State of California
The Resources Agency
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LIGHT-FOOTED CLAPPER RAIL MANAGEMENT AND POPULATION ASSESSMENT, 1996

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ABSTRACT

The seventeenth 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 - 25 April 1996. There were 325 pairs of clapper rails exhibiting breeding behavior in 15 marshes, a 24% increase from the 1995 population estimate and the highest count since annual surveys began. One hundred and fifty-eight pairs, or 49% 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 287 pairs, or 88% of the California population. The other subpopulations are small and in serious jeopardy, which could be counteracted with increased management and the provision of additional habitat. Otherwise, without several large viable population centers, the continued existence of the light-footed clapper rail remains insecure.

A high-tide count on the Seal Beach NWR in December 1996 resulted in the sighting of 55 clapper rails, which is identical to the high count in 1995. Effective control of non-native red foxes (Vulpes) and other management measures resulted in an encouraging expansion of this subpopulation.

Eight trapping sessions at Upper Newport Bay, with 14 - 19 drop-door traps and 398 trap-hours, resulted in the capture and unique color-banding of 15 more clapper rails and 4 recaptures of 3 previously banded rails. One of these was recaptured to remove bands from a badly swollen leg. There were 86 resightings of 10 banded rails in 1996. The average movement detected of these rails was 73 m. The largest spread of detection points for any rail was of 370 m. The longest time span between banding and resighting of any one of the 195 rails banded since March 1981 has been 61.9 months. One of the 10 resighted rails was banded in 1992, 1 in 1993, 3 in 1994, 1 in 1995, 3 in 1996, and one was unknown. Banding success over the 15 years

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of banding is compared, and resightings of banded rails are summarized for the period 1981 - 1995. Over 47% of the 195 rails banded during this period were re-encountered, and 12.2% of the 189 rails captured in drop-door traps were recaptured in them, 1 hour to 48.3 months later.

Fifty-four clapper rail nests were found on the 126 rafts made available in the Seal Beach NWR. Thirty-four of the nests held 46 clutches of eggs and there were at least 24 additional brood nests. Hatching success was 87% for initial attempts and 92% for renests. The 15 nesting rafts deployed at the Kendall-Frost Reserve contained only 3 clapper rail nests and no clutches of eggs. One off-raft nest hatched in a tumbleweed. 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. One of these was an incubation nest first, which hatched successfully; one of the others was a brood nest. None of the rafts on Middle Island in Upper Newport Bay, or in Bolsa Chica, supported clapper rail nests in 1996. However, one of two rafts in Carpinteria Marsh had a successful nesting attempt on it.

Continued coyote (Canis latrans) presence was documented in many of the wetlands during rail predator monitoring activities. Predator control was continued in several of the smaller, more isolated wetlands where problematic quantities of feral cats, skunks, opossums, and rats are encountered.

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 14 species were summarized for 15 winter sessions, 9 on the Seal Beach NWR and 6 at Upper Newport Bay.

INTRODUCTION

Loss and degradation of southern California salt marshes have greatly reduced the habitat acreage and contiguity of wetlands suitable for light-footed clapper rails (Rallus longirostris 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 now offer some promise of recovery. The California population of this endangered bird increased to 325 pairs in 1996, the largest number detected breeding in one year since monitoring and study began in 1979. 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 1996 call counts were conducted in 34 coastal wetlands from March 2 through April 25, from Carpinteria Marsh in Santa Barbara County on the north, to Tijuana Marsh in southern San Diego County.

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 R. 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 non-vocal 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. These birds were intentionally disturbed by the investigator 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 rail distribution, 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 overestimation of the breeding subpopulation.

High Tide Counts

There have been counts of clapper rails during extreme high tides on the Seal Beach National Wildlife Refuge 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 has been 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 5 canoes covered the 369-ha (911-acre) refuge in about 2 hrs on 10 December 1996. High tide counts were also done in Carpinteria Marsh on 27 July, on 11 December in the Kendall-Frost Reserve and Sweetwater Marsh NWR, and on 12 December 1996 in Tijuana Marsh NWR.

Banding, Movements, and Observations

There were 8 trapping sessions, 30 August - 10 November 1996, for a total of 398.5 trap-hours with 15 - 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). As usual in past years, trapping was confined 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 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

With the addition of 14 new rafts, a total of 126 rafts was available for potential rail nesting on the Seal Beach NWR in 1996. A description of the raft design is available in earlier reports (Zembal and Massey 1988). The rafts were renovated in January 1996, 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 waterlogged 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 8 times, 23 March - 10 August 1996, with 6 extra visits to check specific clutches.

An Eagle Scout project provided a few more rafts for a total of 12 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 and floats and checked in late May. Twenty-four rafts were renovated in the Sweetwater Marsh NWR on 6 March 1996 and checked in March and July. 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 placed in Carpinteria Marsh in May 1995 were checked in July.

Predator Control

The U.S. Department of Agriculture's Animal Damage Control (ADC) 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 U.S. Fish and Wildlife Service (Service). A variety of traps was used, depending upon conditions and target species. For example, ADC employed cage traps at Famosa Slough over 17 site visits, 6 December 1995 - 4 January 1996.

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 Island and Hog Island. 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 7 and 28, February 18, March 10, September 29, October 20, November 10, December 1 and 22 on the Seal Beach NWR; and on January 21, February 11, March 3, November 2 and 23, and December 14 at Upper Newport Bay.

RESULTS AND DISCUSSION

Status and Distribution

The breeding behavior exhibited during call counts resulted in a population estimate of 325 pairs of light-footed clapper rails in 15 coastal wetlands in southern California (Table 1). This is the highest annual population total since 1980 and represents a 24% increase from 1995 (Figure 1). This is the third highest total number of wetlands occupied by clapper rails exhibiting breeding behavior in any year (Figure 1). Thiry-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 48.6% of the total in 1996. 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 1996, it was as high as ever recorded, attesting to the seeming vigor and health of the marsh habitat at Upper Newport Bay.

