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Wildlife Management Division

LIGHT-FOOTED CLAPPER RAIL CENSUS AND STUDY, 1991

by

Richard Zembal

Nongame Bird and Mammal Section Report, 92-08

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ABSTRACT

The twelfth consecutive annual census of the endangered Light-footed Clapper Rail (Rallus longirostris levipes) was conducted by call counts throughout the bird's range in California, 3 March - 18 April 1991. There were 235 pairs of Clapper Rails exhibiting breeding behavior in 11 marshes, a 24% increase over 1990. One hundred and twenty-eight pairs, or 54.5% of the state total, were detected at Upper Newport Bay. There were dramatic increases in the Tijuana Marsh NWR, Seal Beach NWR, and some recovery at Kendall-Frost Reserve. Most of the subpopulations are small and face serious problems that should be dealt with through increased management and the provision of additional habitat or they will be lost. There is little security in the continued existence of the Light-footed Clapper Rail without several large viable population centers.

High tide counts were continued on the Seal Beach National Wildlife Refuge and 98 Clapper Rails were sighted in November. This is the highest count by sightings ever reported for one marsh in a single day. 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. With proper management, rails could establish on the adjacent State Ecological Reserve at Bolsa Chica.

Nine trapping sessions at Upper Newport Bay with 8 - 16 drop-door traps and 374 trap-hours, resulted in the capture and unique color-banding of 9 more Clapper Rails and 4 recaptures. There were 37 resightings of 11 banded rails. The average movement detected of these rails was 56 meters. The largest spread of detection points for any rail was of 200 meters. A family group, including a banded female observed in this same territory last year was sighted repeatedly; their movements spanned an area of slightly more than 0.5 ha. The longest time span between banding and

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resighting of any one of the 135 rails banded since March 1981 has been 5 years. The longest banded of the 11 Clapper Rails resighted in 1991 was a female banded in 1988. Histories of some of the resighted rails are related, banding success over the 10 yrs of banding is compared, and additional observations on chick feeding are made.

Thirty-seven Clapper Rail nests were found on the 60 rafts made available in the Seal Beach NWR. Twenty-five of the nests held 30 clutches of eggs and there were at least 4 additional brood nests. Recruitment was very high due to decreased predation. Hatching success was 68% for initial attempts and 90% for renests. There were at least 4 additional incubation nests in the marsh, all placed in large tumbleweeds that were staked in place. The 15 nesting rafts deployed at the Kendall-Frost Reserve contained 9 Clapper Rail nests. Eight of these nests held 12 clutches of eggs. Hatching success was 88% - 100%.

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 52 nights, three were captured, and one adult was radio-collared and followed for only one week when his signal was lost. His movements demonstrated some remaining viability to the San Diego Creek corridor into Upper Newport Bay. Coyote activity was still 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. Destination sites that afford good food, cover, water, denning sites, and low disturbance levels must be maintained at the bay. Lagomorphs dominated the food items identified in 32 coyote scats.

Raptor watches at Upper Newport Bay were begun to quantify bird of prey activity and interactions with marsh birds. Activities and abundance of 8 species were noted during the first session.

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LIGHT-FOOTED CLAPPER RAIL CENSUS AND STUDY, 1991

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INTRODUCTION

The 1991 investigations included a census of the California population of Light-footed Clapper Rails (Rallus longirostris levipes) in the spring of 1991; winter high tide counts on the Seal Beach National Wildlife Refuge, Orange County, CA; trapping, banding, and observations at Upper Newport Bay, Orange County, including monitoring of predators; the placement and monitoring of nesting structures in the Seal Beach National Wildlife Refuge, the University of California's Kendall-Frost Reserve in San Diego County, and initial trials in the Department of Fish and Game's Bolsa Chica Ecological Reserve in Orange 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, Movements, and Observations; Nesting Rafts; Predators; and Miscellaneous Observations which describe the different aspects of this year's study. Each subsection contains methods, results, discussion, and recommendations, where appropriate.

California Population

The twelfth consecutive annual census of the Light-footed Clapper Rail in California was conducted 3 March - 18 April 1991. Thirty-seven 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 11 marshes and the state total increased by 24.3% over 1990, to 235 pairs (Table 1). This is the highest total in the last 7 years and the third largest number of pairs detected in 12 years. Increases at the Seal Beach National Wildlife Refuge (NWR) and Tijuana Marsh were largely responsible for the high state total, although the numbers were up at Kendall-Frost Reserve and the San Diego River Flood Control Channel as well. Additionally, there were incidental sightings of Clapper Rails in 4 other wetlands (see Miscellaneous Sightings below).

The State Ecological Reserve at Upper Newport Bay continues to support more than half of the Light-footed Clapper Rails in the United States. One hundred and twenty-eight pairs were detected in Upper Newport Bay, or 54.5% of the state total in 1991. The concentration of this endangered species in Upper Newport Bay has been apparent since state-wide censusing began in 1980 (Figure 1). The 1990 and 1991 totals for the Newport subpopulation were comparable. 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). Similarly, slight increases in numbers prior to 1990 appear to be

Table 1. Census of the Light-footed Clapper Rail in California, 1980-1991.

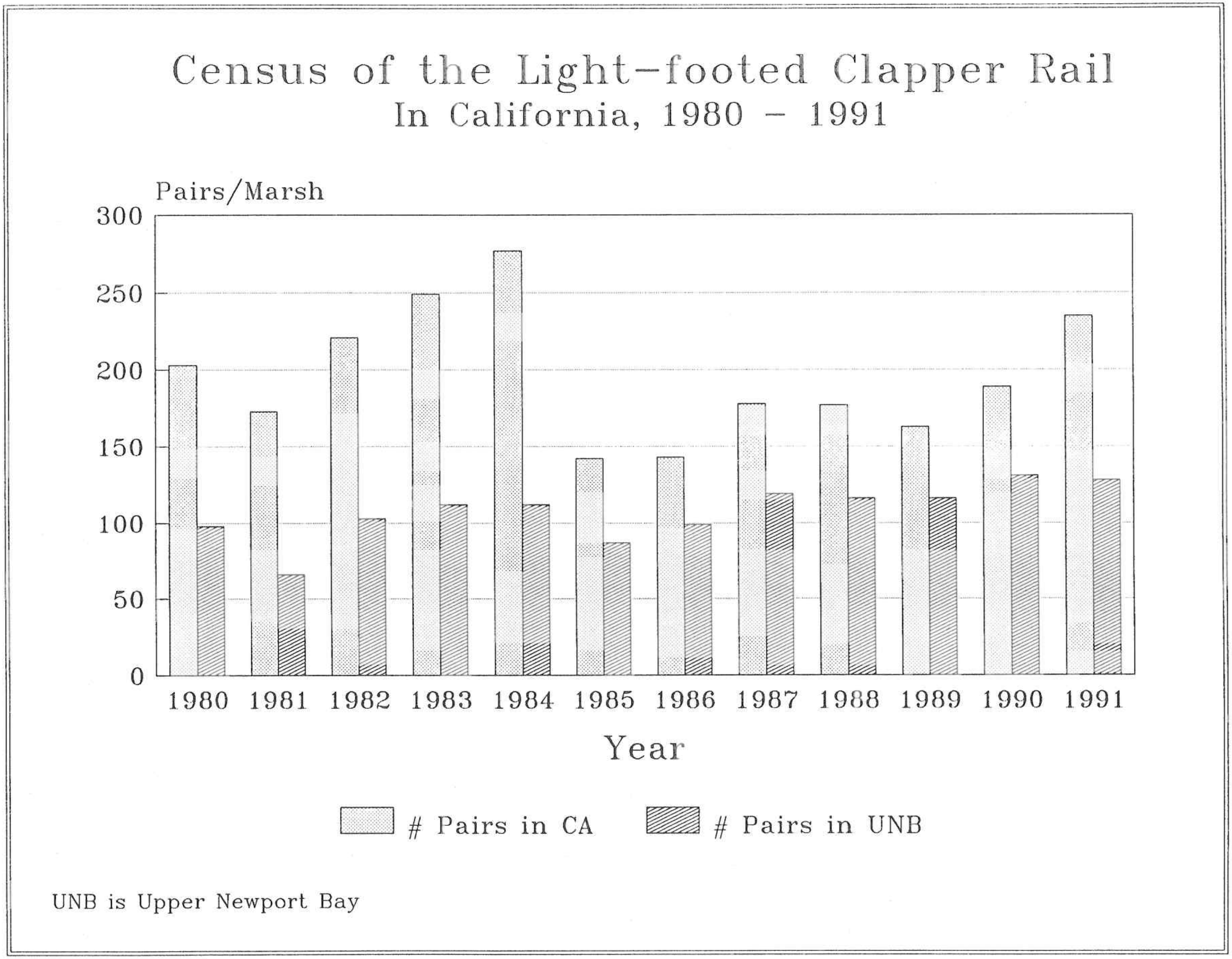
Location	Number of Pairs Detected In:									
	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989
Santa Barbara County										
Goleta Slough	0	0	-	0	-	-	-	-	0	0
Carpinteria Marsh	16	14	20	18	26	7	4	5#	2#	0
Ventura County										
Ventura River Mouth	-	-	0	0	-	-	-	-	-	0
Santa Clara River Mouth	-	-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

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

Table 1. Census of the Light-footed Clapper Rail in California, 1980 - 1991 (Continued).

