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CALIFORNIA LEAST TERN BREEDING SURVEY
1990 SEASON

by

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ABSTRACT

In 1990, an estimated 1706 pairs of California Least Terns (*Sterna antillarum browni*) nested in California, at sites from San Francisco Bay south to the Tijuana River mouth. This number represents a marked increase (approx. 36%) over 1988 and 1989 population estimates and is the highest number recorded since systematic monitoring was begun in 1973. The number of breeding sites decreased from 29 in 1989 to 28 in 1990, with four sites that had been occupied in 1989 going unused and two new sites being discovered. Population gains resulted from increases at established colonies throughout the State, but especially in Los Angeles, Orange, and San Diego Counties.

An estimated 1581 (1487-1676) fledglings were produced in 1990, more than any other year on record. Likewise, the ratio of fledglings:breeding pairs (0.93) was among the highest ever recorded. Outstanding productivity (> 1.0 fledglings/pair) was widespread, being reported from NAS Alameda, Santa Clara River, Venice, Seal Beach NWR, Upper Newport Bay, White Beach, Santa Margarita River, Mariner's Point, and Delta Beach. As in many other successful years, clutch size was high throughout the State, averaging 1.93 eggs/clutch (S.D. = 0.44).

Sources of egg and chick mortality varied from colony to colony. Documented avian predators included Northern Harrier, American Kestrel, Peregrine Falcon, Burrowing Owl, Common Raven, Western Meadowlark, and Loggerhead Shrike. Among mammals, predation by cats and Red Fox was documented, but losses to Coyotes, domestic dogs, Raccoons, Long-tailed Weasels, and rats were strongly suspected at various colonies. Disturbance by human intrusion (pedestrians or vehicles) remained a widespread problem, especially at sites in San Luis Obispo, Santa Barbara, Ventura, and southern San Diego counties.

INTRODUCTION

The California Least Tern is a state and federally listed endangered species that nests on the beaches of central and southern California. Loss of habitat, increased predation, and human disturbance at breeding colonies are some of the factors that limit recovery. Statewide censuses have documented a gradual increase in population from ~625 known pairs in 1973 to ~1250 pairs in both 1988 and 1989. The apparent doubling of the known population over this 15 year period has been a direct consequence of an integrated program for the location, monitoring, and protection of breeding colonies throughout the State. This effort was continued in 1990, and the results are summarized herein.

METHODS

Statewide censuses of the known breeding population of California Least Tern have been conducted each year since 1973. A network of paid and volunteer monitors check all known colony sites on a regular basis (weekly to daily, depending on the site). These monitors submit final reports at the end of the season summarizing (1) counts or estimates of the number of adults, breeding pairs, nests, eggs, chicks, and fledglings at each colony, (2) a chronology of breeding at the site, and (3) documented/suspected predators, other problems, and any steps taken to alleviate them.

The text of the 1990 Final Report serves mainly as an overview of the individual reports submitted by monitors. These reports are rich in detail of site-specific monitoring techniques and how problems were actually recognized and addressed in the field. The reports should serve as a welcome resource to those involved in monitoring or management of the species. The reader is encouraged to obtain copies of these reports, which are grouped by cluster (see Table 2), and are available from the California Department of Fish and Game.

RESULTS

Distribution - In 1990, breeding was observed at 28 sites from Contra Costa County south to the Mexican border (Table 1). Two new breeding sites were discovered: Tern Island, Hayward Shoreline (1 pair) and a new area of the Pismo Dunes (3 pairs). Four sites that were used for breeding in 1989 were not occupied in 1990: Santa Ynez River, Buena Vista Lagoon, Lindbergh Field, and D Street. These 4 colonies had been occupied by a total of 30 pairs in 1989, and 109 pairs in 1988. Least Terns were seen at Buena Vista Lagoon and Lindbergh Field but did not breed. Other former or potential breeding sites that had no breeders in 1990 included two in the San Francisco Bay area (Bair Island, Port Chicago) and several in Mission Bay (Crown Point, South Shores, Stoney Point, North Fiesta Island, and Naval Training Center). Apparent shifts in breeding occurred at Bolsa Chica where Least Terns nested on the southern island but not the northern island, at Terminal Island where birds disturbed by predators moved to a new site, and perhaps at Ormond Beach where large numbers of breeding pairs appeared after a failure at nearby Point Mugu.

