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

LIGHT-FOOTED CLAPPER RAIL MANAGEMENT AND POPULATION ASSESSMENT, 1995

by

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

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ABSTRACT

The sixteenth consecutive annual census of the endangered light-footed clapper rail (*Rallus longirostris levipes*) was conducted by call counts throughout the bird's range in California, 2 March - 7 May 1995. There were 262 pairs of clapper rails exhibiting breeding behavior in 14 marshes, a 9% decline from the 1994 population estimate. One hundred and seventeen pairs, or 45% 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 totalled 229 pairs, or 87% of the California population. The other subpopulations are small and face serious problems that should be dealt with through increased management and the provision of additional habitat or they will be lost. There is little security in the continued existence of the light-footed clapper rail without several large viable population centers.

Three high tide counts were done on the Seal Beach NWR and the high count in 1995 was of 55 clapper rails in November. This count may demonstrate a major reduction in the overall numbers of clapper rails on the refuge. Effective control of nonnative red foxes (*Vulpes*) and other management measures had allowed encouraging expansion of this subpopulation in the recent past. The Seal Beach rails faced an unusually large raptor population in the winter of 1994/1995, and unusually heavy, late rainfall in 1995.

Eight trapping sessions at Upper Newport Bay with 14 - 19 drop-door traps and 354 trap-hours, resulted in the capture and unique color-banding of 8 more clapper rails and 1 recapture. There were 92 resightings of 9 banded rails in

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1994 and 36 re-encounters of 7 banded rails in 1995. The average movement detected of these rails was 44 m in 1994 and 97 m in 1995. The largest spread of detection points for any rail was of 540 m. This rail was a first-year bird that moved to a new section of marsh and then established itself in one locale where it was observed repeatedly. The longest time span between banding and resighting of any one of the 195 rails banded since March 1981 has been 61.9 months. In 1995, 1 of the 7 resighted rails was banded in 1992, 1 in 1993, 3 in 1994, and 2 in 1995. Banding success over the 14 years of banding is compared, and resightings of banded rails are summarized for the period 1981 - 1994. Forty-seven percent of the 187 rails banded during this period were reencountered and 12.2% of the 181 rails captured in drop-door traps were recaptured in them, 1 hour to 48.3 months later.

Fifty clapper rail nests were found on the 111 rafts made available in the Seal Beach NWR. Twenty-eight of the nests held 35 clutches of eggs and there were at least 10 additional brood nests. Hatching success was 89% for initial attempts and 100% for renests. The 15 nesting rafts deployed at the Kendall-Frost Reserve contained only 5 clapper rail nests and 2 clutches of eggs. Hatching success was uncertain but there were at least two additional natural nests. There is continuing evidence that predation is a major problem at Kendall-Frost.

Three of the 24 rafts placed in the Sweetwater Marsh NWR held clapper rail nests. Only one of these was certainly an incubation nest first, and probably successful, the other two were brood nests when found. None of the rafts on Middle Island in Upper Newport Bay, or in Bolsa Chica, supported clapper rail nests in 1995.

Continued coyote (*Canis latrans*) presence was documented in many of the wetlands during rail and predator monitoring activities. In spite of this, predator control was continued in several of the smaller, more isolated wetlands where problematic quantities of feral cats, skunks, opossums, and rats are encountered. A cooperative coyote project in Orange County reached the end of a major data collection phase on 31 August 1995. Eleven coyotes were located 2,200 times and many useful observations were made at 3 wetlands and environs.

Raptor watches at Upper Newport Bay quantified bird of prey activity and interactions with marsh birds. Activities and abundance of 10 diurnal species were summarized for 10 winter sessions.

INTRODUCTION

Loss and degradation of southern California salt marshes has greatly reduced the habitat base, and adjacency of wetlands suitable for light-footed clapper rails (*Rallus longirostris levipes*). One signature effect of large scale habitat conversion and disruption was an increasing rarity in the sightings of clapper rails in coastal southern California. Consequently, the light-footed clapper rail was declared endangered by the Federal, Government in 1970 and by the State in 1971.

The light-footed clapper rail is resident in 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 now offer some promise of recovery. The California population of this endangered bird was up to 300 pairs in 1993, the largest number detected breeding in one year since monitoring and study began in 1979. Herein are reported the results of the seventeenth 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 principle 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 (NWS). 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

Call Counts

Call counts conducted in the spring were found to produce results comparable to exhaustive nest searches in quantifying the breeding pairs engaged in reproductive activity (Zembal and Massey 1985; Zembal 1992, 1993). The 1995 call counts were conducted in 41 coastal wetlands from March 2 through May 7, and from Carpinteria Marsh in Santa Barbara County on the north, to Tijuana Marsh in San Diego County. The call counts resulted in mixed success on various evenings because of unusually rainy weather.

In the 4 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.

The more movement required of an observer during a survey, the more likely that breeding, but infrequently calling, rails were missed. Calling frequency and the detection of calls were influenced by observer's hearing ability and experience with the calls, the stage of breeding of individual pairs, rail density, and weather conditions (Zembal and Massey 1987). Many surveys attempted on stormy, windy days had to be repeated. If calling frequency was high with many rounds issuing from the marsh as adjacent pairs responded to one another, it was possible to map the rails well and move on to survey more marsh. Under usual circumstances approximately 20 ha (50 acres) of marsh could be adequately covered during a single survey.

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.

The playback of a taped "clappering" call appeared to be responded to by the rails as if it were a living pair calling nearby. However, work done with Yuma clapper rails (Rallus longirostris yumanensis) suggests strongly that those closely related rails can become conditioned to the tape if it is used excessively (B. Eddleman, pers. comm.). During prime calling times in the evening or early morning, a playback sometimes elicited a response or even a round of calling. However, there were sometimes no vocal responses to the tape. If played at a time of day when the rails are not particularly prone to call, the only response likely to be solicited was that of the territorial pair intruded upon. Sometimes the response was nonvocal investigation by the pair or one member. Repeated playbacks were likely to elicit aggression. In one instance, a clapper rail attacked and knocked over a decoy that was set near a repeating tape. In another instance, a male attacked another rail, presumably a female, forcefully copulating with her while pecking at the head and neck, dislodging feathers. I finally disturbed these birds to divert the male's aggression. Subsequently, playbacks were used sparingly and with caution.

Used only once per year at a given marsh and with minimal playings, playbacks have yielded important results. Unmated clapper rails, for example, often respond at considerable distances and may approach the tape. Isolated single rails would often approach very closely and remain in the vicinity unless displaced.

In mapping the rails, both duet and single "clapperings" were treated as territories. No advertising singles are treated as discrete territories, since the goal of the survey is an accurate assessment of breeding pairs at the time of the survey. A single is as good an indicator of a territory as a duet, as long as advertising is not heard later from the same vicinity. 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.

The call count results presented in past annual summaries have not included the number of unmated rails detected (collectively referred to as the unmated contingency of a subpopulation). The unmated rails are an important component of each subpopulation, these are the birds that fill the openings brought on by accident and death of pair members. In some wetlands and certain years, the unmated contingency can be a substantial number of rails. In the smaller wetlands, for example, there may be many more unmated than mated rails. This is usually mentioned in discussion of the subpopulations but not quantified in the survey summary table because the reproductive potential of the population is manifest in the number of mated pairs. The unmated contingency functions in helping to maintain the level of reproductive capacity manifest during the call counts; these unmated birds do not contribute to the reproductive output of their subpopulation unless they subsequently mate. Their numbers have not been routinely reported but are presented for selected subpopulations and discussed herein.

High Tide Counts

There have been counts of clapper rails during extreme high tides on the Seal Beach National Wildlife Refuge (NWR) each winter or fall 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. Fourteen observers in 7 canoes covered the 369 ha (911 acre) refuge in about 2 hrs on 4 November 1994, 25 October 1995, and 22 November 1995. High tide counts were also done in Upper Newport Bay on 21 December 1995, and on 2 December 1994 in the Kendall-Frost Reserve, Sweetwater Marsh, and Tijuana Marsh. Kendall-Frost Reserve was also surveyed on 8 September 1994.

Banding, Movements, and Observations

There were 8 trapping sessions, 8 August - 12 October 1995, for a total of 354 trap-hours with 14 – 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 in past years to the oceanward half of Upper Newport Bay from Shellmaker Island to the

Narrows; one trapping session was conducted in the upper end of the bay, near the main dike in 1995. Six of the trapping sessions were accomplished in the 3 hours before dark on evenings with appropriately low tides; the other two were 2-hour morning sessions that were begun at about daylight.

Observations of banded rails were sought on about 50 different 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

A total of 111 rafts were available for potential rail nesting on the Seal Beach NWR during 1995. A description of the raft design is available in earlier reports (Zembal and Massey 1988). The rafts were renovated mostly in March 1995, 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 4 pool floats were attached, one in each corner of a raft. Fastening the flotation on the undersides keeps the rafts off the saturated substrate during low tide and helps dry the wood out. The PVC pipe used was 2 in. schedule 40, which is of a quality suitable for drinking water. The rafts were checked about every 3 weeks from April to mid-August 1995.

Six rafts were made available in the California Department of Fish and Game's Ecological Reserve at Bolsa Chica and checked once. The 15 rafts in the Kendall-Frost Reserve were renovated in March with fresh tumbleweeds and floats and checked in April and June. Twenty-four rafts were renovated in the Sweetwater Marsh NWR on 7 March 1995 and checked in April, June, and August. Ten rafts were available on Middle Island in Upper Newport Bay by April and checked every three weeks into August as part of a Master's Project by Susan Hoffman. Lastly, two rafts were placed in Carpinteria Marsh in May; they will not be checked until 1996.

Predator Control

The U.S. Department of Agriculture's Animal Damage Control was contracted to assess predator activity and remove selected predators from Carpinteria Marsh in Santa Barbara County, the Seal Beach NWR, the Kendall-Frost Reserve in northern Mission Bay, San Diego County, and Famosa Slough off of southern Mission Bay. These activities were funded by the Department and the Service. A variety of traps was used, depending upon conditions and target species. In Carpinteria Marsh, there were 202 trap-nights, with 6 - 12 cage traps set per night, 1 May - 8 August 1995. Padded leghold traps were set in the Seal Beach NWS, Upper Newport Bay and vicinity, and Bolsa Chica State Ecological Reserve, 28 September - 11 November 1994, and in April 1995, to capture coyotes (<u>Canis</u>

latrans) to study their movements and behavior. This is the Master's work of J. Shane Romsos, Humboldt State University, and was supported by the Irvine Company; University of California, Irvine; the Service; and this recovery project.. A total of 1,260 trap-nights was accrued in the Kendall-Frost Reserve with cage traps, 13 April - 23 August 1995. Cage traps were also deployed over 39 site visits in the highly urbanized environs of Famosa Slough, 10 May - 18 August 1995; trap locations were rotated every 2 - 3 days, which eliminated the trap tampering and theft encountered in 1994.

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. Three stations with 2 - 5 observers per station were spaced along the edge of the bay and as much data as possible were taken on number of individuals per species and time engaged in various activities. There were raptor watches on 29 October, 19 November, and 29 December 1995.

Raptor watch was expanded to the Seal Beach NWR in 1995. There are two stations used, one each on Nasa and Hog Islands. There were raptor watches on 24 September, 15 October, 5 November, 26 November, and 16 December 1995.

RESULTS AND DISCUSSION

The breeding behavior exhibited during call counts indicated a population total of 262 pairs of light-footed clapper rails in 14 coastal wetlands in southern California (Table 1). This is the fifth highest annual population total since 1980 and represents a 9% decline from 1994 (Figure 1). This is also the fifth highest total number of wetlands occupied by clapper rails exhibiting breeding behavior (Figure 1). A total of 31 wetlands in coastal southern California have been occupied by clapper rails during at least one annual survey since 1980 (Figure 2).

Because the spring of 1995 was a very wet one, the seeming decline should be treated with skepticism. There is some evidence that the timing of the breeding cycle may be thrown off for some rails during a season like this one, in terms of the initiation of nesting and egg laying and the vigor with which territorial manifestation is proclaimed. This could greatly affect the detectability of some of the individuals on any single visit to a wetland, giving a lower number than the eventual total size of the breeding subpopulation. The physical interference from storm-driven surge to rails adjusting to a particular nesting site could interfere enough with site selection and nest building that some of them are put off. Because the amount of disturbance could easily vary from nest site to nest site, it would stagger the initiation of breeding activities for a percentage of a subpopulation; for some of them, the winter has been prolonged, whereas others, with better protected nest sites might be closer to the regular calendar. This is one possible explanation for the variation observed in several of the call count results. Call counts are usually consistent on consecutive days and were not exactly so this year.

Table 1. Census of the Light-footed Clapper Rail in California, 1980-1995.

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, in addition, a fall or winter occurrence
# indicates, in addition, the detection of unpaired rails (from 1987 on).
a Data are from Paul Jorgensen's field notes.

Table 1. Census of the Light-footed Clapper Rail in California, 1980 - 1995 (Continued).

