State of California
The Resource Agency
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LIGHT-FOOTED CLAPPER RAIL MANAGEMENT AND POPULATION ASSESSMENT, 1993

by

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LIGHT-FOOTED CLAPPER RAIL CENSUS AND STUDY, 1993

by

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ABSTRACT

The fourteenth 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, 3 March - 15 April 1993. There were 300 pairs of clapper rails exhibiting breeding behavior in 13 marshes, a 9% increase over 1992. One hundred and forty-two pairs, or 47.3% 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 270 pairs, or 90% of the California population. Most of the 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.

High tide counts were continued on the Seal Beach NWR and 143 clapper rails were sighted in October. This count demonstrated the maintenance for a second year of high clapper rail numbers on the refuge. Effective control of nonnative red foxes (Vulpes) allowed the manifestation of the clapper rail's high reproductive potential and is leading to the recovery of this important subpopulation. With proper management, rails could establish on the adjacent State Ecological Reserve at Bolsa Chica.

Ten trapping sessions at Upper Newport Bay with 13 - 19 drop-door traps and 518 trap-hours, resulted in the capture and unique color-banding of 16 more clapper rails and 1 recapture. There were 18 resightings of 7 banded rails. The average movement

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detected of these rails was 85 meters. The largest spread of detection points for any rail was of 437 meters. 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 179 rails banded since March 1981 has been 5 years. Six of the 7 resighted rails were first banded in 1992, the other in 1993. Banding success over the 12 years of banding is compared, and resightings of banded rails are summarized for the 11 banding sessions accomplished 1981 - 1992. Over half of the 163 rails banded during this period were reencountered and 12.7% of the 157 rails captured in drop-door traps were recaptured in them, 1 hour to 48.3 months later.

Seventy-nine clapper rail nests were found on the 100 rafts made available in the Seal Beach NWR. Fifty-two of the nests held 73 clutches of eggs and there were at least 9 additional brood nests. Recruitment was very high due to decreased predation. Hatching success was 86% for initial attempts and 60% for renests. The 15 nesting rafts deployed at the Kendall-Frost Reserve contained 13 clapper rail nests but only 5 clutches of eggs. Hatching success was 100% but there is additional evidence that predation is a major problem at Kendall-Frost. More rafts are recommended for both these wetlands and several others.

Twenty-six rafts were placed in the Sweetwater Marsh NWR too late in the spring to expect any use. In spite of the lateness, two of the rafts were nested upon successfully by clapper rails. A nesting raft project was also initiated on Middle Island in Upper Newport Bay. The rafts were placed too late for nesting but clapper rails did use them for cover during a high tide.

Continued coyote (Canis latrans) use of the wetlands at Seal Beach NWR and Carpinteria Marsh was documented during predator monitoring activities.

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

The light-footed clapper rail (Rallus longirostris levipes) is a State and federally listed endangered species that is resident in coastal wetlands in southern California and northern Baja, California, Mexico. Loss and degradation of habitat threaten the continued existence of this subspecies, although 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 fifteenth 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. 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

The fourteenth consecutive annual census of light-footed clapper rails in California was conducted 3 March - 15 April 1993. Thirty-six coastal wetlands were surveyed by mapping territorial pairs based on their calls (Zembal and Massey 1981, 1985; Zembal 1992).

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.

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 15 October 1993. High tide counts were also done at upper Newport Bay on 9 January and 13 November 1993.

Banding, Movements, and Observations

There were 10 trapping sessions, 20 August - 30 October 1993, for a total of 518 trap-hours with 13 - 19 drop-door traps. The traps are wire mesh boxes with two doors and a treadle in the center. They are set in tidal creeks and along other trails used by the rails (see Zembal and Massey 1983, for a full discussion of trapping and banding techniques). As usual, trapping was confined to the oceanward half of Upper Newport Bay from Shellmaker Island to the Narrows. Nine of the trapping sessions were accomplished in the 3 hours before dark on evenings with appropriately low tides; the other was a 3-hour morning session that was begun at about daylight.

Observations of banded rails were sought on about 60 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 were also organized by month to examine survival using the computer program "surge".

Nesting Rafts

A cooperative effort with the El Dorado chapter of the Audubon Society added 20 rafts to the Seal Beach NWR, bringing the total available for potential rail nesting to 100 rafts. A description of the raft design is available in earlier reports (Zembal and Massey 1988). The rafts were renovated mostly in January and February 1993, 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 March through July 1993.

The 15 rafts in the Kendall-Frost Reserve were renovated in March with fresh tumbleweeds and floats and checked monthly into July. Four more rafts were added to the California Department of Fish and Game's Ecological Reserve at Bolsa Chica, bringing the total available there to 10 rafts by March 1993. Twenty-six rafts were placed in the Sweetwater Marsh NWR on 7 April 1993 and checked in June and August. Ten rafts were also placed on Middle Island in Upper Newport Bay in April and checked every two weeks into July; this work is the Master's Project of Sue Hoffman.

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, and the Kendall-Frost Reserve in northern Mission Bay, San Diego County. 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 200 trap-nights, with 10 - 23 cage traps set per night (none was set on 4 nights), 6 - 23 July 1993. On the Seal Beach NWR, padded leghold traps were set over a 3-week period in the spring. A total of 488 trap-nights was accrued in the Kendall-Frost Reserve in June with cage traps.

Raptor Watch

The Clapper Rail Study Group's winter activities included biweekly raptor monitoring on Saturdays, 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. The results comprised an index of raptor pressure in the bay. There were raptor watches on 2 and 23 January and 6 February 1993.

RESULTS AND DISCUSSION

Call Counts

Breeding clapper rails, as indicated by behavior and vocalizations in 1993, were detected in 13 marshes and the state total attained a record high of 300 pairs (Table 1). The increase since 1992 was due to the continued recovery of the subpopulation on the Seal Beach NWR. The subpopulations in the Seal Beach NWR, Tijuana Marsh NWR, and Upper Newport Bay totalled 270 pairs, or 90% of the state population. The Upper Newport Bay subpopulation alone accounted for 47.3% of the state total. In former years up to 71.2% of the state population has bred in Upper Newport Bay (Figure 1).

The Seal Beach NWR subpopulation increased by more than 80% between 1992 and 1993, and became the second largest breeding concentration of light-footed clapper rails in California. With the control of nonnative predators, mostly red foxes (Vulpes vulpes), and provision of nesting sites, the rails have begun to repopulate the entire marsh. The continuation of essential management strategies should lead to full recovery of this subpopulation. The inverse relationship between red fox and clapper rail numbers should dictate caution for the rails; they cannot survive without adequate management activity (Figure 2).

The University of California's Kendall-Frost Reserve suffers from habitat fragmentation and will require management for the clapper rails to thrive there. This small subpopulation rebounded slightly in 1992 but faces substantial problems due to its small size and isolation; it was down to only 5 pairs in 1993. There is definitive evidence of rat (Rattus sp.) predation on eggs and cat (Felis catus) predation on adults (see below). Without intensive management, including annual predator control, clapper rails are not likely to survive in the Kendall-Frost Reserve.

The other 9 breeding subpopulations totalled 25 pairs, or only 8.3% of the state population. San Elijo Lagoon, the largest contributor with about 6 pairs, also held 9 advertising males.

Table 1. Census of the Light-footed clapper rail in California, 1980-1993.

