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LIGHT-FOOTED CLAPPER RAIL CENSUS AND STUDY, 1989

by

Richard Zembal

1989

Nongame Bird and Mammal Section Report

A

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LIGHT-FOOTED CLAPPER RAIL CENSUS AND STUDY, 1989

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ABSTRACT

The tenth consecutive annual census of the endangered Light-footed Clapper Rail (Rallus longirostris levipes) revealed 163 pairs of Clapper Rails in 8 marshes in Southern California. One hundred and sixteen pairs, or 71.2% of the state total, were detected at Upper Newport Bay. All of the small subpopulations 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 the addition of at least one other large viable population center.

High tide counts were continued on the Seal Beach National Wildlife Refuge and 59 Clapper Rails were sighted in October. This is the highest total recorded since these counts were begun in 1975. Effective control of nonnative red foxes (Vulpes vulpes) allowed the manifestation of the Clapper Rail's high reproductive potential and may lead to the recovery of this important subpopulation.

Nine trapping sessions at Upper Newport Bay with 14 - 18 drop-door traps and 560 trap-hours, along with one session of netting during high tide from kayaks, resulted in the capture and unique color-banding of 22 more Clapper Rails. There were 17 resightings of 8 banded rails and 120 position fixes on 6 telemetered rails. These 6 rails were harnessed for radio telemetry and monitored in cooperation with U. S. Fish and Wildlife Service research personnel studying dispersal. The typical movement detected of any rail was a few meters to 200 meters. The largest spread of detection points for a rail was of 675 meters for one of the telemetered rails just before its signal was lost. The longest time span between banding and a

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resighting of a rail for the 115 banded since March 1981 has been 5 years. The longest banded of the 8 Clapper Rails resighted in 1989 was a rail banded in 1986 and resighted 650 meters south of the banding site.

The presence of unmated females is known to be majorly disruptive of successful breeding. However, recent observations suggest that female advertising may eventually be ignored by adjacent paired males. At the Seal Beach NWR, for example, a phenomenal number of young were fledged by a breeding population of 6 pairs and at least 3 unmated females.

Nesting behavior studies through video taping were conducted at Upper Newport Bay but nothing substantial was added to our knowledge. This was primarily due to the scarcity of late nests for monitoring as a result of the very high success of early nests.

The second reported direct observations of Clapper Rail kills by two predatory species, the domestic cat (*Felis domesticus*) and Red-tailed Hawk (*Buteo jamaicensis*), occurred in 1989. The raptors nesting in the vicinity of Upper Newport Bay were documented, as were wintering species and terrestrial predators. Coyotes (*Canis latrans*) were of particular interest since their occurrence apparently disallows mesopredator release. Coyote activity was concentrated along one side of Upper Newport Bay. The uplands along the other side are in need of habitat restoration. The long-term viability of the two corridors used by the coyotes is being greatly affected by land use changes and is proposed for further examination in the near future through telemetry. Telemetry studies of Great-horned Owls (*Bubo virginianus*) are being pursued and a camera triggered by motion has been developed to monitor predators. Predator monitoring, study, and perhaps control are needed at all of the marshes inhabited by Clapper Rails.

Seventeen Clapper Rail nests were found on the 46 rafts made available in the Seal Beach NWR. Four of the nests held clutches of eggs and there were two additional brood nests. Recruitment was very high due to decreased predation. More than half of the young produced were from nests located off the rafts. The 15 nesting rafts deployed at the Kendall-Frost Reserve contained 4 or more Clapper Rail nests, 2 or 3 of which were successful.

An annotated list of the recent literature of the Light-footed Clapper Rail is appended.

INTRODUCTION

The 1989 investigations included a census of the California population of Light-footed Clapper Rails (Rallus longirostris levipes) in the spring of 1989; winter high tide counts; trapping, banding, and observations at Upper Newport Bay, Orange County, California including monitoring of nests and predators; the placement and monitoring of artificial nesting platforms at the Seal Beach National Wildlife Refuge in Anaheim Bay and monitoring of the platforms at the University of California's Kendall-Frost Reserve, San Diego County; and continued analysis of our data for publication and presentations.

This report is organized into subsections describing the different aspects of the investigations. Each subsection contains methods, results, discussion, and recommendations, where appropriate.

California Population

The tenth consecutive annual census was conducted 1 March - 8 April 1989. Thirty-seven coastal wetlands were censused by mapping spontaneous calling or soliciting calls with playbacks of clappering (Zembal and Massey 1985a). Clapper Rails were detected in only 8 of the marshes and the state total was down slightly from 1988 (Table 1). As of the spring counts, therefore, there still was no meaningful recovery from the population crash in 1985. Although this endangered bird remains in great jeopardy in the United States, a recent count on the Seal Beach National Wildlife Refuge indicates that the subpopulation there may be rebounding (see High Tide Counts).

Only a single marsh, that of the State Ecological Reserve at Upper Newport Bay, has a large thriving population. For the second consecutive year, 116 pairs were detected at Upper Newport Bay. Although the counts for most individual marsh parcels were different by a few pairs, the total was the same as in 1988. This was 71.2% of the state's breeding population in 1989 and represents the heaviest concentration of this endangered species during the decade of annual censuses (Figure 1).

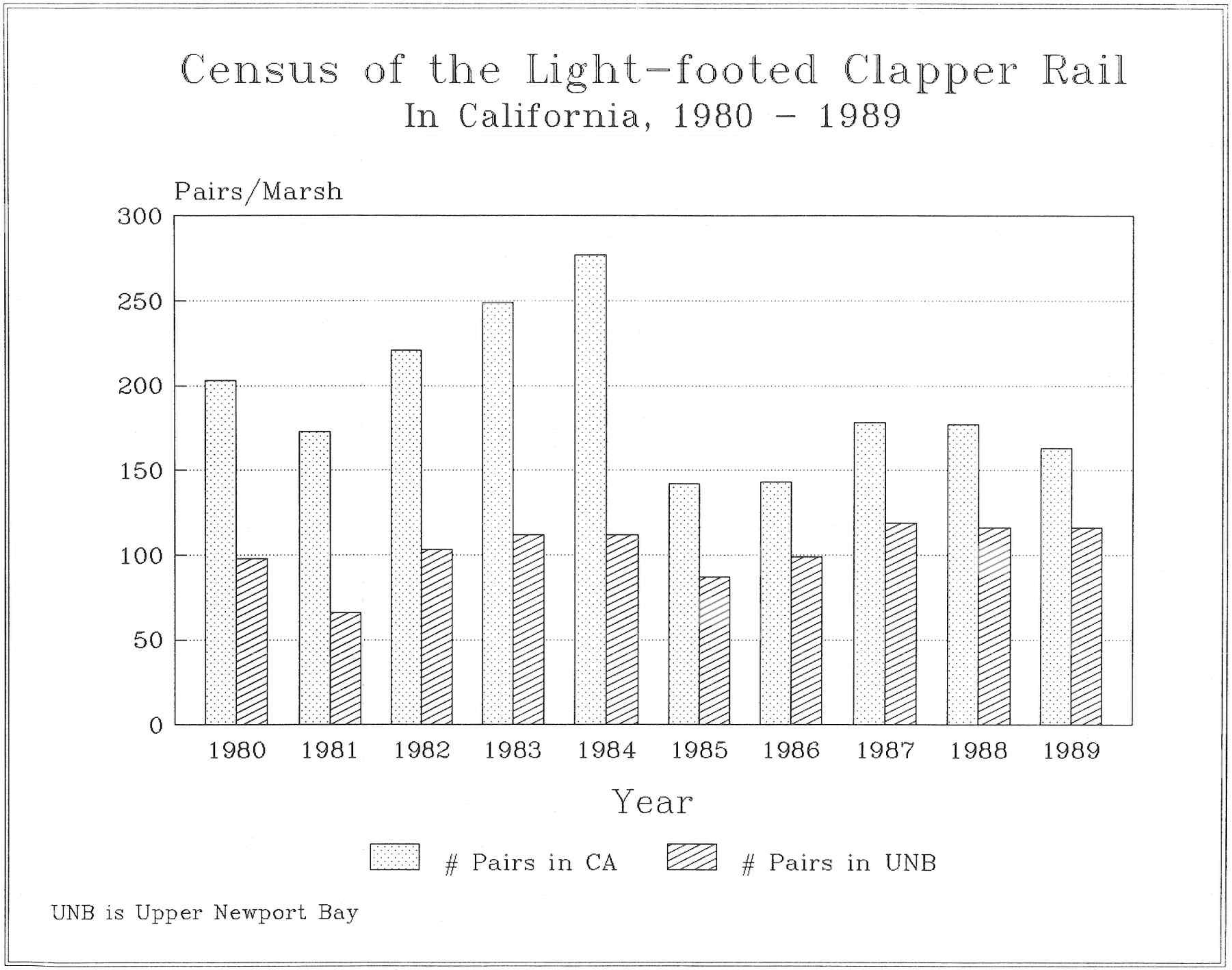
The second largest subpopulation was again documented at the Tijuana National Wildlife Refuge but problems with a skewed sex ratio still persist there. There were 15 territorial pairs detected during the spring count along with advertising females and males. A total of 49 Clapper Rails was heard and 19 of them were singles. Most of the unpaired birds were females but there was a small number of advertising males, too.