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

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

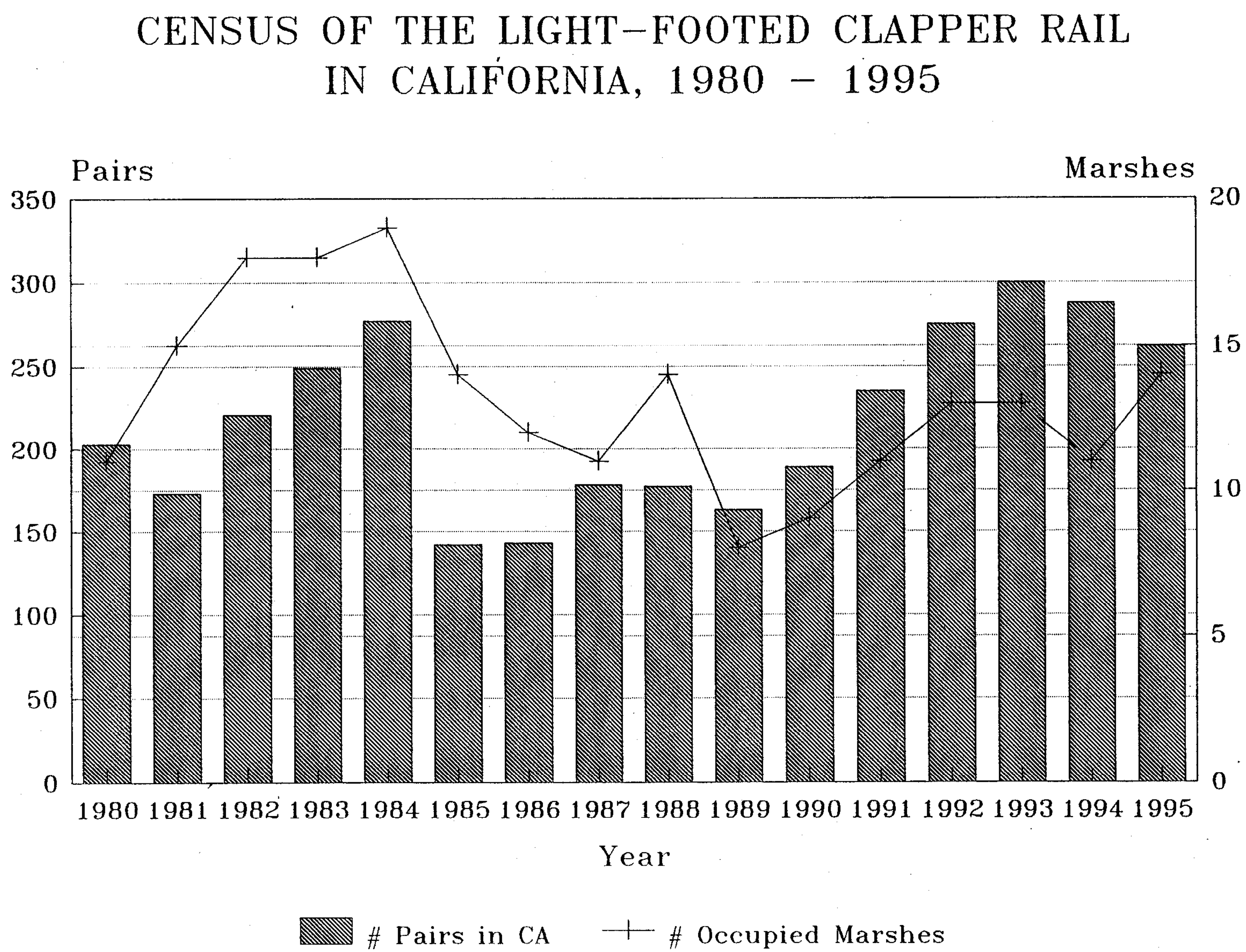
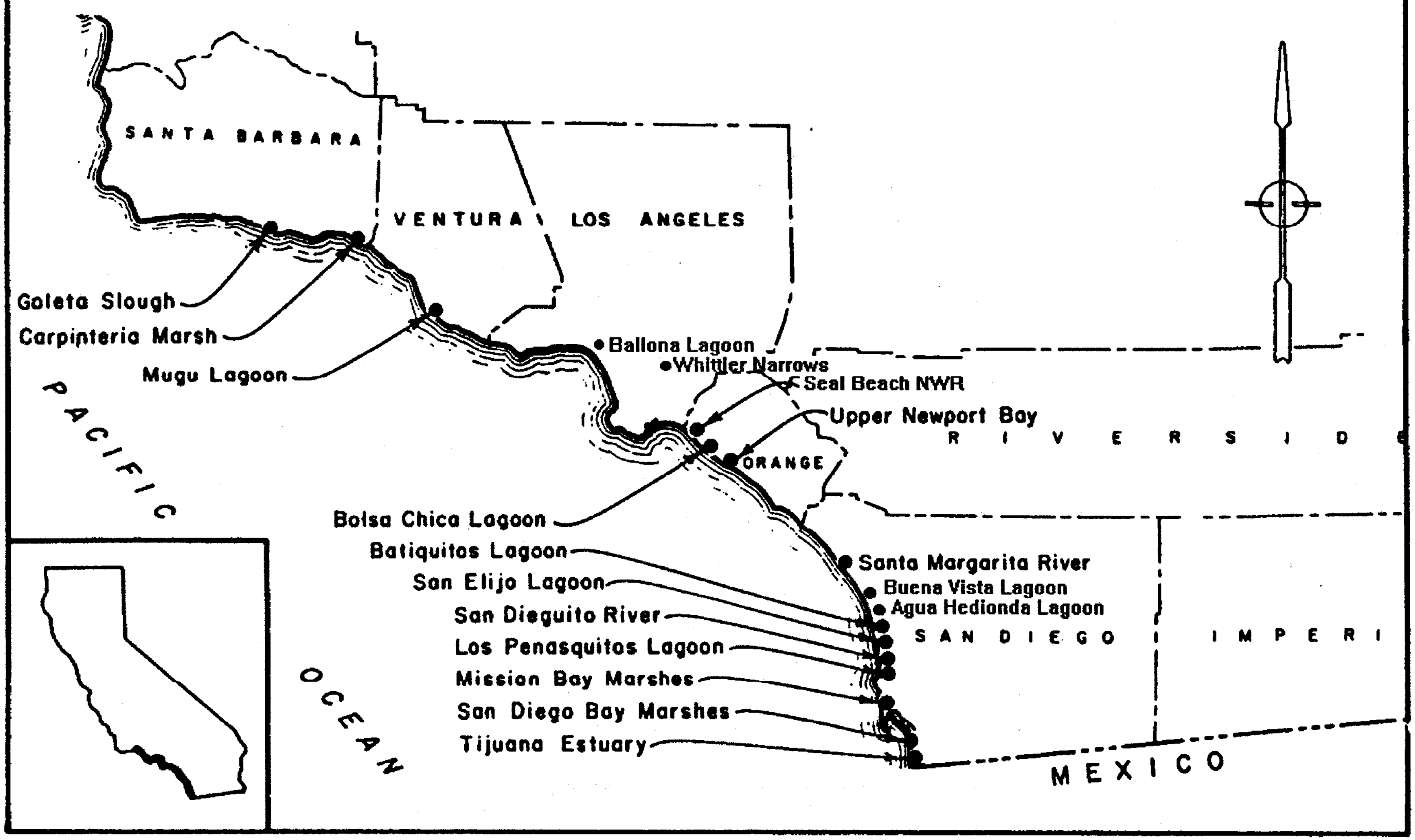

CENSUS OF THE LIGHT-FOOTED CLAPPER RAIL
IN CALIFORNIA, 1980 - 1995
Pairs
Marshes
350
300
250
200
150
100
50
0
20
15
10
5
0
1980 1981 1982 1983 1984 1985 1986 1987 1988 1989 1990 1991 1992 1993 1994 1995
Year
Pairs in CA
Occupied Marshes

FIGURE 1.

Figure 2

LIGHT-FOOTED CLAPPER RAIL DISTRIBUTION



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 45% of the total in 1995. It has usually consisted of around 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 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 NWR, heavy predation ensued over several years as mesopredator release (Soulé 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 5 pairs. Both of these subpopulations have subsequently resurged but only after many years of intensive management.

The three largest subpopulations comprised 90% of the breeding clapper rails on the coast of southern California in 1993, and 87% in 1995. Reciprocally, all other subpopulations have contributed 10% - 37% of the California total since 1980. The largest total contribution by all wetlands combined, minus 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 other, 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. However, the accompanying trend of extreme variability in annual sizes of the small subpopulations and occasionally their complete disappearance is counterproductive: sometimes perplexing, is their occasional recurrence, as in Carpinteria Marsh in 1995. Brief individual wetland treatments and subpopulation graphs are at the end of this report.

THREE MAJOR SUBPOPULATIONS OF LIGHT-FOOTED CLAPPER RAILS

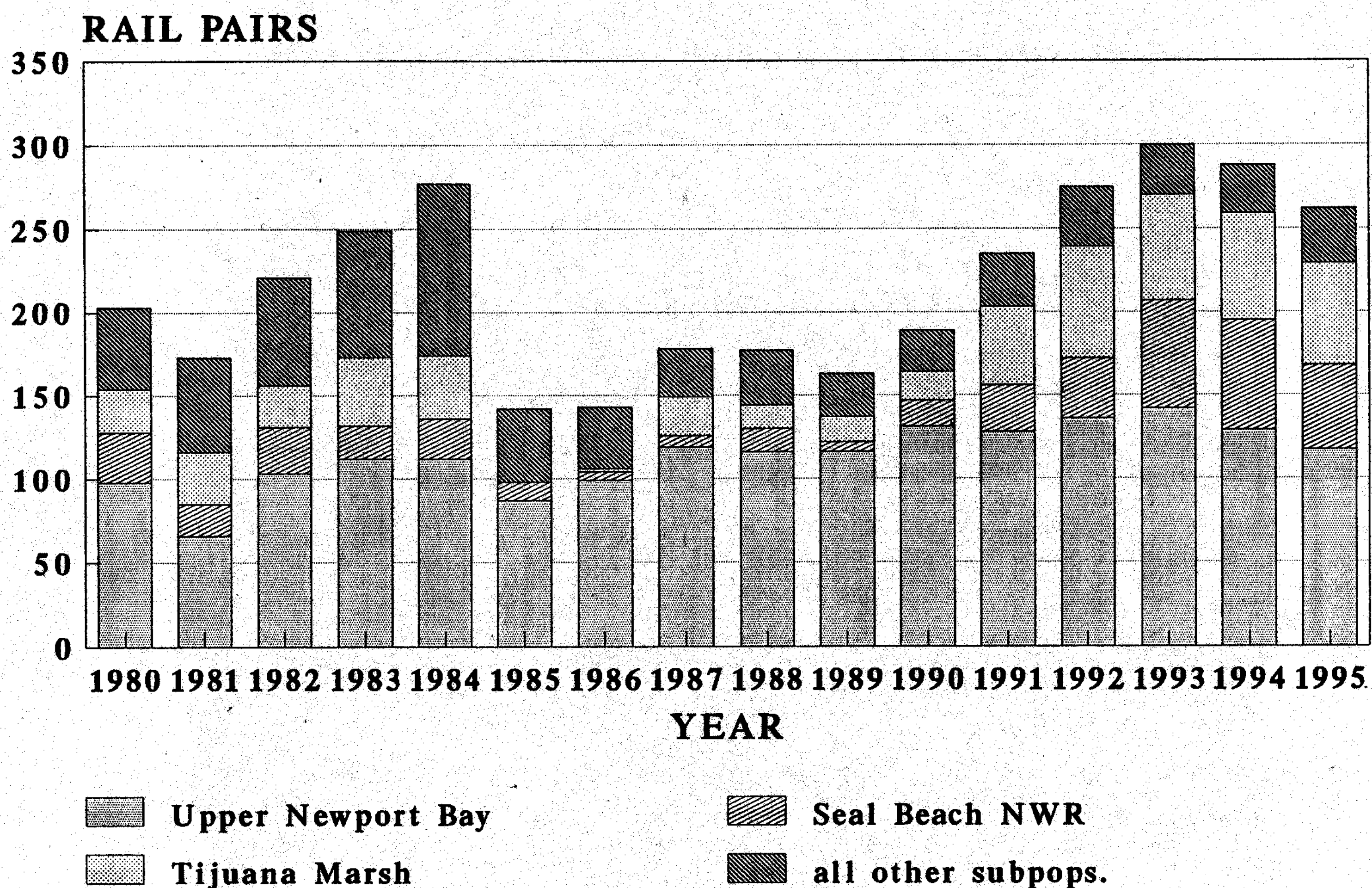


FIGURE 3

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 (Figure 3). All other subpopulations combined have contributed less than 14% to the annual totals since 1990 and the marshes occupied by small numbers of breeding rails change 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; x = 13.2) were occupied in any one year. However, there does appear to be a positive correlation between the overall number of clapper rails and number of occupied marshes (Figure 1). This could be explained by regularly occurring tendencies to roam away from home marshes or by increased tendencies with increasing population pressure (see Zembal et al 1985, 1989). In either case, larger numbers of rails in the big subpopulations would result in more roamers and greater use of marginal habitat and irregularly occupied wetlands. This is partially supported by our observations. Increases at Upper Newport Bay have not resulted in reoccupation of San Joaquin Marsh, located just upstream, but the recovery at the Seal Beach NWR has certainly been coincident with increased occupation of the adjacent Bolsa Chica wetlands.

