State of California
The Resources Agency
Department of Fish and Game
Wildlife Management Division

LIGHT-FOOTED CLAPPER RAIL MANAGEMENT AND POPULATION ASSESSMENT, 1997

by

Richard Zembal, Susan M. Hoffman, and Dr. John R. Bradley

Bird and Mammal Conservation Program Report, 98-01

FINAL REPORT TO

California Department of Fish and Game
1416 Ninth Street
Sacramento, CA 95814

CONTRACT FG6098-01 WM (FY 96/97)

Partially Supported by Section 6 Federal Grant-in-Aid
Funding for Endangered Species, California, EW96, VIII-l

LIGHT-FOOTED CLAPPER RAIL MANAGEMENT AND POPULATION ASSESSMENT, 1997

CONTRACTOR

California State University, Long Beach Foundation
Long Beach, CA 90840

PROJECT ADMINISTRATOR

Dr. Charles T. Collins
Department of Biological Sciences
California State University
Long Beach, CA 90840

PRINCIPAL INVESTIGATOR

Richard Zembal
Research Associate

AUTHORS

Richard Zembal
Susan M. Hoffman
Dr. John R. Bradley

1998

LIGHT-FOOTED CLAPPER RAIL MANAGEMENT AND POPULATION ASSESSMENT, 1997

by

Richard Zembal, Susan M. Hoffman, and John R. Bradley

Research Associates, Department of Biological Sciences
California State University
Long Beach, CA 90840

ABSTRACT

The eighteenth consecutive annual census of the endangered light-footed clapper rail (Rallus lonsirostris levipes) population was conducted by call counts throughout the bird's range in California, 4 March - 1 May 1997. There were 307 pairs of clapper rails exhibiting breeding behavior in 16 marshes, a 5.5% decrease from the 1996 population estimate. However, this was the second highest count since annual surveys began in 1980. One hundred and forty-nine pairs, or 48.5% of the State total, were detected at Upper Newport Bay. The subpopulations in the Tijuana Marsh National Wildlife Refuge (NWR), Seal Beach NWR, and Upper Newport Bay Ecological Reserve totalled 263 pairs, or 85.7% of the California population. The other subpopulations are small and in serious jeopardy that could be counteracted with increased management and the provision of additional habitat.

A high tide count on the Seal Beach NWR in October 1997 resulted in the sighting of 40 clapper rails. The tide was as high as ever observed during winter counts over the past 20 years but the count was low. Effective control of nonnative red foxes (Vulpes) and other management measures resulted in encouraging expansion of this subpopulation in the mid-199Os, but it has declined since then, by 29% between 1996 and 1997. In contrast, the clapper rails in Tijuana Marsh NWR are maintaining a recent high population level, as evidenced by a count of 98 during a November high tide.

Ten trapping sessions at Upper Newport Bay with 14 - 19 drop-door traps and 496 trap-hours, resulted in the capture and unique color-banding of nine more clapper rails and two recaptures of previously banded rails. There were 78 resightings of seven banded rails in 1997. The average movement detected of these rails was 67 m. The largest spread of detection points for any rail was 300 m. The longest time span between banding and resighting of any one of the 219 rails banded since March 1981 has been 61.9 months. One of the seven resighted rails was banded in 1994, two were banded in 1996, and four were banded in 1997. Banding success over the 16 years of banding is compared, and resightings of banded rails are summarized for the period 1981 - 1996. Nearly half, 46.7%, of the 210 rails banded during this period were reencountered, and 12.7% of the 204 rails captured in drop-door traps were recaptured in them 1 hour to 48.3 months later.

Thirty-six clapper rail nests were found on the 125 rafts made available in the Seal Beach NWR. Twenty-five of the nests held 26 clutches of eggs and there were at least 27 additional brood nests. Hatching success was 88% for initial attempts and 100% for one renest. The 15 nesting rafts deployed at the Kendall-Frost Reserve contained five clapper rail nests and one clutch of eggs, which hatched successfully. However, there is continuing evidence that predation is a major problem at Kendall-Frost.

Two of the 24 rafts placed in the Sweetwater Marsh NWR held clapper rail nests. One of these was an incubation nest first, which hatched successfully. The other was a brood nest. None of the rafts on Middle Island in Upper Newport Bay, in Bolsa Chica, or in Carpinteria Marsh, supported clapper rail nests in 1997. However, one of the rafts in Carpinteria Marsh held evidence of chicks being fed upon it.

Raptor watches at Upper Newport Bay and the Seal Beach NWR quantified bird of prey activity and interactions with marsh birds. Activities and abundance of 12 species were summarized for 10 winter sessions, five at each study site. The abundance of red-tailed hawks was noted on the Seal Beach NWR with 19 distinct individuals within attack distance of the Refuge on one of the survey visits.

Zembal, R., S. Hoffman, and J. Bradley. 1998. Light-footed clapper rail management and population assessment, 1997. Calif. Dep. Fish and Game, Wildl. Manage. Div., Bird and Mammal Conservation Program Rep. 98-01. 23 PP.

INTRODUCTION

Loss and degradation of southern California salt marshes has greatly reduced the habitat acreage and contiguity of wetlands suitable for light-footed clapper rails (Rallus lonsirostris levipes). Large-scale habitat conversion and degradation led to an increasing rarity in the sightings of clapper rails in coastal southern California. As a result, the light-footed clapper rail was listed as endangered by the Federal Government in 1970 and by the State in 1971.

The light-footed clapper rail is a resident of coastal wetlands in southern California and northern Baja California, Mexico. Although loss and degradation of habitat threaten the continued existence of this subspecies, management efforts and habitat restoration now offer some promise of recovery. The California population of this endangered bird was up to 325 pairs in 1996, the largest number detected breeding in one year since monitoring and study began in 1979. That high was nearly maintained in 1997. Herein are reported the results of the eighteenth year of survey, study, and management efforts.

STUDY AREAS

The marshes occupied recently by light-footed clapper rails were described by the U.S. Fish and Wildlife Service (1985) and Zembal and Massey (1981). The two principal study areas were the Seal Beach National Wildlife Refuge (NWR) and Upper Newport Bay, both in Orange County. The Seal Beach NWR covers 369 ha (911 acres) of the 2,024 ha (5,000 acre) Seal Beach Naval Weapons Station. About 299 ha (739 acres) of the refuge lands are subject to regular inundation by the tides. There are about 229 ha (565 acres) of salt marsh vegetation, 24 ha (60 acres) of mudflats that are exposed daily, and 46 ha (114 acres) of channel and open water. The wetlands are fully tidal, with a range of about -0.5 m (-1.7 ft) to +2.2 m (+7.2 ft) MLLW, and very productive with a high diversity and abundance of wildlife.

Upper Newport Bay is an Ecological Reserve of the California Department of Fish and Game (Department), located approximately 22 km (13.7 mi) downcoast of the Seal Beach NWR. Approximately 304 ha (750 acres) are fully tidal, including 105 ha (260 acres) of marsh. The bay is flanked by bluffs 9 - 18 m (30 - 59 ft) high and surrounded by houses and roads. There are approximately 100 ha (247 acres) of shrublands remaining undeveloped on the edge of the wetlands and two local drainages with some cover along them coursing into the bay.

METHODS

Status and Distribution

Call counts conducted in the spring have been found to produce results comparable to exhaustive nest searches in quantifying the breeding pairs engaged in reproductive activity (Zembal and Massey 1985; Zembal 1993, 1994). The 1997 call counts were conducted in 35 coastal wetlands from March 4 through May 1, from Carpinteria Marsh in Santa Barbara County on the north, to Tijuana Marsh in southern San Diego County.

In the four marshes with abundant clapper rails, mapping spontaneous calls was the prevalent technique. In marshes with few rails and along long, narrow strips of habitat, playbacks of taped "clappering" calls were used sparingly to elicit responses. In a few years at several marshes, and each year at Tijuana Marsh National Wildlife Refuge (NWR), enough observers were stationed to be within potential hearing range of any calling rail over the entire marsh on a single evening. Most of the marshes are surveyed by a single observer visiting discrete patches of habitat on consecutive evenings until all of the habitat has been censused. Most of the observations for all

years were those of three observers, and since 1985, all but a few of the southern San Diego County wetlands were surveyed by Zembal.

Early morning and late evening surveys were comparable, although evening calling by the rails was more intense and often ended with one or more flurries (Zembal et al 1989). Surveys were usually conducted in the 2 hrs before dark, but some were done at first light to about 2 hrs after sunrise.

In mapping the rails, both duet and single "clapperings" were treated as territories. Although no advertising singles are interpreted as discrete territories, a single "clappering" is as good an indicator of a territory as a duet, as long as advertising is not heard later from the same habitat block. Given an entire census period, most pairs eventually duet from territories where single pair members called earlier. However, the fewer rails in a marsh, the more important it is to count only duets as pairs to avoid over-estimation of the breeding subpopulation.

High Tide Counts

There have been counts of clapper rails during extreme high tides on the Seal Beach NWR each fall/winter since 1975. The counts used to involve stationing enough observers around the perimeter of the flooded marsh to sight all of the rails forced from cover by an extremely high tide. More recently, remnant cover is checked mostly from the water by canoe. This has been necessitated partly by the provision of the nesting rafts and their tumbleweeds since 1987. Many of the rails take refuge on the rafts during higher tides and cannot be seen from shore in the dense cover. Nine observers in five canoes covered the 369 ha (911 acre) refuge in about 2 hrs on 17 October 1997. A high tide count was also done in Tijuana Marsh NWR on 14 November 1997.