Such an imbalance should have equilibrated during the breeding season but apparently did not. This could be the result of breeding inhibition brought on by sibling recognition (see Zembal and Massey 1988), abnormally high predation, or some

Table 1. Census of the Light-footed Clapper Rail in California, 1980 - 1989.

Location	Number of Pairs Detected In:									
	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989
Santa Barbara County										
Goleta Slough	0	0	-[a]	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	-	-	-	*[b]	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
San Joaquin-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	-	5[c]	4	4	10	1	0	2	5[#]	7[#]
San Dieguito Lagoon	-	-	-	-	-	-	-	*	0	0
Los Penasquitos Lagoon	-	0	-	0	0	-	0	-	1[c#]	0
Kendall-Frost Reserve	18	16	6	20	24	17	12	6[c#]	4[c#]	4[#]
San Diego River F. C. C.	-	3	1	2	2	1	0	0	1[c#]	0[#]
Paradise Creek Marsh	1	2	3	1	1	0	0	0	0	0
Sweetwater Marsh	4	5	7	6	14	3	9	5[c#]	5	5[#]
E Street Marsh	3	1	3	3	2	2	2	0[c]	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	1[c]	2[#]	5	5[#]
Dairy Mart Ponds	-	-	-	-	-	-	0	*	1[c]	0[#]
Tijuana Marsh NWR	26	31	25	41	38	0	2	23[c#]	14[c#]	15[c#]
TOTALS: number of pairs	203	173	221	249	277	142	143	178	177	163
number of marshes	11	15	18	18	19	14	12	11	14	8

[a]The dash (-) means that no census was taken.
[b]The star (*) indicates that at least one rail was detected in winter or fall but presence during the breeding season could not be confirmed.
[c]Data are from Paul Jorgensen's field notes.
[#]One or more of the reported points were probably not pairs - see text. This notation was not used prior to 1987.


Census of the Light-footed Clapper Rail
In California, 1980 - 1989
Pairs/Marsh
300
250
200
150
100
50
0
1980
1981
1982
1983
1984
1985
1986
1987
1988
1989
Year
Pairs in CA
Pairs in UNB
UNB is Upper Newport Bay

unknown factor. Heavy predation could greatly disrupt pairing and result in a percentage of the birds being mateless at any given time. Some of the mixed advertising could be solicitations between mates that are unusually persistent due to noise interference with the rail's detection. The high noise levels are caused by regular helicopter overflights. The noise also interferes with the rail's detection of predators. The genetic makeup of the Clapper Rails in the Tijuana NWR needs to be examined along with predator populations, predation levels, and noise levels and effects.

Just one advertising female can interfere with successful breeding in her, and at least one adjacent territory (Zembal and Massey 1985b, 1988). This led to legitimate concern over the reproductive viability of female-skewed subpopulations. However, recent observations suggest that such interference can be more temporary than previously thought (see Vocalizations). Systematic nest searches and monitoring of breeding outcome in the Tijuana NWR, coupled with biweekly call counts, would yield important information on the effects of female advertising over an entire breeding season. This would also allow a better assessment of the status and reproductive health of this subpopulation.

The other 6 of the 8 marshes occupied by breeding Clapper Rails in 1989 held 7 or fewer pairs and there were unpaired Rails at all 8. At Upper Newport Bay, the sex ratio was skewed slightly toward female with at least 5 unpaired. The usual makeup of this important subpopulation, that is in 7 of 10 years, included an abundance of males. Male-skewedness may represent the natural condition; this was the consistent situation during 4 spring counts in the Mexican marshes, our largest and presumably most pristine population centers.

In addition to the 5 pairs detected at Point Mugu, there was a minimum of 4 advertising females. Most of the Clapper Rails detected at San Elijo Lagoon were again located along Escondido Creek in the dense cattail (Typha spp.) beds; the calling indicated a minimum of 5 pairs and 2 advertising males. As many as 12 individuals could have been calling in the Kendall-Frost Reserve but only 2 pairs dueted; the rest of the calls were single clapperings and only a few were simultaneous and consistent enough to differentiate viable territories. This curious calling pattern included no advertising by males or females and the estimate of 4 pairs is conservative. Sweetwater Marsh held as many as 3 unmated males, whereas there were 2 advertising females at the South Bay Marine Reserve. Along with the 6 pairs detected on the Seal Beach NWR, there were at least 3 unmated females.

All but one of the remaining subpopulations of Light-footed Clapper Rails are too small or troubled to survive without immediate and effective management. The number of marshes inhabited by breeding Clapper Rails in coastal southern California went from 19 to 8 in a half decade. Monitoring these rails through a decade, has been a process of documenting their disappearance from one marsh after another.

With a large enough cushion of rails and habitat at Upper Newport Bay, that subpopulation has quickly recovered to repopulate the entire marsh at least twice in the recent past. With too few rails and too little marsh acreage or productivity, the smaller subpopulations have faltered over time or disappeared. Even with ample acreage and productivity, the small subpopulations may not harbor the genetic diversity to handle episodic disasters, even the natural ones. Hard winters and floods can greatly damage nesting habitat and alter salinities with dramatic effects on invertebrate populations, and so the rail's food supply. Between the springs of 1984 and 1985, the 5 largest subpopulations in the state, those at Carpinteria Marsh, the Seal Beach NWR, Upper Newport Bay, Kendall-Frost Reserve, and the Tijuana Marsh NWR all suffered major losses. Only Upper Newport Bay has fully recovered. The 53 ha of Carpinteria Marsh and 26 pairs of Clapper Rails did not provide enough of a cushion for recovery from a calamity there and that subpopulation is gone. The 24 pairs of rails and 226 ha of habitat at the Seal Beach NWR were not enough to cushion the combined effects of too little nesting habitat and too many red foxes. A major difference in these two examples is that at Seal Beach the rail's needs were eventually accommodated with the provision of nesting habitat and the removal of nonnative predators. Now this subpopulation may be on the way to recovery.

Leaving Clapper Rails to their fate has resulted in their local disappearance and would eventually result in their extinction. Over the much longer term, too complacent an attitude about Upper Newport Bay would be a grave mistake. Disasters could strike even there and have in the past. We do not know what the effects would be of heavy rain for several years in succession. There have been chemical and sewage spills into the Bay and there is a recognized problem with sedimentation accelerated by human activities. Calamities that could strike at Upper Newport Bay might not be felt as severely in another portion of the range. In terms of the continued long-term survival of the Light-footed Clapper Rail in the United States, we are taking an unjustifiable chance if we do not work hard toward increased wetland acreage, increased productivity, and quickly fostering at least one additional large population center of Light-footed Clapper Rails in California.

There are difficulties in facilitating this at any of the major coastal wetlands of southern California. The opportunities are probably greatest at marshes that are secure in public ownership and have existing potential for an onsite manager. The problems are not insurmountable but they must be measured and dealt with at each site or the Light-footed Clapper Rail will continue to slide toward extinction.

Miscellaneous Sightings

Clapper Rails were also observed in 1989 at the Bolsa Chica

Ecological Reserve of the California Department of Fish and Game, in the San Diego River Flood Control Channel, and along the Tijuana River. The usual post-breeding season sighting of a single rail at Bolsa Chica was repeated this year in August, September, and October. There were several sightings (E. Burkett, pers. comm.) and all were in the usual place, just downcoast of the downcoast parking area on the edge of the fresh water reeds.

Two single Clapper Rails were observed in early April along the Tijuana River (P. Jorgensen, pers. comm.). One was in the vicinity of the Dairy Mart Ponds and the other was between the ponds and the estuary.

Three advertising females were detected along the downcoast side of the San Diego River Flood Control Channel in early April.