A slight male skewedness in the sex ratios of the various subpopulations was the usual trend observed in the California marshes and during the three survey trips to Mexico. Deviations from this general trend are seen fairly regularly in several of the subpopulations, particularly the very small ones. Nine subpopulations were sex skewed in 1995, 7 were male-biased. There were 53 advertising males detected and 7 advertising females; 28 single males were in the Seal Beach NWR and 5 of the single females were in Upper Newport Bay. In Mexico in 1987, we heard 90 pairs along with 32 advertising males in El Estero, Ensenada, and 156 pairs plus 22 unmated males in San Quintin. At Upper Newport Bay, there have been as many as 21 advertising males in addition to the 103 mated pairs documented that year, and there were 7 years of male dominance in the unmated contingency, alternating for 6 years with female dominance (Figure 4). The number of unmated rails at Upper Newport Bay has never equalled more than an additional 10% over the mated population and it has usually been around 5% or less. There were two big female years at Upper Newport Bay, in 1985 and 1994.

Female advertising is pathetically persistent. Individual females call loudly from the same vicinity in the marsh for many hours each day, morning and evening, day after day for months, when there are no available males to counterbalance the skew for the season. The brief adventures with adjacent mated males, apparently do not persist, nor provide the duty-sharing necessary to successfully nest. Female years are likely brought on by disproportionate male mortality. One of the two big female years at Upper Newport Bay coincided with greatly reduced overall population levels, the other occurred in the midst of slighter reductions. A female year could be one of high raptor abundance, for example, or simply the persistent presence of one or more raptors that have successfully keyed in on clapper rails. Male clapper rails are bolder, spend more time out of cover than females, and would therefor be more susceptible under such conditions than females. Female years do not happen synchronously across the range. There have been years when advertising males and females occupied different, somewhat isolated, sections of the same marsh. In San Elijo Lagoon, for example, in 1993, there were 9

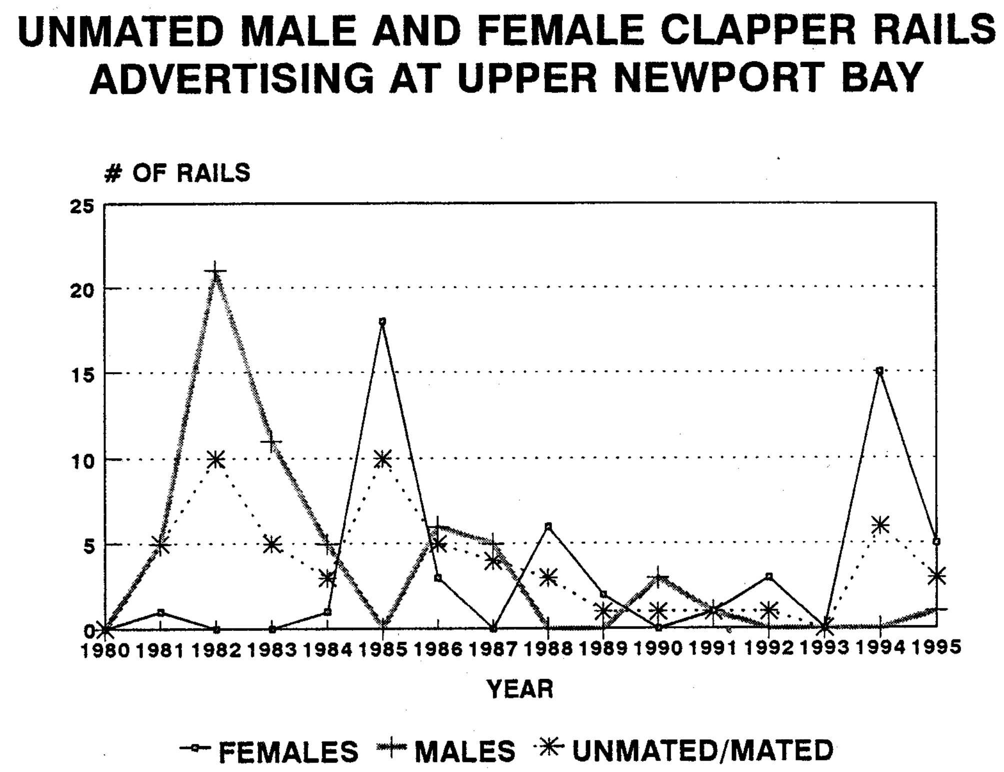


FIGURE 4

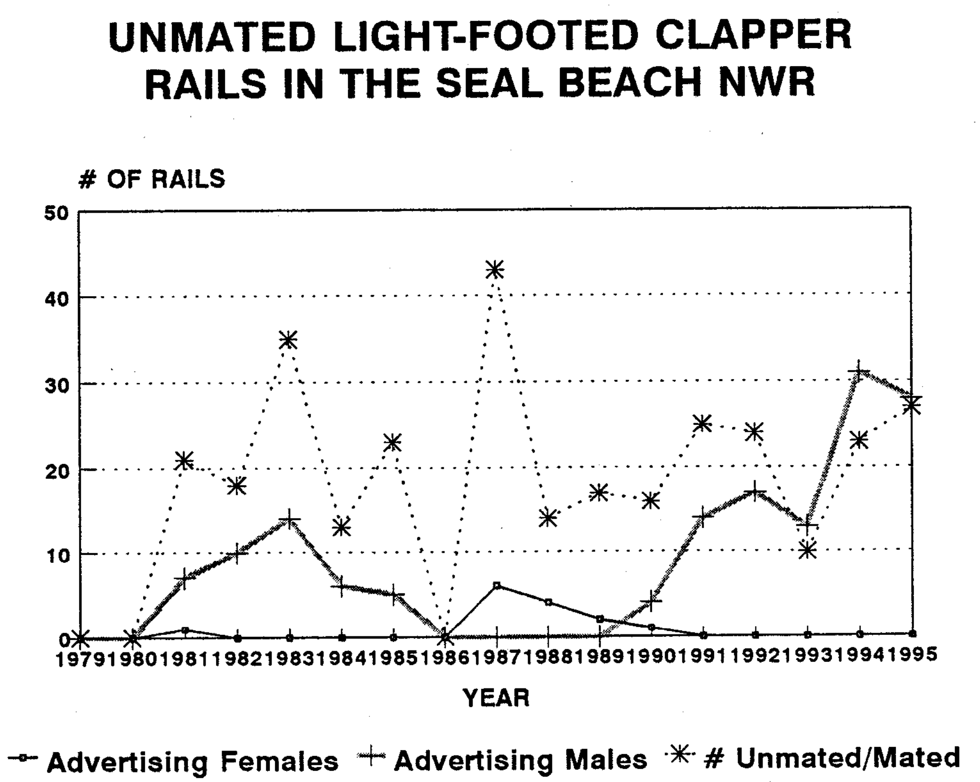


FIGURE 5

advertising males along Escondido Creek and the inner lagoon and an advertising female by herself in the outer lagoon. This has also occurred at Bolsa Chica.

Female bias in the subpopulation at Seal Beach NWR disappeared with the bulk of the red fox population (Figure 5). The unmated contingency of the Seal Beach subpopulation is usually male dominated and there is a much larger pool of unmated rails, compared to Upper Newport Bay. During many years, the number of unmated rails on the Seal Beach NWR has been about 15% - 25% of the number of breeding rails, compared to 5% or less for all but two years at Upper Newport Bay. If greater skew in sex ratios is associated with bigger problems, or greater instability, Seal Beach NWR would warrant more concern and vigilance than Upper Newport Bay or Tijuana Marsh.

An examination of the unmated contingency of the Tijuana Marsh subpopulation reveals that the largest skew occurred during the recovery period following the major environmental perturbations associated with prolonged closure of the ocean inlet (Figure 6). Perhaps one of the most unusual observations at Tijuana Marsh is the consistency of simultaneous advertising by males and females. We speculated that sibling recognition could have played a role in this with the subpopulation recovering from a very limited number of rails. Once this subpopulation peaked at over 60 pairs in 1992 and remained about there for four consecutive seasons, the unmated contingency settled at about 5% - 10%.

This raises the issue of whether the size of the unmated-to-mated ratio is mostly a function of overall size far many subpopulations; with few pairs in a subpopulation, one or more advertising rails represents a large percentage of the total number. Whether the observed ratios are mostly due to mathematics, or to problems affecting the subpopulations is immaterial for the smaller subpopulations; regardless of other factors, they are in big trouble by virtue of their consistently small sizes. For example, the highest ratios of unmated/mated at Kendall-Frost Reserve have largely coincided with the lowest subpopulation levels but the volatility of this subpopulation was made evident with its first sudden drop in 1982 (Figure 7). The true beginning of consistently low numbers in this subpopulation was in 1987, which was preceded by two years of unusual occurrences in the unmated part of the subpopulation, simultaneous advertising by males and females and the largest number of unmated individuals recorded for that wetland. Any unusual change in the composition of the unmated part of a subpopulation could be indicative of unusual predation, or other events that might be dealt with through management to keep catastrophes minimal. However, this would require far more vigilance and management capability than what there is now. For example, intense male skewedness was observed in the Seal Beach NWR in 1994 and 1995. This is good reason for alarm but we are uncertain of the cause, problem, or, therefore, solution. However, a huge wintering raptor population might play a role (see **THE WETLAND SUBPOPULATIONS,** below).

The smallest subpopulations are typically the most heavily sex-biased, and usually there are many more males. This is exemplified at San Elijo Lagoon, where as many as 9 males have been detected along with only 2 pairs (Figure 8). Nest sites are probably very susceptible to predation at San Elijo, where

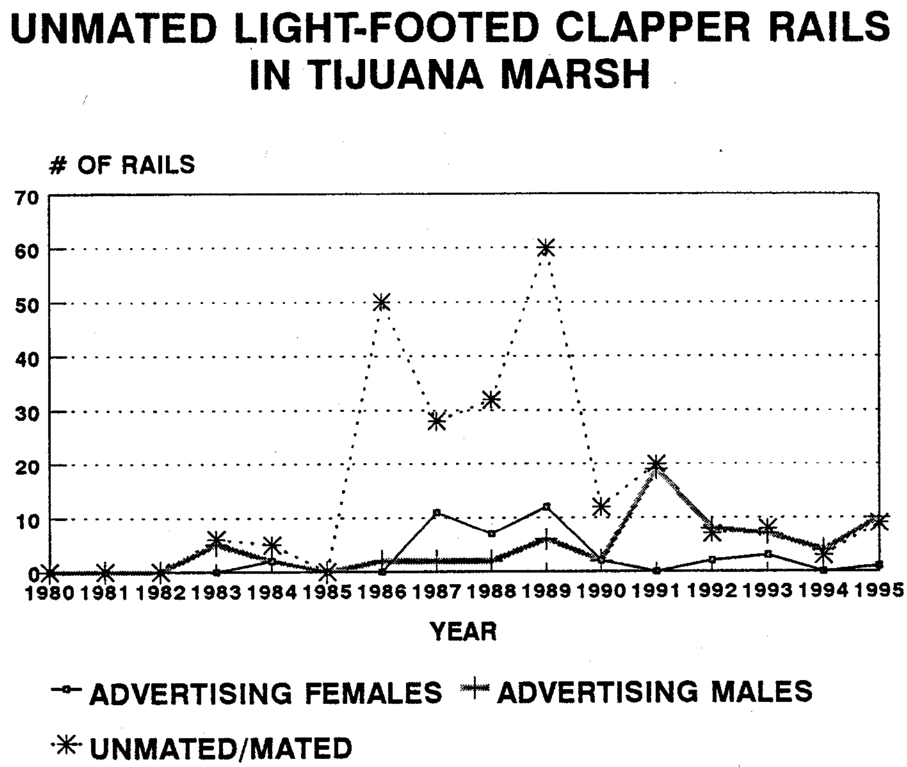


FIGURE 6

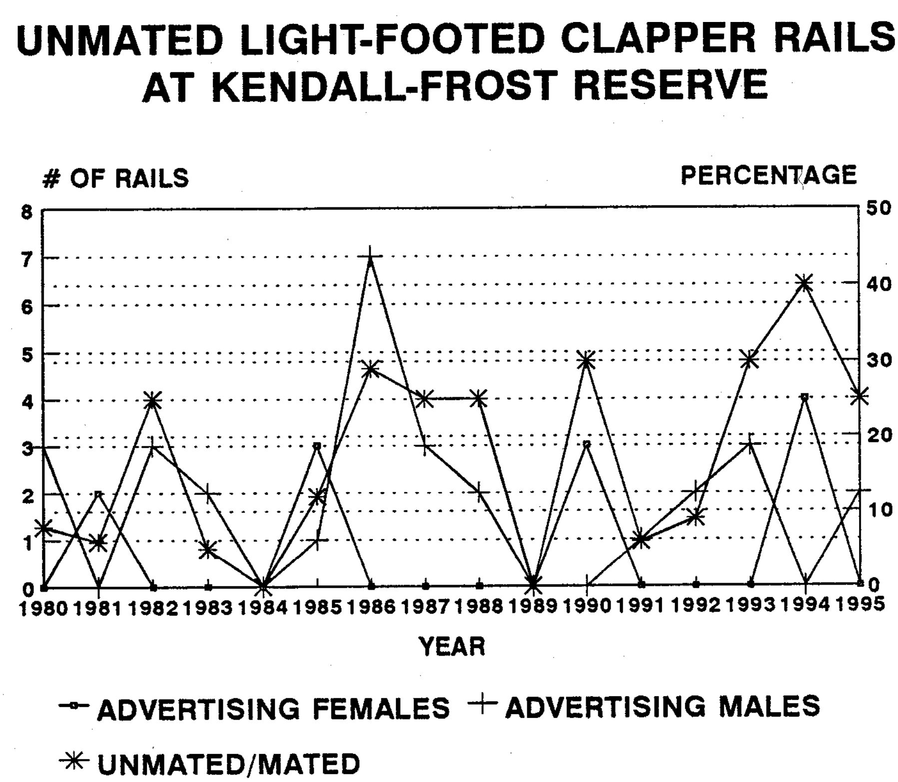


FIGURE 7

wetlands and uplands interdigitate and merge in the brackish and riparian marsh. If females spend a disproportionate amount of time on and at the nest, they would be excessively vulnerable in such a marsh lacking predator-deterring tides that would otherwise disrupt access and cues.

