it is scooped out by the bird (Davis 1968, Swickard 1971, Massey 1974), but in hard soil, it may be any kind of natural or artificial depression - for example, a dried boot print (Swickard 1971). After the eggs are laid, nests are often lined with shell fragments and small pebbles. Swickard found a nest depression completely lined with small twigs.

Eggs and Duration of Nesting Season--Least tern eggs measure approximately 31 x 24 mm (1.2 x 0.9 in.), and are buffy with various brownish and purplish streaks and speckles (Bent 1921, Davis 1968, Hardy 1957, Massey 1974). One to four eggs are laid, with two to three-egg clutches being reported most often (Anderson 1970, Massey 1974). Egg laying usually occurs in the morning, with the eggs laid on consecutive days (Davis 1968, Massey 1974).

The nesting season extends from approximately 15 May into early August, with the majority of nests completed by mid-June (Bent 1921, Grinnell 1898, Swickard 1971). A second wave of nesting occurs from mid-June

to early August. These are mainly renests after initial failures and second year birds nesting for the first time (Massey and Atwood 1981a). Most authorities agree that least terns are capable of successfully raising only one brood per pair in a season.

Incubation--Incubation, which begins with the laying of the first egg, is irregular at first but becomes steady after the clutch is completed (Davis 1968, Massey 1974, Swickard 1971).

Both parents participate, but the female initially takes a much greater part than the male (Davis 1968, Hagar 1937, Hardy 1957, Massey 1974, Swickard 1971). Extremes of from 17 to 28 days have been documented. The usual incubation period is 20-25 days (Massey 1972), with an approximate mean of 21 days (Massey[1], Pers. comm.)

Nest Success and Survival of Young--Most California least tern colonies suffer some losses of eggs and young to predators or unfavorable weather conditions during the course of a normal nesting season. Despite this, hatching success is usually high (especially compared to fledging success--see below). Eighty to 90 percent hatching success of eggs was reported by both Massey (1974) and Swickard (1971) during the 1970-72 period. Infertility appears to be a minor cause of least tern egg failure. For example, Massey found only six infertile or addled eggs out of 157 laid in her study area. Predators have been implicated in

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[1] Ms. Barbara Massey, Research Associate, California State University, Long Beach, CA.

a number of egg losses and colony failures, with coyote (Canis latrans), Norway rat (Rattus norvegicus), striped skunk (Mephitis mephitis), long-tailed weasel (Mustela frenata), common raven (Corvus corax) and American crow (Corvus brachyrhynchos) often named as the known or suspected predators. Dogs (Canis familiaris), gulls and other less commonly implicated species also destroy eggs.

Fledging rates vary greatly from colony to colony and from year to year (Swickard 1971, Massey 1974). The maximum overall success rate (percent of eggs laid resulting in flying young) yet observed in a major colony is about 70 percent (Massey and Atwood 1979). Since 1978, fledging rate (number of young fledged per number of breeding pairs) has varied from an estimated low of 0.46 in 1982 to an estimated high of 0.86 in 1981 (Table 1). Because of its large number of nesting colonies, San Diego County usually contributes the highest percentage of fledglings produced (among counties) in the state. Statewide data from specific nesting colony sites are given in Table 2.

Post-hatching Period Including Predation--Eggs usually hatch on consecutive days, and the chicks, although precocial, are initially weak and helpless. The adults brood continuously during the first day (Davis 1968), but by the second day, the chicks are stronger and make short walking trips from the nest. From the third day on, they are increasingly mobile and active (Davis 1968, Massey 1974). Flightless young have been seen as late as the first week of September (Tijuana

Table 1. Total California Least Tern Breeding Population[1], Minimum Number of Fledglings, and Estimated Fledging Rate in California.

Year	No. of Pairs[1]	Min. Est. No. Fledglings	Fledging Rate[3]
1973	624	N.D.[2]	N.D.
1974	582	N.D.	N.D.
1975	600	N.D.	N.D.
1976	664	N.D.	N.D.
1977	775	N.D.	N.D.
1978	776*	418	0.54
1979	845*	650	0.77
1980	890*	745	0.84
1981	963*	826	0.86
1982	1015*	469	0.46
1983	1180*	857	0.73

[1] Number observed per colony during an entire season of monitoring (movements caused by disruption of individual colonies were taken into consideration to reduce the possibility of double-counting).

[2] N.D. = Not Determined

[3] Fledging rate estimated from minimum number of fledglings divided by the minimum number of breeding pairs.

* Minimum numbers of pairs

Table 2. California Least Tern Reproductive Data (Number of Fledglings) by Colony Site.

Management Area [1]	County and Site	Minimum No. of Fledglings 1978	1979	1980	1981	1982	1983
	ALAMEDA						
a.	Alameda Naval Air Station	13	+	5	103	0	1
a	Alvarado Salt Ponds	1	2	5	0	0	1
a	Oakland Airport					11	6-9
	SAN MATEO						
a	Bair Island	0	0	14	28	23-93	0
	SAN LUIS OBISPO						
b	Pismo Beach					5	?
b	Oso Flaco Lake	0	0	0-6	0	0	0
	SANTA BARBARA						
c	Santa Maria River	15	10	15	5-10	3	3
d	San Antonio Creek	6	4	0	4	2	10
d	Purisima Point (North)	7	0	0	0	0	9
d	Purisma Point (South)	0	25	18-22	12	1	
d	Santa Ynez						4
	VENTURA						
e	Santa Clara River	12	25	11-16	25	16	2
f	Ormond Beach	0	3	0	0	0	2
	Mugu Lagoon	0	0	1	0	0	15
	LOS ANGELES						
g	Venice Beach	75	140	240	195	60	140
g	Playa del Rey	30	25	0	0	0	0
h	Terminal Island	0	0	0	7	15	77-1
*	San Gabriel River	70	60	0	0	0	0
i	Cerritos Lagoon	0	0	6	0	0	0
*	Costa del Sol	0	0	0	12	2	14
	ORANGE						
j	Anaheim Bay	0	0	24	20	2	2
j	Surfside Beach	0	0	3	0	0	0
k	Bolsa Chica (North)	0	3	15	20	70	35
k	Bolsa Chica (South)	0	3	0	0	5	10
l	Huntington Beach	100	90	85	168	50	60
m	Upper Newport Bay	0	0	0	0	0	2

Table 2. (cont.)

Management Area[1]	County and Site	Minimum No. of Fledglings 1978	1979	1980	1981	1982	198
	SAN DIEGO						
n	San Mateo Creek				0	0	0
n	Aliso Creek		5-10	22	10	0	9
n	S. Margarita River (N.)	8	18-25	1-4	25	50	160
n	S. Margarita River (S.)		0	1	25	0	21
o	Buena Vista Lagoon	0	0	2	0-2	0	0
p	Agua Hedionda Lagoon	4	8-10	4	0	0	0
q	Batiquitos Lagoon	0	25-40	16-18	25-27	6	2
r	San Elijo Lagoon	0	5-8	8	8+	12	20-
s	San Dieguito Lagoon	0	0	0-1	0	0	0
*	Whispering Palms Encinitas	0	0	0	4-6	0	0
t	Los Penasquitos Lagoon	10	0	0	0	0	0
u	FAA Island	5	45-50	180-200	80	0	90
u	North Fiesta Island	8	4	3-4	0-2	75	0
u	Stony Point					1-3	0
u	South Sea World Drive					2-4	0
u	Cloverleaf					0	0
v	Naval Training Center	5	0	0	0	0	0
v	San Diego Int. Airport	10	40-65	0	0	2-3	14+
v	Chula Vista Wildl. Reserve	0	0	31	35	12-16	8-
v	Sweetwater River	15	15-20	0	0	2	0
v	North Island NAS	0	60-80	6-12	5	25-30	90
v	Delta Beach	4	2-3	0	0	0	
v	Coronado Cays	10	7	0	0	0	
v	Saltworks	2	8-10	4	0	0	0
w	Tijuana River Mouth	8	18-20	25	15	17	50+
	TOTALS	418	650-742	745-793	826-839	469-553	857-

[1] The prime objective specifies that a minimum of 20 distinctive management areas (MA) are necessary for the tern to qualify for delisting. See objectives for other details. San Francisco Bay, (MA a), Mission Bay (MA u), and San Diego Bay (MA v) must have a minimum of 4, 6, and 6 secure colonies, respectively, before each can qualify toward the goal of 20 secure, distinct management areas. Colonies with the same letter indicate that they are considered representative of a management area.

* Not included as site counted toward 20 secure management locations.

River mouth, R. G. McCaskie[1] and J. M. Sheppard[2], pers. comm.).

Flight stage is reached at approximately 20 days of age, but the young birds do not become fully proficient fishers until after they migrate from the breeding grounds. Consequently, parents continue to feed their young even after they are strong fliers (Massey 1974, Swickard 1971, Tompkins 1959).

Loss of tern chicks has been attributed to American kestrels (Falco sparverius) (Craig 1971), loggerhead shrikes (Lanius ludovicianus) and American crows (Atwood et al. 1977, Bender[3] pers. comm.), house cats (Felis cattus) (Edwards 1919) and dogs (Pentis 1972); to cold, wet weather (Pentis 1972) and to extreme heat spells (CDFG 1981); and to dehydration and starvation (Massey 1972). Burrowing owls (Athene cunicularia) have been known to feed on nesting adult least terns and young (Jorgensen[4] and Collins[5], pers. comm.). Common ravens and red foxes (Vulpes vulpes) are also reported predators. Human disturbance is a perennial problem at some colonies (i.e., Tijuana River Mouth, Delta Beach, and Santa Maria River).

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1 Mr. Guy McCaskie, San Diego, CA.
2 Mr. Jay Sheperd, Office of Endangered Species, U.S. Fish and Wildlife Service, Washington, D.C.
3 Ms. Kristen Bender, past California Least Tern Recovery Team member.
4 Mr. Paul Jorgensen, Biologist, California Department of Parks and Recreation, San Diego, CA.
5 Dr. Charles Collins, Department of Biology, California State University, Long Beach, CA.

In the past, high tides washed away many California least tern eggs (Sechrist 1915, Shepardson 1909); however, most California least terns nest in situations where flooding is not a normal factor. Summer rains sometimes cause losses where nests occur on soils less permeable than beach sands (Swickard 1971).

Post-breeding Dispersal--Fledglings accompanied by adults are often observed at various shallow-water, freshwater, and estuarine marshes prior to migrating south. Post-breeding dispersal to such areas probably affords juveniles the opportunity to develop foraging skills prior to the demands of migration. Most known post-breeding, foraging and roosting areas appear to be characterized by (1) suitable food resources, (2) proximity to active breeding colonies, and (3) relatively protected loafing and nesting sites. The known post-breeding dispersal sites include: Oso Flaco and Dunes Lakes, Santa Ynez River mouth, Mugu Lagoon, Harbor Lake, Guajome Lake, Lake Val Sereno, Whelan Lake, various stretches of the Santa Margarita and San Luis Rey Rivers and O'Neill Lake, Buena Vista, Batiquitos and San Dieguito Lagoons, San Diego River Flood Control Channel, Delta Beach, and the Dairy Mart Ponds.

