

Status and Distribution of The Light-footed Clapper Rail in California, 2007.

Report To

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### Abstract

The twenty-eighth annual census of the Light-footed Clapper Rail in California was conducted from 9 March to 5 June 2007. Thirty coastal wetlands were surveyed by assessing call counts from Carpinteria Marsh in Santa Barbara County, south to Tijuana Marsh National Wildlife Refuge (NWR) on the Mexican border.

A total of 443 pairs of Light-footed Clapper Rails exhibited breeding behavior in 19 marshes in 2007. This is the largest statewide breeding population detected since the counts began in 1980, representing an 8.3% increase over the former high count in 2006 and a 36% increase over the 24-year high reached in 1996. This is the fourth year in succession of record-breaking high counts. Upper Newport Bay was once again the largest subpopulation in California and was back to its second highest total. Tijuana Marsh NWR was at an all-time high level of 142 pairs, a 39.2% increase over 2006. The Newport subpopulation comprised 37.3% of the state population in 2007 and the subpopulation in the Tijuana Marsh NWR comprised 32.1%, together accounting for nearly 70% of the breeding population of this rail in California.

The subpopulation on the San Dieguito River dropped 50% to 15 pairs but remains the largest ever recorded in a freshwater marsh. There were 15 pairs at Point Mugu, its third highest total and the Seal Beach tally was up slightly to 24 pairs. Batiquitos Lagoon held a record high of 22 pairs, as did Los Penasquitos Lagoon and creek with 12 pairs. Three other small subpopulations were at record or recent highs including Buena Vista Lagoon with 8 pairs, San Elijo Lagoon with 12 pairs, and San Diego River with 6 pairs. The San Diego river total included two pairs discovered at Kumeyaay Lake about 8 miles inland of Mission Bay.

Excluding the 2 largest subpopulations, there were 6 subpopulations in double figures, ranging from 12 to 24 pairs and totaling 100 breeding pairs or 22.6% of the state total. The remaining 11 subpopulations ranged from 1 to 8 pairs and totaled 35 breeding pairs of clapper rails, or 8% of the total. The annual increases in the population total of the Light-footed Clapper Rail give encouragement that restoration and management will continue to work toward the recovery of this endangered bird.

### Introduction

The Light-footed Clapper Rail (*Rallus longirostris levipes*) is a state and federally listed endangered species that is resident in coastal wetlands in southern California and northern Baja, California, Mexico. Loss and degradation of habitat threaten the continued existence of this bird, although management efforts now offer some promise of eventual recovery. The California population of this endangered rail was at a former high of 325 pairs in 15 marshes in 1996, the largest number detected breeding since statewide annual surveys were begun in 1980 until 2004 when 350 pairs were detected in 15 marshes.

One of the first major investigations of this rail identified the lack of suitable nesting habitat as a major, widespread limiting factor (Massey and Zembal 1980). Subsequent work demonstrated the need for emergency actions and recommended management strategies to stem the alarming population decline of this endangered bird in southern California. The actions taken have included: 1) habitat restoration, particularly through enhancement of tidal action to former wetlands; 2) study and control of introduced predators and unnaturally high predator populations; 3) provision of nesting sites in marshes with good habitat but limited options for protected nesting locations; 4) studies that have led to adaptive management strategies, benefiting the rail and the other co-inhabitants of these biologically rich ecosystems; 5) development of a protocol for captive breeding and genetic and demographic augmentation of smaller subpopulations; and 6) surveys of the California population, in part to track the effects of management on annual recruitment.

Implementation of these measures has succeeded in protecting and maintaining most of the small subpopulations and in supporting the expansion of a few. However, the benefits of this attention go far beyond this single species. These endangered birds thrive in our most productive, remaining coastal wetlands. Measures that benefit this rail and its environs enhance conditions for a myriad of other species as well, including people. These places and the wildlife are cherished by hundreds of thousands of southern Californians for their inherent aesthetic, recreational, economic, scientific, educational, and ecological values. Furthermore, there are essential links between the coastal wetlands and vast acres of diverse upland habitats and wildlife located many miles from the coast (Soule et al. 1988, Zembal 1993). Consequently, restoring and maintaining the diversity and vital productivity of the coastal wetlands, while achieving the recovery of the Light-footed Clapper Rail, may only be possible in an environment that includes coastal southern California's complete wildlife heritage.

Hundreds of wetland acres have undergone, or are being planned for restoration. However, full recovery and functionality of a coastal wetland may take decades to achieve. In the meantime, habitat suitability for the clapper rail may be quite marginal. All but a few of the current subpopulations of Light-footed Clapper Rails depend upon a marginal habitat base and are too small to be expected to maintain themselves without management.

Population monitoring is essential in understanding the effects of other management efforts and in stewardship of this critically endangered bird toward recovery. Reported herein are the results of the 2007 statewide survey of the Light-footed Clapper Rail.

## Methods

The twenty-ninth consecutive annual census of Light-footed Clapper Rails in California was conducted from March 9 through June 5, 2007. Thirty coastal wetlands were surveyed by mapping territorial pairs based on their calls (Zembal and Massey 1981, 1985; Zembal 1992). All of the coastal marshes with known or suspected rail subpopulations were surveyed until an evening or early morning with good calling activity was encountered. Small wetlands with no recent clapper rail sightings that again yielded negative results were surveyed at least twice as

were marsh parcels with lower than expected results on the first call count. Additionally, nesting data were considered in the assessment of the subpopulations inhabiting the 5 wetlands wherein such data were gathered in 2007 and high tide counts were accomplished on November 6 and October 9, 2006 on the Seal Beach NWR. This NWR is the only wetland inhabited by clapper rails that is inundated thoroughly enough during a 6.5 ft. tide or higher to get a relatively complete visual survey of the rails.