Most of the perturbations that are known to cause major problems for clapper rails are not unique to a particular wetland, although the combinations of factors and effects could confound, even mask, the identification of the cause. Known major problems should be guarded against at each wetland. The Seal Beach NWR, for example, is far from unique in its vulnerability to the potential effects of isolation. Most 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 easily exacerbated by local carnivore management practices.

The conflicts increase with an ever-increasing 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, 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 on habitat edges demanding carnivore management and releasing unwanted pets.

The Tijuana Marsh and Seal Beach NWR sagas offer hope for the light-footed clapper rail. The environmental problems effecting the clapper rails and other wildlife at these wetlands were identified and managed effectively. This has led to subpopulations of over 50 pairs in each for the past three years, indicating the possibilities elsewhere with appropriate monitoring and management.

If the recovery of the light-footed clapper rail is ever to be realized, much better care and advantage must be taken of each of the subpopulations that exist today. Clapper rails should be translocated to Carpinteria Marsh, along with the continuation of annual predator control, nesting raft deployment, and monitoring. 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, consideration should be given to translocations from larger to the smaller subpopulations where consistent management can be provided to reasonably assure that suitable conditions will remain secure. This final recommendation is the result of the recently published work of Fleischer et al., (1995) who found the existing genetic variability in <u>levipe</u>s depauperate, and recommend translocations.

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

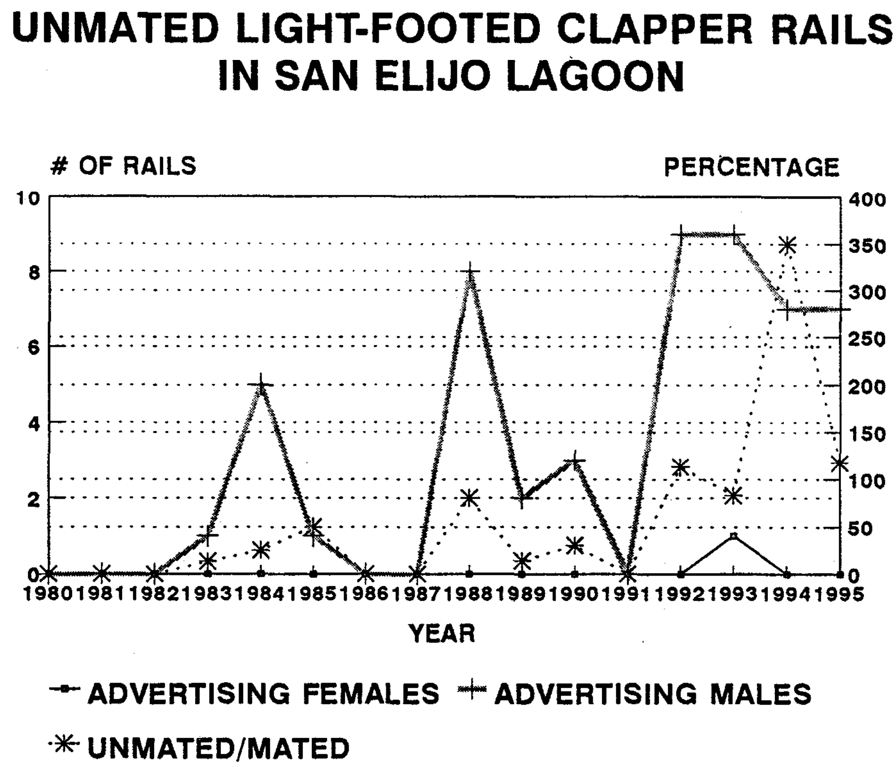


FIGURE 8

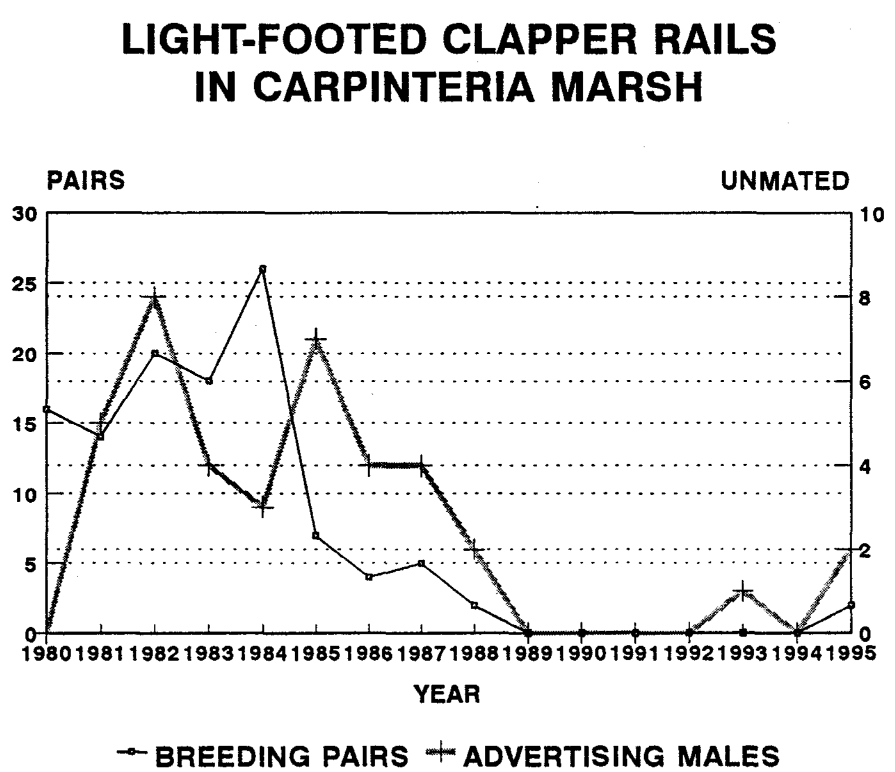


FIGURE 9

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 a major exception to this general rule, although even there, good cover remains along the edges of the flooded wetland, leading to hidden rails and variable count results.

The 1994 high tide count in the Seal Beach wetland gave evidence for a third consecutive year of the maintenance of high subpopulation levels (Table 2). These environs have been managed intensively for the rails through habitat restoration, provision of nesting sites, and predator management, and the rails responded with major growth in their numbers. However, this was not maintained through 1995. The spring call count was 23% lower, the nesting season was poor on the rafts, and by early winter of 1995, the tide survey yielded only one third the number of rails sighted in 1994. Factors that may have driven this decline include the weather and predation.

The spring of 1995 was a very wet one, with regular rain into the early summer. This resulted in unusually regular, large quantities of fresh water into a wetland that usually gets little fresh water influence. This can be physically disruptive to the rails and also may affect their food supply, due to the potentially dramatic changes in salinity. Both uncertain, or shifting, food supplies and physical disruption of nesting sites could have had very negative effects on nesting success and survival in 1995. In addition, raptor predation may have been unusually heavy during the 1994/1995 winter. The raptor population was well-documented during that winter on the Seal Beach Naval Weapons Station and it was unusually large; 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, I have observed as many as 6 red-tailed hawks vying over a single gopher kill. The upland habitats adjacent to the marsh are maintained in low cover and are meagerly productive of prey (although the abundance of great perch sites renders the prey that is there, readily available). Such an abundance of raptors could focus unusually high attention on the marsh and its abundance of bird life. We observed, for example, a red-tailed hawk hovering over and around a raft tumbleweed, as a clapper rail scurried within the remaining, meager cover during a high tide in the winter of 1994.

Occasionally, there were clapper rail remains, typical of raptor kills, discovered on rafts while monitoring. The usual few were discovered in 1995. However, to do what can be done about the possibility of heavy raptor predation, we will replace the old, broken tumbleweeds on the rafts earlier in 1996, in January. Also, we have begun raptor watches at Seal Beach (see below).

The high tide counts in the San Diego County wetlands yielded 9 clapper rails in the Kendall-Frost Reserve, 7 in Sweetwater Marsh, and 64 in Tijuana Marsh. The Kendall-Frost Marsh was totally submerged in a 7.7 ft MLLW tide, raising

Table 2. High tide and call counts of Clapper Rails on the Seal Beach National Wildlife Refuge, 1975 - 1995.

Date	Tidal Height	Clapper Rails Counted	Call[1] Count	% 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)	

[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.

concern for the rails forced to share the meager marsh fringe with domestic pets, predators, and people. Sweetwater Marsh has ample upland cover on several sides and a huge volume of flotsam and debris that the rails use for cover. One of the nesting rafts held a pair of sequestered clapper rails. Tijuana Marsh is very large, with plenty of cover, at least on the marsh margins. Consequently, a thorough count would be quite difficult.

High tide counts at Upper Newport Bay are sometimes productive. However, the most recent count yielded only 9 clapper rails. The tide peaked late enough, that there were already several people out in water craft and the rails were not to be seen. The poor count is typical of results at Upper Newport Bay (see Zembal 1993), given its abundance of cover and aquatic activity.

Banding, Movements, and Observations

Eight clapper rails were captured and uniquely color-banded in 1995 (Table 3), bringing the total number of light-footed clapper rails banded in Upper Newport Bay since 1981 to 195. Four additional rails were captured that were too young to band, and a rail banded in 1994 was recaptured. Six of the rails 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 to past results (Table 3), although the inclusion of captured, but unbanded, first-year rails brings the success up to about average. There were two fruitless early morning sessions, which is surprising, based on past morning results. Incidental captures included a sora (*Porzana carolina*), a rat (*Rattus* sp.), and a song sparrow (*Melospiza melodia*).

There were 92 resightings of 9 banded clapper rails in 1994, and 36 re-encounters with 7 individually color-banded rails in 1995. Three of the clapper rails resighted in 1994 were banded in 1992, 4 were banded in 1993, and 2 were banded in 1994. In 1995, 1 of the resighted rails was banded in 1992, 1 was in 1993, 3 were in 1994, and 2 were in 1995.

The movements of the resighted rails, from sites of last encounter, varied from 1 m to 245 m, and averaged 44 m in 1994; and varied from 5 m - 540 m, and averaged 97 m in 1995. 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 under 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 1995 was of 540 m by rail 1808, a first-year bird.

While, many first-year birds are chased or otherwise make large moves, females have shown strong ties to individual territories. Rail 1362 raised a family in 1993 within 100 m of a site known as "funny duck creek" near the intersection of Back Bay Drive and San Joaquin Hills Road. She was again seen with chicks in 1994 at this same location and was sighted many times during both years, always within an area no wider than about 100 m. Her site-fidelity continued in 1995 when she again raised a brood within 150 m of where she was banded in 1992.

Table 3. Clapper Rail trapping effort and success with drop-door traps, 1981 - 1995.

Year	1981	1982	1983	1984	1986	1987
#Trap Sessions	30	14	13	5	10	8
Date	3/8-	2/14-	1/10-	9/10-	5/27-	7/14-
Span	12/19	10/16	10/21	10/25	11/5	10/23
#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	9/17-	8/18-	9/11-	8/28-	7/31-	8/20-
Span	10/30	10/13	10/22	10/24	10/12	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	16[a]	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	Cumulative
#Trap Sessions	8	8	152
Date	8/21-	8/11-	-
Span	10/7	10/12	-
#Traps Used	19	14-19	8-19
Total Trap-hrs	342	354	5,949
#New Captures	8	8	189[a]
New Caps/Session	1	1	1.24
Trap-hrs/New Cap	43	44	31
#Recaptures	1	1	23
#Recaptured	1	1	22
#No Cap Sessions	2	3	54
%Sessions w Cap	75	62	64

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

Rail #808 was the single recapture for 1995. She was recaptured off of south Shellmaker Island and resighted there many times at locations that spanned about 225 m of marsh. She was mated to rail #807, with whom she was seen copulating several times. They were observed sharing the duties of raising at least three youngsters.

