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LIGHT-FOOTED CLAPPER RAIL CENSUS AND STUDY, 1990

by

Richard Zembal

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LIGHT-FOOTED CLAPPER RAIL CENSUS AND STUDY, 1990

CONTRACTOR

California State University, Long Beach Foundation

Long Beach, California 90840

PRINCIPAL INVESTIGATOR

Richard Zembal

PROJECT ADMINISTRATOR

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

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Research Associate, California State University, Long Beach

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ABSTRACT

The eleventh consecutive annual census of the endangered Light-footed Clapper Rail (Rallus longirostris levipes) revealed 189 pairs of Clapper Rails breeding in 9 marshes in Southern California. One hundred and thirty-one pairs, or 69.3% 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 69 Clapper Rails were sighted in November. This is the highest total recorded since organized 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. In addition, there have been increased sightings of Clapper Rails on the adjacent State Ecological Reserve at Bolsa Chica.

Nine trapping sessions at Upper Newport Bay with 7 - 8 drop-door traps and 197 trap-hours, resulted in the capture and unique color-banding of 11 more Clapper Rails. There were 36 resightings of 10 banded rails. The average movement detected of these rails was 72 meters. The largest spread of detection points for any rail was of 210 meters and included an entire family group. This particular family was observed repeatedly over 9 different dates, traversing a total area of 0.53 ha. The longest time span between banding and resighting of any one of the 126 rails banded since March 1981 has been 5 years. The longest banded of the 10 Clapper Rails resighted in 1990 was a rail banded in 1987 or earlier (this could have been any 1 of 6

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different rails, see text) and resighted 400 meters southwest of the banding site.

Nesting behavior studies were conducted at Upper Newport Bay through a video recorder. One nest was monitored over 4 days, primarily spanning the hatching period, for a total of 33 hours. Information was gathered on various behaviors including incubation times, eggshell eating, chick feeding, nest refurbishment, vocalizations, chick vulnerability at pipping, and asynchrony in hatching.

Thirty-six Clapper Rail nests were found on the 45 rafts and 50 staked tumbleweeds made available in the Seal Beach NWR. Twenty of the nests held 23 clutches of eggs and there were at least 7 additional brood nests. Recruitment was very high due to decreased predation. There were at least two additional nests placed in the marsh. One was in a small patch of cordgrass (Spartina foliosa) enhanced with fresh water; the other was on an isolated high marsh berm made suitable during a 1982 restoration project. The 15 nesting rafts deployed at the Kendall-Frost Reserve contained 9 Clapper Rail nests. Seven of these nests held 10 clutches of eggs. Hatching success was 60% - 80%.

Another Clapper Rail was reported killed by a domestic cat (Felis domesticus) and for the first time, a Northern Harrier (Circus cyaneus) was observed on a freshly killed Clapper Rail. This particular harrier had apparently keyed in on Clapper Rails and was trapped and relocated. There was further documentation of the hazards for Clapper Rails of busy roads and red foxes and a pair of nesting rails was observed fending off a gopher snake (Pituophis melanoleucus). Predator monitoring, study, and perhaps control are needed at all of the marshes inhabited by Clapper Rails.

Predators were observed for several hundred hours at Upper Newport Bay. Coyotes (Canis latrans) were of particular interest since their occurrence apparently disallows mesopredator release. Trapping for coyotes was conducted on 57 nights, three were captured, and one adult was radio-collared twice and followed from June into November. 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 to access the bay is being greatly affected by land use changes that could result in the isolation of this important wetland. The food items identified in coyote scats indicated minimal use of foods obtained in the marsh.

No rail remains were among the contents of 15 pellets regurgitated by Great-horned Owls (Bubo virginianus) at Upper Newport Bay. Radio telemetry will be used to further examine the relationship between these owls, the wetlands, and the rails in the near future.

INTRODUCTION

The 1990 investigations included a census of the California population of Light-footed Clapper Rails (Rallus longirostris levipes) in the spring of 1990; 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 nesting structures at the Seal Beach National Wildlife Refuge in Anaheim Bay and monitoring of the nesting rafts 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 entitled The California Population, Miscellaneous Sightings, High Tide Counts, Banding and Movements, Nesting Behavior, Nesting Rafts, Predators, and Miscellaneous Observations which describe the different aspects of the investigations. Each subsection contains methods, results, discussion, and recommendations, where appropriate.

California Population

The eleventh consecutive annual census of the Light-footed Clapper Rail was conducted 5 March - 19 April 1990. Thirty-six coastal wetlands were censused by mapping spontaneous calling or soliciting calls with playbacks of clappering (Zembal and Massey 1985). Behavior and vocalizations indicative of the presence of breeding Clapper Rails were detected in 9 marshes and the state total was up slightly to 189 pairs (Table 1). This is the highest total in the last 6 years and is attributable to increases at the Seal Beach National Wildlife Refuge (NWR) and Upper Newport Bay. There were incidental sightings of Clapper Rails at 5 additional wetlands (see Miscellaneous Sightings below).

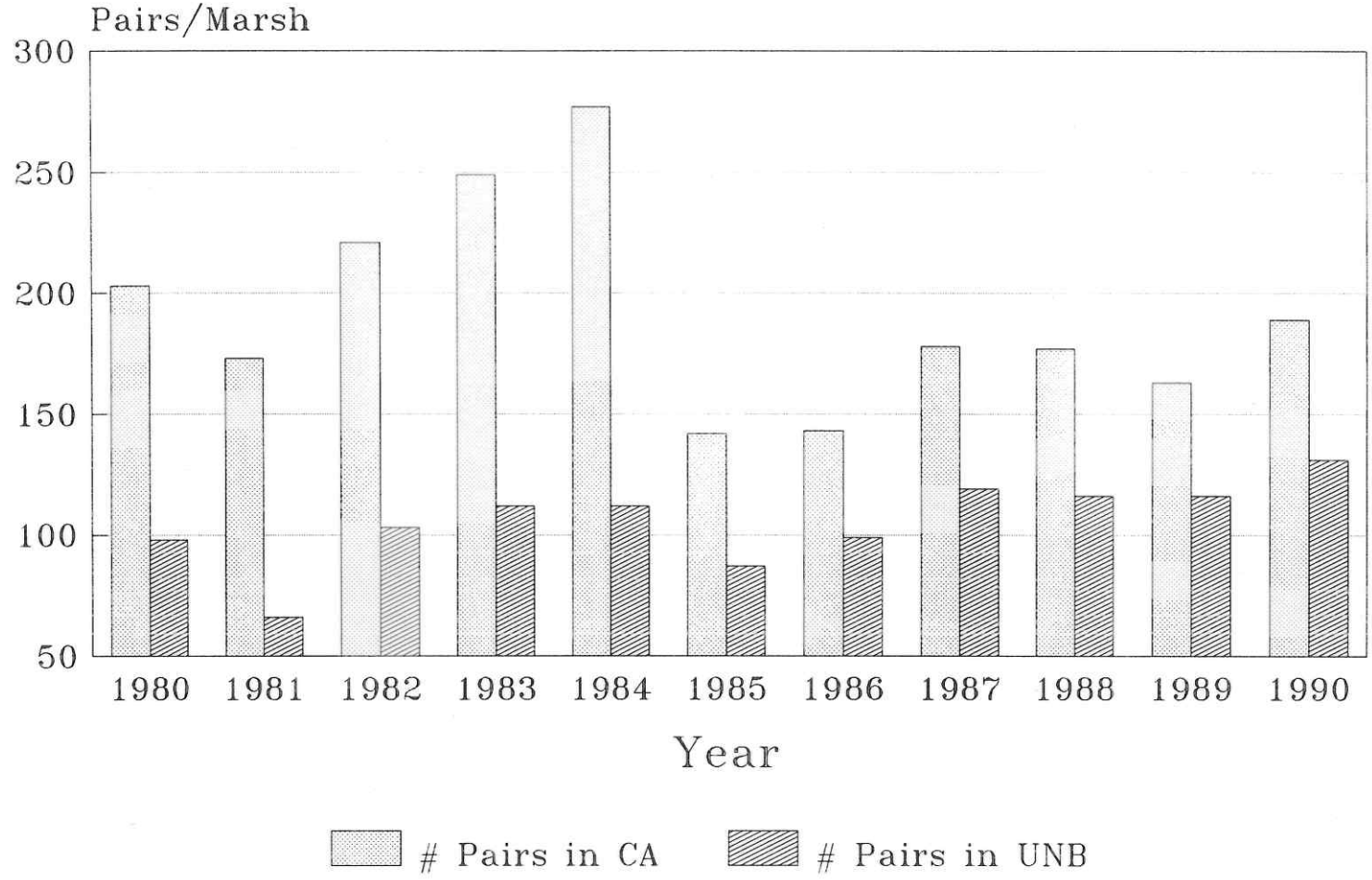
The State Ecological Reserve at Upper Newport Bay continues to support the only subpopulation of Light-footed Clapper Rails in the United States that is large and resilient enough for some reasonable assurance of long-term viability. One hundred and thirty-one pairs were detected in Upper Newport Bay, or 69.3% of the entire state total in 1990. The significant concentration of this endangered species in Upper Newport Bay was apparent throughout the 1980s (Figure 1). The increase of 15 pairs in 1990 was mostly attributable to the development of additional nesting habitat on a new island, located just below the main dike, and now covered in tall, dense cordgrass (Spartina foliosa). Greatly accelerated sedimentation in the Bay, due to human activities in the San Diego Creek watershed, led to accretion, the building of new mudflats, and recent elevations high enough to support the invasion, spread, and final dominance