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

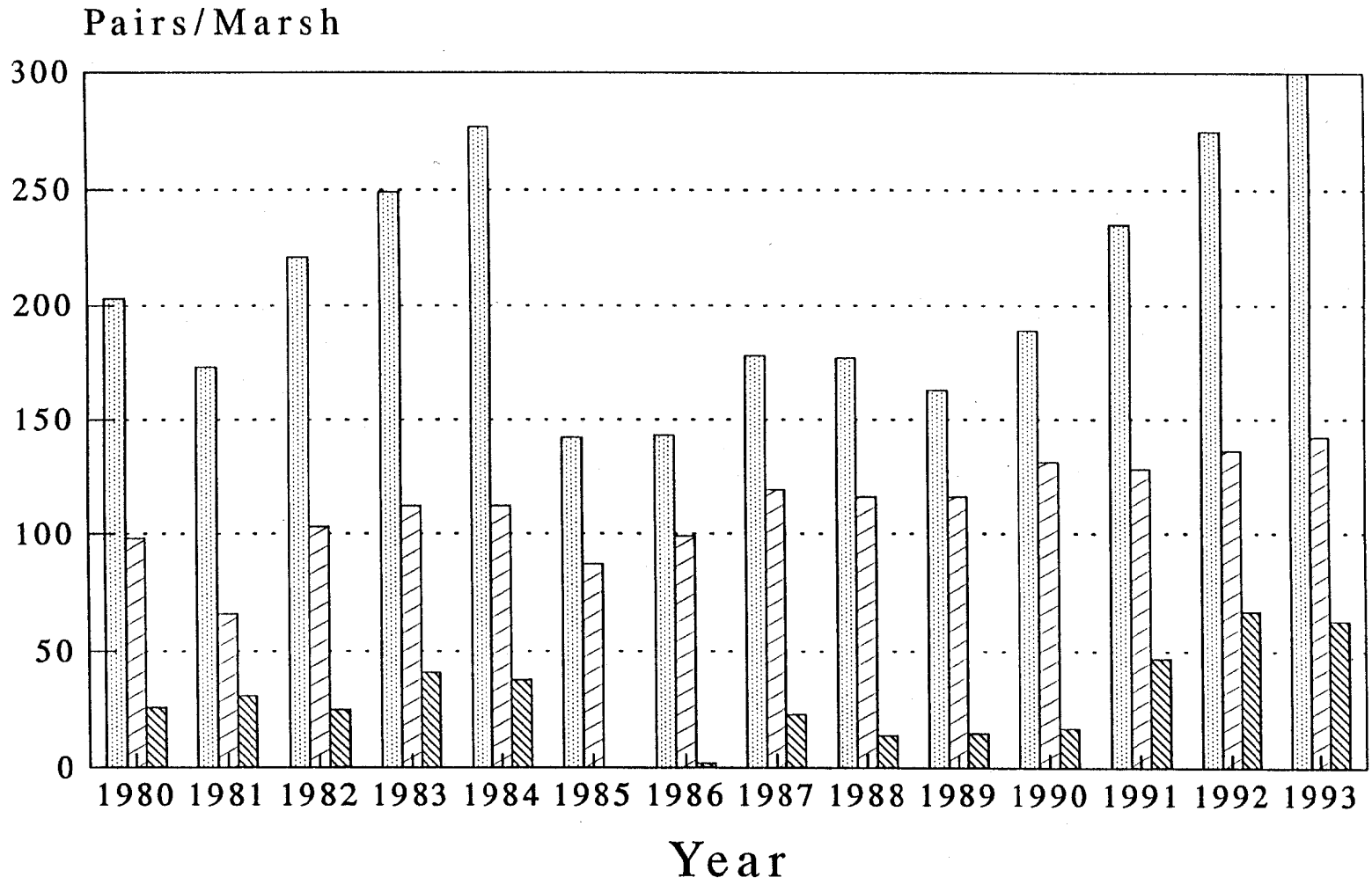
- \- Indicates that no census was taken.
- * Indicates a fall or winter occurrence
- \# Indicates the detection of unpaired rails (used beginning in 1987).
- a Data are from Paul Jorgensen's field notes.

Table 1. Census of the Light-footed clapper rail in California, 1980 - 1993 (continued).

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

- \- 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.

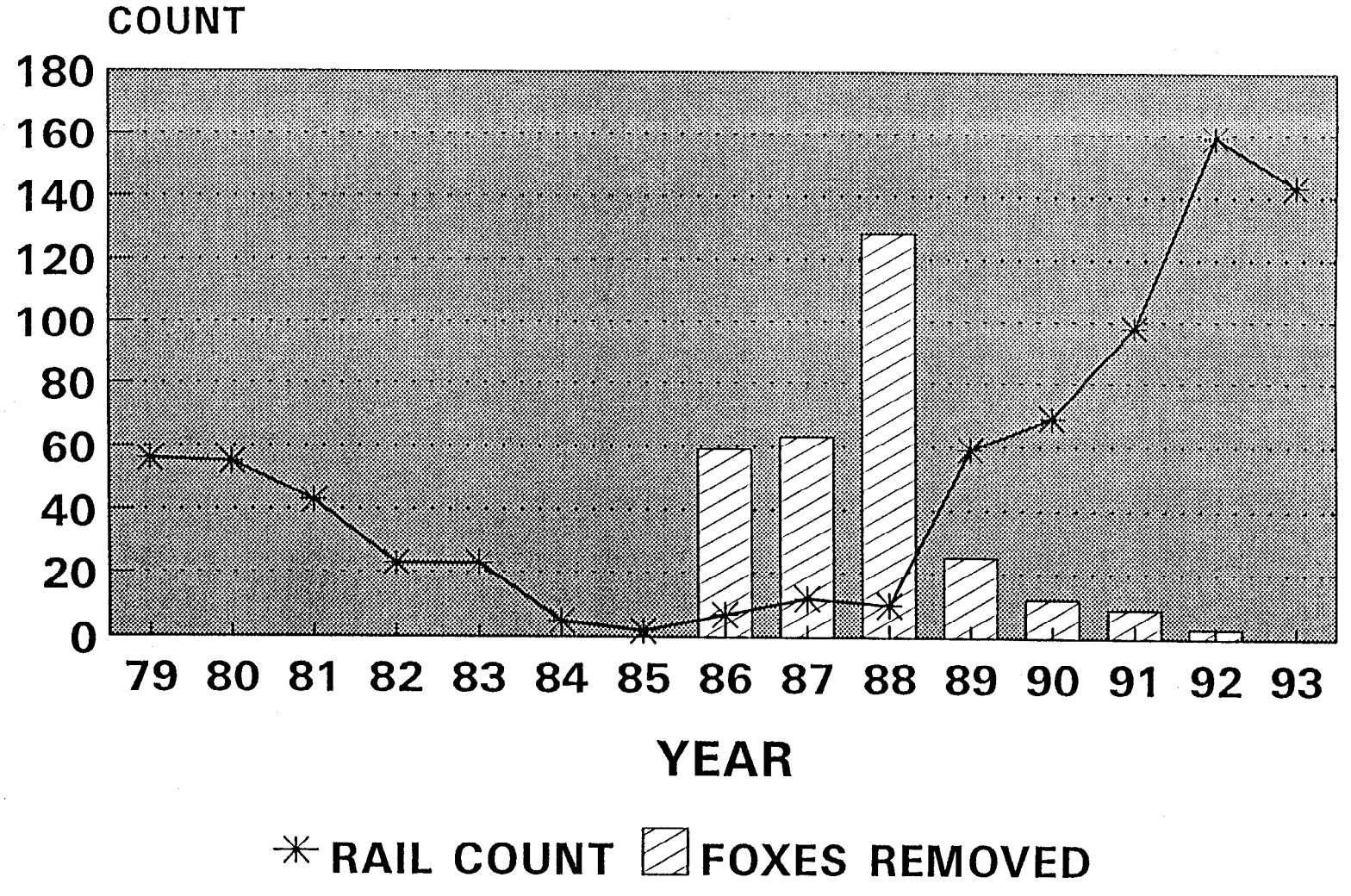
Figure 1: # Census of the Light-footed Clapper Rail In California, 1980 - 1993



UNB is Upper Newport Bay, TMNWR is Tijuana Marsh NWR

Figure 2:

CLAPPER RAILS COUNTED AND RED FOXES REMOVED FROM SBNWR



COUNTS ARE HIGH TIDE SURVEYS

Ironically, there was also an advertising female isolated in the outer lagoon, along the loop trail. All of the advertising males were in the freshwater marsh in the inner lagoon and along Escondido Creek to about 3 km upstream at the Rancho Santa Fe Road crossing. For the first time on recent record, there is definitive evidence of breeding activity in Batiquitos Lagoon in San Diego County. The Dairymart Ponds also had a breeding pair in 1993.