Banding, Movements, and Observations

There were 10 trapping sessions, 1 September - 1 November 1997, for a total of 496 trap-hours with 13 - 19 drop-door traps. The traps are wire mesh boxes with two doors and a treadle in the center. They are set in tidal creeks and along other trails used by the rails (see Zembal and Massey 1983, for a full discussion of trapping and banding techniques). Trapping was confined, as usual in past years, to the oceanward half of Upper Newport Bay from Shellmaker Island to the Narrows. All of the trapping sessions were accomplished in the 3 hours before dark on evenings with appropriately low tides.

Observations of banded rails were sought on about 40 diffe rent dates. Times, locations, behavior, and association with other rails were noted. Resighting and retrapping data were tabulated to examine movements and survival. Movement distances were calculated from the point of last encounter. The re-encounter data are being analyzed by various methods to examine survival and other parameters for publication.

Nesting Rafts

At the Seal Beach NWR, 125 rafts were available for potential rail nesting in 1997. A description of the raft design is available in earlier reports (Zembal and Massey 1988). The rafts were renovated in February 1997 by replacing damaged dowels and the old tumbleweeds and by adding floats to older rafts. New tumbleweeds were placed with the root stock and thickest branches down to deter perching by large birds. Additional flotation was added to water-logged rafts either in the form of PVC pipe in 3 ft lengths,

plugged at the ends, or 4 in. pool floats. Two pieces of pipe were fastened with nylon cord between the outer and next inner planks, or four pool floats were attached, one in each corner of a raft. Fastening the flotation on the underside keeps the rafts off the saturated substrate during low tide and helps dry the wood out. The rafts were checked only twice during the breeding season, down from eight or more visits in past years, to reduce potential disturbance.

A total of 10 rafts were available in the California Department of Fish and Game's Ecological Reserve at Bolsa Chica; they were checked once. The 15 rafts in the Kendall-Frost Reserve were renovated in February with fresh tumbleweeds, cord, and floats and checked in May and December. Twenty-four rafts were renovated in the Sweetwater Marsh NWR on 25 February 1997 and checked in March and December. Ten rafts were available on Middle Island in Upper Newport Bay by April and checked three times as part of a Master's Project by Susan Hoffman. Lastly, six rafts were placed in Carpinteria Marsh in February and checked in June.

Raptor Monitoring

The Clapper Rail Study Group's winter activities included monthly raptor monitoring, weather permitting. These were attempts to quantify raptor presence and activity at Upper Newport Bay and the Seal Beach NWR. Three stations with 2 - 5 observers per station were spaced along the edge of the bay, whereas it took only two stations to cover the NWR with its flat topography, one each on Nasa and Hog Islands. As many observations as possible were made on number of individuals per species and time engaged in various activities. There were raptor watches on January 12, February 2 and 23, October 26, and November 16 on the Seal Beach NWR; and on January 11, February 1 and 22, and November 1 and 22 at Upper Newport Bay.

RESULTS AND DISCUSSION

Status and Distribution

The breeding behavior exhibited during call counts resulted in a population estimate of 307 pairs of light-footed clapper rails in 16 coastal wetlands in southern California (Table 1). This is the second highest annual population total since 1980 and represents a 5.5% decrease from 1996 (Figure 1). This is the third highest total number of wetlands occupied by clapper rails exhibiting breeding behavior in any year (Figure 1). Thirty-one wetlands in coastal southern California have been occupied by clapper rails during at least one annual survey since 1980 (Figure 2).

Southern California's largest subpopulation of light-footed clapper rails has been singularly resilient since 1980, whereas all of the other subpopulations have exhibited more vulnerability to fluctuations in environmental conditions (Figure 3). The Upper Newport Bay subpopulation has been 38% - 71% of the California total since 1980 and was 48.5% of the total in 1997. It has usually consisted of 100 pairs of rails or more and has recovered quickly the few times that it dropped lower. For example, in 1981 it was at its lowest level, 66 pairs, but recovered to over 100 pairs by the following spring. In 1996, it was as high as ever recorded and that level was nearly maintained in 1997.

In contrast, the second and third largest subpopulations at Tijuana Marsh and Seal Beach NWR have been dramatically affected by major environmental perturbations. At Tijuana Marsh, for example, detectable clapper rail breeding activity was eliminated in 1985, following closure of the ocean inlet and the disappearance of tidal influence. At the Seal Beach

Table 1. Census of the Light-footed Clapper Rail in California, 1980-1997.

Location	Number of Pairs Detected In:									
	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989
Santa Barbara County										
Goleta Slough	0	0	-	0	-	-	-	-	0	0
Carpinteria Marsh	16	14	20	18	26	7	4	5#	2#	0
Ventura County										
Ventura River Mouth	-	-	0	0	-	-	-	-	-	0
Santa Clara River Mouth	-	-	0	-	-	-	-	-	-	0
Mugu Lagoon	-	0	-	1	3	7	6	7#	7#	5
Los Angeles County										
Whittier Narrows Marsh	-	-	-	*	0	-	-	-	-	0
Orange County										
Seal Beach NWR	30	19	28	20	24	11	5	7	14	6#
Bolsa Chica	0	0	0	0	-	-	-	*	0	0*
Huntington Beach Strand	-	0	-	-	-	-	0	0	0	0
Upper Newport Bay	98	66	103	112	112	87	99	119	116	116
San Joaquin Reserve	-	-	5	4	1	2	1	0	0	0
Carlson Rd Marsh	-	-	5	4	2	0	0	1#	0	0
San Diego County										
San Mateo Creek Mouth	-	-	0	0	-	-	0	-	0	0
Las Pulgas Canyon Mouth	-	-	0	0	0	-	-	-	-	0
Las Flores Marsh	-	-	0	0	0	-	0	-	0	0
French Canyon Mouth	-	-	-	0	0	-	-	-	-	0
Cocklebur Canyon Mouth	-	-	1	0	0	-	-	0	0	0
Santa Margarita Lagoon	0	0	2	1	2	1	1	1	1	0
San Luis Rey River Mouth	-	-	0	0	-	-	0	0	0	0
Guajome Lake Marsh	-	-	0	1	2	0	0	0	0	0
Buena Vista Lagoon	0	0	0	*	0	-	-	-	0	0
Agua Hedionda Lagoon	1	2	1	7	6	1	0	0	0	0
Batiquitos Lagoon	0	0	0	0	0	-	-	-	-	0
San Elijo Lagoon	-	5a	4	4	10	1	0	2	5#	7#
San Dieguito Lagoon	-	-	-	-	-	-	-	*	0	0
Los Penasquitos Lagoon	-	0	-	0	0	-	0	-	1a#	0
Kendall-Frost Reserve	18	16	6	20	24	17	12	6a#	4a#	4#
San Diego Riv F. C. C.	-	3	1	2	2	1	0	0	1a#	0#
Paradise Creek Marsh	1	2	3	1	1	0	0	0	0	0
Sweetwater Marsh	4	5	7	6	14	3	9	5a#	5	5#
E Street Marsh	3	1	3	3	2	2	2	0a	1#	0
F Street Marsh	-	1	1	0	1	0	0	0	0	0
J Street Marsh	-	1	0	0	-	-	0	0	0	0
Otay River Mouth	3	4	5	3	5	1	1	0	0	0
South Bay Marine Reserve	3	3	1	1	2	1	1a	2#	5	5#
Dairymart Ponds	-	-	-	-	-	-	0	*	1a	0#
Tijuana Marsh NWR	26	31	25	41	38	0	2	23a#	14a#	15a#
Total: pairs	203	173	221	249	277	142	143	178	177	163
marshes	11	15	18	18	19	14	12	11	14	8

- indicates that no census was taken.
* indicates a fall or winter occurrence
# indicates the detection of unpaired rails (used beginning in 1987).
a Data are from Paul Jorgensen's field notes.

Table 1. Census of the Light-footed Clapper Rail in California, 1980 - 1997 (Continued).

Location	Number of Pairs Detected In:							
	1990	1991	1992	1993	1994	1995	1996	1997
Santa Barbara County								
Goleta Slough	0	0	0	0	-	-	0	0
Carpinteria Marsh	0	0	0	0#	0	2#	3#	5#
Ventura County								
Ventura River Mouth	0	0	0	0	0	0	0	-
Santa Clara River Mouth	0	0	0	0	0	0	0	-
Mugu Lagoon	6#	4#	5#	5	6#	5#	3#	4#
Los Angeles County								
Whittier Narrows Marsh	-	-	-	0	0	-	0	0
Orange County								
Seal Beach NWR	16	28	36	65	66	51#	52#	37#
Bolsa Chica	0#	0*	0#	0#	0*	0*	0*	0*
Huntington Beach Strand	0	0	0	0	0	0	0	0
Upper Newport Bay	131	128	136	142	129	117	158	149#
San Joaquin Reserve	0	0	0#	0	0	0	0	0
Carlson Rd Marsh	0	0	0	0	0	0	0	0
San Diego County								
San Mateo Creek Mouth	0	0	0	0	0	0	0	-
Las Flores Marsh	0	0	0	0	0	0	0	-
Cocklebur Canyon Mouth	0	0	0	0	0	0	0	0
Santa Margarita Lagoon	0	0	0	0#	0	0	0	0#
San Luis Rey River Mouth	0#	0	1	0	-	0	0	0
Guajome Lake Marsh	0	0	0	0	-	0	0	0
Buena Vista Lagoon	0a#	2#	5	2#	3#	1#	6#	7#
Agua Hedionda Lagoon	0	0	0	0	0	0	0	1?
Batiquitos Lagoon	0#	0#	0	1#	1#	0#	2	2
San Elijo Lagoon	5#	5	4#	6#	1#	3#	3#	8
San Dieguito Lagoon	0	0	0	0	0	0	0	0
Los Penasquitos Lagoon	0	0#	0#	0#	1	1	1	2
Kendall-Frost Reserve	5#	9	11	5#	5#	4#	1#	2
San Diego Riv F. C. C.	2	5	1a	5	5#	6b	5	5#
Paradise Creek Marsh	0	0	1a	0a	0	1	2	0
Sweetwater Marsh	2#	4a	4a	3a	7#	7	8	3#
E Street Marsh	0	1a	1a	1	0#	2	1	1
F Street Marsh	0	0	0	0	0	0	0	0
J Street Marsh	0	0	0	0	0	0	0	0
Otay River Mouth	0	0	0	0	0	1	3	3
South Bay Marine Reserve	5	2	3a	1	0	0	0	1#
Dairymart Ponds	0a#	0#?	0#	1a	0	-	-	-
Tijuana Marsh NWR	17a#	47a	67a	63a	64	61	77	77#
Total: pairs	189	235	275	300	288	262	325	307
marshes	9	11	13	13	11	14	15	16

- indicates that no census was taken.
* indicates a fall or winter occurrence.
# indicates the detection of unpaired rails (used beginning in 1987).
a Paul Jorgensen Unpublished data; b 2 pairs are in Famosa Slough.