Location	Number of Pairs Detected In: 1990	1991
Santa Barbara County		
Goleta Slough	0	0
Carpinteria Marsh	0	0
Ventura County		
Ventura River Mouth	0	0
Santa Clara River Mouth	0	0
Mugu Lagoon	6#	5#
Los Angeles County		
Whittier Narrows Marsh	-	-
Orange County		
Seal Beach NWR	16	28
Bolsa Chica	0#	0*
Huntington Beach Strand	0	0
Upper Newport Bay	131	128
San Joaquin Reserve	0	0
Carlson Rd Marsh	0	0
San Diego County		
San Mateo Creek Mouth	0	0
Las Flores Marsh	0	0
Cocklebur Canyon Mouth	0	0
Santa Margarita Lagoon	0	0
San Luis Rey River Mouth	0#	0
Guajome Lake Marsh	0	0
Buena Vista Lagoon	0a#	2#
Agua Hedionda Lagoon	0	0
Batiquitos Lagoon	0#	0#
San Elijo Lagoon	5#	5
San Dieguito Lagoon	0	0
Los Penasquitos Lagoon	0	0#
Kendall-Frost Reserve	5#	9
San Diego Riv F. C. C.	2	5
Paradise Creek Marsh	0	0
Sweetwater Marsh	2#	4a
E Street Marsh	0	1a
F Street Marsh	0	0
J Street Marsh	0	0
Otay River Mouth	0	0
South Bay Marine Reserve	5	2
Dairymart Ponds	0a#	0#?
Tijuana Marsh NWR	17a#	41a
Total: pairs	189	230
marshes	9	11

- 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 - 1991
Pairs/Marsh
300
250
200
150
100
50
0
1980
1981
1982
1983
1984
1985
1986
1987
1988
1989
1990
1991
Year
Pairs in CA
Pairs in UNB
UNB is Upper Newport Bay

the result of a gradual expansion of the habitat base and its subsequent occupation by rails. 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 eventually the dominance of cordgrass. The two most dramatic declines, in 1981 and 1985, followed stormy winters and late springs which damaged nesting habitat and affected food supplies.

The second largest subpopulation in the state has come through a significant recovery on the Tijuana Marsh National Wildlife Refuge. The 1991 total was 14.6% higher than the previous record high of 41 pairs detected in 1983. This subpopulation almost disappeared completely in 1985, following the effects of river mouth closure and the prolonged loss of tidal influence. A few pairs managed to subsist and reoccupy the wetland once tidal access was restored. However, a badly skewed sex ratio was in evidence up until the 1990 breeding season when excessive female advertising for mates abruptly ceased.

The census on the Seal Beach NWR revealed the second largest number of breeding pairs recorded there since state-wide surveys were begun in 1980. The combination of predator control and the provision of additional nesting habitat and structures is working. If the program is continued, the full recovery of this important subpopulation should be achieved.

The other 8 breeding subpopulations totalled 32 pairs, or only 13.6% of the State total. However, Clapper Rails appear to be staging a comeback on the Kendall-Frost Reserve and definitive breeding behavior has been documented for the first time in Buena Vista Lagoon. This is of special interest since the habitat in this lagoon is comprised almost totally of fresh water marsh. Seven of the marshes with breeding Clapper Rails in 1991 held 5 or fewer pairs. Without habitat restoration and effective management, these small subpopulations are expected to quickly disappear. Tall, thick cordgrass has expanded in the San Diego River Flood Control Channel and there was evidence of 5 solid pairs breeding there in 1991. This is the highest total detected so far in this wetland. The habitat there has fluctuated widely in the past in response to dramatic fluctuations in the hydrology. This renders unreasonable any expectations that are very high for this little subpopulation.

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 a small percentage of the potential habitat (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 coastal wetlands is in dire need of management and restoration activities. Most of them are relatively small, isolated, and otherwise heavily influenced by people. However, if such management does not begin soon, most of today's inhabited marshes wont have any Light-footed Clapper Rails left to manage. Good management could compensate for many of the inadequacies in habitat parcel size and functionality, and greatly reduce other human-induced problems if it begins soon.

Management that emphasizes Light-footed Clapper Rails should begin with a focus on predation, providing nesting habitat, monitoring reproductive success, and identifying and alleviating chemical contaminant problems. Following the findings of Soule et al. (1987) and recent experiences at Seal Beach (U.S. Fish and Wildlife Service and U.S. Navy 1990), Point Mugu, and other marshes, it is now understood that certain predators can be devastating to the rails. Introduced species, in particular, must be monitored and controlled. Potential predator problems should be suspected and investigated in the small marshes where Clapper Rails are declining or have disappeared. With high predation pressure, many of the marshes inhabited by rails have inadequate nesting cover. Carpinteria Marsh is an extreme example of this. The only nesting sites available to the rails were on high marsh berms that were too easily accessible to terrestrial predators and the entire subpopulation was wiped out.

Clapper Rails should be reintroduced to Carpinteria along with predator control, nesting raft deployment, and monitoring. The rails are subject to heavy contaminant problems in Mugu Lagoon (Ledig 1989) that should be better specified and alleviated. Full tidal regimes should be restored to several San Diego County marshes and management should be implemented at every marsh inhabited by Clapper Rails.

All but one of the remaining subpopulations of Light-footed Clapper Rails are too small or troubled to survive without 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 more than a decade, has been partly a process of watching many small subpopulations barely hang on or disappear entirely. Carpinteria Marsh was home to 26 pairs of Clapper Rails in 1984 and today there is none. This kind of calamity can be avoided and should be.

Miscellaneous Sightings

Clapper Rails were observed in 4 additional wetlands during 1991 but their behavior indicated nonbreeding status (Table 1). The repeated 1990 observations at the Bolsa Chica Ecological Reserve of the California Department of Fish and Game had been encouraging. The recent high reproductive success on the adjacent Seal Beach NWR was the suspected source of as many as 3 Clapper Rails observed simultaneously at Bolsa. However, the detectable presence of Clapper Rails ended abruptly in 1991 coincidental with the appearance and consistent presence of a few red foxes. Playing a tape of clappering on 2 April 1991, rather than eliciting a response from a rail, produced the approach of a curious red fox. The fox trotted toward the tape, then stopped and scanned the area within about 20 m of the observer. The behavior was repeated when I played the tape again about 15 minutes later. Predation pressure is a grave threat to Clapper Rails at Bolsa. The uncontrolled, prolonged presence of introduced predators is compounded by the physical hazard and obstructive noise of vehicles on Pacific Coast Highway which spans the entire length of the wetland.

One or two rails were heard advertising for mates in Batiquitos Lagoon. Tape playing produced the typical response of unmated males in the marsh about 250 m from the intersection of LaCosta Road and El Camino Real on 6 April 1991. Restoration of habitat and a full tidal prism, along with management, could produce a viable breeding subpopulation at this marsh if recent past, and apparently recurring, local movements of rails continue.

The detection at Los Penasquitos Lagoon was of a single, advertising male. The rail responded to a playback of clappering on 18 April 1991, just oceanward of the abrupt bend on Carmel Valley Road, several hundred meters west of its intersection with Sorrento Valley Road. Of all the wetlands of San Diego County, Los Penasquitos posses some of the highest restoration potential for Clapper Rails. This marsh was once home to a large subpopulation and could be again with the restoration of constant tidal influence.

The detection noted for the Dairymart Ponds was actually on the upcoast side of the Tijuana River, in fresh water reeds, just inland of Hollister Road. The response to the tape was of single clappering. The lack of any subsequent calling could indicate the presence of a mated pair. However, instead of subsequent advertising, an unmated rail could have investigated by approaching the tape recorder undetected. In any case, there is not much of a chance for sustained breeding presence in this particular location. There is regular disturbance by people, ready access to predators, and the habitat patch is quite small.