Migration and Wintering Grounds--Least terns usually arrive along the California coast in mid-April to early May and head south by September. Little is known about where the remaining 8 months of each year are spent.

Up to 78 least terns have been observed during the winter as far north as

Colima, Mexico (A. Craig[1] unpubl. rpt.) but subspecfic identify could not be determined. There are only a few reports from the Pacific Coast in Honduras and Guatemala. Small numbers of birds (2-3 individuals) have been reported from the Pacific Coast of Panama, but other investigators have checked suitable locations in Panama and not found wintering least terns. The winter range is still in great need of documentation.

Nothing is known about actual migration routes, but the terns presumably move along the west coast of Baja California, to the west coast of Mexico and further south.

Longevity and Breeding Age--Banded least terns (including all three North American subspecies) have been recovered at up to 21 years of age, and 31 of 61 banded individuals were 5 years old or older (Massey and Atwood 1978). A 15 year old bird has been documented to breed in San Diego (B. Massey and E. Copper[2] pers. comm.). This suggests a relatively long life for individuals of this species.

Banding studies have demonstrated that the usual age of first breeding is 3 years, but that least terns occasionally do breed at age two (Massey and Atwood 1981a,b). One-year old birds occur rarely in breeding areas during the nesting season; they do not participate in breeding activities nor are they in breeding plumage (Massey and Atwood 1978).

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1 Mr. Allan Craig, Biologist, California Department of Fish and Game.
2 Ms. Elizabeth Copper, Tern Biologist, San Diego, CA

Food and Feeding Habits--The California least tern obtains most of its food from shallow estuaries and lagoons, and nearshore ocean waters. Feeding activity at the few sites that have been studied occurs mostly within 3.2 km (2 miles) of breeding colonies, and at many sites foraging is primarily in nearshore ocean waters less than 18.3 m (60 feet) deep. Colonies located near productive estuarine habitats appear to utilize such areas heavily but data regarding the relative value of estuaries to feeding least terns are scarce. The increased use of freshwater marsh systems, lakes, lagoons, and estuarine areas during post-breeding dispersal suggests the special importance of such habitats during the breeding cycle when juveniles are learning to fish for themselves.

The California least tern has not been observed eating anything but fish (Massey 1974). Most fish taken are apparently younger than 1 year old. General size characteristics of the fish eaten are a maximum body depth of less than 1.2 cm and a maximum body length of about 8 cm. The main food items are variable from colony to colony, but usually include northern anchovy (Engraulis mordax) and topsmelt (Atherinops affinis). In San Diego County, deepbody and slough anchovies (Anchoa spp.) are relatively important. Other locally or temporally important species include shiner surfperch (Cymatogaster aggregata), several gobies [notably the yellowfin goby (Acanthogobius flavimanus)], the longjaw mudsucker (Gillichthys mirabilis), California killifish (Fundulus parvipinnis), jacksmelt (Atherinopsis californiensis), and mosquitofish (Gambusia affinis) plus other species (Atwood, Minsky, and Massey, pers. comm). At least 50 species of forage fish have been identified from fish dropped at colony sites (Massey and Atwood 1981b).

Past Conservation Efforts

Past efforts to conserve the California least tern have involved monitoring breeding colonies to determine distribution and location of colonies, pairs, number of fledglings, reproductive rate, and predation problems. Fencing of colonies has been effective in some cases in minimizing human disturbance. Predator control through judicious use and placement of electric fences and other barriers as well as by trapping efforts have reduced losses of adults, eggs, and/or young.

The number of nesting pairs has increased throughout recent years largely because of the result of the above conservation efforts. Unfortunately preliminary data for 1984 indicate a 25-30% reduction of nesting adults (Massey, pers. comm.). As yet, causes for this unexpected decline have not been determined.

A non-inclusive list of actions that have been undertaken on behalf of the least tern include the installation of an electric fence on NASA Island (Seal Beach National Wildlife Refuge) in addition to marsh restoration efforts to increase tidal action. The U.S. Marines-Camp Pendleton and the California Department of Parks and Recreation routinely maintain a fence around nesting colonies and post admonitory signs to minimize human disturbance. This is especially important because Venice Beach and Huntington Beach are two of the largest colonies in the state. Local concerns, other agencies, and the Fish and Wildlife Service cooperate in an effort to manage the Santa Margarita colonies, another essential site.

The U.S. Navy at Point Mugu instituted a research project to evaluate the impacts of predation on terns by the introduced red fox. As indicated by the above, the scope and complexity of recovery actions for least terns has been varied and has involved a host of various agencies.

California Department of Fish and Game (CDFG) has created nesting islands in Bolsa Chica, one of which now supports a large breeding tern colony. CDFG has also attempted to abate the sedimentation problem in Upper Newport Bay in addition to creating nesting sites and protecting existing birds.

The U.S. Navy has fenced Delta Beach to prevent disturbance to the site. Site preparation to enhance the suitability of the area for terns has been undertaken.

Reasons for Decline

No reliable estimates are available on historical numbers of California least terns, but they once were abundant and well-distributed along the southern California coast. Shepardson (1909) describes a colony of about 600 pairs along a 4.8 km (three-mile) stretch of beach in San Diego County. "Good-sized" colonies were located in Los Angeles County (Grinnell 1898).

Reduction in numbers was gradual. This subspecies appears to have escaped the slaughter inflicted on the East Coast populations by the millinery trade of the late 1800's (Bent 1921, Hagar 1937), although there were some early local losses to shooting (Holterhoff 1884) and egg collecting (McCormick 1899). It is doubtful these activities were widespread enough

to adversely influence the population. Although certain least tern colonies were still thriving in the early 1900's, others were already beginning to feel the pressure of human influence.

The Pacific Coast Highway was constructed early this century along previously undisturbed beach, and summer cottages and beach homes were built in many areas. Soon children, dogs and cats were being blamed for disrupting tern nesting (Chambers 1908, Edwards 1919, Massey 1974). The buildup of human use of the beaches displaced more and more colonies at the same time their bay feeding areas were being developed, filled in, and polluted. By the 1940's, most terns were gone from the beaches of Orange and Los Angeles counties (Cogswell 1947), and they were considered sparse everywhere (Grinnell and Miller 1944). Continuing loss of both nesting and feeding habitat and high levels of human disturbance at remaining colonies have been responsible for the continued decline to the present time (Craig 1971).

Current Status

The least tern breeding population in California was approximately 890-1215, 963-1171, 1015-1245, and 1180-1299 pairs in 1980, 1981, 1982, and 1983, respectively (Table 3).

Earlier apparent increases were partly attributable to more thorough surveys of colony locations resulting from experience gained in previous years. Subsequent increases have resulted from colony management and protection efforts. The number of terns nesting in Baja California is

Table 3. California Least Tern Breeding Colonies and Numbers of Nesting Pairs.

Management Area 1	County and Site	Minimum No. of Breeding Pairs 1978	1979	1980	1981	1982	198
	ALAMEDA						
a	Alameda Naval Air Station	80	40	60	74	70-75	3
a	Alvarado Salt Ponds	2	3	12**	0	0	5-
a	Oakland Airport					16-17	56-
	SAN MATEO						
a	Bair Island	0	4	38**	23**	50-55	22
	SAN LUIS OBISPO						
b	Pismo Beach						?
b	Oso Flaco Lake	0	6-8	6-8	0	3	1(
	SANTA BARBARA						
c	Santa Maria River	17-20	18-23	15-18	25	12	7
d	San Antonio Creek	8-10	4	2	4	6	14
d	Purisima Point (North)	5	0	0	0	0	14
d	Purisma Point (South)	0	24-30	25-30	30	15-20	8
d	Santa Ynez						
	VENTURA						
e	Santa Clara River	10-15	15-20	13	20-25	17-20	3
f	Ormond Beach	0	6-8	0	0	7	4
f	Mugu Lagoon	10-12	+	12	0	12-14	22
	LOS ANGELES						
g	Venice Beach	60-75	80-95	150-165	140-160	150-189	140-
g	Playa del Rey	25-30	18-25	+	16	0	0
h	Terminal Island	0	0	0	30-45	60-69	80-
*	San Gabriel River	60-65	50-55	+	16	0	0
i	Cerritos Lagoon	0	0	12-15	3	0	0
*	Costa del Sol	0	0	0	15-21	18-24	20-
	ORANGE						
j	Anaheim Bay	0	6	38-43	40-45	17-20	4
j	Surfside Beach	-	-	2-5	0	0	0
k	Bolsa Chica (North)	0	15-20	20-26	31-54	70-92	110-
k	Bosa Chica (South)	0	19-23	+	19-21	8-10	25-
l	Huntington Beach	75-90	80-95	70-90	105-120	85-111	
m	Upper Newport Bay	8-10	6-7	2-5	0	0	9

Table 3 (cont.)

Management area [1]	County and Site	Minimum No. of Breeding Pairs 1978	1979	1980	1981	1982	198
	SAN DIEGO						
n	San Mateo Creek				1	0	(
n	Aliso Creek	-	15	65-75	23	1	10-
n	S. Margarita River (N.)	30-40	32-40	12-20	25-75	100-115	134-
n	S. Margarita River (S.)	#	0	35-45	25-35	15-30	93-
o	Buena Vista Lagoon	0	0	1	2-3	0	0
p	Agua Hedionda Lagoon	11-15	23-28	11-12	2-6	0	0
q	Batiquitos Lagoon	22-27	38-40	25-30	39	19-31	1
r	San Elijo Lagoon	9	12	15-18	12	24-30	25-
s	San Dieguito Lagoon	0	1	4-5	0	0	0
*	Whispering Palms Encinitas	0	1	0	8	0	2-
t	Los Penasquitos Lagoon	18-25	16	14-16	0	0	0
u	FAA Island	135-155	96	150	75+	0	80
u	North Fiesta Island	8-9	15	6-10	8	55	65-
u	Stony Point	-	-	-	-	4-22	0
u	South Sea World Drive	-	-	-	-	4	0
u	Cloverleaf	-	-	-	-	25	0
v	Naval Training Center	8-12	0	0	0	0	0
v	San Diego Int. Airport	43	108	71	0	4-12	27
v	Chula Vista Wildl. Reserve	0	0	55-60	95-100	73+	75+
v	Sweetwater River	47	24-28	12-15	0	1	1
v	North Island NAS	36	75-80	100	60	61-70	60-
v	Delta Beach	4	10-12	0	0	0	0
v	Coronado Cays	8-10	38-40	0	0	0	0
v	Saltworks	29	28-30	16-25	1	0	0
w	Tijuana River Mouth	8-12	25-30	35-40	12	21-30	60-
	Totals	776-887	845-1049	890-1215	963-1171	1015-1245	1180-1299

* Not included as site counted toward 20 secure management areas.