Breeding Population - An estimated 1706 pairs nested within California during 1990 (Table 1). This represents a dramatic (36%) increase from the roughly 1250 pairs estimated in both 1988 and 1989. The population increase occurred in three of the five clusters recognized by B. Massey and J. Fancher (Auk 98: 596-605, 1989): San Francisco/Alameda cluster increased by 28%; Los Angeles/Orange increased by 32%; San Diego increased by 56% (Table 2). Populations in the San Luis Obispo/Santa Barbara and Ventura clusters exhibited little change from 1989.

Substantial increases in 1990 colony size over 1989 were widespread occurring at NAS Alameda (35%), Mussel Rock Dunes (60%), Santa Clara River (450%), Ormond Beach (1400%), Venice Beach (50%), Terminal Island (68%), Bolsa Chica (205%), Santa Margarita River (81%), FAA Island (42%), Mariner's Point (950%), Chula Vista (250%), Delta Beach (36%), and Tijuana River (31%). The only major decline occurred at Point Mugu, whose absent pairs might well account for the population increases witnessed at Ormond Beach and Santa Clara River. Abandonment of Buena Vista Lagoon was perhaps related to the presence of large numbers of roosting birds (domestic geese, American White Pelicans) on the nesting island, while the abandonment of Lindbergh Field may be attributable to the presence there of a Peregrine Falcon.

Fledging Success - Between 1487 and 1676 young were fledged in 1990 (Table 1), making this the most productive year on record. Assuming a middle value of 1581 ($(1487 + 1676)/2$), production of fledglings was 1.40 times higher than in the most recent "good year" (1988; 1130) and 2.07 times higher than production in the recent "bad year" (1989, 764). The ratio of fledglings:breeding pairs was 0.93, virtually identical to the highest value previously recorded (1986; 0.94). Gross productivity was highest in the two southern clusters (Los Angeles/Orange 730; San Diego 672), intermediate in the northern cluster (San Francisco/Alameda 104) and the middle cluster (Ventura 64), and lowest in the remaining cluster (San Luis Obispo/Santa Barbara 10). The ratio of fledglings:breeding pairs was high in the Los Angeles/Orange (1.07), San Francisco/Alameda (0.95), and San Diego (0.84) clusters, average in the Ventura (0.79) cluster, but very low in the San Luis Obispo/Santa Barbara cluster (0.22). The low ratio reported for the San Luis Obispo/Santa Barbara cluster was due, in part, to the inability to locate the roosting flock of fledglings and adults at the largest colony, Mussel Rock Dunes. Outstanding productivity (> 1.0 fledgling/pair) at individual colonies was widespread, being

reported from NAS Alameda, Santa Clara River, Venice, Seal Beach NWR, Upper Newport Bay, White Beach, Santa Margarita River, Mariner's Point, and Delta Beach.

Breeding Chronology - As in years past, Least Terns arrived at most sites either during the last week of April or during the first week of May (Table 3). First eggs were discovered by the end of April in at least two colonies (Venice, Bolsa Chica), and at five more by the end of the first week of May, giving the 1990 breeding season a relatively early start. First fledglings were reported on June 5 (Seal Beach NWR) and on June 13 (Bolsa Chica). Departures varied widely between colonies, ranging from early July to mid-September.

Clutch Size - Although data were not available from all colonies throughout California, clutch size appeared to be high throughout the State (Table 4). Including both first and second wave clutches, mean clutch size was 1.94 eggs/clutch. For each of the 11 colonies for which data could be compared between 1989 and 1990, clutch size averaged higher in 1990 than in 1989.