Predictably, Buena Vista Lagoon did not maintain the 1992 size of its breeding subpopulation. There are probably 2 pairs breeding there this year. Although there was a total of 4 points of solid single "clappering", male advertising followed nearby in each case, making it difficult to claim these single points as viable breeding territories. The lagoon is a lake with fresh to brackish water and bulrush (Scirpus spp.) and cattails (Typha spp.) in clumps and lining the banks. Saltmarsh plants are locally distributed and found mostly in narrow belts on the fringe of the reeds. Light-footed clapper rails have not done well for very long in such lake-like conditions in the past. Predation is bound to be a major problem for nesting coastal clapper rails in wetlands of this type; nest access is too easy for the common predators, particularly raccoons (Procyon lotor). The maintenance of a small breeding subpopulation in Buena Vista Lagoon will probably be dependent upon fluctuations in predator populations and local movement of rails.

Light-footed clapper rails declined greatly during the 1980s. The total population count is higher now but still far below recovery goals, and most of the remaining rails are concentrated in a small percentage of the potential habitat. Significant insights have been gained concerning this species' needs and our options for effective management, but far too little has been accomplished in the marshes of Southern California for any meaningful cushion from extinction for this endangered bird.

Each of our remaining coastal wetlands is in dire need of management and restoration activities for clapper rails and other endangered, threatened, and special concern species that share these habitats. Most of the wetlands are relatively small, isolated, and otherwise heavily influenced by people. However, if such management does not begin soon, most of today's inhabited marshes won't have any light-footed clapper rails left to manage. Good management could compensate for many of the inadequacies in habitat parcel size and functionality, and greatly reduce other human-induced problems, if it begins soon.

Management that emphasizes light-footed clapper rails should begin with a focus on predation, providing nesting habitat, monitoring reproductive success, and identifying and alleviating chemical contaminant problems. Following the findings of Soulé et al. (1987) and recent experiences at Seal Beach (U.S. Fish and

Wildlife Service and U.S. Navy 1990), Point Mugu, and other marshes, it is now understood that certain predators can be devastating to the rails. Introduced species, in particular, must be monitored and controlled. Potential predator problems should be suspected and investigated in the small marshes where clapper rails are declining or have disappeared. In addition to their having high predation pressure, many of the marshes inhabited by rails have inadequate nesting cover. Carpinteria Marsh is an extreme example of this. The only nesting sites available to the rails were on high marsh berms that were too easily accessible to terrestrial predators and the entire subpopulation was wiped out.

Clapper rails should be reintroduced to Carpinteria, along with an annual program of predator control, nesting raft deployment, and monitoring. The rails are probably subject to heavy contaminant problems in Mugu Lagoon (Ledig 1990) that should be better specified and alleviated. Full tidal regimes should be restored to several San Diego County marshes and management should be implemented at every marsh inhabited by clapper rails.

All but one of the remaining subpopulations of light-footed clapper rails are too small or troubled to survive without effective management. The number of marshes inhabited by breeding clapper rails in coastal southern California has fluctuated widely and declined from 19 in 1984 to 8 just 5 years later. Monitoring these rails through more than a decade has been partly a process of watching many small subpopulations barely hang on or disappear. Carpinteria Marsh was home to 26 pairs of clapper rails in 1984 and to none since 1989. This kind of calamity can and should be avoided.

The success of management for the rails at the Seal Beach NWR is a demonstration of the potential to nurture small subpopulations along to much larger sizes. Control of nonnative predators and the provision of nesting sites resulted in the growth of this subpopulation from just 6 pairs in 1989 to 65 pairs in 1993. What 1994 holds for the rails there will be central to our concepts of recoverability of this subspecies. Tijuana Marsh NWR gives a very contemporary example of the devastation that ocean inlet closure results in for these clapper rails and of the incredible rebound that can occur when this major problem is fixed. Detectable breeding rails decreased from 0 in 1985 to 67 pairs in 1992. The recent events on these two NWRs demonstrate the extremely high reproductive potential of the light-footed clapper rail, given habitat restored and circumstances revitalized through management. If the recovery of the light-footed clapper rail is a worthy goal, the means must be found to duplicate these management measures and add to them adaptively in most of our remaining coastal wetlands.

Miscellaneous Sightings

Clapper rails were observed exhibiting only nonbreeding behavior in 4 wetlands in 1993 (Table 1). There still is no good evidence of recent breeding at Los Penasquitos Lagoon, the Bolsa Chica State Ecological Reserve or the inland marsh there, although advertising clapper rails were present in 1993. An advertising male was also heard in Carpinteria Marsh, the first detected there since 1988. Unless there is a totally unknown source of clapper rails nearby, this rail probably came from Mugu Lagoon, 53 km (33 miles) to the southeast. There was also an advertising male in the marsh at the mouth of the Santa Margarita River, the first since 1988.

Nonbreeding rails have been detected at several sites, off and on for many years. Many were probably explained by movement from subpopulations located very closely to each, unless there was undetected local breeding in some cases. Several wetlands that occasionally hold advertising clapper rails do not fit this simplest of explanations very well; Carpinteria Marsh is now the long distance example. Among other examples is Los Penasquitos Lagoon which is not directly connected, or even nearly so, by wetlands to a known breeding subpopulation. The nearest donor subpopulation is in San Elijo Lagoon, located 11 km (6 mi) upcoast or Kendall-Frost which is 16.5 km (9 mi) downcoast. In either case, the most likely migration route is the ocean and beach. Single rails are so quick to respond to a taped call, and their response is often so dramatic, that these episodic occurrences are much more likely the results of major movements by the rails than of previously undetected birds.

High Tide Counts

High tide counts, where they are feasible, provide important information about reproductive success. The Seal Beach NWR is one of few marshes that are low enough for extreme high tides to inundate most of the available cover. In southern California, extreme high tides occur during daylight hours mostly during the fall and winter. Where and when good counts are possible, direct sightings can be made of many of the rails produced and surviving the few months since the breeding season. The counts are done prior to the onset of the harshest winter conditions, including the major influx of wintering raptors that depend on these environs for food.

The 1993 count on the Seal Beach NWR was conducted on 15 October 1993 and 143 clapper rails were tallied (Table 2). One hundred and seven, or 76%, of the rails counted were using rafts as refugia. The total count was similar to that of 1992 and therefore, indicates a population level at least close to that year's. Since there is no way to know the percentage of the rails that successfully hide from observers during a count (see

Table 2. High tide and call counts of Clapper Rails on the Seal Beach National Wildlife Refuge, 1975 - 1993.