In the 4 marshes with abundant clapper rails, mapping spontaneous calls was the prevalent technique. In marshes with few rails and along long, narrow strips of habitat, playbacks of taped "dueting" were used sparingly to elicit responses. In the Tijuana Marsh NWR, enough observers were stationed within potential hearing range of any calling rail to cover the entire marsh on a single evening. However, most of the marshes were surveyed by a single observer visiting discrete patches of habitat on consecutive evenings until all available habitat had been covered. Most of the observations were those of three observers, but primarily the principal investigator. Additional observers participated primarily in three of the year 2007 counts, those at Seal Beach NWR, Tijuana Slough NWR and Sweetwater Marsh NWR.

The more movement required of an observer during a survey, the more likely that breeding, but infrequently calling, rails would be missed. Calling frequency and the detection of calls are influenced by observer's hearing ability and experience with the calls, the stage of breeding of individual pairs, rail density, and weather conditions (Zemba and Massey 1987). Many surveys attempted on stormy, windy days needed to be repeated. When calling frequency is high with many rounds of calling as adjacent pairs respond to one another, it is possible to map the rails accurately and move on to survey more marsh. However, under usual circumstances approximately 20 ha (50 acres) of marsh can be adequately covered during a single survey.

Surveys are usually conducted in the 2 hrs before dark, but some are done at first light to about 2 hrs after sunrise. In the past, early morning and late evening surveys have been comparable, although evening calling by the rails is more intense and often ends with one or more flurries of intense calling (Zemba et al 1989).

The playback of a taped "clapping" call appears to be responded to by the rails as if a living pair is calling nearby. However, work done with Yuma Clapper Rails (*Rallus longirostris yumanensis*) strongly suggests that this closely related species can become conditioned to the tape if it is used excessively (B. Eddleman, pers. comm.). During prime calling times in the evening or early morning, a playback sometimes elicits a single response or a round of calling. However, there are sometimes no vocal responses to the tape. If played at a time of day when the rails are not particularly prone to call, the only response likely to be elicited is that of the territorial pair intruded upon. Sometimes the response is non-vocal investigation by the pair or one member. Repeated playbacks are likely to elicit aggression. In one instance, a clapper rail attacked and knocked over a decoy that was set near a repeating tape. In another instance, a male attacked another rail, presumably a female, forcefully copulating with her while pecking at the head and neck, dislodging feathers. We finally disturbed these birds (RZ) to divert the male's aggression. Subsequently, playbacks have been used sparingly and with caution.

When used only once per year at a given marsh and with minimal repetition, playbacks have yielded important results. Unmated clapper rails, for example, often respond at considerable distances and may approach the tape. Isolated single rails often approach very closely and remain in the vicinity unless displaced.

In assessing the rail population, duets and some single "clapperings" were treated as territories. Since advertising singles are not indicative of an occupied territory with reproductive potential at the time of the survey, they are not included in the population total. However, a single "clapping" is as good an indicator of a territory as a duet, when advertising is not heard later from the same territory. Eventually, during a 2 – 4 hr census period, pairs often dueted from territories where only single pair members had called earlier. However, the fewer rails in a marsh, the more important it is to count only duets as pairs to avoid over-estimating the breeding subpopulation.

The 2007 call counts were conducted on 34 dates and totaled approximately 300 field-hours.

### Study Areas

Descriptions of all the marshes recently occupied by Light-footed Clapper Rails are available (U.S. Fish and Wildlife Service 1985 and Zembal and Massey 1981). Three of the current principle study areas are at the Naval Air Station Point Mugu (NASPM, also Point Mugu), the Seal Beach NWR, and Upper Newport Bay State Ecological Reserve.

The marsh at Point Mugu is located in southeastern Ventura County on the 1,821 ha (4,500 acre) NBVC, about 13 km (8 miles) west of the Los Angeles County line. There are 1,012 ha (2,500 acres) of jurisdictional wetlands in Point Mugu (USACOE/EPA 1994), including the largest functioning salt marsh in coastal southern California today. Considering the combined acreages of marshes that are regularly occupied, the vegetated marsh and most closely associated habitats at Mugu Lagoon represent more than 25% of the clapper rail's potential habitat base. The marsh is subject to nearly full tidal action in the central and eastern arms with an amplitude of about 9 ft. The tides are dampened by constrictions at Laguna Road and farther west, resulting in a tidal amplitude of only 4 - 5 ft. The wetland vegetation is dominated by pickleweed (*Salicornia virginica*) but scattered stands of spiny rush (*Juncus acutus* ssp. *leopoldii*) are critical for rail nest placement.

The Seal Beach NWR covers 369 ha (911 acres) of the 2,024 ha (5,000 acre) Seal Beach Naval Weapons Station in Orange County near the City of Seal Beach. About 299 ha (739 acres) of the refuge lands are subject to regular inundation by the tides. There are about 229 ha (565 acres) of salt marsh vegetation, 24 ha (60 acres) of mudflats that are exposed daily, and 46 ha (114 acres) of channel and open water. The wetlands are fully tidal, with a range of about - 0.5 m (1.7 ft) to + 2.2 m (7.2 ft) MLLW, and very productive with a high diversity and abundance of wildlife.

Upper Newport Bay is an Ecological Reserve of the California Department of Fish and Game (CDFG), located approximately 22 km (13.7 mi) down coast of the Seal Beach NWR.