Table 1. Census of the Light-footed Clapper Rail in California, 1980 - 1990.

Location	Number of Pairs Detected In:										
	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
Santa Barbara County											
Goleta Slough	0	0	-	0	-	-	-	-	0	0	0
Carpinteria Marsh	16	14	20	18	26	7	4	5#	2#	0	0
Ventura County											
Ventura River Mouth	-	-	0	0	-	-	-	-	-	0	0
Santa Clara River Mouth	-	-	0	-	-	-	-	-	-	0	0
Mugu Lagoon	-	0	-	1	3	7	6	7#	7#	5	6#
Los Angeles County											
Whittier Narrows Marsh	-	-	-	*	0	-	-	-	-	0	-
Orange County											
Seal Beach NWR	30	19	28	20	24	11	5	7	14	6#	16
Bolsa Chica	0	0	0	0	-	-	-	*	0	0*	0#
Huntington Beach Strand	-	0	-	-	-	-	0	0	0	0	0
Upper Newport Bay	98	66	103	112	112	87	99	119	116	116	131
San Joaquin Reserve	-	-	5	4	1	2	1	0	0	0	0
Carlson Rd Marsh	-	-	5	4	2	0	0	1#	0	0	0
San Diego County											
San Mateo Creek Mouth	-	-	0	0	-	-	0	-	0	0	0
Las Pulgas Canyon Mouth	-	-	0	0	0	-	-	-	-	0	0
Las Flores Marsh	-	-	0	0	0	-	0	-	0	0	0
French Canyon Mouth	-	-	-	0	0	-	-	-	-	0	0
Cocklebur Canyon Mouth	-	-	1	0	0	-	-	0	0	0	0
Santa Margarita Lagoon	0	0	2	1	2	1	1	1	1	0	0
San Luis Rey River Mouth	-	-	0	0	-	-	0	0	0	0	0#
Guajome Lake Marsh	-	-	0	1	2	0	0	0	0	0	0
Buena Vista Lagoon	0	0	0	*	0	-	-	-	0	0	0a#
Agua Hedionda Lagoon	1	2	1	7	6	1	0	0	0	0	0
Batiquitos Lagoon	0	0	0	0	0	-	-	-	-	0	0#
San Elijo Lagoon	-	5a	4	4	10	1	0	2	5#	7#	5#
San Dieguito Lagoon	-	-	-	-	-	-	-	*	0	0	0
Los Penasquitos Lagoon	-	0	-	0	0	-	0	-	1a#	0	0
Kendall-Frost Reserve	18	16	6	20	24	17	12	6a#	4a#	4#	5#
San Diego Riv F. C. C.	-	3	1	2	2	1	0	0	1a#	0#	2
Paradise Creek Marsh	1	2	3	1	1	0	0	0	0	0	0
Sweetwater Marsh	4	5	7	6	14	3	9	5a#	5	5#	2#
E Street Marsh	3	1	3	3	2	2	2	0a	1#	0	0
F Street Marsh	-	1	1	0	1	0	0	0	0	0	0
J Street Marsh	-	1	0	0	-	-	0	0	0	0	0
Otay River Mouth	3	4	5	3	5	1	1	0	0	0	0
South Bay Marine Reserve	3	3	1	1	2	1	1a	2#	5	5#	5
Dairymart Ponds	-	-	-	-	-	-	0	*	1a	0#	0a#
Tijuana Marsh NWR	26	31	25	41	38	0	2	23a#	14a#	15a#	17a#
Total: pairs	203	173	221	249	277	142	143	178	177	163	189
marshes	11	15	18	18	19	14	12	11	14	8	9

- 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.

Census of the Light-footed Clapper Rail
In California, 1980 - 1990



UNB is Upper Newport Bay

of cordgrass by 1990. There was also a highly successful early nesting season in 1989, followed by a mild winter.

The second largest subpopulation was again documented on the Tijuana National Wildlife Refuge and past problems with a skewed sex ratio there (Zembal 1989) appear to be diminished. Most of the rails calling from 17 different points gave strong indications of being paired and there were only two additional advertising females.

The census on the Seal Beach NWR revealed the largest breeding population there since the crash in 1985 (The 1985 crash was at least partly weather-related). The combination of predator control and the provision of additional nesting habitat and structures led to the survival of 16 breeding pairs up to the spring of 1990. If the program is allowed to continue, the eventual recovery of this important subpopulation is expected; breeding activity was very high for the second consecutive spring (see Nesting below).

The other 6 breeding subpopulations totalled 25 pairs, or only 13.2% of the State total. Although only 5 probable breeding pairs were detected in the Kendall-Frost Reserve, along with some advertising by females, a high level of successful breeding was apparent in 1990 and this subpopulation may also be rebounding (see Nesting Rafts below). The rails at Sweetwater Marsh NWR, on the other hand, continue to decline and will probably be lost completely without immediate study and management activity. With continued neglect, all of the small subpopulations will disappear in the very short term.

Light-footed Clapper Rails declined greatly during the 1980s. Not only is the total population count low, but most of the remaining rails are concentrated in only one marsh (Figure 1). Significant insights have been gained concerning this species needs and 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 wetlands would benefit greatly from management and restoration activities. Most of them are so small, isolated, and otherwise heavily influenced by people that we may never escape the need to actively manage a single one. To minimize irretrievable losses, like the Light-footed Clapper Rail, from these marshes, management must begin very soon to compensate for inadequacy in size, functionality, and overall productivity.

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 Soule et al. (1988) 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. With high predation pressure, many of the marshes inhabited by rails have inadequate nesting cover. Carpinteria Marsh is an extreme example of this. The rails had only high marsh berm sites to nest on that were easily accessible to terrestrial predators.

Light-footed Clapper Rails should be reintroduced to Carpinteria along with predator control, nesting raft deployment, and monitoring. The rails are dealing with heavy contamination in Mugu Lagoon (Ledig 1989) and some of the young produced there should be used, in part, to repopulate Carpinteria while the chemical problems are analyzed.

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 declined 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. This disappearance should not be allowed to continue.

Miscellaneous Sightings

Clapper Rails were observed in 5 additional marshes during 1990 where breeding was not indicated (Table 1). The repeated observations at the Bolsa Chica Ecological Reserve of the California Department of Fish and Game were very encouraging. The recent high reproductive success on the Seal Beach NWR, located just upcoast, is apparently leading to visitation by rails seeking territories. The usual past sighting at Bolsa Chica has been of a single individual at a time, during the post-breeding period in late summer and fall. In 1989, there were several sightings over a prolonged period (E. Burkett, pers. comm.), but in the usual place, just downcoast of the downcoast parking area on the edge of the fresh water reeds. In 1990, there were reports of Clapper Rails nearly each month. On 19 and 27 April 1990, I observed a slightly injured male at the usual spot in the Ecological Reserve and an advertising female in the single good pocket of fresh water reeds located inland on the oil company property. The male had a limp and was lightly oiled over approximately 10% of its body; the oil looked old and weathered. On 25 August 1990, three Clapper Rails were observed interacting aggressively near the downcoast parking area (Esther Burkett, pers. comm.). Consideration should be given to installing a few nesting rafts here prior to the 1991 breeding season.