CENSUS OF THE LIGHT-FOOTED CLAPPER RAIL IN CALIFORNIA, 1980 - 1997

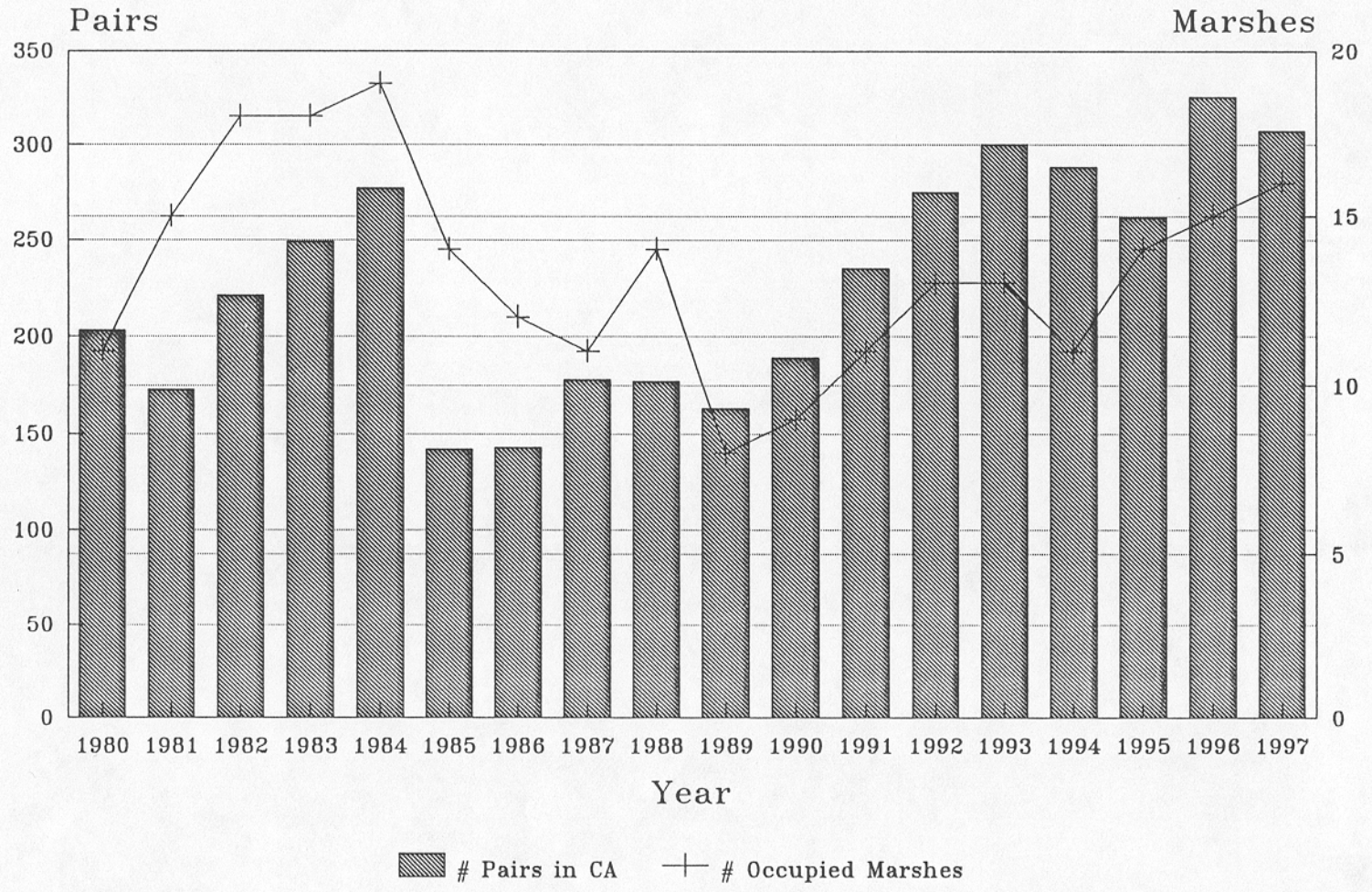
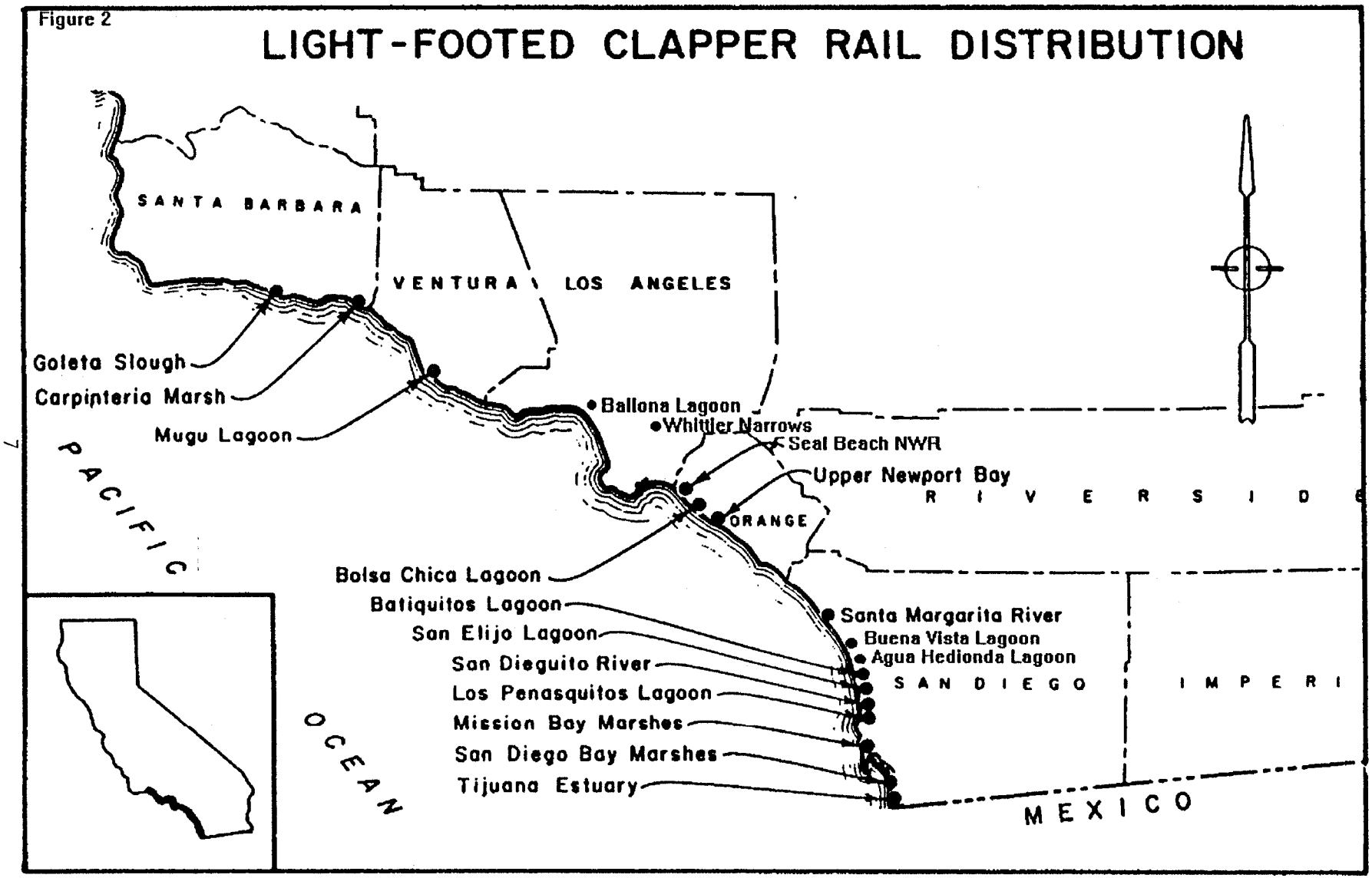


FIGURE 1.