Approximately 304 ha (750 acres) are fully tidal, including 105 ha (260 acres) of marsh. The bay is bordered by bluffs, 9 - 18 m (30 - 59 ft) high, and surrounded by houses and roads. There are approximately 100 ha (247 acres) of shrublands remaining undeveloped on the edge of the wetlands and two local drainages with some cover along them coursing into the bay.

## Results and Discussion

A total of 443 pairs of Light-footed Clapper Rails exhibited breeding behavior in 19 marshes in 2007 (Table 1). This is an 8.3% increase over the former high count in 2006 and a 36% increase over the longer standing high in 1996. This is the fourth consecutive year of record-breaking high counts. The subpopulation in Upper Newport Bay was once again the largest in California and was only 9 pairs lower than its record high in 2005. The Tijuana Marsh NWR subpopulation reached a record level with 142 pairs, a 39.2% increase over its former high set in 2006. The Newport subpopulation comprised 37.3% of the state total in 2007 and the Tijuana Marsh NWR subpopulation comprised 32.1%, together accounting for 69.4% of the breeding population of the Light-footed Clapper Rail in California. In addition, 6 marshes held 12 – 24 pairs each for a combined total of 100 pairs or 22.6% of the state total.

The spring of 2007 was not very conducive climatologically to consistent clapper rail breeding activity, or therefore successful call counts. The winter was the driest on record and the spring was cold. Many surveys were re-scheduled at least once due to poor calling activity. On some days the rails were very vocal, on others there was little activity. Sites that would normally be completed in a single visit were re-visited twice or three times before vocalizing was consistent enough to justify confidence in the survey results. At Upper Newport Bay, for example the counts normally require 8 early mornings or late evenings to complete. In 2007, the Newport counts were started on March 9 and not completed until April 3 because of the extreme variability in vocalizing. In addition to the unusual cold, windy conditions, Newport was being dredged to save it from filling in with sediment. No direct impact of the dredging operation was detected but the monitoring for impacts relied mostly on finding and watching active nests. Very few egg nests were found, the 5 that were discovered were found very late in the nesting season, and all but one was predated. At least one clutch was predated by raccoons, *Procyon lotor*. Additionally, there were raccoon tracks along the length of Newport Bay, raising concerns of an unusually large population of these clever predators.

Tijuana Marsh's subpopulation was 87 pairs strong for two consecutive years prior to the 2006 high count of 102 breeding pairs. The 40-pair increase in 2007 is unprecedented at any marsh but Upper Newport Bay. The increase was not attributable to one single area but fairly well distributed throughout the marsh. What was unusual was the number of pairs calling from the very edge of the wetland and in the maritime scrub bordering the eastern edge of Oneonta Slough. As in 2006, there were more than usual numbers of rails manifesting territoriality on the western edge of the Oneonta Slough portion of the marsh, adjacent to the paved road and apartments; several more than usual were counted in the southern half of Oneonta Slough; again there were two in the cordgrass on the northern edge of the river south of Oneonta; and three in reed beds. Rails were again detected in the restoration area, the model marsh south of the river.

Table 1. Census of the Light-footed Clapper Rail in California, 1980-2007.

Part I: 1980 - 1989

Location	Number of Pairs Detected In:									
	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989
Santa Barbara County										
Goleta Slough	0	0	-	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 Wetlands	-	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 River	-	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

Table 1. Census of the Light-footed Clapper Rail in California, 1980-2007.

(continued) Part II: 1990 - 1999

Location	Number of Pairs Detected In:									
	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Santa Barbara County										
Goleta Slough	0	0	0	0	-	-	0	0	-	-
Carpinteria Marsh	0	0	0	0#	0	2#	3#	5#	3#	2#
Ventura County										
Ventura River Mouth	0	0	0	0	0	0	0	-	0	-
Santa Clara River Mouth	0	0	0	0	0	0	0	-	0	-
Mugu Lagoon	6#	4#	5#	5	6#	5#	3#	4#	4#	4#
Los Angeles County										
Whittier Narrows Marsh	-	-	-	0	0	-	0	0	-	-
Orange County										
Seal Beach NWR	16	28	36	65	66	51#	52#	37#	16#	15#
Bolsa Chica	0#	0*	0#	0#	0*	0*	0*	0*	0*	0
Huntington Beach Wetlands	0	0	0	0	0	0	0	0	0	-
Upper Newport Bay	131	128	136	142	129	117	158	149#	105#	104#
San Joaquin Reserve	0	0	0#	0	0	0	0	0	-	0
Carlson Rd Marsh	0	0	0	0	0	0	0	0	-	0#?
San Diego County										
San Mateo Creek Mouth	0	0	0	0	0	0	0	-	-	-
Las Flores Marsh	0	0	0	0	0	0	0	-	-	-
Cocklebur Canyon Mouth	0	0	0	0	0	0	0	0	0	0
Santa Margarita Lagoon	0	0	0	0#	0	0	0	0#	0	0
San Luis Rey River Mouth	0#	0	1	0	-	0	0	0	0	0
Guajome Lake Marsh	0	0	0	0	-	0	0	0	-	-
Buena Vista Lagoon	0a#	2#	5	2#	3#	1#	6#	7#	4	5#
Agua Hedionda Lagoon	0	0	0	0	0	0	0	1?	1	0
Batiquitos Lagoon	0#	0#	0	1#	1#	0#	2	2	1	3
San Elijo Lagoon	5#	5	4#	6#	1#	3#	3#	8	3#	5#
San Dieguito Lagoon	0	0	0	0	0	0	0	0	0	-
Los Penasquitos Lagoon	0	0#	0#	0#	1	1	1	2	2#	2
Kendall-Frost Reserve	5#	9	11	5#	5#	4#	1#	2	2	4#
San Diego River	2	5	1a	5	5#	6b	5	5#	4	3
Paradise Creek Marsh	0	0	1a	0a	0	1	2	0	0	0
Sweetwater Marsh	2#	4a	4a	3a	7#	7	8	3#	4	3
E Street Marsh	0	1a	1a	1	0#	2	1	1	1	2
F Street Marsh	0	0	0	0	0	0	0	0	1	0
J Street Marsh	0	0	0	0	0	0	0	0	0	0
Otay River Mouth	0	0	0	0	0	1	3	3	2	1
South Bay Marine Reserve	5	2	3a	1	0	0	0	1#	1	0
Dairymart Ponds	0a#	0#?	0#	1a	0	-	-	-	-	-
Tijuana Marsh NWR	17a#	47a	67a	63a	64	61	77	77#	68#	80#
Total: pairs	189	235	275	300	288	262	325	307	222	233
marshes	9	11	13	13	11	14	15	16	17	14