In the 13 years of banding and observing light-footed clapper rails, 1981 - 1994 (there was no activity in 1985), 47.1% of the banded rails were re-encountered (Table 4). Over twelve percent of the 181 clapper rails captured in box traps were recaptured in them, 1 hour to 48.3 months later (average time to recapture = 12.8 months). Eighty-eight of the banded rails were resighted at least once, 0.1 - 61.9 months later with an average final re-encounter time of 13.2 months. The final resightings occurred, 0 - 2,282 m (excluding the one extreme of 21,700 m) from the banding sites and averaged 169 m.

The time to last encounter of 84 clapper rails (excludes 4 dead with no other resighting) was less than 1 yr for 57.1% 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 10). 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 6 pairs with both individuals banded, and an average final re-encounter time of less than 1 yr.

Ideally, disproportionate wariness could be accounted for in these observations, quantitatively. There are great 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.

Nesting Rafts

By the end of the 1995 season, 50 of the 111 rafts on the Seal Beach NWR had clapper rail nests on them, twenty-seven rafts held 35 clutches of eggs, and 10 nests with no evidence of eggs, were used as brood nests (Table 5). This is the lightest use of the rafts since 1992 (Table 6). Hatching success (one or more eggs hatched), was 89% for initial clutches (n = 28) and 100% for renests (n = 7; second clutches in the same nest). Hatching failures were attributable to egg predation by small birds (small beak holes in predated eggs), and to storm damage at two nests.

Most of the 11 new rafts were deployed in the north part of the main marsh, off Bolsa Road, and clustered somewhat near Oil Island Road. Many of the rafts were used by clapper rails for some purpose. For example, 101 of the rails counted during the 1994 high tide survey were sequestered on rafts. Additionally, careful examination revealed shed feathers, cast pellets, and/or crab remains on many rafts, indicating their use for cover and refugia, as well as nesting. We will continue to add rafts each year, in attempting to further recover this subpopulation.

Table 4. Maximum time and distance between encounters with light-footed clapper rails banded, 1981 - 1994.

RECAPTURES IN BOX TRAPS, 1981 - 1994.

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

22 of 181 CRs captured in box traps, were retrapped in them = 12.2%

CLAPPER RAILS RESIGHTED 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 RESIGHTED 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	12-30-94	28.5 mo	100 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
391	9-12-93	3-09-94	5.9 mo	50 m
802	8-21-94	12-30-94	4.3 mo	244 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, 410nrt, 415nr, 420t, 427, 457nrt, 460nrt, 467);
nr = no resighting;
r = recaptured in a box trap.

22 retrapped, 80 resighted, 9 dead = 88 re-encountered
88/187 = 47.1% reencountered 0.1 - 61.9 mo later; avg = 13.2 mos (1,107 mos/84 cr); having moved 0 - 2,282 m, avg = 168.6 m (13,994 m/83 cr)

Time Elapsed To Last Resighting Of 84 Banded Clapper Rails

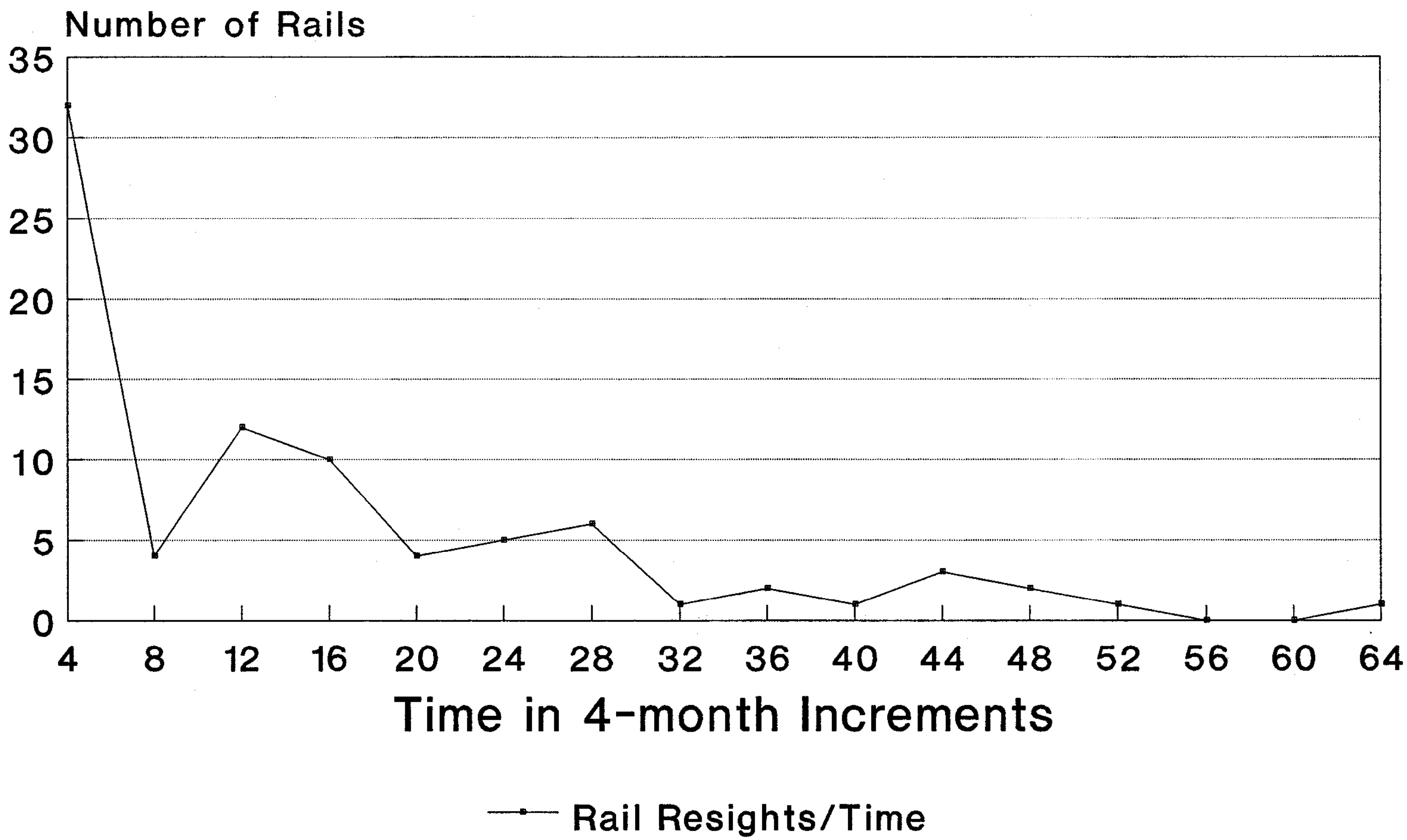


Figure 10

Table 5. Nesting raft use by Clapper Rails in the Seal Beach NWR, 1995.

	Dates of Detection			
Raft #	Nest	Egg/Incubation	Outcome	Remarks
1	4-15	-	-	BN by 7-22
2	6-10	-	-	
3	6-10	-	-	BN by 6-10
7	6-10	-	-	NS
11	-	-	-	Some use 7-22
12	-	-	-	MODO nest
15	6-10	6-10(3)	H 7-19	BN by 5-20
16	-	-	-	Some use 5-20
17	6-10	-	-	
18	5-20	7-1(7)	H 7-17(1 left)	
21	7-22	-	-	
22	6-10	-	-	BN by 7-22
23	5-6	-	-	BN by 6-11
24	5-6	5-6(7)	H 6-10	BN by 6-11
25	6-10	6-10(5)	H 7-1(1 left)	dead ad 5-6
26	6-10	-	-	
27	5-20	6-10	H 6-25	BN
28	3-25	3-25(3)	H 4-30	6 eggs by 4-2
30	5-6	5-6(7)	H 5-20	GRHE on raft 6-10; BN by 8-12
31	5-20	-	-	
34	3-25 NS	7-1(6)	H 7-17	1 P egg nearby
36	3-25	3-25(1) & 5-6(5)	P 4-9(6 eggs by 4-2)(5 by SB?) & H 5-20	
39	3-25	-	-	Some use 7-22
44	4-15	-	-	BN by 7-22
45	3-25	5-6(7) & 6-10(8)	H 5-20 & H 6-25	BN by 6-25
46	3-25	4-22(3)	H 5-20	7 eggs by 5-6
47	3-25	4-17(7) & 6-4(1)	H 5-13 & H 6-25	6 eggs by 6-10; BN
48	5-28	5-28(1)	H 7-1(1 left)	8 eggs by 6-25 BN
52	4-15	-	-	
53	3-25	5-6(5)	H 5-20	
55	5-20	-	-	BN by 7-22
57	3-25	3-25(1) & 6-10(7)	H 5-6 & H 7-1	7 eggs by 4-2 BN
58	3-25	4-19(1) & 6-10(4)	H 5-20(1 left) & H 7-22	P? chick (7 eggs 4-30)
59	6-10	-	-	BN by 7-1
61	3-25	4-17(4) & 6-10(8)	H 5-13 & H 7-1	BN by 5-13 & 7-22
62	7-22	-	-	BN by 7-22
67	5-6	-	-	BN by 7-22
68	3-25	3-25(2) & 7-1(7)	? 5-6 & H 7-17	Storm dump eggs; BN by 7-17
70	4-15	4-15(7)	H 5-6	Inc CR on 6-10, no eggs seen later
71	4-15	4-15(5)	P 5-6	Storm dump then P, BN 7-1
72	5-20	6-4(8)	H 7-1	Alien egg 5-20 AMAV?
74	6-10	6-10(8)	H 7-1(3 left)	
77	4-23	4-23(8)	P 8-12	ad never A, 2 poked left
78	4-15	-	-	
84	-	-	-	Some use 7-1, 22

Table 5 (continued).

85	-	-		-	Alien nest, too small
86	6-10	7-1(4)	H	7-31	5 eggs 7-22, H observed
89	4-15	4-22(7)	H	5-20	BN by 5-20
90	4-22	-		-	
91	5-20	-		-	
95	7-1	-		-	
96	7-1	7-23	H	7-23	BN by 7-23
98	5-20	-		-	NS & 7-1
B5	7-22	7-22	H	7-22	
B8	5-20	5-20	H	5-20	4 chicks, 1 dead 6-10

A = Abandoned; BN = Brood nest; NS = Nest started;
H = Successful hatching; P = Predated; V = Vandalized;
? = Uncertain; SB = small bird; (#) = # of eggs;
MODO = mourning dove; ad = adult rail.

Table 6. Clapper Rail use of nesting structures and hatching success in the Seal Beach NWR, 1987 - 1995.

	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

	1994	1995
No. of rafts available	97	111
No. of nests	75	50
Spring call count	66	51
No. incubation nests	44	28
% of nests with eggs	59	56
% hatching success**	77	89
No. of renests***	22	7
% hatching success	91	100

* 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 (H?, Table 3); 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.

The rail's use of the rafts reached a peak in 1993, and was nearly as high in 1994 (Table 6). The recent increase in clapper rail numbers in Seal Beach was most likely related to intensive predator management and the increased availability of nesting sites (Zembal 1993). This more recent decrease coincided with an extremely large wintering raptor population in 1994/1995, and unusually heavy, late rains in 1995.

We have expressed doubt of the likelihood of a pair of clapper rails producing more than two clutches of eggs. Average egg weight is 22.5 gm (n = 57), so that a clutch of 7 eggs represents over half the body weight of a 300-gm female. In addition, at least 2 months are invested in raising broods. However, for the first time since 1987 when rafts were first deployed, there were two different rafts in Seal Beach in 1994 with evidence of 3 different clutches of eggs, each. Obviously, these could have been laid by more than one female per raft.

Only 5 of the 15 rafts in the Kendall-Frost Reserve held clapper rail nests, and 2 contained single clutches of eggs (Table 7); there were no renests. Hatching success was undetermined. However, there was evidence of nesting in the natural cover with brooding use of two raft-nests. The continued existence of the subpopulation in this little, isolated wetland appears quite tenuous.

The combination of factors that led to past declines in clapper rails at the Kendall-Frost Reserve is not clear. After a brief resurgence in 1992, the subpopulation has fallen again. However, the level of recent raft use seems to indicate the importance of continuing to provide these nesting sites (Table 8). The rafts serve as focal points for monitoring rail use of the marsh, documenting problems, and attempting to alleviate them.

Predation is probably a major limiting factor for rails in this small, isolated wetland. For example, cats were observed on freshly killed clapper rails during high tides in 1989 and 1990. More recently, predator control activity has been annual and there appears to be a large supply of predators for such a small area (see Predator Control, below).

There were two hatches on 2 of the 24 rafts in the Sweetwater Marsh NWR in 1994. Another raft held 2 clapper rails during the high tide count. In 1995, there was nesting activity on 3 rafts including 2 brood nests and a possible hatch. A juvenile rail was flushed from one of the rafts with a brood nest during the August raft monitoring.

Sweetwater is a high marsh and many of the rafts may not float very often. The rafts that have received clapper rail use during the 3 years of raft availability have been those located toward the bay, in the limited lower marsh, cordgrass habitat. The overall utility of rafts at Sweetwater Marsh may be questionable.