High Tide Counts

There have been counts of Clapper Rails during extreme high tides on the Seal Beach National Wildlife Refuge each winter since 1975 (Table 2). The counts used to involve stationing enough observers around the perimeter of the flooded marsh to sight all of the rails forced from cover by an extremely high tide. More recently, remnant cover is checked mostly from the water by canoe. This has been necessitated partly by the provision of the nesting rafts and their tumbleweeds. Many of the rails take refuge on the rafts during higher tides and cannot be seen from shore in the dense cover. Fourteen observers in 7 canoes can adequately cover the 911 acre refuge in about 2 hrs.

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. In fact, at

Table 2. High tide and call counts of Clapper Rails on the Seal Beach National Wildlife Refuge, 1975 - 1991.

Date	Tidal Height	Clapper Rails Counted	Call Count [1]	% Diff.	Notes [2]	
2 Dec 1975	7.0	22	-	-		
31 Dec 1975	6.7	12	-	-		
21 Nov 1976	7.1	24	-	-		
20 Dec 1976	7.1	35	-	-		
21 Dec 1976	7.0	34	-	-		
10 Dec 1977	7.1	16	-	-		
11 Dec 1977	7.1	40	-	-		
18 Jun 1978	6.8	16	42	38.0%	(1979)	+6 youngsters
30 Nov 1978	6.7	38	42	90.5%		
1 Dec 1978	6.7	32	42	76.2%		
3 Sep 1979	6.4	20	42	47.6%		Tide too low
3 Nov 1979	6.6	56	60	93.3%	(1980)	
2 Dec 1979	6.7	32	60	53.3%		
3 Dec 1979	6.7	44	60	73.3%		
21 Nov 1980	6.9	55	38	144.7%	(1981)	
29 Jun 1981	7.0	34	38	89.5%		
12 Nov 1981	6.9	43	56	76.8%	(1982)	
29 Dec 1982	7.0	23	40	57.5%	(1983)	
18 Jan 1984	6.9	23	48	47.9%	(1984)	
21 Nov 1984	6.7	5	22	22.7%	(1985)	+ 7 red foxes
13 Nov 1985	7.1	2	10	20.0%	(1986)	+ 2 red foxes
12 Dec 1985	7.2	2	10	20.0%		+ 2 red foxes
30 Dec 1986	7.2	7	14	50.0%	(1987)	
28 Jan 1987	7.0	7	14	50.0%		
8 Aug 1987	7.3	8	14	57.1%		Tide too late
22 Nov 1987	6.7	12	28	42.9%	(1988)	
21 Dec 1987	7.0	8	28	28.6%		+ 2 red foxes
16 Feb 1988	6.8	10	28	35.7%		
22 Nov 1988	6.9	6	28	21.4%		
16 Oct 1989	6.9	59	12	491.7%	(1989)	Record Count
5 Oct 1990	6.4	57	32	178.1%	(1990)	Tide too low
2 Nov 1990	6.8	69	32	215.6%		Record Count
22 Nov 1991	6.9	98	56	175.0%	(1991)	Record High

[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.

Upper Newport Bay, many of the rails use habitat available on the edge of the flooded marsh, an option unavailable to the rails on the refuge; the edge habitat used includes perches in or under upland shrubs. Even on the refuge, the counts are inconsistent, but the positive data are useful and have added important information to our understanding of both behavior and population trends. We documented winter losses during the rough winter of 1980-1981, for example, with the early 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 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 suggested that the rails had responded to reduced predation pressure. The removal of red foxes from the Naval Station had finally thinned the number of these problematic predators to a level that allowed the rails high reproductive potential to be realized. The results were manifest to observers during the post-breeding count. Increases to record-breaking heights continued and the November 1991 count of a minimum of 98 Clapper Rails is unprecedented. This is currently the highest total count ever recorded on the refuge, including call counts, and the highest number of Light-footed Clapper Rails ever sighted in one marsh in a day and documented in the literature. It is now realistic to expect the recovery of this subpopulation, if predation pressure is kept low and breeding sites continue to be provided. A breeding population well in excess of 100 pairs should be achievable, based on the available habitat and historic occupation.

Banding, Movements, and Observations

There were 9 trapping sessions, 28 August - 24 October 1991, for a total of 374 trap-hours with 8 - 16 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 3 hours. Evening sessions accounted for 334 trap-hours or 89.3% of the total effort. Again this year, the morning tides were not low enough for good trapping.

Nine unbanded Clapper Rails were captured and uniquely color-banded. This brings the total number of Light-footed Clapper Rails banded since 1981 to 135. There were also 4 recaptures of previously banded rails and one Sora was trapped. Table 3 displays the annual efforts and results for the 10 years I have trapped and banded rails.

Trapping success for new captures was relatively poor this year, although counting recaptures, it was actually above the 10-year average. It is tempting to interpret our uniform trapping results of one or two new captures per session and high recaptures as a potential index of relatively low fledging success for the 1991 breeding season. For example, attempted observations of rails in the late summer and fall at Upper Newport Bay resulted in many more fruitless hours than usual. Of approximately 200 hours of observation accumulated on 68 different dates, I had approximately 435 sightings/hearings of Clapper Rails and spent roughly 6.4% of the time in visual contact with rails. This is about 60% of the usual return per effort in an average year and only 25% of an exceptional year. However, a reliable index of fledging success should be based on a vocal census done once or twice per week throughout the fledging and dispersal period. Although there are many uncontrollable factors involved in the observability of Clapper Rails, a weekly assessment of broods on the mudflats with uniform observational techniques used during the fledging and dispersal period would be interesting to compare to vocalizations. In contrast, exceptional trapping seasons in the past have been attributable to one or two sessions with unusually high success of 3 - 7 unbanded rails captured. I believe that such high success is achieved when traps happen to be set through two or more territories with large broods of first-year rails just gaining independence.

There were 37 sightings of 11 banded Clapper Rails at Upper Newport Bay during 1991 including our 4 recaptures. The largest distance between a banding site and resighting, or among resighting locations was about 200m. The average distance moved among all sightings was 56m. Such typically short movements is in keeping with past observations (Zembal et al. 1989).

Rail no. 488 and her family group were observed several times in the same territory as in 1990 on the north side of the San Joaquin Hills Road Marsh parcel. Her mate is still unbanded and they successfully raised at least two young this year. Locations of this group spanned an area in slight excess of 0.5 ha. Rail no. 488 was first color-banded in September 1988 and was last seen on 27 July 1991 in her regular haunts but with part of her color code missing. She is the longest banded of the rails resighted or recaptured in 1991.

Rail no. 488 is not the only banded rail to lose part of a color code. Rail no. 496 was banded on 20 August 1989 and recaptured 125m from the banding site on 24 October 1991. He was

Table 3. Clapper Rail trapping effort and success with drop-door traps, 1981 - 1991.

Year	1981	1982	1983	1984	1986	1987
#Trap Sessions	30	14	13	5	10	8
Date Span	3/8-12/19	2/14-10/16	1/10-10/21	9/10-10/25	5/27-11/5	7/14-10/23
#Traps Used	8	8-14	10-14	14	12-14	13
Total Trap-hrs	937	541	532	182	278	258
#New Captures	20	18	16	9	18	6
New Caps/Session	0.67	1.3	1.2	1.8	1.8	0.75
Trap-hrs/New Cap	47	30	33	20	15	43
#Recaptures	2	1	2	1	7	1
#Recaptured	2	1	2	1	6	1
#No-Cap Sessions	22	5	4	1	0	4
%Sessions w cap	27	64	69	80	100	50

Year	1988	1989	1990	1991	Cumulative
#Trap Sessions	9	9	9	9	116
Date Span	9/17-10/30	8/18-10/13	9/11-10/22	8/28-10/24	-
#Traps Used	12-16	14-18	7-8	8-16	8-16
Total Trap-hrs	349	560	197	374	4,208
#New Captures	6	16a	11	9	129a
New Caps/Session	0.67	1.8	1.2	1.0	1.1
Trap-hrs/New Cap	58	35	18	42	33
#Recaptures	0	0	0	4	18
#Recaptured	0	0	0	4	17
#No Cap Sessions	4	1	4	1	46
%Sessions w cap	56	89	56	89	60

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

missing the plastic spiral bands that are used as the annual code and an integral part of individual recognition. These spiral bands are fused with acetone but some of them are lost anyway and with them, the ability to recognize the individual.

The other three recaptured rails were 25m, 25m, and 0m from their original capture locations. Two were originally banded in 1990, the other in 1989. Two are probably males.

Rail nos. 601 and 616 were both banded in the fall of 1989 and resighted this year near the territory they shared as a pair in 1990. However, rail no. 601, the male, was very bold and frequented Back Bay Drive. He was last seen on 1 May 1991 ambling along the edge of the road and not moving off until a noisy jogger was within one pace of him. He may have been in the process of selecting a site or building a nest, perhaps even in the narrow band of fresh water reeds lining a small ditch on the side of the road away from the marsh. This pair built a nest right next to the road in reeds next to a small pond in 1990. The female was seen in their old haunts with chicks in July. It is uncertain whether or not her bold mate of last year survives.