** Number of nests. 1980 statewide total includes estimated 70-90 pairs in San Francisco Bay Area.

\# Numbers nesting here in 1978 were included in Santa Margarita River (North) site total.

0 No terns present.

\+ Number of fledglings undetermined.

\- No data.

[1] Refer to footnote on Table 2.

unknown. Additional information is needed to assess the importance of least terns nesting in Baja California to the overall recovery effort. Security and management of Mexican colonies must be evaluated to assess the impact of these colonies on recovery goals. Those factors that have contributed to the decline of the California least tern - loss of nesting and feeding habitat, and continued disturbance of nesting colonies - continue to operate, and the bird's status continues to be precarious. There is potential, however, for creating or restoring nesting and feeding habitat in the vicinity of most existing colonies, and in areas that have not been used in the recent past.

PART II

RECOVERY

Objectives

The primary objective of this recovery plan is to restore and subsequently maintain the breeding population of California least terns at a secure level so that delisting can be considered. To achieve this level, the annual breeding population in California must increase to at least 1,200 pairs distributed among secure colonies in at least 20 secure coastal management areas throughout their breeding range. Concurrently, efforts should be directed toward protecting the existing breeding population in Baja California, Mexico. Data from California least tern populations in Baja California are insufficient to incorporate population numbers and necessary fledging rates into the prime objective for reclassification. When these data become available the prime objective will be modified accordingly. Because of current Mexican land use practices, remoteness of areas, and minimal monitoring of land uses, it appears unlikely that the Mexican colonies will contribute substantially to the recovery effort. However, this situation requires clearer definition.

If the 1,200 pair population level is achieved, delisting of the species can be considered, with these provisions: 1) sufficient habitat to support at least one viable tern colony (defined as consisting of a minimum of 20 breeding pairs with a 5-year mean reproductive rate of at least 1.0 young fledged per year per breeding pair) at each of the 20 coastal

management areas (see Table 2) (including San Francisco Bay, Mission Bay and San Diego Bay, which should have 4, 6 and 6 secure colonies, respectively), that are managed to conserve least terns; and 2) land ownership and management objectives are such that future habitat management for the benefit of least terns at those locations can be assured. The security and status of Baja California colonies must be assessed; if any such colonies are estimated to be secure and will be managed in perpetuity to benefit least terns, such colonies will also be incorporated into the quantified prime objective.

Interim reclassification to threatened status can be considered when: 1) the 1,200 pair population level is achieved; 2) 15 coastal management areas (including San Francisco Bay, Mission Bay and San Diego Bay, which should have 3, 5 and 4 secure colonies, respectively) support viable least tern colonies and are managed to conserve least terns; and 3) a 3-year mean reproductive rate of at least 1.0 young/breeding pair is achieved. Once additional information on the Baja California colonies is available, possibly one or two secure sites of the above 15 may be located in Baja. Because of possible non-security of Baja California habitats, it appears unlikely that the Mexican populations will contribute significantly to tern recovery. However, this must be more thoroughly investigated. As additional data become available, the prime objective may be modified to reflect current information.

The chief limiting factor influencing the number of least tern breeding pairs is the availability of undisturbed suitable habitat on the breeding grounds. Therefore, many tasks outlined in this plan include preservation

and management of existing nesting, foraging and roosting habitat, restoration of former nesting habitat and degraded coastal wetlands, creation of nesting islands, and protection of nesting and roosting areas from excessive human disturbance and predation. Research is needed to refine and direct a number of these management actions. Recovery will depend upon a continuing cooperative effort by the U.S. Fish and Wildlife Service, California Department of Fish and Game, California Department of Parks and Recreation, U.S. Army Corps of Engineers, U.S. Navy, U.S. Marine Corps, U.S. Air Force, Federal Aviation Administration, numerous city, county and other local government agencies, private conservation organizations, and the governments of Mexico and other countries within the range of this subspecies.

Step-down Outline

Primary Objective: In order to consider delisting, increase the least tern breeding population in California to a secure level of at least 1,200 pairs distributed in viable colonies in at least 20 coastal management areas distributed throughout its current breeding range with at least a 1.0 reproductive rate as a 5-year average for the total population within the 20 management areas while encouraging the preservation of the existing breeding population in Baja California. Reclassification to threatened status may be considered when there are 1,200 breeding pairs in 15 secure coastal management areas, with an overall-mean productive rate of 1.0 for a consecutive 3-year period.

1. Preserve and manage nesting habitat.

    11. Preserve and manage nesting areas of existing colonies.

111. Develop and implement least tern management plans/programs for secure[1] nesting habitat in Alameda, San Mateo, Santa Barbara, Ventura, and Los Angeles counties.

1111. Alameda Naval Air Station.

1112. Bair Island.

1113. San Antonio Creek.

1114. Purisima Point.

1115. Santa Clara River Mouth.

1116. Mugu Lagoon.

1117. Venice Beach.

112. Develop and implement least tern management plans/programs for secure nesting habitat in Orange County.

1121. Anaheim Bay (Seal Beach National Wildlife Refuge, Naval Weapons Center-Seal Beach).

1122. Huntington State Beach Least Tern Natural Area.

1123. Bolsa Chica Ecological Reserve.

1124. Upper Newport Bay Ecological Reserve.

113. Develop and implement least tern management plans/programs for secure nesting habitat in San Diego County.

1131. San Mateo Creek.

1132. Aliso Creek.

1133. Santa Margarita River Mouth.

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[1] Secure land is defined as being in public ownership or control and is actively managed for its resource values emphasizing endangered species.

1134. Buena Vista Lagoon.

1135. San Elijo Lagoon.

1136. Delta Beach.

1137. San Diego Bay salt pond dikes.

1138. Tijuana River Estuary.

114. Preserve and manage nesting areas for currently insecure colonies.

1141. Protect/secure nesting habitat now in private ownership (San Diego County unless otherwise stated).

11411. Agua Hedionda Lagoon (eastern part).

11412. Los Penasquitos Lagoon.

11413. Playa del Rey (Los Angeles County).

11414. Bayfront end of "D" Street Fill", Sweetwater Marsh.

11415. Oakland Airport (Alameda County).

1142. Manage when, and if, secured.

11421. Agua Hedionda Lagoon (eastern part).

11422. Los Penasquitos Lagoon.

11423. Playa del Rey.

1143. Develop and implement management plans to establish secure nesting areas for colonies on public lands (San Diego County unless otherwise stated).

11431. North Island Naval Air Station.

11432. Chula Vista Wildlife Reserve.

11433. Oso Flaco Lake (San Luis Obispo County).

115. Secure and manage a minimum of six least tern nesting sites in Mission Bay (San Diego County).

1151. Establish an interagency coordinating team to annually maintain least tern colonies.

1152. Annually maintain Crown Point Sanctuary.

1153. Annually maintain FAA Island site.

1154. Annually maintain and protect North Fiesta Island breeding area.

1155. Annually maintain and protect Stoney Point nesting site.

1156. Establish and manage at least two additional breeding sites at the Cloverleaf and South Sea World Drive, or at other potential sites.

116. Develop management plans/programs that identify special site protection problems of certain insecure colonies and implement corrective action as needed in Ventura, Los Angeles, and Alameda counties.

1161. Coyote Hills (Alameda County).

1162. Ormond Beach (Ventura County).

1163. Santa Clara River Mouth (Ventura County).

1164. Cerritos Lagoon (Los Angeles County).

1165. Playa del Ray (Los Angeles County).

1166. Terminal Island--Reeves Field and the land-fill site (Los Angeles County).

117. Develop management plans/programs that identify special site protection problems of certain insecure colonies and implement corrective action as needed in San Diego County.

1171. San Diego International Airport.

1172. Grand Caribe Island, Coronado Cays.

1173. D Street Fill.

12. Provide adequate nesting habitat in former, potential, or newly identified breeding areas.

121. Develop and implement management plans to construct and manage new nesting sites in protected areas.

1211. Anaheim Bay (Seal Beach National Wildlife Refuge, Naval Weapons Station Seal Beach)

1212. Sunset Aquatic Park.

1213. Bolsa Chica Ecological Reserve.

1214. Upper Newport Bay Ecological Reserve.

1215. Silver Strand, south end of San Diego Bay

1216. Naval Training Center, San Diego.

1217. Marine Corps Recruiting Depot-San Diego

122. Manage newly identified sites.

123. Develop and implement least tern management plans/programs for currently non-secure habitats with emphasis on construction of adequate breeding sites.

1231. Protect and manage San Dieguito Lagoon.

1232. Protect and manage mouth of Santa Ana River (southeast area).

2. Protect and manage non-nesting habitat.

21. Maintain adequate feeding habitat for colonies.

211. Protect existing coastal feeding grounds of colonies.

2111. Mugu Lagoon.

2112. Bolsa Chica Bay.

2113. Terminal Island.

2114. Anaheim Bay.

2115. Los Penasquitos Lagoon.

2116. Tijuana River Estuary.

212. Investigate and implement actions needed to increase populations of fish eaten by terns in degraded or potential tern feeding areas.

2121. Mouth of Santa Ana River, southeast area.

2122. San Elijo Lagoon.

2123. Batiquitos Lagoon.

2124. Other areas as needed.

213. Identify major feeding areas.

22. Protect important[1] non-nesting, feeding, and roosting habitats from detrimental land or water use changes in San Luis Obispo, Santa Barbara and Los Angeles Counties.

221. Oso Flaco and Dune Lakes (San Luis Obispo County).

222. Santa Ynez River Mouth (Santa Barbara County).

223. Harbor Lake (Los Angeles County).

224. Belmont Shores (Los Angeles County).

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[1] "Important" = used more than on merely a casual basis.

225. Identify and protect other habitats as needed.

23. Protect important non-nesting, feeding, and roosting habitats from detrimental land or water use changes in San Diego County.

231. Guajome Lake.

232. Lake Val Sereno.

233. Whelan Lake.

234. Santa Margarita River-O'Neil Lake.

235. San Luis Rey River.

236. Dairy Mart Ponds.

237. San Dieguito Lagoon.

238. Buena Vista Lagoon.

239. San Diego River Flood Control Channel.

3. Monitor least tern population to determine status, distribution and progress of management during the breeding season.

31. Determine breeding success.[1]

311. Determine colony locations.

312. Estimate breeding population size.

313. Conduct annual breeding colony surveys.

32. Investigate population dynamics, life history, and movement of terns by banding and marking.

4. Conduct research on California least tern to provide additional necessary information for tern management.

41. Determine effects of environmental pollutants on least terns.

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[1] "Breeding success" = number of young that fledge per number of least tern pairs.