Similarly, at Upper Newport Bay, much of the habitat on Middle Island is middle and upper marsh, and there has been only limited nesting use of the

Table 7. Clapper Rail use of nesting rafts in the Kendall-Frost Reserve, 1995.

Raft #	Dates of Detection: Nest	Dates of Detection: Egg/Incubation	Outcome	Remarks
2	3-16	-	-	BN
3	4-28	4-28	?	
4	-	-	-	Raptor-kill c. rail
8	4-28	4-28(5)	?	5 Duck eggs by 6-16
10	4-28	-	-	
11	-	-	-	Predated egg 2m off
14	4-28	-	-	Small mammal use
15	-	-	-	Brooding use, no BN

BN = brood nest; H = successful hatch; Inc = incubation; ? = outcome uncertain; T = tumbleweed; TN = tumbleweed nest; F = failure; (#) = # of eggs observed.

Table 8. Clapper Rail use of nesting platforms and hatching success in the Kendall-Frost Reserve, 1989 - 1995.

	1995	1994	1993	1992	1991	1990	1989
No. of nests	5	10	12	12	9	9	5?
Spring call count	4	5	5	11	9	5	4
No. incubation nests	2	6	5	10	8	7	3
% of nests with eggs	50	60	42	83	89	78	60
% hatching success*	?	100	100	90	88	85	83
No. of renests**	0	0	0	1	4	3	?
% hatching success	-	-	-	100	100	100	-

*Hatching success is based upon post-hatching sign which is sometimes indeterminate (H?, Table 3); 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.

rafts there during their 3 yrs of availability. There were two nesting attempts in the first year but none since. One clutch was successfully hatched and the fate of the second was uncertain. However, this nest was used for brooding later in the season. Most of the use of the Newport rafts by rails is for high tide cover, particularly on the rafts closest to the best cordgrass cover.

Because Bolsa Chica is subject to a highly dampened tidal regime, the most suitable clapper rail habitat is along its edges. However, directly adjacent are heavily traveled trails and roads, including Pacific Coast Highway. Perhaps, in part, because we have placed the rafts well away from such areas of potential disturbance and danger, they are not in the best habitat and have received no detected use, thus far.

Predator Control and Study

The more isolated and smallest of wetlands occupied by clapper rails are plagued episodically with predator problems. We surmised that the most likely cause of the clapper rail's demise in Carpinteria Marsh was heavy predation and began predator control there, partly in preparation for possible rail reintroductions. In 1995, the animals captured and removed included 7 opossums (*Didelphis marsupialis*), 4 feral cats (*Felis catus*), 5 raccoons (*Procyon lotor*) and 2 striped skunks (*Mephitis*). Also, two domestic cats were captured and returned to their owners. Additional raccoons, skunks, and opossums were removed at the request and expense of local home owners. Carpinteria Marsh appears still to be a drop-off point for animals trapped elsewhere. However, there is evidence of periodic coyote (*Canis latrans*) activity in the marsh, which if regular enough, should help to keep terrestrial predator numbers in balance.

The trapping activity in the Kendall-Frost Reserve resulted in the removal of 14 feral cats, 34 opossums, and 7 striped skunks. No rats were captured this year. This is far too many predators for such a little area and explains at least some of the difficulty the rails have had in this marsh. Without consistent management of predators, the rails do not have much of a chance in the Reserve.

The efforts on the Seal Beach NWS demonstrated little red fox activity and were focused upon support of a cooperative coyote project in Orange County. Six coyotes were radio-collared, 28 September 1994 - 11 November 1994, and 5 more were harnessed in April, 1995. The 11 coyotes were captured and monitored, as follows: a male and female in the Bolsa Chica wetlands and environs; 4 males and a female on the Seal Beach NWS; and 3 females and a male in Upper Newport Bay and environs. Data were collected through 31 August 1995 with a total of 2,200 radio locations and many observations on behavior, habitat and corridor use, foods, etc. One purpose of this study was to calibrate through telemetry a more passive, but accurate, coyote monitoring technique for our semi-isolated wetlands in Orange County. Copies of J. Shane Romsos' thesis will be available through Humboldt State University, c/o Dr. Richard Golightly.

Raptor Monitoring

Raptors were abundant at Seal Beach NWR and Upper Newport Bay during the fall/winter of 1995 (Table 9). A total of 10 species was documented, between the two marshes and red-tailed hawks (*Buteo jamaicensis*) were the most abundantly observed raptors at both sites. The minimum number of red-tailed hawks observed hunting the Seal Beach NWR during the 3 hour observation time ranged from 4 in early fall to 10 in mid-December. The minimum numbers of red-tailed hawks at Upper Newport Bay ranged from 3 to 8. It was not unusual to find four northern harriers (*Circus cyaneus*) hunting either marsh. Peregrine falcons (*Falco peregrinus*) and black-shouldered kites (*Elanus leucurus*) were consistently present at both marshes. Much of the activity at Seal Beach is in the disturbed fields adjacent to the refuge. However, the telephone poles along Bolsa and Seventh Aves., which directly abut the marsh, are favored perches for red-tailed hawks and peregrine falcons. At least 4 red-tailed hawks were perched throughout each session, within easy striking distance of the marsh at Seal Beach (an average of 700 minutes perched during the 180 minute sessions). Upper Newport Bay had 3 perched red-tailed hawks throughout the last two sessions.

No clapper rails were observed being predated during the monitoring sessions. However, a harrier attack on a pair was observed at Upper Newport Bay on 29 October 1995. A duet from northeast New Island ended in strangled screeching (Massey and Zembal 1987). A harrier was observed stepping through the cordgrass at the location of the duet. It took flight without prey. It is speculative whether the harrier, while usually hunting by sight, might also take advantage of auditory cues. If a large harrier began cuing in on duets, it would certainly seem to increase its advantage over a prey item that is beyond the general capability of an average-sized harrier.

The abundance of raptors was similar at the two marshes, given differences in topography and observability. We saw no evidence that the super-normal abundance of raptors at Seal Beach observed in 1994/1995 was being repeated in 1995/1996. Perhaps this bodes well for a better 1996 nesting season.

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Table 9. Raptor Monitoring at Upper Newport Bay and Seal Beach NWR, 1995.

SEAL BEACH NWR

	Minimum # indiv.					# of Encounters					Total Time Perched (min)					Total Time Flight (min)				
	a	b	c	d	e	a	b	c	d	e	a	b	c	d	e	a	b	c	d	e
RTHA	4	6	9	8	10	72	175	208	228	212	312	778	823	862	740	15	35	54	95	188
TUVU	7	5	6	8	2	22	16	8	6	8	2	24	0	6	5	20	12	8	4	12
AMKE	1	4	1	2	2	7	37	6	13	21	11	132	15	35	68	3	6	11	3	8
NOHA	4	2	3	4	4	31	66	101	73	35	79	195	343	162	8	16	63	96	115	119
OSPR	4	2	3	3	1	55	7	48	23	6	238	1	94	87	1	20	21	71	8	20
PEFA	1	0	1	2	2	23	0	34	13	28	99	0	160	14	104	1	0	4	39	12
WTKI	2	0	2	1	2	40	0	41	4	31	149	0	185	8	68	21	0	6	7	69
MERL	0	1	0	1	0	0	1	0	3	0	0	1	0	10	0	0	1	0	1	0
LOSH	1	1	2	1	1	1	2	2	1	1	1	4	1	1	1	0	0	1	0	0

a=9/24/95 0830-1130 hrs., RTHA prey-small mammal; OSPR prey-fish. b=10/15/95 0845-1145 hrs.; c=11/5/95 0830-1130 hrs., OSPR prey-fish, PEFA prey ?; d=11/26/95 0830-1130; e=12/16/95 0830-1130.

UPPER NEWPORT BAY ECOLOGICAL RESERVE

	Minimum # indiv.			# of Encounters			Total Time Perched (min)			Total Time Flight (min)		
	a	b	c	a	b	c	a	b	c	a	b	c
RTHA	3	8	7	31	109	124	11	503	559	81	19	17
TUVU	4	4	4	30	23	3	0	0	0	39	39	6
AMKE	2	1	1	14	1	1	35	1	1	5	0	0
NOHA	2	4	4	71	55	89	131	219	385	121	27	33
OSPR	2	2	1	27	11	13	74	24	61	28	11	0
RSHA	1	0	1	2	0	12	0	0	45	6	0	3
PEFA	1	0	2	2	0	2	6	0	2	1	0	0
WTKI	1	0	2	9	0	2	32	0	4	5	0	0
ACCI	0	1	0	0	3	0	0	2	0	0	4	0

a= 10/29/95 0830-1130 hrs, AMKE prey-large insect; b=11/19/95 0830-1130 hrs, fog 0830-0915 hrs., c= 12/29/95 0830-1130, heavy machinery in use for construction on bluff over Shellmaker Island. Encounters represent 5 minutes perched or in flight or appear/disappear in less than 5 minutes.

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; ACCI-Accipiter spp.

THE WETLAND SUBPOPULATIONS

SANTA BARBARA COUNTY

GOLETA SLOUGH is the northernmost wetland with a recent record of light-footed clapper rail occurrence. The last record of which we are aware was an observation of a family of rails outside the slough, west of Los Carneros Road in freshwater marsh in June 1974 (Brad Schram pers. obs.). There were reports of sightings in the slough proper as recently as 1969 and 1972 (Wilbur 1974).

CARPINTERIA MARSH is the current northern extent of the light-footed clapper rail's range. This subpopulation numbered as high as 26 pairs in 1984 but was extirpated as a breeding colony by 1989 (Figure 9 - see P. 17). There were no rails until an advertising male appeared in 1993, and in 1995 there were 2 breeding pairs and an advertising male in the marsh. This follows several years of predator control, which should have rendered the wetland more secure for rails, but there was no way to predict that they would reoccupy the marsh from such a great distance, presumably Mugu Lagoon. A report examining the feasibility of light-footed clapper rail translocations is nearing completion and Carpinteria Marsh is the first proposed recipient marsh.

VENTURA COUNTY

MUGU LAGOON's subpopulation was recently manifest by an advertising male in 1983 and 7 pairs were breeding by 1985. There have been 4 - 7 pairs since, with a usually male-biased pool of singles (Figure 11). There were as many advertising males, as there were breeding rails in this troubled subpopulation in 1994. This huge, by southern California standards, wetland is fraught with huge problems including contaminants (as evidenced by extremely high egg mortality, (Ledig, 1990),sedimentation and greatly dampened tides, inbreeding clapper rails (D. Ledig, pers. comm.), the effects of a local red fox population coupled with periodic coyote persecution, and lack of funding or interest of the necessary magnitude to solve such difficulties.

LOS ANGELES COUNTY

WHITTIER NARROWS includes a freshwater marsh off the San Gabriel River where several observers heard a dueting pair of clapper rails in the winter of 1983. The rail's continued presence could not be confirmed during the breeding season that year and they have not been heard or seen there since. The occurrence of this pair is further evidence of occasional wanderings up rivers and along the coast by light-footed clapper rails (see Zembal et al 1985).

Los Angeles County's wetlands were largely destroyed but there is great hope for the eventual restoration of a viable system at **BALLONA LAGOON.**

ORANGE COUNTY

SEAL BEACH NATIONAL WILDLIFE REFUGE's subpopulation at its known peak consisted of more than 200 clapper rails which were directly sighted during a high tide count in January 1959 (Lockhart 1977). Subsequently, the