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	38.0%	(1979)	+6 youngsters
30 Nov 1978	6.7	38	42	90.5%		
1 Dec 1978	6.7	32	42	76.2%		
3 Sep 1979	6.4	20	42	47.6%		Tide too low
3 Nov 1979	6.6	56	60	93.3%	(1980)	
2 Dec 1979	6.7	32	60	53.3%		
3 Dec 1979	6.7	44	60	73.3%		
21 Nov 1980	6.9	55	38	144.7%	(1981)	
29 Jun 1981	7.0	34	38	89.5%		
12 Nov 1981	6.9	43	56	76.8%	(1982)	
29 Dec 1982	7.0	23	40	57.5%	(1983)	
18 Jan 1984	6.9	23	48	47.9%	(1984)	
21 Nov 1984	6.7	5	22	22.7%	(1985)	+ 7 red foxes
13 Nov 1985	7.1	2	10	20.0%	(1986)	+ 2 red foxes
12 Dec 1985	7.2	2	10	20.0%		+ 2 red foxes
30 Dec 1986	7.2	7	14	50.0%	(1987)	
28 Jan 1987	7.0	7	14	50.0%		
8 Aug 1987	7.3	8	14	57.1%		Tide too late
22 Nov 1987	6.7	12	28	42.9%	(1988)	
21 Dec 1987	7.0	8	28	28.6%		+ 2 red foxes
16 Feb 1988	6.8	10	28	35.7%		
22 Nov 1988	6.9	6	28	21.4%		
16 Oct 1989	6.9	59	12	491.7%	(1989)	Record Count
5 Oct 1990	6.4	57	32	178.1%	(1990)	Tide too low
2 Nov 1990	6.8	69	32	215.6%		Record Count
22 Nov 1991	6.9	98	56	175.0%	(1991)	Record High
26 Oct 1992	6.8	159	72	220.8%	(1992)	Record High
15 Oct 1993	6.8	143	130	110.0%	(1993)	

[1] The call count given is the number of rails documented in the early spring of the year given in parentheses under notes. The call count closest in time to the high tide count is the one compared.

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

the variation in counts done on successive days, for example, in Table 2), there also exists the possibility that there are more rails than in 1992. Depending upon winter survival, this would be manifest during the 1994 breeding survey.

The count results at Seal Beach demonstrate maintenance of the recovery of this subpopulation. Ongoing management efforts on the NWR include control of non-native predators, particularly red foxes (Vulpes vulpes), and the provision of supplemental nesting sites (see below). The inverse relationship between the rails and red foxes is illustrated in Figure 2.

So much cover remained above the tidal waters and along the bordering upland slopes of Upper Newport Bay, that much of the bay was traversed without sighting a single rail during the count on 9 January 1993. Several rails were observed flying into upland shrubs as flooding progressed. At the far upper end of the bay, however, many rails were seen and a total of 147 clapper rails was tallied, along with 39 soras (Porzana carolina) and 1 Virginia rail (Rallus limicola). Eighty-nine of the clapper rails were seen above the main dike, where the cordgrass is as extensive and robust as it grows anywhere within the range of this endangered bird, and 37 were counted just below the dike in the newest dense habitat on a recently vegetated mudflat (the "new island"). During similar tidal conditions on 13 November 1993 only 14 clapper rails were counted in the entire bay, illustrating the variability between counts where so much cover is available to the rails.

Banding, Movements, and Observations

Sixteen clapper rails were captured and uniquely color-banded in 1993 (Table 3). This brings the total number of light-footed clapper rails banded in Upper Newport Bay since 1981 to 179. Two additional rails were captured that were too young to band, and a rail banded originally in 1992 was recaptured. Nine 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 average (Table 3) and would have fallen well below the norm except for a single evening session that resulted in 5 new captures. This is the largest number of clapper rails captured in one late afternoon session in the 12 years of banding. There was only one morning during the fall trapping period with a low enough tide to accommodate trapping; morning sessions are usually very productive. In this case, we used the one available to experiment with repetition by trapping the same area during the evening and following morning. This will probably never be repeated since the morning produced only one rail and past morning sessions have repeatedly produced three or more captures. Two rails were captured in this area the

Table 3. Clapper rail trapping effort and success with drop-door traps, 1981 - 1993.

Year	1981	1982	1983	1984	1986	1987
#Trap Sessions	30	14	13	5	10	8
Date Span	3/8-12/19	2/14-10/16	1/10-10/21	9/10-10/25	5/27-11/5	7/14-10/23
#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 Span	9/17-10/30	8/18-10/13	9/11-10/22	8/28-10/24	7/31-10/12	8/20-10/30
#Traps Used	12-16	14-18	7-8	8-16	15-19	13-19
Total Trap-hrs	349	560	197	374	527	518
#New Captures	6	16a	11	9	28	16
New Caps/Session	0.67	1.8	1.2	1.0	2.8	1.6
Trap-hrs/New Cap	58	35	18	42	19	32
#Recaptures	0	0	0	4	2	1
#Recaptured	0	0	0	4	2	1
#No Cap Sessions	4	1	4	1	0	3
%Sessions w Cap	56	89	56	89	100	70

	Cumulative
#Trap Sessions	136
Date Span	- -
#Traps Used	8-19
Total Trap-hrs	5,253
#New Captures	173*
New Caps/Session	1.25
Trap-hrs/New Cap	30
#Recaptures	21
#Recaptured	20
#No Cap Sessions	49
%Sessions w Cap	64

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

afternoon before and the disturbance caused by the trapping activity is probably too great to get the most out of trapping successive days in one area. On the other hand, there may not have been a large pool of highly trappable first-year rails roaming this area at the time.

Efforts to resight banded rails were greatly hampered in 1993 by the closure of access to the best observation points for the winter, spring, and early summer. A major land slide took months to remove and caused safety and liability concerns by the City of Newport Beach that prolonged the inaccessibility of most of the best observation areas. As a result, there were only 18 re-encounters with 7 banded clapper rails and all but one of the resighted rails were banded in 1992; the other was banded in 1993.

The movements of the resighted rails from sites of last encounter varied from 0m - 437m, and averaged 85m. These observations are typical of those made in the past. Once established in a territory, the usual move detected of a light-footed clapper rail is generally under a few hundred meters (Zembal et al. 1989). First-year rails are the ones most likely to make the longer moves in attempting to establish a home range. The longest move observed in 1993 was of 437m by rail #382, a first-year bird.

There was only one recapture of a clapper rail banded in a previous year. Rail #369 was first captured as an adult in 1992 and recaptured about one year later, 30 m from the original banding site. She was also observed 3 times in 1993, traversing approximately 75m, 65m, and 60m of marsh. She produced at least 3 chicks and her unbanded mate was seen copulating with her and helping to feed the chicks.

In the 11 years of banding and observing light-footed clapper rails, 1981 - 1992 (there was no activity in 1985), 50.3 % of the banded rails were re-encountered (Table 4). Nearly 13% of the 157 clapper rails captured in box traps were recaptured in them 1 hr to 48.3 months later (average = 12.2 months). Seventy-eight of the banded rails were resighted at least once, 0.1 - 61.9 months later with an average final reencounter time of 12.5 months. The final resightings occurred, 0 - 2,282 m from the banding sites (excluding the one extreme reencounter that occurred 21,700 m from the banding site) and averaged 170 m. The time to last encounter of all 78 clapper rails was less than 1 yr for 57.7% of them. Many of these rails were undoubtedly in their first year of life when banded. Consequently, the array of reencounters is the best index currently available of post-fledging survival, particularly if it is skewed by a few additional months to account for life before banding. It is probably very unusual that a light-footed clapper rail lives beyond 5 or 6 years old. Additionally, the average survival of a pair together in a breeding territory is generally less than two

Table 4. Maximum time and distance between encounters with Light-footed Clapper rails banded, 1981 - 1992.

Recaptures in box traps, 1981 - 1992:

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

20 of 157 CRs captured in box traps, were retrapped in them = 12.7%

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
428r	9-03-82	10-07-83	13.1 mo	130 m
430t	9-03-82	6-12-86	45.5 mo	50 m

Table 4 (continued).