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 non-native 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.

CENSUS OF THE LIGHT-FOOTED CLAPPER RAIL IN CALIFORNIA, 1980 - 1996

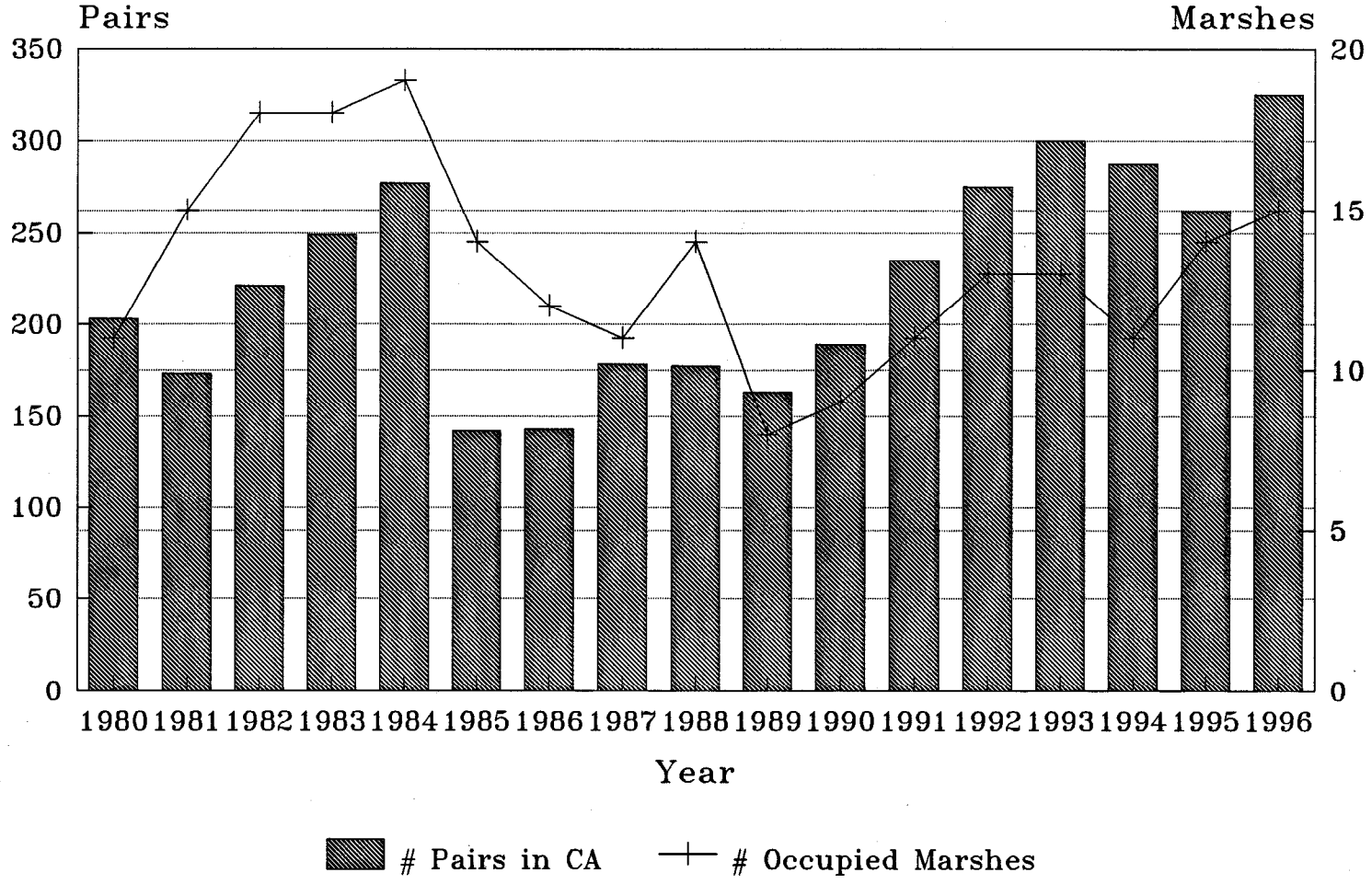


FIGURE 1.

Table 1. Census of the Light-footed Clapper Rail in California, 1980-1996.