High Tide Counts

There have been counts of Clapper Rails during extreme high tides at the Seal Beach National Wildlife Refuge each winter since 1975 (Table 2). The counts involve stationing enough observers around the perimeter of the flooded marsh to sight all of the rails that are forced from cover by an extremely high tide. More recently, remnant cover is also checked from the water by canoe or kayak. In many other marshes, Upper Newport Bay for example, these counts are not worth doing because too much cover remains even during the highest tides to hide most of the birds. The counts are not consistent, even at Anaheim Bay, but the positive data are useful. There has been considerable variation in the total number of birds observed, even during comparable tides with equivalent visibility and coverage on consecutive days; the 1977 and 1979 counts, for example. The higher counts are the most meaningful. We documented heavy losses during the rough winter of 1980-1981, for example, with the third highest early winter count of 55 Clapper Rails, dropping to 38 by the 1981 spring call count.

The winter high tide counts at the Seal Beach NWR should be continued. They may be lacking in consistency but they have added important information to our understanding of both behavior and trends. For example, an observation by Dr. Charles T. Collins of a uniquely color-banded rail in December 1982, definitively documented that individuals of this normally sedentary race will sometimes move between marshes (Zembal et al 1985). With another count during the winter of November 1984, came our first concrete warnings of a devastating problem with a nonnative predator when fewer rails were counted than red foxes. The rail breeding population was cut by more than half between the 1984 and 1985 call counts, and again between 1985 and 1986. It finally began to rise weakly after intensive efforts to control red foxes and the provision of artificial nesting sites. Then on 16 October 1989, the highest count on record since 1975 was tallied.

The October count of 59 rails showed that these birds had

Table 2. High tide counts compared to call counts at Anaheim Bay, 1975 - 1988.

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)	WOW

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.

finally responded, and responded dramatically, to reduced predation pressure. Removal of red foxes from the Naval Station had finally thinned their numbers to a level that allowed the rails high reproductive potential to be realized and then manifest to observers during the Fall count (Twenty-seven Clapper Rails were handled for telemetry and banding by personnel of the Fish and Wildlife Service in October; only 6 were definite adults, 3 were not fully fledged, and the remainder were probable first-year birds - J. Wiley, pers. comm.). There will be extreme high tides and additional counts in December and January to follow the progress of this rebounding subpopulation. If a large number of these rails survive through the breeding season with adequate nesting sites, and predation pressure is kept low, and breeding is as successful as in 1989, this subpopulation may be well on its way to recovery.

Banding and Movements

There were 9 trapping sessions, 18 August - 13 October 1989, for a total of 560 trap-hours with 14 - 18 drop-door traps. The traps are wire mesh boxes with two doors and a treadle in the center. They are set in tidal creeks and along other trails used by the rails (see Zembal and Massey 1983, for a full discussion of trapping and banding techniques). Trapping was confined to the oceanward half of Upper Newport Bay from Shellmaker Island to the Narrows. Five of the trapping sessions were accomplished during the 3 - 4 hours before dark on evenings with appropriately low tides; the other 4 were morning sessions beginning near daylight and continuing for 3 - 4 hours. Evening sessions accounted for 338 trap-hours or 60.4% of the total; morning activities accounted for the remaining 222 trap-hours or 39.6%.

There was one additional trapping session off Upper Island with 2 kayaks and pole nets for 4 hours during an extreme high tide in November and 5 retrapping efforts for telemetered rails. Trapping by watercraft is a technique that works well where there is plenty of open water between the rails and significant amounts of cover. The effort at Upper Newport Bay generally involved a single capture attempt per bird with a pole net. If pressed through continued pursuit, the rails can be pushed to exhaustion and captured by hand. These endangered birds are not pushed in this manner to avoid the potential effects of overtaxing them.

Telemetered rails at Upper Newport Bay were pursued for recapture by canoe and herding into mist nets. Two of three attempts with nets were successful but both attempts by canoe failed.

Twenty-three unbanded Clapper Rails were captured and 22 of them were uniquely color-banded. This brings the total number of Light-footed Clapper Rails banded since 1981 to 115. Six of the rails were also radio-harnessed in cooperation with studies of the Fish and Wildlife Service's California Research Station. One of the rails captured by kayak was released unbanded. It was wet, shivering excessively, and acting oddly. It may have been sick. Upon release it ran off, listing to the right but quickly regained its balance and normal appearance.

There were 16 rails captured in drop-door traps and 7 from kayaks. The overall success with traps was 1.8 new captures per session, compared to 0.67 for 1988, 0.75 for 1987, 1.8 for 1986, and 1.03 new captures per session, 1981-1988, for 90 sessions. There were 35 trap-hours with traps per new capture in 1989, compared to 58.2 trap-hours per new capture in 1988, 42.9 in 1987, 15.4 in 1986, and 33.1 for 1981-1988.

Our first trapping efforts in 1981 were in the morning and unsuccessful. There were 7 sessions in the early morning in 1981, for a total of 207 trap-hours and nothing was caught. Subsequent trapping was mainly done in the late afternoon but since 1986, it has not been very successful. Morning trapping was retried in 1989 and it proved more successful than the evening efforts. This was primarily due to one morning session that resulted in the capture of 7 Clapper Rails, the largest number caught during a single trapping effort so far. Results were otherwise similar with one or two captures per session during both morning and evening hours, although one evening effort resulted in no captures. Morning sessions yielded 11 new captures; evening sessions resulted in just 5. Each new capture in the morning averaged 20.2 trap-hours and there were 2.75 captures per AM session, compared to 67.6 trap-hours per capture in the evening and 1 capture per PM session.

The primary factors involved in high trapping success are probably age and experience of the rails, well-placed traps, and timing such that the birds are maximally active. Camouflaging the traps may actually impair success (Zembal and Massey 1988), and it currently appears that mornings when many adult-sized first year rails are about constitutes a great time for trapping. Upper Island was trapped on the evening of 1 September (during a marginal tide that flooded too early) and 1 rail was captured; it was trapped again the following morning and 7 rails were caught.

Netting from a kayak was a very successful technique. At Upper Newport Bay, 7 rails were captured from 2 kayaks in less than 3 hours. The limiting factor with this technique is high enough tides. Most of the extreme high tides in summer occur after dark. Using these could involve higher predation and strike risks for the flushed birds. The technique is most usable, therefore, during the winter and in some years, the fall, with 2-4 suitable tides per month for 3 or 4 months.

There were 17 resightings of 8 banded Clapper Rails in 1989, with attempted observations concentrated on 47 dates from 19 May to 11 December, for 2 - 6 hours per date or approximately 135 hours. There were also repeated fixes on 34 dates to locate 6 rails telemetered as part of a study by Fish and Wildlife Service personnel of the movements of first year birds (personnel of the California Research Station were also monitoring these rails, so there are additional data). The first rail to be harnessed in 1989 was fitted on 19 August and the last signal was heard from a telemetered rail at Upper Newport Bay on 26 November.

The largest spread between detection points for any of these rails was of 675 meters for one of the telemetered rails, no. 494, just before its signal was lost. The usual movement detected, particularly on a daily basis, was much shorter, in keeping with our past observations (Zembal et al. 1989).

Rail no. 494's area of activity (minimum polygon) spanned a distance of about 222 meters from 19 August to 10 November, encompassing approximately 0.5 hectares (1.2 acres) of marsh (based on 33 location fixes). Its daily movements were typically concentrated in a small part of this total area but were not followed as well as daily movements have been in our past investigations. By 19 November it had moved to an area 204 meters outside its previous haunts, then there was another move totalling 405 meters, and by 26 November its signal was lost from the bay. What became of this rail is unknown. Such large moves over a short period of time preceded the one documented intermarsh movement by a Light- footed Clapper Rail (Zembal et al. 1985). Travelling through unfamiliar areas and being pushed by the challenges of the territorial rails would also increase the risks of predation to the travelling rail. The transmitter could have been damaged or removed by the predator or may have otherwise malfunctioned (see below).

Another of the telemetered rails, rail no. 495, was probably not well-established in a home range either. It was banded on Shellmaker Island on 19 August and by 25 August had taken up residence on the north side of the San Joaquin Marsh parcel, about 205 meters from the banding site. Between 25 August and 13 November it traversed an area about 105 meters long of approximately 0.3 hectares (0.74 acres) (based on 27 location fixes). Dueting that did not involve rail no. 495 was heard in this home range on several occasions during the period. An unsuccessful recapture attempt to remove its failing transmitter, resulted in the rail moving about 170 meters to the south. It remained in this vicinity, where 2 days later it was recaptured and the transmitter was removed.