One of the most frequently sighted rails in 1991 was no. 938, whose family activities occurred on mid-Shellmaker Island within easy view of the road. Her unbanded mate was larger and bolder and with her, was first observed feeding chicks on 5 June 1991 about 50m from where she was banded on 22 October 1990. She was last observed still partly feeding a first year rail on 27 July 1991, 53 days later. This observation increases the estimated time to independence for first year rails to 8 weeks or more. The young rail was poorly seen during the July observation, so I am uncertain how close to fledging the bird was. Better observations were made on 1 July 1991 when three leggy youngsters of about 4 weeks of age and little more than half the size of the adults were fed by both parents on the edge of the cover. In 23 minutes rail no. 938 fed a chick 15 different times and herself once; the mate fed himself 7 times and chicks 9 times. Small crabs and fish were discernable amongst the food. These chicks were already feeding on their own to some extent; several chases of flying insects were observed. However, most food was still being provided by the adults as we watched. Some morsels were taken directly from the adult's bill; others were captured by the adult and dropped in front of a chick that scurried over. Most such dropped presentations were accomplished in front of the chick and with the adult's bill within millimeters of the food morsel, as if pointing with the bill. When an item was missed by the hungry chick, it was picked up by the adult, rethrown and pointed at until the chick finally found it. One important advantage to the chick with this mode of presentation is the eventual recognition of the silhouettes of various food organisms against the substrate.

Nesting Rafts

There were 60 rafts deployed for potential rail nesting sites prior to the 1991 nesting season in the Seal Beach NWR. A description of the raft design is available in earlier reports (Zembal and Massey 1988). The rafts were renovated mostly in February 1991, by replacing damaged dowels and the old tumbleweeds. New tumbleweeds were placed with the root stock and thickest branches down to deter perching by large birds. About 20 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 these tumbleweeds in an inverted "V" with two hidden stakes, allowed them to float somewhat and still kept them relatively stable in the marsh.

Some of the rafts have been in the marsh at Seal Beach since 1987 and began to sink in 1991. Several sit in small pools all day long, even when the tide is out, and have become water-logged. Consequently, floats have been added to the rafts on the undersides. Either PVC pipe in 3 ft lengths, plugged at the ends, or 4 in. pool floats were added to each of 40 rafts, so far. Two pieces of pipe were fastened with nylon cord between the outer and next inner planks or 4 pool floats were attached, one in each corner. Fastening the floats on the underside keeps the rafts off the saturated substrate during low tide and should help dry the wood out. The PVC used was 3 in. diameter schedule 40, which is of a quality suitable for drinking water.

The rafts were checked every 2 - 3 weeks from March through July 1991. The first Clapper Rail nest was found on a raft on 22 March 1991 and the first clutch of eggs was present, along with 8 others, by 17 April 1991. By the end of the season, the rafts had held 37 nests, at least 30 clutches of eggs, and 4 additional brood nests (Table 4). Hatching success (one or more eggs hatched) was 68% for initial clutches and 90% for renests (second clutches in the same nests), similar to years past (Table 5). Most hatching failures this year were attributable to predation by small birds and may have been facilitated by unusual spring rains and poor raft flotation. Although nesting success was lower near Hog Island than in other locations, there was a lot of nesting activity. All 7 of the rafts available there were used (Figure 2); more should be added prior to next season.

There were at least 4 additional nesting attempts made off of the rafts in large tumbleweeds. Such nests are extremely susceptible to tidal wash and at least one of the 4 found in 1991 was destroyed at high tide.

The rail's use of the rafts reached another peak in 1991 (Table 5). 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.

The 15 rafts placed in the Kendall-Frost Reserve in northern Mission Bay, San Diego County, in 1988 were refurbished in early March with fresh tumbleweeds and checked monthly through July 1991. Nine of the 15 rafts held Clapper Rail nests (Figure 3)

Table 4. Nesting raft use by Clapper Rails in the Seal Beach NWR, 1991.

	Dates of Detection			
Raft #	Nest	Egg/Incubation	Outcome	Remarks
1	4-17	4-17	P 4-17	Bird P?
3	3-22	-	-	BN by 6-4
6	4-17	4-17	P 5-7	Bird P?
12	7-5	-	-	
13	4-17	-	-	
14	4-17	4-30 thru 6-14	? & H	BN by 7-29
16	4-17	4-17	H 5-21	
17	3-24	6-6	H 6-24	BN 7-29
18	6-14	6-14	H? 6-24	
20	5-7	5-22	H 6-14	
21	5-22	5-22	H 6-14	2 last eggs P
22	5-7	5-7	H 5-22	BN by 6-4
23	5-7	5-7	V 5-7	
24	5-7	-	-	BN by 5-22
25	5-7	-	-	
26	3-5	5-7	P 5-7	Mammal P
27	7-8	-	-	BN by 7-8
28	5-7	5-7 & 6-4	H 5-22 & 7-8	6 dead chicks
29	5-7	5-7 & 7-8	P 5-7 & H? 7-26	Mammal P
30	5-7	-	-	
31	4-17	-	-	BN by 6-6
32	4-17	5-21	H 6-6	BN by 6-6
33	5-7	5-7	H 6-6	
35	4-17	5-14	H 6-24	BN by 7-8
36	4-17	4-17	P 4-17	Bird P?
37	4-17	4-17	P? 5-7	Some H?
40	4-17	4-17	H 5-14	
41	5-28	5-28	H 7-8	
42	4-17	-	-	
44	4-4	4-17 & 6-6	H 5-7 & 7-8	BN by 7-8
45	4-17	4-30	H 5-22	BN by 5-22
47	4-4	4-17 & 6-6	H 5-14 & 7-8	BN by 7-8
48	4-4	4-17	H 5-21	
50	4-17	4-30	H 6-6	
54	4-17	-	-	
55	6-6	-	-	
60	4-17	-	-	

BN = Brood nest; H = Successful hatching; P = Predated; ? = Uncertain; V = Vandalized.

Table 5. Clapper Rail use of nesting structures and hatching success by area in the Seal Beach NWR, 1987 - 1991.

	1991	1990 (*)	1989	1988	1987
No. of nests	37	36 (15)	17	24	18
Spring call count	28	16	6	14	7
No. incubation nests	25	20 (8)	4	13	12
% of nests with eggs	68	56 (53)	24	54	67
% hatching success**	68	65 (38)	75	8	75
No. of renests***	5	3 (2)	-	2	4
% hatching success	90	100 (100)	-	0	75
% incubation nests near:					
Nasa Island	47	30	100	46	58
% hatching success	86	83	75	17	71
Hog Island	17	30	-	31	17
% hatching success	50	50	-	0	100
Sunset Aquatic Park	13	15	-	8	17
% hatching success	75	100	-	0	50
Kitts Highway	7	10	-	15	8
% hatching success	0	100	-	0	100
South of Oil Island	17	15	-	-	-
% hatching success	80	0	-	-	-

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

**Hatching success is based upon post-hatching sign which is sometimes indeterminate (H?, Table 3); rather than 1 with certain hatching, 0.5 is used in the calculations for nests that probably hatched.