42. Determine factors affecting the choice of location for roosting, loafing, and feeding areas used during the breeding and post-breeding seasons.

43. Determine amount of habitat that is necessary to maintain the current population and the prime recovery objective.

44. Identify potentially suitable nesting sites, including beach, landfill, salt pond, and estuarine areas.

45. Identify factors causing colony disruption and nest site abandonment.

46. Develop or refine management techniques for providing adequate nesting sites and implement techniques where needed.

461. Investigate nest site requirements of colonies.

462. Investigate methods of enhancing nesting sites of existing colonies.

463. Investigate methods of constructing adequate nesting sites in potential breeding habitat.

5. Encourage the protection of population outside the United States.

51. Protect least tern population and habitats in Baja California.

511. Determine colony locations and population size.

512. Identify least tern population and habitat protection problems.

513. Develop cooperative programs between the United States and Mexican governments for least tern protection and habitat preservation.

52. Identify and protect key migration and winter habitats outside the United States.

6. Utilize existing laws and regulations protecting California least tern and its habitat.

   61. Evaluate success of law enforcement.

   62. Propose appropriate new regulations or revisions.

7. Develop and implement a conservation education program.

Narrative

1. Preserve and manage nesting habitat.

California least tern conservation and recovery depends upon the adequate protection and management of habitat for nesting, feeding, roosting, post-breeding dispersal and wintering. It is particularly important that nesting habitat be properly managed to maximize tern productivity. Human disturbance must be minimized. This may entail posting admonitory signs, erecting fences, providing adequate patrols and law enforcement, and undertaking an energetic conservation education program.

Predation of adult terns, eggs, or young and prevention of colony abandonment may be attempted by judiciously monitoring colonies to detect potential or actual predation problems. Control of problem predators by trapping, shooting, use of electric fences, and other means is required and has been successful at increasing tern nesting and reproductive success. Emergency procedures may need to be implemented to maximize tern survival and reproduction.

11. Preserve and manage nesting areas of existing colonies.

In California, least terns have nested in about 20 coastal ecosystems since 1969. The numbers of colonies and their nest site locations in many of these areas have varied from year to year. At least two more nesting areas exist in Baja California, Mexico. If

colonies are to continue in these areas, their nesting and feeding habitats must be preserved.

At some breeding sites, habitat management actions are needed annually to provide suitable nesting substrates. Growth of vegetation, wind, rain, tidal action, vehicle or human foot traffic, and other factors contribute to the deterioration of the quality of nesting substrates. Generally, site preparation actions are needed between February 1 to April 15 (no later than the start of the nesting season). Pre-breeding season management actions may include site inspections to evaluate management needs, removal of vegetation, deposition of sand or other substrate material, disking and leveling of substrates, prevention of rain or tidal water flooding, and placement of clay, concrete or other artificial shelters in or near nesting sites to provide shade for chicks and use of decoys to attract adults. Schedules for annual nest site enhancement actions on State or Federal management areas must be incorporated in management plans for those areas.

Where potential nesting sites are created and adequately prepared, annual nest site enhancement actions and experimentation should continue for at least five years to entice breeding pairs to establish new colonies. If, after this 5 year period, a colony has not become established, the site should be re-evaluated as a potential nesting area.

In some areas, recommended management actions include the

construction of alternate nesting sites where currently used sites are highly vulnerable to disturbance or are jeopardized by habitat loss. In some instances where land development plans would cause the destruction of a nesting site, construction of an alternate nest site may be the only feasible alternative to avoid detrimental impacts.

In areas where nesting sites and/or feeding areas are protected under public ownership or jurisdiction, this plan recommends that responsible agencies develop and implement least tern management plans. Coordination of plans is the responsibility of the California Department of Fish and Game and the U.S. Fish and Wildlife Service.

111. Develop and implement least tern management plans/programs in Alameda, San Mateo, Santa Barbara, Ventura, and Los Angeles Counties.

For most existing colonies, the nesting area is the habitat element most in need of preservation. In California, not all currently used colony nesting sites are protected under State, Federal or other public ownership or jurisdiction. Protected sites are reasonably secure from adverse habitat alteration or are located where human access can be controlled. The remaining active colony nesting sites are located in areas where human disturbance is a recurrent problem, where needed management programs are now difficult or nearly impossible to implement,

or where land use changes threaten the suitability of the site for breeding. For a few of these sites, construction and protection of nearby alternate nesting areas, where possible, would be preferable to the protection of those currently used, but always vulnerable nesting sites. For the remaining areas, however, efforts are now needed to preserve essential nesting habitat through acquisition, zoning or other actions.

1111. Alameda Naval Air Station.

The most effective means of tern conservation in this area is through development and implementation of a least tern management plan. The Navy is currently formulating such a plan; it has constructed and maintains a protective fence around the nesting colony. Monitoring of the colony and predator control is routinely undertaken.

1112. Bair Island.

The most effective means of tern conservation in this area is through development and implementation of a least tern management plan. CDFG is currently working on such a plan.

1113. San Antonio Creek.

The most effective means of tern conservation in this area is through development and implementation of a least tern

management plan.

1114. Purisima Point.

See item 1113.

1115. Santa Clara River Mouth.

See item 113.

1116. Mugu Lagoon.

See item 1113.

1117. Venice Beach

See item 1113.

112. Develop and implement least tern management plans/programs for secure nesting habitat in Orange County.

For most existing colonies, the nesting area is the habitat element most in need of preservation. In California, not all currently used colony nesting sites are now protected under State, Federal or other public ownership or jurisdiction. These protected sites are reasonably secure from adverse habitat alteration or are located where human access can be

controlled. The remaining active colony nesting sites are located in areas where human disturbance is a recurrent problem, where needed management programs are now difficult or nearly impossible to implement, or where land use changes threaten the suitability of the site for breeding. For a few of these sites, construction and protection of nearby alternate nesting areas, where possible, would be preferable to the protection of those currently used, but always vulnerable nesting sites. For the remaining areas, however, efforts are now needed to preserve essential nesting habitat through acquisition, zoning or other actions.

1121. Anaheim Bay (Seal Beach National Wildlife Refuge, Naval Weapons Center-Seal Beach).

The most effective means of tern conservation in this area is through development and implementation of a least tern management plan. Construction of an alternate nesting site is planned. Site enhancement, monitoring, and predator control is ongoing.

1122. Huntington State Beach Least Tern Natural Area.

Effective tern recovery depends upon the development and implementation of a suitable mamagement plan. Monitoring and control of predators is an ongoing process.

1123. Bolsa Chica Ecological Reserve.

See item 1122.

1124. Upper Newport Bay Ecological Reserve.

See item 1122.

113. Develop and implement least tern management plans/programs for secure nesting habitat in San Diego County.

For most existing colonies, the nesting area is the habitat element most in need of preservation. In California, not all currently used colony nesting sites are now protected under State, Federal or other public ownership or jurisdiction. Protected sites are reasonably secure from adverse habitat alteration or are located where human access can be controlled. The remaining active colony nesting sites are located in areas where human disturbance is a recurrent problem, where needed management programs are now difficult or nearly impossible to implement, or where land use changes threaten the suitability of the site for breeding. For a few of these sites, construction and protection of nearby alternate nesting areas, where possible, would be preferable to the protection of those currently used, but always vulnerable nesting sites. For the remaining areas, however, efforts are now needed to preserve essential nesting habitat through acquisition, zoning or other actions.

1131. San Mateo Creek.

See item 1122.

1132. Aliso Creek.

See item 1122.

1133. Santa Margarita River Mouth.

See item 1122.

1134. Buena Vista Lagoon.

See item 1122.

1135. San Elijo Lagoon.

See item 1122.

1136. Delta Beach.

This beach was recently fenced to prevent human disturbance. Vegetation was removed to enhance the site's suitability for tern use. It has been used as a roosting site by large numbers of post-breeding terns. It is anticipated that terns will increase their use of the area and may nest there. The beach

is managed by the Naval Amphibious Base-Coronado.

1137. San Diego Bay Salt Pond Dikes.

See item 1122.

1138. Tijuana River Estuary.

Presently this site does not provide suitable conditions to support a secure least tern colony. A management plan is needed to control human disturbance (primarily horseback riding), minimize the effects of flooding and high tides (may require moving nesting areas to higher ground), and to limit vegetation encroachment. A management plan, once implemented, would be an effective tool to enhance tern reproduction in this location.

114. Preserve and manage nesting areas for currently insecure colonies.

Numerous least tern nesting colonies are located on land that is not managed to benefit least tern. The status of terns is such that their recovery necessitates adequately protecting currently insecure nesting colonies.

1141. Protect/secure nesting habitat now in private ownership (San Diego County unless otherwise stated).

Certain colony sites have the potential to provide good nesting and/or feeding habitat if properly managed. Securing such sites either by acquisition, conservation easements, memoranda of understanding, or other means is necessary to insure their protection; otherwise future habitat modification may make the areas unsuitable for terns. Any habitat that Fish and Wildlife Service may be involved directly in securing will require the preparation of a Land Protection Plan. Such a plan delineates the possible methods of securing a given site.

11411. Agua Hedionda Lagoon (eastern part).

This site is now in private ownership. Proper management to conserve and recover least terns is essential. Considering the pressures to develop the area, acquisition may be the best method to insure the continued use by least tern.

11412. Los Penasquitos Lagoon.

See item 11411.

11413. Playa del Rey (Los Angeles County).

See item 11411.

11414. Bayfront end of "D Street Fill", Sweetwater Marsh.

See item 11411.

11415. Oakland Airport (Alameda County).

See item 11411.

1142. Manage when, and if, secured.

Once areas are secured, active management will be necessary to provide the best habitat conditions for least tern.

11421. Agua Hedionda Lagoon (eastern part).

After this area has been secured, intensive management to conserve and enhance California least terns will be required to maximize the reproductive potential of terns using the site.

11422. Los Penasquitos Lagoon.

After this area has been secured, intensive management to conserve and enhance California least terns will be required to maximize the reproductive potential of terns using the site.

11423. Playa del Rey.

See item 11422.

1143. Develop and implement management plans to establish secure nesting areas for colonies on public lands (San Diego County unless otherwise stated).

Several areas in public ownership provide nesting sites for terns but need additional efforts to improve tern nesting success. Specific management plans should be developed for each area. Enhancing these sites will increase productivity and state-wide population levels.

11431. North Island Naval Air Station.

An existing management plan is being revised in response to development planned on the nesting site. Intensive management of the remaining nesting area and alternate nesting sites is necessary to enhance reproduction.