Clapper rails resighted at least once (continued):

Band #	Band Date	Date Last Observed	Time	Distance
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
602	9-02-89	10-07-89	1.2 mo	100 m
603	9-02-89	10-07-89	1.2 mo	75 m
604	9-02-89	10-07-89	1.2 mo	125 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
358	8-02-92	8-30-92	0.9 mo	87 m
360	8-15-92	8-21-92	0.2 mo	160 m

Table 4 (continued).

Clapper rails resighted at least once (continued):

Band #	Band Date	Date Last Observed	Time	Distance
362	8-15-92	11-24-92	3.3 mo	25 m
364	8-15-92	9-24-92	1.3 mo	2,282 m
369	8-29-92	12-27-92	3.9 mo	55 m
375	9-27-92	11-24-92	1.9 mo	85 m

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t = birds that were followed by telemetry (401, 407, 409, 410, 420, 421, 422, 429, 430, 439, 440, 443, 457, 458, 460, 462, 494, 495, 602, 604, 606, 607);

d = dead (405, 407t, 410nrt, 415nr, 420t, 427, 457nrt, 460nrt, 467);

nr = no resighting;

r = recaptured in a box trap.

Notes: Of 82 reencountered, 20 were retrapped, 72 resighted, 9 dead.

50.3% (82/163) reencountered from 0.1 to 61.9 mo later [avg = 12.5 mos (975.5 mos/78 cr)]

Average move distance = 170 m.

full breeding seasons, based on observations of 6 pairs with both members banded, and an average final reencounter time of slightly less than 1 year. A view emerges of a relatively short-lived species whose numbers are maintained through a high rate of reproduction.

The wary nature of these rails, particularly the females, makes it difficult to know what skewedness toward sex or age might be inherent in a trapping and resighting sample and renders conclusions drawn from such observations tentative. The less wary rails are undoubtedly more prone to predation, spending more time in the open, and are probably more trappable too. For example, only 10 rails were retrapped 10 or more months after initial banding, whereas 34 were resighted. Consequently, it is likely that the warier, longer-lived rails are not proportionately represented in the trapping sample. They certainly are not in the retrapping sample.

Nesting Rafts

By the end of the 1993 season, 79 of the 100 rafts on the Seal Beach NWR had clapper rail nests on them, 52 nests held 73 clutches of eggs, and 9 additional nests were used for brooding (Table 5; Figure 3). This is the highest use of the rafts since the provision of them began in 1987 (Table 6). Hatching success (one or more eggs hatched), was 86% for initial clutches (n = 52) and 60% for renests (n = 21; second clutches in the same nest). Hatching failures were attributable to predation by small birds and mammals, based on signs left at the nests, such as small beak holes in eggs, paw prints on the substrate, and scat on rafts.

Most of the 20 new rafts were deployed south of Oil Island because of the high use of lodged tumbleweeds for nest placement in that area in 1992. The rafts available to the rails included 27 off Nasa Island, 23 off Hog Island, 28 off Oil Island, 8 off Sunset Aquatic Park, 7 off Kitts Highway, 5 off Bolsa Avenue, and 2 in the restoration area (Figure 3). Nearly 100% of the rafts were used by clapper rails for some purpose. For example, 107 of the rails counted during the November high tide count were sequestered on rafts. Additionally, careful examination revealed shed feathers, cast pellets, and/or crab remains on all but a few rafts indicating their use for cover and refugia, as well as nesting. In light of these uses and the growing rail population, 20 more rafts should be added to the total available in 1994, and perhaps 20 more annually thereafter for several years.

The rail's use of the rafts reached another peak in 1993 (Table 6). The decrease in predation, brought about by control of nonnative predators, and increasing rail numbers should result in the repopulation of this entire marsh if the program is continued.

Table 5. Nesting raft use by clapper rails in the Seal Beach NWR, 1993.

Raft #	Nest	Dates of Detection: Egg/Incubation	Outcome	Remarks
1	5-23	-	-	BN by 5-23
3	6-19	-	-	
4	7-10	-	-	
5	4-21	4-21(4)	H 5-23	
6	4-21	4-21	H 4-21	
7	4-21	-	-	
9	5-29	6-19	H 7-10	
11	4-16	-	-	BN by 6-19
12	4-16	4-16	H 4-16(3)	
13	4-16	4-16 & 5-15(6)	H 6-19	
14	4-16	-	-	
15	4-16	4-16 & 5-29(6)	H 5-15 & P 6-19	
16	4-16	5-15(3)	P 5-29	By small bird
17	4-16	-	-	BN by 5-15
18	4-16	4-16(3)	H 4-16 & P 5-15	
19	4-21	?	H? 4-21	
20	4-21	4-21(8)	H? 5-15	
21	4-21	5-15(6)	H 8-12	
22	4-21	-	-	BN by 4-21
23	4-21	4-21	H 4-21(2)	BN by 5-29
24	4-21	4-21	H 5-15	BN by 5-29
25	4-21	5-29(7)	P 6-19	
26	5-15	-	-	
27	5-9	?	H 8-12	BN by 5-29
28	5-29	5-29	H 7-10	
29	4-16	4-16 & 7-10	H 4-16 & P 7-10(6&ad)	
30	5-9	5-9(5) & 6-19	H? 5-29 & H 8-12	
31	5-9	-	-	
32	5-9	-	-	Nest beginnings
33	6-19	-	-	
34	4-16	4-16 & 5-9	H 4-16 & H? 5-29	
35	4-16	4-16	H 5-29	BN by 6-20
36	4-16	?	H 5-9	BN by 5-29
37	5-29	-	-	
38	5-9	-	-	BN by 8-12
40	4-16	4-16 & 5-9(8)	H 5-29	
42	4-16	4-16 & 6-19	H 5-9 & 7-10	BN 5-29
43	5-9	-	-	T mashed 5-29
45	5-29	6-19(5)	H 7-10	
46	4-16	?	H 4-16	
47	4-16	4-16 & 6-20(7)	H? 5-9 & H&P 7-10	
48	4-16	-	-	
50	4-16	4-16(7)	H 5-29	
52	4-16	4-16(5) & 7-10(1)	P 5-9(SB) & ?	
54	4-16	4-16 & 5-29	H 5-9 & 6-19	

Table 5 (continued).

		Dates of Detection		
Raft #	Nest	Egg/Incubation	Outcome	Remarks
55	4-16	5-29	H 6-19	
56	5-9	5-29	H 7-10	
57	5-29	-	-	
58	4-16	? & 6-19(6)	H 4-16 & 7-10	
59	4-16	-	-	BN by 7-10
60	4-16	4-16(7) & 6-19(5)	H 5-9 & 7-10	
61	4-16	4-16 & 6-19(7)	H? 5-29(3) & H 7-10	
62	4-16	? & 5-29	H 4-16 & 6-19	
63	4-16	-	-	BN by 5-29
64	-	-	-	Brooding 5-29
66	4-16	?	H 4-16	BN by 5-29
67	4-16	?	H 4-16(2)	BN by 5-29
68	4-16	4-16 & 6-19(3)	H 5-9 & 7-10	BN 5-29
69	4-16	5-9(4)	H 6-19(1)	BN by 7-10
70	4-16	-	-	
71	4-16	?	H 5-29	
72	5-9	5-9(8)	H 7-10	
73	4-16	5-9 & 6-19(8)	H 5-29 & 7-10	BN 5-29
74	4-16	4-16 & 6-19	H 5-9(1) & 7-10	BN 5-29
75	6-19	-	-	
76	4-16	? & 5-9(9)	P 4-16(2) & 5-29(2)	
77	4-16	-	-	
79	4-21	-	-	
80	5-29	? & 7-10(5)	H 5-29 & ?	
84	-	-	-	Brooding 5-29
85	4-16	? & 5-15	H 4-16(1) & P(SB) 5-15	
89	4-16	4-16(7)	H 5-15	BN by 5-29
90	7-10	-	-	BN by 7-10
91	4-16	? & 5-15(5)	H 4-16(1) & P 5-15	BN 4-16
92	5-29	5-29(4)	H? 6-19	
93	5-15	-	-	BN by 5-29
94	4-16	MODO 5-15(2)	-	BN by 5-29
95	4-16	4-16	H 5-15	BN by 5-29
96	5-15	-	-	BN by 5-15
97	4-16	4-16(1) & 6-19(7)	H 5-15 & H? 7-10	
100	4-16	?	H? 4-16	