***A renest, as treated here, is a second clutch in the same nest.

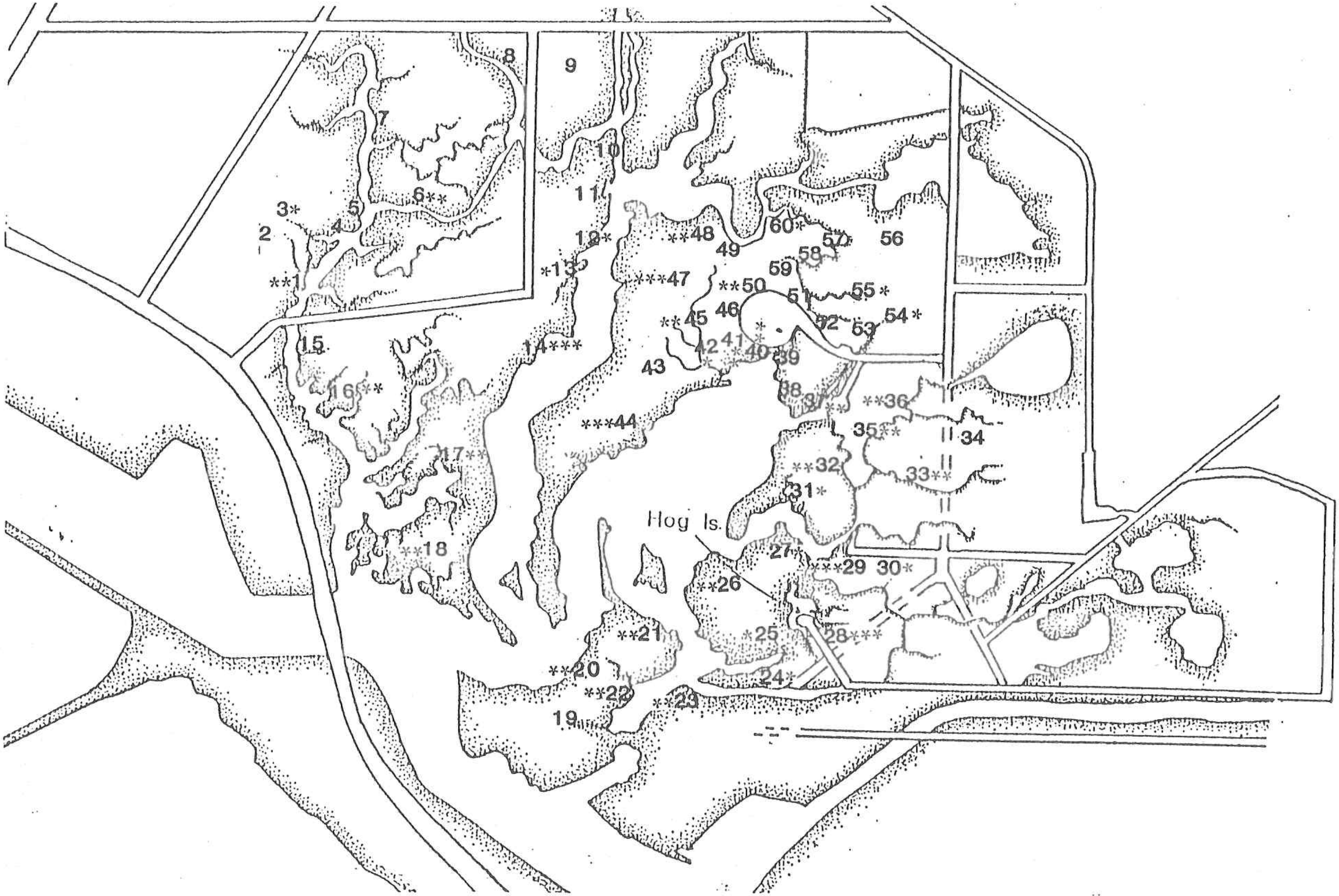


Figure 2. Locations of 60 nesting rafts in the Seal Beach National Wildlife Refuge, 1991.
One * indicates a nest, two *s indicate a clutch of eggs, and three *s indicate two clutches.

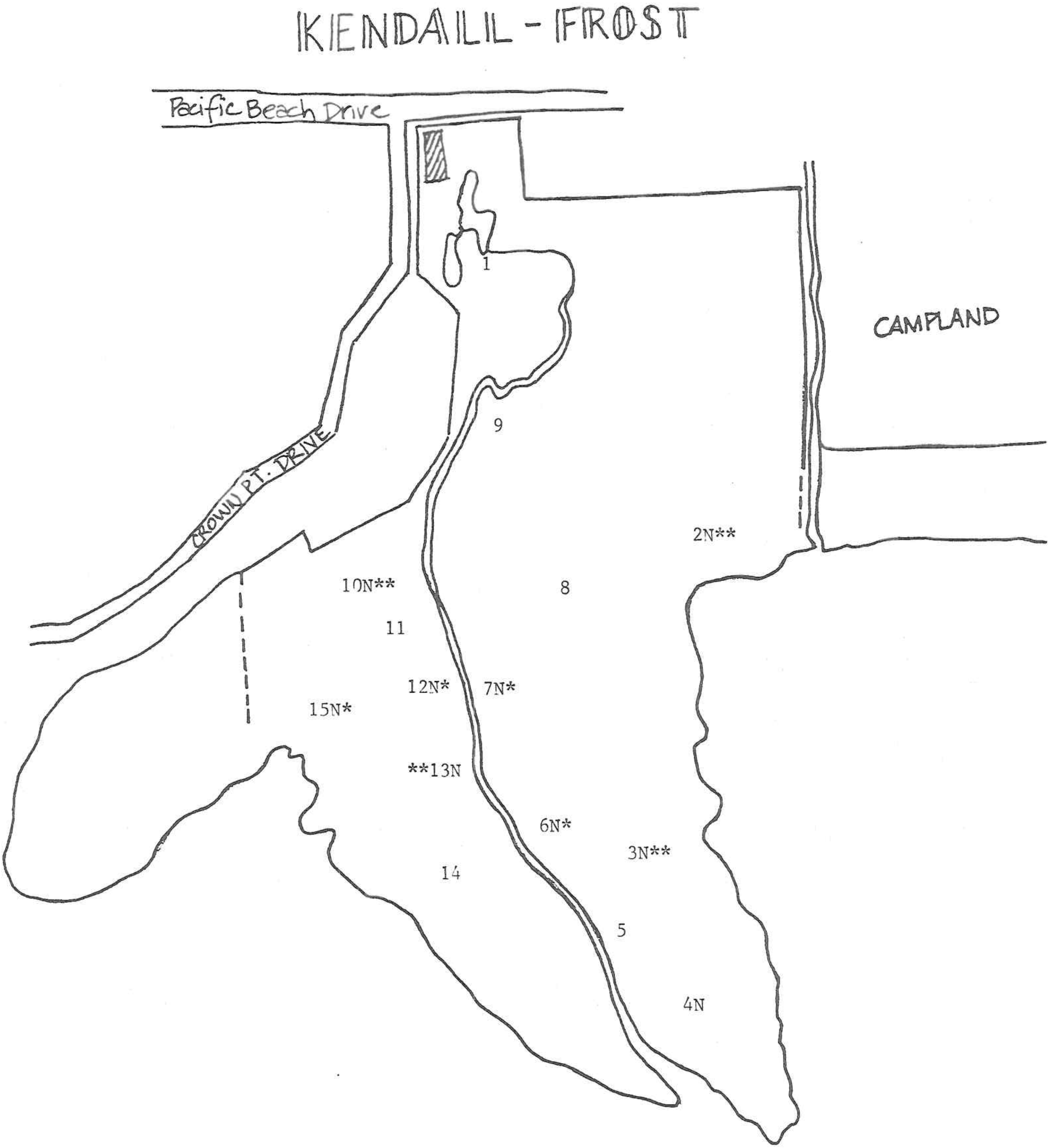


Figure 3. Locations of 15 nesting platforms in the Kendall-Frost Reserve, 1991. Rafts that held Clapper Rail nests are marked with an "N"; each "*" indicates a clutch of eggs.

and 8 of these held 12 clutches of eggs (Table 6). Hatching success for all 12 clutches was 92%. A small mammal dome was found on only one raft at the end of the season in 1991.

All of the factors leading to the decrease in Clapper Rails at the Kendall-Frost Reserve are not clear but the rails now appear to be staging a comeback. The level of recent raft use gives credence to the theory that lack of suitable nesting sites may be limiting to the rails in the Reserve (Table 7). The rafts should serve as focal points for monitoring rail use of this marsh, documenting problems, and alleviating them. Past observations 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. There were cat tracks all over the salt pan in 1991 and at least three different cats were seen. Predator monitoring and control should be ongoing by now at the reserve but is not.

Four nesting rafts were also deployed in the State Ecological Reserve at Bolsa Chica in 1991. However, after the prolonged presence of red foxes in the reserve and the discouraging observations during the vocal survey (see Miscellaneous Sightings), hope was abandoned for any rail use of the rafts in 1991. Rafts alone are not an answer to the rail's problems and the timing and level of predator control are critical.

The high level of their successful use indicates that the provision of nesting structures in the Seal Beach NWR and Kendall-Frost Reserve should be continued. Recommended modifications should include the addition of floats, at least 1 in. finished diameter dowels for stability, placing tumbleweeds with the root stock down, and carving a point on the dowels to deter perching rather than using nix-a-lite. Additional rafts should be added to both the reserve and the refuge.

Predators

Observations of predators was a focal activity at Upper Newport Bay and vicinity on 81 dates, 15 January - 30 November 1991, for 1 - 8 hours per visit. The effort was expended mostly on trapping and monitoring coyotes and observations of raptors. Two student projects are being supported. One is on coyote food habits and is ongoing and summarized below; the other is on owl foods and is in the initial stages.

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

Table 6. Clapper Rail use of nesting rafts in the Kendall-Frost Reserve, 1991.