11432. Chula Vista Wildlife Reserve.

Presently this site does not provide suitable conditions to support a secure least tern colony. A management plan, once implemented, would be an effective tool to enhance tern reproduction in this location.

11433. Oso Flaco Lake (San Luis Obispo County).

See item 11432.

115. Secure and manage a minimum of six least tern nesting sites in Mission Bay (San Diego County).

Twelve different sites around Mission Bay have supported tern nesting colonies since 1960. As recently as 1975, eight of these sites were in use, and in 1982 five areas were used. At least six sites that have been used in the past still possess the potential, if managed, to support viable tern colonies. Controlling vegetation, human disturbance and predation is the key to fostering successful tern colonies around Mission Bay.

1151. Establish an interagency coordinating team to annually maintain least tern colonies.

Several agencies are involved in managing Mission Bay. A coordinated, focused effort is needed to ensure that breeding areas are maintained and properly protected.

1152. Annually maintain Crown Point Sanctuary.

This area could support far more terns than it now does. Annual maintenance (e.g., vegetation removal) is required to maintain habitat quality. Other forms of maintenance may also be required to maximize the reproductive potential of this site.

1153. Annually maintain FAA Island Site.

For its size, this area has supported more nesting terns than any other colony in California. Annual maintenance (e.g., vegetation removal) is required to maintain habitat quality. Effective predator control is required to maximize the reproductive potential of this site.

1154. Annually maintain and protect North Fiesta Island breeding area.

This area could support far more terns than it now does. Annual maintenance (e.g., vegetation removal) is required to maintain habitat quality. Predator control is also required to maximize the reproductive potential of this site.

1155. Annually maintain and protect Stoney Point colony site.

This area could support far more terns that it now does. Annual maintenance (e.g., vegetation removal) is required to maintain habitat quality. Predator control is also required to maximize the reproductive potential of this site.

1156. Establish and manage two additional breeding sites at the Cloverleaf and South Sea World Drive.

These two colony sites in Mission Bay plus the above four sites, if adequately managed (including predator control and fencing),

could substantially increase the reproductive output of least terns in San Diego County.

116. Develop management plans/programs that identify special site protection problems of certain insecure colonies and implement corrective action as needed in Ventura, Los Angeles, and Alameda counties.

Success of insecure (and also secure) colonies may be enhanced by first determining what site specific problems exist. Needed actions may involve signing, fencing, and/or patrolling to control unwarranted human intrusion. Site enhancement (i.e., vegetation removal or thinning) and predator control also may be necessary.

1161. Coyote Hills (Alameda County).

Management actions which deal directly with site specific problems affecting tern survival and reproductive success at this colony site are required. The exact problems of the colony must first be ascertained so that protective strategies can be developed and implemented.

1162. Ormond Beach (Ventura County).

Management actions which deal directly with site specific problems affecting tern survival and reproductive success are required. Disturbance from heavy ORV use appeared to be a major problem at this site but has been prohibited since 1982.

1163. Santa Clara River Mouth (Ventura County).

The major problem at this site is flooding of the nesting area caused by closure of the river mouth by drifting sand in the summer. Opening the mouth is required several times during an average nesting season. Encroaching vegetation and disturbance from ORV's are the other problems that need attention.

1164. Cerritos Lagoon (Los Angeles County).

Management actions which deal directly with site specific problems affecting tern survival and reproductive success are required. There are major people-trespass and predator problems that should be examined in greater detail and alleviated. Problems within the colony must be evaluated so that protective strategies can be developed and implemented.

1165. Playa del Rey (Los Angeles County).

Management actions which deal directly with site specific problems affecting tern survival and reproductive success are required. The exact problems of the colony such as human disturbance and predation must first be identified in greater detail so that protective strategies can be developed and implemented.

1166. Terminal Island--Reeves Field and the land-fill site (Los Angeles County).

Management actions which deal directly with site specific problems affecting tern survival and reproductive success are required. The exact problems of the colony must first be ascertained so that protective strategies can be developed and implemented to secure a permanent nesting location.

117. Develop management plans/programs that identify special site protection problems of certain insecurecolonies and implement corrective action as needed in San Diego County.

Success of insecure colonies may be enhanced by first determining what site specific problems exist. Needed actions may involve signing and/or fencing the important nesting areas or patrolling to control unwarranted human intrusion. Site enhancement (i.e., vegetation removal or thinning) and predator control may be necessary.

1171. San Diego International Airport.

Management actions which deal directly with site specific problems affecting tern survival and reproductive success are required. Problems with airport operations need resolution.

1172. Grand Caribe Island, Coronado Cays.

Because colony site characteristics have been destroyed, a management plan should be developed and implemented that will provide a replacement site.

1173. D Street Fill.

Management actions which deal directly with site specific problems affecting tern survival and reproductive success at this colony site are required. The exact problems of the colony such as human intrusion and predation must first be evaluated so that protective strategies can be developed and implemented. The time required for colony reestablishment needs to be determined once human disturbance has been curtailed. Continued monitoring of human disturbance and predator-related problems will be necessary so that appropriate actions can be taken to alleviate them.

12. Provide adequate nesting habitat in former, potential, or newly identified breeding areas.

A number of areas if properly managed could support nesting colonies of least terns. One important management tool is the creation of additional or alternative nesting habitat. We have achieved some success in determining how sites should be prepared to be attractive to terns. Prevention of unnecessary human

intrusion and an active predator control program may be part of managing these areas.

Least terns readily accept artificial bare ground areas as nesting sites. This is evidenced by the fact that from 1969 to 1977, terns have chosen nest sites on at least 23 human-made land fills or other earthen structures in coastal wetland areas. In 1975 and 1976, 60 percent of known breeding pairs nested on man-made substrates. Experience at the Camp Pendleton (Swickard 1971) and Bair Island colony sites demonstrates that specially constructed nest sites can be acceptable to breeding least terns. Further research and experimentation are needed to refine this management technique. Construction of new nesting sites, restoration of abandoned nesting areas and restoration of feeding areas are recommended actions at many coastal wetlands. These actions are necessary to encourage new colonies to form in potential breeding habitats and to enhance conditions that will allow existing colonies to increase in size.

121. Develop and implement management programs/plans to construct and manage new nesting sites in protected areas.

If new colony sites can be prepared and adequately managed, terns may recolonize certain areas. This could result in an increase in overall number of nesting pairs and reproductive success. It is particularly advantageous to encourage additional nesting in secure habitat since the birds usually have a greater probability of success.

1211. Anaheim Bay (Seal Beach National Wildlife Refuge, Naval Weapons Station-Seal Beach)

Anaheim Bay lies within the Seal Beach National Wildlife Refuge which occupies land owned by the Naval Weapons Station, Seal Beach. The entire colony site at NASA Island may have to be fenced to alleviate predation problems. Because of these predation problems, additional nesting sites may be needed to improve reproductive success. Nesting sites should be created in areas where predators and other disturbance can be effectively controlled.

1212. Sunset Aquatic Park.

In this area, additional nesting sites (preferably adjacent to the National Wildlife Refuge), including an appropriate available nearby food supply, are needed to help augment the numbers of nesting least terns. Nesting sites should be created in the best potential habitat such as areas that are relatively predator-free or could be managed to minimize loss because of predation; areas that are not prone to human intrusion or where access could be properly controlled, and sites near the necessary food supplies.

1213. Bolsa Chica Ecological Reserve.

Additional nesting sites may be desirable to augment the two

created nesting islands. Nesting sites should be created in the best potential habitat such as areas that are relatively predator-free or could be managed to minimize loss because of predation; areas that are not prone to human intrusion or where access could be properly controlled, and sites near adequate food supplies.

1214. Upper Newport Bay Ecological Reserve.

In this area additional nesting sites are needed to help augment the numbers of nesting least terns. Nesting sites should be created in the best potential habitat such as areas that are relatively predator-free or could be managed to minimize loss because of predation; areas that are not prone to human intrusion or where access could be properly controlled, and sites near the necessary food supplies. It appears to be necessary to increase the elevation of the newly created nesting island at the upper end of the bay, and possibly provide additional nesting habitat at an alternate site.

1215. Silver Strand, south end of San Diego Bay (Naval Radio Receiving Facility

The feasibility of establishing a nesting site, such as at the Naval Radio Station, should be investigated. Nesting sites should be created in the best potential habitat such as areas that are relatively predator-free or could be managed to minimize

loss because of predation; areas that are not prone to human intrusion or where access could be properly controlled, and sites near adequate food supplies. In November 1983, the down-coast end of the Silver Strand State Beach was designated as a Natural Preserve. The California Department of Parks and Recreation plans on reestablishing native plants and a least tern nesting colony.

1216. Naval Training Center, San Diego.

Since terns last nested at the site here in 1978, the area has become over-grown with vegetation. Intensive site enhancement is necessary if terns are to nest here again. A management plan, developed and implemented by the Navy, is needed to recreate a colony site.

1217. Marine Corps Recruiting Depot-San Diego

The site should be examined to assess its potential as a future tern nesting colony.

122. Manage newly Identified Sites.

Ten or 12 pairs of California least terns nested in the Santa Ynez River Mouth last year. Fledglings were observed, however no census was undertaken (Farley[1], pers. comm.). The possibility

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1 Commander Earl Farley, Vandenberg Air Force Base

of enhancing tern nesting in the area should be investigated.

123. Develop and implement tern management plans with emphasis on construction of adequate breeding sites in non-secure habitats.

Least tern breeding habitat has been drastically reduced from historical levels. Additional habitat needs to be restored or developed to increase overall nesting numbers. Potential habitat should thus be secured through acquisition, easements, or other means, if necessary, and restored as per a management plan designed specifically for each potential site.

1231. Protect and manage San Dieguito Lagoon.

Part of San Diequito Lagoon is in private ownership. To adequately protect this area, acquisition may be necessary although this is only one possible alternative to secure the site. A management plan should be prepared that stresses preparation of nesting habitat and protection from predators and human beings on the private acreage. The San Dieguito Lagoon Resource Enhancement Program has been approved and is currently being implemented by the City of Del Mar. This includes the construction of a tern nesting island of over 15 ha (6 acres). The California Department of Fish and Game is in the process of designating San Dieguito Lagoon as a state ecological reserve.

1232. Mouth of Santa Ana River, southeast area.

To adequately protect this area, acquisition, conservation easement or other alternatives, may be necessary. A management plan should be prepared that stresses preparation of breeding habitat.

2. Protect and manage non-nesting habitat.

Non-nesting habitat such as that used for roosting, loafing, or feeding must also be protected to enhance tern survivability and the recovery effort.