Figure 2


LIGHT-FOOTED CLAPPER RAIL DISTRIBUTION
SANTA BARBARA
VENTURA
LOS ANGELES
ORANGE
RIVERSIDE
SAN DIEGO
IMPERI
Goleta Slough
Carpinteria Marsh
Mugu Lagoon
Ballona Lagoon
Whittier Narrows
Seal Beach NWR
Upper Newport Bay
Bolsa Chica Lagoon
Batiquitos Lagoon
San Elijo Lagoon
San Dieguito River
Los Penasquitos Lagoon
Mission Bay Marshes
San Diego Bay Marshes
Tijuana Estuary
Santa Margarita River
Buena Vista Lagoon
Agua Hedionda Lagoon
PACIFIC
OCEAN
MEXICO

THREE MAJOR SUBPOPULATIONS OF LIGHT-FOOTED CLAPPER RAILS

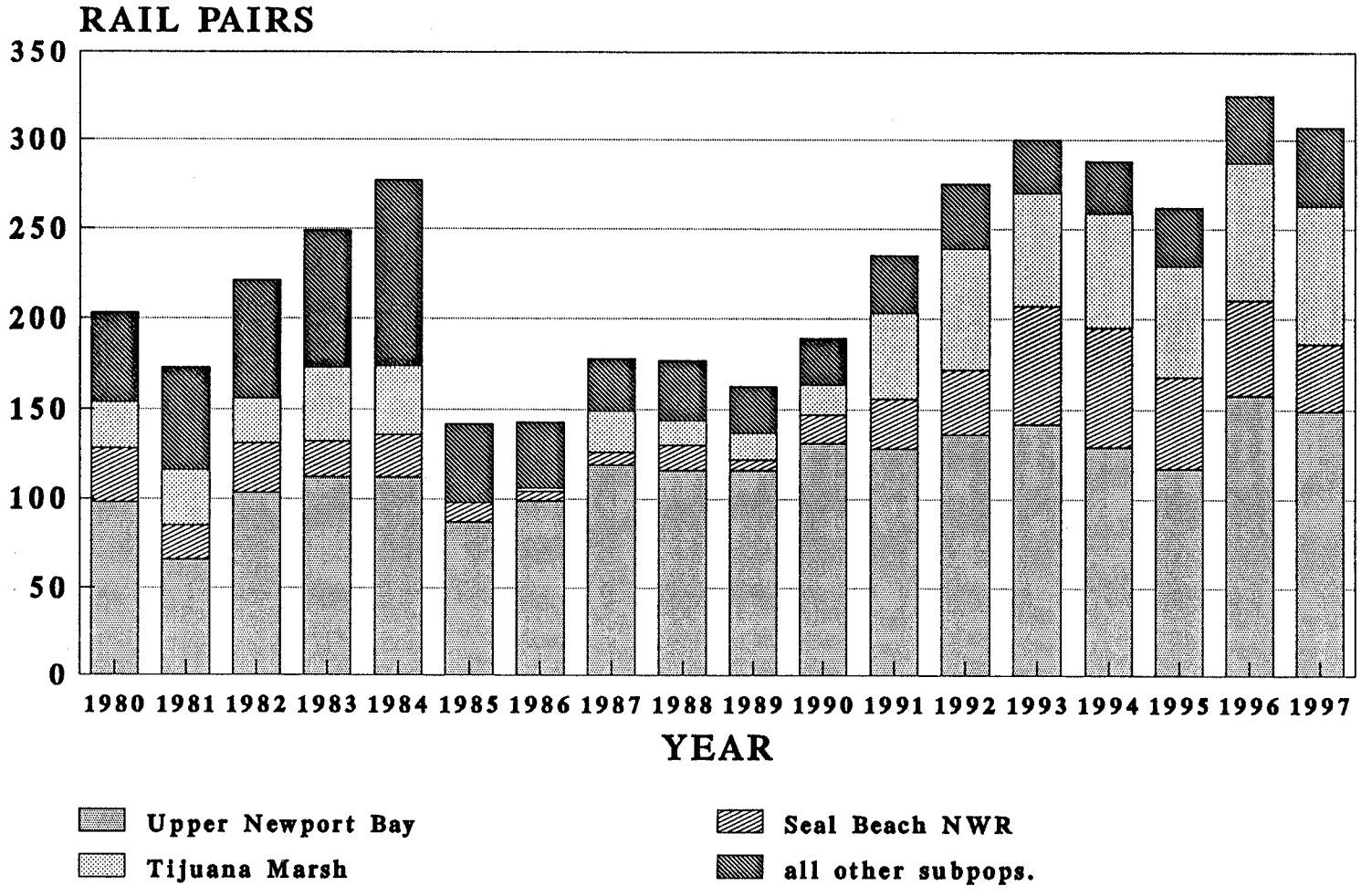


FIGURE 3

NWR, heavy predation ensued over several years as mesopredator release (Soule et al 1988) brought on by the semi-isolation of this wetland (and perhaps human control of selected carnivores) resulted in the disappearance of native top carnivores, particularly the coyote (Canis latrans), and an explosion in a local population of nonnative red foxes (Vulpes vulpes). Clapper rail breeding was nearly eliminated and the subpopulation was reduced to five pairs. Both of these subpopulations have subsequently resurged but only after many years of intensive management. The subpopulation at Tijuana Marsh is holding strongly, whereas at Seal Beach, there were declines of 29% in 1995 and again in 1997.

The three largest subpopulations comprised 85.7% of the breeding clapper rails on the coast of southern California in 1997. All other subpopulations have contributed 10% - 37% of the California total since 1980 (Figure 3). The largest total contribution by all wetlands combined, excluding the top three, was in 1984 when the Carpinteria Marsh and Kendall-Frost Reserve subpopulations were at their known highest with a combined total of 50 pairs of rails, or 18% of the State population. However, both of these subpopulations have crashed since 1984. Kendall-Frost Reserve is one of our smallest rail-inhabited wetlands and is the most isolated, with houses and roads on one side and Mission Bay aquatic recreational activities on the other. Carpinteria Marsh is semi-isolated with ample mesopredators, including red foxes. Detectable clapper rail breeding activity vanished from Carpinteria Marsh in 1989, but reappeared in 1995 following several years of predator control activity.

The smaller subpopulations have fluctuated widely over time. Each is under constant threat of extirpation, whereas with proper monitoring and management any one could become a nucleus for recovery (U.S. Fish and Wildlife Service 1985). The growth and recent maintenance of two subpopulations, in addition to Upper Newport Bay, of greater than 50 pairs is an important advancement for light-footed clapper rail survival. Unfortunately, Seal Beach has fallen below that level. The trend of extreme variability in annual sizes of the small subpopulations and their sporadic disappearance is counterproductive. Their occasional recurrence, as in Carpinteria Marsh in 1995, is perplexing.

There were several interesting recurrences, and other observations of the smaller subpopulations in 1997. Carpintertia is back up to five pairs with some extra males! Clapper rails were detected, probably a pair, in Agua Hedionda Lagoon for the first time since 1985, when the brackish marsh was dewatered and a subpopulation of seven pairs disappeared. There was an advertising female at the mouth of the Santa Margarita River, the first clapper rail detection there in 4 years. This was a year of excess females with 8 of 11 sex-skewed marshes with advertising females. Newport and Tijuana held nine and six single females, respectively, and the San Diego River Flood Control Channel held five lone females along with five pairs. The Buena Vista Lagoon subpopulation included three advertising males and a single female at the time of the census. This undoubtedly resulted in an additional pair there eventually, bringing the total breeders to a high for that marsh of eight pairs. Lastly, the little South Bay Marine Reserve held breeding rails again, a pair and an unmated female, following 4 years of no detected activity.

The growth of the State population since the crash of 1985 has been due to improved conditions and clapper rail numbers in the three largest subpopulations, particularly Upper Newport Bay and Tijuana Marsh (Figure 3). All other subpopulations combined have contributed less than 15% to the annual totals since 1990. Additionally, different marshes were occupied by these small numbers of breeding rails over the years. For example, a total of 31 wetlands have been occupied by breeding clapper rails since 1980, but never more than 19 marshes (8 - 19; $\bar{x}$ = 13.2) were occupied in any one year. However, there does appear to be a positive relationship between the overall

number of clapper rails and number of occupied marshes (Figure 1). This could be explained by regularly occurring tendencies of birds to roam away from home marshes, perhaps largely in first-year rails that are more stimulated with increasing population pressure (see Zembal et al 1985, 1989). Larger numbers of rails in the big subpopulations would result in more roamers and greater use of marginal habitat and irregularly occupied wetlands.

Most of the perturbations that are known to cause problems for clapper rails are not unique to a particular wetland, but the combination of problems at a given wetland confounds dealing with the issues there. However, known major problems should be preventable at each of the managed wetlands. For example, the Seal Beach NWR is not unique in its vulnerability to the effects of isolation. All of our remaining wetlands are now isolated to some degree and will be more so over time, if recent trends continue. The effects of isolation on predator populations are predictable but easily exacerbated by local carnivore management practices. However, knowing this, measures could be taken on the scale necessary to circumvent problems, from the land use planning arena, to the realm of local public relations with regard to pet management.

Conflicts increase with an increased human presence on the edges of the wetlands and the corridors still connecting them, however tenuously, with larger open spaces. The ongoing disappearance of open spaces and fragmentation of the many habitats they comprise, also enhances the chances for local outbreaks of mesopredators. This occurs when source populations of native top carnivores are directly reduced, the directness and viability of access routes and habitat enroute is diminished, established behavioral patterns are interfered with, and the carnivore population balance is effected by more people and pets on habitat edges, accompanied by uses and demands that require a much greater intensity of wildlife management to counter-balance.

The Tijuana Marsh and Seal Beach NWR sagas offer hope for the light-footed clapper rail. The environmental problems affecting the clapper rails and other wildlife at these wetlands were identified and managed effectively by management agencies. This led to subpopulations of over 50 pairs in each, indicating the possibilities elsewhere with appropriate monitoring and management. However, Seal Beach, where the number of rails has recently declined again, also highlights the need for continuing management that is adaptive to changing conditions.

If the recovery of the light-footed clapper rail is ever to be realized, much better care must be taken of each of the subpopulations that exist today. Clapper rails should be translocated to Carpinteria Marsh, and annual predator control, nesting raft deployment, and monitoring should be continued. The contaminant problems in Mugu Lagoon (Ledig 1990) should be specified and alleviated. Full tidal regimes should be restored to the wetlands where feasible, particularly in San Diego County, and management should be implemented and ongoing at each wetland occupied by clapper rails. Finally, clapper rails should be translocated from Upper Newport Bay to the smaller subpopulations where management could reasonably assure that suitable conditions would be sustained. The recommendation for translocations is based upon recent work (Fleischer et al., 1995) that demonstrated the genetic variability in <u>levipes</u> to be depauperate in the small subpopulations.