	Dates of Detection			
Raft #	Nest	Egg/Incubation	Outcome	Remarks
2	4-18	4-18 & 7-10	H 5-28 & 7-30	4-18 Inc N in T 10 m NW
3	4-18	4-18 & 6-11	? & H 7-10	Inc 5-28, BN use 7-30
4	4-18	-	-	-
6	4-18	4-18	F	Tidal Wash
7	4-18	4-18	H 5-28	BN Use 6-11
10	4-18	4-18 & 5-28	H 5-28 & 7-10	
11	-	-	-	BN 3m away 6-11
12	3-9	5-28	H 7-10	BN by 7-10
13	4-18	4-18 & 7-10	H 5-28 & 7-30	N with dome 7-30
14	-	-	-	BN 15m off by 6-11 Nearby TN H 7-10
15	3-9	4-18	H 5-28	BN by 5-28

BN = brood nest; H = successful hatch; Inc = incubation; ? = outcome uncertain; T = tumbleweed; TN = tumbleweed nest; F = failure.

Table 7. Clapper Rail use of nesting platforms and hatching success in the Kendall-Frost Reserve, 1989 - 1991.

Year	1991	1990	1989
No. of nests	9	9	5?
Spring call count	9	5	4
No. incubation nests	8	7	3
% of nests with eggs	89	78	60
% hatching success*	88	85	83
No. of renests**	4	3	?
% hatching success	100	100	-

*Hatching success is based upon post-hatching sign which is sometimes indeterminate (Hatch ?, Table 4); rather than a value of 1 as with certain hatching, 0.5 is used in the calculations for nests that probably hatched.

**A renest, as treated here, is a second clutch in the same nest.

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. Just as important is informing the public of the need for coyotes to keep uninformed sentiment or less important priorities from perpetuating poor coyote control practices. 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. 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 in the process of a dramatic resurgence. 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, coyotes are again frequenting Mugu 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 Monitoring and Movements - At least two seperate sightings of coyotes occurred on the Seal Beach NWS in 1991. Potential corridors of travel for coyotes to and from the station await investigation and perhaps restoration. A wildlife corridor connecting Bolsa Chica and the refuge would be very helpful, as well. Facilitating the planning for these corridors and educating the public about the need is to be part of the endangered species management scheme for the refuge (USFWS and USN 1990) and should also be a priority of the Department's.

I attempted to continue study of movements by coyotes into Upper Newport Bay by trapping and radio-collaring two or three animals. With the expertise gained by personnel of the Department and Service sponsored red fox project, we attempted to capture a coyote in a box trap. Approximately 80 trap-night were accumulated with 2 box traps baited with road-kills or hot dogs, 2 February - 7 June 1991. A board was used to extend the treadle toward the door slightly and to hold earth for a more natural feel. The traps were baited and ran for several days with the doors wired open before they were activated. Coyotes actually entered the traps and nearly cleaned them of food on several occasions but never when they were armed. Leghold traps were also used, 4 June - 24 July 1991, for a total of about 466 trap-nights with 4 - 20 traps. The box traps were deployed on the south end of the upper bay near John Wayne Gulch and in Big Canyon; the legholds were set at the far upper end of the bay, just below East Bluff Drive near Jamboree Road and in an open field adjacent to the University of California's San Joaquin Marsh Reserve. This later site is accessed by coyotes along San Diego Creek and is located about 3.25 km (2 mi) ENE of the upper end of the bay.

Just as in 1990, the first coyotes captured were puppies. Both were females and of 12 and 13 lbs, too small to collar. They were caught adjacent to the U.C. Reserve and released quickly. A 30 lb male was captured at Upper Newport Bay on 24 July 1991, collared and released.

This male was only followed for a week before his signal was lost and has not yet been regained. Immediately upon release, he ran along the edge of the bay to San Diego Creek, under a large bridge at Jamboree Road with heavy work traffic clanking overhead, to the Bonita Creek confluence with San Diego Creek. I found him there, 0.5 km (0.3 mi) from the bay, about 2 hrs after collaring. He was followed daily thereafter. By 26 July 1991, he had moved into a section of Mason Regional Park with some coastal sage scrub on the slopes and cover on the bottom lands including a ribbon of riparian woodland (which is where he had taken cover). He was about 3 km (1.9 mi) from the bay by then but by nightfall had doubled that distance, moving mostly to the east and directly away from the bay. Just before sundown, I got too close and he moved away along the riparian belt under Ridgeline Road which had medium use by autos at the time. The culvert he used was dirt and mud bottomed with an opening about 2.5 m (8 ft) high and 5m (16 ft) wide. The road is only 4-laned so there is good visibility through the culvert and the willow canopy abuts the road on both sides providing complete cover. However, it is still of interest that the animal would use the culvert with road noise so prominent overhead.

By the time his signal had disappeared, the coyote had gotten to a location along Shady Canyon, about 9 km (5.6 mi) east and slightly south of the trap site at the bay. From here, there is open space all the way to the coast to the south, Laguna Canyon to the east, and Quail Hills to the north. Eleven subsequent combings of these areas for a signal were unsuccessful. The major achievement through monitoring this animal was the confirmation that there is viable access to the bay along the San Diego Creek corridor. However, the cover available through the first km (0.6 mi) of the Mason Park link in the travel route the collared coyote used is quite sparse but could be much improved along a small drain that borders University Drive. The culvert connecting this drain to San Diego Creek is probably large enough for coyote use but is quite long and "L" shaped, offering no visibility to the far side. This undoubtedly forces any coyotes using this corridor onto the road.

Coyotes require large expanses of habitat. What is still available along Upper Newport Bay includes in excess of 405 ha (1,000 acres) of wetlands and mostly narrow belts of adjacent upland habitats. This alone is not enough habitat to sustain coyote presence at the bay. Maintenance of corridor links to larger expanses of uplands is essential. Land use planning along Big Canyon, San Diego Creek, and the smaller links to open space from these must be accomplished in ways that accommodate linkages for continued or improved wildlife movement. Also essential is the planned restoration of habitat in the uplands along the bay, coupled with better control of use by people and their dogs. Areas must be available to the coyotes that are relatively disturbance free if the bay is to continue to attract these essential predators.

Critical existing destination sites should be maintained at the bay. The slopes and field bordered by John Wayne Gulch, Backbay Drive, Jamboree Road, and San Joaquin Hills Road afford good hunting, cover, water, and a relative lack of disturbance. Coyotes denned on the mesa top of this area, known as the Newporter North site, in 1990 and on the west-facing slopes in 1991. However, I did not discover the 1991 den site until months after a lactating female coyote was struck by a car and killed on Jamboree Road at Big Canyon. This was probably her den and the pups undoubtedly perished.

Coyote sign was much more sporadic at Upper Newport Bay and environs in 1991 than in 1990. Four adult coyotes have perished, 2 were struck by cars and 2 were shot, in less than 2 yrs. Good management of and planning for the bay must include public education and whatever else is needed to maintain a strong presence by this important top carnivore.

Coyote Foods - I supported and collaborated in a study of coyote foods at Upper Newport Bay that was begun in February 1991. The study is still in progress but a preliminary report, based upon 32 scats collected in February - August 1991, is attached. A larger number of scats are currently being analyzed and collections are ongoing.

In brief summary, the findings to date indicate the importance of lagomorphs (found in 25 of the scats), particularly cottontails (Sylvilagus audubonі) (present in 18 samples) in the coyotes diet. One disparity between the current study and my past observations is a relative lack of fruits, particularly Myoporum in the recent samples. This may be partly explained by poor fruit bearing in 1991. Of interest to me is the finding of feathers in 4 samples. However, they await identification as the study continues.

Raptors - Great Horned Owls (Bubo virginianus), Barn Owls (Tyto alba), American Kestrels (Falco sparverius), and Ravens (Corvus corax) raised young in the cavities on the cliff face west of Shellmaker Island again in 1991. Black-shouldered Kites (Elanus caeruleus), Red-tailed Hawks (Buteo jamaicensis), and Red-shouldered Hawks (Buteo lineatus) nested near the bay and were regular visitors during the breeding season. However, no direct attacks of Clapper Rails were observed this year.

There were capture attempts made on Great Horned Owls on three nights and vigilance by the red fox researcher living in the trailer on Shellmaker Island for opportunities to trap owls. Despite months of readiness, no good opportunity to draw an owl to a trap has presented itself. Trapping opportunities are not great at the bay, so that I intend to go after an owl on the nest in 1992 for radio-harnessing. Telemetry will allow us to gather information on use of the marsh by these owls, their food habits, and whether or not they are significant predators of the Clapper Rail.