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

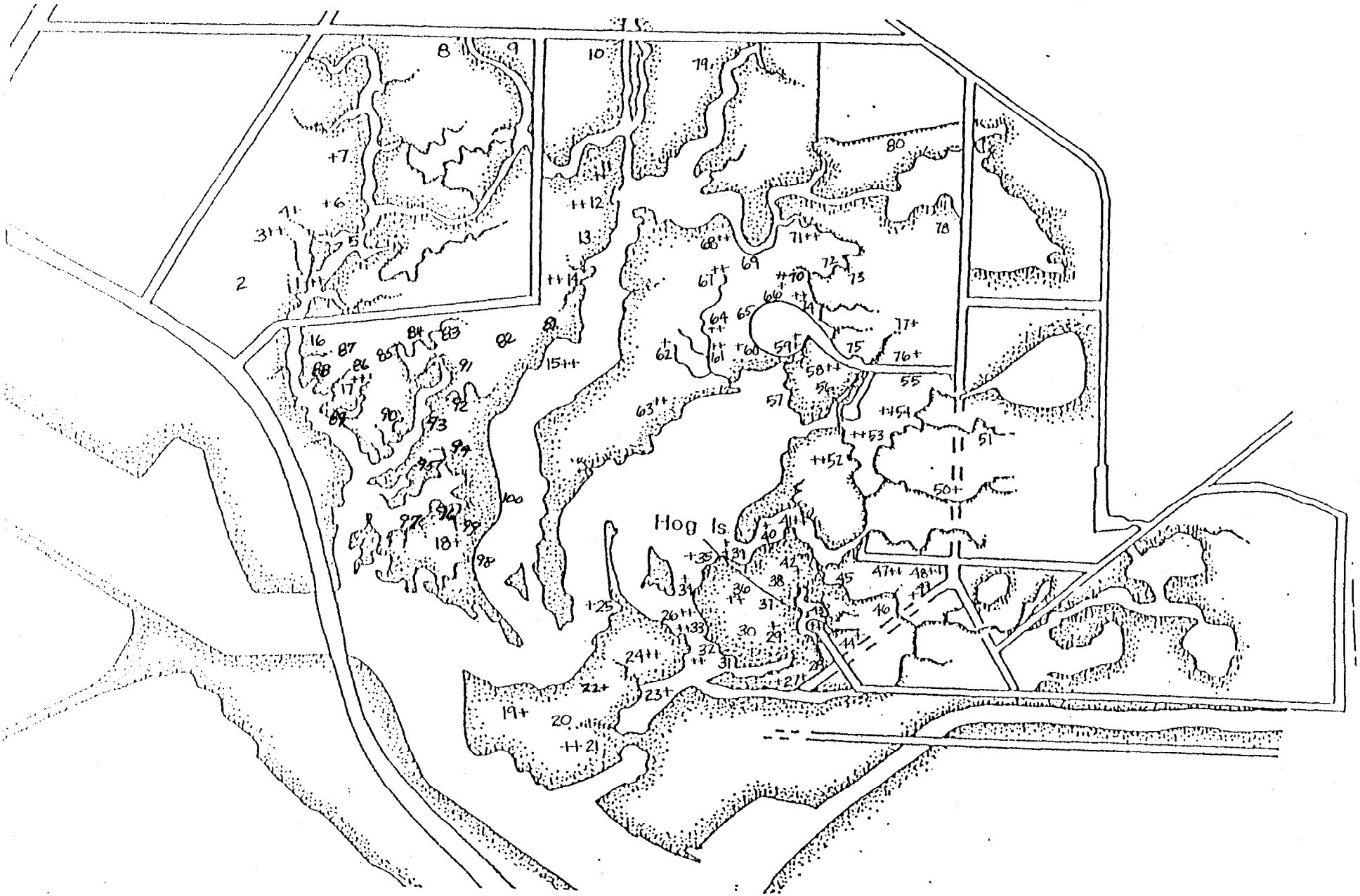

Figure 3. Locations of 100 nesting platforms in the Seal Beach National Wildlife Refuge, 1993. One + indicates a nest, two +s indicate at least one clutch of eggs.

Table 6. Clapper rail use of nesting structures and hatching success by area in the Seal Beach NWR, 1987 - 1993.

	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
% incubation nests near:								
Nasa Island	41	38	47	30		100	46	58
% hatching success	83	63	86	83		75	17	71
Hog Island	23	31	17	30		-	31	17
% hatching success	82	88	50	50		-	0	100
Sunset Aquatic Park	8	10	13	15		-	8	17
% hatching success	67	75	75	100		-	0	50
Kitts Highway	4	5	7	10		-	15	8
% hatching success	100	50	0	100		-	0	100
South of Oil Island	23	17	17	15		-	-	-
% hatching success	62	71	80	0		-	-	-

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* 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.

Thirteen of the 15 rafts placed in the Kendall-Frost Reserve held clapper rail nests (Figure 4) but only 5 contained single clutches of eggs (Table 7); there were no renests. Small mammal domes and/or droppings were found on 3 rafts. Hatching success for the 5 clutches was 100%. Most of the small mammal activity could be the work of rats (Rattus sp.).

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 been decimated again. The level of recent raft use gives credence to the theory that lack of suitable nesting sites may be limiting to the rails in the Reserve (Table 8). The rafts should serve as focal points for monitoring rail use of this marsh, documenting problems, and alleviating them. The observations of cats on freshly killed clapper rails during high tides in 1989 and 1990 should serve as a warning. Predation is probably a major limiting factor for the rails in this little isolated wetland. There were cat tracks all over the salt pan in 1993 and the cat problem was examined thoroughly; it is severe (see below).

Rat predation of eggs and young is also potentially serious. Eggs laid but left unattended until full clutches are achieved would be the most vulnerable to rodent predation. With no sign of an egg, other than full clutches, it was an unusual year. In the past, several nests would have a few eggs on one visit, then an incubating adult would be found on the subsequent visit. The infrequency of visits, variability in timing, and small number of clutches could explain the difference in 1993. However, there could be serious loss of eggs occurring, as well.

Since rafts were newly deployed at the Sweetwater Marsh NWR in 1993, misgivings were raised by reluctant helpers. The doubts are the same raised each time a new location for rafts is contemplated and so merit discussion. The two major concerns raised were over the "introduction" of foreign tumbleweeds and their seeds to the marsh, "none are out there now", and the lack of evidence that any other than a Seal Beach clapper rail will nest in a tumbleweed or on a raft. These concerns were addressed by what we observed in the marsh while we deployed the rafts.