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

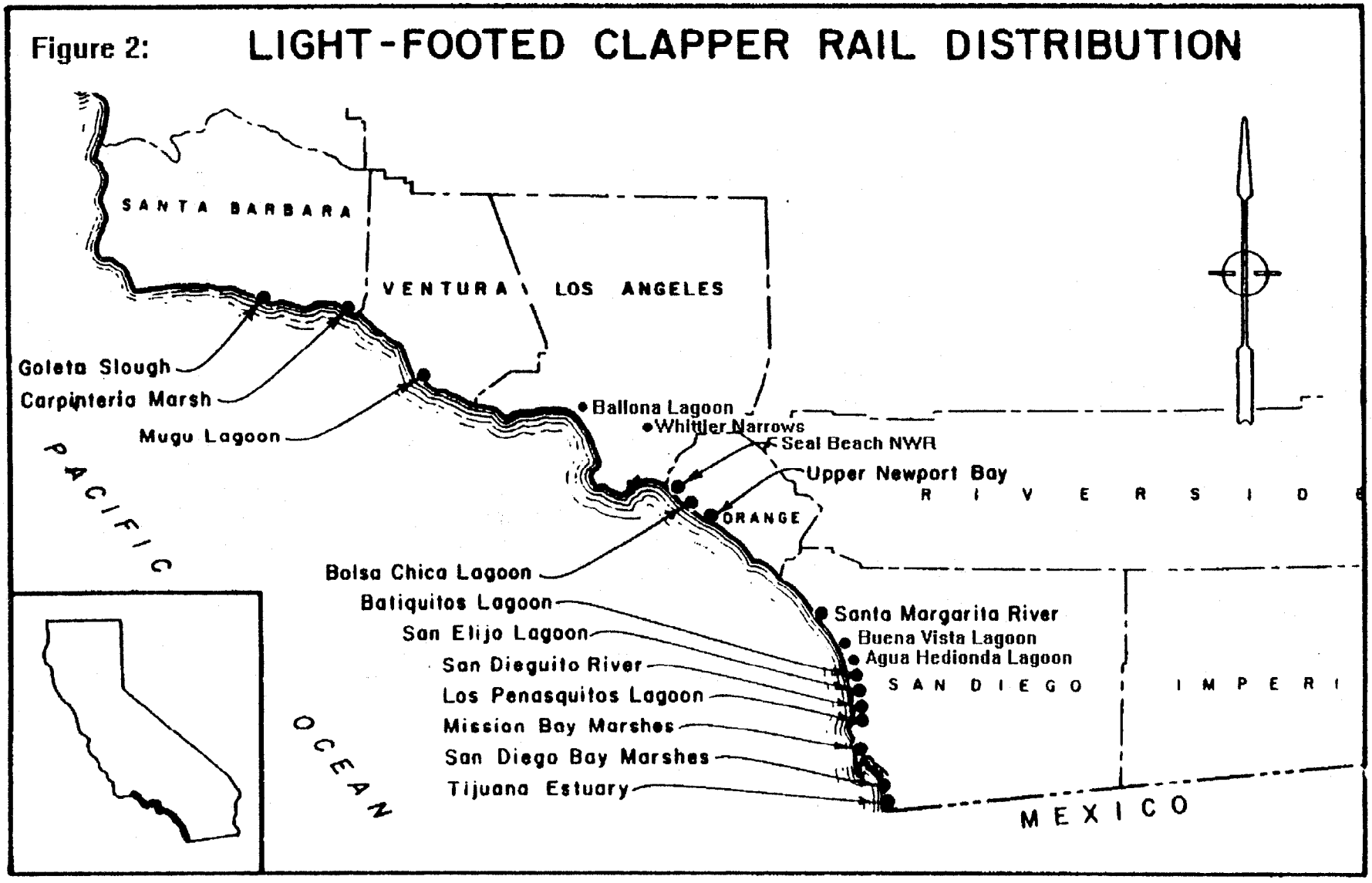
- indicates that no census was taken.
* indicates a fall or winter occurrence
# indicates the detection of unpaired rails (used beginning in 1987).
a Data are from Paul Jorgensen's field notes.

Table 1. Census of the Light-footed Clapper Rail in California, 1980 - 1996 (Continued).

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

- 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.