The sighting on the San Luis Rey River was of a single advertising male on 24 March 1990. I watched the rail for about 10 minutes at the mouth of the river on the north edge near the train trestle. This bird could be a remnant roamer from the flooded Santa Margarita, following prolonged closure of the ocean inlet there. There is little chance of its long-term survival in the marginal habitat currently available along the northern San Diego County coast.

Claude Edwards reported a keking Clapper Rail in Buena Vista Lagoon, on the south side, east of Interstate 5, near the duck feeding area. I could not detect Clapper Rail presence during the breeding season but did hear a lone singing Belding's Savannah Sparrow (Passerculus sandwichensis beldingi) along the upcoast side of the inner lagoon on 24 March 1990.

Doug Willick sighted two Clapper Rails in Batiquitos Lagoon near the intersection of LaCosta Road and El Camino Real on 31 March 1990. I could not elicit a response to taped calls on 3 subsequent visits. The existing habitat at Batiquitos Lagoon could not support a viable subpopulation of breeding Clapper Rails.

Claude Edwards also reported a Clapper Rail at the Dairymart Ponds in 1990. I could not repeat the sighting during two visits with taped calls when breeding rails should have been responsive.

High Tide Counts

Isabelle Kay reports the results of two high tide counts at and near the Kendall-Frost Reserve. On 11 January 1990, 15 Clapper Rails were sighted along with 3 cats (Felis domesticus) and a rat (Rattus sp.). A dead Clapper Rail appeared to have been killed by a cat. A high tide survey was also done on 25 January 1990 along Rose Creek which empties into Mission Bay adjacent to Kendall-Frost and contains some nice cordgrass. One Clapper Rail was observed just south of the Garnet Street Bridge. I suspect that the habitat along the creek is sufficient to support a few rails when winters are mild and runoff is low. The creek will be added to the spring census.

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. This has been necessitated partly by the provision of the nesting rafts and their tumbleweeds. Many of the rails take refuge on the rafts during higher tides and cannot be seen from shore in the dense cover.

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 and have added important information to our understanding of both behavior and population trends. 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. 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). We also got one of our first

Table 2. High tide counts compared to call counts at Anaheim Bay, 1975 - 1990.

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)	
5 Oct 1990	6.4	57	32	178.1%	(1990)	Tide too low
2 Nov 1990	6.8	69	32	215.6%	Highest Count Record	

[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.

concrete warnings of a devastating problem with a nonnative predator when fewer rails were counted than red foxes in November of 1984. The rail breeding population was cut by more than half between the 1984 and 1985 call counts, and again between 1985 and 1986. It began to rise once intensive efforts were implemented to control red foxes and additional nesting sites were provided. The Seal Beach subpopulation had grown significantly by 16 October 1989, as evidenced by the highest count recorded during any high tide count since 1975.

The October 1989 count of 59 rails showed that the rails had finally responded 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. The results were manifest to observers during the Fall count.

The October 1990 count of 57 rails demonstrated that the positive trend had continued. However, the tide during this count was only 6.4 ft and complete coverage of the marsh was not achieved. During an adequately high tide in November, a minimum of 69 Clapper Rails were seen. This is the highest total count since organized counts were begun in 1975, including call counts. It is now very hopeful that if predation pressure is kept low, and breeding sites are provided, that this subpopulation may be well on its way to recovery.

Banding and Movements

There were 9 trapping sessions, 11 September - 22 October 1990, for a total of 197 trap-hours with 7 - 8 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. Eight of the trapping sessions were accomplished during the 3 - 4 hours before dark on evenings with appropriately low tides; the other was a morning sessions beginning near daylight and continuing for 4 hours. Evening sessions accounted for 165 trap-hours or 83.8% of the total. The morning tides were not low enough for good trapping this year.

Eleven unbanded Clapper Rails were captured and uniquely color-banded. This brings the total number of Light-footed Clapper Rails banded since 1981 to 126. A problem was identified with part of the color-banding technique this year and it was modified. We now only band below the tarsus because one of the rails banded as part of another project on the Seal Beach NWR, probably died due to complications caused by a band above the tarsus. The band became lodged on the fleshy part of the leg and caused severe edema and infection. The sick rail was captured from canoe during the October high tide count and succumbed in the midst of medical attention at the San Diego Zoo. I immediately modified the banding to avoid any potential for

repetition of these circumstances at Upper Newport Bay.

Trapping success in 1990 was 1.2 new captures per session, compared to 1.8 in 1989, 0.67 in 1988, 0.75 in 1987, 1.8 in 1986, and 1.16 new captures per session, 1981-1989, for 99 sessions. There were 17.9 trap-hours per new capture in 1990, compared to 35 trap-hours per new capture in 1989, 58.2 in 1988, 42.9 in 1987, 15.4 in 1986, and 33.7 for 1981-1989. No Clapper Rails were captured during four trapping sessions. Three of these were on the small marsh parcel near San Joaquin Hills Road. There are few places that are productive with traps in this parcel and a limited number of rails. However, this is where some of our most revealing observations have occurred due to good visibility. There was also a feral cat working this parcel but I finally trapped and removed him (see Predators). The final nonproductive trapping session was an early morning one during tidal conditions that were too high for good trapping.

There were 36 resightings of 10 banded Clapper Rails in 1990, with attempted observations concentrated on 52 dates from 20 April to 15 December, for 1 - 6 hours per date or approximately 200 hours.

The largest spread between detection points for any of these rails was of 210 meters for an entire family group, the female of which was banded, no. 488. The usual movement detected, particularly on a daily basis, was much shorter, in keeping with our past observations (Zembal et al. 1989). The average maximum spread between detection points of any particular rail was 72m. Rail no. 488's family group spent a lot of time feeding, even on the open mudflat and so they were watched on 9 different dates. Their area of activity was along the north extent of the San Joaquin Hills Road marsh parcel and was very narrow, measuring about 210m X 25m, or 0.53ha. Roughly 30% of this area was mudflat which seasonally would not be much used.

Another of the resighted rails had lost a portion of its color code but was one of 6 possible birds. This rail was banded in mid-July 1987 or earlier. All of the other resighted rails but two were banded in 1989 (6 rails) or 1990 (1 rail). Rail no. 488 was banded in mid-September of 1988 as an adult. There is some possibility that a female banded in 1981, rail no. 403, was resighted but the observation was too quick for confirmation of the color code. The area of this observation is being revisited regularly but positive identification has yet to be made. This would be a longevity record of note. 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).

There were two mated pairs of banded Clapper Rails observed in 1990 and another pair with one bird banded. Both fully banded pairs were on Upper Island. Rails no. 601 and 616 were observed allopreening and copulating. Rail no. 601 is a 443 gm male, no.

616 is a 318 gm female. Rails no. 605 and 608 were also fully banded and paired. Rail no. 605 is probably the female at 347 gm; rail no. 608 weighed 408 gm when captured in 1989. The other banded pair member was rail no. 488, who mated successfully with an unbanded bird in 1990. Rail no. 488 is female and weighed 325 gm when banded in 1988. Observations of the pair that included rail no. 488, and other pairs, led to new insight in our understanding of nesting behavior (see below).

Nesting Behavior

Nest searches were conducted along the east side of Upper Newport Bay to locate nests for monitoring through a video camera. There were searches for nests on 8 dates, 2 May - 10 June 1990, for 2 - 6 hours per search. Searches were conducted carefully by one observer concentrating in likely locations. Of the 21 nesting locations discovered, 15 had hatched already and 5 were poorly located for video taping or were attended by extremely skiddish rails.