The signals from the other 4 telemetered Clapper Rails in Upper Newport Bay were lost 7 - 77 days after harnessing, prior to any hint of long-range movement. Intermarsh movement, predation, and transmitter failure would be the most likely causes of signal loss and transmitter failure is suspected in 3 cases. (All but one of the transmitters used were of identical make.) For example, rail no. 494's transmitter began to fail less than one month after activation; the bird was recaptured and refitted. Upon recapture and deharnessing, it was discovered that the antenna on rail no. 495's transmitter had been pulled out cleanly and rust lined the hole.

The final transmitter was by Communication Specialists and of high quality. This unit is actually still pulsing away in the marsh. It is stationary in reeds so dense that it is irretrievable without doing great damage to habitat that is highly visible from Back Bay Drive. Since no odor was detected from this site, the rail was either completely consumed by a predator or it managed to slip out of the harness.

Scouring Upper Newport Bay and nearby wetlands has not revealed any of the 4 missing signals. Fish and Wildlife Service personnel are continuing to monitor several rails telemetered at the Seal Beach NWR and will periodically check for the missing transmitters and rails.

Only one rail banded prior to 1989, rail no. 465, was resighted in 1989. It was first banded in 1986 about 650 meters north of where it was seen in 1989 along south Shellmaker Island. Over much of the bay banded rails could still occur undetected in the dense habitat. However, after hundreds of hours of seeking observations of banded rails, the oldest known individual is still rail no. 406, first banded in 1981 and last observed in 1986. Light-footed Clapper Rails probably do not live much longer than this except unusually (see discussion in Zembal and Massey 1988). The greatest longevity reported in the literature for a Clapper Rail is 7.5 years (Clapp et al. 1982).

Vocalizations

There has been one well-documented sequence of observations on the effects of kek-burring. Those observations led to the conclusion that the presence of unmated females could be majorly disruptive to the breeding success of Light-footed Clapper Rails (Zembal and Massey 1985b, 1988). Again in 1987 during the spring count at the South Bay Marine Reserve, a presumed male Clapper Rail was observed running back and forth between two kek-burring females. If this response by a male were sustained through the breeding season, the successful rearing of young with either female would be precluded. However, recent observations at Upper Newport Bay indicate that a male's responsiveness to kek-burring is not always long-lasting.

There was an excess of females at Upper Newport Bay again in 1989. Two of these were listened for regularly, one off the southwest tip of Middle Island and the other off northeast Shellmaker Island. Both females called repeatedly in the late afternoon and early morning but could be heard at any time of day from regular locations. They apparently were maintaining territories, they certainly maintained their locations of calling, and there was regular dueting from adjacent pairs. A typical sequence during peak calling involved 131 calls in 10 minutes by the Middle Island rail. Most calls involved 1 - 4 "kek" notes followed by a short "burr".

After a short period of equilibration, the calling of these two females was apparently ignored by adjacent rails. In early April the Middle Island female attracted a male but the situation did not last; dueting was heard from her regular location on only one day. She continued her advertising from the same small area through June.

An adjacent male's response to female advertising probably depends upon many factors including stage of reproduction, age and experience, and social status. The unanswered persistence of these two females is indirect evidence that under certain circumstances, adjacent paired males eventually ignore advertising females. Ignoring an available female early enough in the breeding season ensures that enough time and mutual effort are available with a steady mate to raise young. How such mate recognition and maintenance is accomplished by the rails is unknown. Straying to an unpaired female early in the breeding season and copulating presents the remote possibility that the female could rear young on her own.

The Seal Beach NWR subpopulation was heavily female-skewed in 1989, yet reproduction was highly successful. There were at least 3 unmated females advertising amongst only 6 pairs of Clapper Rails. However, by October there were at least 59 Clapper Rails present in the marsh, and most of them were first-year birds. Twenty-seven of these rails were handled and 21, or 77.8% of them, were probably birds of the year (J. Wiley, pers. comm.). Since nearly half of the rails were examined, this percentage is probably a good estimate of the composition of the entire subpopulation. That is, 77.8% of all 59 Clapper Rails, or 46 rails were likely to be hatching-year birds. Each pair, therefor, would have to have raised 7 or 8 youngsters, perhaps involving some renesting, and/or females without full-time mates actually managed to add a few young to the total on their own. Unpaired females accomplishing this is unlikely. Predation of eggs and young had to have been very low for so few rails to be so very successful.

Nesting Behavior

Nest searches were conducted along the east side of Upper Newport Bay to locate nests that could be monitored closely through a video camera. There were nest searches on 14 dates, 6 June - 23 September 1989, for 2 - 6 hours per search. As usual, to minimize the danger of our trampling chicks, nest searches were not begun until the young from first nesting attempts were several weeks old.

The initial nests at Upper Newport Bay were very successful in 1989. There were active brood nests found everywhere and later nesting attempts were minimal. Consequently and despite intensive searching of much of Upper Newport Bay, only one late nest was found there. Another late nest was also found on the Seal Beach NWR.

The nest at Upper Newport Bay was discovered on 13 July in *Scirpus robustus*, edging the saltmarsh along Back Bay Drive on south Shellmaker Island. It contained 7 eggs. The nest was monitored through the video camera for 3 hours on 14 July and 7.5 hours on 15 July. Since the eggs were unmarked, hatching was at least a few days off and additional video taping was postponed until such time as hatching appeared imminent. The nest was visited on 16 July and there were only 3 eggs left; all of them had disappeared by 18 July. The nest was secured to the reeds on one side, and higher tides had apparently lifted the free side of the nest, dumping the eggs.

A late nest discovered on a raft at the Seal Beach NWR would have been ideal for video monitoring. However, permission to use a video camera on the Naval Station was slower in coming than the chicks and the opportunity was lost. Consequently, nothing of substance was added to our knowledge of nesting behavior through video taping in 1989 (see Zembal and Massey 1988).

Nest monitoring should commence 2 weeks or so earlier in 1990, or even earlier if carefully done, when many nests would be available. Searching out late nests is very labor intensive and fruitless, as in 1989, when there is an extremely high degree of successful first nesting attempts.

Predation

Observations of predators and sign was the focal activity at Upper Newport Bay on 41 dates, 18 March - 7 December, for 2 - 7 hours per visit. There were also incidental observations on many additional visits. This effort was expended on attempted observations of rail-predator interactions, documenting the locations of nesting raptors, examining sign left by terrestrial predators, and in live trapping.

Observed Predation. Interactions between a Clapper Rail and a predator are rarely observed directly. However, a Red-tailed Hawk (*Buteo jamaicensis*) was observed killing and eating a Clapper Rail at Upper Newport Bay in January 1989 (G. Gerstenberg, pers. comm.). This is only the second documented observation of an actual kill by a Red-tailed Hawk.

The winter abundance of Red-tailed Hawks is high in the vicinity of Upper Newport Bay. However, 5 of these hawks is the maximum ever observed hunting the marsh and adjacent bluffs at one time. The hawks observed for prolonged periods hunted mostly over the uplands. Upland prey they were observed taking included cottontails (*Sylvilagus audubonii*), ground squirrels (*Spermophilus beecheyi*), gophers (*Thomomys bottae*), and gopher snakes (*Pituophis melanoleucus*). Wetland birds observed taken besides Clapper Rails included American Coots (*Fulica americana*), American Widgeon (*Anas americana*), and Green-winged Teal (*Anas crecca*).

Also directly observed for only the second time was the killing of a Clapper Rail by a domestic cat. The observation was by Ms. Parker-Chapman in the Tijuana Marsh on 18 October 1989 (R. Ryno, memo to file). This cat was quite tame and the incident highlights the extreme vulnerability of Clapper Rails seeking refuge along the marsh fringe during the higher tides. All of the marshes currently occupied by Clapper Rails are frequented by cats, domestic and feral.

Avian Predators. Raptor nesting sites were searched for, particularly Great- horned Owls (*Bubo virginianus*) and Red-tailed Hawks, to monitor them for prey remains. The raptor nesting activity within a half mile of Upper Newport Bay in 1989 included a minimum of 1 Great Horned Owl territory, 2 Barn Owls (Tyto alba), 2 Red-shouldered Hawks (Buteo lineatus), 1 Cooper's Hawk (Accipiter cooperii), 1 Black-shouldered Kite (Elanus caeruleus), and 3 American Kestrel (Falco sparverius) territories. There were also 5 Northern Raven (Corvus corax) nests found.