21. Maintain adequate feeding habitat for colonies.

An ideal nesting substrate will not attract and support least tern breeding pairs if suitable feeding conditions do not exist within a reasonable distance. With few exceptions, colonies form adjacent to estuaries, lagoons, bays or channels where food supplies are readily available. If efforts to preserve colonies are to be successful, the associated feeding areas also must be preserved. Yearlong habitat preservation efforts are needed in major least tern foraging areas. Especially important are feeding areas where least tern adults and fledglings roost after the nesting season ends and before migration south begins.

Least tern colonies need dependable supplies of small fish to sustain the adults and young throughout the breeding season. Several southern California coastal wetlands are now in a degraded condition (e.g., Mudie et al. 1974, 1976). This plan recommends that responsible management agencies investigate and implement actions that are needed to improve feeding conditions for least terns in wetland ecosystems which lack adequate fish populations. In some wetlands restoring tidal circulation is essential to restoring estuarine fish populations. Sedimentation and pollution are other factors that affect forage supplies.

211. Protect existing coastal feeding grounds of colonies.

Existing coastal foraging habitat must be protected by maintaining high water quality, minimizing tideland fill and drainage projects and by restoring or improving tidal flow in wetlands to enhance feeding habitat. If water quality is reduced, fish populations upon which least terns feed could diminish or be locally extirpated, resulting in adverse impacts to tern nesting success. If tidelands are filled or drained, fish habitat will be lost thus reducing the tern's prey base. This also may affect tern nest site selection and reproductive rate.

If the quality of nearby feeding grounds can be improved, the probability that a local nesting colony can be successful may be increased. It is also very important that high quality feeding grounds adjacent to highly productive colonies be

maintained. Improving tidal flow to wetlands can be a very effective means of increasing wetland production.

2111. Mugu Lagoon.

The possibility of improving tidal actions should be explored. Any additional actions that appear feasible should be initiated.

2112. Bolsa Chica Bay.

Foraging conditions for least terns could be improved by reestablishing tidal action to restorable wetlands.

2113. Terminal Island.

Within Los Angeles Harbor, shallow water feeding habitat appears very important to the foraging needs of this tern colony. Maintaining this habitat and providing acceptable water quality are undoubtedly important to conserving Los Angeles Harbor as acceptable breeding habitat.

2114. Anaheim Bay.

Foraging conditions for least terns could be improved by enhancing tidal action in some areas of the estuary.

2115. Los Penasquitos Lagoon.

Tidal action must be restored to this area to improve foraging conditions for least terns.

2116. Tijuana River Estuary.

Least tern foraging habitat could be expanded and enhanced by restoring tidal influence in portions of the north and south reaches of the estuary that have been cutoff from tidal waters in recent years. Agricultural runoff and sewage effluent pose threats to water quality in the Tijuana River Valley. Estuarine waters should be periodically analyzed to identify potential problems and provide a basis for recommending management actions. Flooding and high tides can destroy least tern nests. The possibility of moving the colony site to higher ground should be evaluated and, if deemed feasible, the site should be relocated or modified as needed.

212. Investigate and implement actions needed to increase populations of fish eaten by terns in degraded or potential tern feeding areas.

Tern use of a particular area is partly dependent upon food resources. Sufficient populations of fish of the appropriate size must be available. If sites with low fish numbers could be restored with a concomitant increase in forage availability,

it is anticipated that terns may begin to use the area, or their current use will increase. Thus, additional individuals could be supported.

2121. Mouth of Santa Ana River, southeast area.

This is a prime area to increase the fish forage supply for least terns. A study is needed to determine the best method to enhance fish populations.

2122. San Elijo Lagoon.

This area appears to have significant potential for increasing forage supplies for least terns. Necessary actions must be determined so that efficient strategies to increase fish numbers can be developed.

2123. Batiquitos Lagoon.

See item 2121.

2124. Other areas as needed.

See item 2121.

213. Identify major feeding areas.

Providing suitable fish resources for tern foraging is essential to enhance tern survivorship.

22. Protect important non-nesting, feeding, and roosting habitats from detrimental land or water use changes in San Luis Obispo, Santa Barbara and Los Angeles Counties.

Tern habitat has been drastically reduced from what was historically available. What remains should be protected so that further potential declines in tern numbers can be arrested. Terns must be provided suitable non-nesting habitat for roosting and feeding.

221. Oso Flaco and Dune Lakes (San Luis Obispo County).

California least terns use this area for a variety of non-nesting activities. It is important that the birds can continue to use these areas without adverse disturbance. Undue stress or disturbance may affect their survivability, success at obtaining sufficient food supplies, and predator avoidance; and thus, may influence the probability of tern recovery.

222. Santa Ynez River Mouth (Santa Barbara County).

This is a traditional feeding and roosting site used during

post-breeding dispersal. Management needs should be devised to protect these values.

223. Harbor Lake (Los Angeles County).

Terns are known to roost, feed, or loaf in this area. This is a particulary important post-breeding area where young of the year congregate in substantial numbers. These birds should not be disturbed.

224. Belmont Shores (Los Angeles County).

See item 221.

225. Identify and protect other habitats as needed.

Other areas may need protective measures. Once these areas are identified, site-specific actions may be proposed.

23. Protect important non-nesting, feeding and roosting habitats from detrimental land or water use changes in San Diego County.

Tern habitat has been drastically reduced from what was historically available. What remains should be protected so that further potential declines in tern numbers can be arrested. Terns must be provided suitable non-nesting habitat for roosting and feeding.

231. Guajome Lake.

See item 221.

232. Lake Val Sereno.

See item 221.

233. Whelan Lake.

See item 221.

234. Santa Margarita River-O'Neil Lake.

See item 221.

235. San Luis Rey River.

See item 221.

236. Dairy Mart Ponds.

See item 221.

237. San Dieguito Lagoon.

See item 221.

238. Buena Vista Lagoon.

See item 221.

239. San Diego River Flood Control Channel.

See item 221.

3. Monitor least tern population to determine status, distribution and progress of species management during the breeding season by conducting annual breeding colony surveys.

Population monitoring is necessary to evaluate the success of management actions and to modify such actions or implement new ones, if necessary.

31. Determine Breeding Success.

The only way to determine whether the prime objective has been obtained is to assess the number of breeding pairs, their distribution, and reproductive success. Surveys indicate when a colony is having difficulty and can provide an opportunity for biologists to quickly try to resolve problems that may arise (e.g., removal of predators). Breeding population surveys are needed annually in California and in Baja California. These

surveys will identify active colony sites, determine colony size and evaluate breeding success. This information is necessary for evaluating management and protection efforts. There is also a need to refine census techniques to reduce the time and costs involved in data collection, yet not sacrifice the quality of data.

311. Determine colony locations.

The location of individual colony sites must be determined before a comprehensive survey can be conducted.

312. Estimate breeding population size.

The size of the breeding population usually varies throughout the nesting season. Therefore censusing during the entire season is needed to arrive at a reasonable estimate of the number of pairs. Such information is beneficial in assessing the status of the recovery effort.

313. Conduct annual breeding colony surveys.

Even if many least terns are nesting, recovery will still only be achieved if reproductive success is sufficiently high to compensate for mortality losses and provide for a long-term tern stability. Breeding success is determined by the number of young that fledge per number of least tern pairs (or nesting attempts

in the case of renesting) which is ascertained during annual breeding colony surveys.

32. Investigate population dynamics, life history, and movement of terns.

Banding and marking least tern chicks can provide information on age-class structure, mortality rates, and estimates of longevity. These factors can be used to predict long-range stability of tern populations. Such information will include the degree of colony fidelity (i.e., the extent to which birds return to the same breeding area year after year), the degree of shifts between breeding colonies or the establishment of new ones, the age at first breeding, techniques for aging young birds in colonies, life expectancy, factors affecting clutch size, renesting attempts, and breeding success.

4. Conduct research on California least tern to provide additional necessary information for tern management.

Studies are needed to provide information to make appropriate management decisions. Many of these studies will entail banding and color marking large numbers of least tern chicks.

41. Determine effects of environmental pollutants on least terns.

Adverse effects from pollutants may affect terns' egg producing

abilities, the viability of eggs, and the fish food supply on which both the adults and young depend. The recovery effort could be thwarted by environmental contaminants. More information on this aspect of tern biology is needed. A substantial pesticide threat may occur from chemicals used for mosquito larvicide control. These may have high invertebrate toxicities. It is conceivable that pesticides could alter the benthic communities to such an extent that fish production or availability could be changed drastically. Agricultural fields near estuaries could also be affected (Faatz[1], pers. comm.).

42. Determine factors affecting the choice of location for roosting, loafing, and feeding areas used during the breeding season and during post-breeding dispersal.

Because such areas need to be protected against adverse land and water uses, factors that determine site selection by the birds should be assessed.

43. Determine how much habitat is necessary to maintain the current population and the prime recovery objective.

This information will provide a more concise estimate of the amount of habitat needed to ensure recovery. Components of

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1 Dr. Wayne C. Faatz, Wildlife Biologist, Ecological Effects Branch, Environmental Protection Agency, Washington, D.C.

this determination include the number of hectares with the associated biomass of small fish being regularly used by the terns, the food requirements for a nesting pair, the minimum density of appropriate fish, and the amount of lagoons, bays etc. required to support a given number of terns through the nesting period (e.g., 100 pairs/40 ha of minimum fish density waters).

44. Identify potentially suitable nesting sites, including beach, landfill, salt pond and estuarine areas.

Wildlife biologists need additional information regarding what constitutes suitable nesting habitat so that they can concentrate management efforts (i.e. enhancement of potential nest sites) in such areas.

45. Identify factors causing colony disruption and nest site abandonment.

It is unfortunate that terns fairly frequently abandon nesting colonies. This tendency is especially prevalent early in the nesting season and has tentatively been correlated to disruption (mainly by predators). Early in the nesting season initial colony surveys should be done from a distance to minimize disturbance. A more detailed appraisal on the causes of disruption and abandonment of colony sites is needed so that remedial measures may be implemented.

46. Develop or refine management techniques for providing adequate nesting sites and implement techniques where needed.

Additional information is required on nest site management so that reproductive success can be enhanced.

461. Investigate nest site requirements of colonies.

If tern nest site requirements are thoroughly understood, appropriate nest enhancement procedures can be implemented.

462. Investigate methods of enhancing nesting sites of existing colonies.

Various types of nest enhancement procedures should be undertaken and evaluated so the most effective means of habitat improvement can be determined.

463. Investigate methods of constructing adequate nesting sites in potential breeding habitat.

Some areas of potential habitat will require rehabilitation. Construction techniques need to be refined so that they are economical and efficient.

5. Encourage the protection of breeding population outside the United States

Recovery of California least terns will be partly dependent on successful protection and management of those terns nesting in Baja California. Once the status, including distribution, numbers, and threats, has been determined, the importance of Mexican populations to overall least tern recovery can be ascertained.

51. Protect least tern population and habitats in Baja California.

California least terns are known to nest in Baja California. Suitable protection measures must be undertaken to ensure the terns' continued reproductive success in this area, thus aiding the recovery effort.