The single nest that was monitored was discovered in bulrush (Scirpus robustus) edging the salt marsh about 20 m from Back Bay Drive along the south end of Shellmaker Island. There were 7 eggs in the nest on 2 May and a Clapper Rail incubating 9 eggs on 5 May 1990. The nest was visited every 3 - 5 days and then daily starting on 24 May 1990, when at least one egg was starred. The nest was watched through the video camera on 5 May and 25 through 27 May 1990, for a total of 33 hours. The camera was camouflaged with a drab-colored towel and placed on a tripod in the marsh about 10 m from the nest. One of 4 observers watched the nest constantly on a television screen on the road edge. The camera was turned on regularly to tape significant events under good lighting conditions.

Incubation, brooding, and feeding duties were shared by the adults. Fifteen exchanges of incubation/brooding duty were observed. A continuous stint of incubation duty for one adult varied from 45 to 170 minutes and averaged 90.6 minutes (n = 14).

One egg of the two examined was starred (a pre-condition to pipping) on 24 May and on 25 May 1990 at 0824 hrs, the first egg hatched. Three additional chicks appeared to have hatched that same morning by 1031 hrs. The fifth and final chick to hatch from this clutch probably did not hatch until the following morning. The adults removed from the nest one egg that was nearly intact but presumably addled and the 3 final chicks died after pipping. These 3 eggs were collected, cold and unattended, on 28 May for contaminants analysis. I suspect that these chicks drowned during the extremely high tide series that happened to coincide with their pipping. There was a 7 ft tide on 24 May, which is nearly the highest tide that occurs here in non-storm conditions.

All of the chicks were very active by midday on 26 May, roaming up and down the ramp. By 1345 hrs, the adults were leaving the nest with its three unhatched eggs unattended for

brief periods. By the third day of monitoring, the day after the last viable egg hatched, the young were very active and the adults had been off the nest for about 2 hrs by 1100 hrs.

Egg turning was noted most on the first day of hatching. It subsided greatly on the following day, once the last viable egg had hatched, but was resumed on the third day. When there was an adult on the nest on the day after the last hatching, the dead eggs were again focused upon with interrupted incubation and occasional turning. The incubating adult turned the eggs as many as 4 times in one hour on the first day of hatching, only once per hour on day two, and 8 times, 0816 - 0857 hrs, on day three when only the nonviable eggs remained.

Egg shell eating by both adults was again documented. It appeared that this was the principle way that this pair disposed of egg shells. The only shell observed to be physically removed from the nest was that of a nearly whole, addled egg. The adults also occasionally ate what appeared to be chick fecal sacks.

Other activities of the incubating rails included occasional gleaning and consuming of invertebrates from the nest rim. Nest reinforcement was also regularly observed. There were 15 - 29 deliveries of 1 - 3 stems during three separate hours on day one of hatching and as many as 21 deliveries in one hour on day two. The stems were delivered to the top of the nest ramp, or actually passed to the incubating rail. The incubating rail then accomplished the nest refurbishment.

Feeding of the chicks began in earnest about 2 hrs after the first chick hatched. Many feeding visits by the non-incubating rail could have been accomplished off to the side and out of view. The foraging rail often passed the food to the incubating adult who then massaged or worked the morsel rapidly with its bill and fed the chicks. As time passed, there was more direct feeding of the chicks by the foraging bird. Both rails appeared to regurgitate food as well as feed items directly. Many of the later feedings were accomplished by dropping the food item in front of a chick with the adult's bill raised slightly above the food. There were 25 feeding visits recorded from 1038 to 1800 hrs on the first day of hatching, with a maximum of 6 during any one hour. On the second day of hatching, there were 101 feeding visits recorded, 0700 - 1606 hrs, with a high of 29 visits during a single hour to the 5 chicks. However, the chicks presumably were being fed off the nest as well. During the third and final day of observation, 60 feedings were recorded on the nest, 0700 - 1100 hrs, with a high of 28 feedings during a single hour. Very small crabs and isopods were the only recognized foods.

The return of the non-incubating rail was usually accompanied by a soft, high-pitched "whining", "weeping", or "whirring" call by both adults. The chicks emerged to be fed when this call and/or a low "clucking" or "clicking" sound was given. A guttural or grunted "ooh" call was heard twice. The sound was made softly, three times in succession during each call. The adults body feathers were puffed out during each call and it seemed to be given in response to disturbance. This call

may be the one used to elicit stillness in the chicks.

Addled eggs appear to be recognized and removed by the adults when they are broken during egg turning. Egg turning is done with the bill or feet. Accomplished with the bill, it can be fairly gentle but with the feet it is often vigorous enough that the eggs can be heard clanking loudly together. The three unhatched eggs were decomposing and odoriferous, but still relatively intact. Consequently, the adults split their time between incubation and attending mobile chicks for 1.5 days and may have continued to do so without the slight disturbance of the camera. For example, a brood observed 500 m from this site on 27 May 1990, contained 7 youngsters, one of which was half the size of its presumed siblings and looked several days younger. Unless this was a case of adoption, the adults incubated an egg for several days beyond the hatching date for most of these young. Another pair with at least three chicks of about one week old on 8 June 1990 were still sporadically incubating 2 intact but addled eggs.

Hatching of Light-footed Clapper Rails appeared not to be entirely synchronous in some cases. Additionally, simultaneous hatching may expose some chicks to greater danger in this marsh environment. The eggs are inundated occasionally but will float and the mobile chicks can move to safe ground during high water. The chick in a pipped egg, however, is at risk during high tides when they are high enough to wet the nest. Once an egg is pipped, any delay in hatching due to the mechanisms of synchronous hatching, prolongs this period of extreme vulnerability.

Nesting Structures

There were 45 rafts and an additional 50 staked tumbleweeds provided prior to the 1990 breeding season for potential nesting sites in the Seal Beach NWR. A description of the raft design is available in earlier reports (Zembal and Massey 1988). The rafts were renovated in February 1990, by replacing damaged dowels and the old tumbleweeds. New tumbleweeds were placed with the root stock and thickest branches down to deter perching by larger birds. Tumbleweeds were also staked in the marsh to offer alternative nesting sites. Tumbleweeds that lodge in the marsh accumulate flotsam and cordgrass wrack, particularly near the base. This gives them a certain amount of flotation during high tides. Staking the placed tumbleweeds in an inverted "V" with two hidden stakes, allowed them to float somewhat and kept them in place and relatively stable.

Checking the structures for nests was done about every 3 weeks for a total of 11 visits, 13 March - 10 July 1990. The first Clapper Rail nest on a raft was already present during the first check; the first nest with eggs was discovered on 17 April. By the last examination, 21 rafts and 15 staked tumbleweeds had held nests, of which 20 were egg nests and at least 7 others were used for brooding (Table 3, Figure 2). Hatching success (one or

Table 3. Nesting raft and staked tumbleweed use by Clapper Rails in the Seal Beach NWR, 1990.

		Dates of Detection			
Raft #	Nest	Egg/Incubation	Outcome		Remarks
1	5-11	-		-	
2	4-17	-		-	BN use by 7-10
3	4-17	5-11	H	5-22	
4	6-12	-		-	BN use by 7-10
5	4-17	4-17	H	5-15	
6	4-17	4-17	?	4-17	Renest H by 6-12
7	6-12	6-12	H	7-10	
8	4-17	4-17	H	5-15	
9	4-17	4-17	P	5-15	Probably by bird
10	4-17	4-17	H	5-15	
11	5-15	-		-	BN use by 5-15
12	4-17	-		-	BN use by 7-10
13	6-6	-		-	BN? use by 7-10
14	5-11	-		-	BN use by 6-6
15	7-10	-		-	BN use by 7-10
16	4-17	4-17	H	5-11	
17	6-6	6-6	H	7-10	
18	3-13	6-6	H	7-10	
19	4-17	4-17	H	5-11	
20	4-17	-		-	
21	4-17	6-6	H	7-10	
Tumbleweeds					
A	4-17	5-11	H	6-6	
B	7-10	-		-	BN use by 7-10
C	5-11	-		-	
D	4-17	-		-	
E	4-19	4-19	H?	5-11	
F	3-15	4-19	TW	5-11	Renest H by 6-12
G	5-11	5-11	TW	6-12	
H	4-17	4-17	H	5-15	
I	4-17	4-17	H	4-17	
J	5-15	-		-	
K	3-13	-	TW	6-12	
L	4-17	-		-	
M	4-17	-	TW	6-12	
N	5-15	6-12	P	7-10	Probably by skunk
O	4-17	4-17	H?	5-11	Renest H by 6-12

BN = Brood nest; H = Successful hatching; P = Predated;
TW = Tidal Washed; ? = Uncertain.