- indicates that no census was taken.

\* indicates a fall or winter occurrence.

# indicates the detection of unpaired rails (used beginning in 1987).

a Paul Jorgensen Unpublished data; b 2 pairs are in Famosa Slough.

Table 1. Census of the Light-footed Clapper Rail in California, 1980 - 2007.  
(continued) Part III: 2000 - 2007.

Location	Number of Pairs Detected In:								
	2000	2001	2002	2003	2004	2005	2006	2007	
Santa Barbara County									
Goleta Slough	-	0	0	0	-	-	-	-	
Carpinteria Marsh	1#	1#	2	0#	0#	0	0	0	
Ventura County									
Ventura River Mouth	-	-	0	0	-	-	-	-	
Santa Clara River Mouth	-	-	0	0	-	-	-	-	
Mugu Lagoon	7#	7#	10#	14#	19#	14#	17#	15#	
Los Angeles County									
Whittier Narrows Marsh	-	-	0	-	-	-	-	0	
Orange County									
Seal Beach NWR	10#	11#	24#	23#	16#	15#	21#	24#	
Bolsa Chica	0	0	0*	0	0	0	*	*	
Huntington Beach Wetlands	-	0	0	0	0	0	4#	4	
Upper Newport Bay	150#	124#	129#	144#	165#	174#	158#	165#	
San Joaquin Reserve	0	0	0	0	-	0	0	0	
Carlson Rd Marsh	0#	0	0	0	-	0	0	0	
San Diego County									
San Mateo Creek Mouth	0	0	0	0	0	-	-	-	
Las Flores Marsh	0	0	0	0	0	-	-	-	
Cocklebur Canyon Mouth	0	0	0	0	0	-	-	-	
Santa Margarita Lagoon	0	0	1	2	1	2	1	1	
San Luis Rey River Mouth	0	0	0	0	0	0	0	0	
Guajome Lake Marsh	0	-	-	0	-	-	0	0	
Buena Vista Lagoon	5#	3#	6#	5#	5#	6#	8#	8#	
Agua Hedionda Lagoon	2	2	1	4	5	4#	7#	4	
Batiquitos Lagoon	2#	3#	3#	5	11	16#	19#	22	
San Elijo Lagoon	1#	1#	2	7#	7#	6#	15#	12#	
San Dieguito Lagoon	0#	0#	0	0#	6	12#	31#	15#	
Los Penasquitos Lagoon	1	1	2	1#	2#	2	7#	12#	
Kendall-Frost Reserve	4	4	5#	6#	14	14	5#	4#	
San Diego River	3#	4	6	6#	8#	5	4	6	
Paradise Creek Marsh	0	0	0	0	0	0	0	0	
Sweetwater Marsh	2	3#	3#	1#	3#	1	4#	4#	
E Street Marsh	2	0	1	1	0	0	2	1	
F Street Marsh	0	0	0	0	0	0	0	0	
J Street Marsh	1	0	0	1	0	0	0	0	
Otay River Mouth	1	1	1	0	0	1	2	1	
South Bay Marine Reserve	0	0	0	0	0	0	1	2	
Dairymart Ponds	-	-	-	2	1	1	0	1	
Tijuana Marsh NWR	61#	52#	78#	64#	87	87#	102#	142#	
Total: pairs	253	217	274	286	350	360	408	443	
marshes	16	14	16	16	15	16	18	19	

- indicates that no census was taken.

\* indicates a fall or winter occurrence.

# indicates the detection of unpaired rails (used beginning in 1987).

This record count at Tijuana Marsh occurred on an evening with no helicopter activity and so none of the usual associated noise interference. However, the count would have been high even with helicopter noise. The calling frequency at Tijuana Marsh that evening was more intense than most of the seasoned observers had ever experienced. It is also of interest that this extreme density of breeding rails comes at a time when the Mexican marshes occupied by Light-footed Clapper Rails are apparently under heavy siege by domestic animals being grazed directly in the salt marshes.

The subpopulation of Light-footed Clapper Rail newly discovered in the San Dieguito River Valley in 2004, inland of the lagoon and El Camino Real, was first reported to be comprised of only 6 breeding pairs. That population estimate was probably low due to the lateness of the census and in 2005 there was evidence of at least 12 pairs, although this too was a conservative estimate. Finally in 2006, the survey on April 1<sup>st</sup> revealed a significantly large subpopulation with calling from 25 dueting pairs, 12 singles clapping, and 5 advertising males. Finally, the rails were extremely vocal during the 2006 survey giving confidence that the count was accurate and indicating at least 31 breeding pairs. This ranked San Dieguito as the third largest subpopulation of Light-footed Clapper Rails in 2006 and the largest ever reported in a freshwater marsh system.