The newly formed Clapper Rail Study Group has begun raptor watches with me at Upper Newport Bay. Observers are stationed along the bay to note raptor occurrence, foraging, and time-budget information. The first monitoring session was held on 30 November 1991 with 9 observers at 3 stations. Observations were made for slightly over 3 hrs, 0750 hrs - 1107 hrs, on a cool blustery day with plenty of wind for birds of prey to ride. The following is the list of species sighted and minimum number of individuals per species; the number in parentheses is the number of encounters I had with that species: 9 (39) Turkey Vultures (Cathartes aura), 5 (23) Red-tailed Hawks, 4 (6) Northern Harriers (Circus cyaneus), 2 (4) American Kestrels, 1 (13) Peregrine Falcon (Falco peregrinus), 1 (1) Prairie Falcon (Falco mexicanus), 1 (1) Sharp-shinned Hawk (Accipiter striatus), and 1 (2) Osprey (Pandion haliaetus). I watched the Peregrine hunt for a total of about 28 min. with about 12 unsuccessful stoops. The Peregrine dove twice at House Finches (Carpodacus mexicanus) over the uplands and 4 times at Northern Pintails (Anas acuta) without flushing them into the air. Northern Harriers hunted the marsh for 19 minutes as I watched; more than half that time was directly over rail habitat but only one successful attack was observed and that was on something very small. These observations give an index of predation pressure at the bay and over time may lead to a better understanding of the Clapper Rail's part in the raptor's diet.

Miscellaneous Observations

Before he left the project, Jeff Lewis observed one of his radio-collared red foxes at Upper Newport Bay on the west side on 22 March 1991, 0100 - 0300 hrs. This animal was part of the group that roams the golf course from the 55 Freeway, now all the way to the bay. This situation should be monitored and control initiated, if visitation becomes regular.

Publications and Presentations

The information gathered through these observations is disseminated to the public through publications and speaking engagements. 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 and was published in the Western Tanager (Los Angeles), the Orange County, and Long Beach Chapters under the title " The Light-footed Clapper Rail, secretive denizen of the lower marsh shadows".

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 Department's docents for Upper Newport Bay; Sea and Sage Chapter of the Audubon Society; the Friends of Upper Newport Bay; Planning staff of the City of Irvine; three different classes at the University of California at Irvine; Upper Newport Bay Conservancy; National Association of Retired Federal Employees; Orange County Chapter of "Women For"; Irvine Unified School District's science teachers; Irvine Community Meeting at the Church of Christ; and Meadowpark Elementary School.

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COYOTE (*CANIS LANTRANS*) FOOD HABITS IN UPPER NEWPORT BAY, CALIFORNIA

by Winfred Wong and Tom Babayan

ABSTRACT

The food habits of coyotes (*Canis lantrans*) in Upper Newport Bay, California are determined by fecal analysis . A total of 32 scats were examined. Lagomorphs consisted of 78% of the scats examined while rodents and birds each contributed 12.5%. Insects only accounted for 3.1% of scat analyzed. Coyotes ate relatively little vegetation and fruit - each consisted 9.4% of the scat analyzed. Plastic and tin foil occurred in 6.2% of the samples.

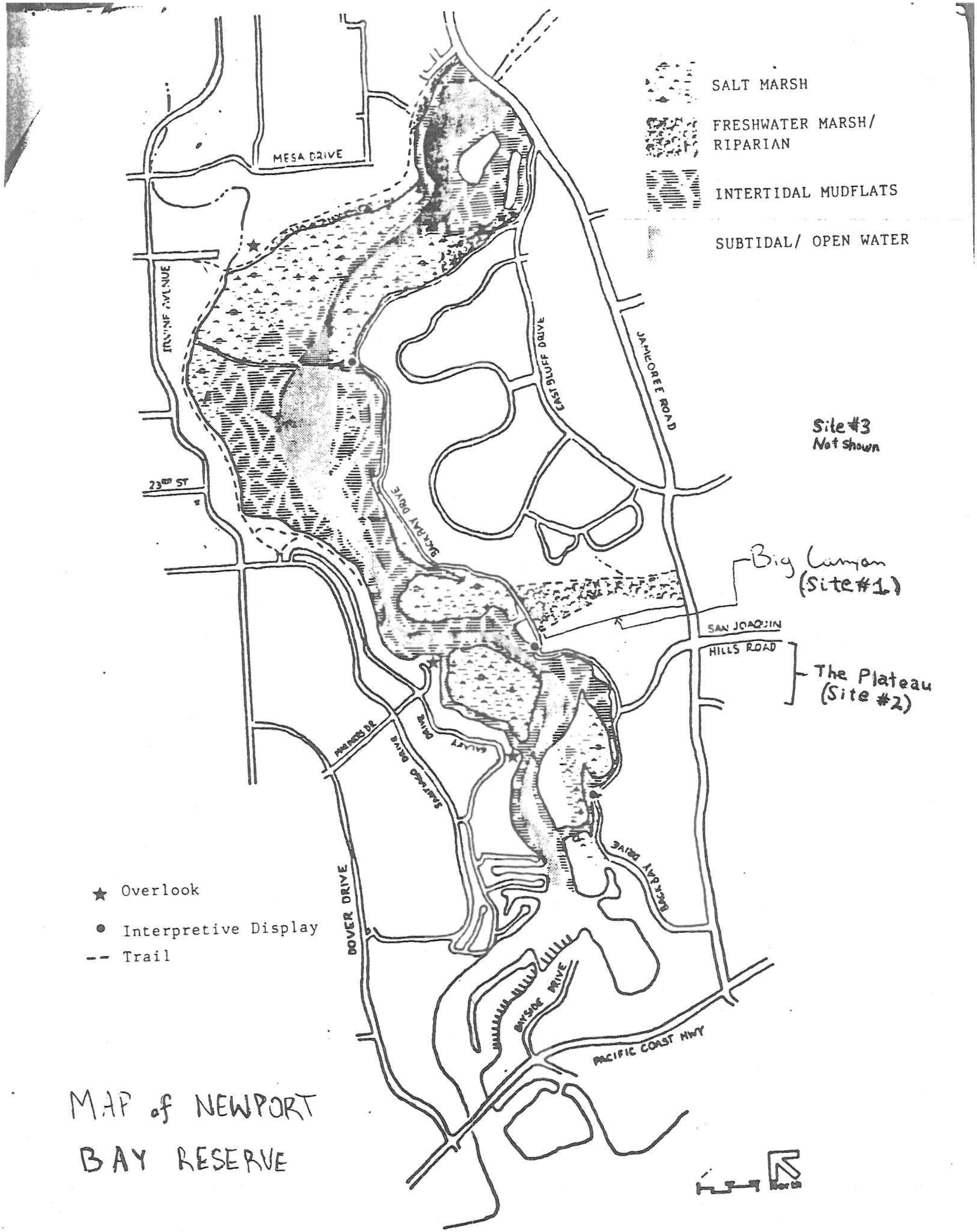
INTRODUCTION

Much study has been devoted to the food habits of the coyote (*Canis lantrans*). Widely accepted as generalist, opportunistic feeders, the coyotes' diet is diverse over its entire home range, which extends from Guatemala to Northern Alaska. H.T. Gier (1975) reports that coyotes are known to eat bison, deer, elk, sheep, rabbits, rodents, birds, amphibians other than toads, lizards, most snakes, fish, crustaceans, insects, fruit and even cattle feed. One summary of 5 separate food habits studies in North America reports rabbits (41.1%) and rodents (32.2%) to be the major prey items. Birds (15%) and fruits (7.9%) also constitute a portion of the diet (Zembal, 1990). Coyotes living near human settlements have also shown an ability to take advantage of anthropogenic food sources (MacCracken, 1982).

In managed habitats where ground nesting birds are desirable to preserve, coyotes can play a beneficial role by reducing the number of small mammals (such as raccoons and red foxes) that may prey on bird eggs . The purpose of this study is to determine the food habits of the coyote population in Southern California's Newport Bay Reserve. Because the Bay is used by several endangered species of birds, including the ground nesting light-footed clapper rail, particular attention will be paid to the amount of small mammals and birds found in the coyote diet. Because the study site is in the middle of an urban setting, a secondary focus will be placed on anthropogenic food sources.