Aerial displays by courting pairs of Red-tailed Hawks were observed one to several miles to the east and to the west of the bay but no nests were found near the bay during exhaustive searches. This is probably due to a lack of suitable nesting sites. Trees that otherwise would attain a sufficient height and stature to provide a good nest site are trimmed regularly by municipal maintenance crews. The few cliff sites and trees that are suitable are subject to more disturbance by people than is tolerated by this species.

The scarcity of nesting sites near the bay resulted in very low visitation to the bay by Red-tailed Hawks during the spring. Sighting a hawk in the marsh was unusual from about April into August. In contrast, it is unusual not to see at least one Red-tailed Hawk, or as many as 5, soaring or perched during most of the rest of the year. These hawks are most abundant in the fall and winter when inexperienced first-year rails would be quite vulnerable to predation. The hawks were least abundant in 1989 during the nesting season. Reduced predation pressure from raptors is probably one result of their dispersal from the bay to nest and may also be a factor that contributes variably to high rail production during certain years.

There are crevices in two cliff faces that are nested in by Great Horned Owls at Upper Newport Bay. The one on the south-facing wall just east of Middle Island was inactive this year but was active in 1988. The other was active again in 1989 on the south-facing sandstone wall just west of Shellmaker Island. The nest crevice was poorly located for retrieval of prey remains and pellets. The only bird remains in the 12 pellets and pieces found were smaller than a Clapper Rail.

Great-horned Owls hunt all of Upper Newport Bay, both the wetlands and the adjacent uplands. There are probably 3 territories and perhaps a fourth that encompass the marsh. These owls are capable of being major predators of Clapper Rails but the frequency of encounters is probably dependent upon sporadic nighttime activity by the rails. Limited evidence suggests that Light-footed Clapper Rails are not routinely active at night (Zembal et al. 1989). However, Great Horned Owls have been heavily implicated in past Clapper Rail predation (Zembal and Massey 1986). This will be more thoroughly examined in 1990.

The Barn Owl pellets examined at Upper Newport Bay contained parts of rodents and other creatures much smaller than a Clapper Rail. Young rails are potentially at risk but are generally not active or detectable when these owls are hunting.

The Red-shouldered Hawks and Cooper's Hawks appeared mostly to hunt habitats other than the saltmarsh. The single pair of Cooper's Hawks and western pair of Red-shouldered Hawks nested in

Big Canyon to the east of Upper Island. One of the Red-shouldered Hawks frequented a perch in a tall willow at the mouth of the canyon with a good view of the saltmarsh but was never observed attacking in that direction. The eastern pair cruised the fields along the bluff tops and were observed there with high regularity but were never seen venturing into the marsh either. The Cooper's Hawks often flew low over the slope shrublands bordering the marsh in search of prey such as small birds flushed from cover. On 3 occasions a Cooper's Hawk flew over the marsh but high and apparently just in passage. I once observed a Cooper's Hawk take a Chukar (Alectoris chukar) and have little doubt that a large hawk could handle a Light-footed Clapper Rail. However, it would rarely have the opportunity at Upper Newport Bay. This hawk's hunting mode would seldom bring it into contact with a rail and the rail's probable response would be to run into cover rather than to flush.

Both Black-shouldered Kites and American Kestrels were observed hunting the marsh on a regular basis. Prey much smaller than an adult Clapper Rail is their usual fare but young rails are at potential risk. One kite and two of the kestrels frequented the marsh, where they were regularly seen perched and hunting. One kestrel regularly hunted a small stand of reeds and captured at least three Red-winged Blackbirds (Agelaius phoeniceus). On two occasions a kestrel was observed unsuccessfully attacking small sandpipers.

The other raptors observed at Upper Newport Bay included Short-eared Owl (Asio flammeus), Burrowing Owl (Athene cunicularia), Merlin (Falco columbarius), Peregrine Falcon (Falco peregrinus), Prairie Falcon (Falco mexicanus), Sharp-shinned Hawk (Accipiter striatus), Osprey (Pandion haliaetus), Northern Harrier (Circus cyaneus), and Turkey Vulture (Cathartes aura). Not one of these species is likely to prey heavily on Light-footed Clapper Rails, except under unusual circumstances.

Short-eared Owl pellets from San Francisco Bay were examined by Johnston (1956); 3 of 638 individuals of identified food items were Clapper Rails. Short-eared Owls are rare winter visitors to Upper Newport Bay and generally take smaller prey. Burrowing Owls could be a threat to chicks except that they usually hunt the uplands and may have been recently extirpated from the bay. A Merlin was sighted just once in 1989 and small prey would be the usual fare. Prairie Falcons are also sporadic to rare winter visitors to the bay; they could prey on Clapper Rails but encounters may be minimized by the rarity of visitations and density of the rail's usual cover. Likewise, Sharp-shinned Hawks are rarely observed near the marsh and would usually take much smaller prey. The Osprey eats fish almost exclusively and Turkey Vultures are scavengers.

Although Turkey Vultures are no direct threat to a Clapper Rail, they could cue an observer to a fresh kill. A Red-tailed Hawk on a meal in the marsh is usually attended by two or more vultures awaiting leftovers. Turkey Vultures are very abundant at Upper Newport Bay with its abundance of food; 24 were seen at one time in late November, for example.

A pair of Peregrine Falcons showed interest in a crevice in the cliff face west of Shellmaker Island but departed in early April. There is probably too much human activity along these cliffs for Peregrine Falcons to attempt nesting. These falcons are regular at Upper Newport Bay in winter and quite capable of taking a Clapper Rail. However, a rail harassed by a stooping falcon would usually run into cover rather than flush.

Most Northern Harriers are too small and weak of talon to prey on an adult Light-footed Clapper Rail. Large harriers may occasionally take them. Harriers regularly and systematically hunt in a low glide over the very marsh vegetation frequented by Clapper Rails and so, are the raptors most likely to encounter a rail up close. However, in well over 2,000 hours of observation since 1979, only prey much smaller than a Clapper Rail has been observed taken by a harrier. The largest prey I have seen them take is a Willet (Catoptrophorus semipalmatus), whereas nearby ducks, even teals, have ignored foraging harriers. In Tijuana Marsh attempted pounces by harriers on Clapper Rails have been observed but so far no kills have been recorded (P. Jorgensen, pers. comm.). Harriers have been documented taking the smaller Clapper Rails of eastern marshes (Collopy and Bildstein 1987, Meanley 1985) and observations to document interactions will be continued in southern California.

Ravens were abundant and successful nesters around Upper Newport Bay in 1989. Many family groups of 3 - 5 members were seen foraging, mostly in areas with very low growing or sparse cover. Young Clapper Rails and eggs would be very vulnerable to these keen-eyed omnivores, except for the raven's usual choice of very open foraging grounds. Both ravens and American Crows (Corvus bracyrhynchos) probably detect a Clapper Rail nest on occasion and attempt to take eggs or young (see Massey and Zembal 1987). Nests are particularly detectable near hatching time when canopy maintenance is abandoned and feeding activity is abundant. A large flock of crows still congregates near the mouth of Big Canyon and hunts the bay, particularly near Upper Island (see Zembal and Massey 1988). As these successful corvids continue to increase in our urban environments, they could pose increasing problems for endangered species like the Clapper Rail. One case of egg predation was observed on a raft at the Seal Beach National Wildlife Refuge and was probably ascribable to a small bird. The eggs were broken in medium to large-sized fragments, and only part of the contents was consumed. One of the most conspicuous potential perpetrators of this was a pair of nesting Northern Mockingbirds (Mimus polyglottos). The mockingbird nest was in a Myoporum laetum within a few hundred meters of the rail nest.

Terrestrial Predators. The terrestrial predators documented at Upper Newport Bay included the coyote (Canis latrans), gray fox (Urocyon cinereoargenteus), raccoon (Procyon lotor), striped skunk (Mephitis), bobcat (Lynx rufus), feral cat (Felis catus), long-tailed weasel (Mustela frenata), and opossum (Didelphis *virginiana*).

Two of these species, the gray fox and bobcat, may be of more limited distribution at Upper Newport Bay than the others. Definitive sign of gray foxes was observed in the southeast field, above and to the east of Shellmaker Island. Sparse bobcat sign was found in Big Canyon. Indirect evidence and sightings of the other terrestrial predators were more widespread around the bay.

Coyote sign was most abundant in the field to the east of Shellmaker Island, in Big Canyon, and at the upper end of the bay, below East Bluff Drive. Evidence of use is disturbingly absent in the fields bordering the western side of the bay and along the new bike trail to the north. The habitat in these fields is introduced grasses; there is very little cover, minimal food production, and very heavy use by people and their pets. Native shrublands should be replanted to replace the nonnative grasses in these open fields. Perhaps half of the area should remain open for foraging raptors and other wildlife, but the grasses in the open areas should be replaced with native forbs.