Figure 2: LIGHT-FOOTED CLAPPER RAIL DISTRIBUTION



THREE MAJOR SUBPOPULATIONS OF LIGHT-FOOTED CLAPPER RAILS

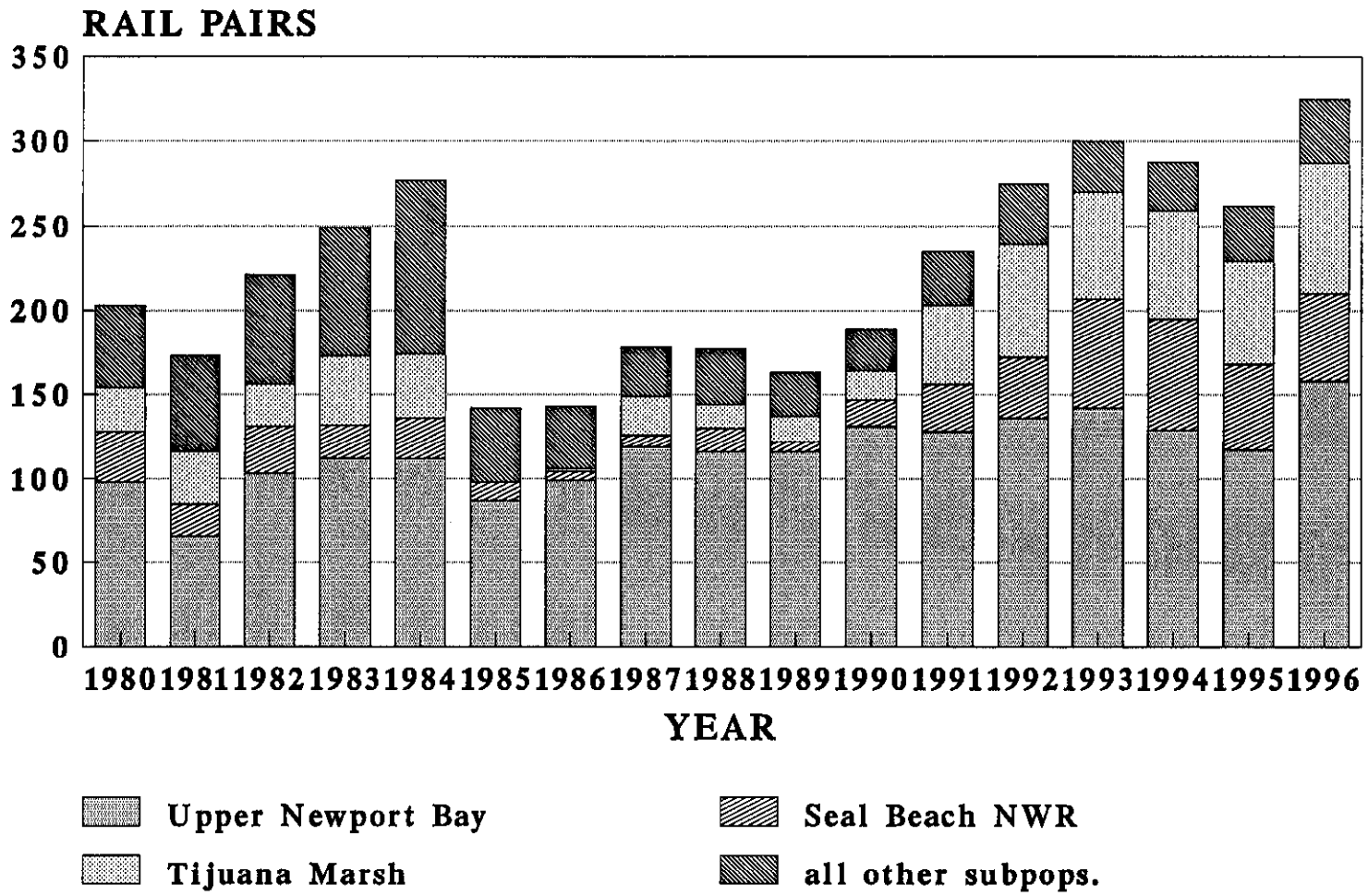


FIGURE 3

The three largest subpopulations comprised 88.3% of the breeding clapper rails on the coast of southern California in 1996. 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 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 their sporadic disappearance is counterproductive. Their occasional recurrence, as in Carpinteria Marsh in 1995, is perplexing.

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, thiry-one wetlands have been occupied by breeding clapper rails since 1980, but never more than 19 marshes (range, 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 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 along 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 enhance 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 en route is diminished, established behavioral patterns are interfered with, and the carnivore population balance is affected by more people and pets on habitat edges, with the people demanding implementation of their personal vision on wildlife management.

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. This has led to subpopulations of over 50 pairs in each for the past four 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 R. l. levipes depauperate, and recommend translocations.

The restoration project and management at Batiquitos Lagoon currently present the highest possibility of new habitat for the light-footed clapper rail. If the lagoon were to remain open to the ocean for decades and ample productive marsh were to develop, conditions there might be suitable for another large subpopulation. However, it is likely to be a very slow process.

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, leading to hidden rails and variable count results.

The 1996 high tide count in the Seal Beach wetland gave evidence for a fourth 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. The rails responded with major growth in their numbers that has stabilized at approximately 50 pairs. The local fox population is too small to be a major problem for the rails, so something else must be regulating additional growth of this rail subpopulation.

Raptor predation 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 6 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.

Table 2. High tide and call counts of Clapper Rails on the Seal Beach National Wildlife Refuge, 1975 - 1996.

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)	

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.

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 while monitoring, clapper rail remains typical of raptor kills were discovered on rafts. The usual few were discovered in 1996; if there were large numbers of rail kills, they were unobserved in the marsh. Just in case heavy raptor predation is occurring, broken tumbleweeds were replaced on the rafts earlier in 1996, providing better cover for the rails during January high tides. Also, raptor watches were continued at Seal Beach (see below).

The high tide counts in the San Diego County wetlands yielded 1 freshly killed clapper rail in the Kendall-Frost Reserve, 2 rails in Sweetwater Marsh, and 36 in Tijuana Marsh. Kendall-Frost Marsh was amply submerged in a 7.4 ft MLLW tide, raising concern for those rails forced to share the meager marsh fringe with domestic pets, predators, and people. The only clapper rail seen there was warm, freshly decapitated, and being consumed by a red-shouldered hawk (Buteo lineatus). Three cats were also seen roaming the edge of Kendall-Frost during the count. Cats are of far greater concern for rails than red-shouldered hawks. 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 and with plenty of cover, at least on the marsh margins. Consequently, a thorough count would be quite unusual.

Although we saw only 3 clapper rails, the high tide visit to Carpinteria Marsh at dusk in July was rewarding. At least 3 pairs of rails and a single "clappered" testify to the inexplicable return and current persistence of the clapper rails there.

Banding, Movements, and Observations

Fifteen clapper rails were captured and uniquely color-banded in 1996 (Table 3), bringing the total number of light-footed clapper rails banded in Upper Newport Bay since 1981 to 210. Two additional rails were captured that were too young to band, and there were four recaptures of three banded rails. Five 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 better than average, and the inclusion of captured but unbanded first-year rails and recaptures raises the success to high (Table 3). There were two sessions with no captures and one incidental capture of a sora (Porzana carolina).

There were 86 resightings of 10 banded clapper rails in 1996. One of the resighted rails was banded in 1992, 1 was banded in 1993, 3 were banded in 1994, 1 in 1995, 3 in 1996, and one was unknown (missing an annual code band).

The movements of the resighted rails from sites of last encounter varied from 5 m to 370 m, and averaged 73 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 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 #808, at that time a first-year bird. By 1996, rail #808 had established herself and was resighted 17 times over an area that spanned about 185 m of marsh. Her average move between sightings was of 62 m.

While many first-year birds are chased or otherwise make large moves, females, once established, have shown strong ties to individual territories. For example, rail #362 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

Table 3. Clapper Rail trapping effort and success with drop-door traps, 1981 - 1996.

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	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	Cumulative
#Trap Sessions	8	8	8	160
Date	8/21-	8/11-	8/30-	-
Span	10/7	10/12	11/10	-
#Traps Used	19	14-19	14-19	8-19
Total Trap-hrs	342	354	398	6,347
#New Captures	8	8	15	204a
New Caps/Session	1	1	1.88	1.34
Trap-hrs/New Cap	43	44	27	31
#Recaptures	1	1	4	27
#Recaptured	1	1	3	25
#No Cap Sessions	2	3	2	56
%Sessions w Cap	75	62	75	65

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

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. We did not see her family in 1996 but did see her twice within 100 m of where she was banded for her fourth year in the same home range.