STUDY AREA AND METHODS

Upper Newport Bay in Orange County, California, is a salt marsh consisting of tidal mudflats and freshwater tributaries supplied primarily from San Diego Creek. Cordgrass (*Spartina folisosa*) grows within the mudflats while coastal sage intermixed with chaparral grows along the area surrounding the bay. Currently, three sites are being used as study areas near Upper Newport Bay (~~see page 5 for map~~). Transects were established along dirt roads and trails in each of the three sites. A 0.5-km transect in Big Canyon, a 0.5-km transect on a plateau near the intersection of San Joaquin Road and Jamboree, and just recently added, a 1-km transect near Big Canyon Reservoir were all used as study areas. Big Canyon is surrounded by suburban apartments and homes built upon its ridges. Dense riparian vegetation grows on the canyon floor along a small stream origination from Big Canyon Reservoir. Our transect runs around the edges of the dense vegetation. The west side of Big Canyon widens into the bay while at the other end the canyon is interrupted by a


SALT MARSH
FRESHWATER MARSH/ RIPARIAN
INTERTIDAL MUDFLATS
SUBTIDAL/ OPEN WATER
MESA DRIVE
IRVINE AVENUE
23RD ST
EASTBLUFF DRIVE
JAMBOREE ROAD
BACKBAY DRIVE
Site #3 Not shown
Big Canyon (Site #1)
SAN JOAQUIN HILLS ROAD
The Plateau (Site #2)
GALAXY DRIVE
DOVER DRIVE
BAYSIDE DRIVE
PACIFIC COAST HWY
★ Overlook
● Interpretive Display
-- Trail
MAP of NEWPORT BAY RESERVE
North

heavily used road, a golf course and homes but continues on the unpopulated area of the San Joaquin Hills. The trails running through this area are used often by bikers and bird watchers. Wider trails have been covered with broken black asphalt to make access easier for city maintenance vehicles. The asphalt trails compounded with increased human activity in the area has decreased the scat output and has forced us to add other areas to our study.

The second site is a flat area bounded by heavily used streets on one side and a bluff overlooking the bay on the other. This area consists of a wide open area with stubs of dried mustard plants frequently cut by the city, and an island of tall vegetation. Our transect runs around edges of this island of vegetation and along the bluff. This area is used less by people and dogs relative to Big Canyon.

The third site is about 2-km from the Bay near the San Joaquin Landfill and Big Canyon Reservoir. Our transect runs along the coastal sage covered ridges of Coyote Canyon. This area has very low human activity because the landfill has been out of operation for some time.

Each site was cleared of all scat before the study began so that each subsequent scat could be dated. Scat was collected every week from Big Canyon and from the plateau since human disturbances exist in these areas while scat was collected every two weeks from remote Coyote Canyon. Scat was distinguished from dog and fox scat by its characteristic shape, size and texture. Questionable scats were discarded. All samples were individually bagged, labeled and placed in a refrigerator for storage. Thirty-two samples dated from

February to August of 1991 from the plateau and primarily from Big Canyon were placed in nylon sacks made from panty hose, soaked in water and a small amount of bleach for 1-2 days, rinsed thoroughly, and air dried. The resultant products were then searched for hair, bones, claws, teeth, skin, vegetation and seeds for identification.

Percent frequency was calculated by dividing the number of times the prey occurred in the scats by the total number of scat.

RESULTS

Lagomorphs by far outnumbered all other prey in the coyote's diet. Cottontail rabbits (*Sylvilagus audubonii*) consisted of 56.2% of the coyote's diet while Black-tailed jackrabbits (*Lepus californicus*) consisted of 21.8% of the coyote's diet. Among the Cottontails, two juveniles were identified as prey.

Rodents consisted of 12.4% of the coyotes' diet: California voles (*Microtus californicus*) contributed 6.2%, a deer mouse (*Peromyscus maniculatus*) contributed 3.1%, and a California ground squirrel (*Spermophilus beecheyi*) contributed 3.1% to the figure.

Although no evidence of raccoons (*Procyon lotor*) was found in any of the samples, a freshly killed raccoon was discovered along our Big Canyon transect. The remains included a head and tufts of fur mostly around the remains but also further away. Scat collected during this period have not yet been analyzed to determine whether the raccoon was the prey of a coyote.

Birds occurred in 12.5% of the scat. The feathers have yet to be identified.

Percent Frequency and Number of Occurences
of Food Items in Upper Newport Bay
from 32 Coyote Scats
February 1991 - August 1991

Food Item	% freq	n
Mammals		
Cottontail rabbit (Sylvilagus audubonii)	56.2	18
Black-tailed jackrabbit (Lepus californicus)	21.8	7
California vole (Microtus californicus)	6.2	2
California ground squirrel (Spermophilus beecheyi)	3.1	1
Deer mouse (Peromyscus maniculatus)	3.1	1
Birds		
Unidentified	12.5	4
Insects		
Unidentified	3.1	1
Fruits		
Seeds	9.4	3
Vegetation	9.4	3
Plant fragments		
Grass		
Human Refuse		
Plastic	3.1	1
Tin foil	3.1	1
Unknown	21.9	7

Fruit and vegetable matter were not accurately quantified and will be done at a later date. Only samples with an abundant amount of seeds or vegetable matter were noted in this report. Scat with a small percentage of seeds and vegetable matter were omitted. Otherwise, seeds were found in 6.2% of the scat. Vegetable matter occurred in 6.2% of the scat as well.

Human refuse occurred in 6.2% of the samples analyzed, and insects occurred in only 3.1% of the samples.

DISCUSSION

Fecal analysis is by no means a perfect way of studying food habits of coyotes. It is unknown whether the scat collected from an area is from a single coyote or from several since all three sites in this study fall within a range of a single coyote (Zembal 1990). A food habits study must evaluate the diets of several coyotes in order to dampen any kind of bias effects a single coyote might incur.

If the scat collected come predominantly from a single individual, then a bias will likely exist toward larger prey. Each scat in itself is a sampling unit of an individual's diet. Hence one large prey eaten by one individual can be represented several times in several scats deposited at different locations. Weaver and Hoffman (1979) found in a controlled feeding experiment, that prey weighing over 107g were more likely to be overestimated. This might explain the great disparity between percent occurrences of lagomorphs and other smaller prey items. Similar food habit studies (Barrett 1983, Bowyer and McKenna 1983, Elliott and Guetig 1990, MacCracken

1982, Toweill and Anthony, Zembal 1990) have shown rabbits to always be a part of the coyote's diet. However, our study so far shows a 78% occurrence of rabbits in coyote scat, a far greater dependence than the other studies have recorded. It is difficult to eliminate over representation of larger prey since the entire area of Upper Newport Bay is within range of a single coyote. Only studies of coyote density and movements can tell us whether sampling error played a role in the large number of lagomorphs represented in our study.

The large difference between the percent occurrences of lagomorphs and smaller prey is possibly because smaller prey can be under represented since bones and hair of small prey can be lost among those of larger prey. In addition, the number of small prey of the same species may be obscured within the same scat since several small prey remains could be mistaken as one small prey. Only meticulous analysis of samples and experience can reduce the under representation of smaller prey. In this study 28% of the scat examined contained more than 1 prey item.

Of significant importance is the 12.5% occurrence of birds (feathers) and the lack of egg shells found in the samples. This indicates that coyotes do not normally raid the nests of ground-nesting birds and that birds themselves actually constitute a small portion of the coyote's diet. We believe this has significant implications for the management of the Bay and the preservation of endangered birds like the light-footed clapper rail. Because coyotes displace clapper rail enemies such as the red fox and do not themselves feed heavily on rail eggs or birds, the coyote is a beneficial top predator in the Bay's ecosystem. Future management practices should focus on maintaining and even increasing the coyote presence in the Upper Newport Back Bay.

Our secondary focus is on the anthropogenic food sources used by the coyote. The presence of plastic and tin foil indicate that coyotes may encounter food-related items left by people. However, with these items occurring in only two scats (6.2%), it seems that coyotes rely little on human generated food sources. Our findings conflict with MacCracken's (1982) study of a suburban population of coyotes that showed anthropogenic food sources contributing to the population's survival. It may be that coyotes will resort to human food only if their natural prey base runs low. Because Big Canyon is often littered with food-related garbage, we believe the Upper Newport Bay coyotes eat human food as they encounter it while searching for prey.

Coyotes consumed less vegetable matter and fruit relative to another study in Upper Newport Bay by Zembal (1990). In that study, 45.6% of the scat contained myoporum seeds. In this study, coyotes may rely less on fruits and vegetable matter because the lagomorph population is significant enough to sustain the predator population. In Zembal's study only 19.6% of the scat contained lagomorphs. One possible explanation for this disparity is the seasonality of the coyotes' diet. Because the coyote is an opportunist as well as a generalist feeder, it's feeding habits may change throughout the year. We will be better able to address the issue of coyote dependence on fruits when the samples from the rest of the year have been cleaned and analyzed.

Acquiring more samples will add to our current data and allow us to make better conclusions about coyote food habits in this area. Our conclusions in this report are limited by the small sample size and lack of samples during some months. Only the continuation of this project will correct these problems and enable us to strengthen our conclusions.

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