Coyotes were heard or seen in the field to the east of Shellmaker Island (2 sighted, 1 heard), in Big Canyon (of 2 sighted near MacArthur Boulevard, 1 was shot by a policeman), to the west of Middle Island (2 heard), and on Upper Island.

The coyote observed in the marsh on Upper Island was a female that ventured out during midday, probably from a resting spot on the slope to the east. Two Red-tailed Hawks were feeding on an American Coot with the usual audience of 3 Turkey Vultures on the far, western edge of the island. The coyote probably observed the kill and saw the possibility for an easy snack. She trotted out of the marsh and back up the eastern slope without disturbing the raptors; it appeared that my presence and attention in her direction caused her retreat.

Since the documentation of the circumstances leading to mesopredator release (Soule et al. 1988), concern for the viability of the local coyote population around Upper Newport Bay has grown. We now know that the regular presence of a few coyotes keeps explosions in small predator numbers from occurring, protecting other wildlife, particularly birds, from the exorbitant predation that follows coyote extirpation. The local coyotes probably cover large expanses on a regular basis that include the bay. If this is to continue, viable corridors for wildlife movement must be maintained between the bay and the much larger open spaces remaining in Orange County to the east. As of 1989, regular dispersal by coyotes into the bay is still occurring along routes that connect to Big Canyon and San Diego Creek. As more of Orange County is converted to houses and similar purposes, the remaining corridors could easily be left too narrow or urbanized to be viable. If urbanization proceeds as it has elsewhere, the remaining open space could also be rendered too fragmented to maximally function as wildlife habitat and home to large roaming top predators. Since the wetland organisms are directly affected by a food chain that includes critical habitat components located miles from the bay, decisions on the fate of that habitat should consider the importance of this viable wetland. The maintenance of Upper Newport Bay as a maximally functional wetland should be a top priority; its conversion to something approaching an outdoor zoo and requiring heavy and constant management should be avoided at all costs. The fate of at least one endangered species could be part of what is at stake.

Predator trapping was performed mostly to further document the distribution of the small predators. Raccoon-sized box traps were used in the vicinity of Shellmaker Island. A total of 46 trap-nights and 10 trap-days were accrued with 2 - 5 traps set on 11 different dates. The various baits tried included cat food, sardines, and live mice. The only animals actually handled were a striped skunk and 4 ground squirrels. The ground squirrels were so readily captured that daytime trapping was abandoned. Sign at the traps indicated heavy interference from people, even at night. A minimum of two additional captures occurred, a cat and an opossum, but they were released by well-wishers. Live mice in small wire baskets appear to be very effective bait for cats but trapping cats at Upper Newport Bay may be difficult without repeated visits to the traps to keep people from releasing the animals. It is difficult to hide the traps along the thin edge of the marsh where cat sign abounds and captured animals are noisy enough to draw the attention of passersby.

<u>Predators At Carpinteria Marsh.</u> A red fox was observed dead on the road along Highway 101 adjacent to Carpinteria Marsh on 29 October 1989 (Dr. W. Ferren, pers. comm.). I also found fox-sized tracks on the road berm that bisects the marsh along with numerous cat, dog, and raccoon tracks. In addition, a large tree stump lodged in the center of the marsh is riddled with raccoon scat (D. Ledig, pers. comm.). It may be that the loss of the Clapper Rails in Carpinteria Marsh was due to heavy predation. If this is the case, predator control and/or the restoration of a more complete food chain through management might render this marsh again suitable for Clapper Rails.

<u>Future Work.</u> A few of the Great Horned Owls that frequent the wetlands will be followed more closely through radio telemetry in 1990. This will result in information on the owl's territory sizes, proportionate use of wetlands and uplands, and prey selection.

A tool for aiding in the documentation of prey taken by harriers and other applications was designed and built in 1989 and is now being tested. It is a camera triggered by a microwave motion detector. The motion detector fires a solenoid attached to the camera which depresses the shutter button. The motion detector is the same type that triggers grocery store doors to open when approached by a shopper and is powered by a 12 volt battery. The camera, detector, and battery are housed in a waterproof box with a plexiglass front. A clock placed in the field of view below perches frequented by raptors, at den entrances, near bait, or at rail nests will allow the time of photographed events to be recorded as well. The motion-triggered camera rig works well; the major difficulty to be overcome is in setting the sensitivity properly to preclude firing by plants moving in the wind.

Three different collar designs have also been built to determine the best design for radio tracking coyotes. Better information is needed on the movements of coyotes around and to Upper Newport Bay. Particularly critical is a better understanding of the corridors these animals will use and minimum viable sizes of such corridors.

Nesting Rafts

The 46 rafts placed in the Seal Beach NWR in 1988 were still floating adequately in 1989. They were refurbished by replacing damaged dowels and the old tumbleweeds. The raft design was described in earlier reports (Zembal and Massey 1988). The one modification in 1989 was the placement of 10 - 15 green bamboo stakes protruding through the tumbleweeds on 15 rafts to deter perching by large birds and the associated disturbance to the rails. The stakes had round toothpicks shoved into their ends to aid in perching deterrence and wood glue was dabbed on tumbleweed branches contacted by the stakes to secure them. The rafts were all refurbished by 20 February 1989. They were subsequently examined about once every 2 - 3 weeks. There were 18 raft checks, 12 March - 10 October 1989.

The first Clapper Rail nest on a raft was already present during the first raft check; the first nest with eggs was discovered on 12 April. By the last examination, 17 rafts had held nests, of which 4 were eggs nests and at least 2 others were brood nests (Figure 2). Two of the clutches of eggs hatched successfully, one probably hatched, and the fourth was predated, probably by a small bird (Table 3). There were at least 5 additional nests off the rafts, 4 of which hatched. Three of these were in tumbleweeds near rafts and were examined; the other 2 were in evidence from brood nest use and placement on 2 rafts. There were also 2 Mallard (*Anas platyrhynchos*) nests on the rafts.

The entire marsh was not searched for nests to avoid unnecessary disturbance to the rails. It is evident, however, that more than half of the rails produced in the NWR prior to the count of 59 in October, were the result of successful nests off the rafts. Such high nesting success was made possible by reduced predation pressure brought about by effective control of red foxes.

It took a large number of bamboo stakes placed at various angles to effectively repel large birds from perching on the raft tumbleweeds. As many as 30 could be required in a large tumbleweed. The anti-perching prods were installed on a raft when a nest was found, unless there were eggs in the nest. It is not clear if the addition of these sticks through the tumbleweed