Predation - Despite the widespread productivity, mortality and desertion caused by predation continued to be a problem at most colonies in the state (Table 5). Most often, predation took the form of sudden and mysterious disappearances of eggs/chicks without unequivocal documentation of the predator involved. Most of the documented predators were diurnal, avian species. Northern Harrier was a predator at Tijuana River and Chula Vista WR. American Kestrels took chicks at NAS Alameda and Huntington Beach, and were suspected predators at several sites in San Diego County. Peregrine Falcons took an adult at FAA Island and were implicated in desertions at NAS Alameda and Lindbergh Field. A pair of Burrowing Owls preyed on chicks and caused desertions at NAS Alameda. Gulls (spp?) took eggs at FAA Island. Common Raven was a documented nest predator at Santa Margarita River and Tijuana River and was a suspected predator at Point Mugu and Ormond Beach. American Crows were not reported as predators in 1990. A Loggerhead Shrike attempted unsuccessfully to take a chick at Mariner's Point and the species was a suspected predator at PG&E Pittsburg, Batiquitos Lagoon, and FAA Island. Western Meadowlarks destroyed one nest at Chula Vista and 22 nests at Bolsa Chica.

Among mammals, a cat at Venice (eventually trapped) and Red Fox at Oakland Airport were the only documented predators. Cats were also present and regarded as potential predators at other sites (NAS Alameda, Terminal Island). Fox control measures appear to have been largely effective in 1990, although Red Foxes were mentioned as possibly disruptive at Terminal Island and Point Mugu. Pre-season removal of Red Foxes at Bolsa Chica prevented losses there and continuing removal at Seal Beach NWR has been effective. Other likely mammalian predators included Coyotes (Pismo Dunes, Purisma Point), Long-tailed Weasel (Santa Margarita River), and rats (Terminal Island, Mariner's Point).

Ants caused serious egg and chick mortality at FAA Island, but were controlled by application of formicides.

Other Sources of Disturbance - Despite monitoring and posting of colonies, disturbance resulting from human intrusion into colonies remained a problem at many sites on public lands (Table 6). Pedestrians, vehicles, and pets disturbed terns at at least 10 sites. Human disturbance was regarded by monitors as an important factor contributing to failure of pairs at Pismo Dunes, Mussel Rock Dunes, Santa Clara River, Ormond Beach, Batiquitos Lagoon, and Tijuana River.

The presence of roosting birds was noted as a factor at Bolsa Chica where larger tern species and Black Skimmers excluded Least Terns from nesting on the northern island, at Buena Vista Lagoon where domestic geese, gulls, and American White Pelicans may have discouraged terns from nesting, and at Lindbergh Field where a resident Peregrine Falcon may have discouraged nesting. Tidal flooding caused problems at Point Mugu and rain flooded nests at Santa Margarita River.

DISCUSSION

The remarkable increase in the breeding population and the excellent productivity during 1990 are not likely to be artifacts of increased effort or expertise, since the monitoring effort (and in most cases, the individual monitors) remained constant. Rather, they appear to represent a genuine surge in population size and reproductive output.

The widespread increase in population was probably related to two factors. First, 1988 was a year of high productivity (1130 fledglings) and many two-year old birds from that 1988 cohort may have entered the breeding population in 1990. Second, the early laying and large clutch size together suggest that 1990 may have been a good food year, and this may have encouraged participation by adults that did not breed during the relatively poor 1989 season. The high number of young fledged in 1990 was a consequence of the high number of breeders, but also the relatively high success of those pairs at many colonies. Their success may, in turn, have been influenced by availability of prey, but it was also related to enhanced protection at many sites. For example, ground predators and human disturbance have been controlled by fencing at many colonies, and aggressive, pre-season predator control was of great value at the State's largest colony, Santa Margarita River, also at Seal Beach NWR and Bolsa Chica. The importance of swift predator removal during the season was also evidenced at several other colonies. Early identification and removal of documented predators at NAS Alameda (Burrowing Owls, American Kestrel), Venice (cat), Bolsa Chica (meadowlark), and FAA Island (ants) permitted these colonies to recuperate from early losses and - in all cases - finish the season with high success.