We believe that this subpopulation is still significantly large in 2007 but calling was as poor as it was in most of the other marshes and the estimate was down by half. San Dieguito was surveyed three times in 2007 and during each visit, rails finally vocalized hours after having repeatedly ignored the playback broadcast of a duet quite near their positions. This lack of intense calling was observed at most marshes and probably indicated great disparity in readiness to breed within the subpopulations. The spottiness of intense calling in most of the marshes continued through the breeding season, probably indicating that some of the rails present in some marshes did not breed in 2007. In Upper Newport Bay, for example intensive nest searches over 17 days, perhaps 100 acres, and 300 field-hours revealed only 6 incubation nests, 4 of which were predated in the same areas that held 24 nests, 12 of which were active egg nests when discovered in 2006.

Re-examination of the call count and nest data for the Seal Beach NWR indicates that this subpopulation has probably been 20+ pairs for several consecutive years, including 2007. However, with so much marsh available to the rails, there ought to be a much larger breeding contingency there. The viability of this subpopulation is still questionable and there are no new clues about what limits the rails on the NWR. However, raptor predation is suspected and we may re-initiate monthly raptor monitoring sessions. This is the only marsh currently occupied by Light-footed Clapper Rails that gets fully inundated during a high tide of about 6.5 ft (MLLW), or higher. Tides of this height occur regularly in the late summer usually in darkness and in the fall or winter in the early morning. The rails are forced onto debris or to the edge of the marsh where there is little cover and busy roads just beyond. This greatly exposes the rails to potential predators and may be part of the problem at Seal Beach. However, the completeness of inundation also allows fairly dependable surveying of the subpopulation outside the breeding season. Accordingly, the rails were counted again from canoes on 9 October 2006 and 6

November 2006 and 103 and 95 individuals were sighted, respectively (Table 2). The higher  
 Table 2. High Tide and Call Counts of Clapper Rails on the Seal Beach  
 National Wildlife Refuge, 1975 - 2006.

Date	Tidal Height	Clapper Rails Counted	Breeding Pair Members		Notes
			Before	After	
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	+6 youngsters
30 Nov 1978	6.7	38	-	42	
1 Dec 1978	6.7	32	-	42	
3 Sep 1979	6.4	20	42	60	Tide too low
3 Nov 1979	6.6	56	42	60	
2 Dec 1979	6.7	32	42	60	
3 Dec 1979	6.7	44	42	60	
21 Nov 1980	6.9	55	60	38	First red fox den found
29 Jun 1981	7.0	34	60	38	Tide too late, dark
12 Nov 1981	6.9	43	38	56	
29 Dec 1982	7.0	23	56	40	
18 Jan 1984	6.9	23	40	48	
21 Nov 1984	6.7	5	48	22	+ 7 red foxes
13 Nov 1985	7.1	2	22	10	+ 2 red foxes
12 Dec 1985	7.2	2	22	10	+ 2 red foxes
30 Dec 1986	7.2	7	10	14	Begin red fox trapping, 59 foxes removed in 1986
28 Jan 1987	7.0	7	10	14	63 red foxes removed in 1987
8 Aug 1987	7.3	8	14	14	Tide too late, dark
22 Nov 1987	6.7	12	14	28	
21 Dec 1987	7.0	8	14	28	+ 2 red foxes
16 Feb 1988	6.8	10	14	28	
22 Nov 1988	6.9	6	28	12	128 red foxes removed in '88
16 Oct 1989	6.9	59	12	32	Record High Tide Count; 25 red foxes removed in 1989
5 Oct 1990	6.4	57	32	56	Tide too low
2 Nov 1990	6.8	69	32	56	Record High Tide Count
22 Nov 1991	6.9	98	56	72	Highest Population Total
26 Oct 1992	6.8	159	72	130	Highest Population Total
15 Oct 1993	6.8	143	130	132	Highest Population Total
4 Nov 1994	7.0	150	132	102	220 Red-tailed Hawks counted On the NWS on 11 December 1994
25 Oct 1995	6.5	53	102	104	Tide too low
22 Nov 1995	6.9	55	102	104	
10 Dec 1996	6.7	55	104	74	
17 Oct 1997	6.6	40	74	32	
04 Nov 1998	6.8	30	32	30	

23 Nov 1999 7.0 17 30 20  
 Table 2 (continued). High Tide and Call Counts of Clapper Rails on the Seal Beach National Wildlife Refuge, 1975 - 2006.

Date	Tidal Height	Clapper Rails Counted	Breeding Pair Members		Notes
			Before	After	
11 Dec 2000	6.9	30	20	22	
15 Nov 2001	6.7	35	22	48	
04 Dec 2002	7.1	62	48	46	
26 Oct 2003	6.7	96	46	32	
12 Nov 2004	6.7	52	32	30	
15 Nov 2005	6.7	57	30	42	
09 Oct 2006	6.6	103	42	48	
06 Nov 2006	7.0	95	42	48	
26 Oct 2007	7.1	32	48	-	

count was the fourth highest of any high tide count on the NWR. With good survival through the winter, we would have expected a breeding population larger than 24 pairs in 2007.

Unfortunately, the most recent count taken after the 2007 breeding season only revealed 32 rails. Either the rails had already moved undetected onto the edges or there were heavy losses at the end of the breeding season. Potential rail predators were out in abundance during the counts, hunting the marsh and edges, including Red-tailed Hawks (*Buteo jamaicensis*), Northern Harriers (*Circus cyaneus*), Peregrine Falcon (*Falco peregrinus*), Cooper's hawk (*Accipiter cooperi*) and American kestrels (*Falco sparverius*). Continued upgrading and maintenance of the artificial rafts on the Seal Beach NWR is essential to the protection of the wintering rails and success of the breeding rails. Usually at least half of the rails counted during the winter high-tide counts have been sequestered on rafts and afforded much better protective cover thereby.