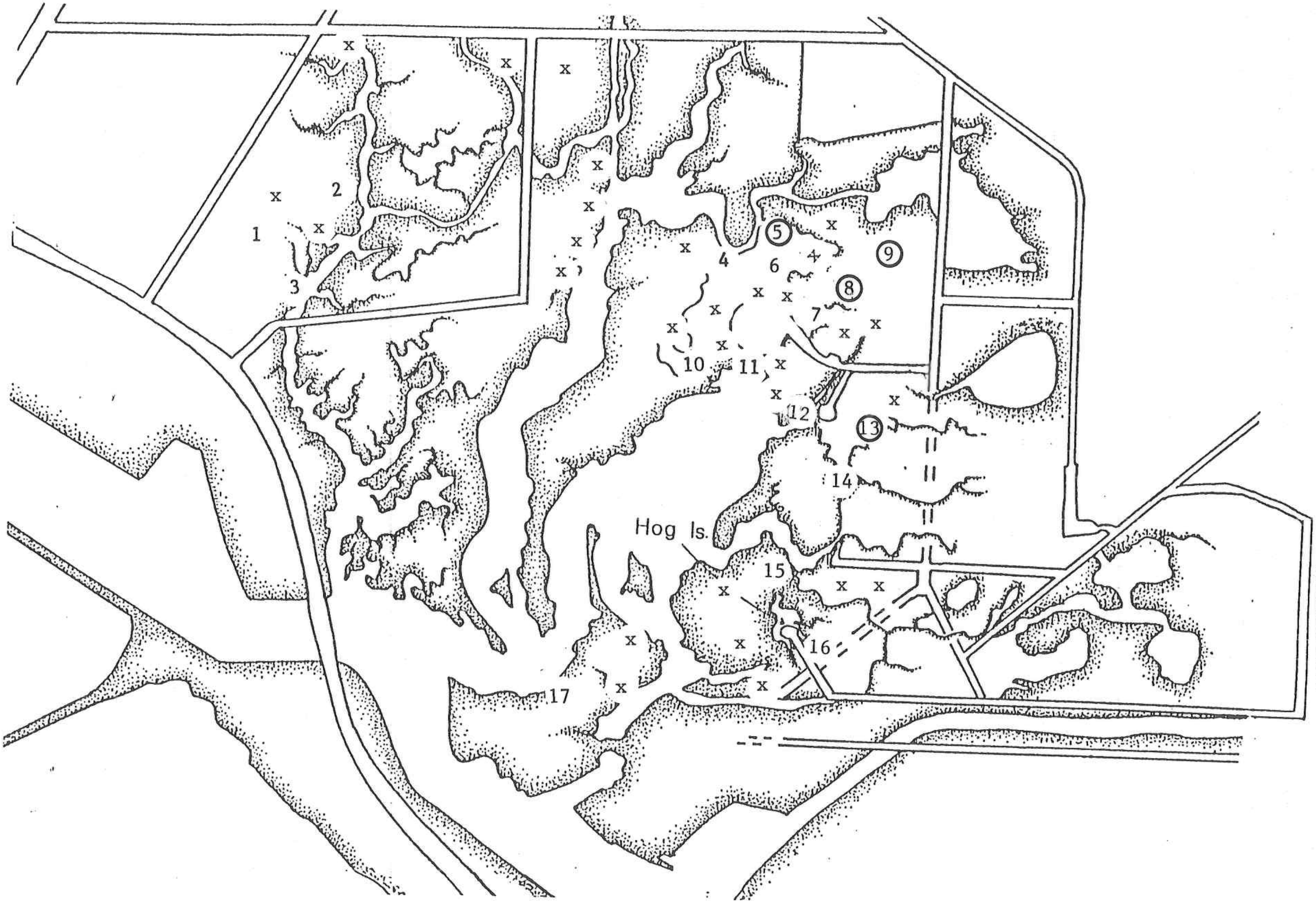


Figure 2. Locations of 46 nesting platforms in the Seal Beach National Wildlife Refuge, 1989. Rafts that are numbered held Clapper Rail nests; nest sites that are circled held eggs.

Table 3. Nesting raft use by Clapper Rails in the Seal Beach NWR, 1989

Raft # [1]	Nest	Dates of Detection Egg/Incubation	Outcome [2]	Remarks [3]
1	3-12	-	-	
2	3-31	-	-	Mallard Nest, H
3	3-31	-	-	Adjacent T Nest, H
4	3-13	-	-	
5	3-31	4-12	H 5-10	
6	3-13	-	-	
7	3-13	-	-	BN use, chicks seen
8	5-10	5-31	P 6-4	Adjacent T Nest, TW
9	3-31	5-10	H? 5-31	
10	3-31	-	-	
11	7-11	-	-	BN use
12	5-31	-	-	
13	8-8	8-8	H 8-23	
14	3-13	-	-	
15	5-10	-	-	Mallard Takeover
16	3-31	-	-	
17	6-21	-	-	Adjacent T Nest, H

[1] The rafts were renumbered by area in 1989.

[2] H = Successful hatching; P = Predated; ? = Uncertain;

[3] TW = Tidal Washed; H = Hatched; T = Tumbleweed;
BN = Brood nest.

and nest rim disturbed the rails, but none of the egg nests on the NWR were on rafts treated with anti-perching stakes; one at the Kendall-Frost Reserve was, however. If prods are to be used in the future, they should be installed with the new tumbleweeds and on only half or fewer of the rafts. It appears to be just as effective to install the tumbleweeds with the heavy stem down. The upper twigs are small, laden with stickers, and do not appear to provide enough support for regular perching by larger birds.

The 45 rafts remaining in the NWR should be refurbished in 1990 (the raft nearest Sunset Aquatic Park was vandalized). Rather than additional rafts, large tumbleweeds should be added to the sites available for Clapper Rail nests. Flotsam collects in a tumbleweed's rim and gives it some flotation. This should be taken advantage of by staking the tumbleweeds in place using two short dowels embedded to form an inverted "V" inside the tumbleweed. This should keep the tumbleweed in place and relatively stable, yet allow it to float slightly, while hiding the dowels. When a tumbleweed alone is used as a nesting site, nest and eggs are vulnerable to wash out during higher tides. How vulnerable depends on the density of the tumbleweed, the height of nest placement in the tumbleweed, and the height of the tide. Consequently, the densest tumbleweeds available should be used.

The 15 rafts placed in the Kendall-Frost Reserve in northern Mission Bay, San Diego County, in 1988 were also checked twice. There were at least 4 and perhaps 5 or more Clapper Rail nests on the rafts in 1989. Two of the nests hatched eggs and another might have hatched but might also have been predated.

The confusion on the number of nests is the result of small mammal use of the rafts. Several rafts had domed nests of a small mammal on them but looked as if they were Clapper Rail nests originally. The hay mounds were made of dried cordgrass and a had a small central chamber. Similar mounds have not been found on the rafts in other marshes but have been seen in the ruderal fields at Upper Newport Bay. There they are located along runways that appear to belong to California meadow mice (<u>Microtus</u> <u>californicus</u>). The species responsible for the mounds on the rafts should be confirmed and the situation should be monitored to ensure that there is no interference with rail nesting.

Provision of the raft nesting sites should be continued in 1990 and the rails should be monitored as closely as possible. All of the factors leading to the decrease in Clapper Rails at the Kendall-Frost Reserve are not clear but the use of the rafts in 1989 is in keeping with the theory of a decrease in cordgrass density. The rafts should serve as focal points for monitoring rail use of this marsh, documenting problems, and alleviating them.

<u>Publications and Presentations</u>

The information generated by these investigations, partially through the support of the California Department of Fish and Game, is disseminated to the public through publications and speaking engagements. A paper on the status of the Light-footed Clapper Rail, after monitoring this endangered species through the 1980s, is in preparation. The recent literature on the Light-footed Clapper Rail was compiled with a summary or the abstract for each citation. This compilation is appended.

Aspects of the life history of the Light-footed Clapper Rail and efforts being made to recover this endangered species by the Department, the Service, and others were presented in speaking engagements to: Orange County School District tour guides; Sea and Sage Chapter of the Audubon Society; Ecology class at Golden West College; the Friends of Upper Newport Bay; and students, faculty, and interested citizens at the Centro de Investigacion Cientifica y de Educacion Superior de Ensenada, Baja California, Mexico.

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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.

RECENT LITERATURE OF THE LIGHT-FOOTED CLAPPER RAIL

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

A survey of the California population of the Light-footed Clapper Rail was conducted in spring 1980. Censusing was done by listening to spontaneous vocalizations of the rails at dusk and plotting locations of calling pairs on maps. Nest searches of the marshes corroborated the findings of the vocalization census. Fifteen coastal saltmarshes were censused and 203 nesting pairs were found. The birds were concentrated in 5 marshes - Carpinteria Marsh, Anaheim Bay, Upper Newport Bay, Kendall-Frost Reserve, and Tijuana Marsh. An addendum summarizes the 1981 survey of 23 southern California marshes and two marshes in Mexico. There was a 15% reduction in the California total.

2. Jorgensen, P. D., and H. L. Ferguson. 1982. Clapper Rail preys on Savannah Sparrow. Wilson Bull. 94(2): 215.

Describes an attack on an adult Belding's Savannah Sparrow by a Light-footed Clapper Rail. Reviews published accounts on foods of Clapper Rails that hinted at birds in the diet.

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

Reviews techniques for rail capture from the literature and summarizes success and failure with the live-capture of Light-footed Clapper Rails in southern California. Three hundred and seven hours of trapping over 85 dates, 16 February 1981 - 9 September 1983, resulted in 1,905 trap-hours and the capture of 52 Clapper Rails and recapture of 13. The highest success in Southern California was with drop-door traps but a variety of possible techniques was explored.

4. Zembal, R., and B. W. Massey. 1983. The Light-footed Clapper Rail: distribution, nesting strategies, and management. Cal-Neva Wildlife Trans., 1983:97-103.

Censusing by vocalizations of the known populations of Light-footed Clapper Rails in California revealed 203 pairs in 11 coastal marshes from Carpinteria to Tijuana Marsh in the spring of 1980, 173 pairs in 15 marshes in 1981, and 221 pairs in 18 marshes in 1982. The rails were detected, in order of decreasing abundance, in marshes with abundant, dense cordgrass (<u>Spartina foliosa</u>), in pickleweed (<u>Salicornia virginica</u>) dominated marshes with little or no cordgrass, and in brackish to freshwater marshes with dominant reeds (<u>Typha</u> spp. and <u>Scirpus</u> spp.).