Despite the high productivity in 1990, much room for concern remains. Nearly two-thirds of the State's production of fledglings was concentrated in just six colonies (Santa Margarita River, Venice Beach, Bolsa Chica, Seal Beach NWR, FAA Island, and NAS Alameda). This leaves future productivity vulnerable to point threats such as local predators and oil spills. In fact, the 1990 success of four of these six colonies would have been seriously compromised by local predators had they not been recognized early and removed in time for recovery to ensue.

RECOMMENDATIONS

Colony Sites - With the statewide population increasing, the creation of new sites and development of existing sites must be considered a high priority. Attempts to create new sites have met with mixed success in San Diego County, where many existing "potential" sites have gone unused. In Los Angeles/Orange Counties, where the Least Tern population has increased greatly, new sites are especially needed. An attempt to establish new sites in Los Angeles County will be undertaken in 1991 and 1992 (B. Obst, P. Baird). A new site across (south side) the San Gabriel River from the existing Huntington Beach colony is scheduled will be added in 1991. Continual enhancement of least tern sites is an important priority, in addition to site preparation prior to nest initiation. In Ventura County,

Ormond Beach appears to have excellent potential for sustaining a large and successful colony, and this potential will be developed in 1991 with community support along the model of the Santa Clara River site. Increased protection from human disturbance will be needed to fully develop the potential of colonies in San Luis Obispo and Santa Barbara Counties, where numbers and breeding success have traditionally been low.

Monitoring - Monitoring must continue at all sites at at least the 1990 level. A wide disparity in monitoring effort currently exists between colonies within the State (Table 7), and this translates into a disparity in colony protection and reproductive success. Colonies with only weekly monitoring appear to be more likely to fail than those with daily monitoring and they often fail without a clear identification of the problem, thereby precluding any constructive intervention. In practice, decreased funding will prevent any real increase in monitoring effort for 1991; expansion of the Monitoring Program's success will require innovative development of new funding sources and/or volunteer involvement of the sort already in effect at Santa Clara River.

The need for increased standardization of methodology should be addressed in 1991. Estimates of population size and fledging success are dependent upon the method used to make the estimates, and these appear to vary slightly from site to site. Disparate monitoring levels will continue to prevent data gathered from all colonies to be of equal quality; however, a standardized monitoring form (B. Obst) complete with a glossary of terms (K. Keane), and recommendations for conducting fledgling counts (B. Massey) should be distributed to all monitors prior to the beginning of 1991 breeding season.

Predator Control - Predator control should continue at all sites. Early detection and exclusion/removal of predators is clearly linked to fledging success. Only rare colonies seem to succeed without intervention (e.g., Upper Newport Bay) and even then, perhaps only temporarily (e.g., Point Mugu). Fenced enclosures have proved to be effective at excluding or deterring ground predators and, where feasible, may be management option. Increased involvement by Animal Damage Control (ADC) to remove specific, documented predators is also warranted. A stable funding base to cover such contingencies should be sought.

Although our ability to recognize and deal with predators has evolved greatly over the past several years, many field monitors remain frustrated by the emphasis on "crisis management", i.e., removal of predators only after damage has been done. This policy impacts not only the breeding success of the Least Terns but also the morale of the program participants. However, the alternative approach, wholesale removal of all potential predators prior to the season's onset, collides with broader goals of managing coastal wetlands to retain some semblance of their natural biodiversity. The conflict is especially clear in the case of controlling native raptors which may be serious Least Tern predators but are themselves rare (Burrowing Owl, Northern Harrier) or listed as Endangered (Peregrine Falcon). Intense predator management at key sites with proven fledging potential (e.g., FAA Island, Santa Margarita River, Venice, Bolsa Chica, NAS Alameda, Seal Beach NWR, and others) coupled with spot removal of problem animals at other sites may ultimately be the best approach. The pre-season removal of exotic predators should continue. The need for explicit policies regarding predator management is now critical to ensure both the continued success of the terns and the health of the protection program.