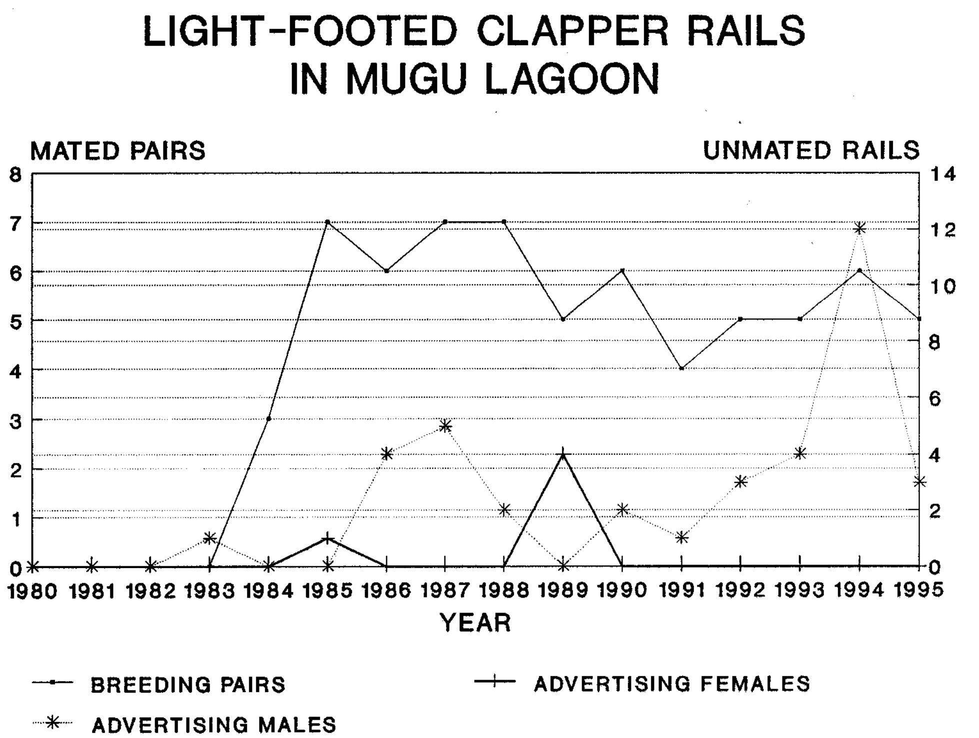

FIGURE 11

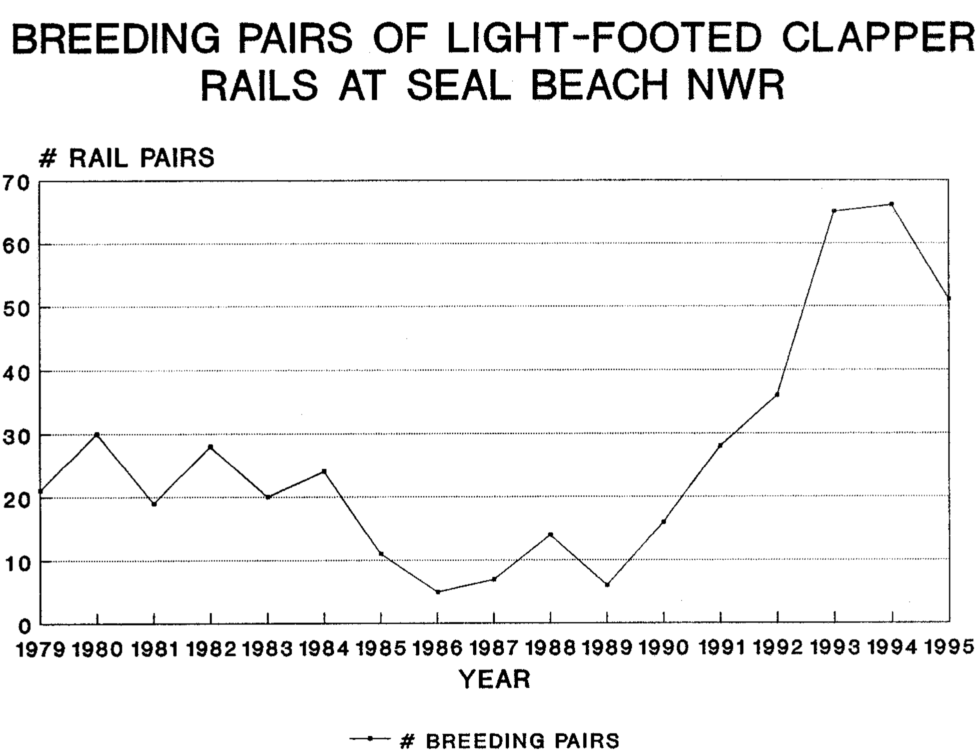

FIGURE 12

subpopulation was nearly extirpated by heavy predation in 1985 - 1989, involving particularly red foxes. This problem was exacerbated by a relative lack of suitable nesting habitat. Appropriate management led to more suitable conditions and the clapper rails increased to a recent high of 66 pairs (Figure 12). This subpopulation is not yet fully recovered but there is certainly increased promise of its recovery. The larger number of rails and ongoing management should greatly aid the resiliency of this subpopulation. Over 200 red-tailed hawks (Buteo jamaicensis) were banded on the NWR and environs in the winter of 1994 (S. Thomas, pers. comm.). The upland habitats surrounding the marsh are meagerly productive of prey (I have seen as many as 6 red-tails on the ground vying over a gopher kill), which places focus on the marsh and its abundance of birds. The remains of many clapper rails with characteristics typical of raptor kills have been found in recent years. The endangered species management plan for the Station calls for upland habitat restoration (U.S. Fish and Wildlife Service and U.S. Navy 1990), which is urgently needed to encourage coyote presence and to remove some of the incredible raptor predation pressure on the marsh.

BOLSA CHICA is located just down coast of the Seal Beach NWR and has probably reaped the benefits of the local clapper rail resurgence. Clapper rail observations are routine at the Bolsa Chica wetland now. However, I have been unable to document breeding. There is the potential for the restoration of hundreds of acres of salt marsh at Bolsa Chica which may eventually, but greatly, benefit the rails. Incorporating a built-up dune edge or other noise barrier along the immediately adjacent Pacific Coast Highway would greatly enhance the rails detection of predators. Every effort should be made to keep Bolsa from becoming any more isolated for top carnivores and to retain as many acres of immediately associated upland habitats as possible.

UPPER NEWPORT BAY has held over 71% of southern California's light-footed clapper rails since 1979 and housed 117 breeding pairs in 1995. This subpopulation has been the only one in California to consistently total 100 pairs or more and to demonstrate strong resiliency to environmental perturbations in the recent past (Figure 13). Sexton (1972) observed 16 - 27 clapper rails during high tide counts and estimated a total of 27 - 39 rails. By the winter of 1977 - 1978, the estimate was up to 75 clapper rails with 60 actually observed (Wilbur et al 1979). One year later, the Newport total was up to 98 pairs, due largely to the development of prime rail habitat in the upper end of the bay. This area was used for salt evaporation, abandoned, and the main dike was breached in 1969 (Lockhart 1977), allowing full tidal action. By 1979, the old salt pond area was occupied by 27 breeding pairs. The quality of the cordgrass on the three islands has deteriorated following the last massive sediment removal project. There is a major problem with unnaturally high sedimentation rates which needs to be dealt with, but doing it all at once has led to scour and perhaps other problems. Much of the in-bay sediment trapping capacity that was created has been filled now by sediment that still is not being adequately dealt with at, or closer to, its source. A significant portion of the island-nesting rails attempt to breed in the fresh water reeds directly adjacent to the uplands and associated people activity and easy predator access. The corridor connectivity to the bay is tenuous; there will be future problems which will be exacerbated by any more impacts to the uplands around the bay or along the corridors.

BREEDING PAIRS OF LIGHT-FOOTED CLAPPER RAILS AT UPPER NEWPORT BAY

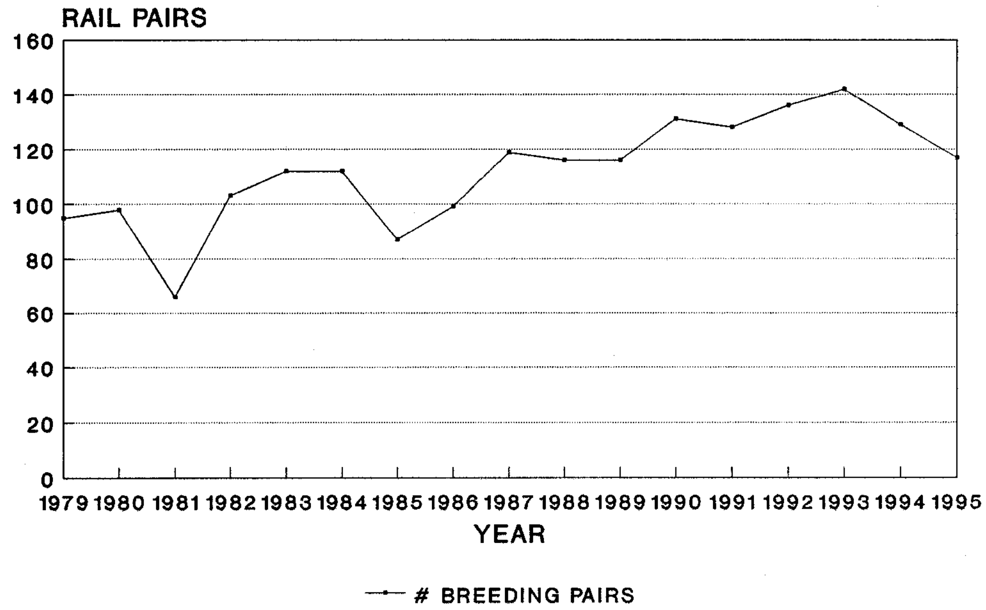

FIGURE 13

LIGHT-FOOTED CLAPPER RAILS IN 4 COASTAL WETLANDS IN SAN DIEGO COUNTY

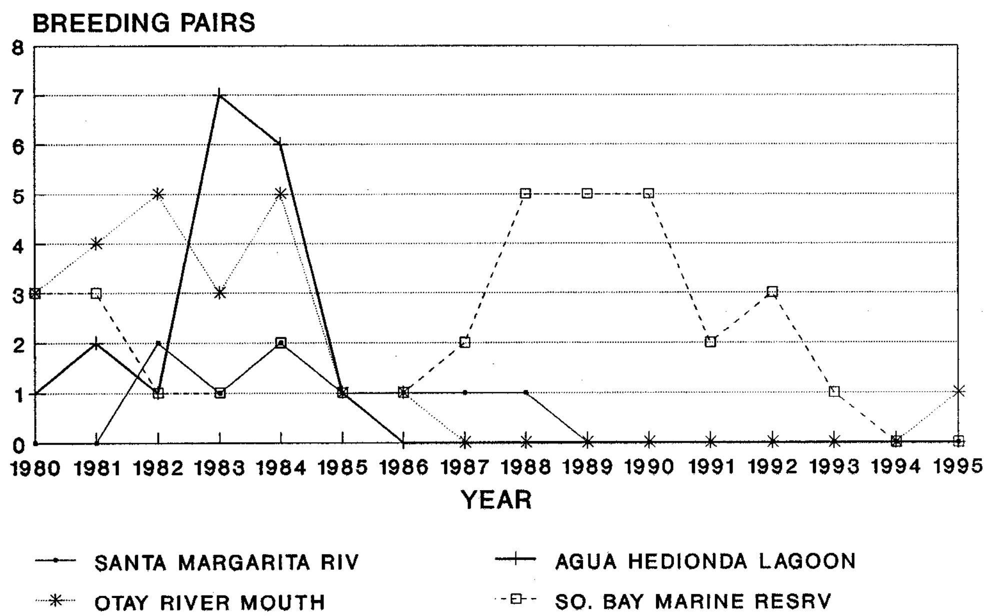

FIGURE 14

SAN DIEGO COUNTY

CAMP PENDLETON COASTLINE includes several wetland parcels along 17 miles of coast, the most likely of which to be used by clapper rails, at least as dispersal refugia include **SAN MATEO CREEK MOUTH, LAS FLORES MARSH, COCKLEBUR CANYON MOUTH,** and **SANTA MARGARITA LAGOON.** All but the Santa Margarita are mostly fresh water marsh and only the Santa Margarita has had any detectable breeding activity which peaked at two pairs in the early 1980s (Figure 14). This subpopulation was since extirpated during prolonged loss of tidal exchange. Tidal action was restored with the help of storm flows but rails have not recolonized. The marsh is high, pickleweed-dominated with ample salt flats and greatly dampened tidal influence. Any future major use of the marsh by clapper rails will require substantial restoration activity. The one other of these wetlands where clapper rails have been detected was Cocklebur, into which advertising males presumably dispersed from the Santa Margarita in 1982.

SAN LUIS REY RIVER MOUTH contains a small stand of fresh water marsh behind a sand berm that allows minimal saltwater intrusion. The berm is regularly breached in winter storms. There were indications of one breeding pair in one year, 1992. The remnant saltmarsh of the Santa Margarita historically stretched to the San Luis Rey River.

GUAJOME LAKE MARSH is a fresh water wetland located along the San Luis Rey River about 7.5 miles from the coast. In 1983 and 1984, there were one and two breeding pairs of clapper rails, respectively, in the marsh. This is further testimony to the ability of these rails to occasionally colonize an inland wetland.

BUENA VISTA LAGOON is the northernmost of 6 largely open-water lagoons in northern San Diego County. It is the most freshwater-oriented of these lagoons but includes a belt of salt marsh plants between the uplands and reeds that is essential for foraging rails. The clapper rails detected have included 1 - 5 pairs and. numerous advertising individuals each year. The annual variation in the size of this subpopulation reflects the intensive edge activities and probable high predation rates. Of the small subpopulations, this one most warrants study, monitoring, and management. In determining Buena Vista's problems and potential, management strategies could be developed that would apply to the other lagoons and fresh water marshes.

AGUA HEDIONDA LAGOON has a small pickleweed flat and used to include a significant freshwater marsh which supported 1 - 7 pairs of clapper rails (Figure 14). This subpopulation was lost when the marsh was dewatered beginning in 1985 as part of a drainage improvement/development project.

BATIQUITOS LAGOON is edged in reeds and a narrow, intermittent belt of salt marsh plants. One pair of clapper rails was detected in 1993 and 1994 in the largest local expanse of wetland vegetation, in the southeast corner of the lagoon. Batiquitos Lagoon is undergoing major restoration which should result in full tidal action and greatly improved habitat for the clapper rail. If all goes well, there should be habitat suitable for a large subpopulation within two decades.