Rail #808 was mated to rail #807 in 1995 and 1996. They were observed sharing the duties of raising youngsters in both years in the same area of Shellmaker Island, with sightings that spanned about 200 m. Rail #808 is the female and was observed 17 times, compared to 36 resightings of the male. The average distance between consecutive sightings for both was 69 m. As has been a regular problem in the past, rail #807 had lost his annual code band at some point in 1996. He was banded with green plastic on the right leg and yellow over the Service band on the left. For much of 1996, we assumed that the male with yellow left, still mated to rail #808, was #807.

Rail #812 occupied the home range just to the south of rails #807 and #808. During several simultaneous resightings of rail #812 and one or both of its northern neighbors, it was again evident that border tension persisted; that overlap in activity areas occurred; and that agonistic reaction to encounters usually involved posturing and repositioning, rather than outright pursuit or other more physical interaction.

There were 4 recaptures in box traps of 3 banded rails in 1996. Two were originally banded in 1996, approximately 1 month to 2.5 months earlier. Rail #823 was recaptured 250 m from its banding site, across a major tidal creek and mudflat, and flew to within 130 m of the banding site upon release. Rail #828 was recaptured at the same site as rail #823 and on the same date, 175 m from its original banding site. Rail #802 was banded in 1994 and recaptured 370 m from its banding site. However, it was re-encountered 10 times in 1996, within an area that spanned about 150 m. Rail #802's bands were removed because the upper one had been jammed up into the joint and considerable edema had developed below the bands. The rail appeared otherwise healthy and quite mobile, although limping on the swollen leg. It weighed 378 gm when banded in 1994, and 414 gm when recaptured. It re-entered another trap 25 m to the north of the recapture site and was caught again an hour later.

In the 14 years of banding and observing light-footed clapper rails, 1981 - 1995 (there was no activity in 1985), 47.7% of the 195 banded rails were re-encountered (Table 4). Over 12% the 189 clapper rails captured in box traps were recaptured in them 1 hour to 48.3 months later (average time to recapture = 12.1 months). Ninety-three of the banded rails were re-encountered at least once, 0.1 - 61.9 months later, with an average final re-encounter time of 13.2 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 89 clapper rails (excludes 4 dead with no other resighting) was less than 1 yr for 57.3% 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-lived (Figure 4). Five or 6 years 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 year.

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 - 1995.

Recaptures in box traps, 1981 - 1995.

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
808	11-05-94	8-11-95	9.2 mo	45 m

23 of 189 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	6-19-95	34.1 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
802	8-21-94	12-28-95	16.2 mo	244 m
807	9-09-94	10-13-95	13.1 mo	188 m
808r	11-05-94	8-11-95	9.2 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

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.

23 retrapped, 85 resighted, 9 dead = 93 re-encountered
93/195 = 47.7% reencountered 0.1 - 61.9 mo later; avg = 13.2 mos (1,173.4 mos/89 cr); having moved 0 - 2,282 m, avg = 169 m (14,869 m/88 cr)