There are many planned and current coastal wetland restoration projects in southern California. All of them, particularly the ones at Bolsa Chica and Batiquitos Lagoon, present great possibilities for new habitat for the light-footed clapper rail. Wetland restoration is typically a very slow process. However, given enough time and reasonable success, there is likely to be ample habitat to recover this endangered rail some day. A viable, diverse population must be maintained in the meantime.

High Tide Counts

Counting clapper rails during tides of 6.7 ft MLLW, or higher, would be the preferred technique for monitoring the population if this survey method worked effectively at most marshes. High enough tides occur during daylight hours mostly during the fall and winter in southern California. Consequently, where they can be used well, they allow surveys of post-breeding subpopulation levels prior to the onset of the harshest winter conditions. However, few of our marshes can be surveyed well, because most of them provide ample cover to hide the rails even during the highest tides. The Seal Beach NWR is an exception to this general rule, although even there, good cover remains along the edges of the flooded wetland, where rails can hide, leading to variable count results.

The 1997 high tide count in the Seal Beach wetlands was the lowest it has been since the rails began recovering from the red fox onslaught in 1989 (Table 2). The refuge has been managed intensively for the rails through habitat restoration, provision of nesting sites, and predator management. Initially, the rail subpopulation responded with major growth that peaked in 1993 and 1994 at 66 pairs, then dropped to about 50 pairs for two years. The subpopulation declined by 29% this past year and may be even lower now. The local fox population is too small to be the primary suspect in the rails' current decline, and the search is ongoing for causative factors.

Raptor predation in the Seal Beach wetlands is a potentially significant regulator of the rails' numbers, particularly during years of unusual abundance, for example the 1994/1995 winter. The raptor population was well-documented during that winter on the Seal Beach Naval Weapons Station and 220 red-tailed hawks (Buteo jamaicensis) were counted on a single day, 11 December 1994 (Pete Bloom, pers. comm.). This is about twice the number counted during the peak in a normal year. During such times of raptor abundance at Seal Beach, as many as six red-tailed hawks have been observed vying over a single gopher kill. Unusual abundance of raptors could focus higher attention on the marsh and its abundance of bird life.

The rails are most exposed during high tides. We have observed, for example, red-tailed hawks hovering over and around raft tumbleweeds, with clapper rails scurrying within. However, other evidence of raptor predation is meager. Occasionally, clapper rail remains that were typical of raptor kills were discovered on the rafts. The usual few such remains were discovered in 1997. If there were large numbers of rail kills, they were left unobserved in the marsh. Raptor watches have continued at Seal Beach (see below), but no abundant raptor predation evidence was obtained.

The high tide count in Tijuana Marsh yielded one of the highest counts ever obtained there, 98 clapper rails. We suspect that this marsh always has larger numbers of rails than are counted because of the ample cover left to hide rails in, and on the edge of the marsh. This year, nearly all of the cover in the marsh was submerged, resulting in a good count. The unusual extent of inundation was probably attributable to the warm water stacked up against the west coast which boosted high tides by at least 1 foot. For example, at Seal Beach there were sections of roads inundated that we had never been under water before.

Banding, Movements, and Observations

Nine clapper rails were captured and uniquely color-banded in 1997 (Table 3), bringing the total number of light-footed clapper rails banded in Upper Newport Bay since 1981 to 219. One additional rail was captured that was too young to band, and there were two recaptures. Five of the rails

Table 2. High tide and call counts of Clapper Rails on the Seal Beach National Wildlife Refuge, 1975 - 1997.

Date	Tidal Height	Clapper Rails Counted	Call Count[1]	% Diff.	Notes[2]
2 Dec 1975	7.0	22			
31 Dec 1975	6.7	12			
21 Nov 1976	7.1	24			
20 Dec 1976	7.1	35			
21 Dec 1976	7.0	34			
10 Dec 1977	7.1	16			
11 Dec 1977	7.1	40			
18 Jun 1978	6.8	16	42	38%	(1979) +6 youngsters
30 Nov 1978	6.7	38	42	91%	
1 Dec 1978	6.7	32	42	76%	
3 Sep 1979	6.4	20	42	48%	Tide too low
3 Nov 1979	6.6	56	60	93%	(1980)
2 Dec 1979	6.7	32	60	53%	
3 Dec 1979	6.7	44	60	73%	
21 Nov 1980	6.9	55	38	145%	(1981)
29 Jun 1981	7.0	34	38	90%	
12 Nov 1981	6.9	43	56	77%	(1982)
29 Dec 1982	7.0	23	40	58%	(1983)
18 Jan 1984	6.9	23	48	48%	(1984)
21 Nov 1984	6.7	5	22	23%	(1985) + 7 red foxes
13 Nov 1985	7.1	2	10	20%	(1986) + 2 red foxes
12 Dec 1985	7.2	2	10	20%	+ 2 red foxes
30 Dec 1986	7.2	7	14	50%	(1987)
28 Jan 1987	7.0	7	14	50%	
8 Aug 1987	7.3	8	14	57%	Tide too late
22 Nov 1987	6.7	12	28	43%	(1988)
21 Dec 1987	7.0	8	28	29%	+ 2 red foxes
16 Feb 1988	6.8	10	28	36%	
22 Nov 1988	6.9	6	28	21%	
16 Oct 1989	6.9	59	12	492%	(1989) Record Count
5 Oct 1990	6.4	57	32	178%	(1990) Tide too low
2 Nov 1990	6.8	69	32	216%	Record Count
22 Nov 1991	6.9	98	56	175%	(1991) Record High
26 Oct 1992	6.8	159	72	221%	(1992) Record High
15 Oct 1993	6.8	143	130	110%	(1993)
4 Nov 1994	7.0	150	132	114%	(1994)
25 Oct 1995	6.5	53	102	52%	(1995) Tide too low
22 Nov 1995	6.9	55	102	54%	(1995)
10 Dec 1996	6.7	55	104	53%	(1996)
17 Oct 1997	6.6	40	74	54%	(1997)

[1] The call count given is the number of rails documented in the early spring of the year given in parentheses under notes.

[2] The notes, other than the call count year in parentheses, give additional observations made during the high tide count.

Table 3. Clapper Rail trapping effort and success with drop-door traps, 1981 - 1997.

Year	1981	1982	1983	1984	1986	1987
#Trap Sessions	30	14	13	5	10	8
Date Span	3/8-12/19	2/14-l0/16	l/l0-10/21	9/10-l0/25	5/27-11/5	7/14-l0/23
#Traps Used	8	8-14	10-14	14	12-14	13
Total Trap-hrs	937	541	532	182	278	258
#New Captures	20	18	16	9	18	6
New Caps/Session	0.67	1.3	1.2	1.8	1.8	0.75
Trap-hrs/New Cap	47	30	33	20	15	43
#Recaptures	2	1	2	1	7	1
#Recaptured	2	1	2	1	6	1
#No-Cap Sessions	22	5	4	1	0	4
%Sessions w cap	27	64	69	80	100	50

Year	1988	1989	1990	1991	1992	1993
#Trap Sessions	9	9	9	9	10	10
Date Span	9/17-10/30	8/18-10/13	g/11-10/22	8/28-l0/24	7/31-10/12	8/20-10/30
#Traps Used	12-16	14-18	7-8	8-16	15-19	13-19
Total Trap-hrs	349	560	197	374	527	518
#New Captures	6	16a	11	9	28	16
New Caps/Session	0.67	1.8	1.2	1.0	2.8	1.6
Trap-hrs/New Cap	58	35	18	42	19	32
#Recaptures	0	0	0	4	2	1
#Recaptured	0	0	0	4	2	1
#No Cap Sessions	4	1	4	1	0	3
%Sessions w Cap	56	89	56	89	100	70

Year	1994	1995	1996	1997	Cumulative
#Trap Sessions	8	8	8	10	170
Date Span	8/21-10/7	8/11-10/12	8/30-ll/l0	9/l-11/l	
#Traps Used	19	14-19	14-19	13-19	8-19
Total Trap-hrs	342	354	398	496	6,843
#New Captures	8	8	15	9	213a
New Caps/Session	1	1	1.88	0.9	1.25
Trap-hrs/New Cap	43	44	27	55	32
#Recaptures	1	1	4	2	29
#Recaptured	1	1	3	2	27
#No Cap Sessions	2	3	2	4	60
%Sessions w Cap	75	62	75	60	65

a An additional 6 new captures were achieved by boat with dip nets.

captured were probably first-year birds, based on plumage characteristics, particularly the contrast in, and extent of, flank stripping.

This year's trapping success was poor compared with past results, but the inclusion of the captured, unbanded young rail and the recaptures raises the success slightly (Table 3). There were four sessions with no captures and slightly over 1 capture per session, counting recaptures. The two recaptured birds were both banded in 1997.

There were 78 resightings of seven banded clapper rails in 1997. One of the resighted rails was banded in 1994, two were banded in 1996, and four were banded in 1997.

The movements of the resighted rails away from sites of last encounter varied from 0 m to 300 m, and averaged 67 m. These observations are similar to those made in the past. Once established in an area, the usual move detected of a light-footed clapper rail is generally less than a few hundred meters (Zembal et al., 1989). In addition, first-year rails are the ones most likely to make the longer journeys in attempting to establish a home range. For example, the longest move observed in 1997 was of 300 m by rail #836, a first-year bird that was recaptured 1 hr after banding and 300 m away from the banding site.

Rail #830 was mated to rail #831 in 1997. They were observed sharing the duties of raising seven youngsters at Shellmaker Island near Acacia point, with sighting locations that spanned about 280 m. Rail #831 was the female and was observed 30 times, compared with 41 resightings of the male. The average distance between consecutive sightings was similar for both, 62 m and 64 m.