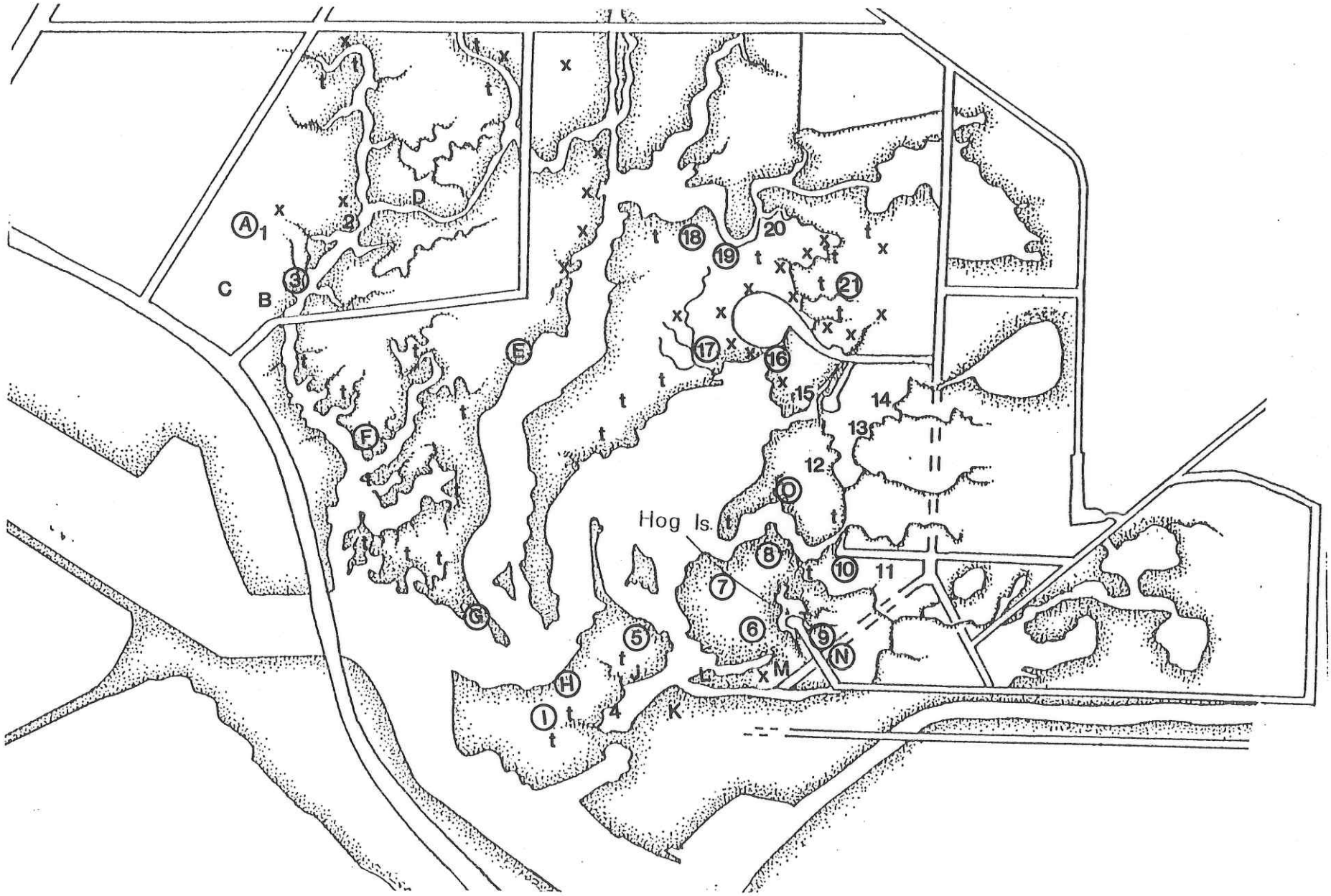


Figure 2. Locations of 45 nesting platforms (X's and numbers) and 50 staked tumbleweeds (t's and capital letters) in the Seal Beach National Wildlife Refuge, 1990. Rafts that are numbered and tumbleweeds that are lettered held Clapper Rail nests; those that are circled held eggs.

more eggs hatched) was 83% on the rafts but only 38% in the staked tumbleweeds, for an average of 65%. There were also 3 renests (second clutches on the same nests), all of which hatched successfully. Counting the renests, overall hatching success was about 70%. Nests in staked tumbleweeds were highly susceptible to tidal wash; only a limited number of the very largest tumbleweeds should be selectively placed as potential nesting sites in the future.

This is the largest number of nests ever found on provided sites (Table 4). 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.

There were at least two additional nesting attempts off the rafts. One was located on a piece of old road that was isolated in the marsh for just such purposes during a 1982 restoration project. The other was in a 5m by 10m patch of tall dense cordgrass directly adjacent to Bolsa Road. This cordgrass patch was invigorated by fresh water from a leaky water pipe along the road edge. The cordgrass in this patch was thick and 1.5 to 2 times as tall as the adjacent grass. The successful use of these nesting sites provides additional support for management strategies suggested repeatedly in the past.

The 15 rafts placed in the Kendall-Frost Reserve in northern Mission Bay, San Diego County, in 1988 were refurbished in March with fresh tumbleweeds and checked in April, June, and July 1990. Nine of the 15 rafts held Clapper Rail nests (Figure 3) and 7 of these held 10 clutches of eggs (Table 5). Nesting success for all 10 clutches was at least 60% and perhaps 80%. Visitation was too infrequent to document nesting outcome with certainty in 4 cases. Small mammal nests were again found on two rafts but they were not rebuilt after I broke them up in March.

All of the factors leading to the decrease in Clapper Rails at the Kendall-Frost Reserve are not clear but the rails may now be staging a comeback. The level of raft use in 1990 gives credence to the theory that lack of suitable nesting sites may be limiting to the rails in the Reserve. The rafts should serve as focal points for monitoring rail use of this marsh, documenting problems, and alleviating them. The observation of a cat on a freshly killed Clapper Rail during a high tide should serve as a warning. Predation is probably a major limiting factor for the rails in this little isolated wetland.

The high level of their successful use in 1989 indicates that the provision of nesting structures in the Seal Beach NWR and Kendall-Frost Reserve should be continued in 1990.

Predators

Observations of predators and sign was a focal activity at Upper Newport Bay and vicinity on 151 dates, 7 March - 13 December 1990, for 1 - 7 hours per visit. This effort was expended mostly on trapping and monitoring coyotes but also

Table 4. Clapper Rail use of nesting structures and hatching success by area in the Seal Beach NWR, 1987 - 1990.

	1990 (*)	1989	1988	1987
No. of nests	36 (15)	17	24	18
No. incubation nests	20 (8)	4	13	12
% of nests with eggs	56 (53)	24	54	67
% hatching success	65 (38)	75	8	75
No. of renests	3 (2)	-	2	4
% hatching success	100 (100)	-	0	75
% incubation nests near:				
Nasa Island	30	100	46	58
% hatching success	83	75	17	71
Hog Island	30	-	31	17
% hatching success	50	-	0	100
Sunset Aquatic Park	15	-	8	17
% hatching success	100	-	0	50
Kitts Highway	10	-	15	8
% hatching success	100	-	0	100
South of Oil Island	15	-	-	-
% hatching success	0	-	-	-