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TABLE 1 - CALIFORNIA LEAST TERN COLONY SIZE AND FLEDGING SUCCESS, 1990.

COLONY	PAIRS	FLEDGLINGS
S.F. BAY AREA		
P.G.E., Pittsburg	3	0
Port Chicago	0	0
NAS Alameda	99	101-108
Oakland Airport	6	0
Tern Isl., Hayward	1	0
S.L.O./S.B. CO.s		
Mussel Rock Dunes (Guadalupe)	32	7
Pismo Dunes	4	0
San Antonio Creek	1	0
Purisma Point	9	3
Santa Ynez River	0	0
VENTURA CO.		
Santa Clara River	27	34
Ormond Beach	42	30
Point Mugu	12	0
L.A./ORANGE CO.s		
Venice Beach	206	279
Terminal Island	32	12
Seal Beach NWR (Anaheim Bay)	102	136-157
Bolsa Chica, so. isl.	217	180-200
Huntington Beach	46	18
U. Newport Bay	70	85
SAN DIEGO CO.		
White Beach	20	21
Santa Margarita		
north beach	244	230-280
salt flats	24	19-24
salt flats isl.	25	26-31
Buena Vista Lag.	0	0
Batiquitos Lagoon	27	26
San Elijo Lagoon	11	3
FAA Island	177	120-150
Nav. Training Ctr.	0	0
Mariner's Point	19	33-40
Crown Point	0	0
South Shores	0	0
Stoney Point	0	0
North Fiesta Island	0	0
Lindbergh Field	0	0
Chula Vista Rsv.	70	26-38
D Street	0	0
North Island NAS	38	20-25
Saltworks	25	8-12
Delta Beach	45	54
Tijuana River	72	16-39
TOTAL 1990	1706	1487-1676
1989-	1240	764
1988-	1253	1130

TABLE 2 - CALIFORNIA LEAST TERN CLUSTER SIZE AND FLEDGING SUCCESS, 1990

CLUSTER	PAIRS	FLEDGLINGS		RATIO (FLEDG:PRS)	
		Range	Middle		
SAN FRANCISCO/ ALAMEDA	109	101-108	[104]	0.94	
SAN LUIS OBISPO/ SANTA BARBARA	46	10	[10]	0.22	
VENTURA	81	64	[64]	0.79	
LOS ANGELES/ ORANGE	673	710-751	[730]	1.09	
SAN DIEGO	797	602-743	[672]	0.84	
TOTAL	1706	1487-1676	[1581]	0.94	

TABLE 3 - CHRONOLOGY OF CALIFORNIA LEAST TERN BREEDING EFFORT, 1990.

	ACTIVITY PERIOD		DATE OF FIRST:		
	START	END	EGG	CHICK	FLEDGLING
COLONY					
S.F. BAY AREA					
P.G.E., Pittsburg	1-May	10-Aug	15-May	6-Jun	24-Jul
NAS Alameda	26-Apr	16-Aug	1-May	1-Jun	15-Jun
Oakland Airport	3-May	25-Jul	20-May	19-Jun	non
S.L.O./S.B. CO.s					
Mussel Rock Dunes	30-Apr	3-Aug	15-May	14-Jun	unknown
Pismo Dunes	1-Jul	29-Jul	20-Jul	25-Jul	19-Jul
San Antonio Creek	24-Apr	15-Jul	29-Jul	none	none
Purisma Point	28-Apr	15-Jul	21-May	8-Jun	8-Jul
VENTURA COUNTY					
Santa Clara River	5-May	21-Aug	6-Jun	3-Jul	14-Jul
Ormond Beach	11-Jun	14-Sep	11-Jun	28-Jun	3-Jul
L.A./ORANGE CO.s					
Venice Beach	18-Apr	unknown	30-Apr	21-May	17-Jun
Terminal Island	6-May	25-Jul	11-May	2-Jul	25-Jul
Seal Beach NWR	5-Apr	27-Jul	2-May	26-May	5-Jun
Boisa Chica	29-Apr	25-Jul	29-Apr	21-May	13-Jun
Huntington Beach	2-May	23-Jul	8-May	30-May	1-Jul
U. Newport Bay	2-May	25-Jul	6-May	28-May	20-Jun
SAN DIEGO CO.					
White Beach	8-May	unknown	8-May	unknown	unknown
Sta. Margarita R.	2-May	13-Aug	2-May	24-May	17-Jun
Batiquitos Lagoon	23-Apr	19-Aug	5-May	10-Jun	24-Jun
San Elijo Lagoon	26-Apr	5-Jul	13-May	7-Jun	30-Jun
FAA Island	28-Apr	19-Aug	5-May	10-Jun	24-Jun
Mariner's Point	2-May	1-Aug	1-May	21-May	19-Jun
Chula Vista Rsv.	6-May	24-Aug	13-May	13-Jun	4-Jul
Saltworks	10-May	17-Aug	10-May	5-Jun	24-Jul
Tijuana River	24-Apr	31-Jul	8-May	5-Jun	10-Jul