The two recaptures in box traps were both of rails banded in 1997. One was recaptured 1 hr after banding and 300 m away. The other was recaptured at its banding site nearly one month later.

In the 15 years of banding and observing light-footed clapper rails, 1981 - 1996 there was no activity in 1985), 46.7% of the 210 banded rails were re-encountered (Table 4). Over 12% of the 204 clapper rails captured in box traps were recaptured in them 1 hour to 48.3 months later (average time to recapture = 11.4 months). Ninety-eight of the banded rails were re-encountered at least once, 0.1 - 61.9 months later, with an average final re-encounter time of 13.5 months. The final resightings occurred 0 - 2,282 m (excluding the one extreme of 21,700 m) from the banding sites and averaged 167 m.

The time to last encounter of 94 clapper rails (excludes four dead with no other resighting) was less than 1 yr for 56.4% of them. Most of these rails were in their first year of life when banded. Even if the array of re-encounters is skewed by a few months to account for life before banding, it is apparent that light-footed clapper rails are probably not very long-live (Figure 4). Five or 6 yrs of life appears to be quite unusual. Additionally, the average survival of a pair together in a breeding territory is generally less than two full breeding seasons, based on observations of six pairs with both individuals banded, and an average final re-encounter time of less than 1 yr.

Although variable wariness could not be accounted for quantitatively in these observations, there are differences observed in wariness and trap-avoidance among individuals, perhaps due in part to sex or age. The less wary rails are more observable, perhaps more easily trapped, and certainly more prone to predation. Older, warier individuals, and females, could be less easily trapped or observed, and under-represented in our observations and re-encounters.

Table 4. Maximum time and distance between encounters with Light-footed Clapper Rails banded, 1981 - 1996.

Recaptures in box traps. 1981 - 1996.

Band #	Band Date	Retrap Date	Time Span	Distance
401t	3-22-81	11-14-81	7.7 mo	112 m
403	4-04-81	7-10-83	27.2 mo	327 m
406	5-17-81	7-27-83	26.3 mo	212 m
407dt	5-23-81	2-15-82	8.7 mo	5 m
409t	8-06-81	8-20-81	0.5 mo	25 m
428	9-03-82	10-07-83	13.1 mo	130 m
449	8-26-83	10-08-83	1.4 mo	67 m
464	5-27-86	7-29-87	14.1 mo	55 m
465	5-27-86	8-21-86	2.8 mo	105 m
467d	5-27-86	11-05-86	5.4 mo	25 m
470	8-22-86	10-24-86	1.9 mo	85 m
471nr	8-22-86	10-08-86	1.5 mo	15 m
472nr	8-22-86	9-21-86	1 mo	170 m
472		9-21-86	1 hr	0 m
476nr	10-08-86	10-24-86	0.5 mo	60 m
488	9-17-88	9-27-92	48.3 mo	0 m
496	8-20-89	10-24-91	25.9 mo	75 m
612	9-24-89	9-24-91	24 mo	25 m
937	10-20-90	9-27-91	11.2 mo	45 m
941	10-22-90	9-28-91	11.2 mo	25 m
350nr	10-22-91	9-29-92	11.2 mo	45 m
369	8-29-92	9-17-93	12.6 mo	65 m
362	8-15-92	10-07-94	25.8 mo	95 m
802	8-21-94	9-14-96	24.8 mo	96 m
802		9-14-96	1 hr	25 m
808	11-05-94	8-11-95	9.2 mo	45 m
823	8-31-96	11-10-96	2.3 mo	250 m
828nr	10-14-96	11-10-96	0.9 mo	175 m

26 of 204 CRs captured in box traps, were retrapped in them = 12.7%

Clapper Rails resishted at least once:

Band #	Band Date	Date Last Observed	Time	Distance
401rt	3-22-81	9-20-84	41.9 mo	40 m
402	4-04-81	6-01-81	1.9 mo	93 m
403r	4-04-81	8-27-84	40.8 mo	5 m
404	4-26-81	10-02-82	17.2 mo	30 m
405d	4-26-81	9-10-84	40.5 mo	80 m
406r	5-17-81	7-15-86	61.9 mo	190 m
407rdt	5-23-81	4-18-83	22.8 mo	85 m
409rt	8-06-81	9-01-81	0.8 mo	15 m
412	8-29-81	10-21-82	13.7 mo	95 m
413	8-30-81	11-24-81	2.8 mo	10 m
416	9-05-81	9-09-83	24.1 mo	190 m
419	11-14-81	11-18-81	0.1 mo	10 m
420dt	11-21-81	12-06-81	0.5 mo	190 m
421t	2-17-82	6-06-83	15.6 mo	15 m
422t	2-17-82	7-18-82	5 mo	70 m
425	8-20-82	11-16-84	26.9 mo	485 m
426	8-20-82	9-05-82	0.5 mo	100 m
427	8-20-82	10-07-82	1.6 mo	75 m

Table 4 (continued).

Clapper Rails resishted at least once (continued):

Band #	Band Date	Date Last Observed	Time	Distance
428r	9-03-82	10-07-83	13.1 mo	130 m
430t	9-03-82	6-12-86	45.5 mo	50 m
431	9-04-82	9-09-83	12.2 mo	108 m
432	9-18-82	12-29-82	3.4 mo	21,700 m
433	9-18-82	1-13-83	3.8 mo	1,020 m
435	9-20-82	10-07-82	0.6 mo	270 m
436	9-20-82	2-26-83	5.2 mo	750 m
437	10-16-82	10-30-82	0.5 mo	35 m
439t	1-16-83	3-02-83	1.5 mo	90 m
441	1-21-83	2-15-83	0.8 mo	60 m
442	4-10-83	10-15-84	18.2 mo	156 m
446	7-13-83	9-09-87	49.9 mo	610 m
449r	8-26-83	10-21-83	1.8 mo	67 m
451	9-09-83	10-07-83	0.9 mo	20 m
455	9-10-84	10-07-84	0.9 mo	410 m
458t	9-10-84	7-15-87	34.2 mo	200 m
459	9-15-84	12-01-84	2.5 mo	15 m
462t	10-25-84	10-08-86	23.4 mo	111 m
463	10-25-84	11-03-84	0.3 mo	50 m
464r	5-27-86	7-29-87	14.1 mo	15 m
465r	5-27-86	6-08-89	36.4 mo	600 m
467rd	5-27-86	2-28-87	9 mo	50 m
468	8-21-86	9-09-87	12.6 mo	125 m
469	8-21-86	9-09-87	12.6 mo	35 m
470r	8-22-86	9-10-87	12.6 mo	25 m
473	9-05-86	10-28-88	25.8 mo	778 m
475	10-08-86	6-24-87	8.5 mo	115 m
480	10-17-86	7-15-87	8.9 mo	0 m
481	11-02-86	10-12-88	23.3 mo	130 m
488	9-17-88	7-18-92	46 mo	10 m
494t	8-19-89	10-18-89	2 mo	60 m
495t	8-19-89	11-15-89	2.9 mo	180 m
496r	8-20-89	6-22-91	22.1 mo	50 m
601	9-01-89	5-01-91	20 mo	100 m
603	9-02-89	10-07-89	1.2 mo	75 m
605	9-02-89	9-29-90	12.9 mo	185 m
607t	9-02-89	9-29-89	0.9 mo	110 m
608	9-02-89	9-29-90	12.9 mo	185 m
611	9-23-89	2-13-91	16.7 mo	175 m
612r	9-24-89	7-06-91	21.4 mo	110 m
616	10-07-89	9-20-92	35.4 mo	135 m
937r	10-20-90	7-20-91	9 mo	10 m
938	10-22-90	5-02-92	19.4 mo	40 m
941r	10-22-90	6-05-91	7.4 mo	25 m
942	8-28-91	5-02-92	9.2 mo	50 m
945	8-29-91	10-31-91	2.1 mo	200 m
353	7-31-92	9-29-92	2 mo	76 m
354	7-31-92	10-25-92	2.8 mo	304 m

Table 4 (continued).

Clapper Rails resighted at least once (continued):

Band #	Band Date	Date Last Observed	Time	Distance
355	7-31-92	8-14-94	24.5 mo	50 m
358	8-02-92	8-30-92	0.9 mo	87 m
360	8-15-92	8-21-92	0.2 mo	160 m
362r	8-15-92	7-18-96	47.1 mo	182 m
364	8-15-92	9-24-92	1.3 mo	2,282 m
369r	8-29-92	8-06-94	23.4 mo	82 m
371	9-12-92	8-21-93	11.3 mo	50 m
375	9-27-92	11-24-92	1.9 mo	85 m
379	10-12-92	8-20-93	10.3 mo	20 m
380	8-20-93	6-07-94	9.6 mo	197 m
381	8-20-93	8-09-94	11.6 mo	245 m
385	9-03-93	8-25-94	11.7 mo	169 m
388	9-04-93	10-29-95	25.8 mo	25 m
391	9-12-93	3-09-94	5.9 mo	50 m
395	10-30-93	6-23-96	32.8 mo	75 m
802	8-21-94	9-16-96	24.9 mo	244 m
807	9-09-94	7-22-96	22.4 mo	188 m
808r	11-05-94	8-19-96	21.4 mo	540 m
809	8-28-95	9-10-95	0.4 mo	20 m
810	8-28-95	9-10-95	0.4 mo	20 m
812	8-29-95	8-19-96	11.7 mo	74 m
823r	8-31-96	11-10-96	2.3 mo	250 m
825	9-13-96	12-11-96	2.9 mo	100 m

t = birds that were followed by telemetry (401, 407, 409, 410nr, 420, 421, 422, 429nr, 430, 439, 440nr, 443nr, 457nr, 458, 460nr, 462, 494, 495, 602nr, 604nr, 606nr, 607); d = dead (405, 407t, 4l0nrt, 415nr, 420t, 427, 457nrt, 460nrt, 467); nr = no resighting; r = recaptured in a box trap.