Although the Clapper Rail numbers in Seal Beach were relatively stable at 24 breeding pairs in 2007, this subpopulation was again most heavily male-skewed. Both the extraordinary abundance of unmated males and the inability of this subpopulation to return to mid-1990s levels are of concern. In the past there has been evidence of heavy, probably female-skewed winter losses. The Seal Beach subpopulation has had the advantage of genetic augmentation through translocations of adults and eggs but heavy predation or a similar inimical factor continues. Seal Beach NWR received 6 captive-bred rails in 2002; 8 eggs from Newport stock were swapped and hatched by a Seal Beach pair and their 7 eggs were incubated, the young were reared, and returned to Seal Beach in 2003; and 5 captive-bred rails were released into the NWR in 2004. No additional augmentation has happened since 2004 because of the extreme male-skew and continued uncertainties about the inimical factors operating in this marsh.

The subpopulation in Batiquitos Lagoon at 22 pairs was nearly tied for fourth largest in the state in 2007. The rails are thriving and the subpopulation is increasing gradually because the ecological functionality of the wetland is improving dramatically over time due to the major restoration project implemented there. In December 1996, the mouth of the lagoon was opened

to the ocean, the final step in a \$57 million restoration project and since then the carrying capacity for Clapper Rails has been on the rise. The lagoon has remained tidal and rail habitat has been increasing and improving. Breeding rails were detected on the north side of the lagoon for the first time in 2004 and a total of 11 pairs was detected. In 2007 there were at least 6 breeding pairs vocalizing from the edge of the western tern island; 6 pairs along the western half of the north edge of the inner lagoon; 8 pairs along the southern edge; a pair again in the northeast corner of the basin just west of the freeway; and a pair on Encinitas Creek about 0.5 miles south of La Costa Boulevard, just downstream of LeVante Street.. The cordgrass in the west basin is extensive and looks vigorous, although much of it appears to be regularly over-washed. There was one pair there in 2007 in the northeast corner in a reed bed bordered by the tallest cordgrass in the west basin. Marsh restoration appears to be working for this endangered bird in Batiquitos Lagoon, increasing expectations for a large, thriving population there within a decade or so. In support of this possibility 16 captive bred rails have been released into this marsh since 2004.

Since doubling in size between 2001 and 2003, the Point Mugu subpopulation has fluctuated between 14 and 19 pairs, 2003 - 2007. This subpopulation fluctuated between 3 and 7 pairs for nearly 20 years until recent augmentations fostered its growth. There is an efficient predator management program in place, consistent rail and marsh management, and the Clapper Rail breeding population is stable, although not as large as would be hoped for in this, the biggest contiguous patch of potential habitat in the state. Again in 2007, rails were observed attempting to breed in the eastern arm of the lagoon. Intensive monitoring, demographic and genetic augmentation, and provision of additional nesting cover should continue to add stability or foster the growth of this northern subpopulation.

That 2007 was a year of unusually intermittent vocalizing and late or reduced breeding activity was also observed at Point Mugu. Between May 14, and June 19 over 200 hours of systematic field observations were accrued, mostly by the same observer, both in the early morning and late afternoon. During these observations “kecking” was the most common rail vocalization heard. There were only 8 duets recorded from 5 locations, 15 single “clapperings“ from the same 5 plus 3 additional locations, and 124 incidents of “kecking” from all over the marsh. Less than half of the usual nesting activity was directly observed in the field and at least one pair was still incubating eggs on July 13, 2007.

There have been occasional re-sightings of banded rails at Point Mugu, indicating that some of the captive-bred rails remained local after being released into the marsh. However, at least one of them, a female banded 1035-8878 did not. A photograph was taken of this rail at Upper Newport Bay on December 12, 2004 by Steve Metz. This female was captive-bred at the Chula Vista Nature Center and released into the eastern arm of Point Mugu on August 28, 2004, 106 days before her picture was taken at Newport. This shatters the old long-distance movement of 13.5 miles recorded for the subspecies *levipes* (Zembal et al. 1983). The distance from Point Mugu to Upper Newport Bay is approximately 90 miles along the coast. This indicates that at least one and probably others of the captive-bred rails are more prone to movements between marshes than was previously observed in wild birds. It also indicates that at least one of the

released rails chose not to stay at Point Mugu; others may have behaved similarly.

The San Elijo Lagoon subpopulation was at its second highest level in 2007 with 12 pairs of breeding Clapper Rails. Although San Elijo Lagoon has had major efforts to restore tidal function, the lagoon still closes to the ocean with regularity. Seven of the rail pairs were in the inland lagoon in fresh water marsh; 5 pairs were in the central lagoon west of the freeway; and none revealed themselves in 2007 along Escondido Creek. San Elijo received an augmentation of 8 captive-bred rails in 2004 and 5 in 2006 at the dike in the inner lagoon. One of the 2004 rails was re-sighted near the railroad tracks in the central lagoon on December 13, 2004, 6 months following release, and one of the 2006 rails was observe repeatedly over 6 months off of the Rios Avenue trail.

Los Penasquitos Marsh is dominated by vegetation indicative of prolonged closure to the ocean, particularly pickleweed. However, fresh water influence and freshwater marsh edge are increasing and the rails appear to be using the freshwater habitat increasingly. The detection of 12 pairs is a record high for this wetland. There were 10 pairs in the freshwater marsh in the southeastern third of the lagoon and an additional 2 pairs and 3 advertising males along Sorrento Valley Creek, inland of the 805 freeway. Five captive-bred rails were released in 2004 but there have been no re-sightings.