511. Determine colony locations and population size.

The first step in managing the Baja least terns is to determine the size and location of each colony. The number of breeding terns in Baja California is unknown, hence their potential contribution to the recovery effort can not be assessed at this time.

512. Identify least tern population and habitatprotection problems.

Each colony should be monitored and evaluated to determine what, if any, problems exist. Once the problems have been described then measures to counteract them can be developed and initiated. The security and future management plans for specific sites must be considered in the evaluation of the impact of Baja California's least terns on recovery.

513. Develop cooperative programs between the United States and Mexican governments for least tern protection and habitat preservation.

A cooperative program is necessary to coordinate the recovery effort for this subspecies and to ensure that appropriate conservation actions are taken by both parties.

52. Identify and protect key migration and winter habitats outside the United States.

Preliminary surveys have been conducted to identify wintering habitat of the California least tern. Additional work is needed to further define key migration and wintering habitat so it can be adequately protected and managed. This is particularly important because of a recent drastic (25% or more) decline in the number of terns returning from the wintering grounds to breed in the U.S. Without more precise

information on the location(s) and conditions on the wintering grounds, it is difficult to delineate the specific problems that are causing the decline in population numbers. Clearly, obtaining data on wintering birds is thus becoming increasingly important and crucial to tern conservation. The population cannot tolerate a yearly loss of such a large proportion of the adults.

6. Utilize existing laws and regulations protecting least tern and their habitat.

Recovery is dependent upon the judicious enforcement of rules and regulations designed to prevent losses of birds and to enhance population status.

61. Evaluate success of law enforcement.

To maximize least tern protection, an appraisal of the law enforcement strategy should be routinely conducted. Modifications in the strategy to increase efficiency can then be recommended.

62. Propose appropriate new regulations or revisions.

If it becomes evident that additional regulations or a modification of existing provisions are necessary to adequately protect terns, such changes should be expeditiously proposed.

7. Develop and implement a conservation education program regarding recovery of California least tern.

Public support is generally enhanced when the public is informed of the conditions of an endangered species and the steps necessary to conserve it. This may be accomplished through a series of pamphlets, informational signs posted near selected habitats and audio-visual programs for local schools.

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PART III

IMPLEMENTATION SCHEDULE

The schedule that follows is a summary of actions and costs for the California least tern recovery program. It is a guide to meet the objectives of the Recovery Plan, as elaborated upon in Part II, Action Narrative Section. This table indicates the general category for implementation, recovery plan tasks, corresponding step-down outline number, task priorities, duration of the tasks, which agencies are responsible to perform the tasks, and the estimated costs to perform the tasks. General categories and priority numbers are defined on the following page. Note that priority 3 tasks, contrary to the usual format of recovery plans, are included because recovery of this subspecies is well underway and few priority 1 items remain to be done. Implementing Part III is the action of the recovery plan, that when accomplished, will bring about the recovery of this endangered species.

GENERAL CATEGORIES FOR IMPLEMENTATION SCHEDULES

Information Gathering - I or R (research)

1. Population status
2. Habitat status
3. Habitat requirements
4. Management techniques
5. Taxonomic studies
6. Demographic studies
7. Propagation
8. Migration
9. Predation
10. Competition
11. Disease
12. Environmental contaminant
13. Reintroduction
14. Other information

Acquisition - A

1. Lease
2. Easement
3. Management Agreement
4. Exchange
5. Withdrawal
6. Fee title
7. Other

Management - M

1. Propagation
2. Reintroduction
3. Habitat maintenance and manipulation
4. Predator and competitor control
5. Depredation control
6. Disease control
7. Other management

Other - O

1. Information and education
2. Law enforcement
3. Regulations
4. Administration

RECOVERY ACTION PRIORITIES

1 = An action that must be taken to prevent extinction or to prevent the species from declining irreversibly.
2 = An action that must be taken to prevent a significant decline in species population/habitat quality, or some other significant negative impact short of extinction.
3 = All other actions necessary to provide for full recovery of the species.

[1] Continuous - once a task is begun it will continue.

Ongoing = currently underway.

[2] Agency abbreviations:

AF - U.S. Air Force

BCDC - San Francisco Bay Conservation and Development Commission

CDFG - California Department of Fish and Game

CDPR - California Department of Parks and Recreation

CE - Corps of Engineers

EPA - Environmental Protection Agency

FAA - Federal Aviation Administration

FS - Fauna Silvestre (Mexico)

LA City - Los Angeles City

LE - Law Enforcement (U.S. Fish and Wildlife Service)

NABC - Naval Amphibious Base, Coronado

OCHPBD - Orange County Harbor, Beaches and Park Department

RE - Refuges (U.S. Fish and Wildlife Service)

SDCPR - San Diego County Department of Parks and Recreation

SDGE - San Diego Gas and Electric

SDUPD - San Diego Unified Port District

SE - Endangered Species (U.S. Fish and Wildlife Service)

SLC - State Lands Commission

SWRCB - State Water Resources Control Board

USM - U.S. Marine Corps

USN - U.S. Navy

[3] TBD = to be determined

PART III
IMPLEMENTATION SCHEDULE
CALIFORNIA LEAST TERN RECOVERY PLAN

General Category	Plan Task	Task No.	Task Priority	Duration of Task (yrs)[1]	Responsible Agency[2] FWS Region	FWS Program	Other	Fiscal Year Costs (est.)[3] ($1,000's) 1	2	3	Comments and Notes
	Develop and implement management plans/programs for secure nesting habitat in 5 northern counties										
M3	Alameda Naval Air Station	1111	3	Ongoing			USN	10	11	12	
M3	Bair Island	1112	2	10			CDFG*	5.0	0.5	0.5	
M3	San Antonio Creek	1113	3	10			AF CDFG	2.0 2.0	1.0 1.0	0.5 0.5	
M3	Purisima Point	1114	3	Ongoing			AF*	0.5	0.6	0.7	
M3	Santa Clara River Mouth	1115	3	10			CDPR	2.0	1.0	0.5	

General Category	Plan Task	Task No.	Task Priority	Duration of Task (yrs)	Responsible Agency[1] FWS Region	FWS Program	Other	Fiscal Year Costs (est.) ($1,000's) 1	2	3	Comments and Notes
M3	Mugu Lagoon	1116	3	Ongoing			USN	2	1	0.5	
M3	Venice Beach	1117	2	Ongoing			CDFG*		TBD		
							CDPR		TBD		
							LA City	0.5	0.6	0.7	
	Develop and implement least tern management plans/programs for secure nesting habitat in Orange County										
M3	Anaheim Bay (Seal Beach NWR)	1121	2	Ongoing		RE*		0.5	0.6	0.7	
M3	Huntington State Least Tern Natural Area	1122	2	Ongoing			CDPR*	0.5	0.6	0.7	
							CDFG		TBD		
M3	Bolsa Chica Ecological Reserve	1123	2				CDFG	2	1	0.5	
M3	Upper Newport Bay Ecological Reserve	1124	3	Ongoing			CDFG	75	10	1	
	Develop and implement management plans/programs for secure nesting habitat in San Diego County										

General Category	Plan Task	Task No.	Task Priority	Duration of Task (yrs)	Responsible Agency[1] FWS Region	FWS Program	Other	Fiscal Year Costs ($1,000's) 1	2	3	Comments and Notes
M3	San Mateo Creek	1131	3	10			CDPR USM	1 1	1 1	0.5 0.5	
M3	Aliso Creek	1132	3	Ongoing			USMC* CDFG	2	1	0.5	
M3	Santa Margarita River Mouth	1133	2	Ongoing			USM* CDFG	2	2 TBD	2	
M3	Buena Vista Lagoon	1134	3	Ongoing			CDFG* C. Oceanside	10.5	0.6 TBD	0.7	
M3	San Elijo Lagoon	1135	2	Ongoing			CDFG* SDCPR	1.5	1.6 TBD	1.7	
M3	Delta Beach	1136	3	Ongoing			USN* Leslie Salt (?)	0.5	0.6 TBD	0.7	
M3	San Diego Bay salt pond dikes	1137	2	3	1	SE	 CDFG* Western Salt Co.* SDUPD	 5	TBD 2 TBD TBD	 1	
M3	Tijuana River Estuary	1138	3	Ongoing	1	SE	 CDPR CDFG		TBD		
	Protect/secure nesting habitat now in private ownership										
A7	Aqua Hedionda Lagoon (eastern part)	11411	2	1			CDFG* SDCPR City of Carlsbad		TBD		Total cost 100K

General Category	Plan Task	Task No.	Task Priority	Duration of Task (yrs)	Responsible Agency[1] FWS Region	FWS Program	Other	Fiscal Year Costs (est.) ($1,000's) 1	2	3	Comments and Notes
A7	Los Penasquitos Lagoon	11412	2	3	1	SE	CDPR* CE CDFG C. of San Diego		TBD		
A7	Playa del Rey	11413	3	5	1	SE	CDFG* Summa Corp.		TBD		
A7	Bayfront end of "D Street Fill", Sweetwater Marsh	11414	2	5	1	SE	CDFG SDUPD	2	TBD 1 TBD	1	
A7	Oakland Airport	11415	2	5			CDFG		TBD		
	Manage when, and if, secured										
M3	Agua Hedionda (eastern part)	11421	2	Continous			CDFG*	2	1	1	
M3	Los Penasquitos Lagoon	11422	2	Continous			CDPR* SDGE	1 1	1 1	1 1	
M3	Playa del Rey	11423	3	Continous	1	SE	CDFG* Summa Corp.	0.5 1	0.5 0.5 TBD	0.5 0.5	
	Develop and implement management plans to establish secure nesting areas on public lands										

General Category	Plan Task	Task No.	Task Priority	Duration of Task (yrs)	Responsible Agency[1] FWS Region	FWS Program	Other	Fiscal Year Costs ($1,000's) 1	2	3	Comments and Notes
M3	North Island Naval Air Station	11431	3	Ongoing			USN	7.0	8.0	9.0	
M3	Chula Vista Wildlife Reserve	11432	3	Ongoing			SDUPD* CDFG	0.5	0.6 TBD	0.7	
M3	Oso Flaco Lake	11433	3	10			CDPR	2	1	0.5	
M7	Establish and maintain interagency coordinating team to manage breeding sites	1151	2	Continous	1	SE*	 CDFG	4 1	2 0.5	2 0.5	
M3	Annually maintain Crown Point Sanctuary	1152	3	Ongoing			CDFG City of San Diego*	3.0	0.5 TBD	0.6	
M3	Annually maintain breeding area at FAA Island	1153	1	Ongoing			FAA* CDFG	0.6	0.7 TBD	0.8	