26 retrapped, 89 resighted, 9 dead = 98 re-encountered
98/210 = 46.7% reencountered 0.1 - 61.9 mo later (excludes 4 dead);
avg = 13.5 mos (1,266.2 mos/94 cr); having moved 0 2,282 m, avg = 167 m
(15,543 m/93 cr (excludes 4 dead and the 21 km move)

Time Elapsed To Last Resighting Of 94 Banded Clapper Rails

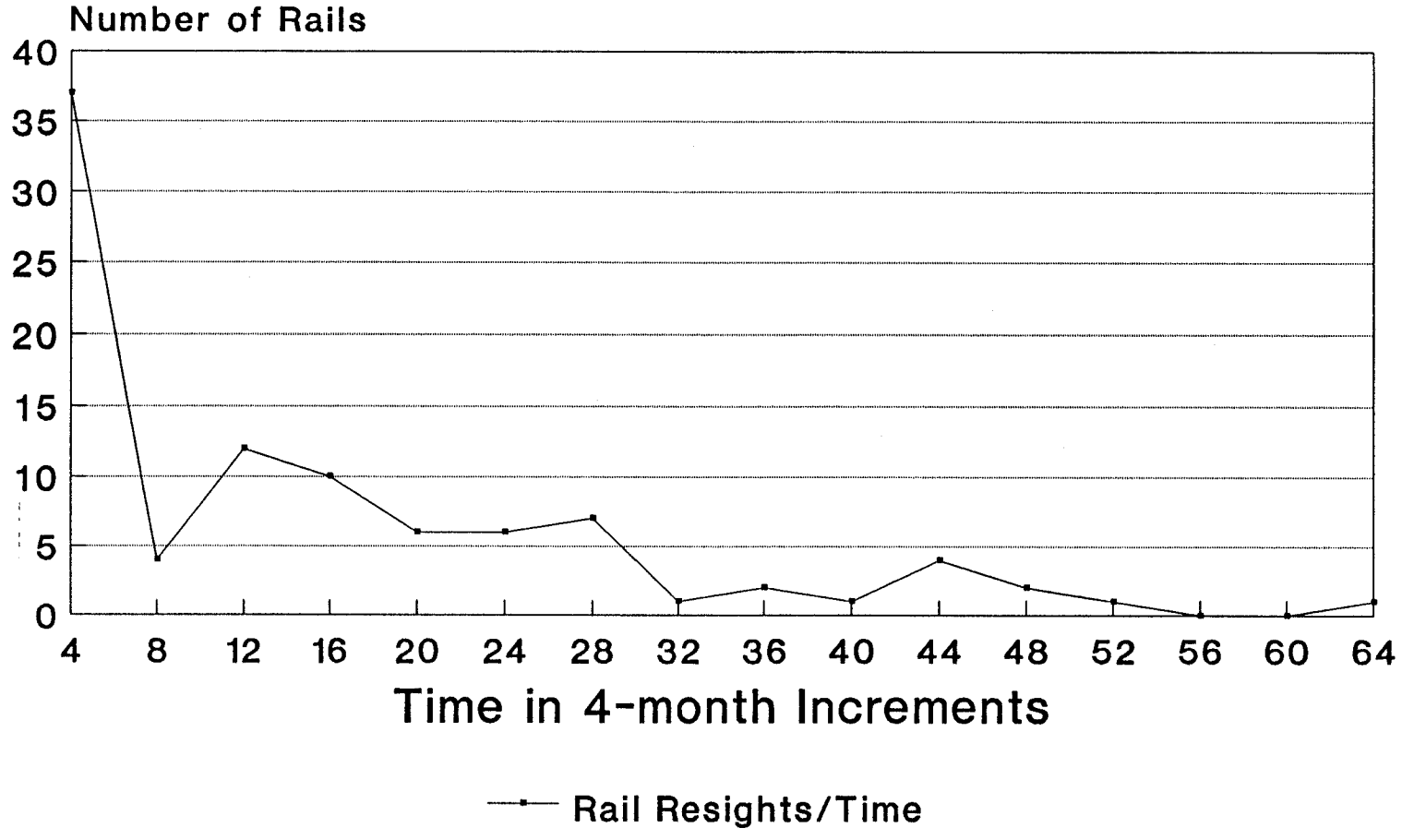


Figure 4

Nesting Rafts

There were clapper rail nests on 36 of the 125 rafts made available in the Seal Beach NWR in 1997. Twenty-five of the nests held at least 26 clutches of eggs, and there were 27 additional brood nests. This is the lowest use recorded in the 1990s, but this study could well under-represent second clutches because of the infrequency of nest checks (Table 5). Our potential disturbance of the rails through frequent nest checking was minimized this year to avoid compounding the factors already operating to suppress the expansion of this subpopulation. However, the number of brood nests is encouraging, since it could indicate increasing use of natural cover for incubation nests. Egg survival to hatching was high, and again this year there was no indication of major predation problems during the nesting season.

Management of terrestrial predators and the provision of nesting rafts on the Seal Beach NWR, appear to have been important in the resurgence of clapper rails to a recent high in 1993 and 1994. Raft use has been proportionate to population levels determined in spring call counts. Maintenance of the rail population below 1993/1994 levels at about 50 pairs in 1995 and 1996, and then the 29% decrease in 1997, could be associated with high raptor populations in the winter (see Zembal et al. 1996, Zembal et al. 1997, and Raptor Monitoring below). If raptor predation is a major limiting factor for the rails on the NWR, the rafts could be contributing to the problem. The visibility of the rafts amidst the consistent marsh cover and topography, and the seasonal concentration of rail activity on and around the rafts, could make the rails more obvious and vulnerable to keen-eyed birds of prey. Also, some of the rafts may offer to hunting raptors elevated perches on tumbleweeds flattened by weathering, herons, and egrets. Although efficient management options are not obvious, we will continue to study the role of the rafts in potentially increased vulnerability of the rails and will experiment with possible redesigns.

The Kendall-Frost Reserve is one of our smallest, isolated wetlands and the rail population there has crashed in spite of episodic predator control and the provision of rafts. This was indicated in the call count results, raft monitoring, and past winter high tide counts. Although there were five rail nests on rafts this spring, there was only one clutch of eggs (Table 6). This was the second poorest of seasons on the rafts since 1989, the year the rafts were first deployed in the reserve. The spring call count yielded rails only on the third attempt and indicated a very low level of activity.

Two of the 24 rafts in the Sweetwater Marsh NWR held clapper rail nests in 1997. One of these was an incubation nest that successfully hatched. Another was a brood nest, indicating successful hatching in natural marsh cover. This is a high marsh, and the rafts may not float very often, except for those nearest San Diego Bay. These are the ones that appear to get the most use by rails, as well. We have questioned the overall utility of the rafts in Sweetwater Marsh, but as long as a few, at least, are used each year, we shall continue making them available.

Rails were again observed using the rafts on Middle Island in Upper Newport Bay during higher tides, but no nesting ensued in the spring. Similarly, there has been no detected use of the rafts at Bolsa Chica to date for nesting. In addition, the rafts in Carpinteria Marsh held no nests. However, there was evidence of rail activity on two of the six rafts provided, including chicks feeding on one of them.

Raptor Monitoring

Twelve species of predatory birds were documented during the fall/winter at Upper Newport Bay and the Seal Beach NWR (Table 7). The red-tailed hawk

Table 5. Clapper Rail use of nesting structures and hatching success in the Seal Beach NWR, 1987 - 1997.

	1993	1992	1991	1990	(*)	1989	1988	1987
No. of rafts available	100	80	60	45	(20)	46	46	28
No. of nests	79	53	37	36	(15)	17	24	18
Spring call count	65	36	28	16		6	14	7
No. incubation nests	52	32	25	20	(8)	4	13	12
% of nests with eggs	66	60	68	56	(53)	24	54	67
% hatching success**	86	73	68	65	(38)	75	8	75
No. of renests***	21	10	5	3	(2)	-	2	4
% hatching success	60	95	90	100	(100)	-	0	75
No. of brood nests	9	12	4	7		2	0	1?

	1994	1995	1996	1997
No. of rafts available	97	111	126	125
No. of nests	75	50	54	36
Spring call count	66	51	52	37
No. incubation nests	44	28	34	25
% of nests with eggs	59	56	65	69
% hatching success**	77	89	89	88
No. of renests***	22	7	12	1
% hatching success	91	100	92	100
No. of brood nests	15	10	24	27

* The first number is for all nests; the second is for those placed in staked tumbleweeds.

** Hatching success is based upon post-hatching sign which is sometimes indeterminate; rather than 1 with certain hatching, 0.5 is used in the calculations for nests that probably hatched.

*** A renest, as treated here, is a second clutch in the same nest. Renests were probably undercounted in 1997 with only 2 nest checks.

Table 6. Clapper Rail use of nesting platforms and hatching success in the Kendall-Frost Reserve, 1989 - 1997.

	1993	1992	1991	1990	1989
No. of nests	12	12	9	9	5?
Spring call count	5	11	9	5	4
No. incubation nests	5	10	8	7	3
% of nests with eggs	42	83	89	78	60
% hatching success*	100	90	88	85	83
No. of renests**	0	1	4	3	?
% hatching success	-	100	100	100	-

	1994	1995	1996	1997
No. of nests	10	5	3	5
Spring call count	5	4	1	2
No. incubation nests	6	2	0	1
% of nests with eggs	60	50	0	20
% hatching success**	100	?	-	100
No. of renests***	0	0	0	0
% hatching success	-	-	-	-

** Hatching success is based upon post-hatching sign which is sometimes indeterminate; rather than 1 with certain hatching, 0.5 is used in the calculations for nests that probably hatched.