The 2007 count in Buena Vista Lagoon indicated that this wetland's high of 8 pairs had been maintained for a second year. Totals of 5 pairs, 5 singles, and 5 males were detected. Of these 4 pairs were in the central lagoon, 3 were in the inner lagoon, and there was 1 pair detected in the little outer lagoon. There are many management issues at this little freshwater marsh and they are shared with most of the other coastal wetlands including abundant non-native trees and shrubs that harbor perching predators and homeless humans.

There was a sewage spill in 2007 that raised concern for the rails in Buena Vista Lagoon. The spill entered the inner lagoon. During surveys on 17 and 28 March, there were 3 singles, 1 pair and, an advertising male detected in the inner lagoon. One of the singles was directly adjacent to the little parking lot in the southeast corner of the lagoon, right on top of remediation activities for the spill. After the spill, RZ went back to do another survey to see if the commotion associated with spill remediation had resulted in the rails moving around. On this post-spill date 2 pairs, 2 singles, and an agitated kecker were documented in the inner lagoon. One of the pairs called from a new location but because there were still only 4 points of clapping, it was not counted as an additional pair. The single that had been detected at the spill remediation activity site was still there.

The marsh at Agua Hedionda Lagoon has held a maximum of 7 pairs of Light-footed Clapper Rails, once in 1983 and again in 2006 but was back down to 4 pairs in 2007. The brackish marsh inland of the inner lagoon was greatly impacted by a change in drainage in the mid-1980s and the rails were barely detectable through the 1990s. The 5 pairs located in 2004 was the highest level observed since then and this level was probably sustained in 2005 when 4 pairs and an advertising female were detected during an early season count. Given the usual presence of unmated males in Agua Hedionda, the female likely found a mate and bred. With the recently

increased street runoff from adjacent housing, the main freshwater marsh has rejuvenated to some extent, perhaps to the benefit of the rails as evidenced by the record number in 2006. Five captive-bred rails were released into Agua Hedionda Lagoon in 2004 on the inland edge of the inner lagoon but none has been re-sighted since.

The subpopulation in the University of California Reserve at Kendall-Frost rebounded significantly in 2004 and 2005 but was significantly reduced in 2006 and 2007. Although this marsh is small, totally isolated, and surrounded by urban housing, it is managed under the University of California Reserve System. The stewardship includes appropriate predator management, habitat restoration, and people, particularly researcher management to assure minimal disturbance to the rails and their habitat. Additionally, nesting rafts have been provided and used heavily by the rails since 1987. There have also been translocations of eggs and adults. This culminated in 2004 and 2005 breeding populations of 14 pairs, the highest total there since 1985 but it was not sustained. In spite of the appropriate management of the marsh, it may always be a struggle for the rails in such a tiny, isolated wetland. For example, a Cooper's Hawk was observed powering through the main tidal channel; just one such animal remaining local and hunting from the adjacent high-rise condominiums would have excellent visual access to the entire wetland and take a major toll on the rails. A Cooper's hawk was video-taped in 2006 tenaciously crashing into pickleweed after a Clapper Rail at Bolsa Chica.

Three of the breeding pairs of Clapper Rails in the Sweetwater Marsh NWR and environs were in the Vener Pond section of the main marsh, including a pair in the pond east of the volunteer parking lot, one was in the "E" Street Marsh, and one pair and an advertising female were on the river upstream of the freeway. The pair in the pond was observed on June 28 with 6 chicks swimming from the island to the east shore by Tina Matthias and David DiDonato. The totals for the Sweetwater complex had not been up to 4 pairs since 1998. Eleven Clapper Rails were released to Sweetwater in 2005, so the adult rails sighted were checked for bands but none was seen.

The cordgrass continues to expand and dominate a significant portion of the mouth of the San Diego River and an all-time high of 8 pairs of breeding Light-footed Clapper Rails were there in 2004. However, this was not sustained in 2005 when only 5 pairs were detected but the channel was full with heavy runoff caused by the second wettest year on record. Although the cordgrass survived these high flows, the numbers of breeding rails detected in 2006 and 2007 were low. Otherwise, based upon the extent and current condition of the habitat, it should abound with rails. However, regular floods may limit the habitat suitability for the rails there. It should be noted that multiple call counts were attempted on the channel in 2006 and 2007 and none was very convincing; responses to the tape were very brief and distant. Two of the pairs reported here for 2007 were actually detected 13 miles inland at Kumeyaay Lake. This is the second year of multiple reports of sightings and audio detections of Clapper Rails in freshwater marsh at this lake.

The salt marsh at the mouth of the Santa Margarita River typically held a single pair of nesting rails for many years. However, in 2002 and 2003 there were two pairs, one at the river mouth

and another between Stuart Mesa Road and the railroad tracks. Both were in brackish marsh in the midst of salt marsh patches. In 2004 only the pair at the river mouth was detected, both pairs were back in evidence again in 2005, but only one was detected in 2006, at the more inland site and one in 2007 at the river mouth.

An adult Clapper Rail and a chick were observed in the South Bay Marine Reserve in 2005 after the survey report was compiled. In 2006, there was a strong clapping response to the tape by a single rail with no following advertising, indicating that for the second consecutive year there were breeding rails in the Reserve. In 2007, both a pair and a single responded to the tape.