SAN ELIJO LAGOON's subpopulation has exhibited a chaotic flux and extreme sexual skew that must reflect the effects of major problems (Figure 15). The wetland habitat intricately interdigitates with the uplands and the predator access is easy, direct, and unobstructed by tidal wash that would erase cues and confuse locality in a healthier system. Predation rates are probably high and there are all the other perturbations associated with high edge exposure. All of the occupied habitat is situated along the lagoon margin and the narrow inland water course abutted by roads, houses, people, their activities and pets.

SAN DIEGUITO LAGOON has only one recent record, that of an advertising male in 1982. This wetland is not expected to be supportive of a viable clapper rail subpopulation without the restoration of constant tidal action.

LOS PENASQUITOS LAGOON once had a large subpopulation of clapper rails, estimated at about 100 individuals (Wilbur 1979, Wilbur et al. 1979); when the ocean inlet closed off, the number went to zero. By the 1990s, clapper rails again became detectable, most recently including at least one breeding pair. This has coincided with mechanical opening of the lagoon mouth and restoration of fairly regular tidal influence. However, the marsh contours, vegetation, and other characteristics have been affected by several decades of inlet closure, flooding from watershed drainage, and sedimentation. Restoration of this coastal wetland for clapper rails would seem to make sense, recognizing its potential based upon past known use.

KENDALL-FROST RESERVE is small and isolated but has held as many as 20 pairs of clapper rails (Figure 16). Needed predator control has targeted rats and feral cats for the past few years, but the rails have not resurged significantly. There was some recuperation in the early 1990s with the provision of nesting rafts, which partly compensated for diminished cordgrass vigor and the resulting short supply of nesting cover.

SAN DIEGO RIVER FLOOD CONTROL CHANNEL has developed prime cordgrass nesting habitat over the past several years and the clapper rails have slowly responded (Figure 16). FAMOSA SLOUGH is a narrow off-branch that is totally surrounded and bisected by roads and houses. Two pairs of clapper rails nested in Famosa in 1995 within meters of people, their pets, cars, houses, music, etc.

THE SWEETWATER MARSH COMPLEX includes **PARADISE CREEK MARSH** which is connected by a long narrow marsh to the main **SWEETWATER MARSH, E STREET MARSH** (which is separated by a road berm with culverts from the main marsh) and **F STREET MARSH.** The latter connects to San Diego Bay through a culvert and is separated from the other marshes by several hundred meters of old field. The subpopulation in this complex peaked in 1984 at 18 pairs (Figure 17). These are high marshes with local, small stands of cordgrass that are capable of adequately accommodating clapper rail nests. Nest rafts provided in 1991 have received little use. Major potential problems like predation and contaminants await more thorough examination.

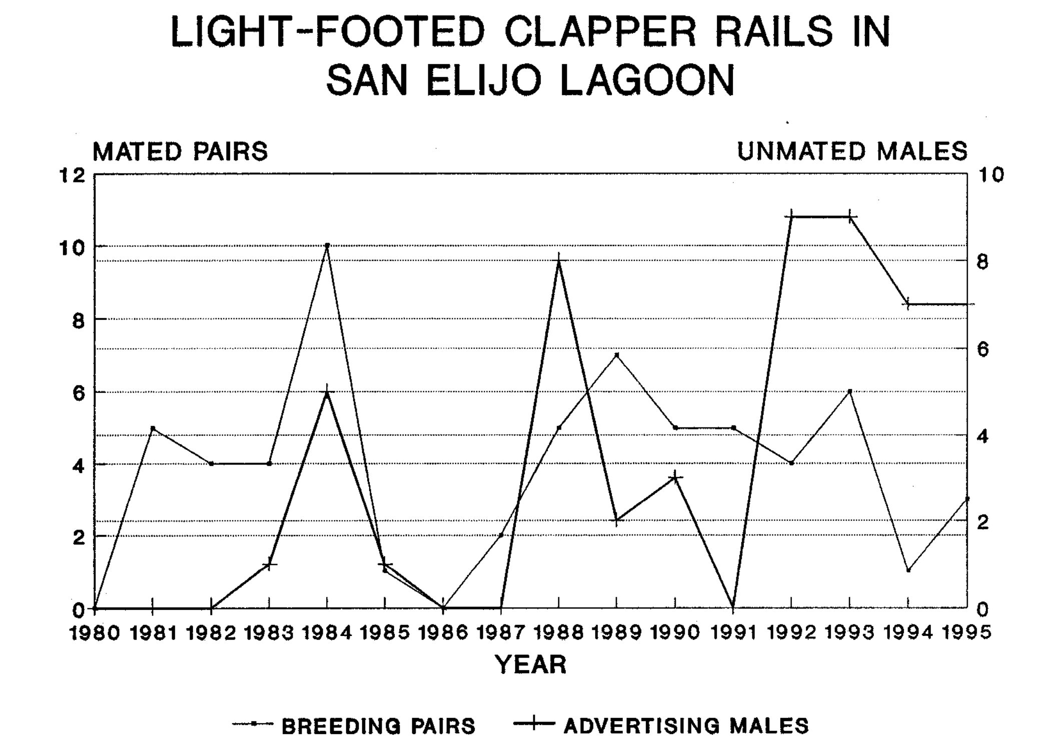

FIGURE 15

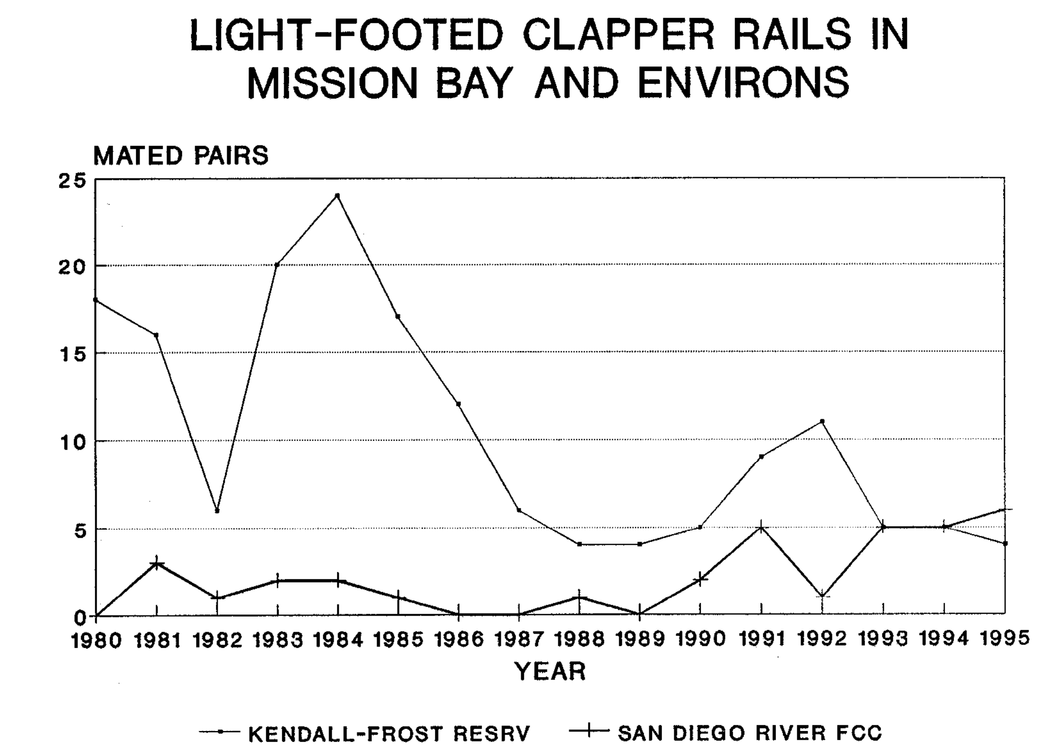

FIGURE 16

LIGHT-FOOTED CLAPPER RAILS IN THE SWEETWATER MARSH COMPLEX

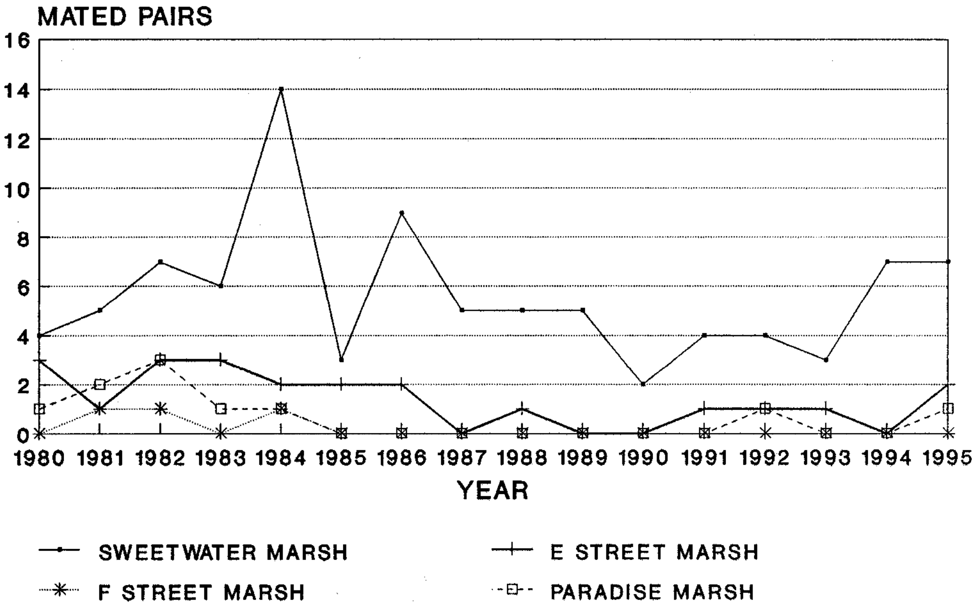

FIGURE 17

BREEDING PAIRS OF LIGHT-FOOTED CLAPPER RAILS IN THE TIJUANA MARSH

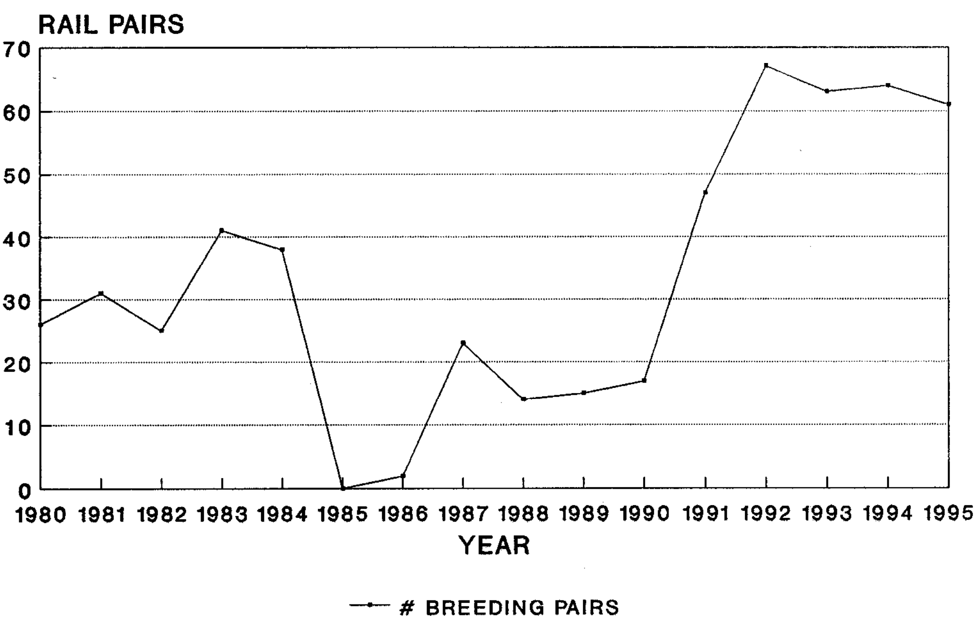

FIGURE 18

J STREET MARSH is small but contains tall dense cordgrass that looks deserving of clapper rail occupation. In spite of this there is only one recent record of breeding activity, in 1981.

OTAY RIVER MOUTH is narrowly confined within berms from I-5 to south San Diego Bay. The marsh includes a very narrow belt of salt marsh plants nearest the bay with two nice stands of cordgrass. Up to 5 pairs bred in this vulnerably thin wetland in the early 1980s but by 1987 detectable breeding activity had ceased (Figure 14). Then, in 1995 a single breeding pair was discovered in the cattails much further inland near the freeway where a bike path crosses the channel.

SOUTH BAY MARINE RESERVE held 5 breeding pairs of clapper rails in 1988 - 1990 and had at least 1 breeding pair each year, for 15 years (Figure 14). However, this little subpopulation was extirpated in 1994.

DAIRYMART PONDS and the other large fresh water marsh pockets between Dairymart Road and the Tijuana Marsh are regularly used by clapper rails. Annually, there are advertising singles in these wetlands and regularly, there is breeding activity.

TIJUANA MARSH's expansive diversity of saltmarsh and other wetland habitats has supported more than 60 pairs of clapper rails for the past 4 consecutive breeding seasons (Figure 18). This is the known high for this marsh and ranks this subpopulation as the second largest in California. International efforts are in progress to deal with contaminant issues in the Tijuana River drainage. However, the sedimentation problem that closed the ocean inlet and destroyed habitat suitability for clapper rails in 1985 still demands careful monitoring and will occasional require expensive restoration work. These efforts should be proactive.

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