*** A renest, as treated here, is a second clutch in the same nest. Renests were probably undercounted in 1997 with only 2 nest checks

Table 7. Raptor Monitoring at the Seal Beach NWR and Upper Newport Bay, 1997.

SEAL BEACH NWR

	Minimum # indiv.					# of Encounters					Total Time Perched (min)					Total Time Flight (min)					Total Time Feeding (min)	
	a	b	c	d	e	a	b	c	d	e	a	b	c	d	e	a	b	c	d	e	d	e
RTHA	8	15	10	8	19	57	433	232	141	450	224	1895	973	480	1887	1	34	49	105	81	-	20
TUVU	-	2	3	10	7	-	6	13	49	30	-	-	1	106	54	-	8	19	49	21	-	-
AMKE	-	2	1	3	1	-	15	2	27	9	-	63	10	86	23	-	1	-	8	4	2	-
NOHA	1	2	2	2	2	6	25	28	13	47	5	28	38	54	194	9	56	42	21	15	-	-
OSPR	-	1	1	2	3	-	4	32	31	51	-	14	155	140	195	-	-	3	6	38	-	3
PEFA	1	1	1	1	1	1	1	11	30	27	-	1	48	148	125	1	-	-	-	2	-	-
WTKI	-	-	-	1	-	-	-	-	1	-	-	-	-	-	-	-	-	-	1	-	-	-
LOSH	-	1	-	-	-	-	1	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-
GOEA	-	1	-	-	-	-	6	-	-	-	-	27	-	-	-	-	1	-	-	-	-	-
SEOW	-	-	-	-	1	-	-	-	-	5	-	-	-	-	21	-	-	-	-	1	-	-
RSHA	-	-	-	-	1	-	-	-	-	1	-	-	-	-	1	-	-	-	-	-	-	-
Acci	-	-	1	-	-	-	-	1	-	-	-	-	1	-	-	-	-	1	-	-	-	-
Unid.	-	-	1	-	-	-	-	1	-	-	-	-	1	-	-	-	-	3	-	-	-	-

a=1/12/97 Rain, obs 0900-1015, observations from one site only last 30 min.; b=2/2/97 0830-1130 Fog obstructing view until approx 1000; c=2/23/97 0830-1130; d=10/26/97 AMKE - prob BESS and fish; e=11/16/97 0830-1130, 6.5 high tide, RTHA-prey unidentified, OSPR-fish, coyote on road to Tern Island 0820, 17 LFCR observed on rafts, one sharing raft with NOHA.

UPPER NEWPORT BAY ECOLOGICAL RESERVE

	Minimum # indiv.					# of Encounters					Total Time Perched (min)					Total Time Flight (min)					Total Time Feeding (min)			
	a	b	c	d	e	a	b	c	d	e	a	b	c	d	e	a	b	c	d	e	b	c	d	e
RTHA	7	5	4	1	4	167	83	74	13	82	760	330	338	54	372	13	26	36	3	18	-	-	-	-
TUVU	2	3	3	1	-	6	4	20	1	-	-	-	-	-	-	6	12	38	1	-	-	-	-	-
AMKE	1	1	1	3	1	1	2	7	16	10	1	10	31	50	31	-	-	-	5	1	-	-	-	-
NOHA	3	3	2	2	2	56	28	21	36	47	188	86	73	22	124	29	17	12	67	27	-	-	-	1
OSPR	1	1	1	1	1	3	16	2	34	1	3	-	-	145	-	-	1	2	2	1	80	-	18	-
PEFA	1	-	-	1	-	1	-	-	1	-	5	-	-	-	-	-	-	-	1	-	-	-	-	-
WTKI	-	2	2	2	4	-	17	20	10	62	-	66	76	48	249	-	7	14	-	19	-	1	-	15
Acci	-	1	1	-	-	-	4	1	-	-	-	6	-	-	-	-	7	2	-	-	-	-	-	-
Unid.	2	-	-	-	-	9	-	-	-	-	40	-	-	-	-	-	-	-	-	-	-	-	-	-
LOSH	-	-	-	-	1	-	-	-	-	1	-	-	-	-	-	-	-	-	-	1	-	-	-	-

a=1/11/97:0830-1130; b=2/1/97: 0830-1130 heavy fog first 45 min. OSPR=fish; c=2/22/97: 0830-1130 WTKI-small mammal; d=11/1/97 0830-1130, two sites, 1 observer/site, high tide, many instances of human intrusion into marsh & closed channels. OSPR-fish and unidentified. E=11/22/97 0830-1130, NOHA-unidentified, WTKI-unindentified, OSPR-carried fish out of study area.

RTHA-Red-tailed Hawk; TUVU-Turkey Vulture; AMKE-American Kestrel; NOHA-Northern Harrier; OSPR-Osprey; PEFA-Peregrine Falcon; WTKI-White-tailed Kite; MERL-Merlin; LOSH-Loggerhead Shrike; RSHA-Red-shouldered Hawk; MERL-Merlin; Acci-Accipter spp.; Unid-Unidentified raptor.

was the most abundant raptor at both sites. The minimum number of red-tailed hawks observed on the NWR ranged from 8 to 19 each survey, compared with a range of 1 to 7 individual red-tailed hawks at Upper Newport Bay. There were usually two northern harriers (Circus cyaneus) observed hunting the NWR and the Bay, with three documented at Upper Newport Bay during two winter sessions. Peregrine falcons (Falco peregrinus) and white-tailed kites (Elanus leucurus) were consistently present at both marshes.

Despite the monitoring efforts, no raptor kills of rails were observed directly. However, a very high level of raptor abundance and activity were well documented on the Seal Beach NWR, and we suspect that many clapper rails are being taken by red-tailed hawks, in particular. This could go on undetected since most of the kills would be made in marsh cover and the carcasses would be discarded in the thick vegetation.

ACKNOWLEDGMENTS

We thank Diane Zembal for her continued support and participation and the Clapper Rail Study Team members, particularly Becky Bradley, Dick Kust, and Jim Robbins. Mike Mitchell helped with logistical needs on the Seal Beach NWR. Lisa Barnet provided access and support on the Seal Beach NWR. The Seal Beach raft and raptor monitors and Newport banders also included Becky Bradley, Claire Crow, John Fitch, Clarann Levakis, and David Walker along with numerous renovaters. The California Department of Fish and Game provided storage space and access at Upper Newport Bay. Thanks to Dr. Charles Collins for his continued support and advice and to Ron Jurek for review of this report and his efforts on behalf of the light-footed clapper rail. We thank the dozens of people who aid with rail counts and contribute observations each year. These studies were conducted under Federal Permit No. ZEMBRL-3, Master Bird Banding Permit No. 22420, and a Memorandum of Understanding and Scientific Collecting Permit with the State. This work was partially supported by Federal Aid for Endangered, Threatened, and Rare Wildlife, through a California Department of Fish and Game contract with California State University, Long Beach.

LITERATURE CITED

Fleischer, R.C., G. Fuller, and D.B. Ledig. 1995. Genetic structure of endangered clapper rail (Rallus longirostris) populations in southern California. *Conserv. Biol., 9(5):* 1,234 - 1,243.

Ledig, D. 1990. Preliminary report in the ecology of the light-footed clapper rail at Mugu Lagoon, Ventura County, California. Report to Calif. Dept. Fish and Game, nongame wildlife, Sacramento, CA. 17pp.

Soulé, M.E., D.T. Bolger, A.C. Alberts, J. Wright, M. Sorice, and S. Hill. 1988. Reconstructed dynamics of rapid extinctions of chaparral-requiring birds in urban habitat islands. *Conserv. Biol., 2* (1) : 75 - 92.

U. S. Fish and Wildlife Service. 1985. Recovery plan for the light-footed clapper rail. Portland, OR. 121 pp.

Zembal, R., and B.W. Massey. 1981. A census of the light-footed clapper rail in California. *West. Birds,* 12: 87 - 99.

Zembal, R., and B.W. Massey. 1983. To catch a clapper rail -- twice. *No. Amer. Bird Bander,* 8(4): 144 - 148.

Zembal, R., and B.W. Massey. 1985. Distribution of the light-footed clapper rail in California, 1980 - 1984. *Amer. Birds,* 39(2): 135 - 137.

Zembal, R., J.M. Fancher, C.S. Nordby, and R.J. Bransfield. 1985. Intermarsh movements by light-footed clapper rails indicated in part regular censusing. *Calif. Fish and Game* 71(3): 164 - 171.

Zembal, R., and B.W. Massey. 1988. Light-footed clapper rail census and study, 1988. Calif. Dept. Fish and Game, Nongame Bird and Mammal Sec. Rep. 28pp.

Zembal, R., B.W. Massey, and J.M. Fancher. 1989. Movements and activity patterns of the light-footed clapper rail. *J. Wildl. Manage.* 53(l): 39 - 42.

Zembal, R. 1993. Light-footed clapper rail census and study, 1992. CA Dept. Fish and Game, Nongame Bird and Mammal Sec. Rep. 93-8. 33 pp.

Zembal, R. 1994. Light-footed clapper rail management and population assessment, 1993. Contract Report CA Dept. Fish and Game, 94-6. 32 pp.

Zembal, R., Hoffman, S., and Dr. J. R. Bradley. 1996. Light-footed clapper rail management and population assessment, 1995. Calif. Dep. Fish and Game, Bird and Mammal Conservation Program Rep. 96-04. 43 pp.

Zembal, R., Hoffman, S., and Dr. J. R. Bradley. 1997. Light-footed clapper rail management and population assessment, 1996. Calif. Dep. Fish and Game, Bird and Mammal Conservation Program Rep. 97-08. 28 pp.