One of the highlights of the 2006 survey of Light-footed Clapper Rails was the discovery of yet another breeding location in the Santa Ana River Marsh, also previously known as Newport Slough. Four 4 pairs again were detected there in 2007 and are listed in Table 1 under the Huntington Beach Wetlands. The Santa Ana Marsh is at the southern terminus of the Huntington Beach Wetland Complex, several wetland patches strung along the coast totaling more than 200 acres. The 92-acre Santa Ana Marsh was restored as part of the Federal Flood Control Project on the Santa Ana River. Dampened tidal influence was re-established and cordgrass was planted primarily along a narrow eastern portion of the marsh that lies between an oil field and the south dike of the river. In both 2006 and 2007, the rails inexplicably occupied only the western half of this cordgrass marsh.

The last known Clapper Rail call from Carpinteria Marsh was from an unmated female vocalizing constantly with no answering call in 2003. In 2004, there was total silence until April 13 when two males were released in the hope that the female was still alive. Unfortunately, in 2005 through 2007 the silence persisted. This northern wetland is plagued with domestic cats in the marsh and other predators of concern. The Carpinteria subpopulation and wetland are in major need of intensive management but the wherewithal and interest appear to be lacking. A local resident recently reported red foxes actively denning at the southern end of the dirt road extension of Esteros Way on the very edge of the marsh. Without dealing with the foxes in particular through consistent predator management, the chances for a viable subpopulation in Carpinteria Marsh are non-existent.

Clapper Rail vocalizations were reported for Bolsa Chica and the San Joaquin Reserve in 2007. However, breeding is not suspected to have occurred. Several attempts to elicit responses to a tape-playback of a duet were unsuccessful.

Ten of the 19 marshes with breeding Clapper Rails in 2007 had skewed sex ratios and 8 of those were male-skewed. A total of 57 advertising males and 5 females were heard during the call counts including 10 unmated males at Point Mugu, 17 single males on the Seal Beach NWR, 16 males and 2 females at Upper Newport Bay, 5 males in Buena Vista, 1 female in San Elijo, 1 male in the San Dieguito River Valley, 3 males in Los Penasquitos Lagoon, 2 males in the Kendall-Frost Reserve, 1 female in Sweetwater Marsh, and 3 males and a female in Tijuana Marsh. As in 2007, the usual condition has been a slight male bias during most years in most marshes. An extreme male skew like that at the Seal Beach NWR indicates major ongoing

issues, unfortunately of an unknown nature.

Additional reports of Clapper Rail detections were investigated in 2007; the following is the most noteworthy of them. Mary Beth Stowe reported hearing three individual clapper rails at Kumeyaay Lake on 25 April 2006 in Mission Trails Park on the San Diego River. Several additional reports came in for 2007 and two pairs likely bred there. The further investigation of Los Penasquitos Creek, east of the freeway led to the detection of 3 additional breeding pairs of clapper rails in 2006 and two pairs in 2007. The continued annual release of additional captive-bred Clapper Rails appears to be resulting in increased numbers of rails and increased occupation of inland sites.

There is one, large viable subpopulation of Light-footed Clapper Rails in existence in California today. Only the subpopulation at Upper Newport Bay has demonstrated the resilience to rebound quickly following weather-induced catastrophes in the past 30 years. The subpopulation in the Tijuana Marsh NWR has grown significantly but the lack of sediment control in the Tijuana River Watershed, other water quality issues therein, and the lack of an emergency response plan and funding to deal quickly with river mouth closure are problematic. Major sediment deposition occurred in the area of the river mouth in 2004/2005 and the marsh restoration site that held 5 breeding pairs of Clapper Rails in 2004 before the causative storms was devoid of breeding rails in 2005 but abounded with thick, newly deposited sediment (It should be noted that breeding rails were back in the restored habitat in 2006 and 2007). There were 6 other subpopulations with 12 - 24 pairs each in 2007 and 11 with 1 – 8 pairs each. Those 11 totaled 36 pairs of rails or 8% of the state population. Five wetlands held just one or two pairs each; these smallest subpopulations are in serious jeopardy. Without restoration and species-specific management in these wetlands, there is little likelihood of the Clapper Rail's recovery in them.

The Light-footed Clapper Rails in California have reached a population high for the fourth consecutive year. This has been the result of management efforts for the rails and major habitat restoration. With significantly greater management efforts and restoration, we could likely recover the Light-footed Clapper Rail.

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#### Literature Cited

Massey, B.W., and R. Zembal. 1980. A comparative study of the Light-footed Clapper Rail in Anaheim Bay and Upper Newport Bay, Orange County, CA. Contract Rep., End. Spp. Office, U. S. Fish and Wildl. Serv., Sacramento, CA. 69pp.

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

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

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

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

\_\_\_\_\_. 1983. To catch a Clapper Rail -- twice. *No. Amer. Bird Bander* 8: 144-148.

Zembal, R., J.M. Fancher, C.S. Nordby, and R.J. Bransfield. 1983. Intermarsh movements of Light-footed Clapper Rails indicated in part through regular censusing. *California Fish and Game* 71: 164 - 171.

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

\_\_\_\_\_. 1987. Seasonality of vocalizations by Light-footed Clapper Rails. *J. Field Ornith.* 58: 41 - 48.

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

Zembal, R. 1992. Light-footed Clapper Rail census and study, 1992. Contract Report to Calif. Dep. Fish and Game, Wildl. Manage. Div., Nongame Bird and Mammal Section Rep. 91-3. 32pp.

\_\_\_\_\_. 1993. The need for corridors between southern California's coastal wetlands and uplands, in J. E. Keeley, ed., *Interface between Ecology and Land Development in California*, Symposium proceedings, Southern California Academy of Sciences meetings at Occidental College, 1992.

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