TABLE 4 - CLUTCH SIZE OF CALIFORNIA LEAST TERNS, 1990.

	NUMBER OF CLUTCHES			CLUTCH SIZE	
	1 EGG	2 EGGS	3 EGGS	MEAN	S.D.
COLONY					
S.F. BAY AREA					
P.G.E., Pittsburg	1	3	1	2	0.71
NAS Alameda	9	90	15	2.1	0.45
S.L.O./S.B. CO.s					
Mussel Rock Dunes	1	26	4	2.1	0.4
Pismo Dunes	0	3	0	2	0
San Antonio Creek	0	1	0	2	0
Purisma Point	0	9	0	2	0
VENTURA COUNTY					
Santa Clara River	5	17	1	1.83	0.49
Ormond Beach	5	14	2	1.86	0.57
L.A./ORANGE CO.s					
Venice Beach	24	198	20	1.98	0.43
Terminal Island	2	5	2	2	0.71
Seal Beach NWR	9	81	9	2	0.43
Bolsa Chica(north)	38	193	8	1.87	0.42
Huntington Beach	4	33	9	2.11	0.53
SAN DIEGO CO.					
Sta. Margarita R.	42	297	40	2	0.47
FAA Island	25	159	4	1.89	0.38
Mariner's Point	11	25	3	1.8	0.57
Chula Vista Rsv.	15	66	2	1.84	0.43
Saltworks	6	28	1	1.86	0.43
Tijuana River	18	76	2	1.83	0.43
TOTAL	215	1324	123	1.94	0.44

TABLE 5 - DOCUMENTED AND SUSPECTED PREDATORS AT CALIFORNIA LEAST TERN COLONIES, 1990.

COLONY	DOCUMENTED PREDATOR		SUSPECTED PREDATOR	
	Avian	Mammalian	Avian	Mammalian
S.F. BAY AREA				
P.G.E., Pittsburg			L	
Port Chicago				
NAS Alameda	K,S		P	D
Oakland Airport		F	H,K,R	
S.L.O./S.B. CO.s				
Mussel Rock Dunes				
Pismo Dunes				C
San Antonio Creek				
Purisma Point				C
Santa Ynez River				
VENTURA CO.				
Santa Clara River				
Ormond Beach			R	N
Point Mugu			R	F
L.A./ORANGE CO.s				
Venice Beach		D		
Terminal Island				T,F,D
Seal Beach NWR				D
Bolsa Chica(north)				
(south island)	M			
Huntington Beach	K			
U. Newport Bay				
SAN DIEGO CO.				
Sta. Margarita R.	R			W
Buena Vista Lag.				
Batiquitos Lagoon			K,L	A
San Elijo Lagoon			G,B,R	A
FAA Island	M,G,P		O,K,L	
Nav. Training Ctr.				
Mariner's Point			L	T
Delta Beach	Y		K,H	
Lindbergh Field			P	D
Chula Vista Rsv.	H,M			
D Street				
North Island NAS			K	
Saltworks				
Tijuana River	R,H,M			
Crown Point				
South Shores				