Dense cordgrass provides a highly utilized habitat, but all of a marsh and its environs are used to some degree. A most productive situation is apparently provided by a large marsh comprised of numerous habitats as exemplified by Upper Newport Bay, where nearly half of the nesting pairs in the state were detected in 1980 and 1982. Birds do occur, however, in very small marshes with nearly monotypic vegetational cover. In contrast, populations have disappeared from several marshes that were, and in most cases still are, periodically subjected to closed ocean entrances and subsequent prolonged flooding. Additionally, viable populations have not been detected in those coastal brackish to freshwater marshes comprised totally of open water and emergent reeds.

A total of 221 nesting sites was examined at Upper Newport Bay, Tijuana Marsh, and Anaheim Bay during 1979 through 1981. Incubation nests were placed, in order of decreasing frequency, in dense cordgrass, in higher marsh plants and usually in stands isolated by low marsh or mudflat, in tumbleweeds or wrack lodged mostly in lower marsh plants, and in stands of freshwater reeds. About 95% of the incubation nests examined were built directly in or were isolated by lower marsh habitats.

Known agents of nest destruction were high tides in the lower marsh and upland predators in the upper marsh. Optimally, therefore, nesting sites must be densely vegetated and high enough to afford protection from high tides, yet isolated enough in the marsh to be effectively protected from upland predators. The hatching success of 57% for poorly isolated upper marsh nests was significantly lower than that of about 81% for all other nests.

Habitat quality, as affected in part by weather, appeared to influence nest placement. Upper marsh sites were most heavily utilized where and when tall, dense cordgrass was least abundant. The scarcity of suitable nesting habitat appears to be a major limiting factor for several Clapper Rail populations. Methods are suggested for providing additional nesting habitat and for improving the quality of existing habitat.

5. Massey, B. W., R. Zembal, and P. D. Jorgensen. 1984. Nesting habitat of the Light-footed Clapper Rail in Southern California. J. Field Ornithol., 55(1):67-80.

Nesting activities of the Light-footed Clapper Rail were observed for 3 seasons in 3 Southern California coastal saltmarshes. We found 208 nests, representing about 85% of the breeding pairs in the study areas. Nests were grouped into 5 categories. The rails' preferred breeding habitat was tall, dense cordgrass (Spartina foliosa) in the low littoral zone, where they build platform nests out of dead cordgrass stems. Where or when such habitat was not available, the birds still nested preferentially in low marsh, using tide-deposited materials as nesting cover. Nests were also built in Salicornia virginica and other upper marsh plants on hummocks of high ground surrounded by low marsh. Only rarely did the rails nest in high marsh that was contiguous with uplands. Stands of freshwater reeds were present at one marsh and were used regularly for nesting, as well as foraging and roosting. Clutch size, hatching success, and causes of nest failure were documented whenever possible. Major causes of nest failure were flooding of nests in low marsh and predation of high marsh nests. The dearth of suitable nesting habitat in coastal marshes of Southern California is a severely limiting factor to the growth of the

Light-footed Clapper Rail population.

6. U. S. Fish and Wildlife Service. 1985. Recovery plan for the Light-footed Clapper Rail. U. S. Fish and Wildlife Service, Portland, Oregon. 121 pp.

This is the revision of the original 1977 plan. Available biological information and recovery needs are presented. According to the plan, recovery to threatened status would require 800 pairs within 4,000 ha of adequately protected, suitably managed, secure wetland habitat consisting of at least 50% appropriate marsh vegetation in at least 20 marsh complexes. Copies of the plan are available through the FWS Reference Service, Informatics General Corporation, 6011 Executive Blvd., Rockville, Maryland 20852, telephone 1-800-582-3421.

7. Zembal, R., and B. W. Massey. 1985. Function of a rail "mystery" call. Auk 102(1):179-180.

The contextual use of the "ornithological mystery" call, "kicker" song, or "kek-burr" is described for the Light-footed Clapper Rail. The observations leading to the conclusion that this is the primary advertising call of the female are related.

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

This is a status review of the endangered Light-footed Clapper Rail following 5 consecutive annual censuses of the U. S. population. The population total was lowest in 1981 with 173 pairs detected in 15 marshes, and highest in 1984 with 277 pairs in 19 marshes. The vulnerability of this species and need for additional habitat are emphasized.

9. Zembal, R., J. M. Fancher, C. S. Nordby, and R. J. Bransfield. 1985. Intermarsh movements by Light-footed Clapper Rails indicated in part through regular censusing. Calif. Fish and Game 71(3): 164-171.

The Light-footed Clapper Rail, a state and federally listed endangered species, was monitored at 5 coastal marshes on or in the vicinity of Camp Pendleton, U. S. Marine Corps Base, San Diego County, California. Monitoring was accomplished mostly through censusing for vocal responses to systematic playing of recorded calls during both morning and evening hours on 13 dates spanning the period 10 May - 22 November 1983. The results of monitoring the relatively larger breeding population at Agua Hedionda Lagoon, the single study site located off the base, aided in interpretation of results at the other 4 marshes. A small breeding population was verified at the mouth of the Santa Margarita River and dispersing transients were detected at Las Flores Marsh. The evidence for movements by Light-footed Clapper Rails away from home marshes is presented and discussed.

10. Massey, B. W., and R. Zembal. 1987. Vocalizations of the Light-footed Clapper Rail. J. Field Ornithol., 58(1): 32-40.

Eight calls are described in the repertoire of the Light-footed Clapper Rail. The major calls are the "clapper", "kek", "agitated kek", and the "kek-burr". The "clapper" is the basic species call, used both for general territorial pronouncements and in contexts where mutual recognition of mates is important. Both sexes "clapper". The "kek" and "kek-burr" are advertising calls of non-mated males and females, respectively. The "agitated kek" is a response to intrusion or disturbance. All calls are variants on a single note; differences in sounds are due to changes in pitch, length of notes and of intervals between notes, and intensity.

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

Weekly monitoring of the spontaneous evening vocalizations of Clapper Rails at two marshes in Southern California was carried out for one year. Information resulted concerning the relative use of the common calls, and the frequency and seasonality of calling. The most commonly heard calls were the "clapper", "kek", and "agitated kek". Vocalizing showed a bimodal curve over the year, with strong peaks during the spring breeding season and again in late summer when juveniles join in the calling.

12. Eddleman, W. R., F. L. Knopf, B. Meanley, F. A. Reid, and R. Zembal. 1988. Conservation of North American Rallids. Wilson Bull., 100(3): 458-475.

This is the report of the Conservation Committee. An overview is provided for the 9 species of Rallidae that regularly breed in North America including general habitat requirements, trends in habitat loss, habitat manipulation, effects of hunting and trapping, the plight of the rarer taxa, and research needs. Recommendations for enhancing habitat and populations are made.

13. Zembal, R., and J. M. Fancher. 1988. Foraging behavior and foods of the Light-footed Clapper Rail. Condor 90: 959-962.

Foraging Light-footed Clapper Rails were observed for approximately 180 hours and mostly at Upper Newport Bay, Orange County, California. A total of 50 gm of regurgitated pellets from three marshes was analyzed and the motions involved in 11 foraging bouts, totaling about 45 min, were video taped and analyzed. Over 90% of the time that Clapper Rails were observed foraging, they hunted the marsh executing numerous surface gleans and usually shallow probes. The average gleaning and probing rate for 11 foraging bouts was 675/hr, resulting in the capture of about 250 tiny morsels/hr. This rail eats a wide variety of animal foods, executing many different foraging strategies that include crabbing, fishing, and scavenging. Crabs are probably important in the diet, along with snails, insects, and the many tiny, quite mobile invertebrates of the marsh. Plant material is uncommon in the diet.

14. 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.

We monitored 54 individually color-banded Light-footed Clapper Rails (9 were harnessed for radio telemetry) to determine movements, home range, and activity patterns. Resightings over 3 years indicated a strong site tenacity. Maximum distances between locations for a given rail were generally < 400 m (averages were 12 - 289 m). Minimum home range sizes varied from 0.36 to 1.66 ha. Territorial rails maintained small home ranges all year. Young birds moved more than established adults. Rails usually covered only small portions ($\leq$ 30%) of their entire ranges on a daily basis. All of the marsh and environs were used by rails. Larger movements were associated often with chases, predator alarms, and high tides. Daily activity peaked in the early morning and late evening.