Most of the tumbleweeds we placed on the 26 rafts were found lodged in the marsh; we pulled them from the marsh as we moved from one site to the next. The few remaining tumbleweeds needed were taken from the upland edge of the marsh, exposed to winds that would eventually have blown many of them into the marsh as well. Most people will never get to go physically into a tidal marsh and it must be noted that from the edge, tumbleweeds are not conspicuous to one unpracticed in tumbleweed observation. Tumbleweeds tend to lodge low, against debris and berms, and in tidal creeks. This makes them inconspicuous and is also the problem with relying for rail nesting on tumbleweeds that just

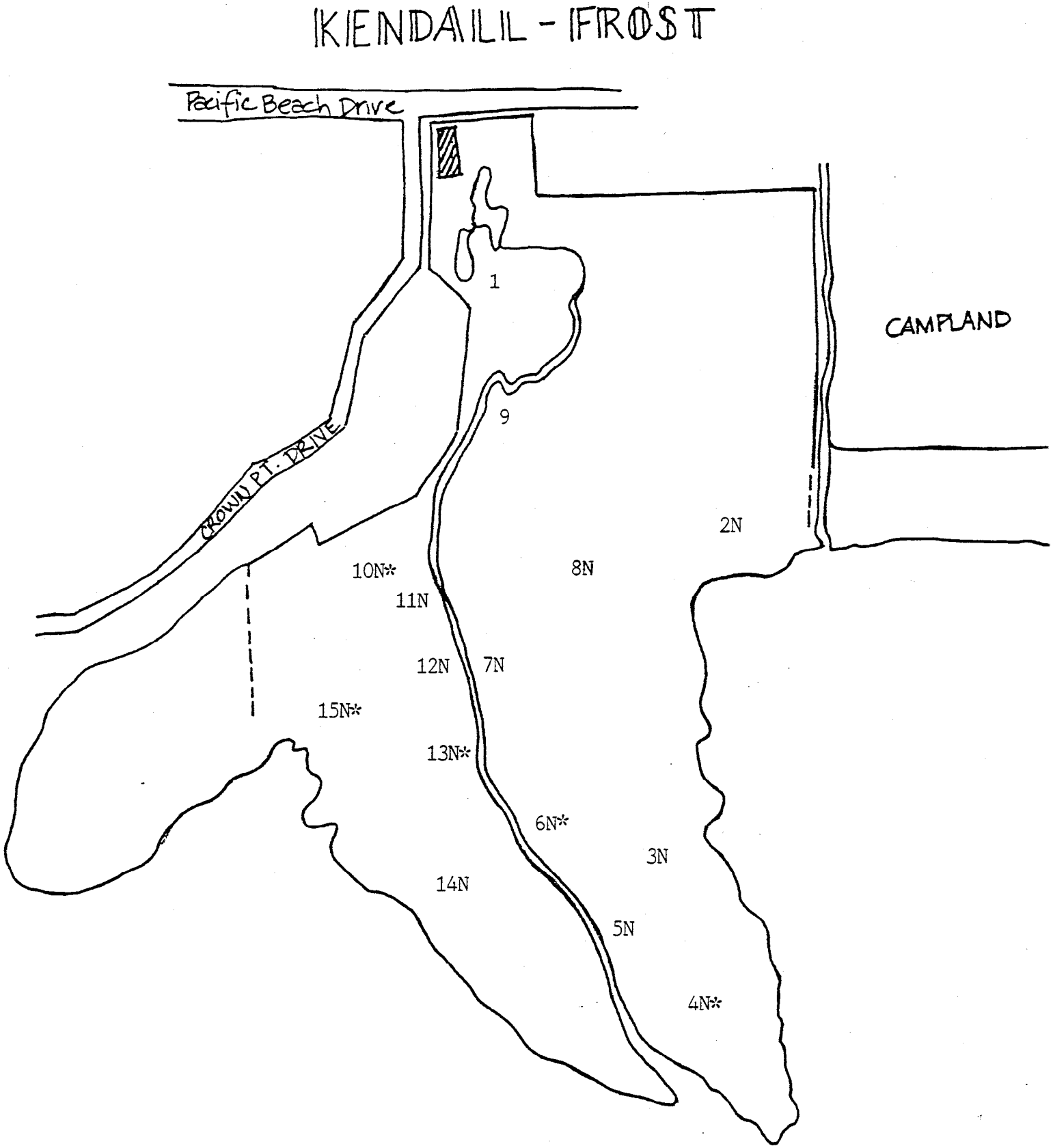

Figure 4. Locations of 15 nesting platforms in the Kendall-Frost Reserve, 1993. Rafts that had Clapper Rail nests are designated with an "N"; each "*" indicates a clutch of eggs.

Table 7. Clapper rail use of nesting rafts in the Kendall-Frost Reserve, 1993.

		Dates of Detection		
Raft #	Nest	Egg/Incubation	Outcome	Remarks
2	3-20	-	-	
3	5-20	-	-	BN by 7-29
4	5-20	5-20 (8)	H 7-29	BN by 7-29
5	5-20	-	-	
6	3-20	4-7	H 5-20	BN by 7-29
7	3-20	-	-	Rat use
8	3-20	-	-	
10	4-7	4-7	H 5-20	BN by 7-29
11	3-20	-	-	
12	3-20	-	-	BN by 5-20
13	4-7	4-7	H 5-20	BN by 7-29
14	3-20	-	-	Rat use/BN
15	4-7	4-7	H 5-20	Rat use/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 - 1993.

	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	-

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* 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.

happen to lodge in the marsh; most of them lodge too low to provide enough protection from tidal wash. On the day of raft placement, I also found 2 clapper rail nests, one with 6 eggs in the main marsh and one with 8 eggs in F Street Marsh. Both of these nests were built in huge tumbleweeds. The main marsh tumbleweed nest subsequently hatched successfully, but the F St nest was washed out during high tides.

It is somewhat phenomenal, considering the lateness of raft availability at Sweetwater, but there were 2 successful nesting attempts by clapper rails on rafts in 1993. I observed the chicks and a defending adult in F St Marsh and a brood nest and other positive signs on one raft in the main marsh. The vigor, height, and density of cordgrass in Sweetwater appeared very poor in 1993, compared with several past seasons in the 1980s. A low supply of good nesting cover was indicated by the rail's use of marginally paced tumbleweeds and immediate adoption of the rafts. If the lack of suitable nesting sites is not complicated by additional problems, and we are not too late, perhaps we can foster a more viable subpopulation of clapper rails on the NWR with rafts. If there are other severe problems, monitoring the rails on the rafts will help identify them and they too should then be alleviated. Strong subpopulations at Upper Newport Bay, Tijuana Marsh, Seal Beach, and Sweetwater Marsh would provide the greatest cushion from extinction this endangered bird has had since at least the 1960s.

The raft project at Upper Newport Bay also got a late start in 1993, with the deployment of 10 rafts on 17 April 1993. None was used for nesting during the breeding season but at least two provided cover for clapper rails during a super high tide in November. These rafts have now been out long enough to allow discovery by first-year rails searching for territories and perhaps will be used in 1994. The contrast in results between the Upper Newport Bay study and Sweetwater was unexpected. With so many rails at Newport, I expected use of a raft or two, but with so few rails at Sweetwater, I thought raft use would take until next season. This highlights how poor the options for nesting must be at Sweetwater.

Because of widespread concern for potential disturbance of 4 species of nesting terns and black skimmers (Rynchops niger) at Bolsa Chica, the rafts were not properly checked. Given the noise and potential death threat of Pacific Coast Highway traffic to the rails, along with conflicting priorities, it is unclear whether raft provision should be continued there, so close to a major highway and such a treasured seabird colony.

Predator Control

The predator control activity in Carpinteria Marsh was accomplished in preparation for potential translocation of

clapper rails back into the marsh. The animals captured and removed included 6 opossums (Didelphis marsupialis), 3 feral cats (Felis catus), and 4 raccoons (Procyon lotor). Two domestic cats were captured and returned to their owners, and several pertinent observations and recommendations were made. Domestic dogs were observed in the marsh and there was an extremely high level of human intrusion, mostly associated with sanctioned studies. Several raccoons and cats were trap-shy, indicating that they may have been trapped elsewhere and dumped at Carpinteria. Fortunately, a coyote (Canis latrans) moved into the marsh to hunt demonstrating some continued connectivity between the marsh and inland habitats; trapping was discontinued to avoid disturbance to the coyote. If rails are to be moved back into Carpinteria, predator monitoring, and perhaps control, would have to occur annually. Local animal agencies and organizations would have to be coordinated with and the number of simultaneous studies and resulting activity level in the marsh would need to be closely monitored.