Abbreviations: A -Raccoon, B- Great Blue Heron, C-Coyote, D-Cat, F - Red Fox, G - gull, H-Northern Harrier, K- American Kestrel, L- Loggerhead Shrike, M-Western Meadowlark, N - canine sp?, O - owl sp?, P - Peregrine Falcon, R - Common Raven, S - Burrowing Owl, T - rat, W-Long-tailed Weasel, Y - Red-tailed Hawk

TABLE 6 - SOURCES OF DISTURBANCE AT CALIFORNIA LEAST TERN COLONIES, 1990.

COLONY	DISTURBANCE FACTOR		
	Human	Animal	Other
S.F. BAY AREA			
P.G.E., Pittsburg			
Port Chicago			
NAS Alameda	A		F
Oakland Airport			
S.L.O./S.B. CO.s			
Guadalupe Dunes	P		
Pismo Dunes	V		
San Antonio Creek			
Purisma Point			
Santa Ynez River			
VENTURA CO.			
Santa Clara River	P		
Ormond Beach	P,V	D	
Point Mugu			F
L.A./ORANGE CO.s			
Venice Beach			
Terminal Island			
Seal Beach NWR			L
Bolsa Chica(north)		B	
(south island)			
Huntington Beach	C		
U. Newport Bay			
SAN DIEGO CO.			
Sta. Margarita R.	A,V		F
Buena Vista Lag.		B	
Batiquitos Lagoon	P,V	D	
San Elijo Lagoon	P		
FAA Island		B	
Nav. Training Ctr.			
Mariner's Point			
Crown Point	P,C	D	
South Shores	V		
North Fiesta Isl.	P	D	
Stoney Point		B	
Delta Beach			
Lindbergh Field		B	
Chula Vista Rsv.			
D Street			
North Island NAS			
Saltworks			
Tijuana River	P,V	H	

Abbreviations : A - aircraft, B - roosting birds, C - construction, D - dogs, F - flooding, H - horses, L - fishing line, P - pedestrians, V - vehicles.

TABLE 7 - MONITORING EFFORT AT CALIFORNIA LEAST TERN COLONIES, 1990.

COLONY	PRIMARY MONITOR	NUMBER OF VISITS
S.F. BAY AREA		
P.G.E., Pittsburg	L.Collins	17
Port Chicago		
NAS Alameda	L.Collins	119
Oakland Airport	L.Feeney	101
S.L.O./S.B. CO.s		
Mussel Rock Dunes	P.Persons	47
Pismo Dunes	J.Dougherty	11
San Antonio Creek	J.Dougherty	10
Purisma Point	J.Dougherty	26
Santa Ynez River	S.Schweiger	31
VENTURA CO.		
Santa Clara River	D.Davis	61
Ormond Beach	D.Schafer	27
Point Mugu	T.Keeney	unknown
L.A./ORANGE CO.s		
Venice Beach	L.Massey	104
Terminal Island	W.Schew	19
Seal Beach NWR	M.Silbernagle	37
Bolsa Chica	W.Schew	13
Huntington Beach	W.Schew	15
U. Newport Bay	W.Schew	18
SAN DIEGO CO.		
Sta. Margarita R.	L.Belluomini	50
Buena Vista Lag.	J.Konecny	10
Batiquitos Lagoon	J.Konecny	12
San Elijo Lagoon	R.Patton	14
FAA Island	J.Price	49
Nav. Training Ctr.	E.Copper	unknown
Mariner's Point	L.Patla	25
Crown Point	L.Patla	20
South Shores	L.Patla	17
North Fiesta Isl.	L.Patla	17
Stoney Point	L.Patla	17
Delta Beach	E.Copper	unknown
Lindbergh Field	E.Copper	16
Chula Vista Rsv.	D.Stadtlander	19
D Street	D.Stadtlander	unknown
North Island NAS	E.Copper	unknown
Saltworks	J.Price	18
Tijuana River	R.Patton	32