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

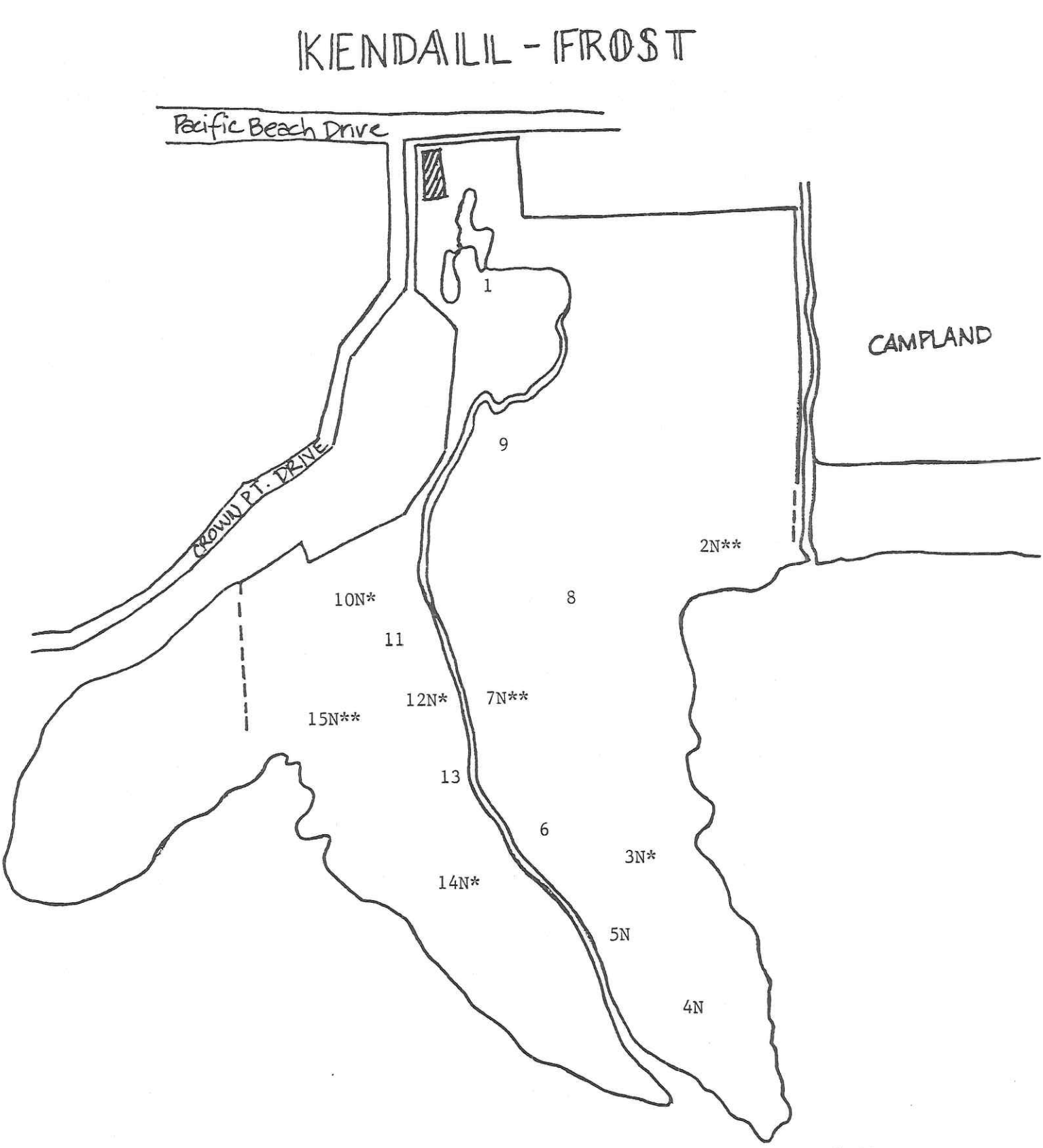


Figure 3. Locations of 15 nesting platforms in the Kendall-Frost Reserve, 1990. Rafts that had Clapper Rail nests are designated with an "N"; each "*" indicated a clutch of eggs.

Table 5. Clapper Rail use of nesting rafts in the Kendall-Frost Reserve, 1990.

	Dates of Detection			
Raft #	Nest	Egg/Incubation	Outcome	Remarks
2	4-28	4-28	H? 6-16	Renest H by 7-27
3	4-28	4-28	H 6-16	
4	4-28	-	-	
5	3-24	-	-	BN use by 6-16
7	4-28	4-28	? 6-16	Renest H by 7-27
10	3-24	3-24	H 4-28	BN use 6-16
12	6-16	6-16		H by 7-27
14	6-16	6-16	H 6-16	BN nearby
15	4-28	4-28	? 6-16	Renest H by 7-27

BN = brood nest; H = successful hatch; Inc = incubation; ? = outcome uncertain.

included seeking information on, and attempted observations of, rail-predator interactions, the occurrence of other predators, and limited additional live trapping.

Predation on Clapper Rails - Another report of a Light-footed Clapper Rail killed by a domestic cat was made (Isabelle Kay, pers. comm.). The incident was observed adjacent to the University of California's Kendall-Frost Reserve in Mission Bay during a high tide count. Three different cats were observed during this count. The vulnerability of Clapper Rails to these introduced predators cannot be overemphasized. When the tide is high, many of the rails may venture to the marsh edge, right where cats would be waiting. The rails have no prolonged history of contact with cats and probably possess no ingrained knowledge of their unique hunting techniques. There were no native predators with similar habits, or in such numbers, to prepare them for evading domestic cats. Cats should be removed from our remaining coastal wetlands by fostering awareness and responsibility in nearby pet owners and trapping, as needed. Increased monitoring and management are particularly needed at Kendall-Frost. There are many dwellings and a campground, including numerous cats, on its very edge. A predator monitoring program, along with predator control as indicated, and a pet-owner awareness campaign are badly needed there.

Direct human-caused death of a Clapper Rail was also reported in 1990 (Karl Polling, pers. comm.), with implications for Bolsa Chica and other wetlands with adjacent major roads. A Clapper Rail struck by a vehicle was found on the beach side of Pacific Coast Highway, just west of the bridge over the ocean inlet channel to the Seal Beach NWR on 12 December 1989. There was a super high tide of 7.2 ft MLLW on the morning this freshly struck rail was found. Rails flushed from the edge of a marsh when the marsh vegetation is underwater (and sometimes even when it is not) usually fly away from the marsh in search of cover. They fly very low and are quite likely to be struck by a vehicle if there is a busy road nearby. This is extremely problematic at the State Ecological Reserve at Bolsa Chica where many Clapper Rail sightings have been right next to Pacific Coast Highway at the parking area. If the placement of rafts on the side of the Reserve furthest from the highway help draw the rails away from the road, this alone would be a benefit great enough to justify the deployment of rafts.

Clapper Rail (Rallus longirostris obsoletus) remains were found associated with red fox dens in San Francisco Bay this year (Kevin Foerester, pers. comm.). The physical evidence indicated that the 3 or 4 Clapper Rails found at den sites were victims of predation by foxes. Clapper Rails are disappearing rapidly from San Francisco Bay; red foxes are probably the major reason.

Personnel of the Tijuana Marsh NWR reported a female Northern Harrier (Circus cyaneus) on freshly killed Clapper Rails this winter. There were also numerous observations of Clapper Rails being attacked during high tides. This particular female

had apparently keyed in on Clapper Rails and was in the process of teaching juveniles such behavior when she was captured and removed to Sacramento Valley by Pete Bloom and the Service. This is recognized as unusual behavior for a Northern Harrier. The routine taking of such large prey would require a big harrier and learned behavior. When these circumstances do arise, it is essential that intervention occur on behalf of the rails.

A gopher snake (Pituophis melanoleucus) attack on a Clapper Rail nest was observed at Upper Newport Bay at the end of a tour I led on 5 May 1990. The nest was located about 20 m from the shoulder of Back Bay Drive on south Shellmaker Island. The substrate between the road and the nest was very mucky. The nest had no canopy (and so was presumed to be close to hatching) and held 5 eggs. The snake could be seen writhing around with the adult Clapper Rails actively attacking it. No calls were heard as the rails moved in quickly with their wings spread, pecking at the snake. The rails occasionally flew up a foot or two with their legs dangling. Several blows landed on the snake's head (eyes?) and it retreated after about 20 minutes of intermittent battle. The snake or one of the defending rails punctured one of the eggs which was taken to the nearest veterinarian. The egg was injected with an anti-bacterial agent and sealed with paraffin but still spoiled. I watched this nest from the road for another hour and the snake returned but again was beaten back. This time the encounter lasted only about one minute. Three days later I observed a 4 ft long gopher snake that had been hit on the road, but was still quite mobile. This was directly adjacent to the nest and may have been the same snake. A photographer I directed to this nest filmed (from the road edge) all 4 of the remaining eggs hatching 8 days after the snake attack.