General Category	Plan Task	Task No.	Task Priority	Duration of Task (yrs)	Responsible Agency[1] FWS Region	FWS Program	Other	Fiscal Year Costs (est.) ($1,000's) 1	2	3	Comments and Notes
M3	Annually maintain and protect north Fiesta Island breeding areas.	1154	1	Ongoing			CDFG City of San Diego*		TBD		
M3	Annually maintain and protect Stoney Point nesting site.	1155	3	Ongoing			CDFG City of San Diego*	2	TBD 5	5	
M3	Establish and manage at 2 additional breeding sites at Cloverleaf and South Sea World Drive.	1156	2	Ongoing			CDFG City of San Diego*		TBD		
	Develop and implement management program that identify site protection problems for insecure colonies in Ventura, Los Angeles, and Alameda Counties										
M7	Coyote Hills	1161	3	Continous	1	SE	Leslie Salt (?)	0.5	0.6 TBD	0.7	
M7	Ormond Beach	1162	2	Ongoing			CDFG	2	1	1	
M7	Santa Clara River Mouth	1163	2	Ongoing			CDPR*	10.5	0.6	0.7	

General Category	Plan Task	Task No.	Task Priority	Duration of Task (yrs)	Responsible Agency[1] FWS Region	FWS Program	Other	Fiscal Year Costs (est.) (1,000's) 1	2	3	Comments and Notes
M7	Cerritos Lagoon	1164	3	Ongoing			CDFG* Bixby Ranch Co.	10.5	0.6 TBD	0.7	
M7	Playa del Rey	1165	2	Ongoing			CDGF* Summa Corp.		TBD		
M7	Terminal Island-Reeves Field and the land-fill site.	1166	1	Ongoing	1	SE	 CE* CDFG	0.5 0.5 0.5	0.5 0.6 0.6	0.5 0.7 0.7	
	Develop and implement plans/programs that identify special site protection problems of insecure colonies and implement corrective action in San Diego County										
M7	San Diego International Airport	1171	3	5	1	SE	 FAA SDUPD*	0.5 0.5	0.5 0.6 TBD	0.5 0.7	
M7	Grand Caribe Island Coronado Cays	1172	3	5			CDFG*	0.7	0.6	0.5	
M7	D Street Fill	1173	2	10			CDFG* SDUPD/CE City of Chula Vista		TBD		
	Develop implement management plans/programs to construct and manage new nesting sites in protected areas										

General Category	Plan Task	Task No.	Task Priority	Duration of Task (yrs)	Responsible Agency[1] FWS Region	FWS Program	Other	Fiscal Year Costs (est.) (1,000's) 1	2	3	Comments and Notes
M3	Anaheim Bay (Seal Beach National Wildlife Refuge)	1211	2	5	1	RE	USN	20 10	3 2	3 2	
M3	Sunset Aquatic Park	1212	3	10			CDFG USN		TBD		
M3	Bolsa Chica Ecological Reserve	1213	3	Ongoing			CDFG* Signal Landmark Inc. (?)	1.0 1.0	1.0 1.1	1.5 1.2	
M3	Upper Newport Bay Ecological Reserve	1214	2	5			CDFG	30	10	5	
M3	Silver Strand, south end of San Diego Bay	1215	3	Ongoing			CDPR*	0.5	0.6	0.7	
M3	Naval Training Center, San Diego	1216	2	Continous			USN SDUPD	0.5	0.6 TBD	0.7	
M3	Marine Corps Recruiting Depot-San Diego	1217	3	Continous			USN		TBD		
	Develop and implement management plans/programs in non-secure habitats										
M3	Protect and manage San Dieguito Lagoon	1231	2	Ongoing			CDFG* City of Del Mar SLC		TBD		
M3	Protect and manage mouth of Santa Ana River (southeast area).	1232	3	Ongoing			CDFG CE*		TBD		

General Category	Plan Task	Task No.	Task Priority	Duration of Task (yrs)	Responsible Agency[1] FWS Region	FWS Program	Other	Fiscal Year Costs (est.) ($1,000's) 1	2	3	Comments and Notes
M3	Develop or refine management to provide nesting sites and implement techniques where needed	13	2	3			CDFG	3	3	3	
	Protect existing coastal feeding grounds of colonies										
	Maintain high water quality, minimize tideland fill and drainage projects, restore or improve tidal flow to wetlands to provide adequate feeding habitat:										
M3	Mugu Lagoon	2111	3	Ongoing			USN		TBD		
M3	Bolsa Bay	2112	3	Ongoing	1	SE	CDFG Signal-Landmark		TBD		
M3	Terminal Island	2113	2	Ongoing	1	SE	LA Port District CDFG* CE		TBD		
M3	Anaheim Bay	2114	3	Ongoing			USN CDFG		TBD		
M3	Los Penasquitos Lagoon	2115	3	Ongoing			CDPR* CDFG Landowner?		TBD TBD		

General Category	Plan Task	Task No.	Task Priority	Duration of Task (yrs)	Responsible Agency[1] FWS Region	FWS Program	Other	Fiscal Year Costs (est.) ($1,000's) 1	2	3	Comments and Note
M3	Tijuana River Estuary	2116	3	Ongoing	1	SE RE*	 CDFG USN CDPR*		TBD		
M3	Investigate and implement actions to increase prey base	212	3	Ongoing	1	SE			TBD		
M3	Mouth of Santa Ana River, southeast area	2121	3	5			CE* CDFG	5	3	1	
M3	San Elijo Lagoon	2122	3	5			CDFG	5	3	2	
M3	Batiquitos Lagoon	2123	2	5			CDFG CDPR SLC	5	3 TBD TBD	2	
M3	Other areas as needed	2124	3	TBD	1		CDFG	10	5	5	
I2	Identify major feeding areas	213	2	3	1	SE	 CDFG*	2 3	2 3.5	3 4.0	
	Protect important non-nesting, feeding, and roosting habitats in San Luis Obispo and Los Angeles counties										
M3	Oso Flaco and Dunes Lakes	221	2	Ongoing	1		CDPR	2	2	2	

General Category	Plan Task	Task No.	Task Priority	Duration of Task (yrs)	Responsible Agency[1] FWS Region	FWS Program	Other	Fiscal Year Costs (est.) ($1,000's) 1	2	3	Comments and Notes
M3	Santa Ynez River Mouth	222	2	Ongoing	1		CDFG	2	2	2	
M3	Harbor Lake	223	2	Ongoing	1		CDFG	2	2	2	
M3	Belmont Shores	224	3	Ongoing	1		CDFG	2	2	2	
M3	Identify and protect other habitats as needed	225	3	TBD	1	SE	CDFG		TBD		
	Protect important roosting habitat in San Diego County										
M3	Guajome Lake	231	2	Ongoing			CDFG	1	1	1	
M3	Lake Val Sereno	232	2	Ongoing			CDFG	1	1	1	
M3	Whelan Lake	233	2	Ongoing			CDFG	1	1	1	
M3	Santa Margarita River-O'Neill Lake	234	2	Ongoing			USM	1	1	1	
M3	San Luis Rey River	235	2	Ongoing			CE	1	1	1	
M3	Dairy Mart Ponds	236	2	Ongoing			CDFG	1	1	1	
M3	San Dieguito Lagoon and Buena Vista Lagoon	237	2	Ongoing			CDFG* CDPR	0.5 0.5	0.5 0.5	0.5 0.5	
M3	San Diego River Flood Control Channel	238	2	Ongoing			CDFG	1	1	1	
M3	Delta Beach	239	2	Ongoing			NABC	1	1	1	

General Category	Plan Task	Task No.	Task Priority	Duration of Task (yrs)	Responsible Agency[1] FWS Region	FWS Program	Other	Fiscal Year Costs (est.) ($1,000's) 1	2	3	Comments and Notes
	Monitor population to determine status, distribution, and progress of management during breeding season										
I1	Determine breeding success	31	2	Ongoing	1	SE		8	9	10	Includes 311-313
							CDFG*	8	9	10	
I14	Investigate population dynamics, life history, and movement of terns by banding and marking	32	2	Ongoing	1	SE		2	2	2	
							CDFG*	2	2	2	
I12	Determine effects of environmental pollutants on least terns	41	3	Ongoing	1	CE		1.0	1.0	1.0	
							CDFG	1.0	1.0	1.0	
							EPA/SWRCR	1.0	1.0	1.0	
I3	Determine factors affecting choice of locations for roosting, loafing, and feeding during breeding and post-breeding seasons	42	2	Ongoing	1	SE		5	5	5	
							CDFG	5	5	5	
I2	Determine amount of habitat necessary to maintain current populations and recovery objective	43	3	TBD	1	SE					
							CDFG		TBD		
I2	Identify potentially suitable nesting sites	44	2	Ongoing	1	SE					
							CDFG		TBD		
I14	Identify factors causing colony disruption and nest site abandonment	45	2	Ongoing	1	SE					
							CDFG		TBD		

General Category	Plan Task	Task No.	Task Priority	Duration of Task (yrs)	Responsible Agency[1] FWS Region	FWS Program	Other	Fiscal Year Costs (est.) ($1,000's) 1	2	3	Comments and Notes
R3	Investigate nest site requirements	461	2	10	1	SE		5	5	5	
R4	Investigate methods to enhance nest sites in potential breeding habitat	462	2	10			CDFG*	5	5	5	
R4	Investigate methods to construct adequate nesting sites in potential breeding habitat	463	2	10			CDFG*	5	5	5	
M3	Encourage protection of population outside of U.S.	5	2	Ongoing	1	SE			TBD		
M3	Protect terns and habitat in Baja California	51	3	Ongoing	1	SE			TBD		
I1	Determine colony locations and population size in Baja	511	3	TBD	1	SE*	FS		TBD		
I14	Identify least tern population and habitat protection problems	512	2	TBD	1	SE*	FS		TBD		
O4	Develop cooperative program between U.S. and Mexico for tern protection	513	3	1	1	SE*	FS		TBD		
M3	Identify and protect key migration and winter habitat outside of U.S.	52	2	10	1	SE		5	5	5	

General Category	Plan Task	Task No.	Task Priority	Duration of Task (yrs)	Responsible Agency[1] FWS Region	FWS Program	Other	Fiscal Year Costs (est.) ($1,000's) 1	2	3	Comments and Notes
02	Utilize laws and regulations	6	2	Ongoing	1	LE	CDFG*	2.0 1.0	2.5 1.5	3.0 2.0	
02	Evaluate success of law enforcement	61	2	Ongoing	1	LE*	CDFG	0.5	0.5	0.5	
02	Propose appropriate new regulations or revisions	62	3	TBD	1	LE	CDFG		TBD		
01	Develop and implement a conservation education program	7	3	Contin-uous	1	SE	CDFG DPR	0.5 0.5 0.5	0.6 0.6 0.6	0.7 0.7 0.7	