Time Elapsed To Last Resighting Of 89 Banded Clapper Rails

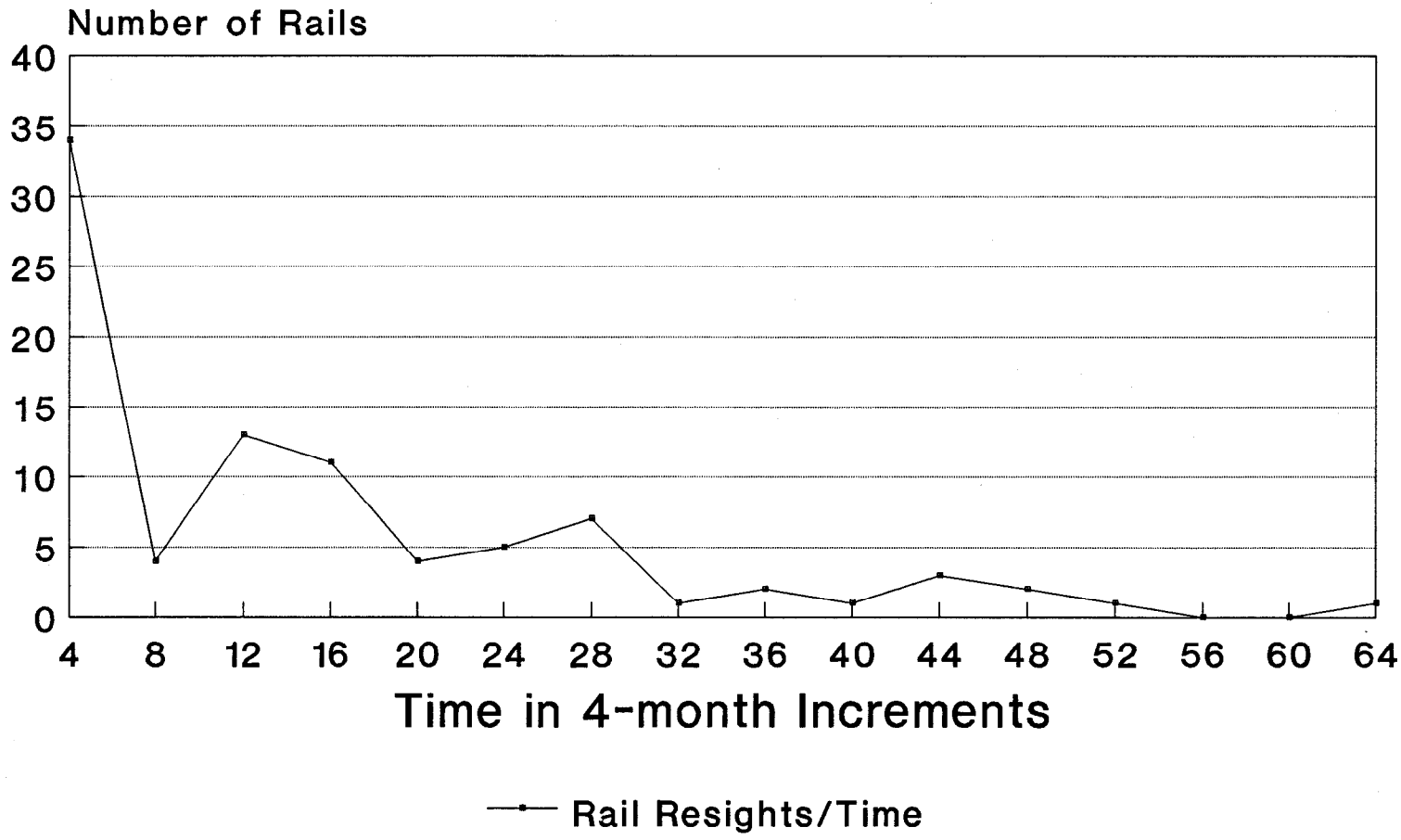


Figure 4

Nesting Rafts

There were clapper rail nests on 54 of the 126 rafts made available in the Seal Beach NWR in 1996. Thirty-four of the nests held 46 clutches of eggs and there were at least 24 additional brood nests (Table 5). This is slightly higher use than in 1995, but well below the 1993 and 1994 seasons (Table 6). 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.

Half of the 14 new rafts were used by the rails for essential breeding activities already in this first year of their availability. Four of them held 7 clutches of eggs, 5 of which hatched. Three additional new rafts were used for brood nests.

Management of terrestrial predators and the provision of nesting rafts at this 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 rails below 1993/1994 levels at about 50 pairs for the past two years could be associated with high raptor populations in the winter (see Zembal et al. 1995, 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 (see Kendall-Frost raft discussion below). The visibility of the rafts amid 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. Some of the rafts may also offer elevated perches on tumbleweeds flattened by weathering, herons, and egrets-another advantage to hunting raptors. 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 experiment with possible solutions.

The Kendall-Frost Reserve is one of our most isolated, small 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 winter high tide count. Although there were three rail nests on rafts this spring, there were no eggs (Table 7). This was the poorest of seasons on the rafts since 1989, the year the rafts were first deployed in the reserve (Table 8). The spring call count yielded only one pair and an advertising male; raft monitoring and maintenance revealed three raptor-killed rails on three different raft tumbleweeds; and the one rail seen on the winter count had just been killed and was being consumed by a red-shouldered hawk. With a spring 1995 count of just 4 pairs and a 1996 count of one pair, there were very few rails left in this marsh. For them to be so vulnerable to raptor predation at such low population levels is alarming and perplexing.

Three of the 24 rafts in the Sweetwater Marsh NWR held clapper rail nests in 1996. 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. However, for the first time there was a successful hatching on a raft in the Vener Pond area, a recently restored area in the middle of the marsh. We had questioned the overall utility of the rafts in Sweetwater Marsh, but as long as at least a few are used each year, we will continue to make them available.

Two rails were observed on Raft #8 on Middle Island in Upper Newport Bay on February 27 during a high tide, but no nesting ensued in the spring. Similarly, there has been no detected use of the Bolsa Chica rafts to date for nesting. In contrast, one of two rafts in Carpinteria Marsh was used successfully by a clapper rail pair. We will provide the rails additional rafts in 1997, if all of the necessary permissions can be obtained in time.

Table 5. Nesting raft use by Clapper Rails in the Seal Beach NWR, 1996.

Raft #	Nest	Dates of Detection: Egg/Incubation	Outcome	Remarks
1	3-23	4-13(7) & 6-8(6)	H 5-4 & H 6-29(1 left)	BN by 7-6
2	8-10	-	-	BN by 8-10
7	3-23	4-13	H 5-18	BN by 5-18
11	5-4	-	-	BN by 6-8
12	5-4	5-4(6)	H 6-8	BN by 6-8
13	3-23	-	-	BN by 8-10
14	4-13	5-4	H 5-18	BN by 6-8
15	3-23	5-18(6)	H 6-29	
16	6-8	-	-	BN by 6-8
23	7-20	-	-	BN by 7-20
25	3-23	4-13(5)	H/P 5-4	Some egg predation
27	3-23	4-13 & 6-29(6)	H 5-18 & H 6-29(1 left)	BN by 6-8
28	4-13	-	-	BN by 7-20
29	5-18	-	-	BN by 6-29
30	5-4	5-4(6)	H 6-8	BN by 8-10
31	4-13	4-13(2)	P 5-4	Egg Predation
34	6-8	-	-	BN by 6-8
36	3-23	-	-	BN by 6-8
39	3-23	4-13 & 6-29(5)	H 5-18 & 6-29	BN by 6-8
40	4-13	-	-	BN by 6-8
42	5-4	-	-	
44	3-23	5-4(5)	H/P 5-18	Egg Predation BN by 6-8
46	3-23	6-8	H 6-8	BN by 6-8
47	6-8	6-8(7)	H 6-29(2 left)	BN by 8-10
48	4-13	4-13(2) & 5-4(4)	H 5-18	BN by 7-20
49	5-18	-	-	BN by 7-20
50	8-10	-	-	BN by 8-10
53	3-23	4-13(3) & 6-29(5)	H 5-18 & H 7-20	
54	3-23	6-29	H 7-20	
57	3-23	5-4 & 6-29	H 5-18 & H 7-20(1 left)	
59	4-13	5-4	H 6-8	
63	6-29	-	-	BN by 8-10
64	5-4	6-29	H 7-20	
66	4-13	5-18	H 6-8	
67	4-13			
68	3-23	4-13(4), 5-4(6), 6-8(4)	H 5-18 & H 7-20(1 left)	
70	5-4	-	-	BN by 8-10
73	3-23	4-13(1), 5/4(7), 6-29(3)	H 6-8 & H 7-20	BN by 7-20
77	3-23	-	-	
84	6-8	-	-	BN by 6-8
85	6-8	-	-	BN by 6-8
89	3-23	4-13 & 6-8(4)	H 5-4 & H 6-29	chicks seen
91	6-8	-	-	BN by 6-8
92	8-10	-	-	BN by 8-10
93	3-23	4-13(5)	P 5-4	Adult predated
95	3-23	4-13(7) & 6-29(6)	H 5-18 & H 7-20	BN by 6-8
96	6-8	6-8(1) & 6-29(7)	H 7-20	(2 left)
98	-	-	P 5-18	Adult predated
100	4-13	4-13(4)	H 5-18	BN by 6-8
102	5-18	-	-	