Coyotes - 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. It is now understood that the regular presence of coyotes keeps explosions in the number of smaller predators from occurring, protecting other wildlife, particularly birds, from the heavy predation that follows coyote extirpation. These smaller predators, feral cats and foxes for example, prey heavily on birds and bird eggs and have caused local bird extinctions where coyotes have been precluded. 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. 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 endangered species and other significant resources is at risk.

Examples of predation problems involving endangered species were observed recently at the Seal Beach NWR and Mugu Lagoon. With a recent lack of coyote presence at Seal Beach, the introduced red fox population exploded locally and nearly extirpated the Light-footed Clapper Rail (USFWS and USN 1990). With control of the red fox and provision of nesting habitat, the rails are now increasing there. In the marsh at Mugu Lagoon, a local explosion of red foxes was manifest for a few years, concurrent with the disappearance of coyotes. More recently, the coyote population has resurged and red fox sightings are now rare. Along with the natural check on red foxes brought about by coyotes at Mugu Lagoon came the manifestation of a small subpopulation of Light-footed Clapper Rails beginning in 1983.

Coyote Movements - This was the initial year of heavy study emphasis on the coyotes of Upper Newport Bay and environs. The purposes of this project are to examine the movements of the local coyotes around Upper Newport Bay, obtain a better understanding of the characteristics of the corridors they will use, and study their behavior.

There were 5 sessions of trapping for coyotes with padded leghold traps, 10 April - 27 October 1990. There was a total of 682 trap-nights accrued, with 4 - 35 traps set for 57 nights. The traps were checked daily in the early morning and late afternoon. The purpose of trapping was to radio-collar 1 - 3 coyotes to follow their movements and behavior. The collars are a special design by Spence Porter of Communications Specialists in Orange County. The design was modified after use of the initial two collars. Collar weight is about 160 gm with an expected battery life of about 34 months.

Our first, second, and last trapping sessions were adjacent to Upper Newport Bay, in the field above and to the south of San Joaquin Hills Road at Back Bay Drive. The others were up to about 1.5 miles (3 km) from the bay along San Diego Creek.

The second and fifth sessions of trapping were successful, although many predators of several species were captured during each session including bobcat (Lynx rufus), raccoon (Procyon lotor), striped skunk (Mephitis mephitis), and opossum (Didelphis virginiana). All but two skunks were released unharmed. Two coyote pups, both male and weighing 8 and 9 pounds, were captured near their den in session 2. Twelve days later on 12 June 1990, a 30 pound male was captured and radio-collared.

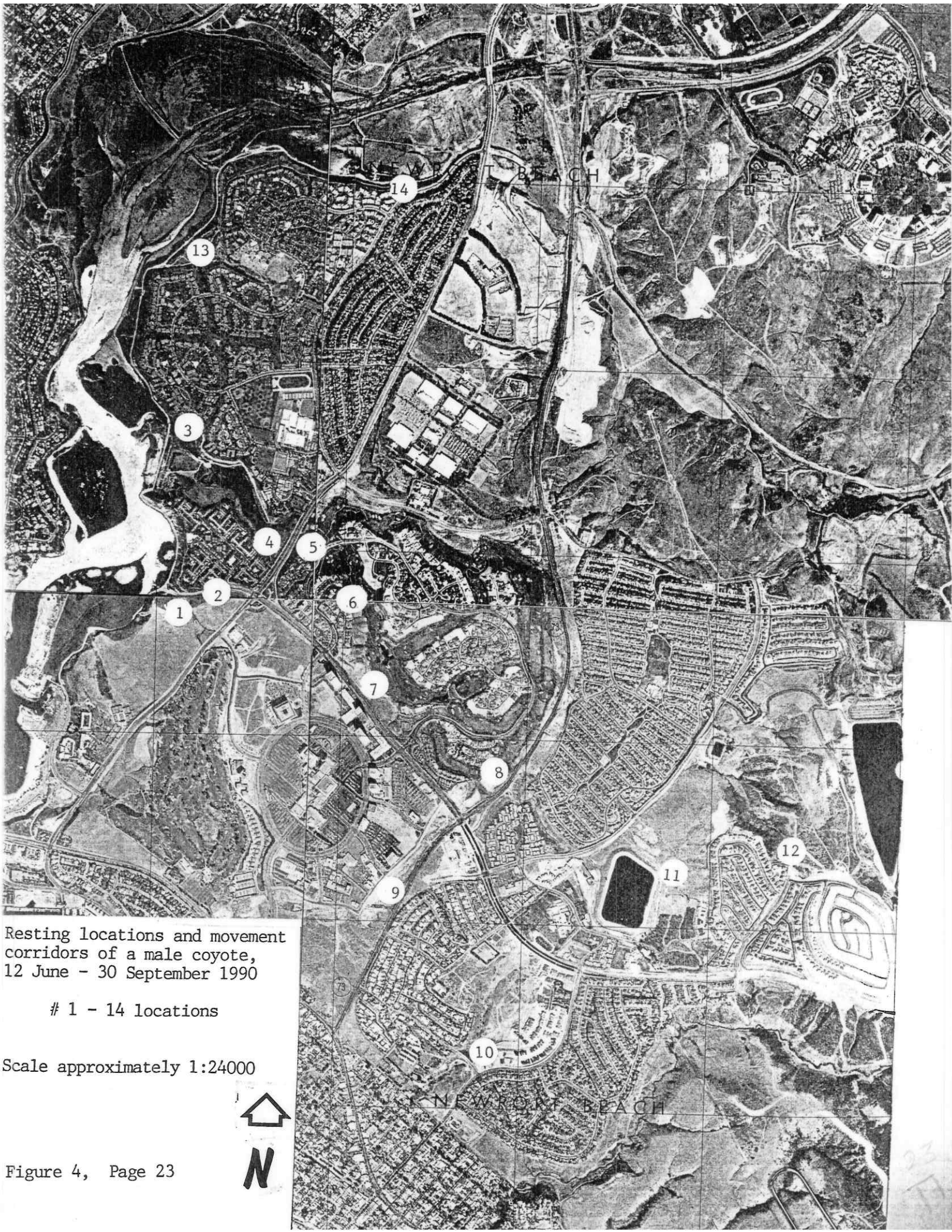
I attempted to document this animal's location once or more

on 99 days, 12 June - 16 November 1990. His first transmitter failed after a small crack allowed moisture to corrode the battery. His signal was lost from 2 October - 26 October, when he was recaptured and refitted with a second transmitter. His signal disappeared again in late November. It was later revealed that the animal had been shot by County Animal Control Officers. Acting on the advice of others who have collared coyotes, I fitted this animal loosely enough to allow it to slip out of the collar if it got stuck on something. This turned out to be bad advice for this animal since it managed to get its leg through the collar and hobble itself, cutting off circulation and causing associated problems. More than 3 months of data were gathered prior to such a poor finale.

The vicinities of the coyote's locations have been numbered 1 - 14 on Figure 4; the foraging habitat and cover available between and beyond these locations is apparent on the orthophoto. The following is an account of his locations: June 12 (locations 1 and 2), 13 (3), 14 (5), 15 (6), 16 (3), 17 (3-4), 18 (7), 19 (4), 20 (4), 22 (2-4), 23 (7), 24 (8), 27 (12), 29 (12); July 1 (12), 4 (12), 5 (9), 6 (4), 10 (5), 12 (2), 15 (1), 16 (12), 18 (12), 19 (11), 22 (2), 24 (3), 26 (3), 28 (5-6), 30 (12); August 3 (2), 4 (3), 6 (12), 13 (3), 19 (10), 20 (14), 21 (?), 22 (3-4), 23 (5), 25 (6), 26 (3), 27 (12), 30 (13), 31 (?); September 1 (?), 2 (12), 3 (13), 6 (12), 8 (14), 9 (5-6), 11 (6), 13 (2), 14 (5), 15 (5), 16 (10), 18 (not UNB), 19 (5), 20 (not UNB), 21 (7), 22 (5), 23 (5), 24 (8), 27 (3-4), 28 (13), 29 (5), 30 (14); October 2 - 20 (?), 26 (recaptured at 1), 28 (9); November 1 (5), 2 (4), 3 (3-4), 4 (14), 5 (3), 6 (6), 8 (7-8), 9 (6), 10 - 12 (3-4, probably in trouble from here on).