The trapping activity in Kendall-Frost resulted in the capture and removal of 17 rats, 9 feral cats, 1 opossum, and the capture and return to the marsh edge of 12 striped skunks (Mephitis mephitis). This is far too many predators and explains at least some of the difficulty rails have had in Kendall-Frost. Without consistent management of predators, the rails will never fully populate the Reserve and may not even survive there.

Trapping activity on the Seal Beach NWS resulted in no red fox captures and revealed the consistent presence of coyotes. A paired male and female coyote were trapped, released, and should have been radio-collared but the proper permits had not been obtained. The Seal Beach NWR must continue to receive monitoring, at a minimum, to ensure that the coyotes continue to balance the predator populations effecting the rails there.

Raptor Watch

Table 9 summarizes the bird of prey activity documented during 8 sessions of monitoring Upper Newport Bay. Ten species of raptors were encountered and their activities quantified. The red-tailed hawk (Buteo jamaicensis; RTHA) was the most abundant aerial predator observed and posed the greatest potential threat to wetland birds during daylight hours. As many as 6 individuals were documented in a single morning, with the constant presence of more than 3 individuals for one of the monitoring sessions.

The northern harrier (Circus cyaneus; NOHA) is the raptor of second highest concern as a threat to clapper rails. As many as 4 individuals were documented on single mornings and one or two were present constantly. This raptor is of most threat to young rails, although in years past, large females have been observed

Table 10. Raptor Watches at Upper Newport Bay, 1991 - 1993.

	Min. # Individuals				# of Encounters				% Time Perched				% Time in Flight				# of Kills			
	a	b	c	d	a	b	c	d	a	b	c	d	a	b	c	d	a	b	c	d
RTHA	6	5	6	4	53	85	55	74	6	209	193	183	63	14	62	16	0	0	0	0
TUVU	9	8	5	6	56	40	31	29	3	1	0	6	34	39	26	43	0	0	0	0
AMKE	2	3	4	5	5	34	23	9	1	73	47	11	4	5	21	4	0	0	2*	0
NOHA	4	4	3	3	19	40	9	39	7	44	0	92	23	56	23	23	0	5##	0	0
OSPR	-	-	1	2	1	-	8	40	-	-	43	95	1	-	6	21	0	-	1**	1
RSHA	-	-	1	1	-	-	3	3	-	-	3	2	-	-	2	1	-	-	0	0
SSHA	1	-	1	-	1	-	1	-	0	-	0	-	1	-	1	-	0	-	0	-
COHA	-	1?	-	-	-	1	-	-	-	0	-	-	-	1	-	-	-	0	-	-
PEFA	1	-	-	-	14	-	-	-	0	-	-	-	33	-	-	-	0#	-	-	-
PRFA	1	-	-	-	1	-	-	-	0	-	-	-	1	-	-	-	0	-	-	-
	e	f	g	h	e	f	g	h	e	f	g	h	e	f	g	h	e	f	g	h
RTHA	4	6	3	5	58	115	120	94	117	163	296	349	19	44	8	55	0	1	0	0
TUVU	7	14	4	8	50	164	78	159	9	267	58	7	42	7	31	115	0	0	0	0
AMKE	2	2	1	4	11	13	12	21	21	1	10	18	2	16	1	9	0	0	0	0
NOHA	3	3	1	2	58	53	7	13	87	110	0	7	39	15	3	3	0	0	0	0
OSPR	1	-	1	-	9	-	21	-	10	-	7	-	4	-	23	-	0	-	0	-
RSHA	1	-	-	-	15	-	-	-	25	-	-	-	3	-	-	-	0	-	-	-
COHA	-	-	1	1?	-	-	7	1	-	-	4	0	-	-	12	1	-	-	0	0
PEFA	-	1?	-	1	-	1	-	1	-	0	-	0	-	1	-	1	-	0	-	0

a = 30 Nov 91, 0830-1100 hrs.; b = 8 dec 91, 0830-1100 hrs.; c = 7 Nov 92, 0830-1130 hrs.; d = 21 Nov 92, 0730-1200 hrs at Shellmaker, 0900-1115 hrs. at the other two stations; e = 5 Dec 92, 0830-1130 hrs.; f = 19 Dec 92, 0830-1130 hrs.; g = 23 Jan 93, 0830-1130 hrs.; h = 6 Feb 93, 0830-1130 hrs.

*very small prey, insect-sized; **flatfish, halibut?; #peregrine falcon dove at house finch twice, northern pintail four times; ##northern harrier took a small mammal and a western sandpiper.

Encounters represent 5 minutes perched or appear/disappear of an individual in less than 5 minutes; % Time Perched is total time at least one individual perched during the observation period, addative for the three stations/total observation time; %Time in Flight is as above for flight, soar, or hunting time in the air.

taking adult rails during high tides in the Tijuana Marsh NWR (P. Jorgensen, pers. comm.).

The Cooper's hawk (Accipiter cooperii; COHA), peregrine falcon (Falco peregrinus; PEFA), and prairie falcon (Falco mexicanus; PRFA) are potential predators of clapper rails, particularly in years of greater presence of these predators. The COHA and PEFA are less likely to encounter clapper rails under circumstances that fit their usual hunting modes well, in the air, for example. However, I have observed PRFAs take many chukars (Alectoris chukar), a larger gallinaceous bird of the high desert that is prone to run rather than fly; it is likely that some rails would be taken by PRFA, if this raptor consistently hunted an occupied wetland.

A clapper rail chick and a mallard (Anas platyrhynchos) chick were observed hunted and eaten by black-crowned night-herons (Nycticorax nycticorax) on the mudflat at Upper Newport Bay. The herons stalked the chicks, successfully separated them from adults, and eventually nabbed them and swallowed them whole. The mallard would race in and defend by charging the attacking heron, and in the process expose another chick to attack by a different heron. It is uncertain how common this behavior is. Groups of herons, spread out over the mudflat and stand poised like statues. This is particularly common in the late breeding season. The mallard, whose chick was taken, walked her brood right past and within easy striking distance for the heron. No threat was apparent until the attack occurred. The chick was hurt and disoriented by the first heron strike; there were several additional attacks and strikes with the mallard trying to defend, until the chick was finally eaten. The clapper rail chick was so badly hurt, by the time I observed the action that it was flailing on the mudflat alone when a heron came up and nabbed it.

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LITERATURE CITED

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

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

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

U.S. Fish and Wildlife Service and U.S. Navy. 1990. Final Environmental Impact Statement, Endangered Species Management and Protection Plan, Naval Weapons Station - Seal Beach, Seal Beach National Wildlife Refuge. U.S. Fish and Wildlife Service, Laguna Niguel, and U.S. Navy, Seal Beach, CA.

Zembal, R., and B. W.0 Massey. 1981. A census of the Light-footed Clapper Rail in California. West. Birds 12: 87 - 99.

Zembal, R., and B. W. Massey. 1985. Distribution of the Light-footed Clapper Rail in California, 1980 - 1984. Amer. Birds 39(2): 135 - 137.

Zembal, R., and B. W. Massey. 1987. Seasonality of vocalizations by Light-footed Clapper Rails. J. Field Ornith. 58(1):41-48.

Zembal, R., B.W. Massey, and J.M. Fancher. 1989. Movements and activity patterns of the Light-footed Clapper Rail. J. Wildl. Manage. 53(1): 39 - 42.