Table 5 (continued).

105	3-23	-		-	BN by 6-8
107	7-20	-		-	BN by 7-20
108	5-18	5-18(1)	H	6-29	(1left)
109	3-23	6-8	H	6-8	BN by 6-8
112	5-4	5-4(5)	H	6-8	BN by 7-20
113	3-23	-		-	BN by 8-10
114	3-23	4-13(2) & 6-29(7)	H	5-8 & H 7-20	(1 left)
116	3-23	4-13(5) & 6-29	P	4-13 & H 7-20	Egg predation
118	6-8	-		-	BN by 8-10
119	3-23	-		-	BN by 8-10
121	6-8	-		-	
122	4-13	-		-	BN by 8-10
124	3-23	-		-	
125	3-23	4-13(1)	P	4-13	SB P
126	4-13	4-13, 5-18(1), 6-29(6)	H	5-18(1 left) & H 7-20	

A = Abandoned; BN = Brood nest; NS = Nest started;
H = Successful hatching; P = Predated; V = Vandalized;
? = Uncertain; SB = small bird; (#) = # of eggs;

Table 6. Clapper Rail use of nesting structures and hatching success in the Seal Beach NWR, 1987 - 1996.

	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	1996
No. of rafts available	97	111	126
No. of nests	75	50	54
Spring call count	66	51	52
No. incubation nests	44	28	34
% of nests with eggs	59	56	65
% hatching success**	77	89	89
No. of renests***	22	7	12
% hatching success	91	100	92

* 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.

Table 7. Clapper Rail use of nesting rafts in the Kendall-Frost Reserve, 1996.

		Dates of Detection		
Raft #	Nest	Egg/Incubation	Outcome	Remarks
2	5-30	-	-	
4	5-30	-	-	
13	5-30	-	-	Just Nest Beginnings
15	2-29	-	-	10 Duck eggs

A clapper rail nest in a tumbleweed near raft 8 had hatched by 5-30.

Table 8. Clapper Rail use of nesting platforms and hatching success in the Kendall-Frost Reserve, 1989 - 1996.

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

*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.

Predator Control and Study

The more isolated, small wetlands occupied by clapper rails are plagued episodically with predator problems. The most likely cause of the clapper rail's demise at Carpinteria Marsh was heavy predation. Similarly, the subpopulations at Kendall-Frost and Famosa Slough (off of the San Diego River Flood Control Channel) have crashed. There was no detectable clapper rail breeding activity in Famosa Slough this spring. In the Kendall-Frost Reserve the only rail observed in the most recent effort to detect them was one being consumed by a red-shouldered hawk. Prior to that, the closest encounter with rails in the Reserve was with the remains of three that were eaten by raptors on three different raft tumbleweeds. Kendall-Frost at least has some breadth to it and good cover, which should afford adequate protection for rails. Famosa Slough is very narrow and totally edged by houses and disturbed uplands, with easy access for people, pets, and predators.

Predator management activities were undertaken at many marshes, including the three mentioned above. ADC activity at Famosa Slough resulted in the capture of 4 domestic cats (Felis catus), 2 raccoons (Procyon lotor), and 7 opossums (Didelphis marsupialis). All cats were released.

The findings at, and recommendations for, Famosa Slough are applicable to many of our smaller, isolated wetlands:

1) Create a public relations campaign to educate the public living near the wetlands.
   a) Provide information regarding endangered species of the area, their vulnerability, and potential predators.
   b) Identify the value of maintaining endangered species in the ecosystem.
   c) Describe the devastating effects that feral and domestic pets can have on populations of endangered species through predation.
2) Continue ADC program to assist in the protection of endangered species from predation at Famosa Slough.
3) Fence the entire perimeter of the slough.
4) Obtain law enforcement assistance to reduce/alleviate equipment tampering or theft.

Additional observations and discussion of predation issues can be found in the High Tide Count and Nesting Rafts Sections of this report and below.

Raptor Monitoring

A total of 14 species of predatory birds was documented during the fall/winter at Upper Newport Bay and the Seal Beach NWR (Table 9). The red-tailed hawk was the most abundant raptor at both sites. The minimum number of red-tailed hawks observed on the NWR ranged from 4 in the fall to 16 in the winter. The minimum number of red-tailed hawks at Upper Newport Bay ranged from 3 to 8 on different count days. Two or 3 northern harriers (Circus cyaneus) typically hunted the NWR, and up to 6 were at Upper Newport Bay during one winter session. Peregrine falcons (Falco peregrinus) and white-shouldered kites (Elanus leucurus) were consistently present at both marshes.

Despite the monitoring efforts, no raptor kills of rails were observed directly (see Kendall-Frost discussion under High Tide Counts, however). Raptor abundance was well documented, with about twice the activity on the NHR as last year.