This male coyote's locations spanned all of Upper Newport Bay but only along the Back Bay Drive side and movement out of the Bay area was apparently confined to the Big Canyon corridor, at least as evidenced by his daytime locations. His outermost locations along Back Bay Drive are approximately 2.4 miles apart and his travels from the mouth of Big Canyon at Upper Newport Bay to Spyglass Hill is a straight line distance of about 2.5 miles. Twenty-five, or 40.3%, of 62 daylight locations through September were at Upper Newport Bay, including the half mile of Big Canyon bayward of Jamboree Road. Fourteen of these locations, or 22.6% of the fixes and 56% of the locations in Upper Newport Bay, were in the 45 acres of riparian woodland and coastal scrub at the mouth of Big Canyon, bayward of Jamboree Road. Nineteen locations, or about 31% of the total, were along the Big Canyon Country Club between Jamboree Road and MacArthur Boulevard. His documented movements in October and November were similar.

Coyote movement along Upper Newport Bay is not restricted by physical barriers, other than water and mud, but is probably restricted by people use. There are approximately 1,000 acres of estuary and associated uplands at Upper Newport Bay and there is likely to be some use of the entire area by coyotes. However, coyote sign is very sparse on the west and north sides, where people and dogs roam too freely and there is little cover. The



Resting locations and movement corridors of a male coyote, 12 June - 30 September 1990

1 - 14 locations

Scale approximately 1:24000

Figure 4, Page 23

collared coyote was never documented on the west side. If this animal regularly traveled through the marsh to the west or north side of the bay, I would have expected at least one daytime fix there. Further examination of this and the use of the wetlands for foraging will be pursued during the continuation of these studies.

The male coyote was trapped above San Joaquin Hills Road and Backbay Drive (location 1), adjacent to a denning site that was active this year. The two captured pups may have been fathered by the collared coyote. After release, he travelled over the edge of the hill and spent the day on the north-facing slope above San Joaquin Hills Road, amongst native coastal sage scrub mixed with myoporum (Myoporum laetum) and pampasgrass (Cortaderia atacamensis). There is running water and a narrow wetland strip on this slope as well. His daytime resting spots were always in thick cover and usually in draw-bottom wetlands with abundant willows (Salix spp.), or on slopes covered in coastal sage scrub with intermixed elements of chaparral and varying occurrences of introduced plants.

Access along Big Canyon to the vicinity of Spyglass Hill was facilitated by 12 - 15 ft diameter culverts under the two major road crossings. The local coyotes have also been seen crossing major roads and another male was struck by a car on Jamboree Road near Big Canyon in mid-June. Coyotes have been observed crossing this road to access the Newport Beach Country Club and were also observed hunting the open edge of MacArthur Boulevard near locations 8 and 9.

A major factor in the local occurrence of coyotes other than adequate cover and food is undoubtedly disturbance, particularly at resting and denning areas. The Big Canyon Country Club has adequate resources for a few coyotes and relatively little use by people. Local coyotes are much less likely to be disturbed by people, particularly their dogs, adjacent to these exclusive residential developments, than at the bay where people and pet use is significantly heavier.

Coyotes are known to require large expanses of habitat. What is still available along Upper Newport Bay and Big Canyon is not enough to sustain coyote presence at the bay. Restoration of habitat in the uplands along the bay is planned for future action and will be important, particularly if coupled with better control of use by people and their dogs. However, maintenance of critical destination sites at the bay, particularly the slopes and field bordered by John Wayne Gulch, Backbay Drive, Jamboree Road, and San Joaquin Hills Road is critical. Equally as important is assuring that viable linkages remain open along Big Canyon from the bay to the larger remaining open spaces to the east. There is no habitat link there now but access is not extremely difficult to Buck Gully, near Pelican Hill, from Big Canyon Reservoir and Pacific View Memorial Park Cemetery; this currently involves a few hundred meter jaunt along the eastern terminus of San Joaquin Hills Road. This is a bottleneck in the Big Canyon corridor that will soon worsen with construction

proceeding at this site. The potential for an alternative outlet of the Big Canyon corridor still exists under MacArthur Boulevard and Ford Road, just south of their juncture, to access the open space remaining around Bonita Reservoir and Coyote Canyon.

Coyote Foods - Coyote foods were not a focus of this initial phase of work. However, about 100 scats and kill remains were examined adjacent to Upper Newport Bay for bird parts. Only two bird kills, both Mallards (Anas platyrhynchos), were found. Forty-six scats were dissected more carefully and the principle contents are probably reflective of the local coyote's general food choices. The most abundant food remains evident in the scats were the seeds from myoporum fruits (present in 45.6% of the samples). Myoporum seeds were evident in scat throughout the period they were available, from June through September. The most abundant prey included rabbits (19.6%), ground squirrels (Spermophilous beecheyi, 6.5%), small mammals (4.3%), opossums (4.3%), and domestic cat (4.3%). The remaining items identified from the 46 samples were the Mallards (4.3%), peach pits (4.3%), gopher snake (2.2%), crayfish (2.2%), and prickly pear fruits (Opuntia sp., 2.2%). There was little evidence in this small sample of much prey taken from the wetlands. The Mallards are partly domesticated and beg for food. They often sleep the night on the road edge, directly below the field where the two kills were found. The crayfish are from the fresh water channel on the slope or a ditch that runs along the edge of the road. This small sample was probably left by several coyotes and demonstrates a heavy predilection for upland prey. There was abundant sign of coyotes on the marsh edge and along the dirt road on Shellmaker Island. Some of the scat examined was probably theirs. However, pursuing observations of one of these individuals at night during future work should enhance our understanding of the role that the marsh inhabitants play in coyote food habits.

Additional Predator Trapping - A gray feral cat was observed on the marsh edge in June at Upper Newport Bay. It was in a section of marsh that is relatively accessible along high ground and the cat was actually seen in the marsh. The next day, one of the Mallards near there had a badly bloodied head and another had been killed and partly eaten. Of greater concern were the inhabitants, including young, of the three Clapper Rail territories along this section of marsh. Live traps baited with sardines were deployed for two nights. The cat was captured and taken to the local Animal Shelter.

Raptors - Great Horned Owls (Bubo virginianus), Barn Owls (Tyto alba), and a pair of American Kestrels (Falco sparverius) raised young in the cavities on the cliff face west of Shellmaker Island. About 15 Great Horned Owl pellets were examined. The only bird remains found were smaller than a Clapper Rail. A pair of Black-shouldered Kites (Elanus caeruleus) raised two young in a nest in the willows, directly across from the tern nesting

island at Upper Newport Bay.

Telemetry units have been procured for placement on two Great Horned Owls in 1991. These owls have been implicated heavily in predation on Clapper Rails (Zembal and Massey 1986). The use of the marsh for foraging and the relative vulnerability of the rails will be examined in next year's work.

Miscellaneous Observations

The mysterious, cup-shaped, white stones that were sorted from the contents of pellets regurgitated by Light-footed Clapper Rails at Upper Newport Bay (Zembal and Fancher 1988) have been positively identified (Darlene McGriff, pers. comm.). They are gastroliths from the cardiac stomachs of crayfish. The stones are formed when calcium carbonate is resorbed from the old exoskeleton just before molting. The calcium carbonate is stored in the gastroliths for redeposition in the new exoskeleton. The stones can be as large as about 1 cm across, depending upon the stage in the molt cycle.

Publications and Presentations

The information generated by these investigations 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 review for publication in American Birds. An article on the ecology and plight of the Light-footed Clapper Rail was submitted for review to all of Southern California's coastal Audubon Society chapters. A book for young people on Southern California's wetlands and their endangered species is in preparation.

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: The American Ornithologist's Union; The Department's docents for Upper Newport Bay; Sea and Sage Chapter of the Audubon Society; the Friends of Upper Newport Bay; an Ecology class at Golden West College; University of California at Irvine; Saddleback College; California State University at Fullerton; Upper Newport Bay Conservancy; and Meadowpark Elementary School.

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