Table 9. Raptor Monitoring at Upper Newport Bay and the Seal Beach National Wildlife Refuge, 1996.

SEAL BEACH NWR

	Minimum # indiv.					# of Encounters					Total Time Perched (min.)					Time in Flight (min.)				
	a	b	c	d	e	a	b	c	d	e	a	b	c	d	e	a	b	c	d	e
RTHA	15	8	8	7	4	280	178	160	128	11	1270	763	662	448	234	32	38	14	94	8
TUVU	-	3	2	4	2	12	15	14	21	5	-	-	3	53	2	-	33	13	19	4
AMKE	1	2	2	1	1	-	12	6	1	5	62	51	8	1	13	5	1	2	-	3
NOHA	3	1	2	3	3	19	10	10	35	23	60	16	5	29	66	21	15	12	91	43
OSPR	2	1	1	1	1	19	1	21	17	4	123	4	89	63	60	41	-	3	2	4
PEFA	2	-	1	-	1	39	-	17	-	1	38	-	84	-	2	-	-	-	-	1
WTKI	1	1	3	1	-	14	2	10	1	-	57	1	16	-	-	14	6	19	1	-
MERL	-	-	-	-	1	-	-	-	-	3	-	-	-	-	-	-	-	-	-	4
LOSH	-	-	1	-	1	-	-	1	-	1	-	-	1	-	1	-	-	-	-	-
FEHA	1	-	-	-	-	12	-	-	-	-	44	-	-	-	-	3	-	-	-	-
RSHA	-	-	-	1	-	-	-	-	1	-	-	-	-	-	-	-	-	-	3	-
ACCIP	1	-	1	-	-	1	-	11	-	-	-	-	1	-	-	1	-	1	-	-
UNID	-	1	1	1	3	-	24	1	1	3	-	103	1	1	59	-	-	1	1	1

	f	g	h	f	g	h	f	g	h	f	g	h
RTHA	8	8	16	179	212	361	610	750	1555	204	95	63
TUVU	5	7	3	6	23	7	4	54	2	2	18	5
AMKE	2	2	2	24	18	26	54	46	101	8	4	4
NOHA	2	3	3	40	79	61	96	268	85	54	39	63
OSPR	2	2	2	12	34	19	-	158	41	8	6	27
PEFA	2	1	1	20	24	10	84	108	36	9	1	2
WTKI	1	1	1	3	34	5	2	162	20	9	1	-
MERL	-	-	1	-	-	30	-	-	150	-	-	1
LOSH	1	1	-	3	1	-	4	1	-	1	-	-
RSHA	1	-	-	7	-	-	32	-	-	2	-	-
SEOW	-	1	-	-	1	-	-	-	-	-	1	-
GOEA	-	-	1	-	-	12	-	-	57	-	-	-
UNID	1	2	2	1	3	6	-	31	18	1	1	2

a=1/7/96; b=1/28/96, foggy, only 1 station; c=2/18/96; d=3/10/96; e=9/29/96, heavy fog for 0.5 hr.; f=10/20/96; g=11/10/96; h=12/1/96; i=12/22/96, not included, poor results due to heavy rain; all counts were 830-1130 AM except h which was 9-1130 AM.

Table 9 (continued)

UPPER NEWPORT BAY ECOLOGICAL RESERVE

	Minimum # indiv.						# of Encounters						Total Time Perched (min.)						Time in Flight (min.)					
	a	b	c	d	e	f	a	b	c	d	e	f	a	b	c	d	e	f	a	b	c	d	e	f
RTHA	5	3	3	5	5	8	106	57	56	122	93	163	480	193	232	445	327	561	17	41	15	71	59	19
TUVU	3	3	7	2	7	6	23	21	21	31	45	37	-	5	1	1	-	49	30	19	22	39	56	39
AMKE	-	1	2	3	-	1	-	1	2	25	-	3	-	-	1	57	-	3	-	1	1	16	-	-
NOHA	6	2	-	2	3	3	106	41	-	30	34	74	376	161	-	31	72	231	75	61	-	43	37	61
OSPR	1	1	-	2	1	-	13	22	-	43	1	-	65	94	-	150	1	-	-	-	-	37	-	-
RSHA	-	-	1	-	1	1	-	-	1	-	1	1	-	-	1	-	1	-	-	-	2	-	-	-
PEFA	-	-	1	-	-	1	-	-	1	-	-	6	-	-	-	-	-	5	-	-	2	-	-	-
WTKI	2	2	1	3	2	2	10	26	8	37	12	31	31	64	31	164	141	117	11	51	2	2	4	12
ACCI	-	-	1	1	-	-	-	-	1	1	-	-	-	-	-	-	-	-	-	-	1	1	-	-
MERL	-	1	1	-	-	-	-	1	2	-	-	-	-	-	3	-	-	-	-	1	-	-	-	-
UNID	-	1	-	1	1	2	-	15	-	5	9	6	-	65	-	17	40	14	-	3	-	4	2	2
LOSH	1	1	-	-	-	-	3	2	-	-	-	-	15	10	-	-	-	-	-	-	-	-	-	-

a=1/21/96 0830-1130 hrs NOHA-mouse, second mouse?; b=2/11/196 0830-1130 hrs WTKI-gopher (at 1210 5 RTHA's at coot); c=3/3/96 0800-1130 hrs; d=11/2/96 0845-1130 hrs AMKE-fish, insect? WTKI-large prey; e=11/23/96 0830-1130 hrs NOHA-unidentified prey; f=12/14/96 0830-1130 hrs WTKI & PEFA-unidentified prey.

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-Accipter spp.; MERL-Merlin; SEOW-Short-eared Owl; GOEA-Golden Eagle; UNID-Unidentified raptor.

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